Probabilistic Model Checking with PRISM

Production Line

Patrick SARDINHA

System description

We have a **production chain** made up of:

machines that extract resources

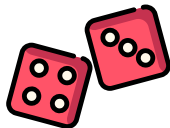machines that transform resources

ways to transport resources

We have different types of **disruptive events**:

technical failures on machines with a certain probability

non-deterministic quantities of extracted resources

Resource extraction

We have different kinds of machine:

Burner mining drill:

- needs a mineral source to operate

- takes some time to mine a certain amount of minerals

- can break down with a certain probability

Offshore pump:

- needs a water source to operate

- takes some time to produce a certain amount of water

- can break down with a certain probability

Resource transformation

We have different kinds of machine:

Boiler:

needs fuel and water to operate

takes some time to transform water into steam

Can also break down with a certain probability

Steam engine:

needs a source of steam

takes some time to produce a certain amount of electricity

can break down with a certain probability

Resource transformation

We have different kinds of machine:

Stone furnace:

needs fuel to operate

takes a fixed number of minerals
and turns them into a fixed number
of manufactured goods

Can also break down with
a certain probability

Assembling machine:

needs an electrical source to operate

takes some time to produce a certain
number of products from some resources

can break down with a certain probability

Resource routing

We have different types of transportation:

 Rails   Pipe   Electric pole

transports minerals   -   water or steam   -   electricity
or products

takes some time per transport unit and a maximum number of resources is authorized

possible technical failure with a certain probability
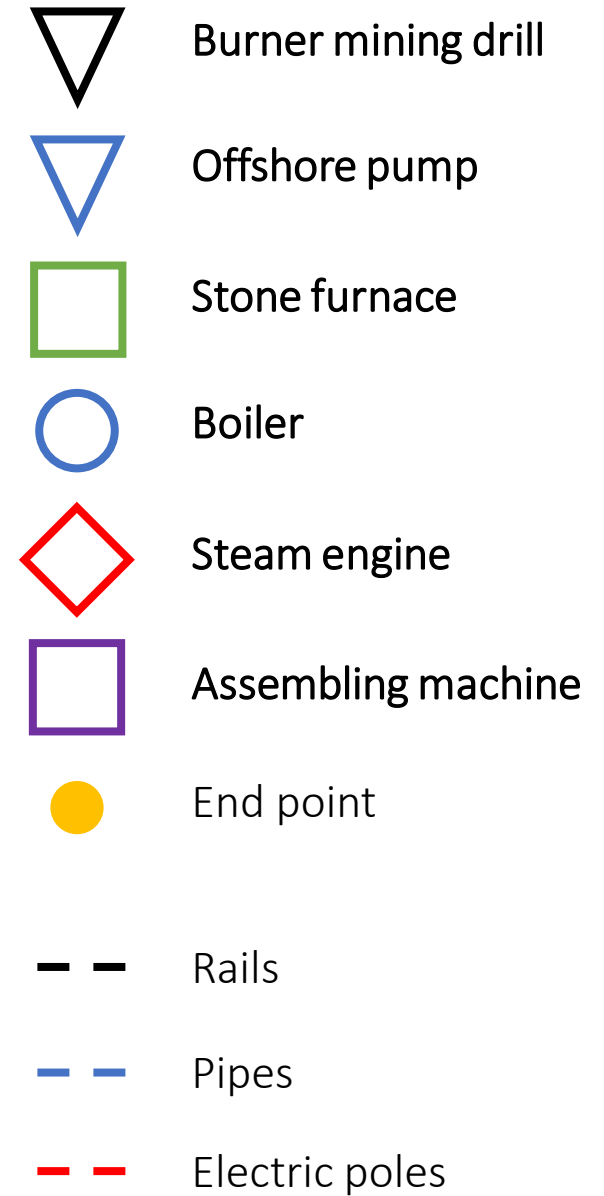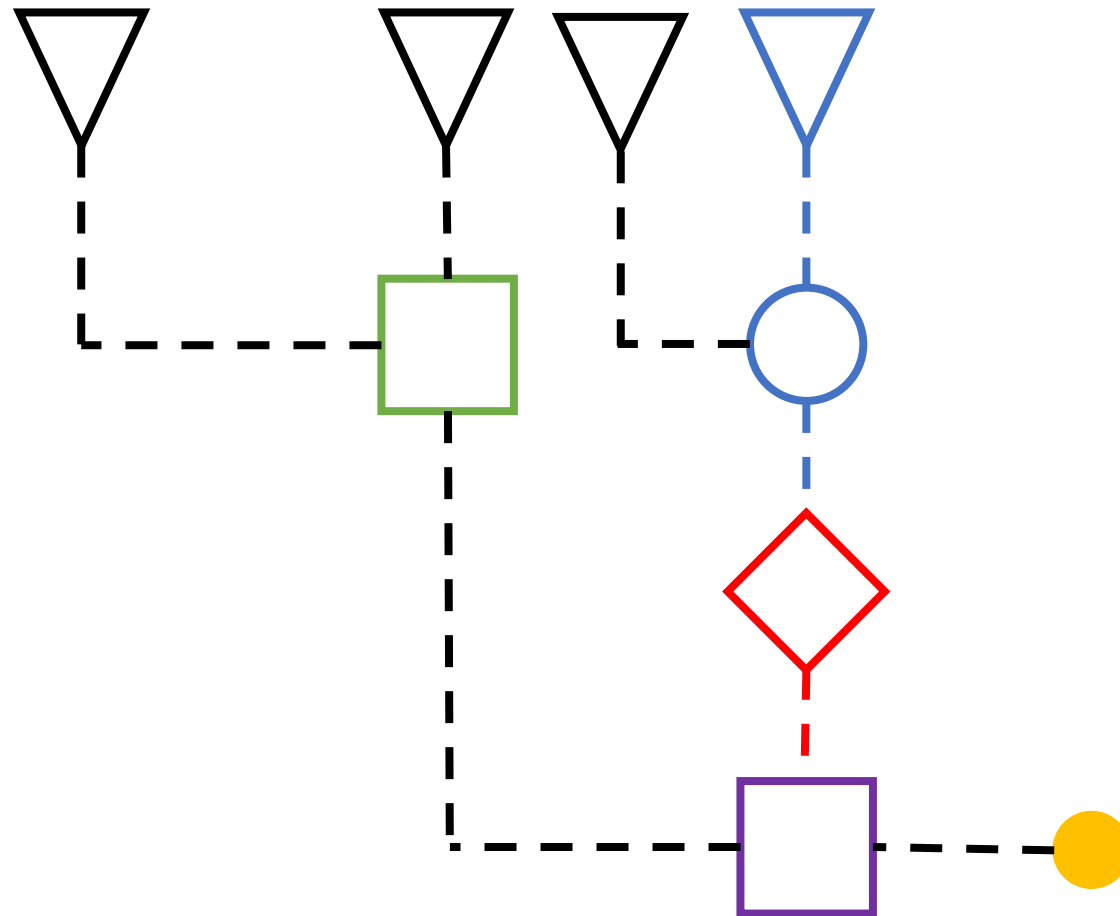
Production line: Properties

The idea would be to observe the impact on the overall production of a production chain when disruptive events take place

These events can be possible technical failures but also the variability in the extraction of resources

Production line: Model

Burner mining drill

Offshore pump

Stone furnace

Boiler

Steam engine

Assembling machine

End point

Rails

Pipes

Electric poles

8

Work incoming

Look for properties to check

Study more modeling and simulation of production flows

     - Action flow table

     - Petri network

See tools to model industrial processes

See how to use PRISM with our system

References

PRISM: https://www.prismmodelchecker.org/

Factorio wiki: https://wiki.factorio.com/Main_Page

Modélisation et simulation de flux de production:

Franck Fontanili, *Intégration d'outils de simulation et d'optimisation pour le pilotage d'une ligne d'assemblage multiproduit à transfert asynchrone,* Partie IV, page 87-133

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