Quality of Service in Loop for Better Robot Navigation

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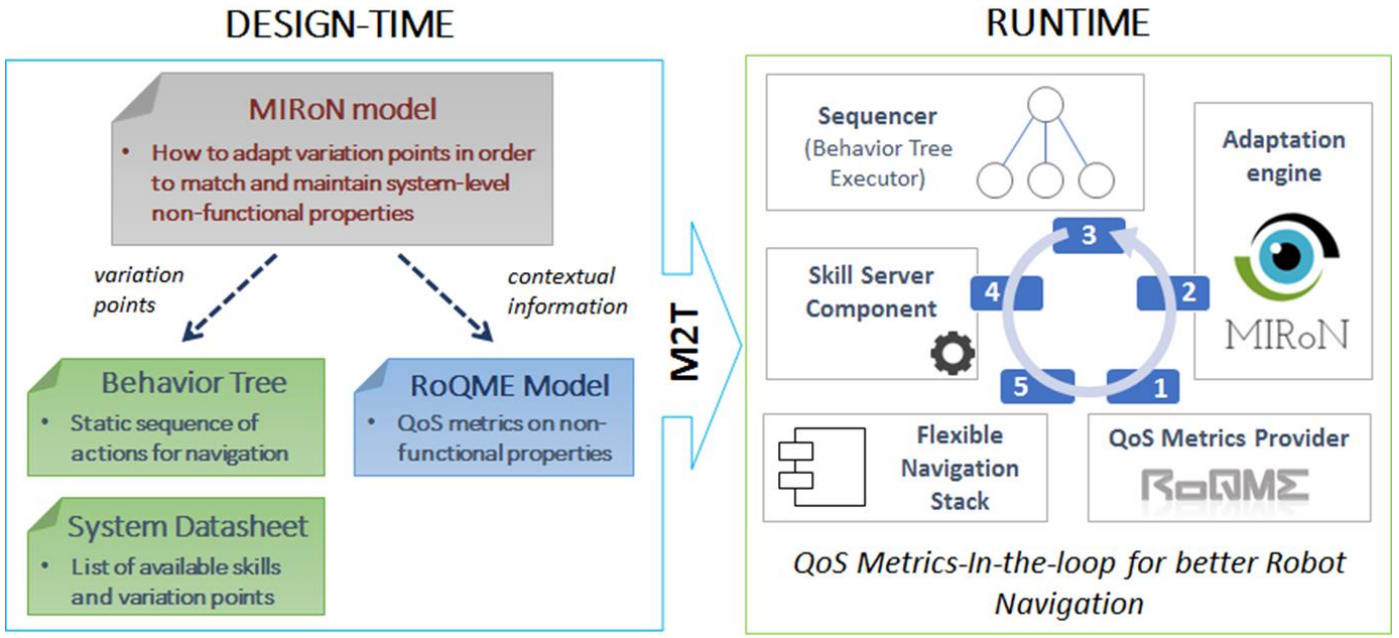
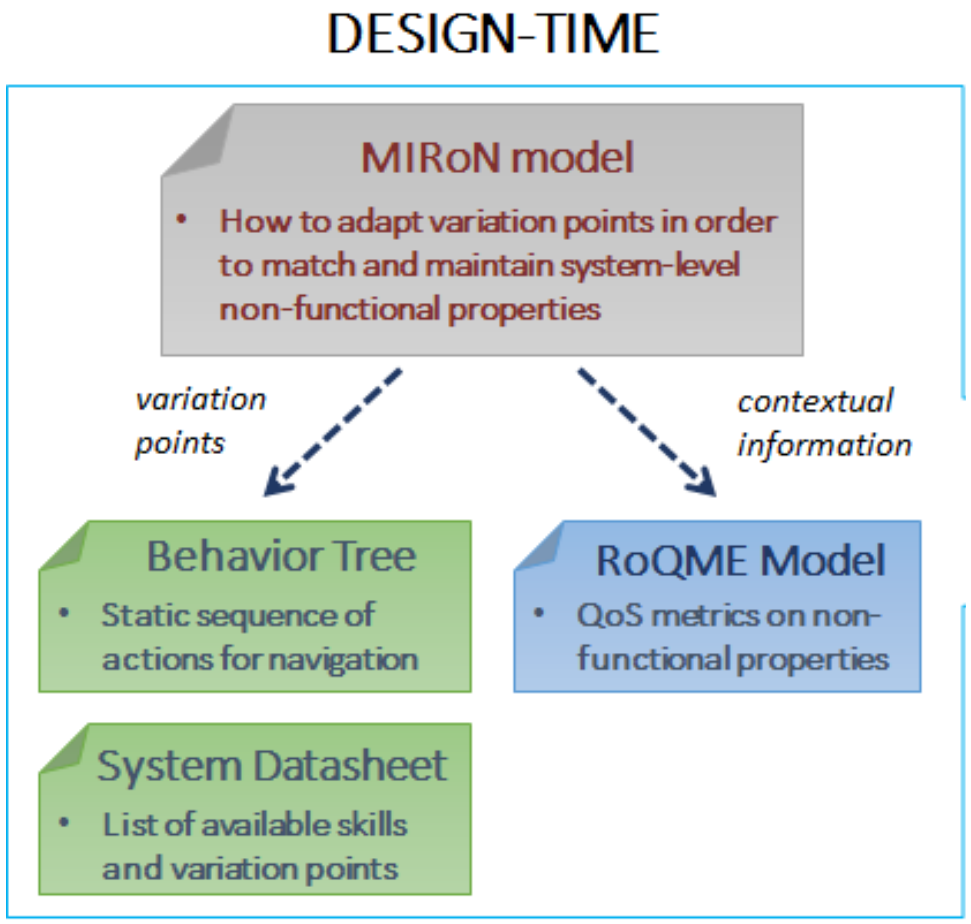
- Adaptive robot navigation at design-time
- Composition and runtime self-adaptation
- Experimental evaluation
- Conclusions and future work

Introduction



https://github.com/MiRON-project

Introduction



- Variation points
- Contexts
- Adaptation policies

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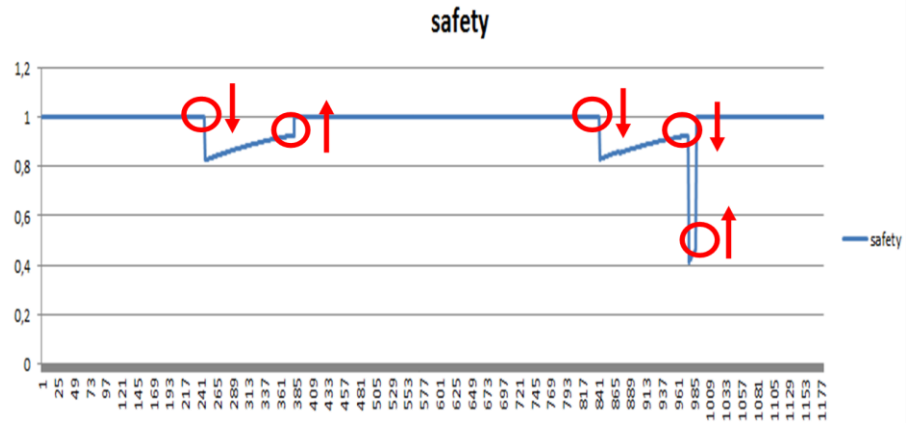
Adaptive robot navigation at design-time

RoQME models

```
property safety reference 1
property power_autonomy reference 1
property mission_completion reference 0,5
```

```
context PeopleInRoom : Boolean
context WantedPersonFound : Boolean
context BatteryLevel : number
context BatteryCharging : Boolean
context RobotBump : Boolean
context PersonBump : Boolean
context ObjectIdentified : Boolean
context SearchingPerson : Boolean
```

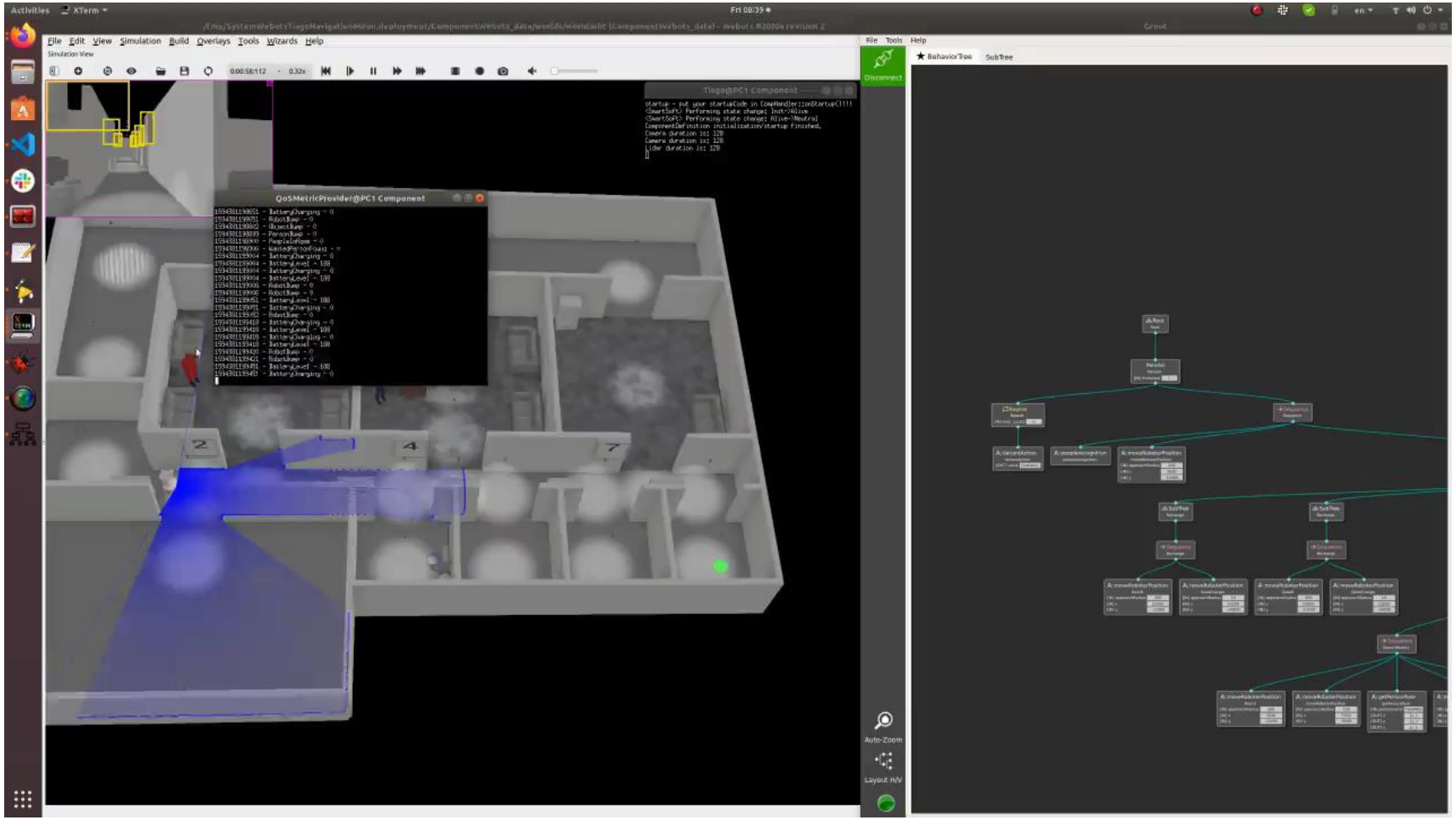



```
o1 : eventWhen ( ObjectIdentified ) reinforces safety
o2 : eventWhen ( !PeopleInRoom )    reinforces safety
o3 : ( RobotBump -> !RobotBump )    reinforces safety low
o4 : eventWhen ( PeopleInRoom )     undermines safety low
o5 : eventWhen ( PersonBump )       undermines safety high
...
```

Observations

Adaptive robot navigation at design-time

Nominal Behavior Tree models

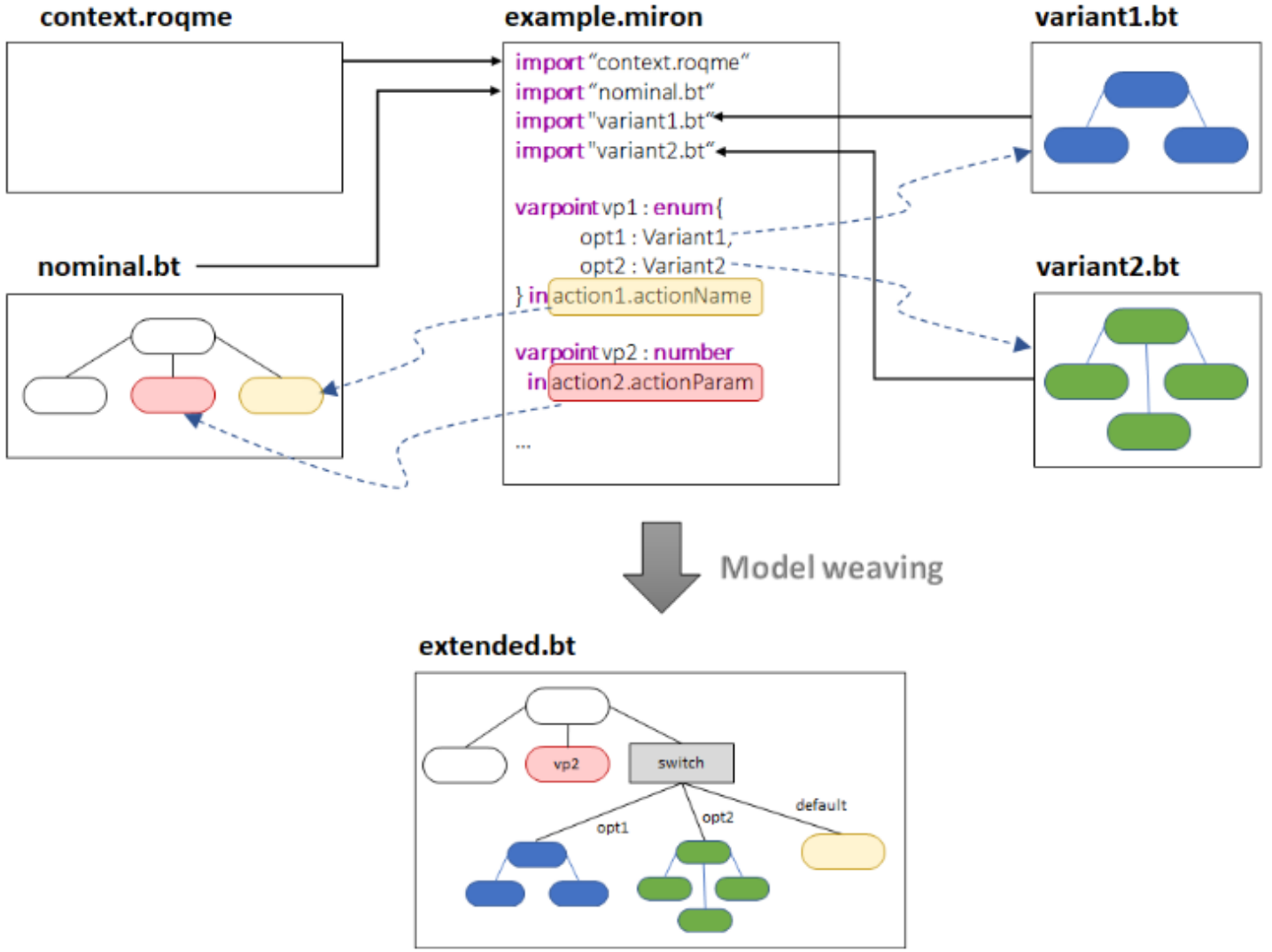


https://github.com/BehaviorTree/Groot

https://www.behaviortree.dev/

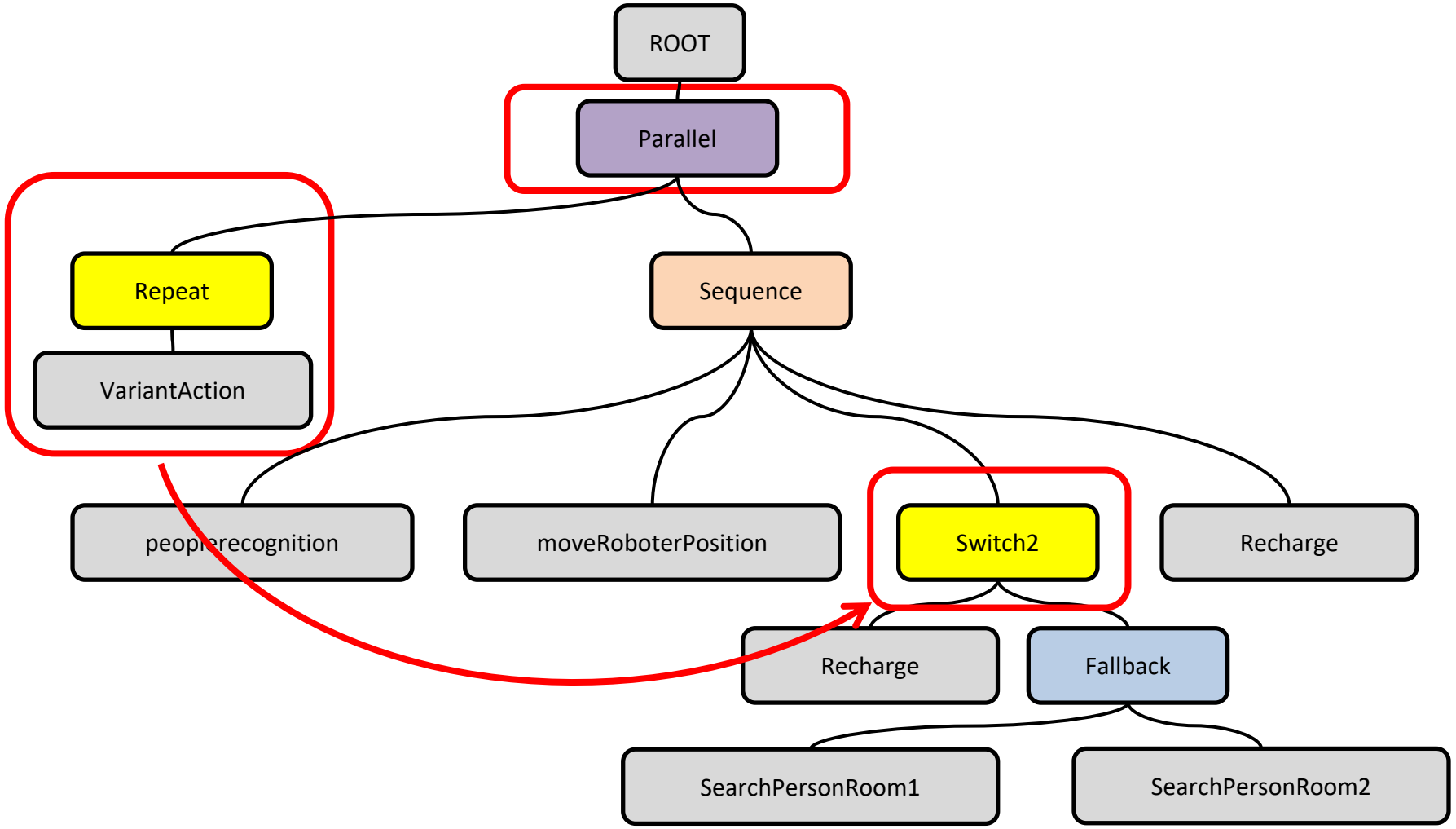
Adaptive robot navigation at design-time

Modeling behavior variability in MIRoN



Adaptive robot navigation at design-time

Modeling behavior variability in MIRoN



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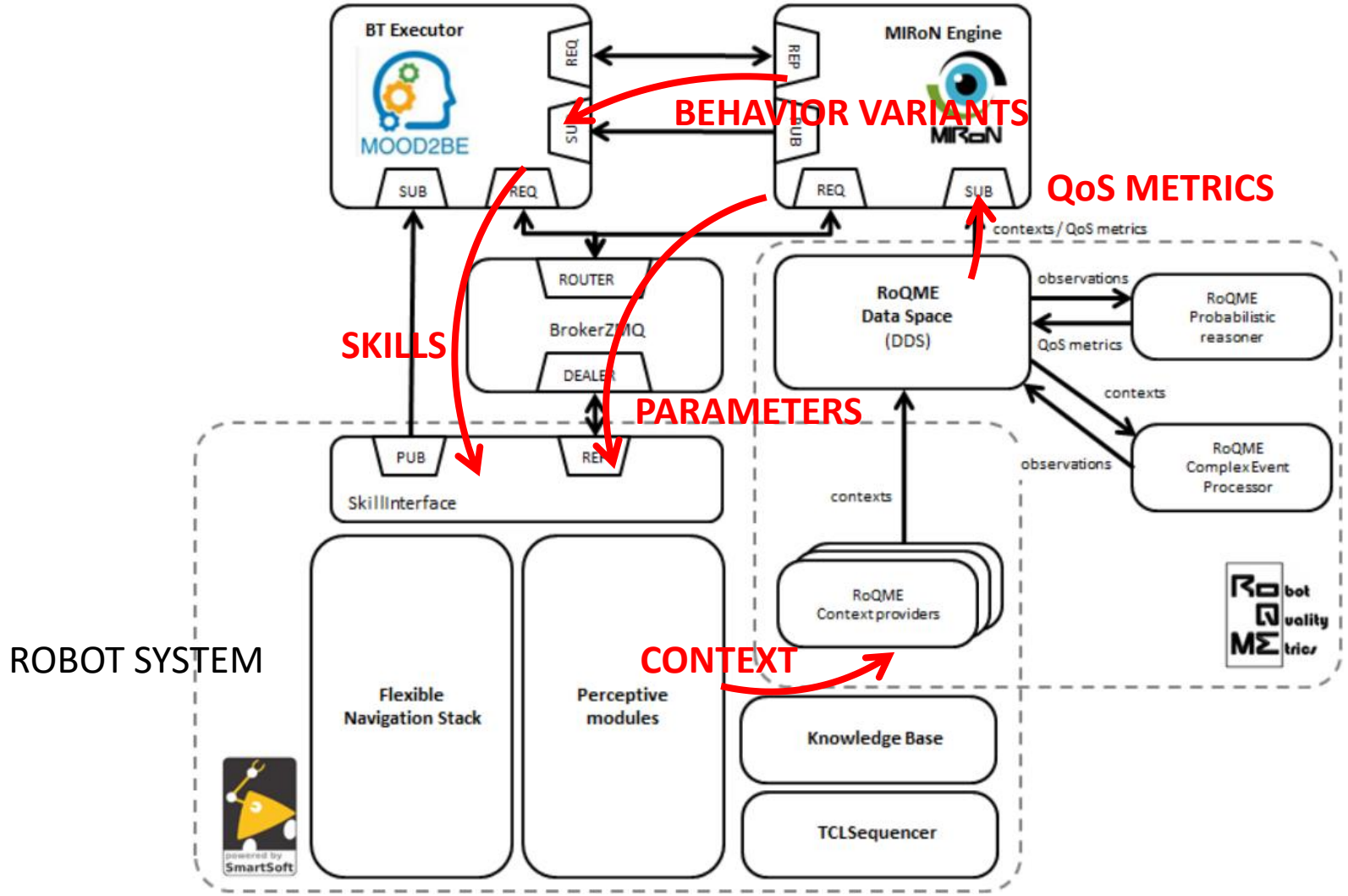
Composition and runtime self-adaptation



ROBOT SYSTEM

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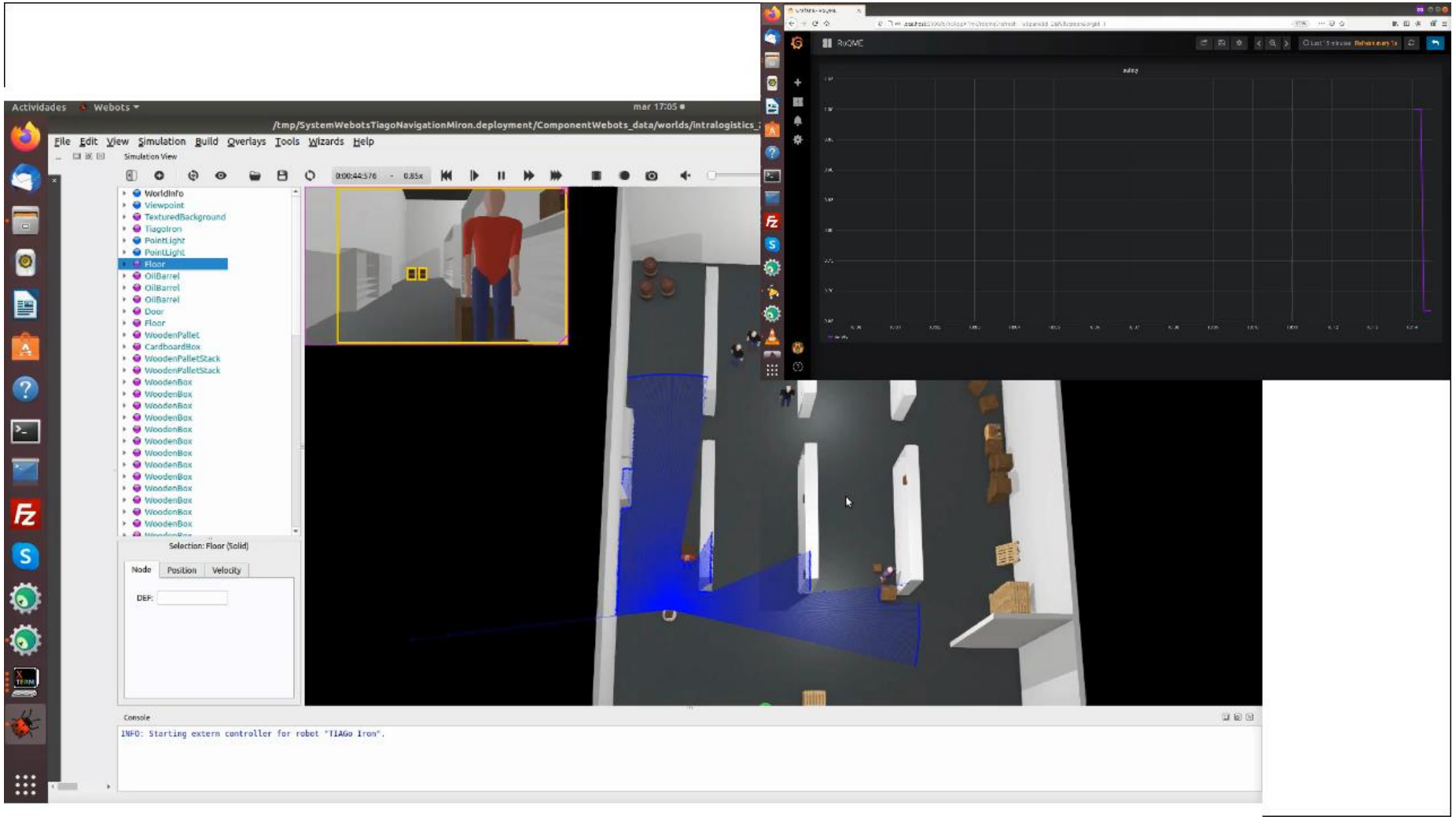
Experimental evaluation



Conclusions and future work

MIRoN supports…

- The runtime prediction and estimation of QoS metrics defined on non-functional properties.
- The systematic use of models for dynamically reconfiguring the robot behavior, defined in terms of Behaviors Trees.

Future planes include…

- Dealing with different sources of uncertaininty.
- Supporting reconfigurations at the component-level (rewiring).
- Applying reinforcement learning techniques enabling meta-adaptation.

Thank you!

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@MIRoN_ITP (https://twitter.com/miron_itp)

https://github.com/roqme/
https://github.com/MiRON-project/