

Real-time visualization of robot operation sequences

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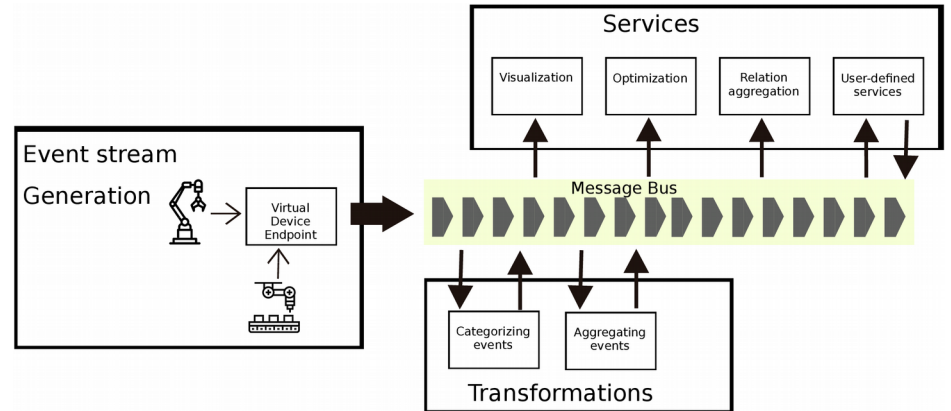
We would like to....

- Visualize the ongoing operations
- Have virtual models mimic physical systems
- Evaluate system performance
- Understand the behavior of the system

To be able to perform these tasks we require large amount of data!

Gathering data

- Event driven, scalable architecture.
- Robot actions are converted to event streams by the Virtual device.
- Events are then transformed by a series of transformations into an usable abstraction.
- Services continuously perform computations on events based on user requirements.



The Data

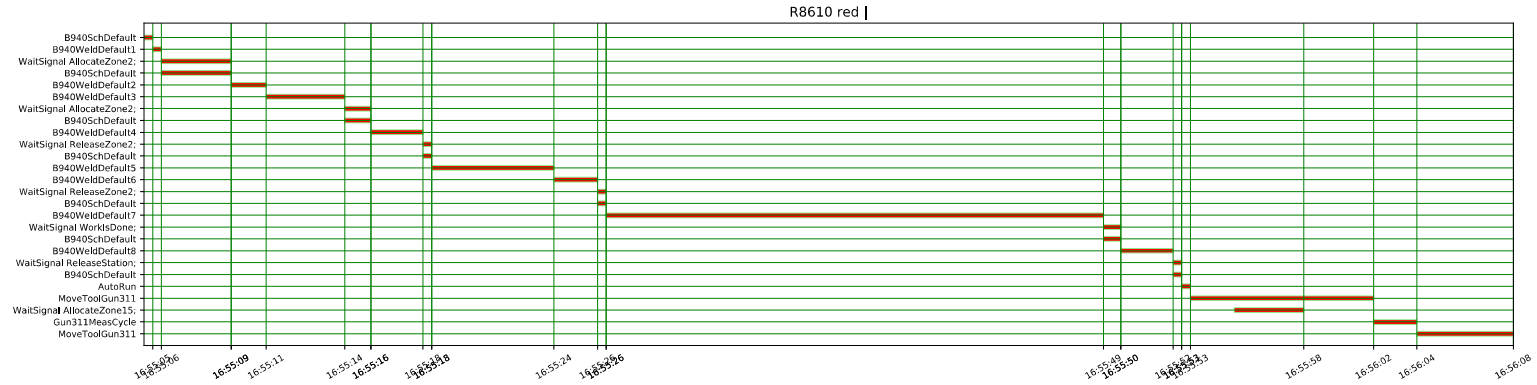
- Structured data.
- Each line defines an event:
 - Name of the operation.
 - Time of execution.
 - Resource where executed.
 - Defining start or stop.

false	ExecEngine;	r8253	2017-10-19T09:28:54.182+02:00	wait	17410101
false	ExecEngine;	r8254	2017-10-19T09:28:54.166+02:00	wait	17410101
false	main	r8256	2017-10-19T09:28:53.979+02:00	routines	17410101
true	D930SchDefault	r8256	2017-10-19T09:28:53.979+02:00	routines	17410101
false	D930SchDefault	r8256	2017-10-19T09:28:54.369+02:00	routines	17410101
true	D930WeldDefault1	r8256	2017-10-19T09:28:54.369+02:00	routines	17410101
false	WaitSignal AllocateZone3;	r8255	2017-10-19T09:28:54.447+02:00	wait	17410101
false	D931SchDefault	r8255	2017-10-19T09:24:29.981+02:00	routines	17410101
true	main	r8255	2017-10-19T09:24:29.981+02:00	routines	17410101
false	main	r8253	2017-10-19T09:28:54.182+02:00	routines	17410101
true	D931WeldDefault1	r8253	2017-10-19T09:28:54.182+02:00	routines	17410101
false	main	r8254	2017-10-19T09:28:54.166+02:00	routines	17410101
true	D931WeldDefault1	r8254	2017-10-19T09:28:54.166+02:00	routines	17410101
false	main	r8255	2017-10-19T09:28:54.447+02:00	routines	17410101

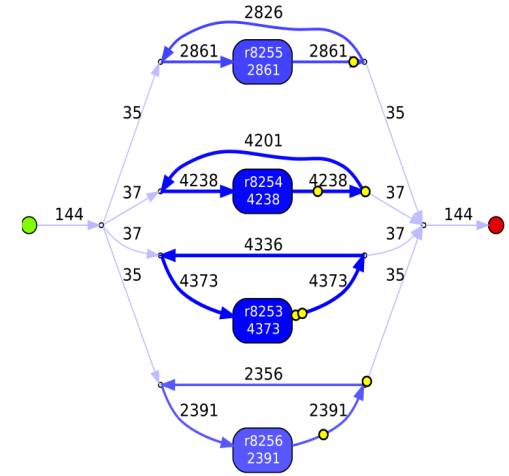
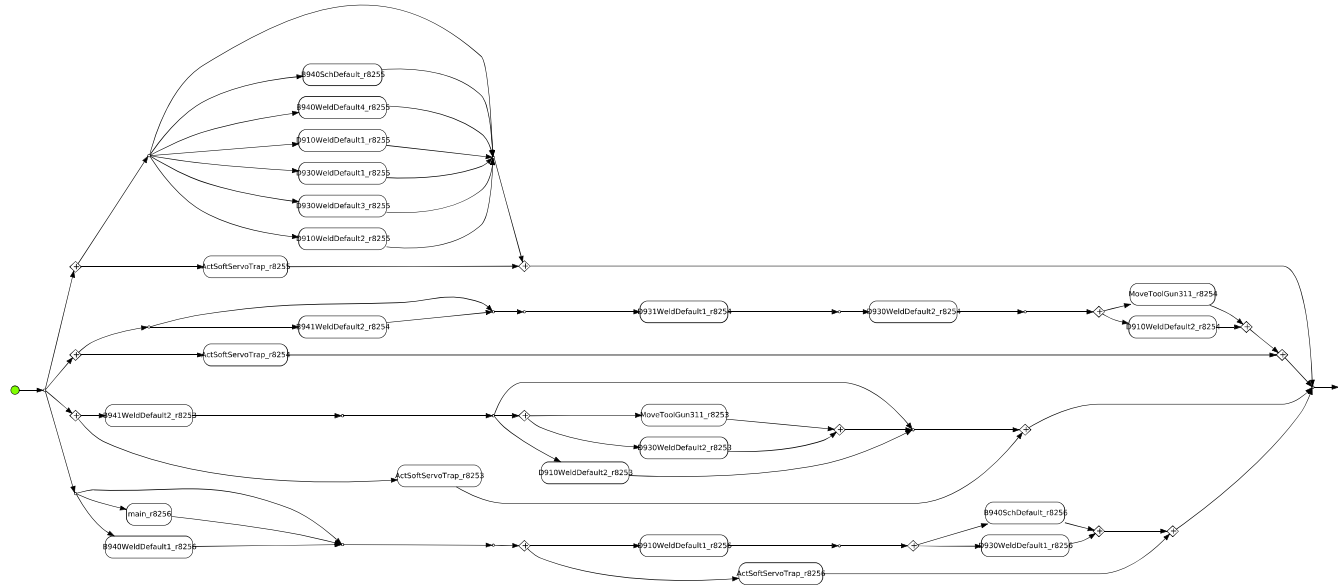
Applications

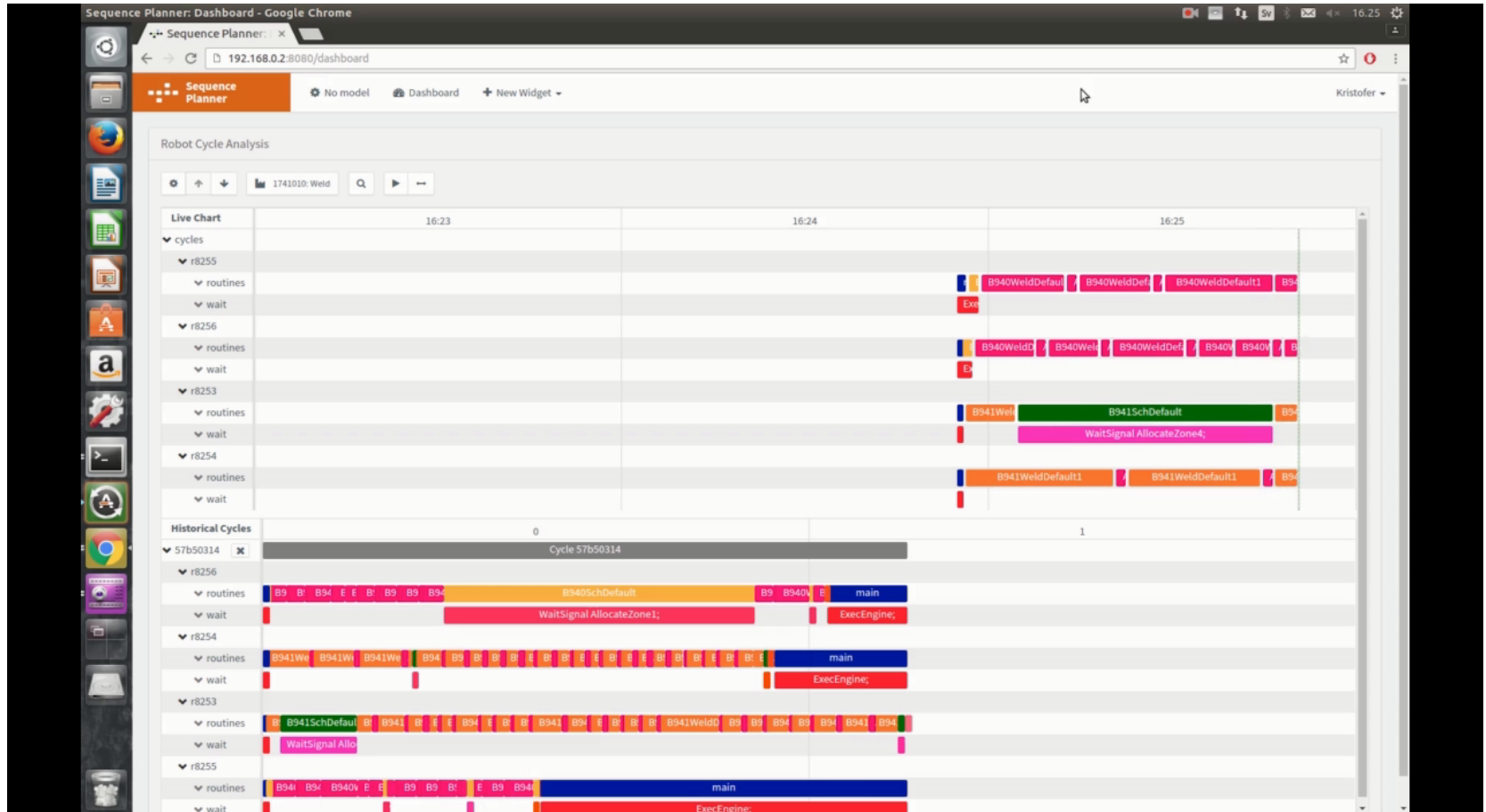
- Calculation of performance indicators
 - Cycle and wait time
 - Resource utilization
 - etc
- Visualizations
- Creation and verification of model
- Simulate a digital twin
- Behavior identification by tracing events

Gantt view



Model views





What next?

- Create events from PLC operations
- Can we use virtually created models along generated data to build more realistic models?
- Validation of generated models



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