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Runtime Deployment, Management and Monitoring of Web of Things Systems

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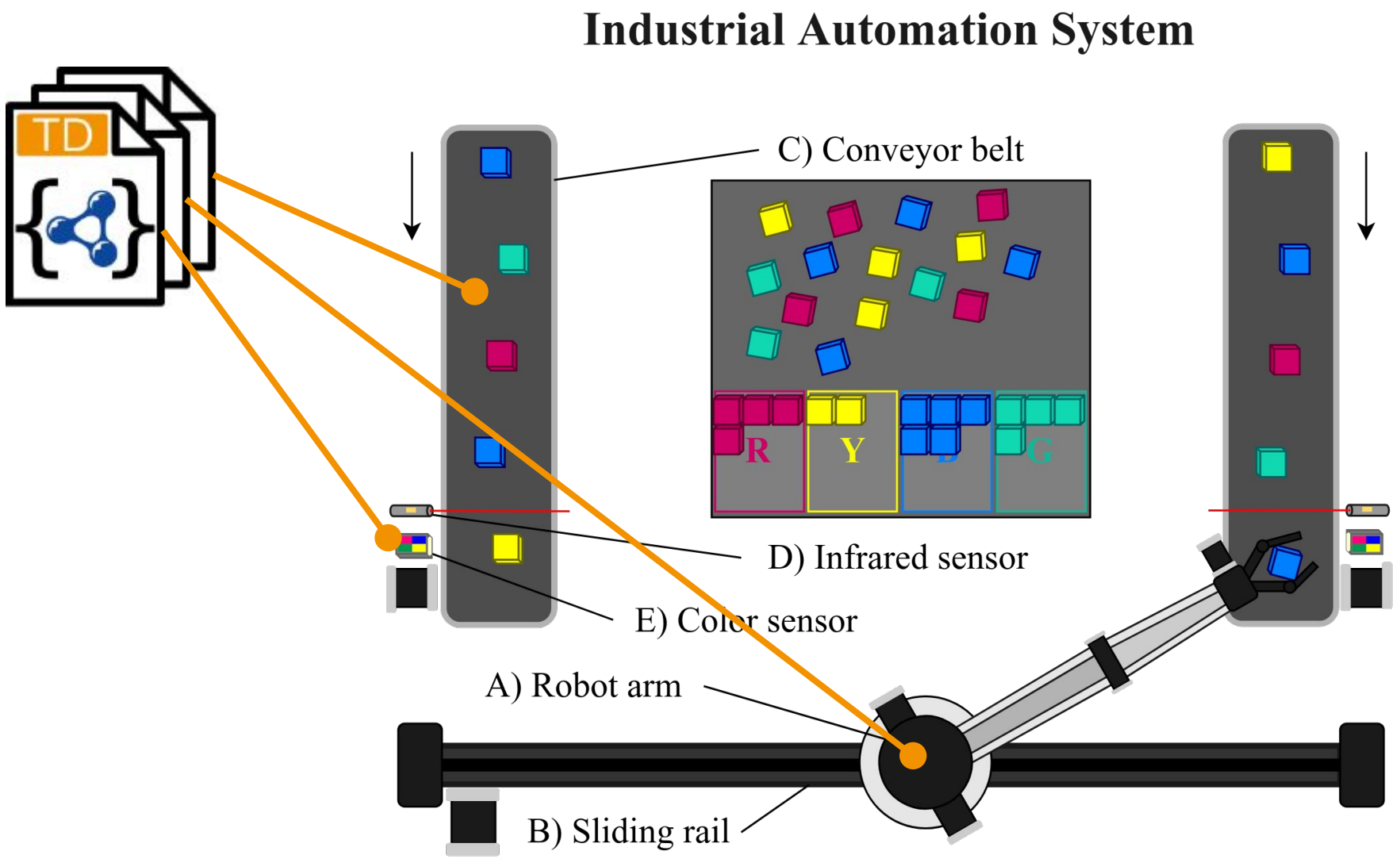
1. Introduction

2. Approach

3. Evaluation

4. Conclusion

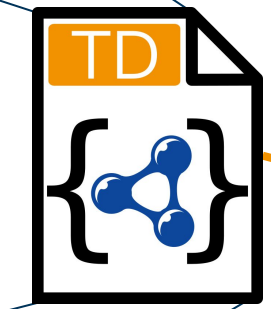
Motivation

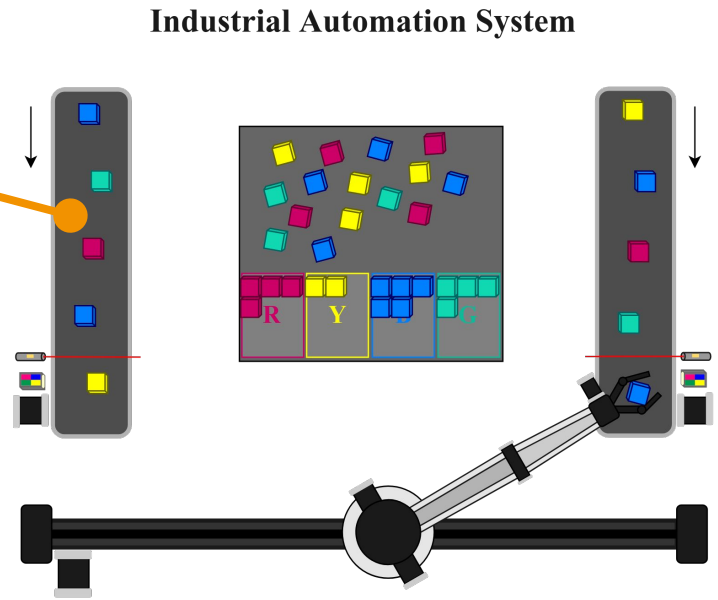

Industrial Automation System
TD
C) Conveyor belt
R
Y
G
D) Infrared sensor
E) Color sensor
A) Robot arm
B) Sliding rail

WoT Thing Description

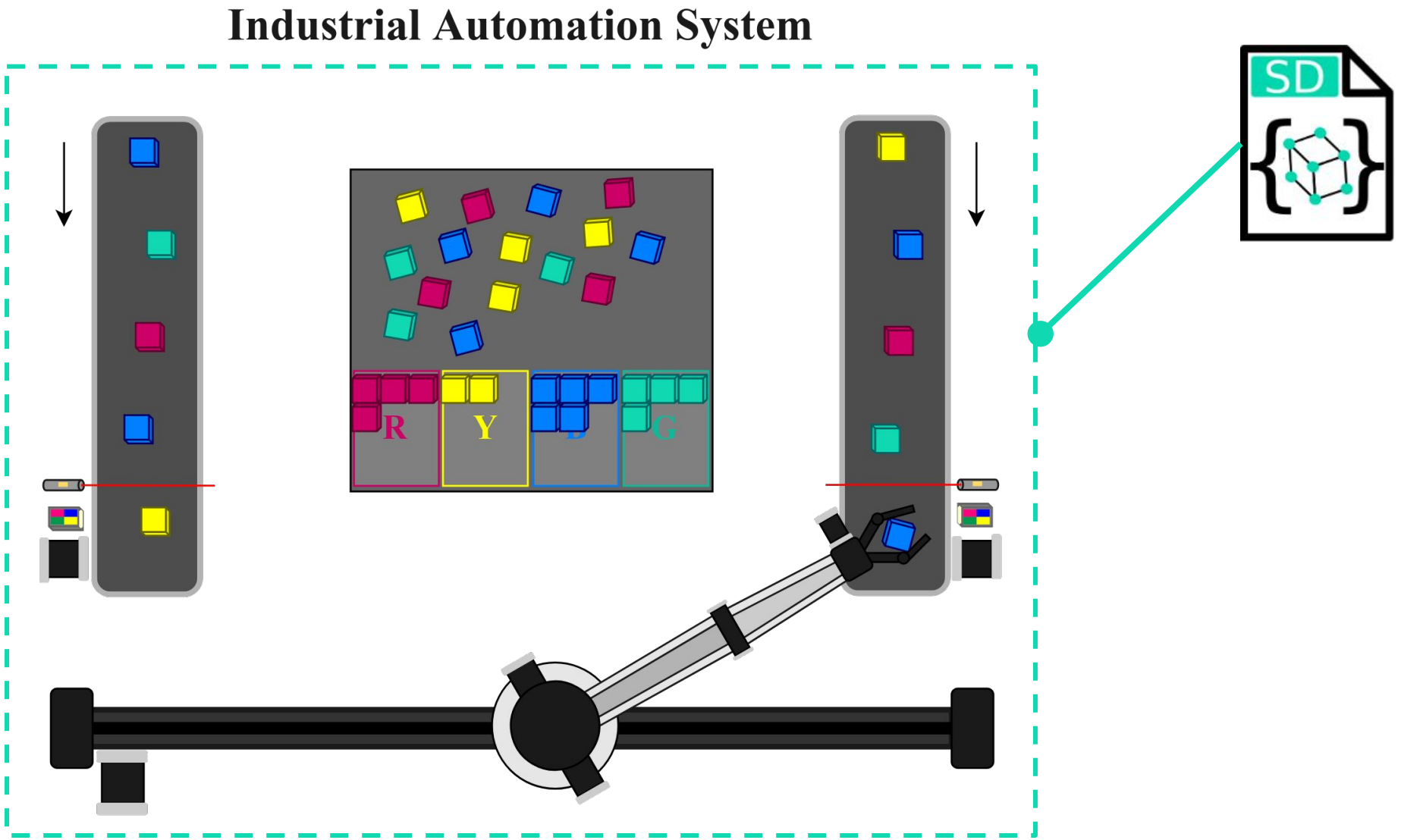
TD of Conveyor Belt

```
"name": "LeftConveyorBelt",
"@type": "conveyor-belt",
"properties": [
   "speed": {
        "type": "number",
        "minimum": -100.0,
        "maximum": 100.0
    },
   "status": {{
        "type": "string",
        "enum": [ "on", "off" ],
    }
],
"actions: [
   "start": {...},
   "stop": {...},
],
"events: [
   "emergencystop": {...},
],
"security": [...]
```





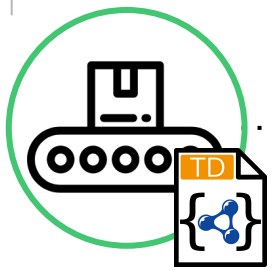
WoT System Description



Problem Statement

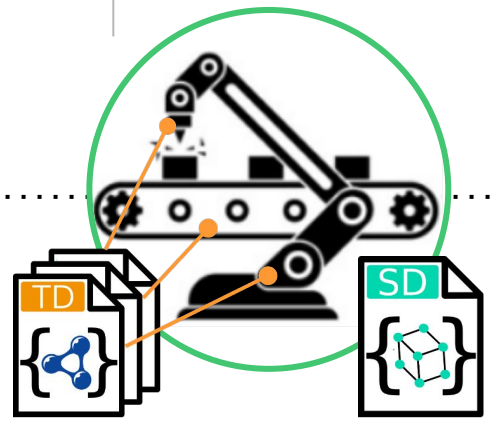
Thing Description

Allows modelling simple and complex **standalone Things**



System Description

Allows describing interaction logic between Things, in order **to create WoT Systems**

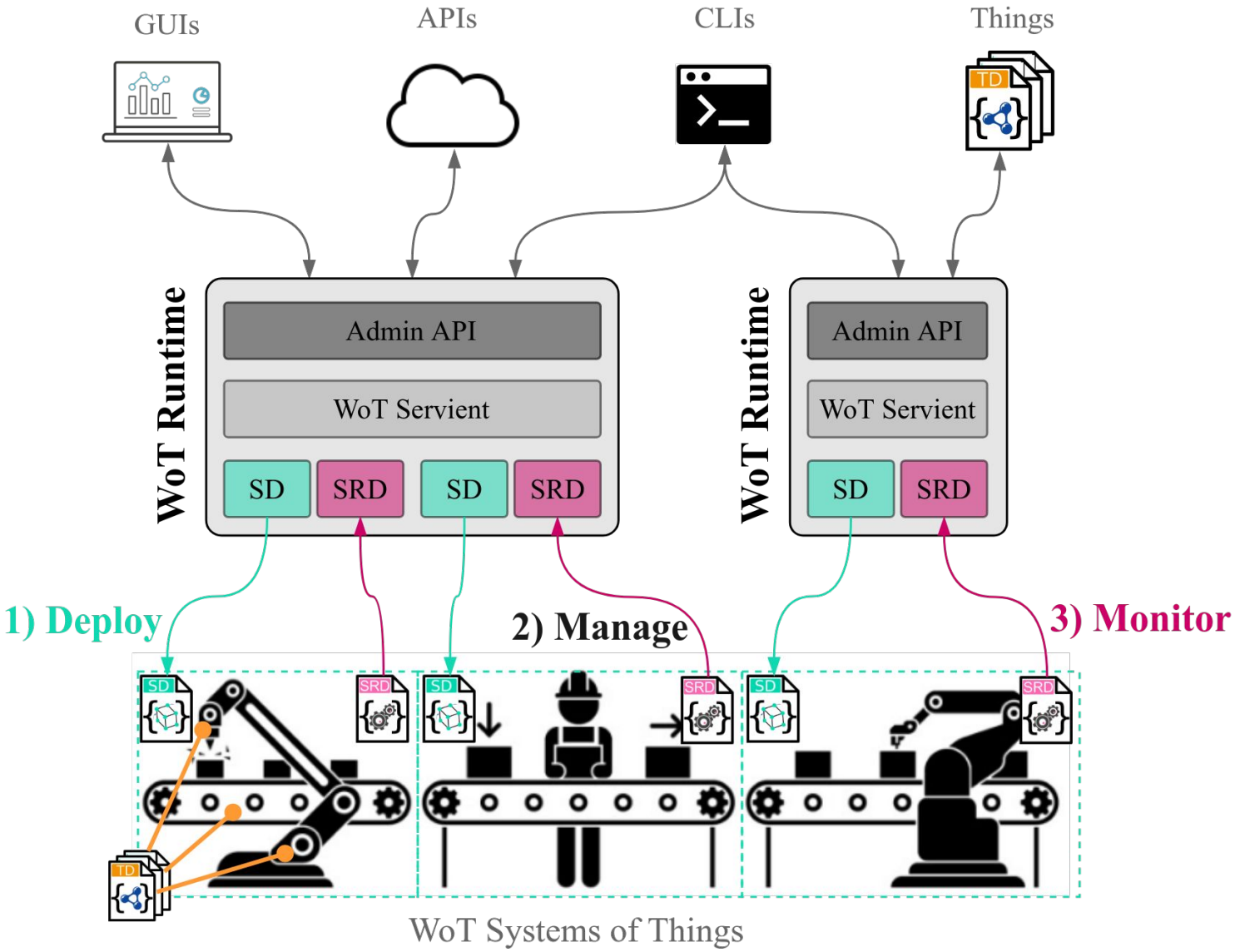


Development Tools

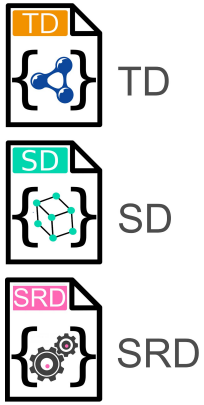
For **deployment, management, and monitoring** of WoT Systems

Approach

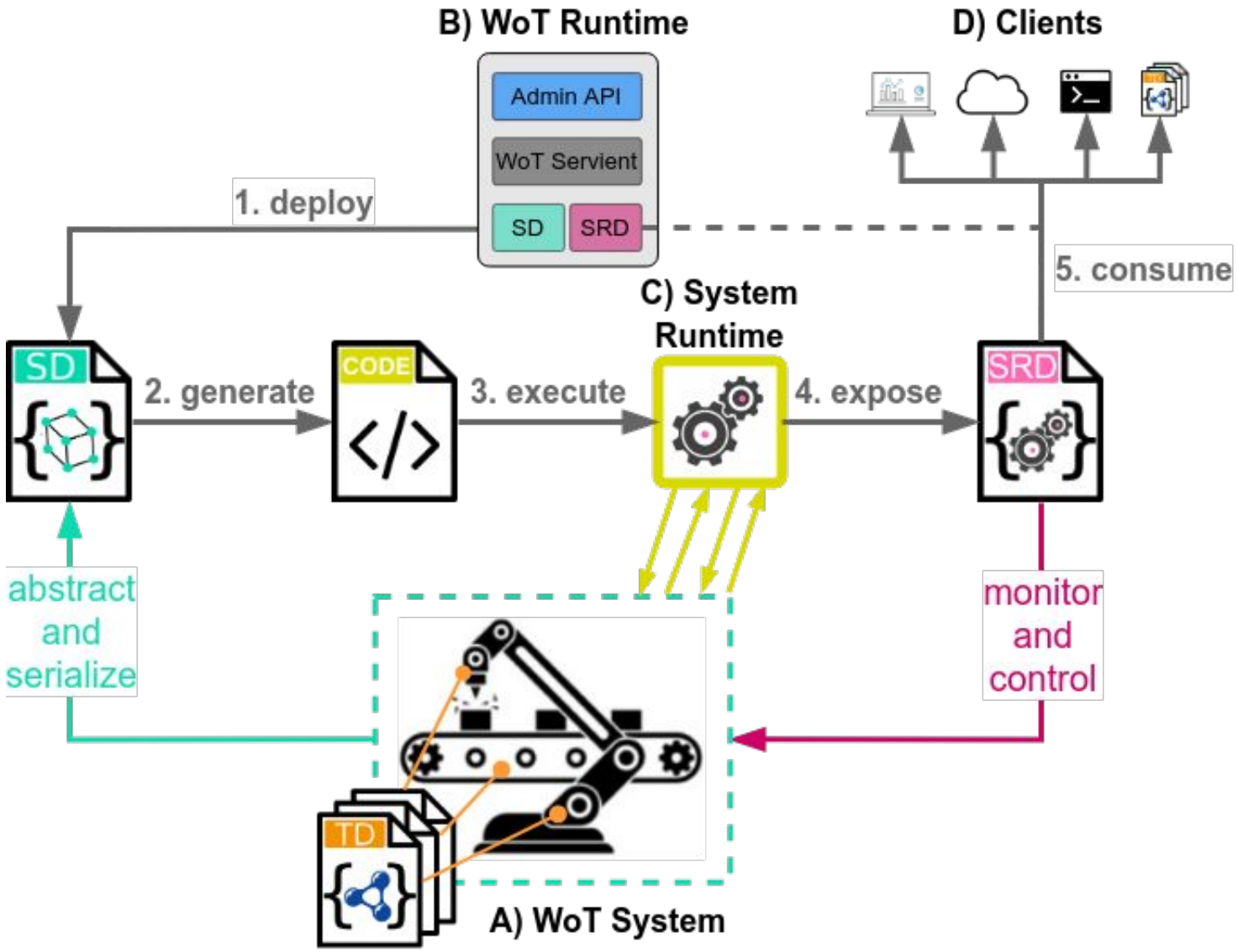
Overview



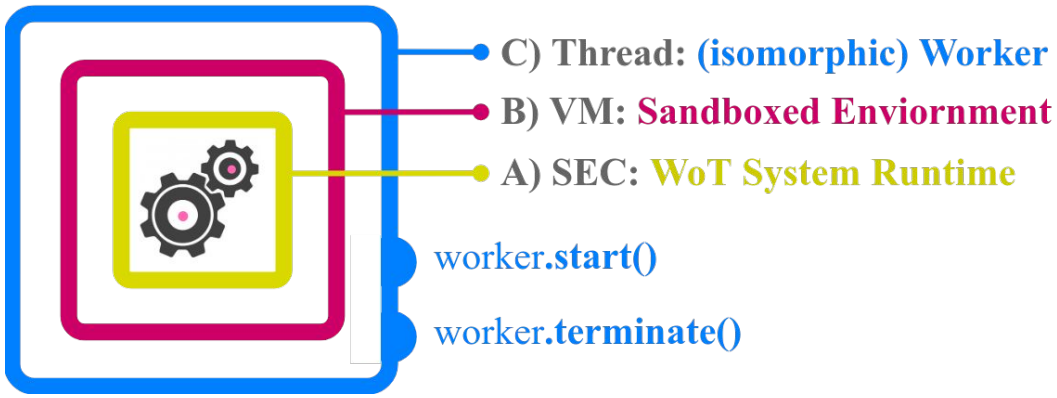
KEY

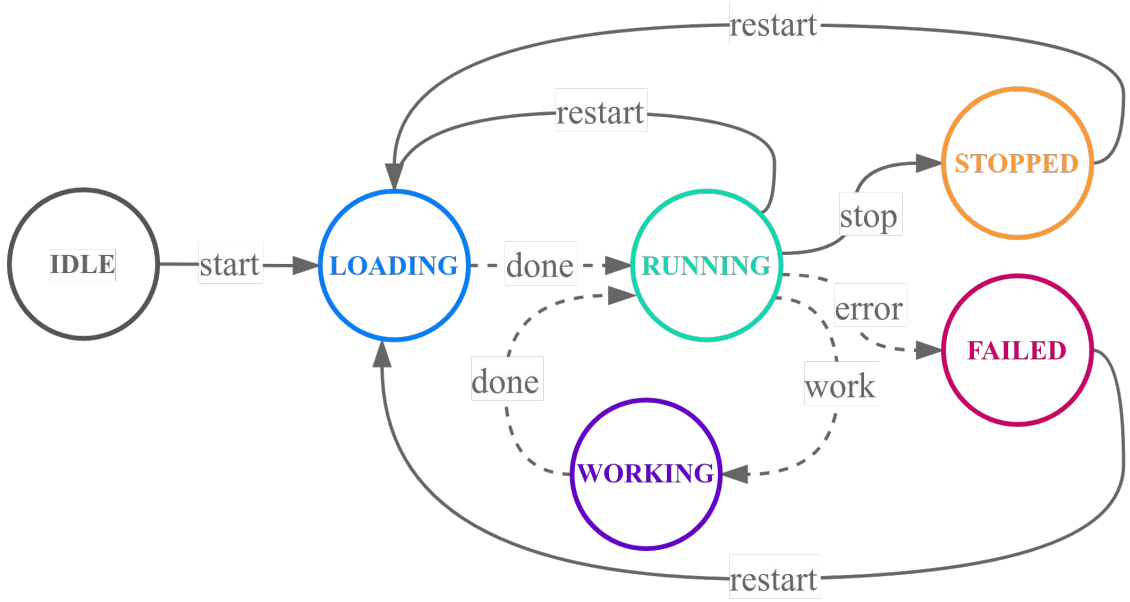


Methodology

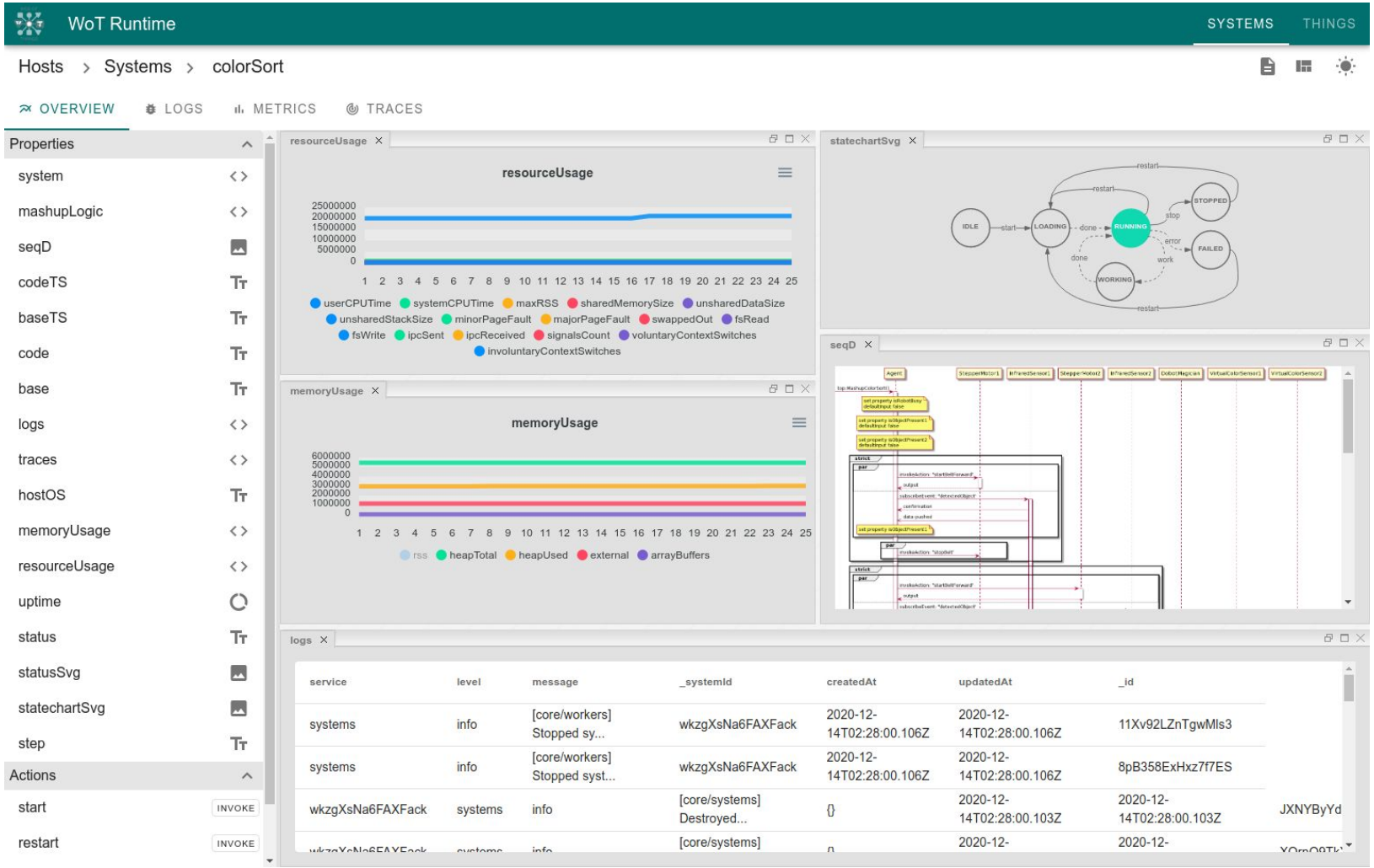


Execution Environment and Control

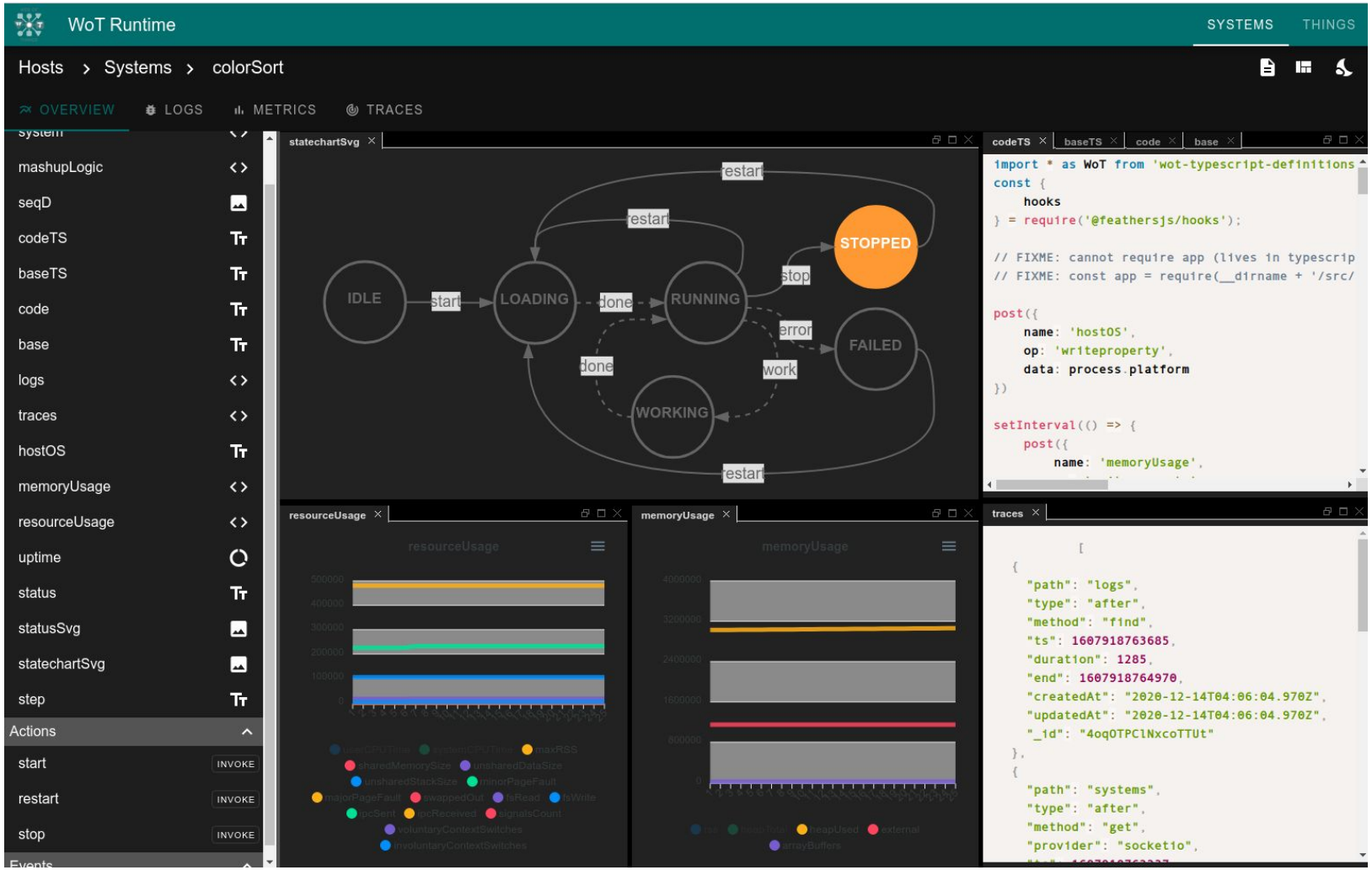




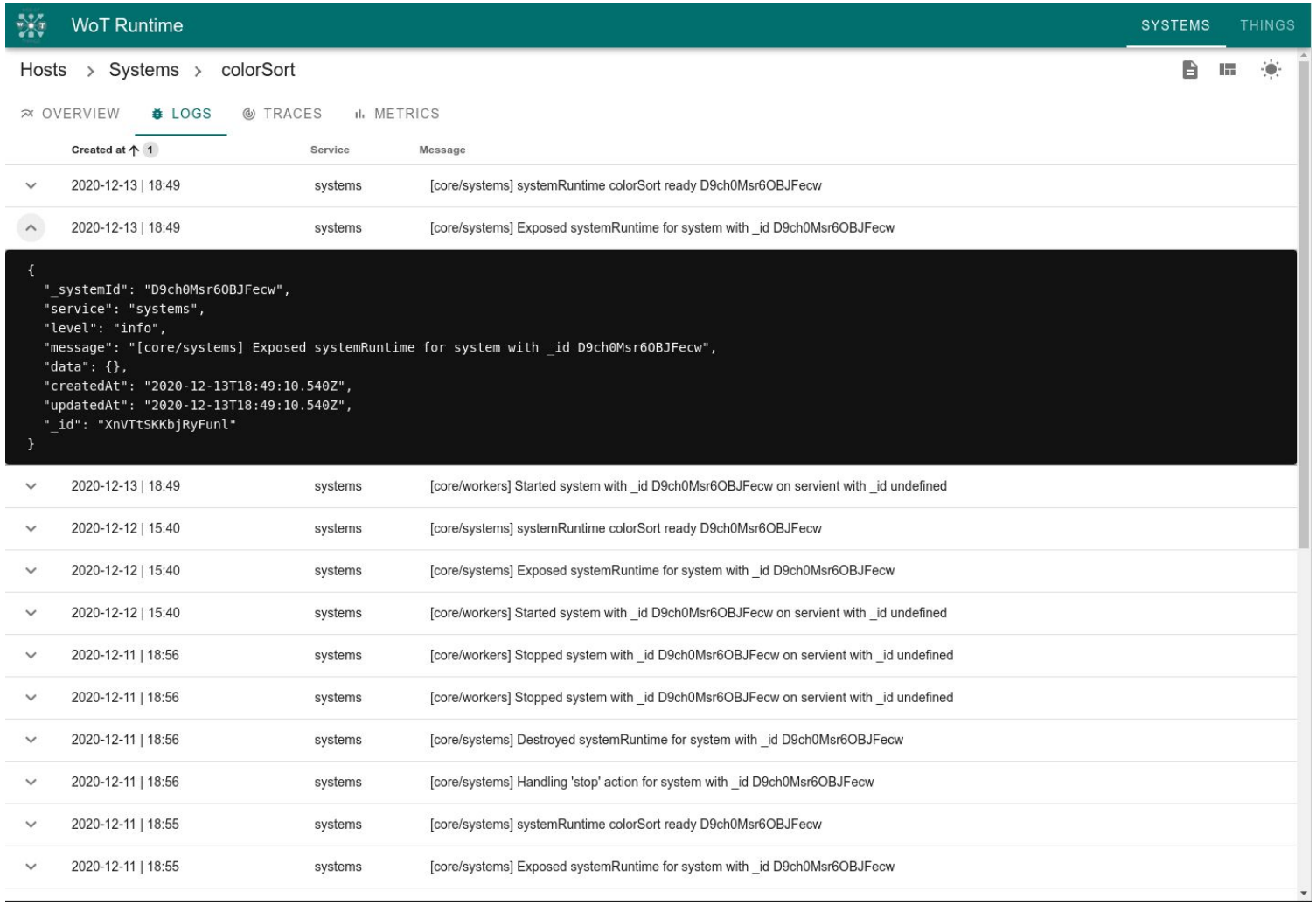
WoT Runtime UI - System Dashboard



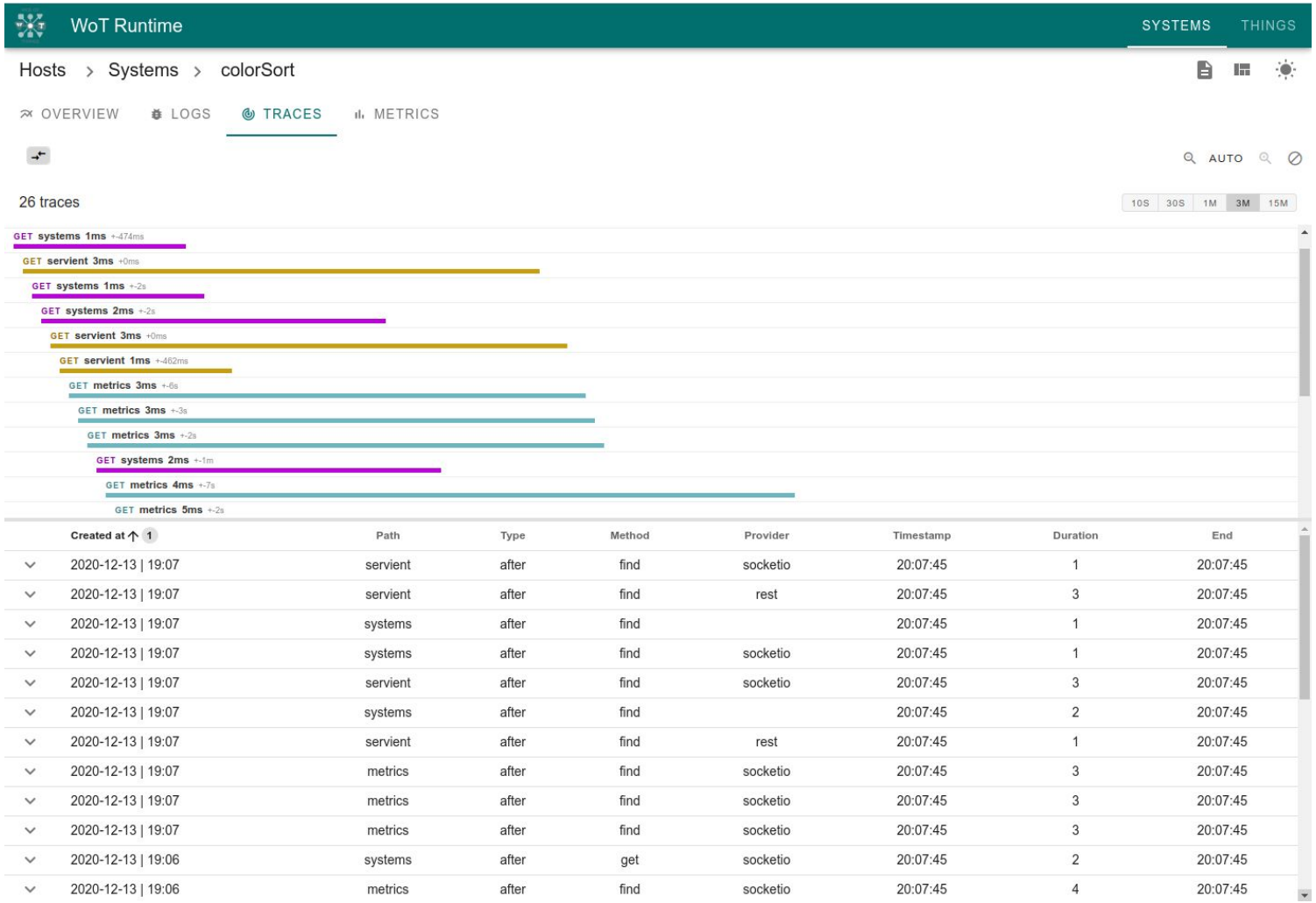
WoT Runtime UI - System Dashboard (dark)



WoT Runtime UI - Logs

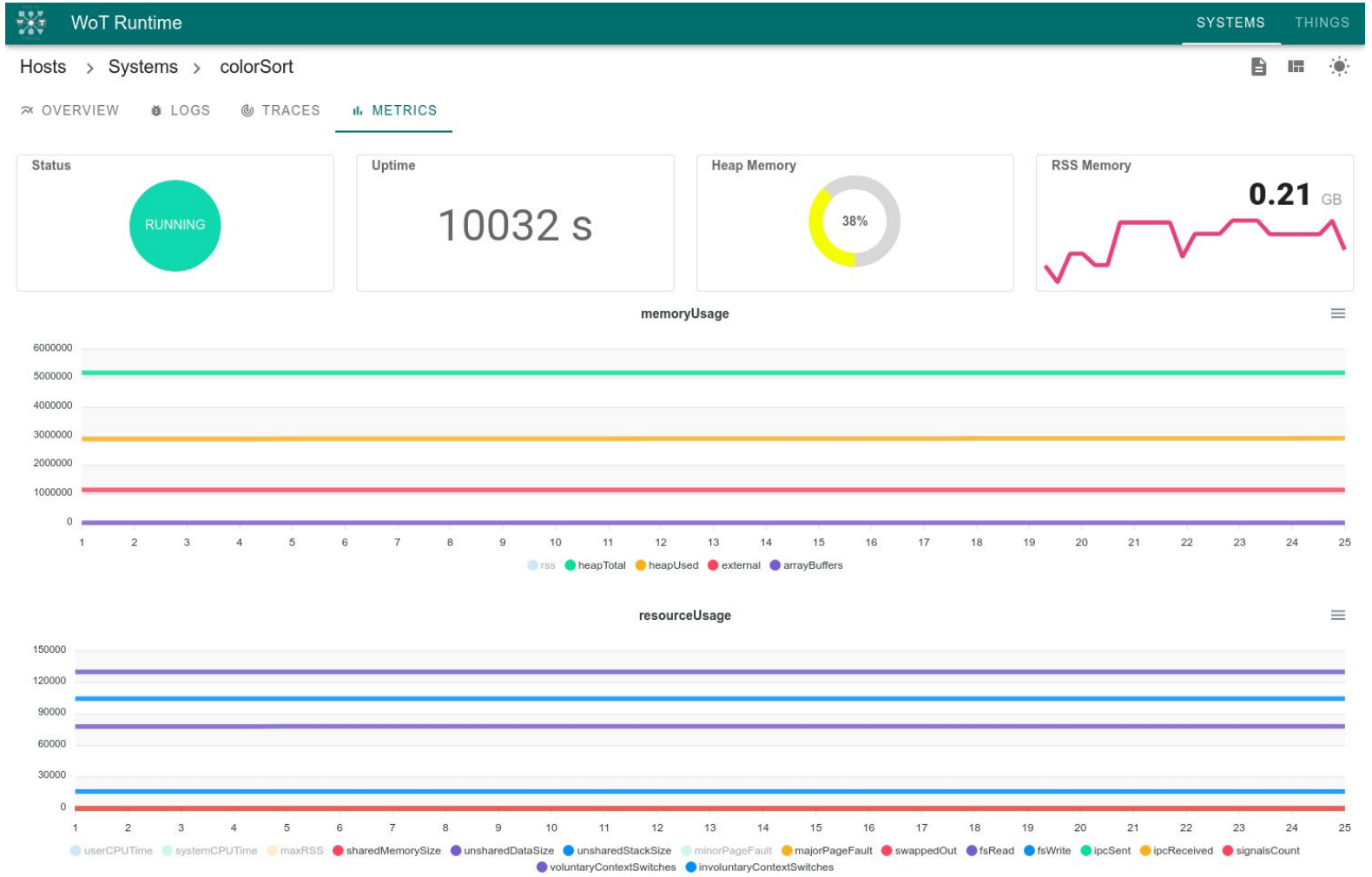


WoT Runtime UI - Traces



Created at	Path	Type	Method	Provider	Timestamp	Duration	End
2020-12-13 | 19:07	servient	after	find	socketio	20:07:45	1	20:07:45
2020-12-13 | 19:07	servient	after	find	rest	20:07:45	3	20:07:45
2020-12-13 | 19:07	systems	after	find		20:07:45	1	20:07:45
2020-12-13 | 19:07	systems	after	find	socketio	20:07:45	1	20:07:45
2020-12-13 | 19:07	servient	after	find	socketio	20:07:45	3	20:07:45
2020-12-13 | 19:07	systems	after	find		20:07:45	2	20:07:45
2020-12-13 | 19:07	servient	after	find	rest	20:07:45	1	20:07:45
2020-12-13 | 19:07	metrics	after	find	socketio	20:07:45	3	20:07:45
2020-12-13 | 19:07	metrics	after	find	socketio	20:07:45	3	20:07:45
2020-12-13 | 19:07	metrics	after	find	socketio	20:07:45	3	20:07:45
2020-12-13 | 19:06	systems	after	get	socketio	20:07:45	2	20:07:45
2020-12-13 | 19:06	metrics	after	find	socketio	20:07:45	4	20:07:45

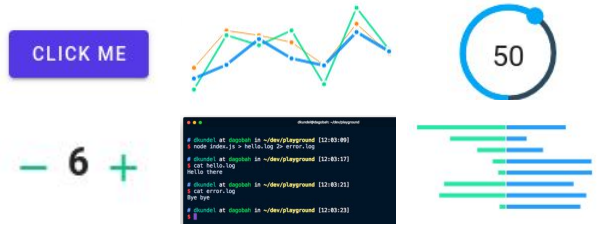
WoT Runtime UI - Metrics



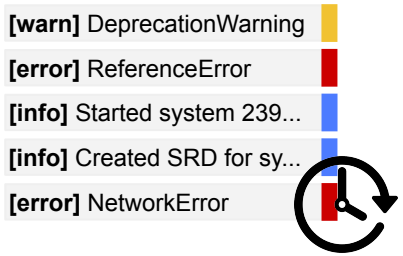
Results

Smart Farm Simulation Use Case

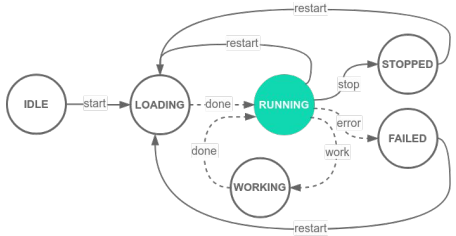
C) Mashup **monitoring and control** via auto-generated GUI

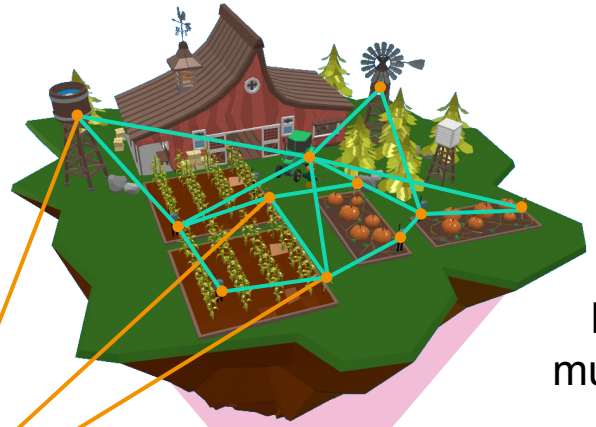


B) Runtime monitoring via **logs, metrics and traces**

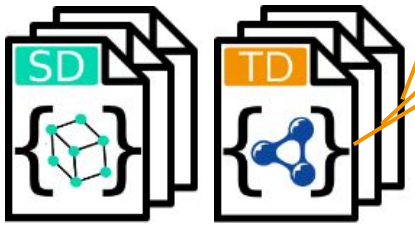


D) **Safe and secure** execution environment

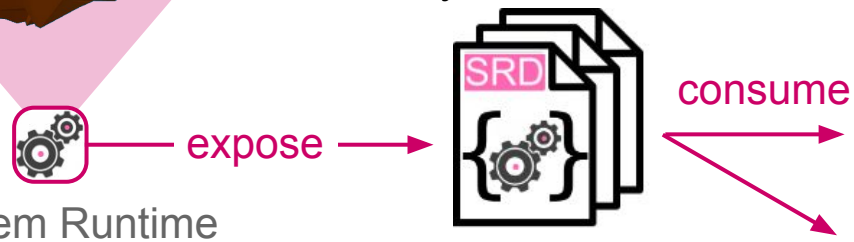




A) **Management** of multiple **SDs and TDs** via API



E) **SRD** for composing multi-layered architectures



System Runtime

Conclusion

In conclusion:

- The WoT Runtime Framework introduces an additional WoT building block for:
  - remote deployment of SDs into safe execution Environments,
  - management of WoT System Runtimes,
  - and monitoring and control through the auto-generated SRD
- The SRD allows composing multi-layered WoT architecutes
- The approach is evaluated in two use cases
  - An industrial automation scenario
  - and a smart farm simulation

  demonstrating how the proposed solution works in practice
- The WoT Runtime framework lays the basis for future in distributed WoT architectures

Thank you for your attention