# Model-checking State Machines in the Wild

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Automated Reasoning in Consumer Payments, Amazon.com

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If you knew **the historical state of every Thing** and could **correctly reason** on top of that data…

what **problems** would you solve?

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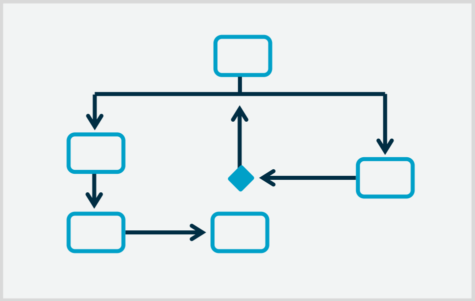
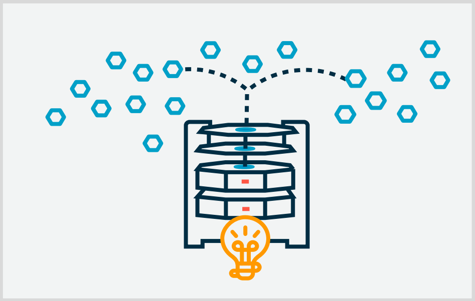
# AWS IoT Events

AWS IoT Events is a managed service that continuously monitors data from your equipment to identify their state, detect changes and trigger the appropriate responses when changes occur



Build simple logic to evaluate incoming telemetry data to detect stateful changes in equipment or a process

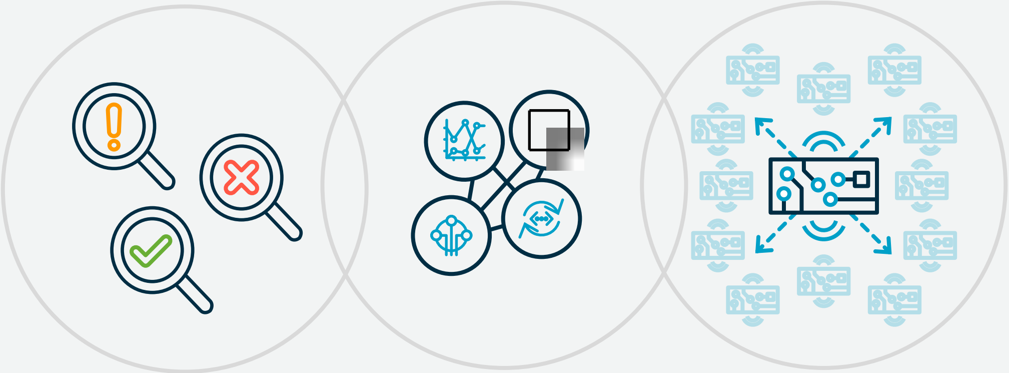


Detect events from data across thousands of sensors and other sources

Trigger responses to optimize operations

Analytics Services

# AWS IoT Events



### Event Detector Models and Alarms

Reduce the cost of device maintenance

### Trigger actions to other AWS services

Uncover new insights and trigger actions

### Auto-scale for your entire fleet

Easily automate operations

Analytics Services

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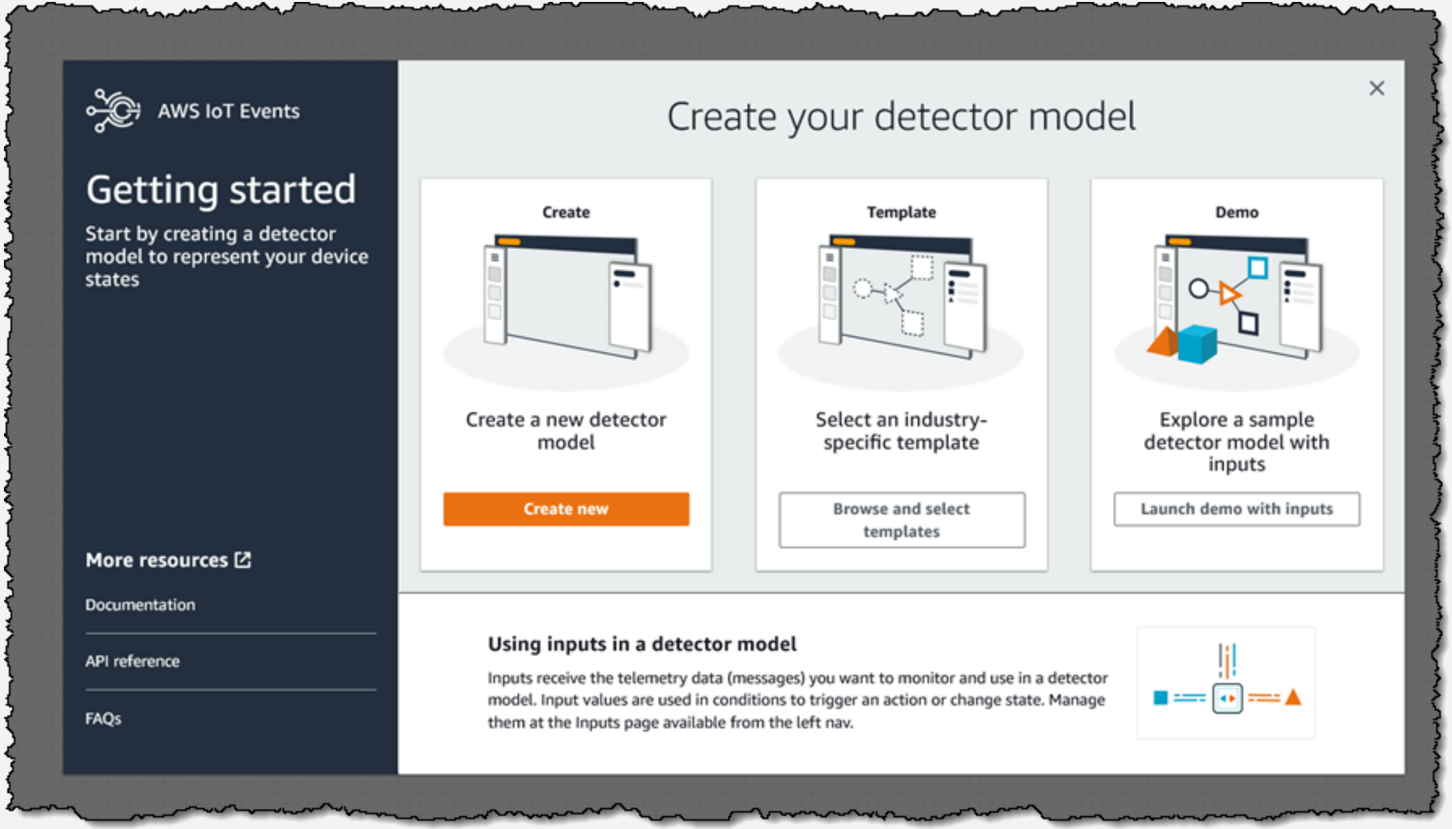
# AWS IoT Events



AWS IoT Events

## Getting started

Start by creating a detector model to represent your device states

More resources

Documentation

API reference

FAQs

## Create your detector model

**Create**

Create a new detector model

**Template**

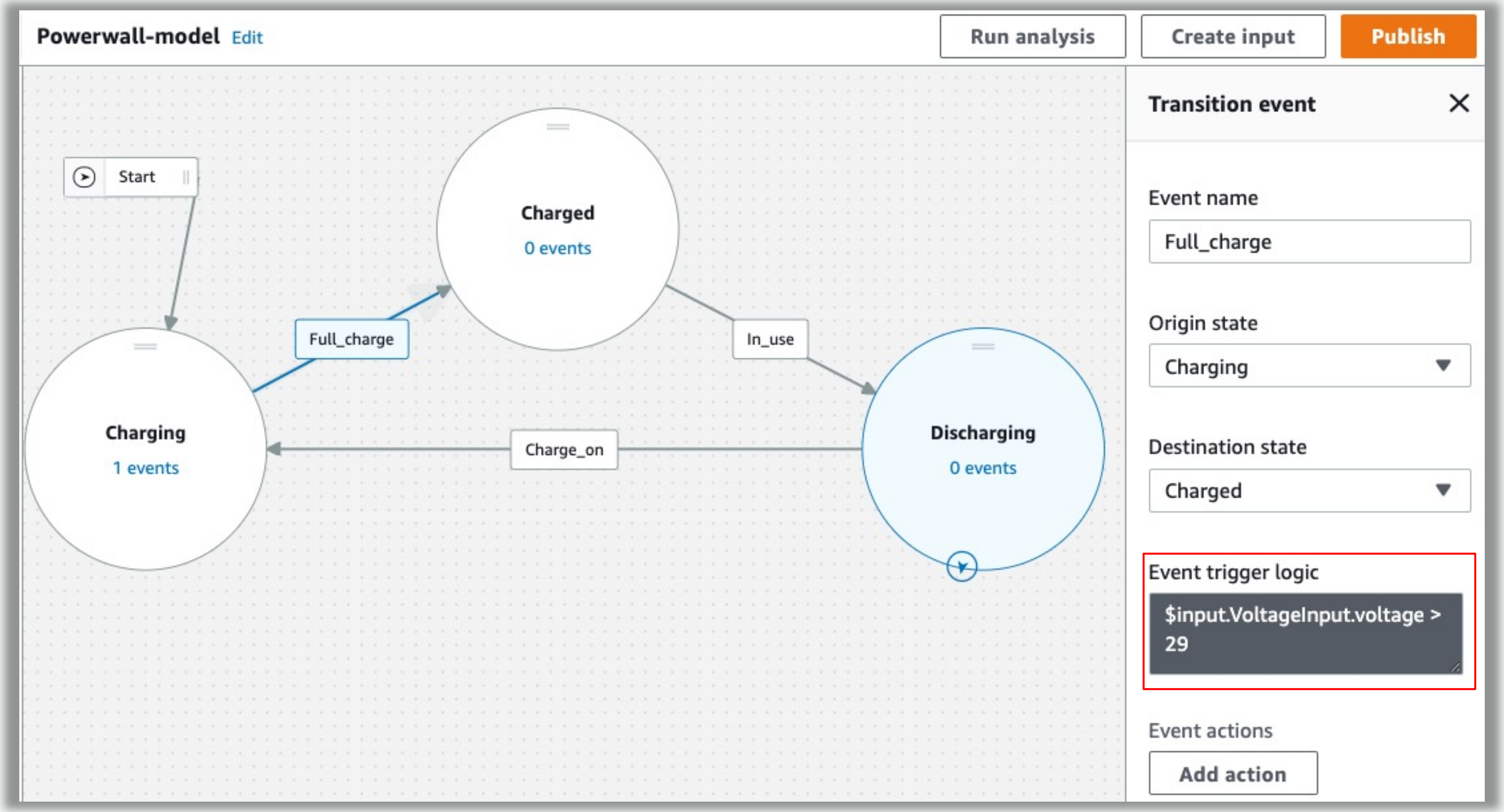
Select an industry-specific template

**Demo**

Explore a sample detector model with inputs

**Using inputs in a detector model**

Inputs receive the telemetry data (messages) you want to monitor and use in a detector model. Input values are used in conditions to trigger an action or change state. Manage them at the Inputs page available from the left nav.



Event name: Full_charge

Origin state: Charging

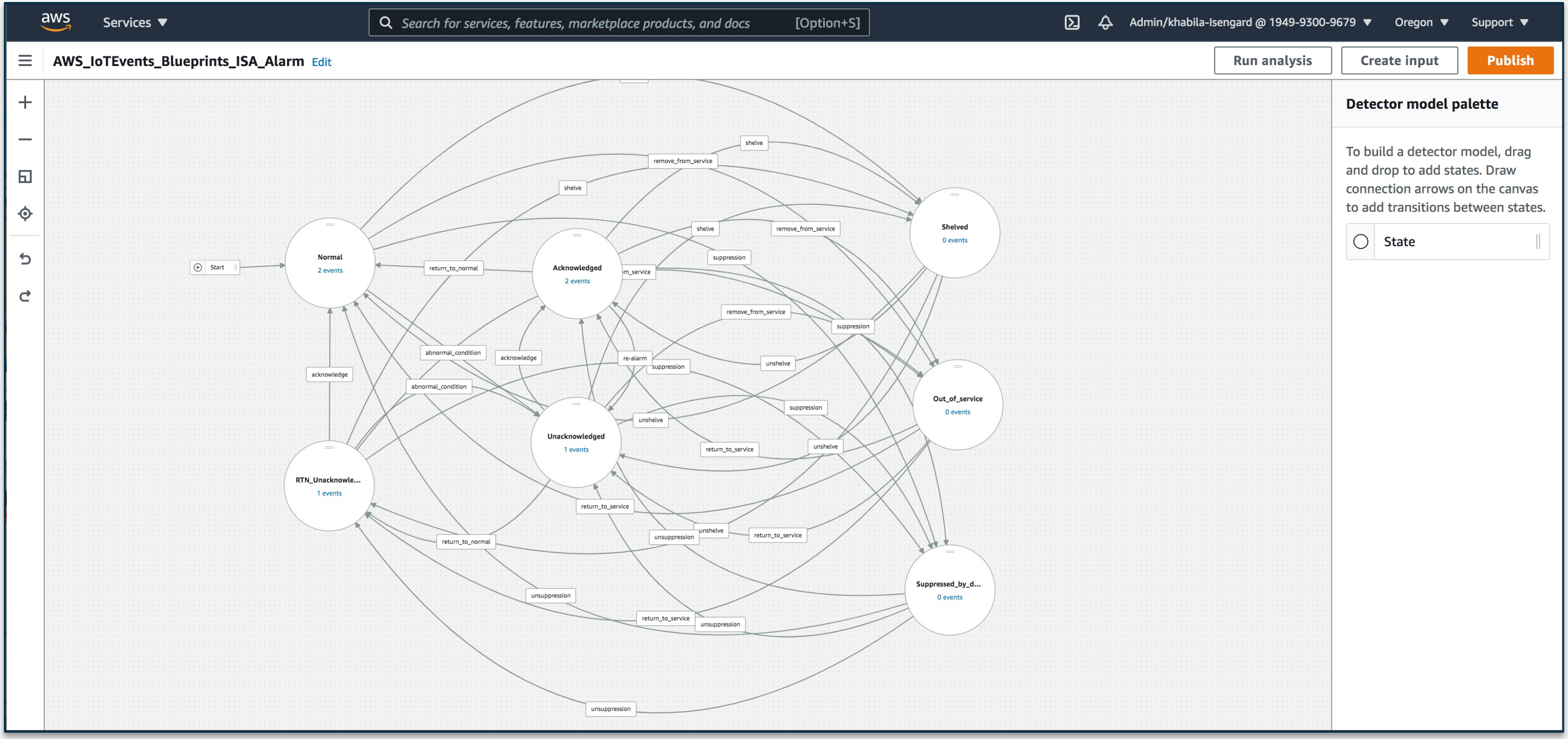
Destination state: Charged

Event trigger logic:

```
$input.VoltageInput.voltage > 29
```

Event actions

# AWS IoT Events – Complex Detector Models



To build a detector model, drag and drop to add states. Draw connection arrows on the canvas to add transitions between states.

Analytics Services

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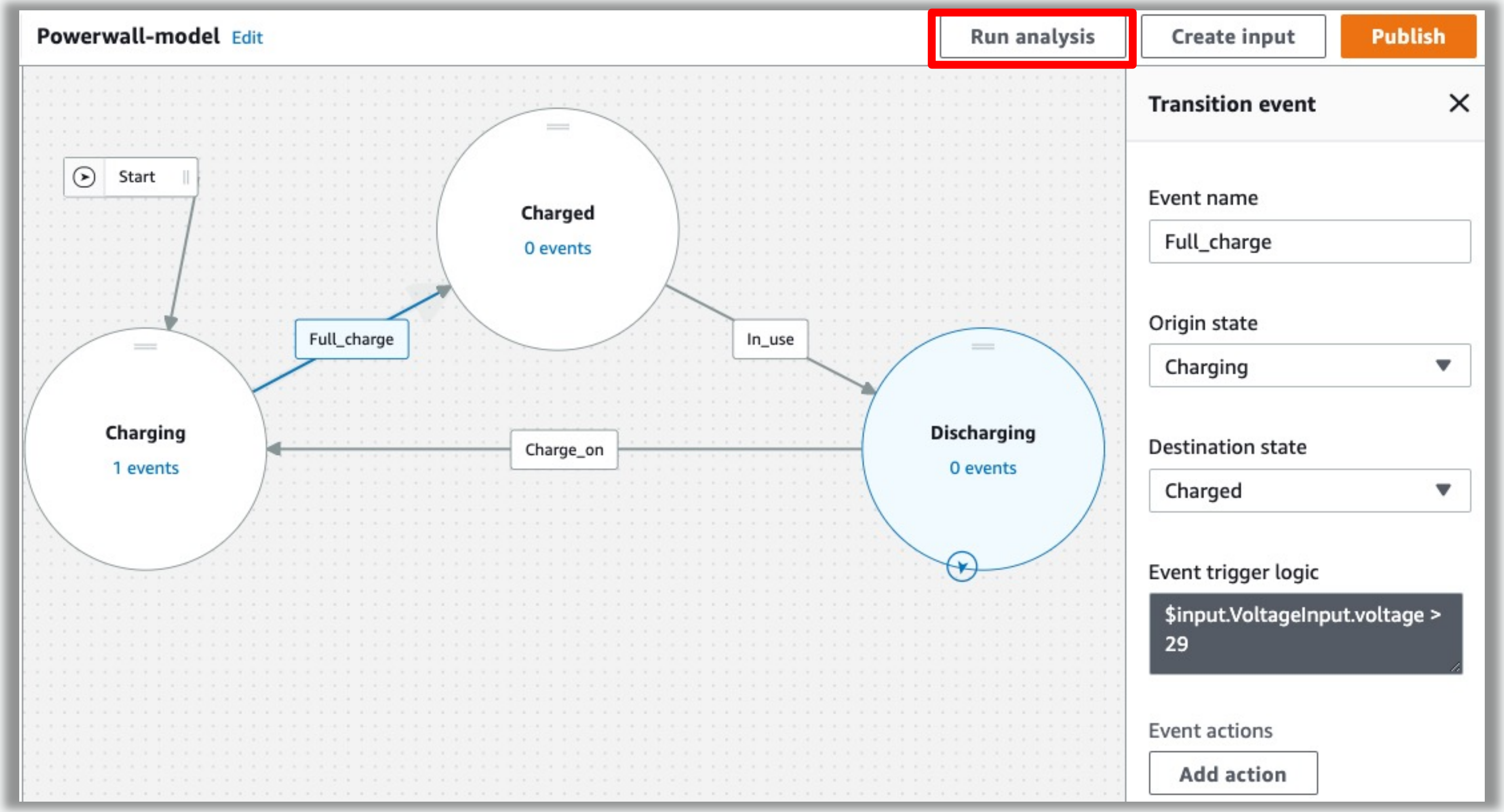


Transition event

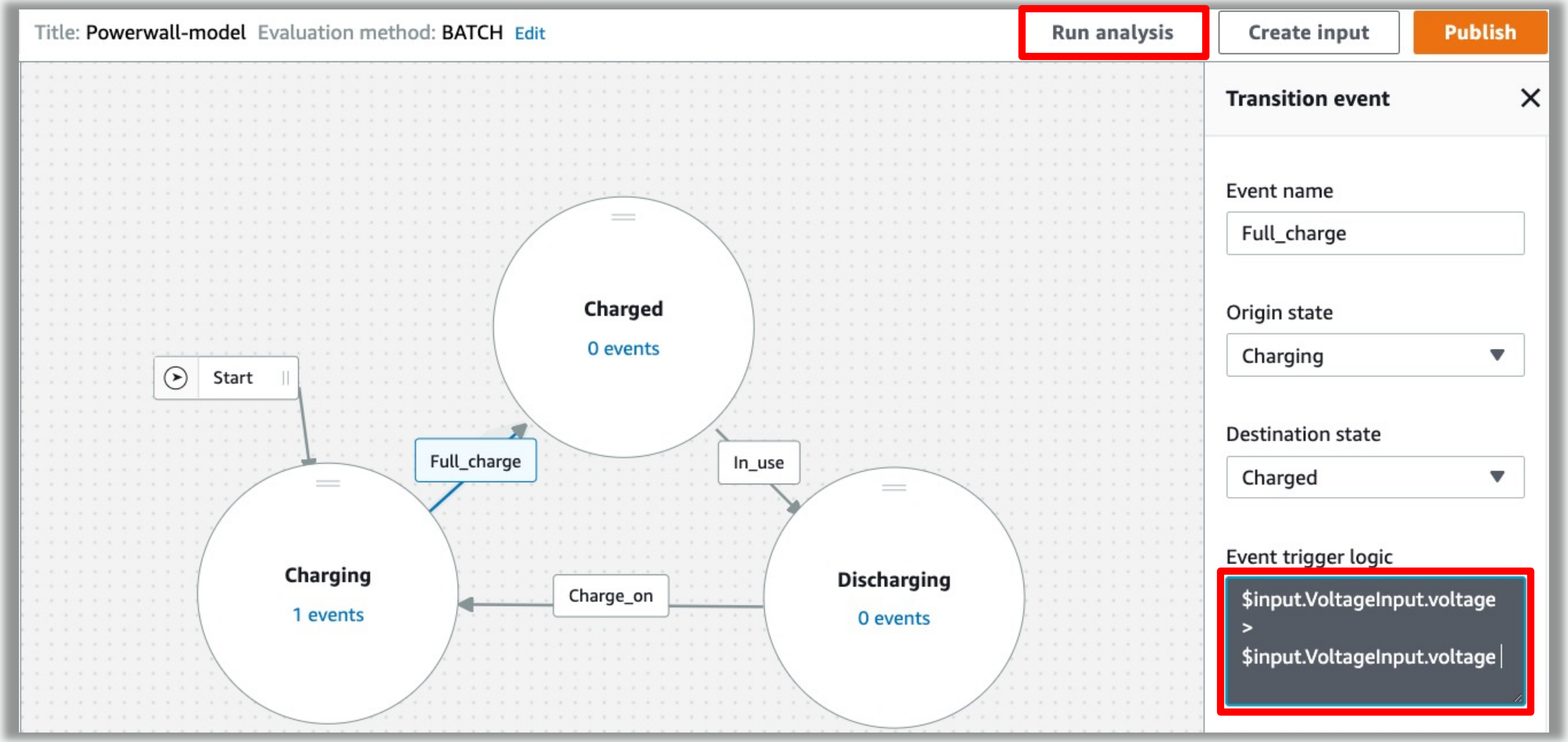
Event name: Full_charge

Origin state: Charging

Destination state: Charged

Event trigger logic:

```
$input.VoltageInput.voltage >
29
```



Title: Powerwall-model Evaluation method: BATCH Edit

Transition event

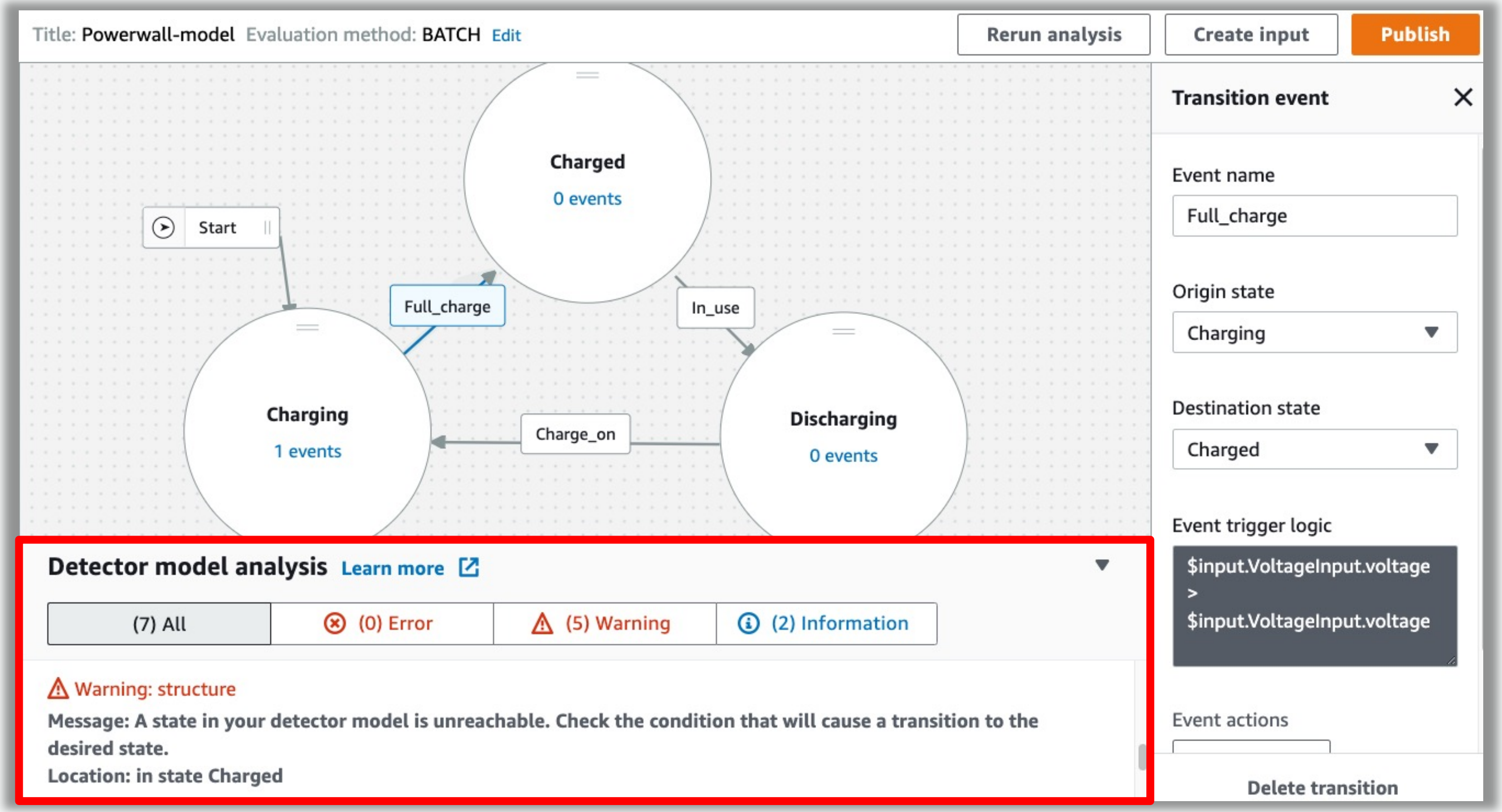
Event name: Full_charge

Origin state: Charging

Destination state: Charged

Event trigger logic

```
$input.VoltageInput.voltage
>
$input.VoltageInput.voltage
```



Event name: Full_charge

Origin state: Charging

Destination state: Charged

Event trigger logic

```
$input.VoltageInput.voltage
>
$input.VoltageInput.voltage
```

Event actions

## Detector model analysis

Learn more

(7) All | (0) Error | (5) Warning | (2) Information

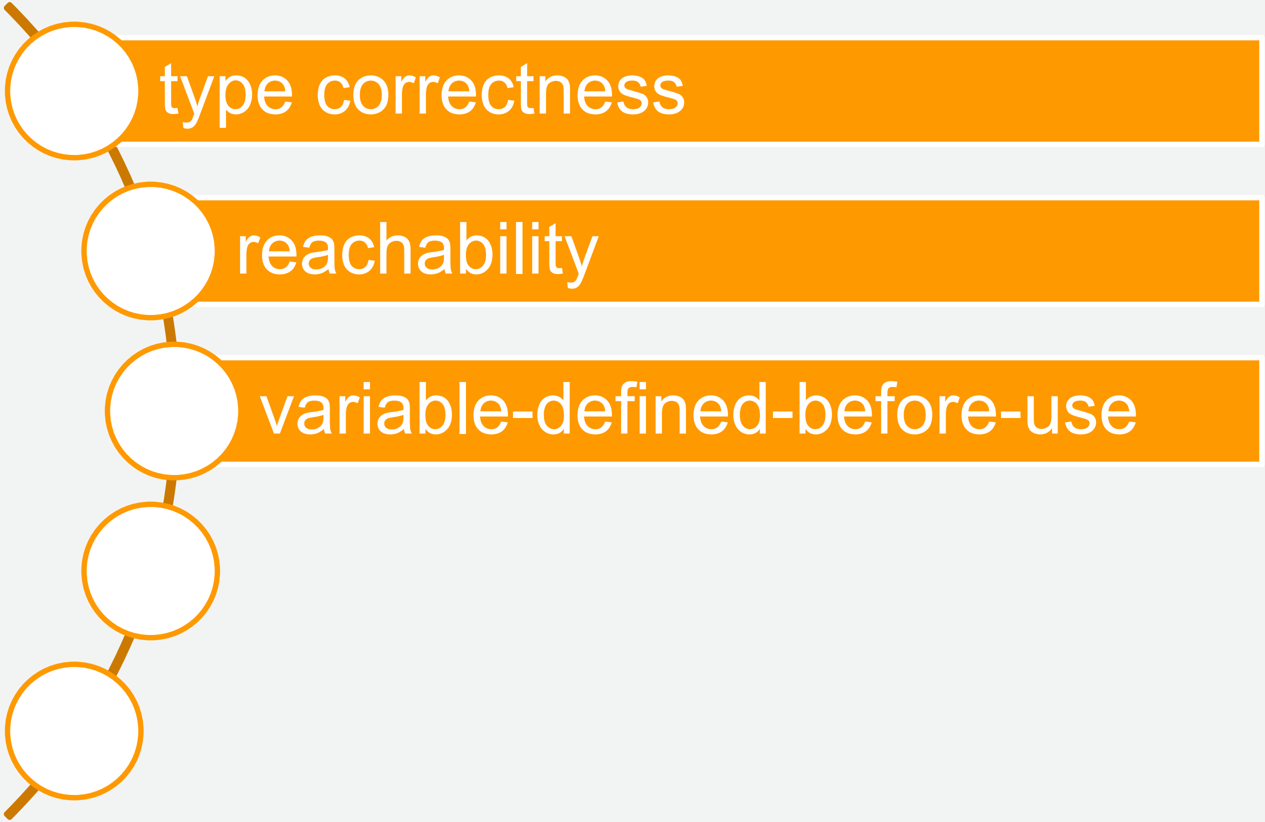
⚠ Warning: structure

Message: A state in your detector model is unreachable. Check the condition that will cause a transition to the desired state.

Location: in state Charged

1. Gacek et al., The JKIND model checker, CAV 2018
2. Halbwachs et al., The synchronous dataflow programming language Lustre, IEEE 1991

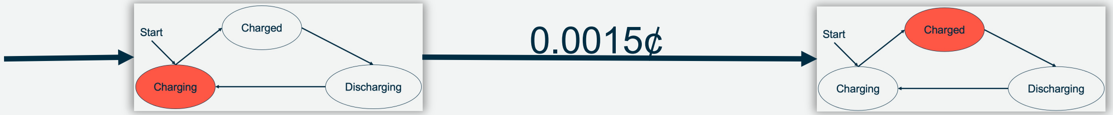
# Correctness properties for detector models

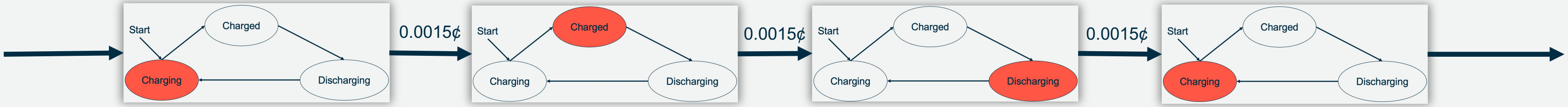


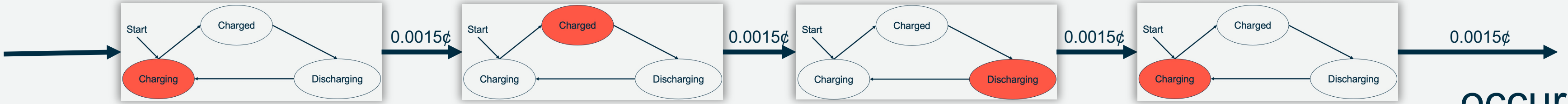
type correctness

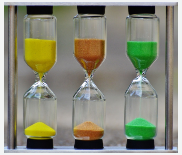
reachability

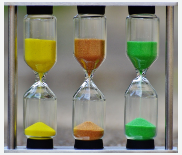
variable-defined-before-use

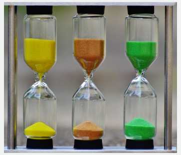










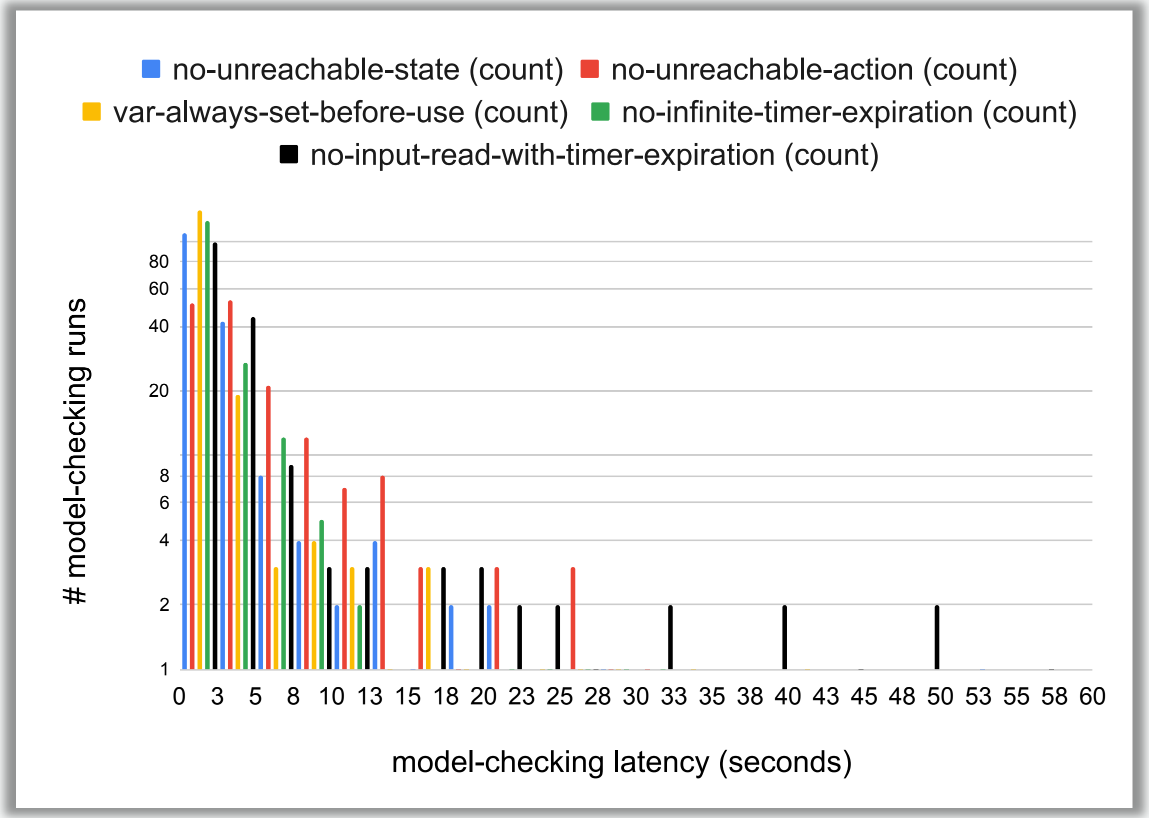


occurs infinitely

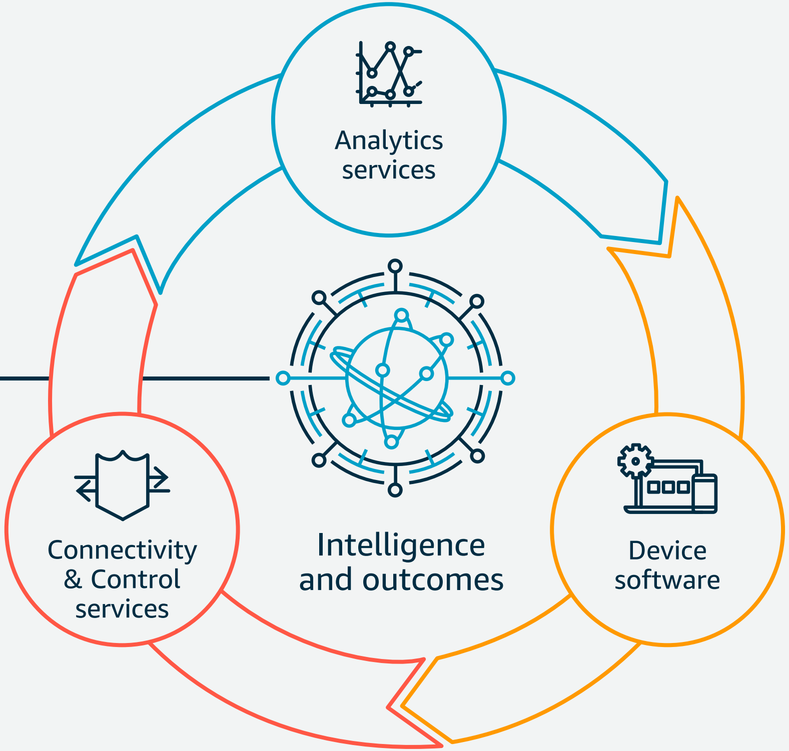
# Correctness properties for detector models

- type correctness
- reachability
- variable-defined-before-use
- no infinite timer expirations
- no input read on timer expiration

# Performance



Now that you **know** the state of every thing, and **can *correctly*** reason on top of that data, what problems would you solve?



aws.amazon.com/IoT

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# Thank you!

Vaibhav Sharma

Contact information

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Learn more:

## AWS IoT Events

Webpage

(https://aws.amazon.com/iot-events/)

Getting Started

(https://docs.aws.amazon.com/iotevents/latest/developerguide/what-is-iotevents.html)

Documentation

(https://docs.aws.amazon.com/iotevents/?id=docs_gateway)

Training

(https://www.aws.training/LearningLibrary?filters=classification%3A25&search=&tab=digital_courses)

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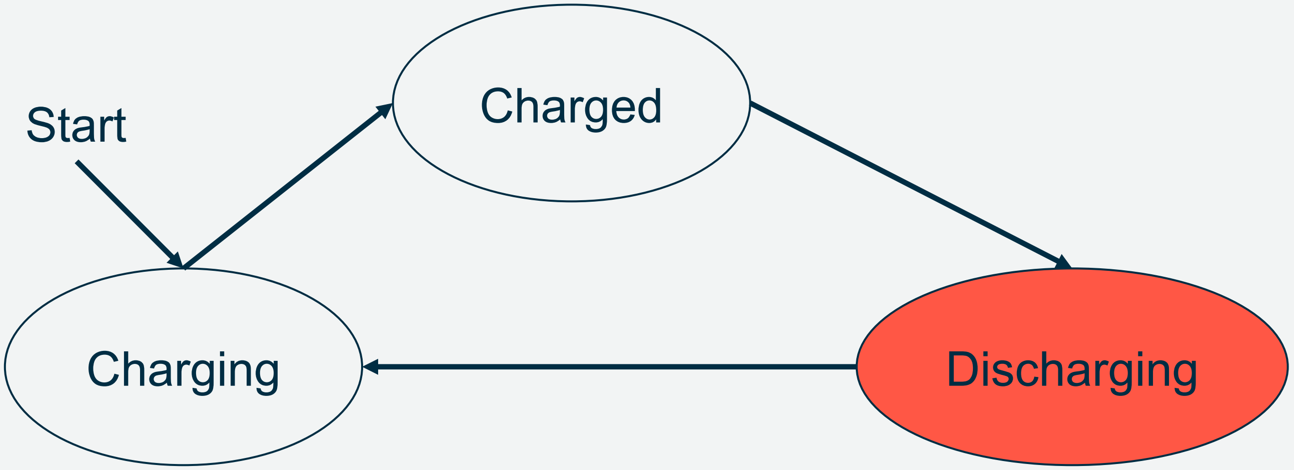
Start
Charged
Charging
Discharging