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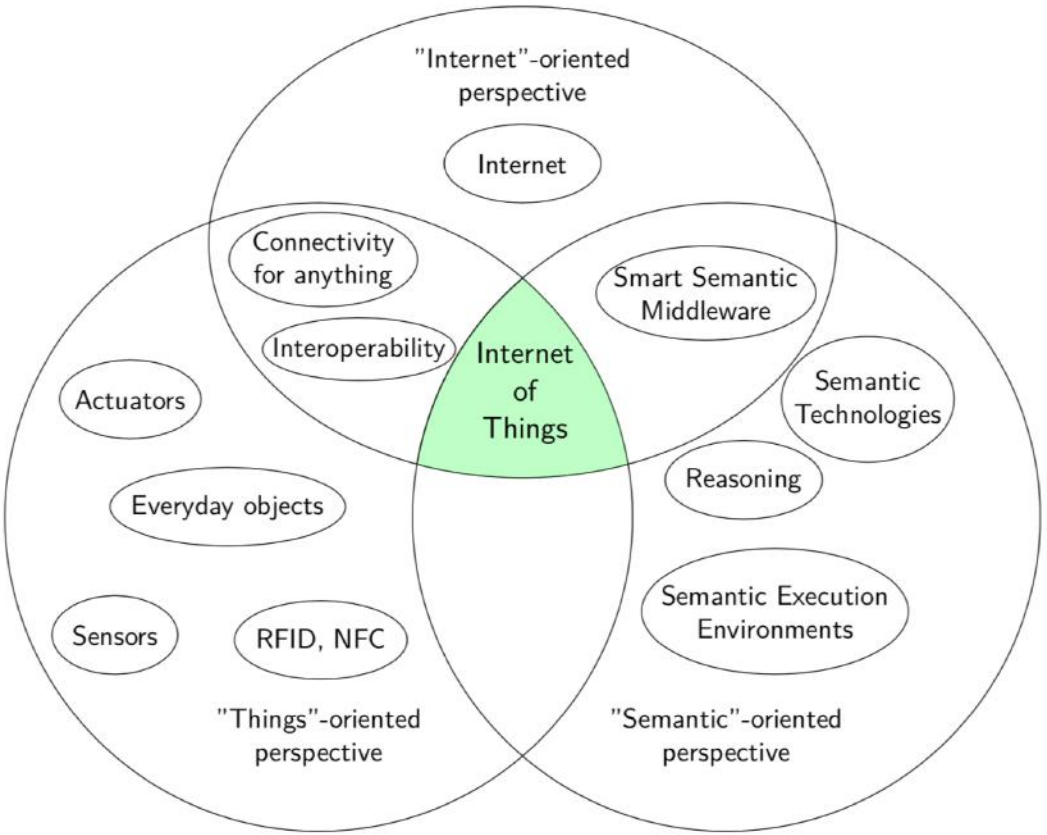
Developing a Deployment Agent for the Internet of Things

Bachelor Thesis – Final Talk

SWC Software Construction | RWTH AACHEN UNIVERSITY

Internet of Things



- Addressing & Networking Issue
- Hardware Limitations
- Infrastructure
- Security
- Privacy

gridBox

central control unit for energy systems

Plug-and-play

custom Linux-based embedded system

Marvell Armada 385, Cortex-A9, Dual-Core

gridBox - Problems

Unreliable network connections

Offline

Different environments

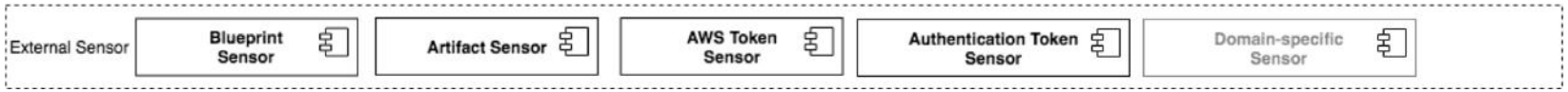
Loss of data

gridBox - Problems

Sensors

One Simple Task

- Collects arbitrary data on each request
- Transforms into a fact



Sensors

Blueprints

- Set of desired running processes

Fact

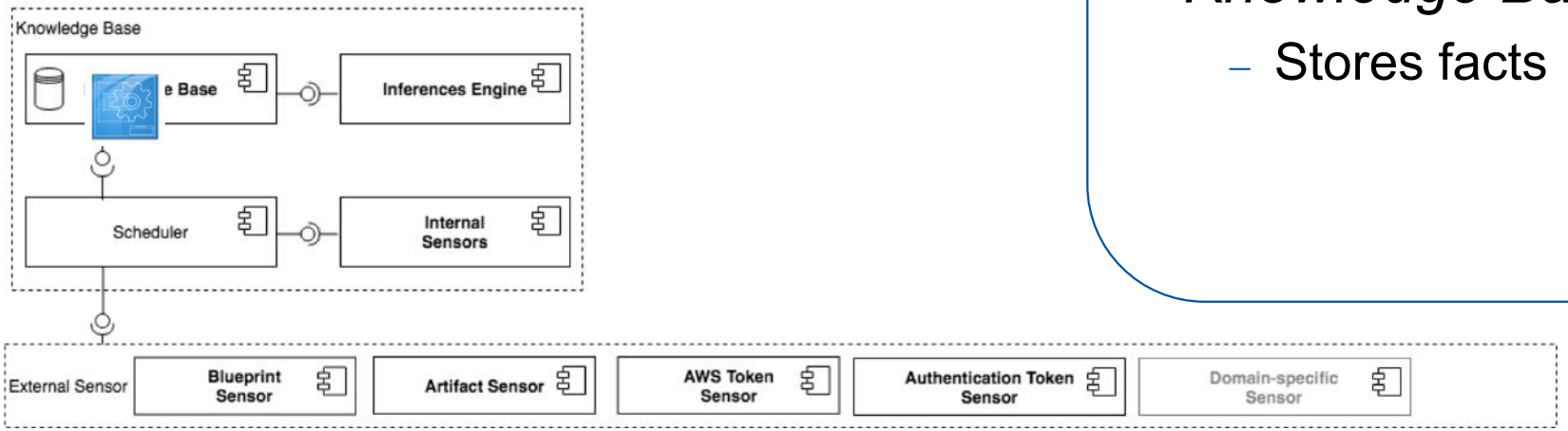
Field	Value
Namespace	Blueprints.Remote
Key	Latest

Value	[{
	"image": "nginx:latest",
	"volumes": [
	{
	"source":"/data/",
	"target":"/usr/src/www"
	}
	]
	}]

ExpiresAt	Now + 7 days
Owner	Blueprint-Sensor

```go
// Fact represents an information about the environment which is
// available through the knowledge base.
type Fact struct {
    // Namespace is represents a logical group of facts.
    //
    // This property is required and cannot be change after
       creation.
    Namespace string

    // Key is a unique identifier within a given namespace.
    //
    // This property is required and cannot be change after
       creation.
    Key string

    // Value should hold the information used by the rule engine
       to make a
    // decision.
    //
    // This property is required but mutable.
    Value interface{}

    // CreatedAt is the time at which the fact was created.
    CreatedAt time.Time

    // UpdatedAt is the time at which the fact was updated.
    UpdatedAt time.Time

    // ExpiresAt is the time at which the fact is no longer
       available.
    ExpiresAt time.Time

    // Owner is the writer which inserted fact.
    //
    // This property is required and cannot be changed after
       creation.
    Owner string
}
```

Knowledge Base



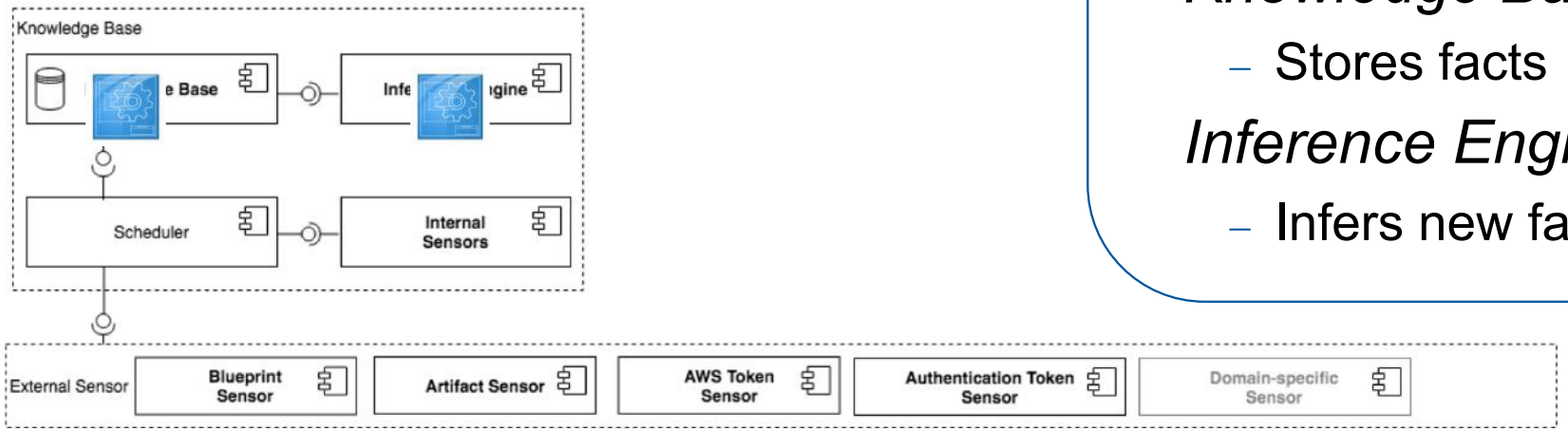
Scheduler

- Collects facts periodically
- Stores consistent

Knowledge Base

- Stores facts

Inference Engine



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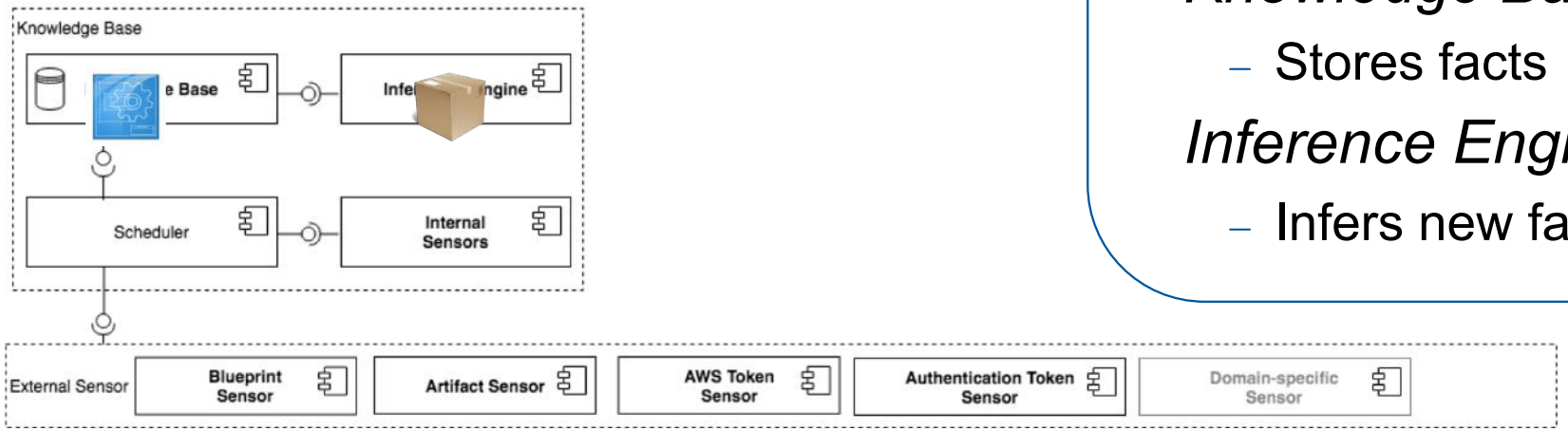
Inference Engine

- Infers new facts

Inference Engine



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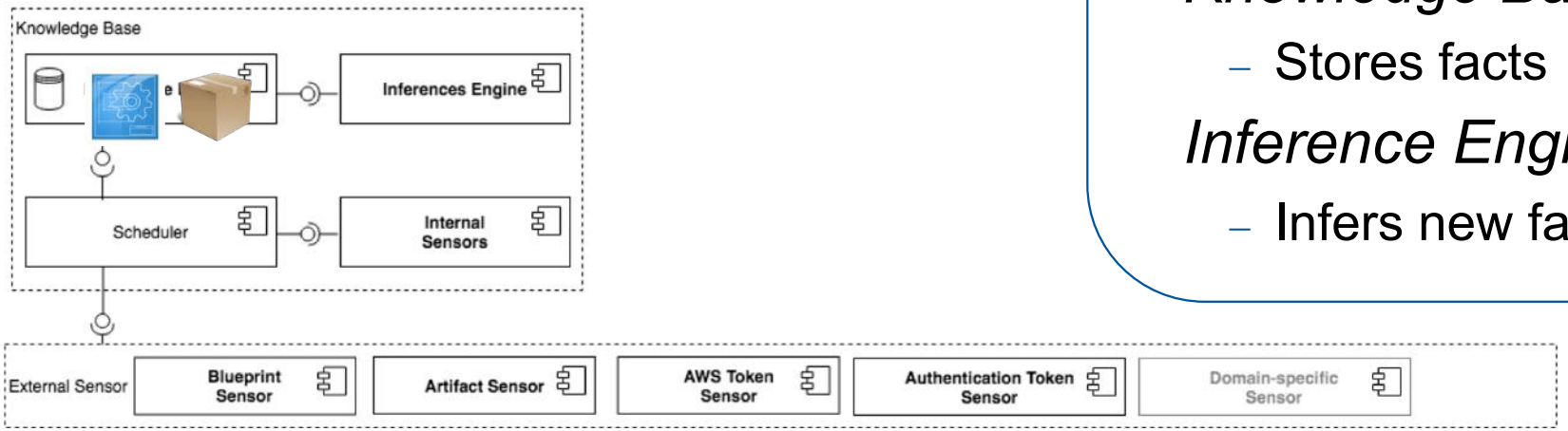

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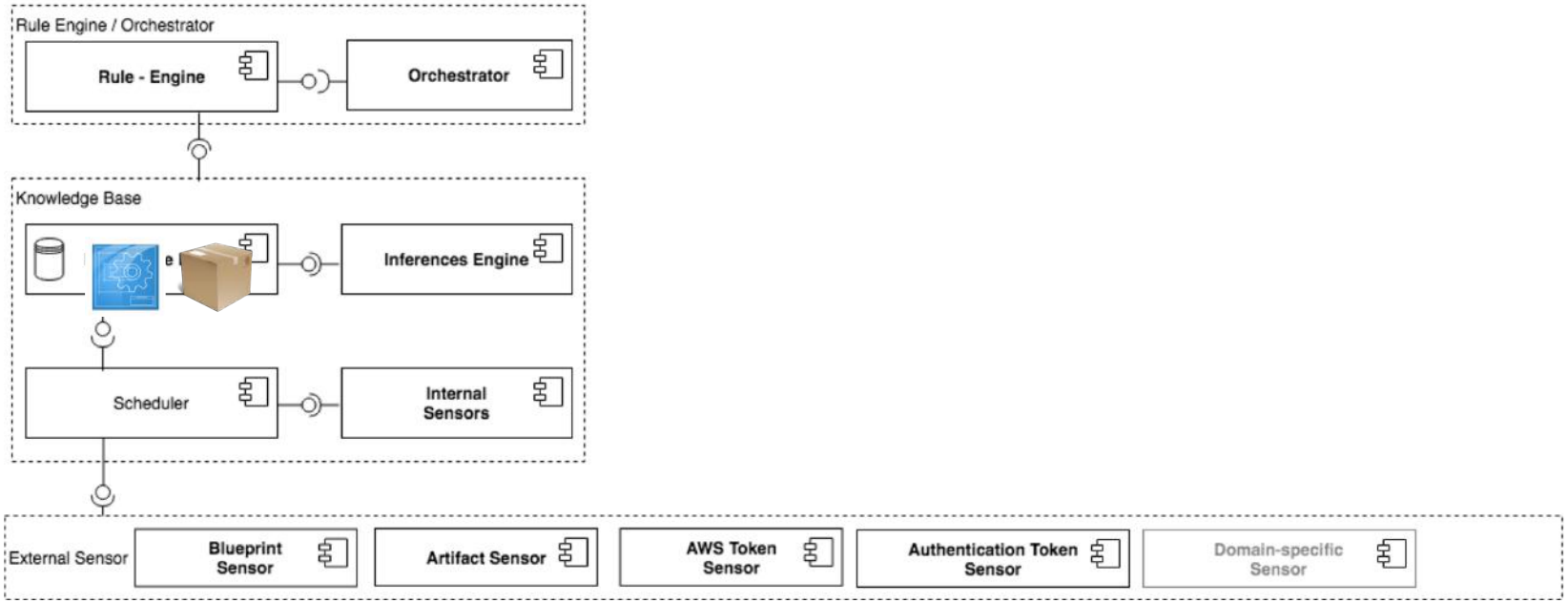
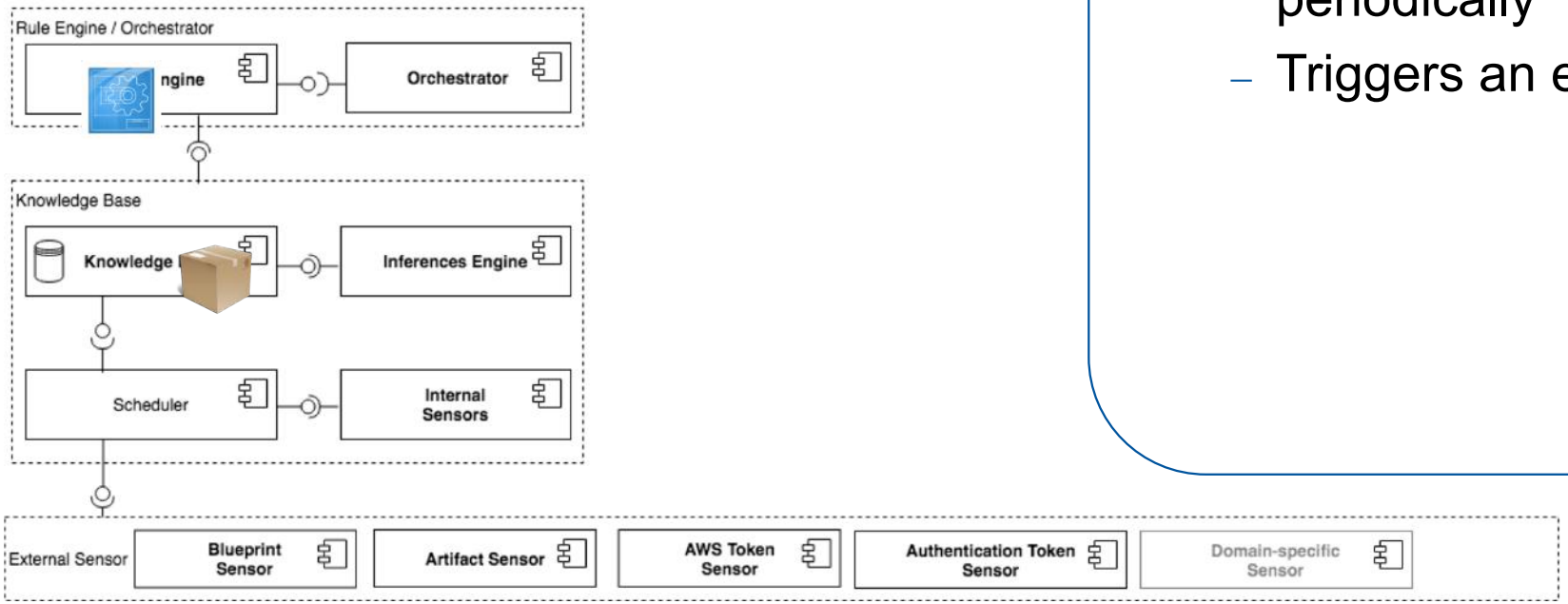
Rule Engine


Rule Engine / Orchestrator
Rule - Engine
Orchestrator
Knowledge Base
Inferences Engine
Scheduler
Internal Sensors
External Sensor
Blueprint Sensor
Artifact Sensor
AWS Token Sensor
Authentication Token Sensor
Domain-specific Sensor

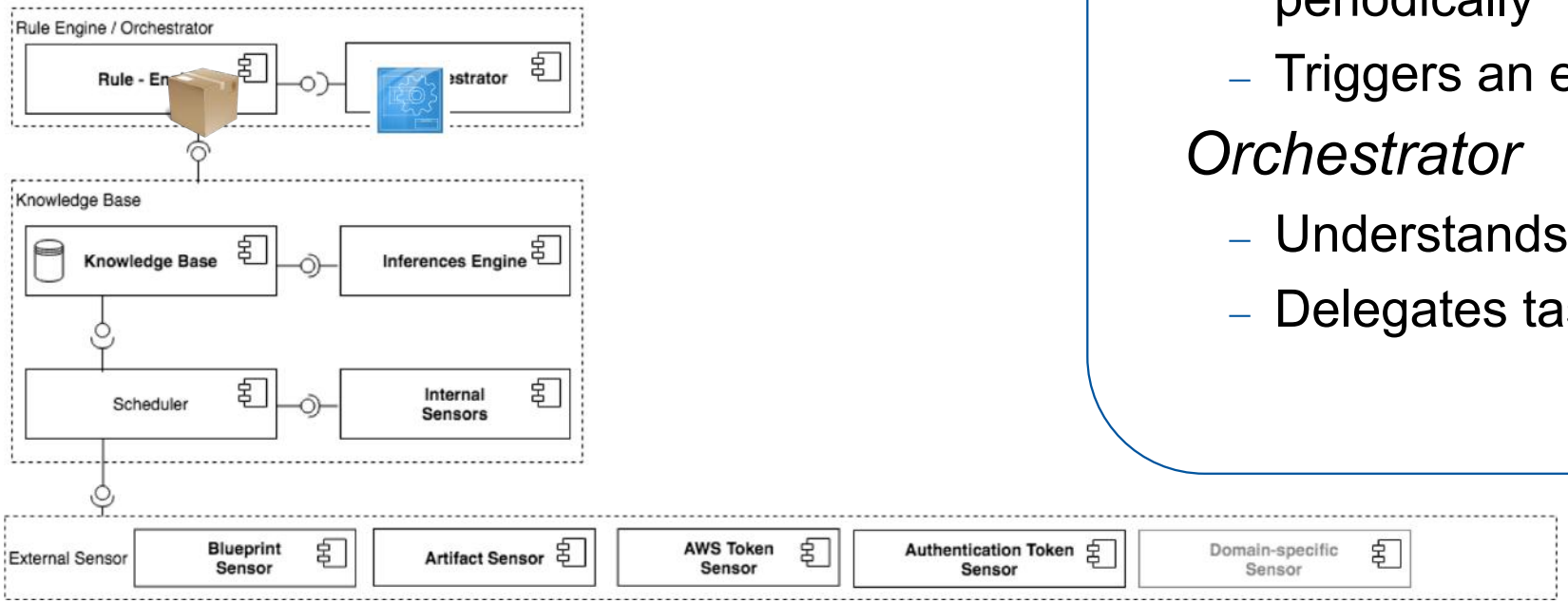
Rule Engine



Rule Engine

- Checks rules periodically
- Triggers an event

Orchestrator



Rule Engine

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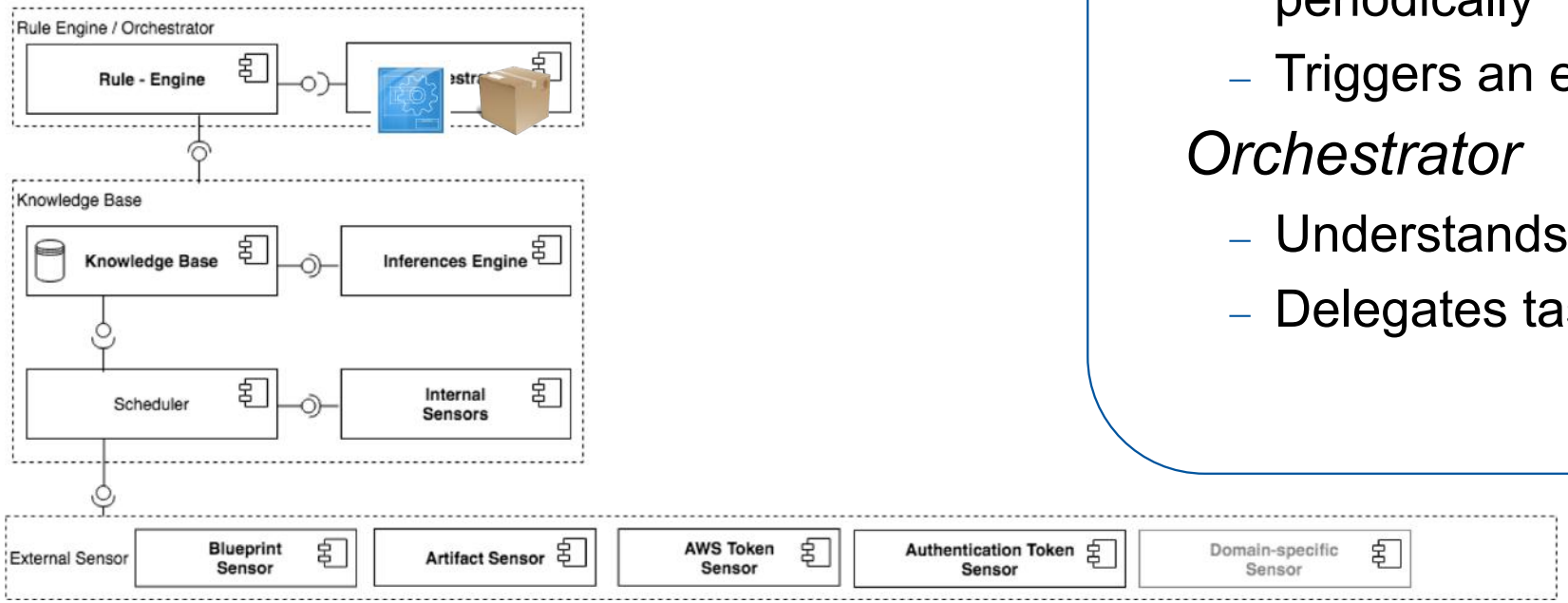
Orchestrator

- Understands event
- Delegates tasks

Orchestrator



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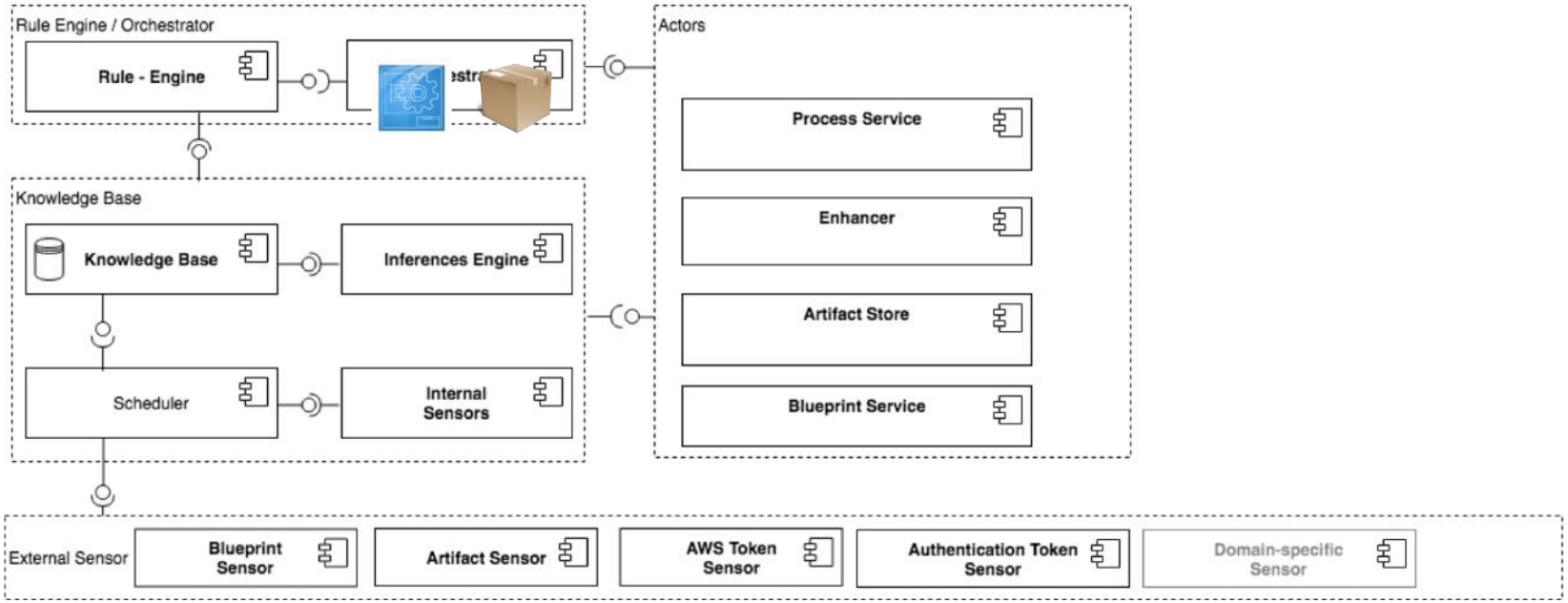
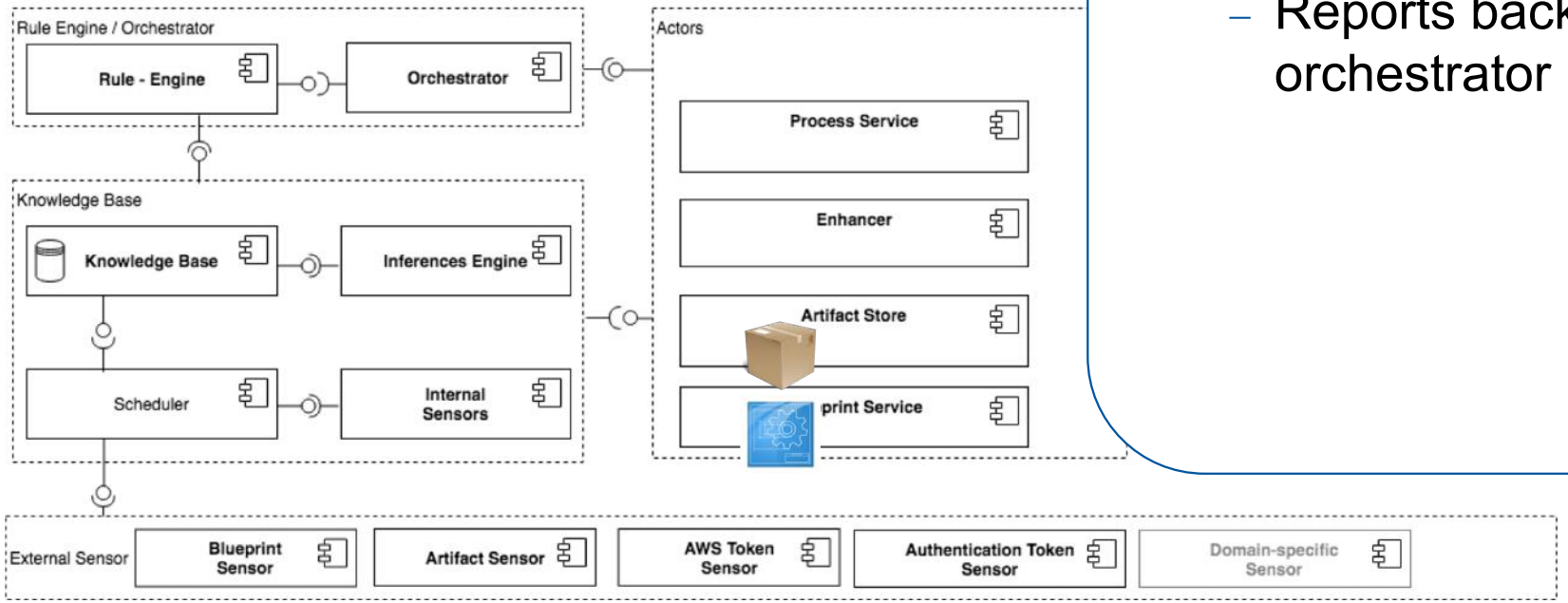
Actors


Rule Engine / Orchestrator
Rule - Engine
Knowledge Base
Knowledge Base
Inferences Engine
Scheduler
Internal Sensors
Actors
Process Service
Enhancer
Artifact Store
Blueprint Service
External Sensor
Blueprint Sensor
Artifact Sensor
AWS Token Sensor
Authentication Token Sensor
Domain-specific Sensor

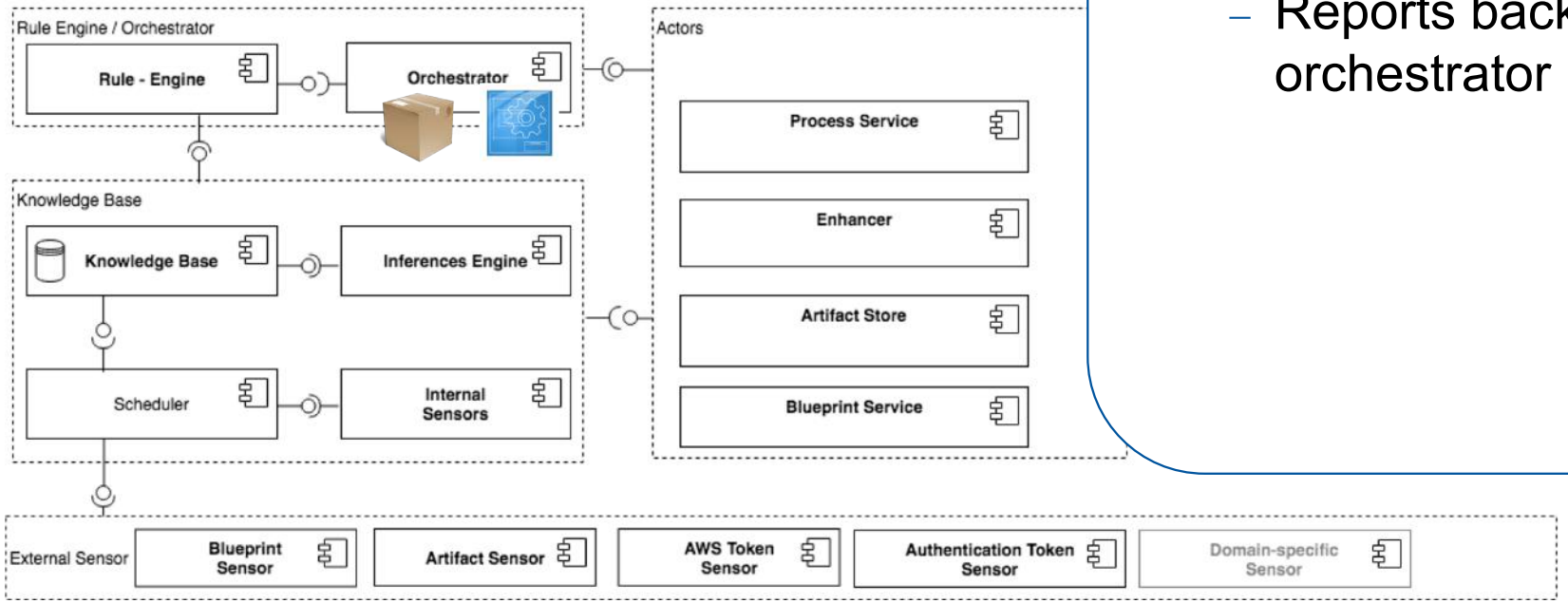
Actors



Actors

- Performs the tasks
- Reports back to orchestrator

Actors



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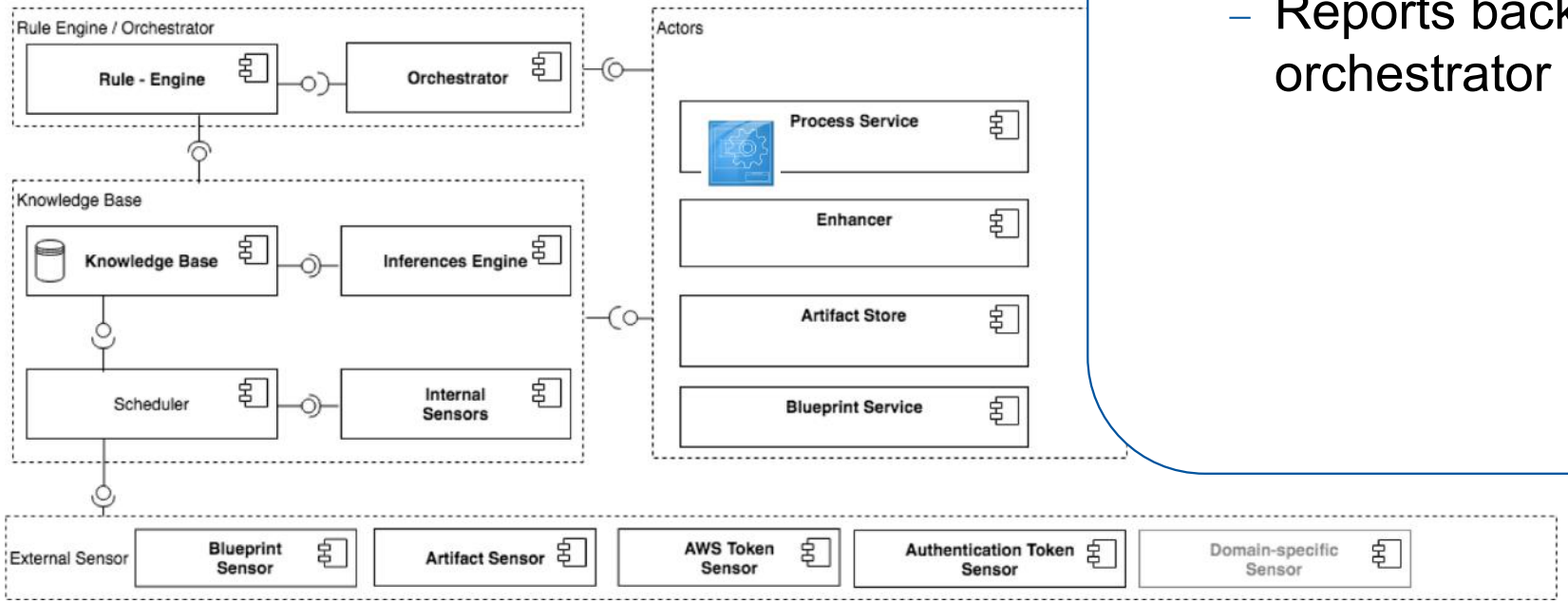

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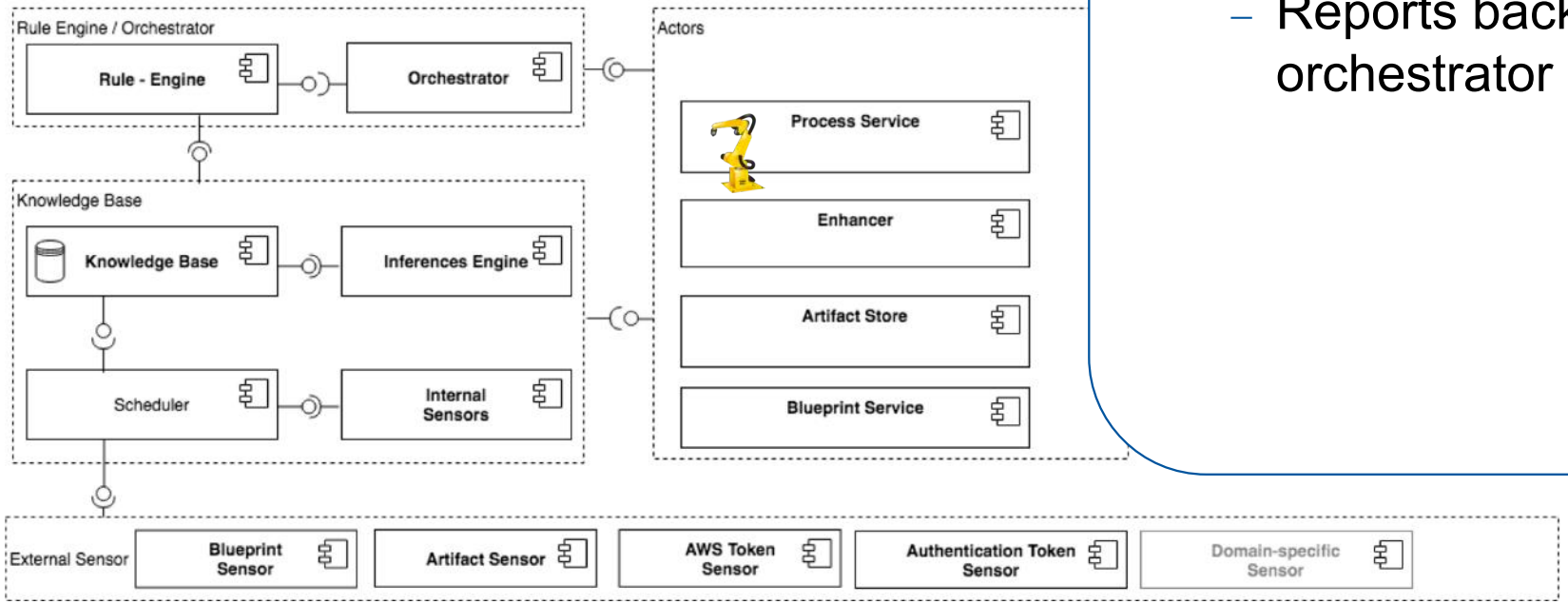

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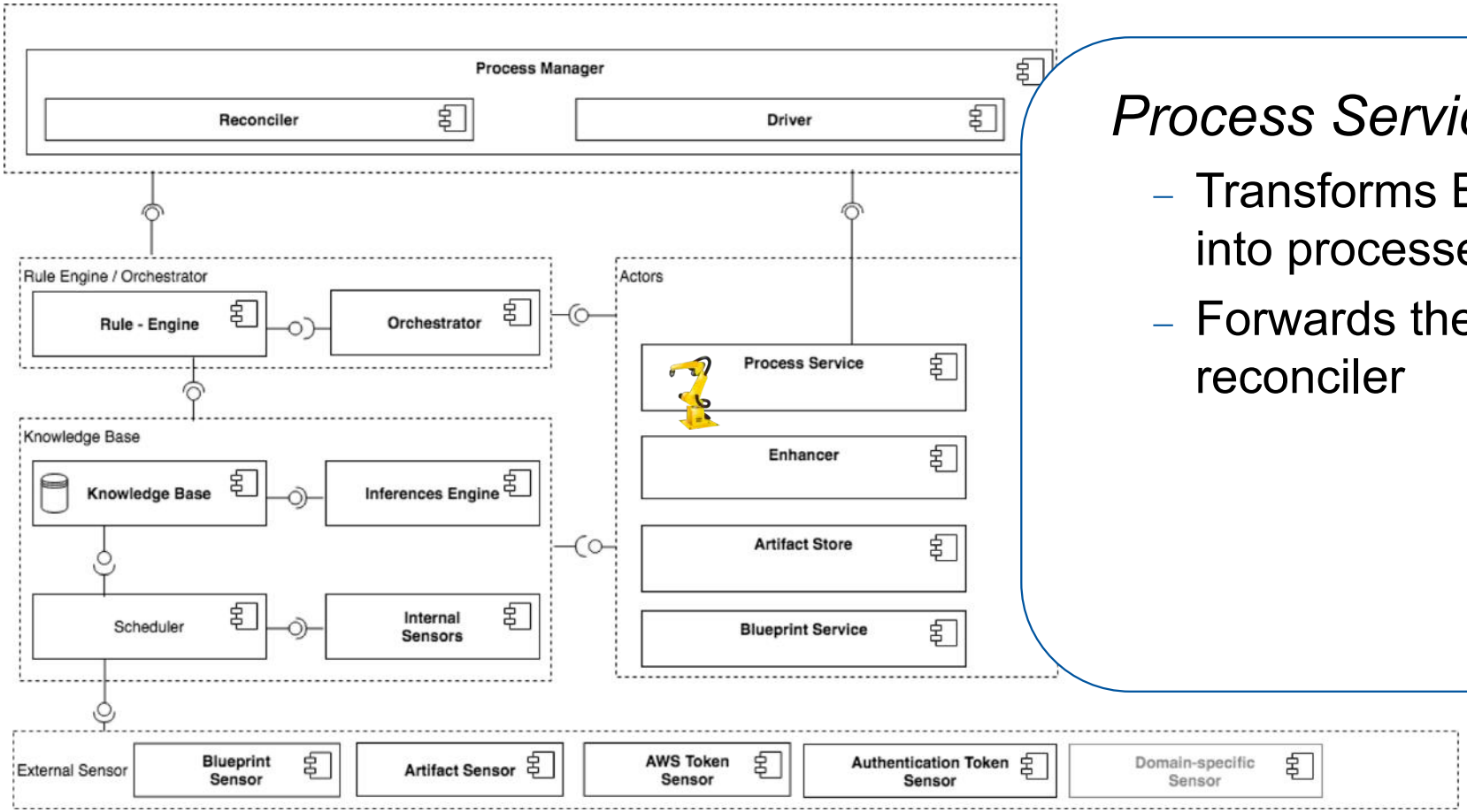
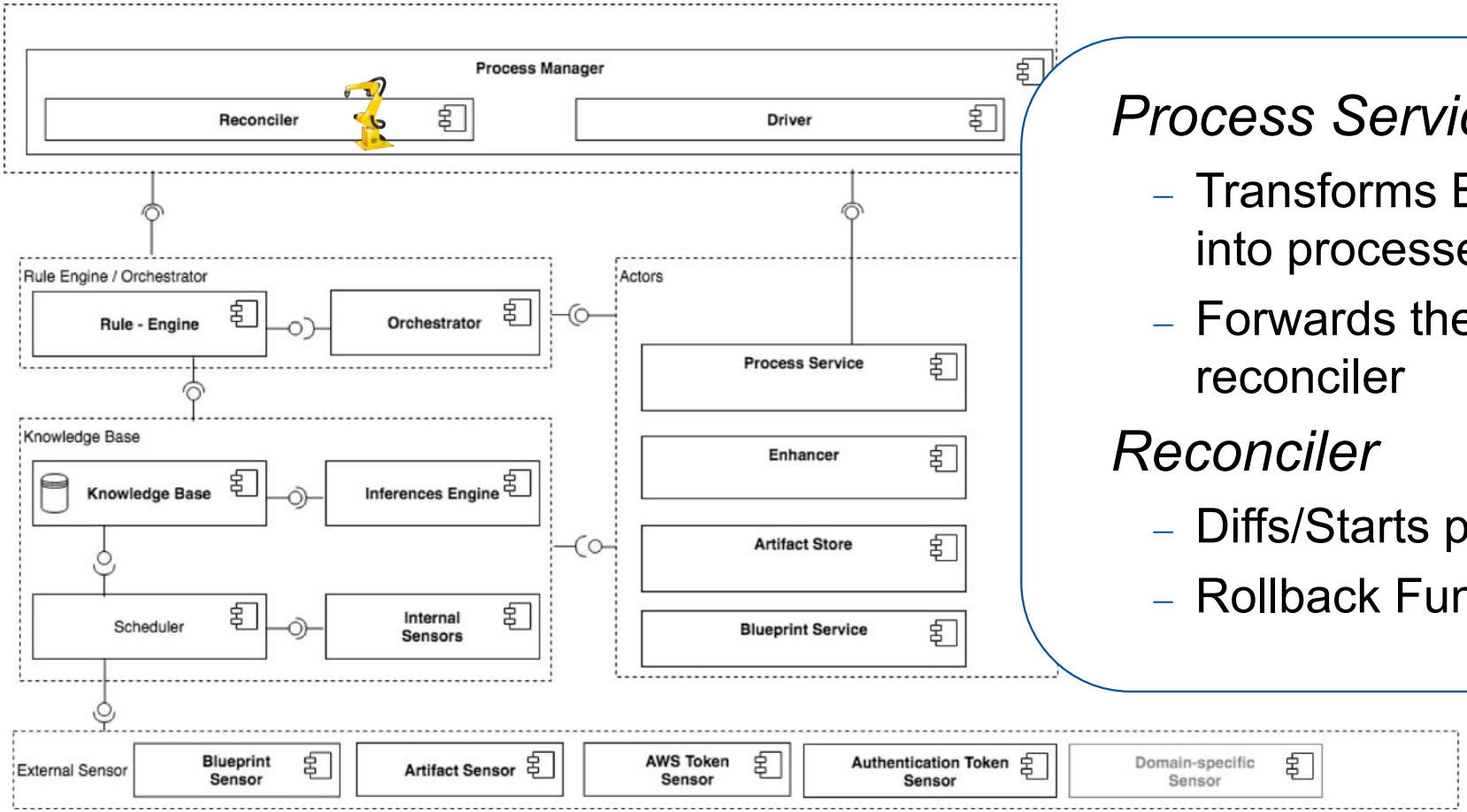
Process



Process Service

- Transforms Blueprints into processes
- Forwards them to the reconciler

Process



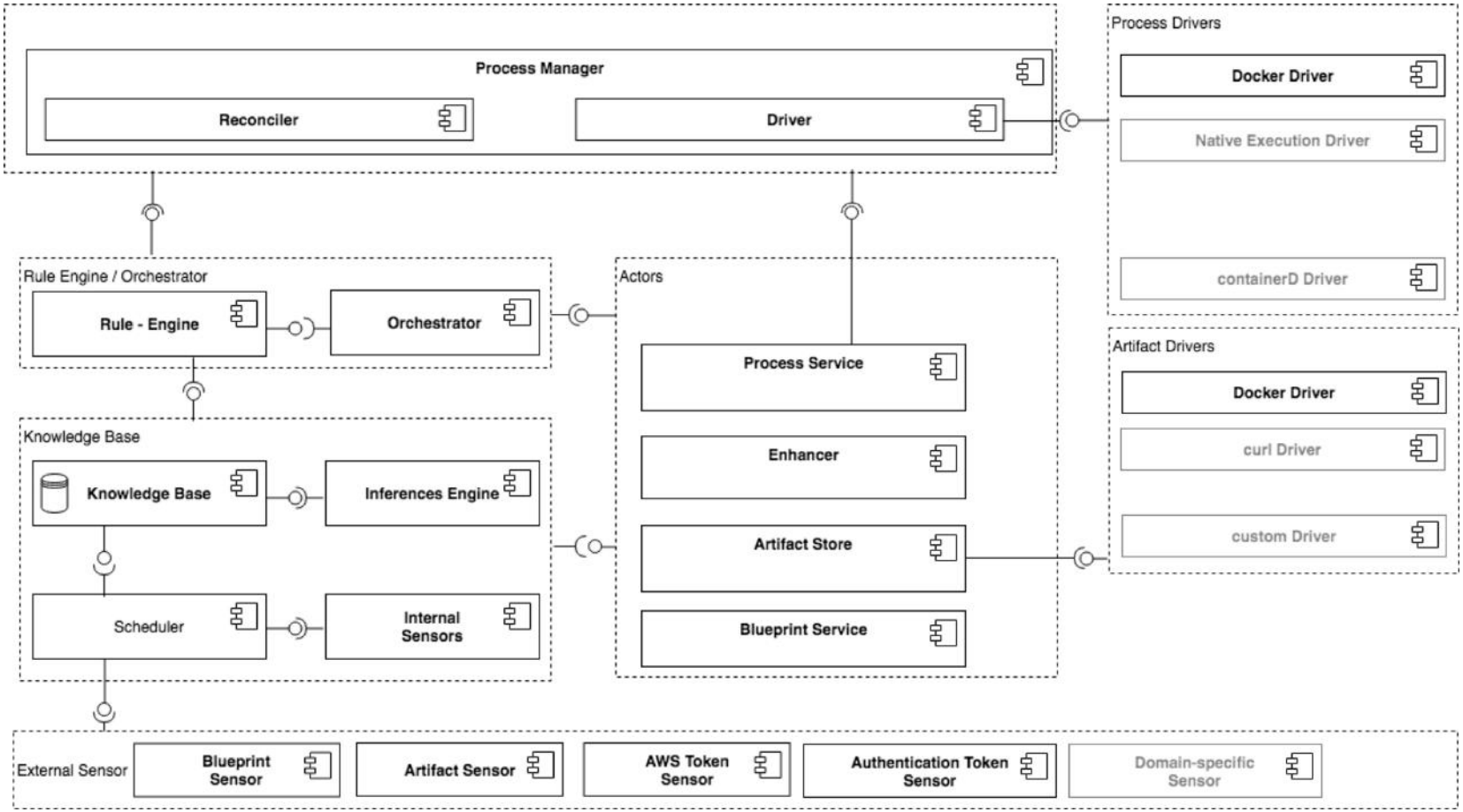
Process Service

- Transforms Blueprints into processes
- Forwards them to the reconciler

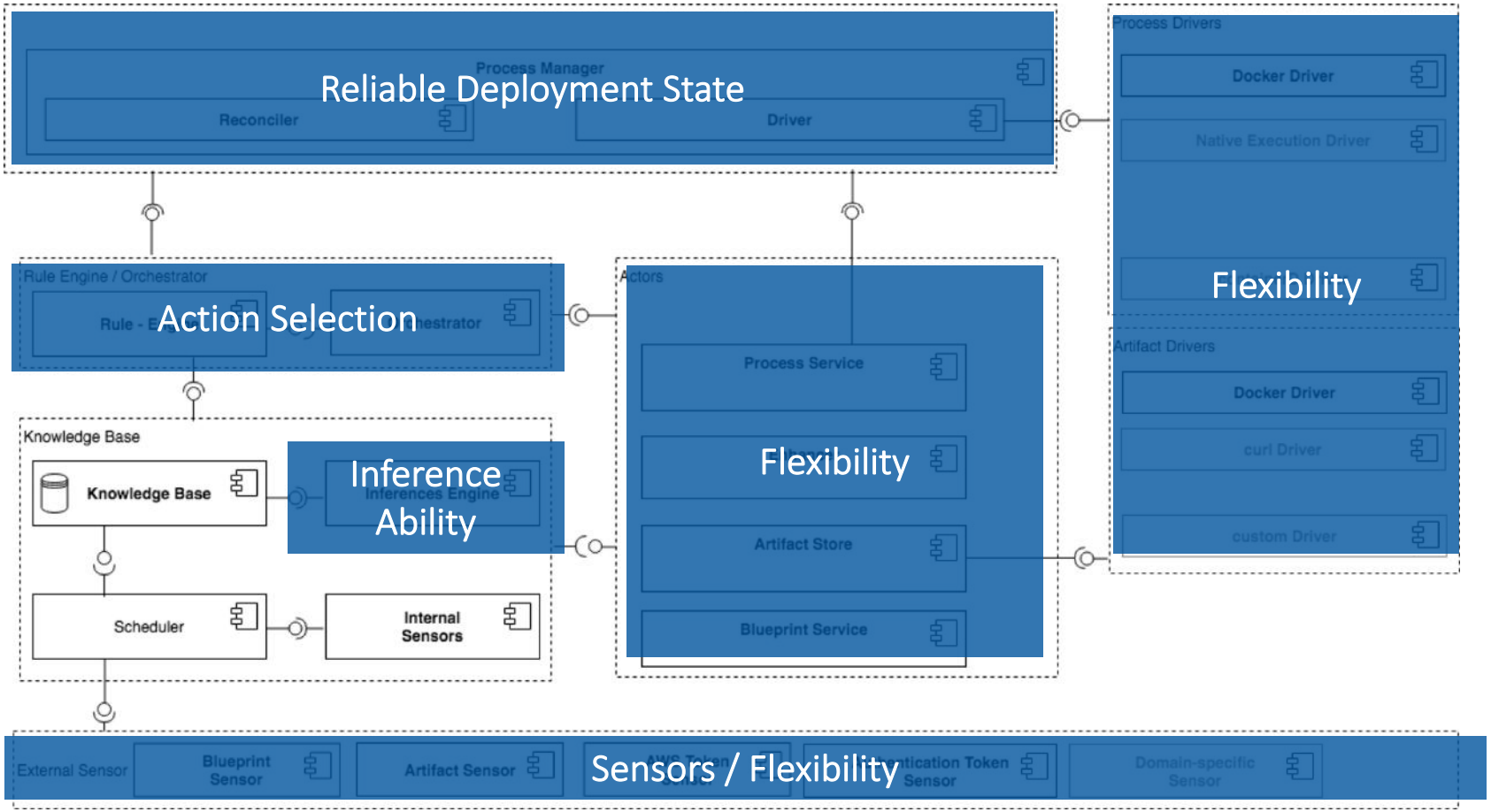
Reconciler

- Diffs/Starts processes
- Rollback Function

Architecture



Requirements



gridBox - Solution

Latest versions on the gridbox

No box is left behind

Less manual errors

Certainty of the Deployment

Case Study - gridX

- Objectives
  - Impact of Scalability
  - Impact on Deployment Robustness

- Collected Data
  - Validation of Deployment Blueprint
  - Multiple of Deployments at Once
  - Failure of Preconditions

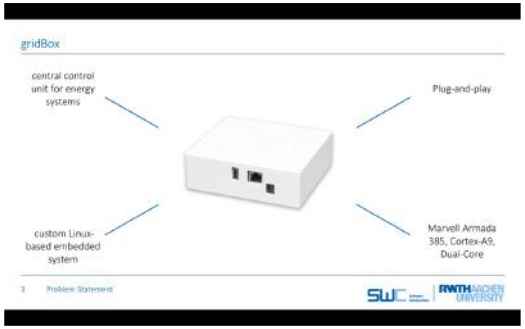
In a nutshell

The deployment agent minimizes the risk of broken deployments because the agent puts the decision problem at the last possible time.

Future Work

- Rule Engine
- Driver
- Sensors
- Consensus

Summary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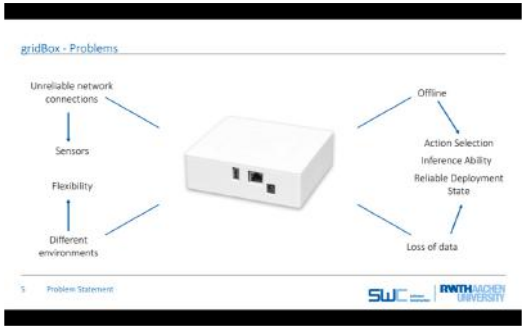
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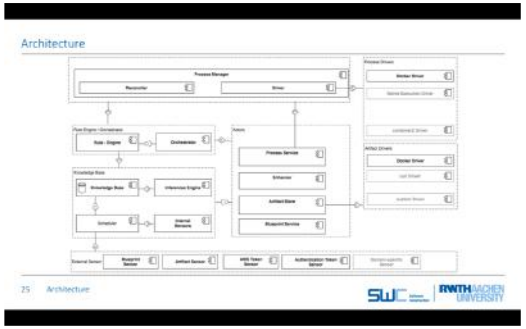
Unreliable network connections
Sensors
Flexibility
Different environments
Offline
Action Selection
Inference Ability
Reliable Deployment State
Loss of data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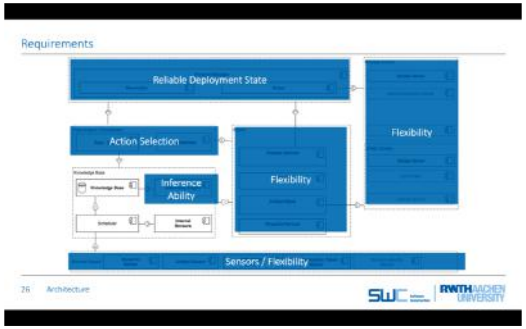
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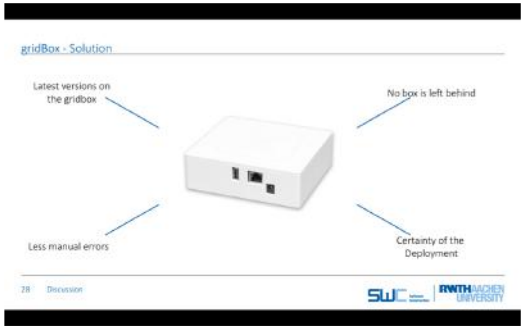
Flexibility
Sensors / Flexibility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