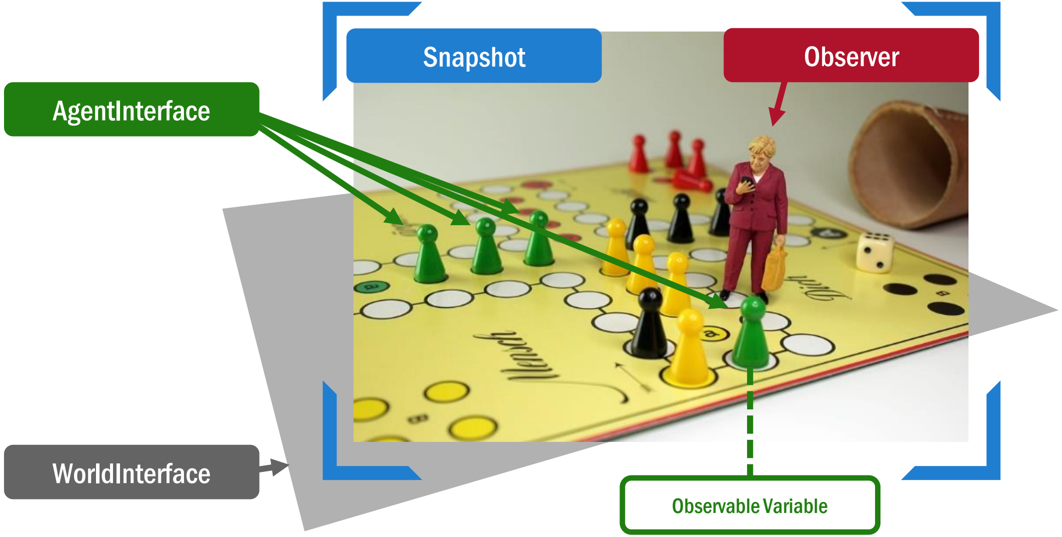
Obervation and Logging

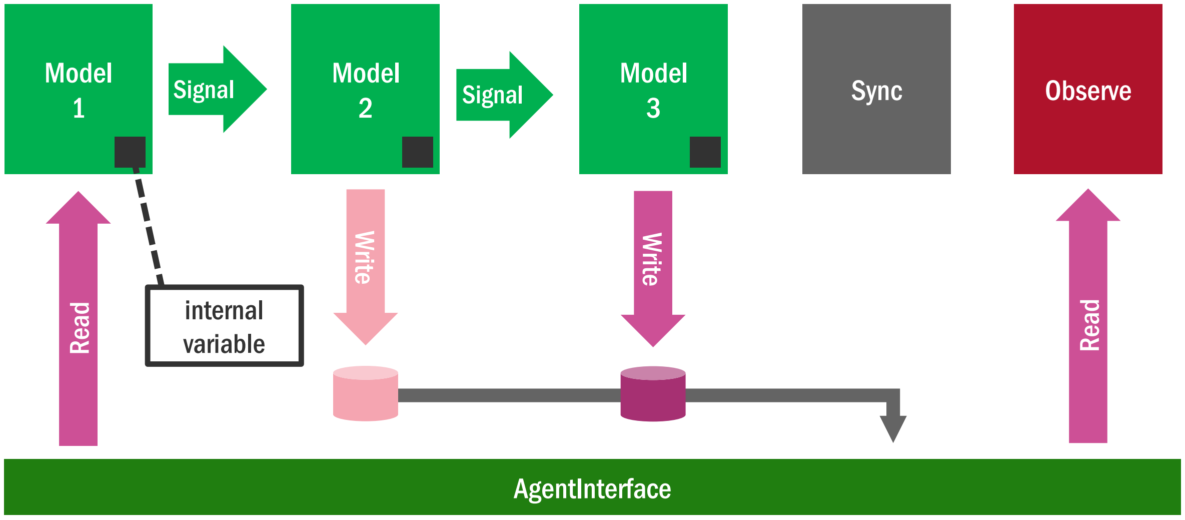
intech



What‘s going on

- ✓ **Agents** move on the field (**World**)
- ✓ At the end of a turn, the **scheduler** informs **observers** to do their work
- ✓ Observers look at at the current situation (**snapshot**)
- ✓ They see what the world exposes (**WorldInterface**) and what the agents expose (**AgentInterface**)
- ✓ They don‘t see, what‘s not exposed
- ✓ They don‘t see, how the agents came to their final decisions

Issue Description



Note, some Models do not have access to the AgentInterface

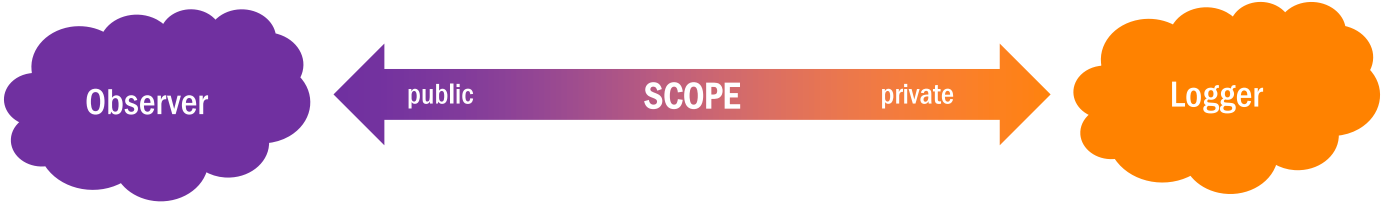
Sequence

- ✓ An Agent consists of serveral Models, each with access to the **AgentInterface**
- ✓ Within a simulation step, Models use **Signals** for communication
- ✓ At the end, writes are **synchronized**
  Currently, the last write wins
- ✓ Then, **Observers** to do their work

Unobservable Entities

- ✓ Multiple **writes** to the AgentInterface within the current turn
- ✓ **Signals**...
  (although more ore less public)
- ✓ Internal **variables**
- ✓ **Evolution** of internal variables
- ✓ Internal **Events** (e.g. State Transition)

Behind the AgentInterface



Observer

public SCOPE private

Logger

Notes

- ✓ Good for generic use, such as CollisionDetection
- ✓ Currently, use runResult for data exchange

Control Flow

The core is in control of what data is available and when it is analyzed.

What‘s the goal of openPASS?

- ✓ Generate meaningful data for analysis.
- ✓ Don‘t reinvent the wheel
- ✓ Compatibilty to standard analytics

What are the real requirements?

Notes

Currently only used to write runtime application information into the log files (aka **CallbackInterface**)

Control Flow

The models know what to write and when to write it. Consumers can access data as soon as it is written.

Observation vs. Logging

THE BIGH MESH UP

Combine **Observation and Logging in the ObservationInterface**

What to do

✓ **Resuscitate ObservationInterface**
- PCM Use isolated the Models from the ObservationNetwork
  The ObservationInterface does not offer model specific methods anyhow
- No configurable assignement of observations to specific modules
  The ModelLibrary can simply forward all ObservationModules

✓ **Extend ObservationInterface**
- At least: Insert-Method, e.g.
  `Insert(time, agentId, topic, key, value)`

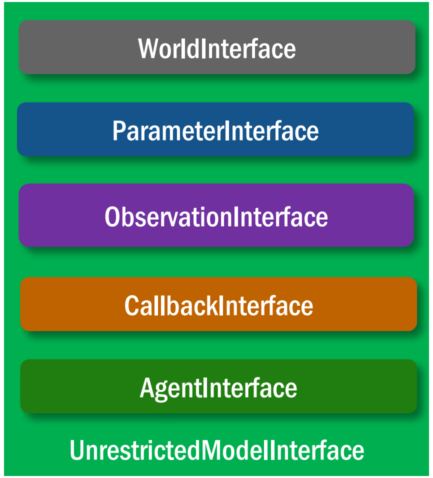
Pro

✓ Almost works out of the box

Con

✓ Unclear, to which time-step reported value belongs (out of sync)

✓ **Definitly, only a workaround:**
No future-proof architectural strategy and no seperation of concerns



Option 1

Minimally invasive

PUBLISH/SUBSCRIBE PATTERN

Introducing PublishInterface

What to do

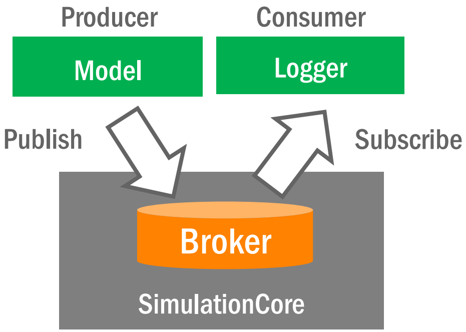
- ✓ **Replace ObservationInterface**
- ✓ **Extend SimulationCore**
- ✓ **Ideally, hide logic from Model**
  (see next Slides)

Pro

- ✓ Seperated concerns
- ✓ Everyone can publish private data
- ✓ Decoupled producer and consumer

Con

- ✓ Decoupled producer and consumer ;)
- ✓ **Definitly, only a workaround:**
  No future-proof architectural strategy and no seperation of concerns



Producer

Model

Consumer

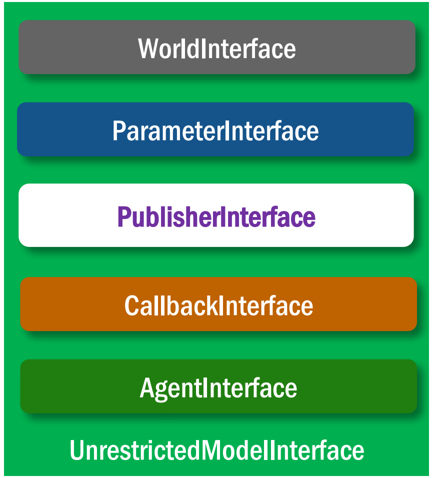
Logger

Publish

Subscribe

Broker

SimulationCore



WorldInterface

ParameterInterface

PublisherInterface

CallbackInterface

AgentInterface

UnrestrictedModelInterface

Option 2

Update UnrestrictedModelInterface

Example

Pseudo Code (Auto-Publishing)

```
template<typename T>
class Observable
{
    std::list<T> _values;

public:
    explicit Observable(T initValue) {
        set(initValue);
    }

    const T get() const {
        return _values.back();
    }

    void set(T value)  {
        _values.push_back(value);
    }

    const std::list<T>& values() const
    {
        return _values;
    }

    …
```

Managed by Broker

```
    …

    Observable& operator=(T value) {
        set(value);
        return *this;
    }

    operator T() const {
        return get();
    }

    bool operator==(const T& lhs) {
        return lhs == get();
    }

    bool operator==(const Observable&
                              lhs)
    {
        return lhs.get() == get();
    }
};
```

Might be a request to the Broker

```
int main()
{
    Observable x{0.0}, y{0.0};

    // assign to local variable
    double a = x;
    // store update (publish)
    x = 12.0;

    if (x == 12.0) {
      // compare to base type
    }

    if (x == y) {
     // compare to observable
    }

    for (auto value : x.values()) {
        // loop history
    }
}
```

payload <double>

Apache Kafka

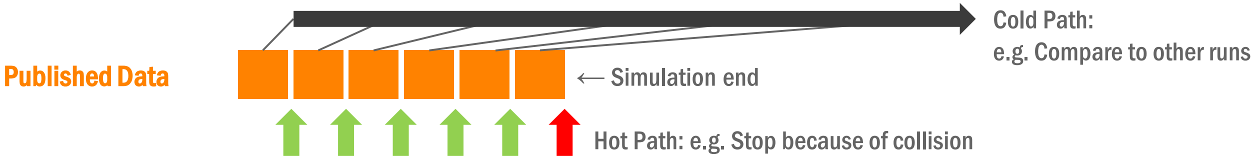
- ✓ Publish and subscribe to streams of records, similar to a message queue
- ✓ Store streams of records in a fault-tolerant durable way
- ✓ Process streams of records as they occur

MQTT

- ✓ Easy information organization through hierarchical topics, e.g *Deathstar/Laser/Temperature* or *Deathstar/Laser/**
- ✓ OASIS accepted ISO Standard
- ✓ Quality of Service implementation

What we should aim for

- ✓ Publish/Subscribe System (could also replace **Signals**)
- ✓ A lightweight interface or decorator for publishing
- ✓ A new ModelInterface
- ✓ Independent logger (consumers)
- ✓ Compatibilty to persisting (streaming) systems, opening support for consumers with different processing speed (hot/cold paths)


Published Data
Cold Path:
e.g. Compare to other runs
← Simulation end
Hot Path: e.g. Stop because of collision

Option 3

The bigger picture