

# Reducing Flight Delays with Kubernetes and Tensorflow

Daniel van der Ende & Tim van Cann



# GO DATA DRIVEN

- **IT Consultancy**
- **40 Data Scientists, Machine Learning Engineers, and Data Engineers**
- **Based in Amsterdam**
- **We help organisations be successful with data and AI**



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**499,444**

Air Transport Movements at Schiphol

**71.1**

Million Passengers at Schiphol

**79.2**

Million Passengers

**1.6**

Billion Euro Real Estate

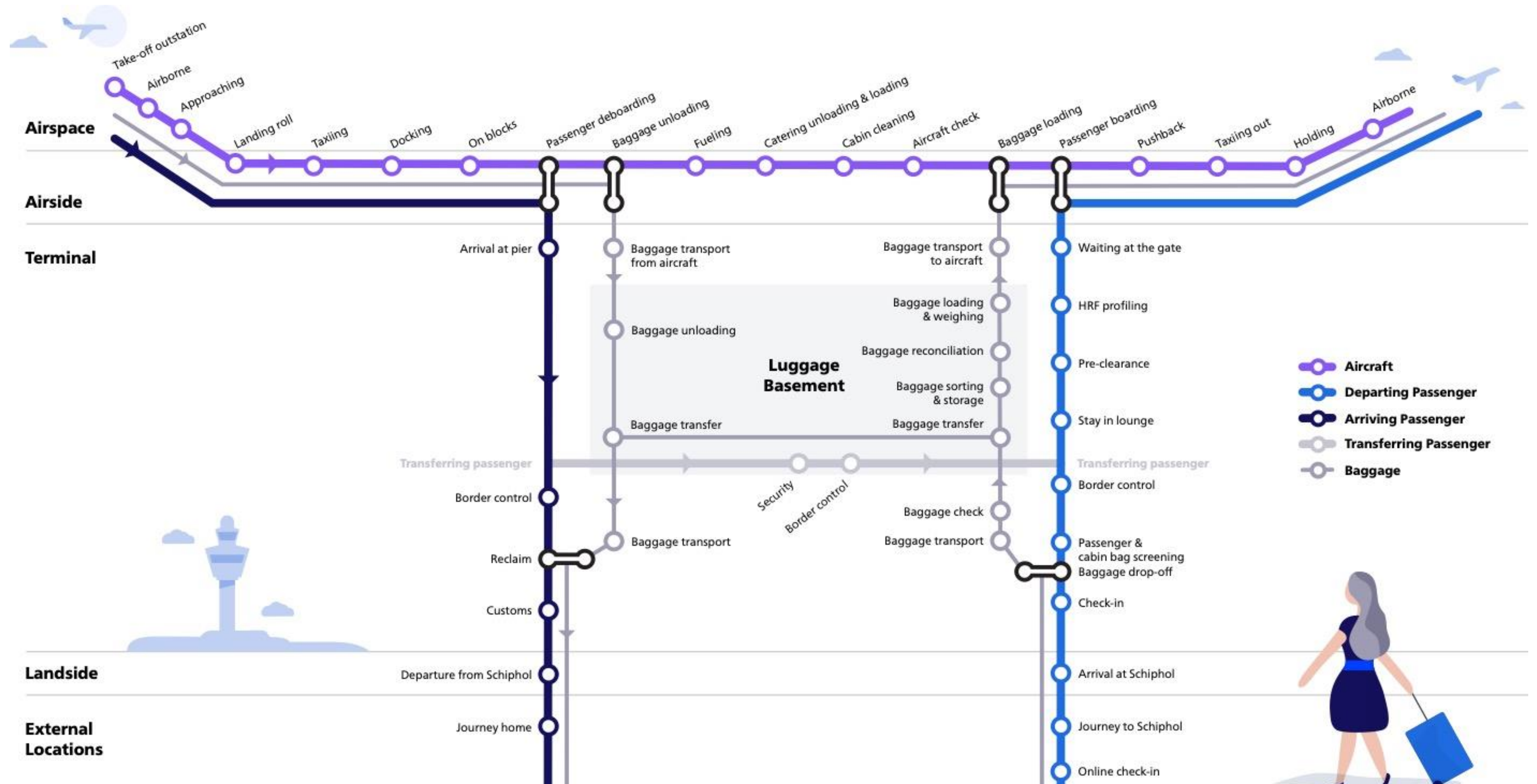
## **Mission**

Connecting the Netherlands

## **Ambition**

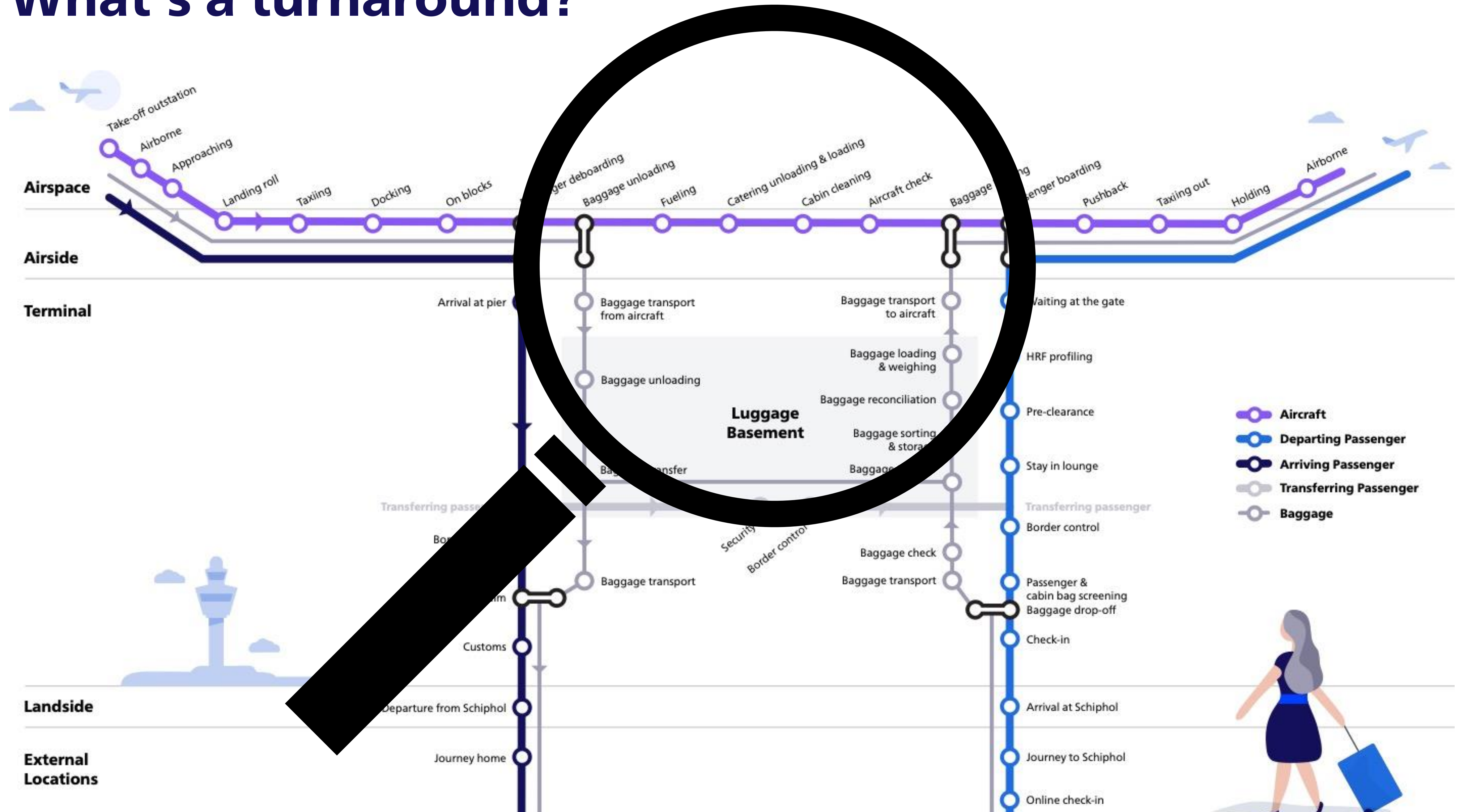
Europe's Preferred Airport

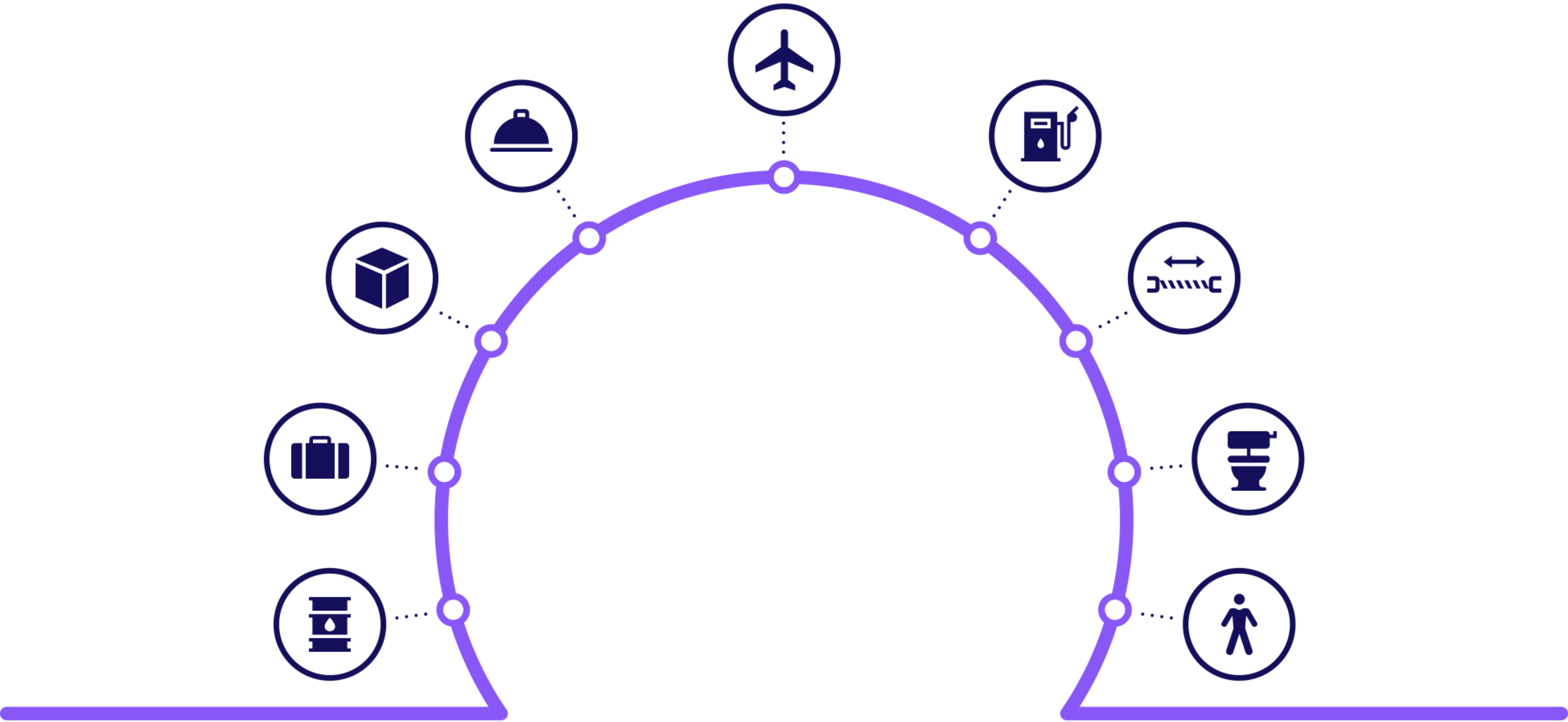
# What's a turnaround?





# What's a turnaround?



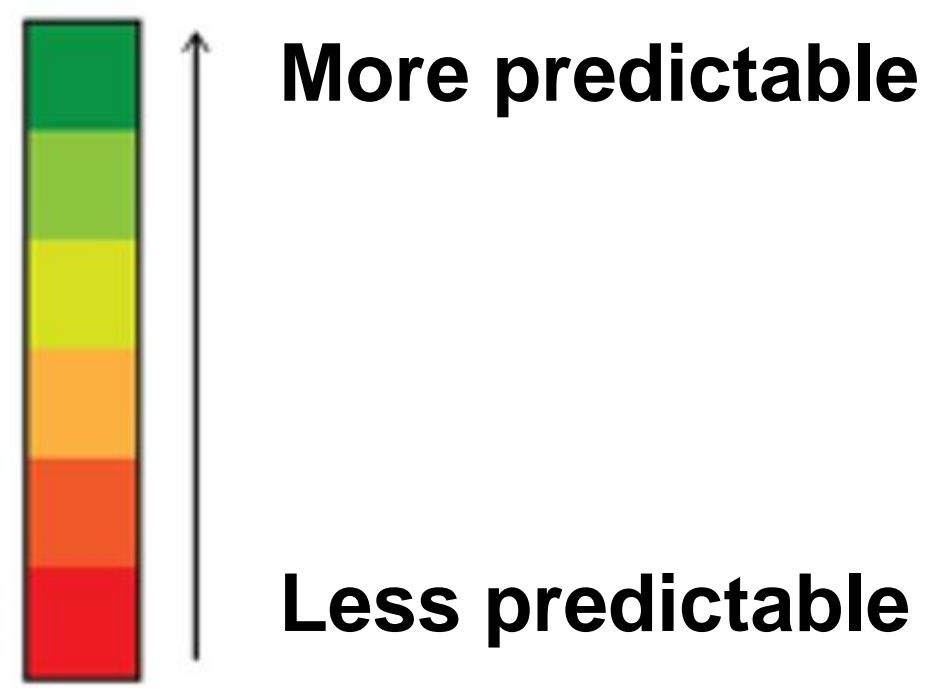
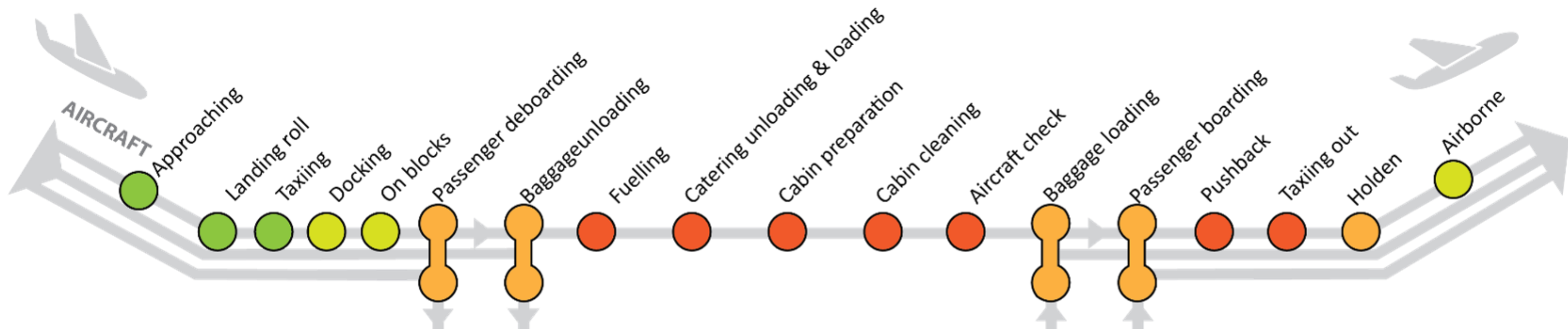




# What's a turnaround?





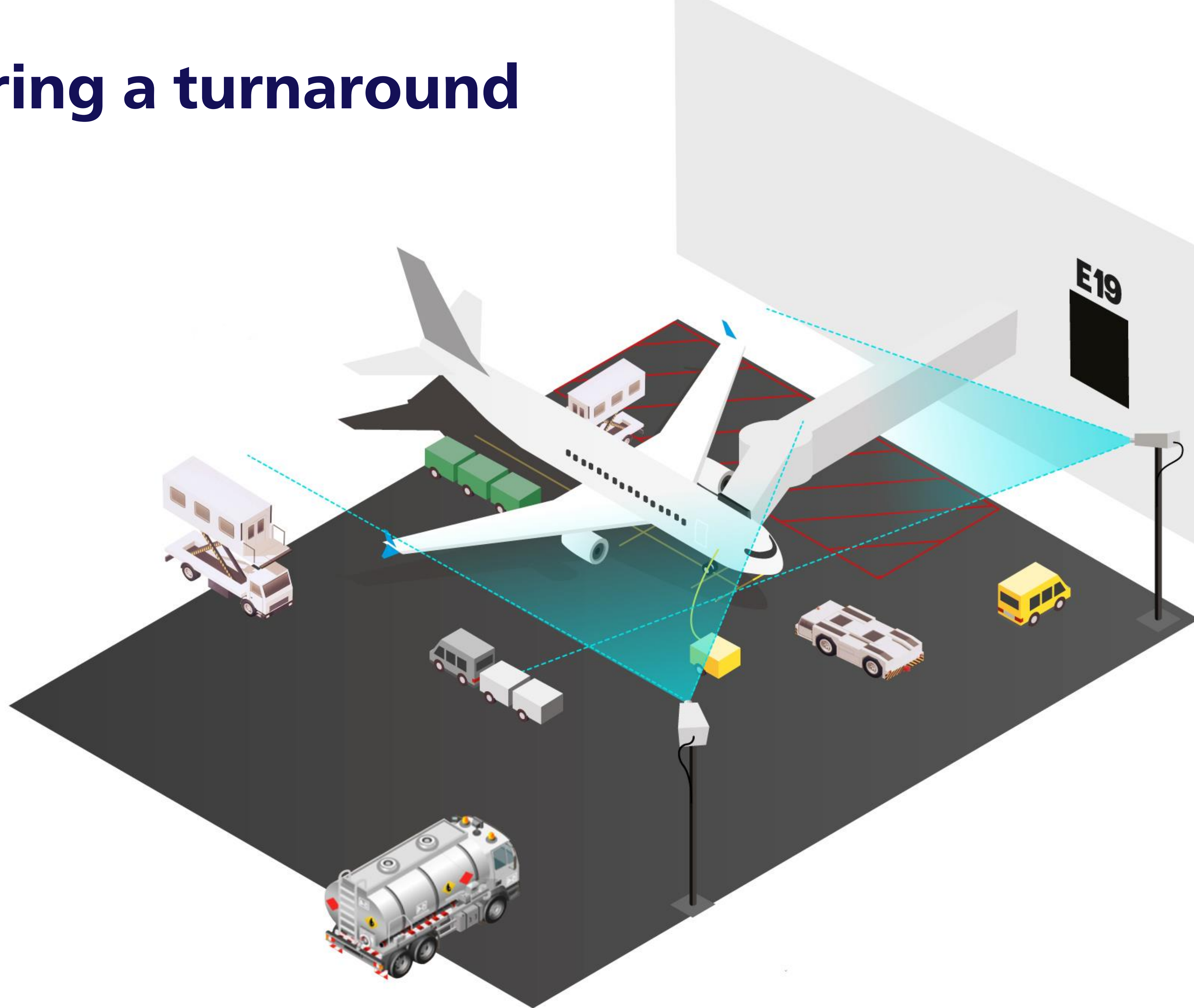






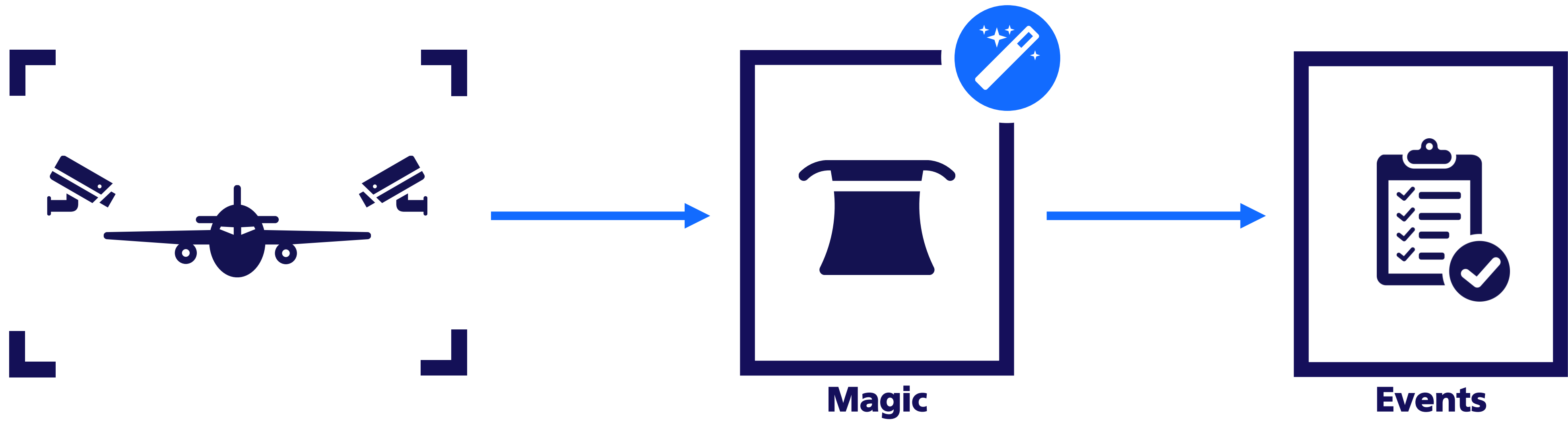


# Monitoring a turnaround



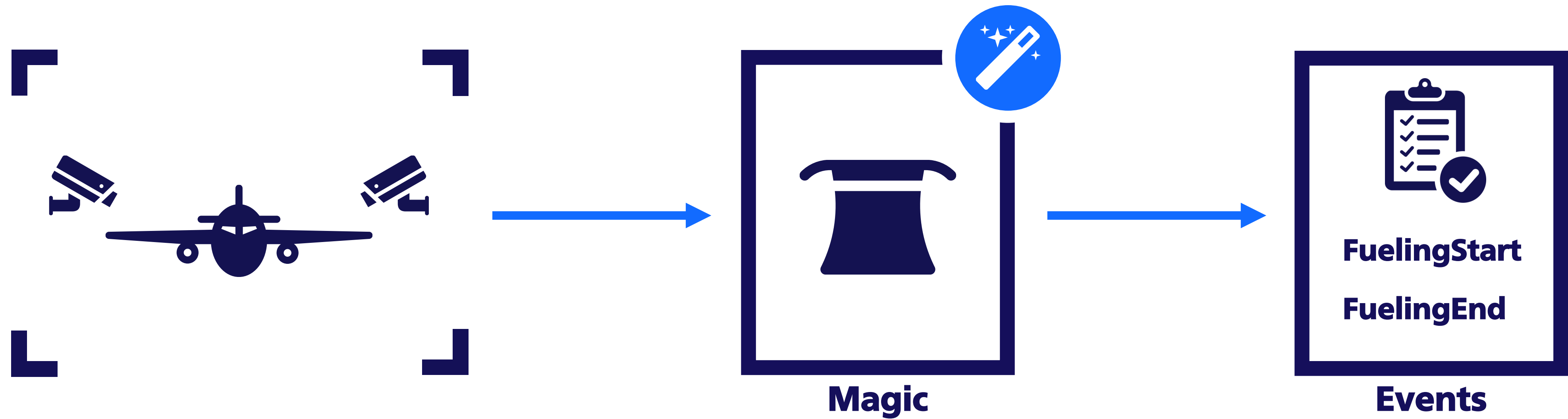


# High level Design



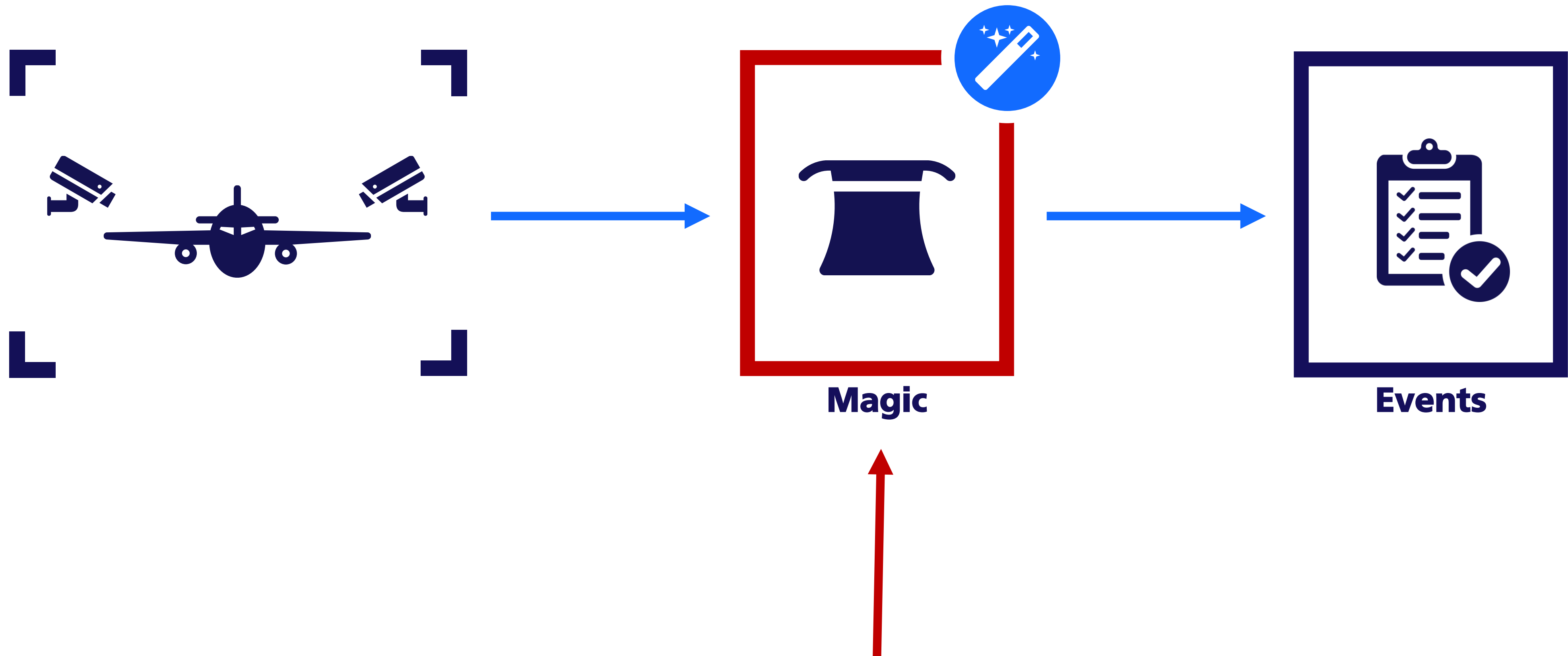


# High level Design



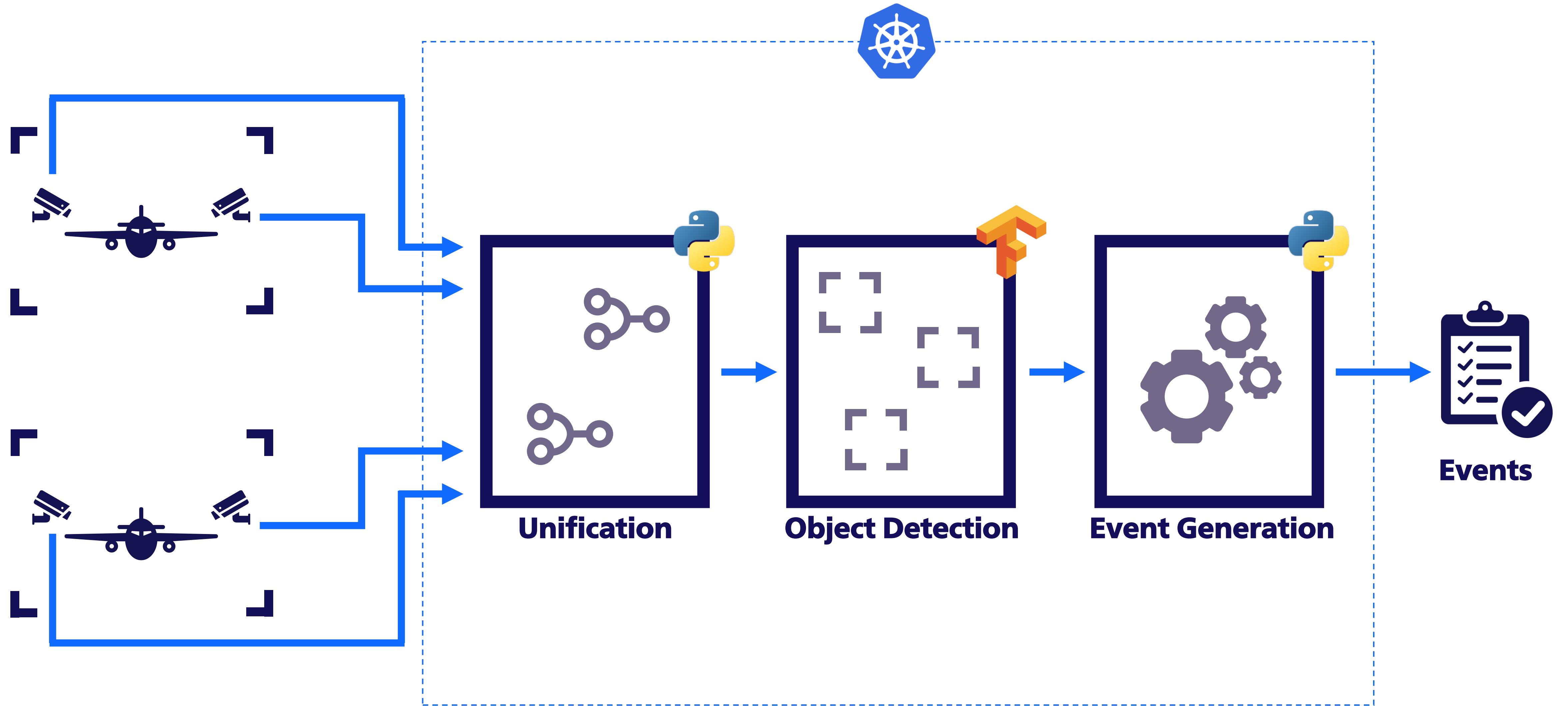


# High level Design



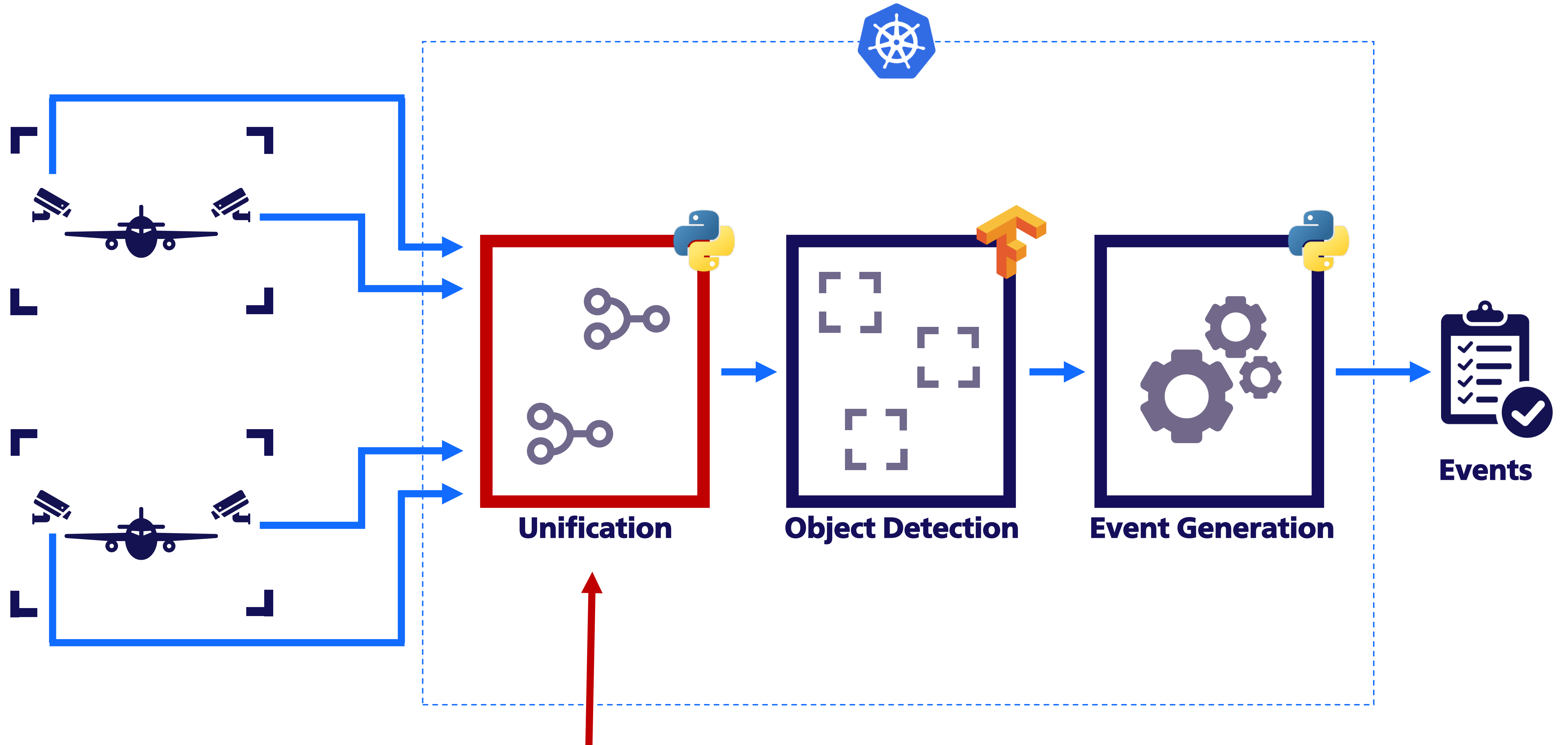


# Streaming!





# Streaming!



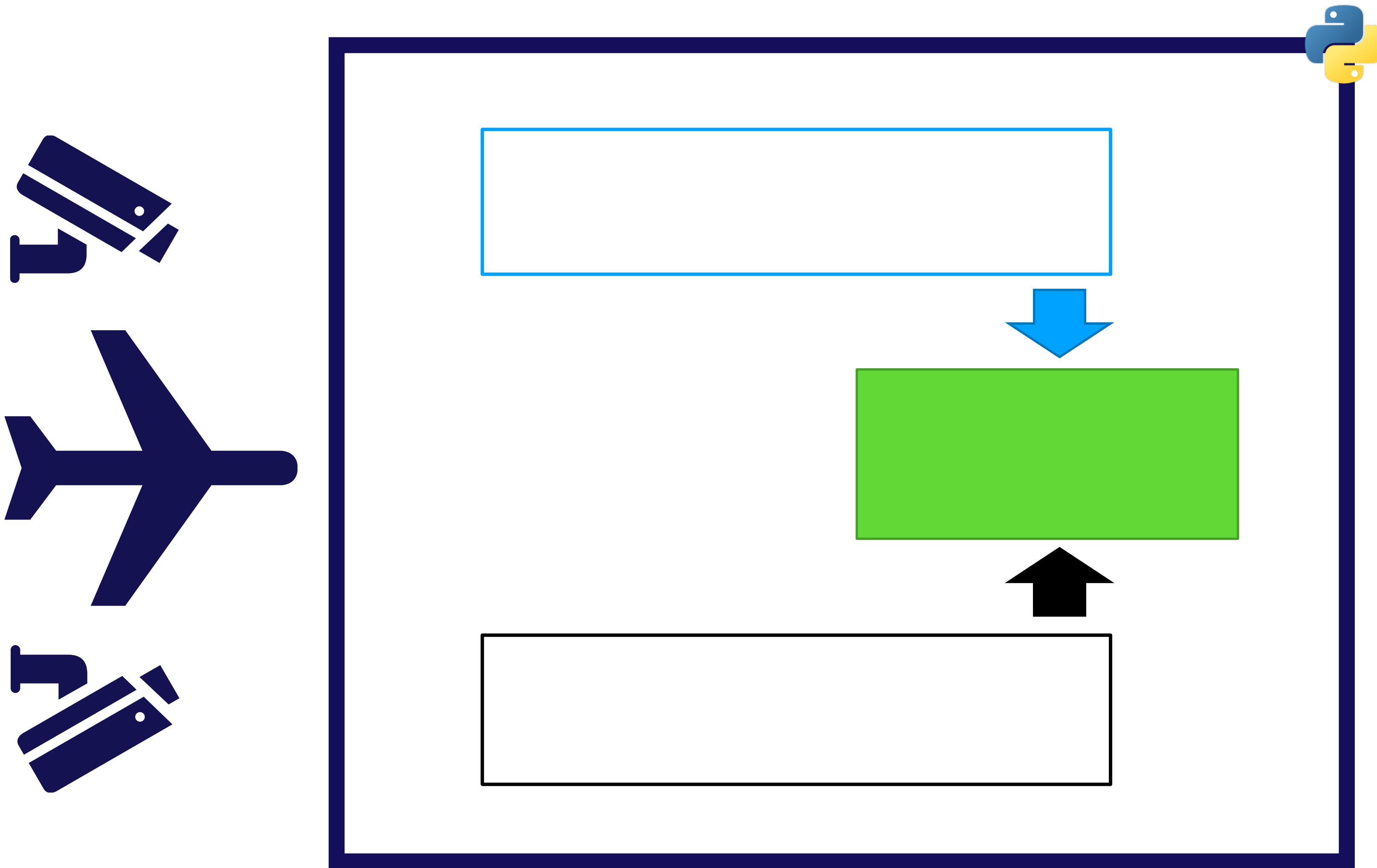


# Unification of camera's



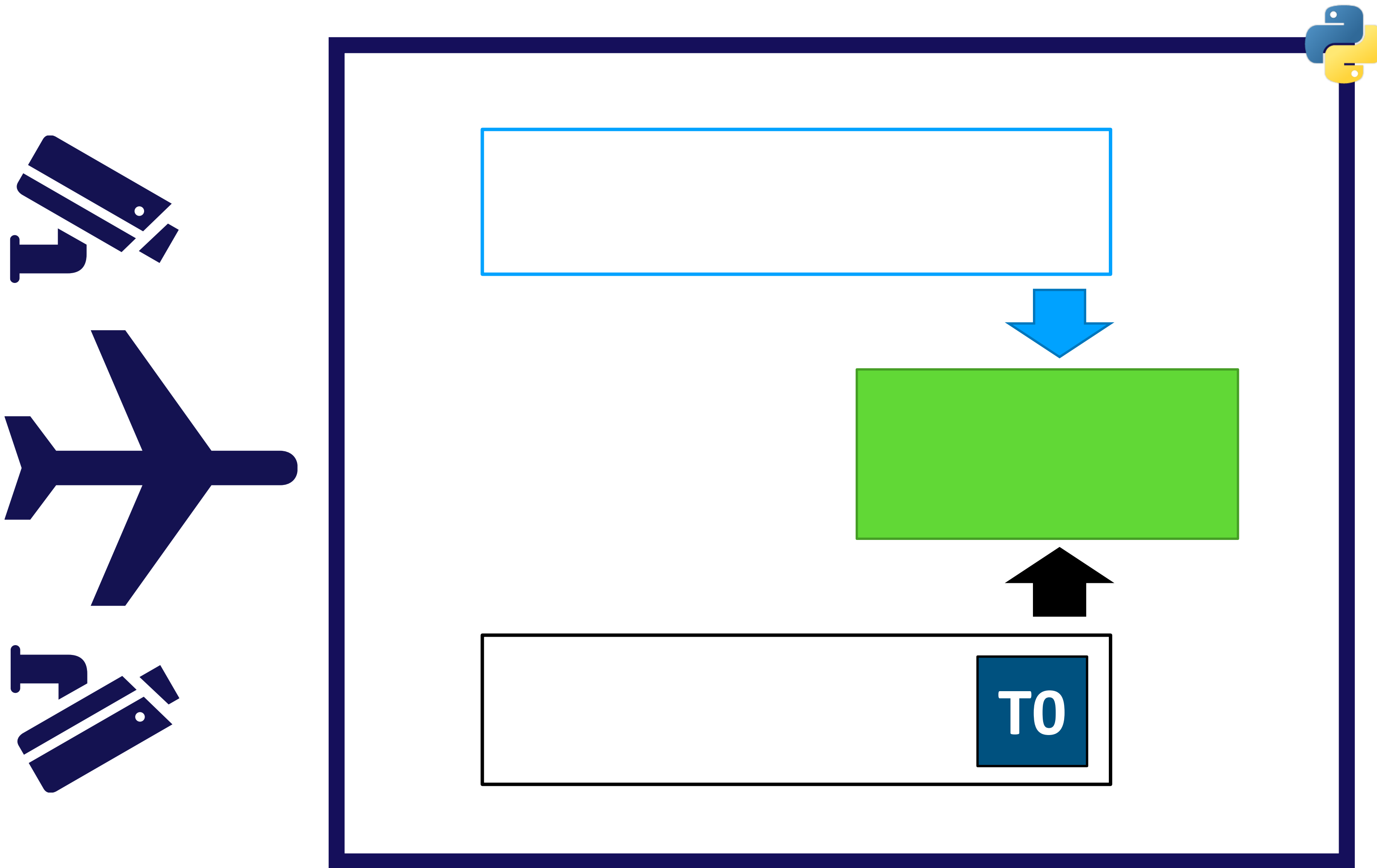


# Unification of camera's



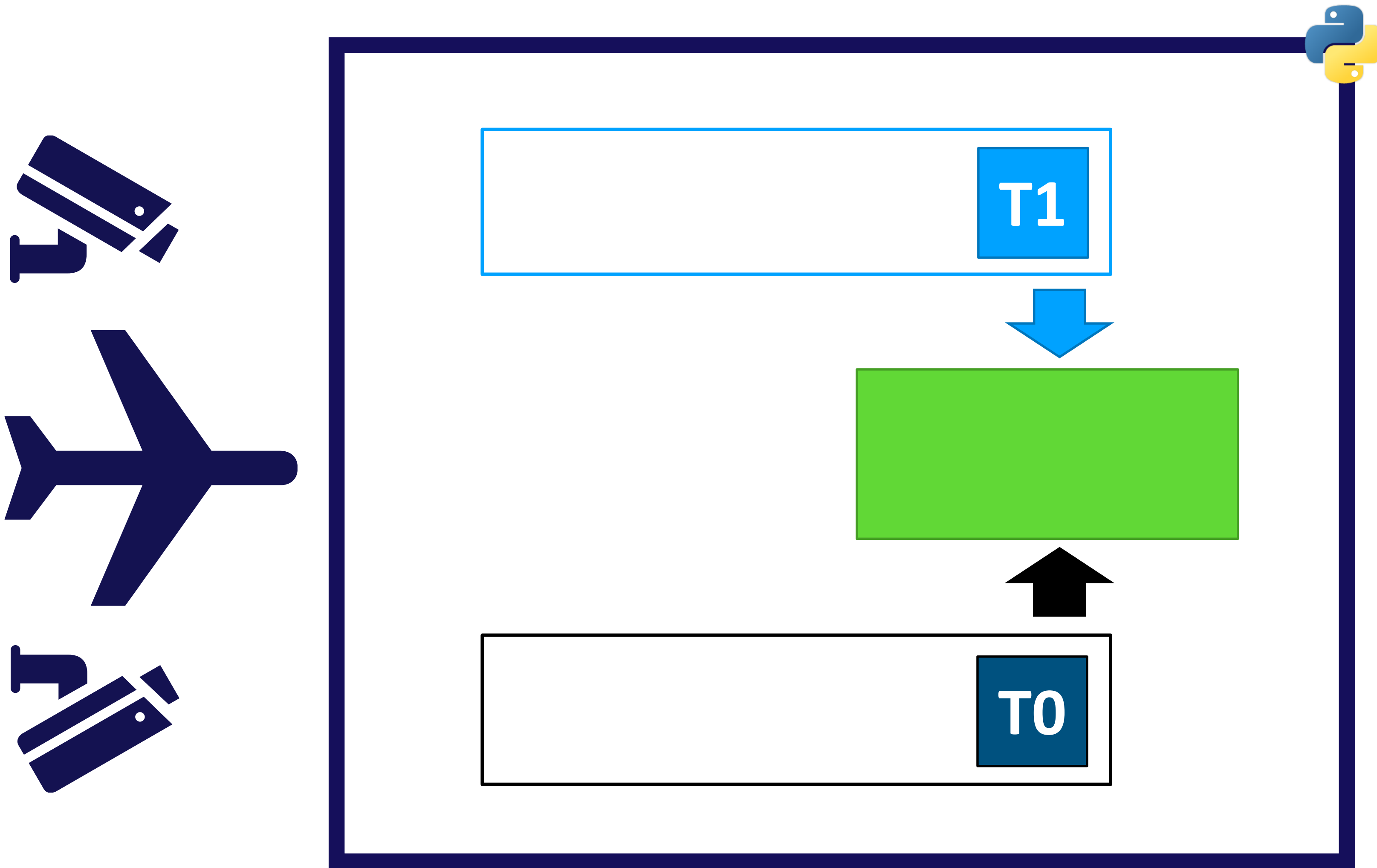


# Unification of camera's



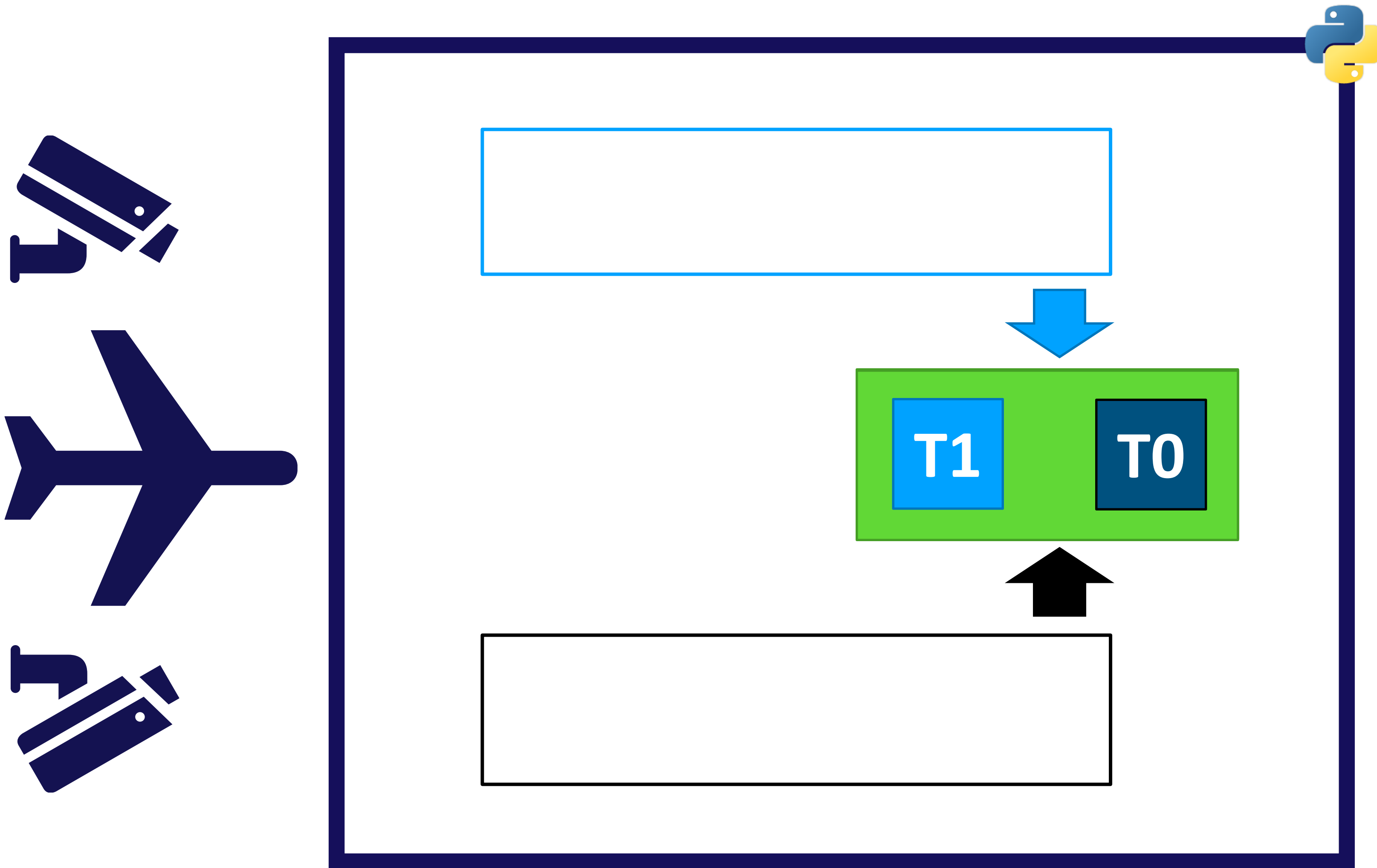


# Unification of camera's



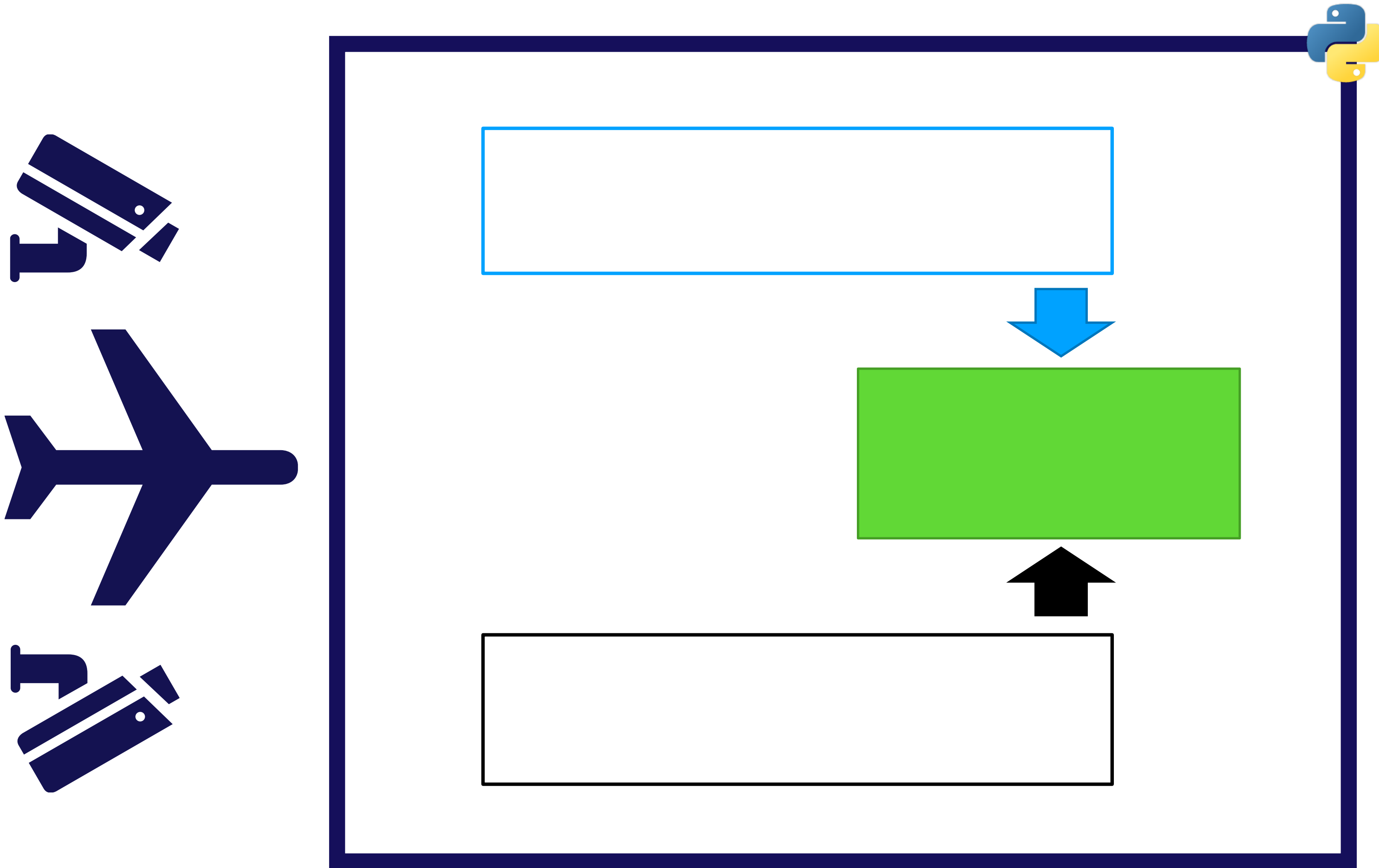


# Unification of camera's



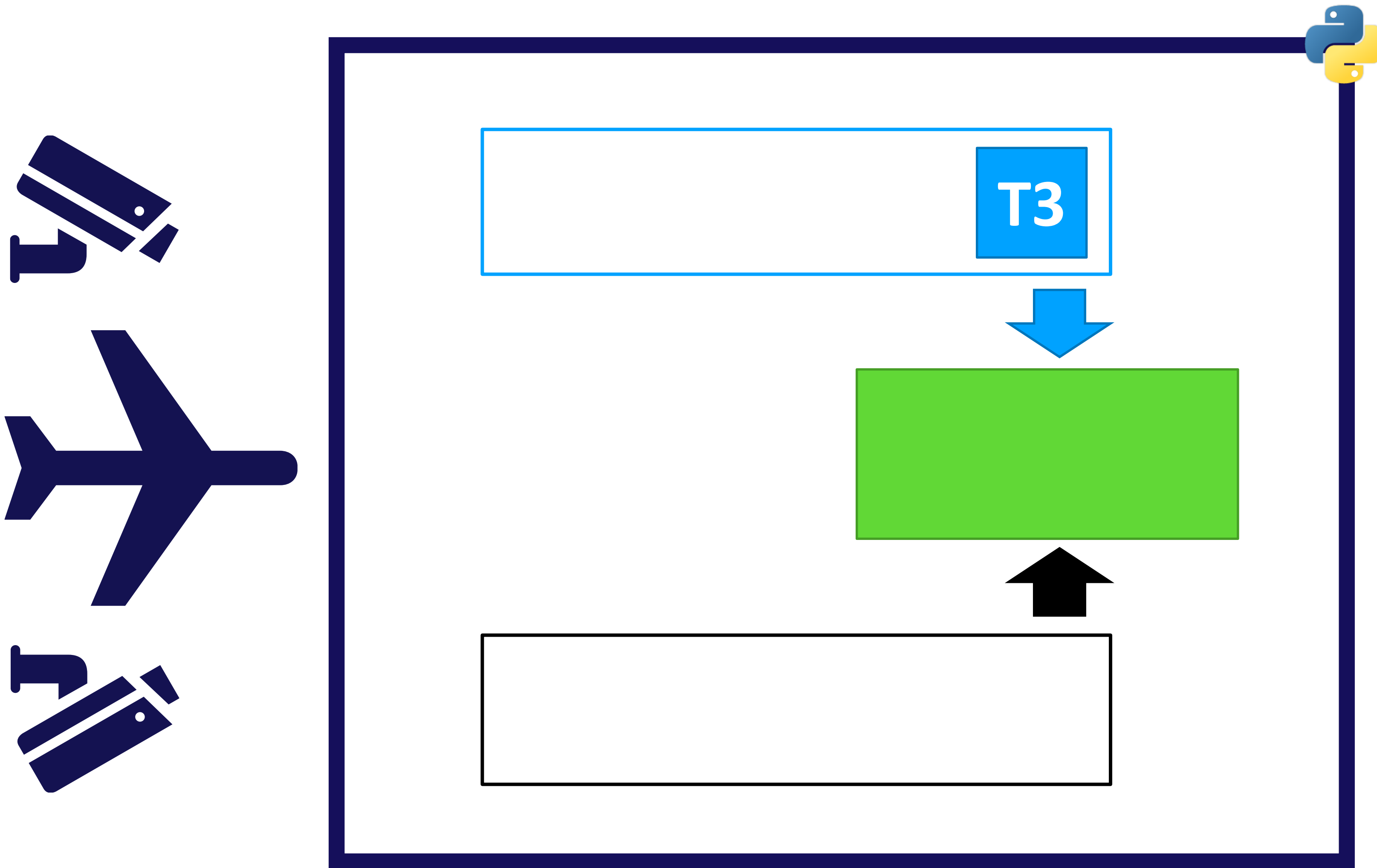


# Unification of camera's



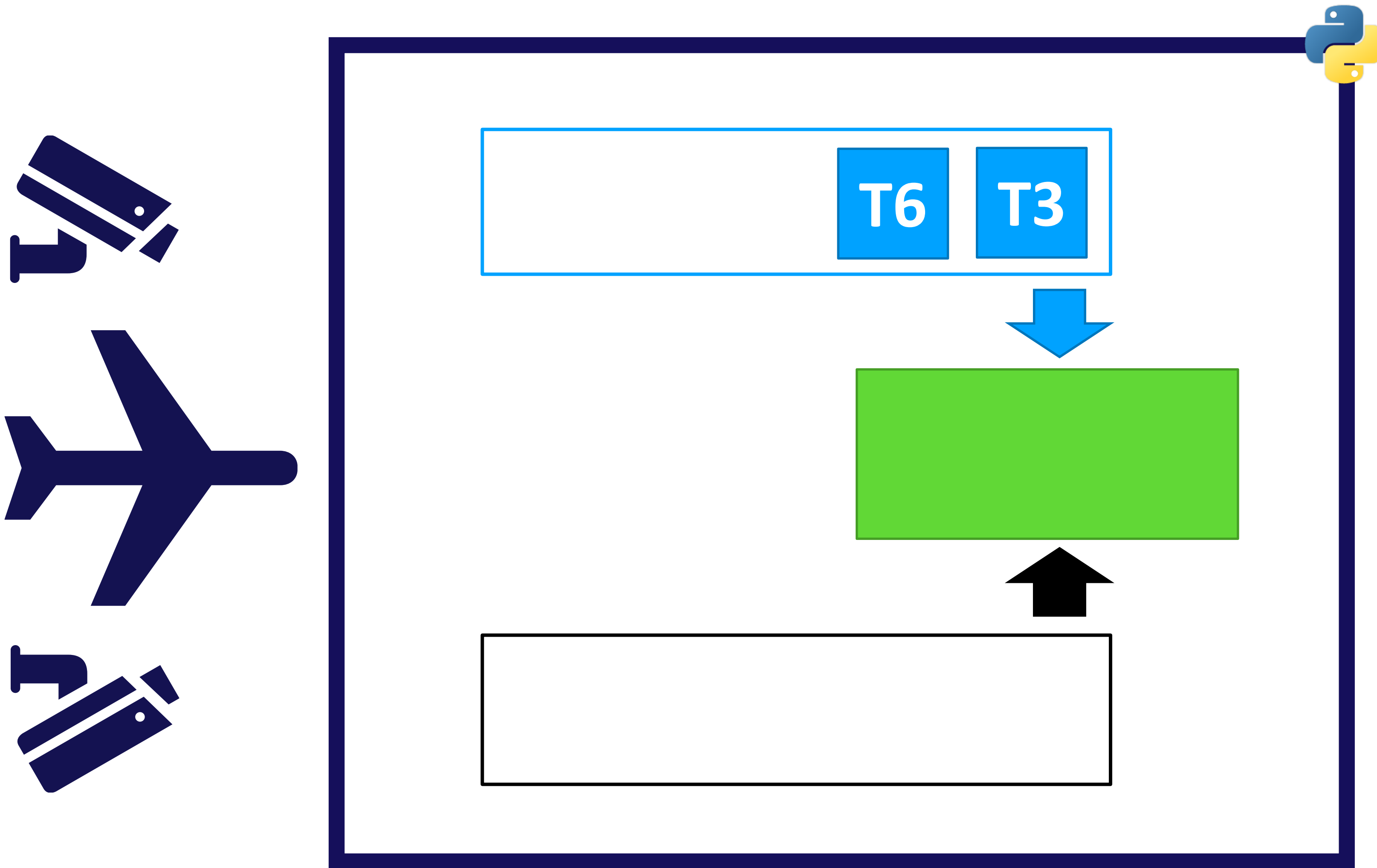


# Unification of camera's

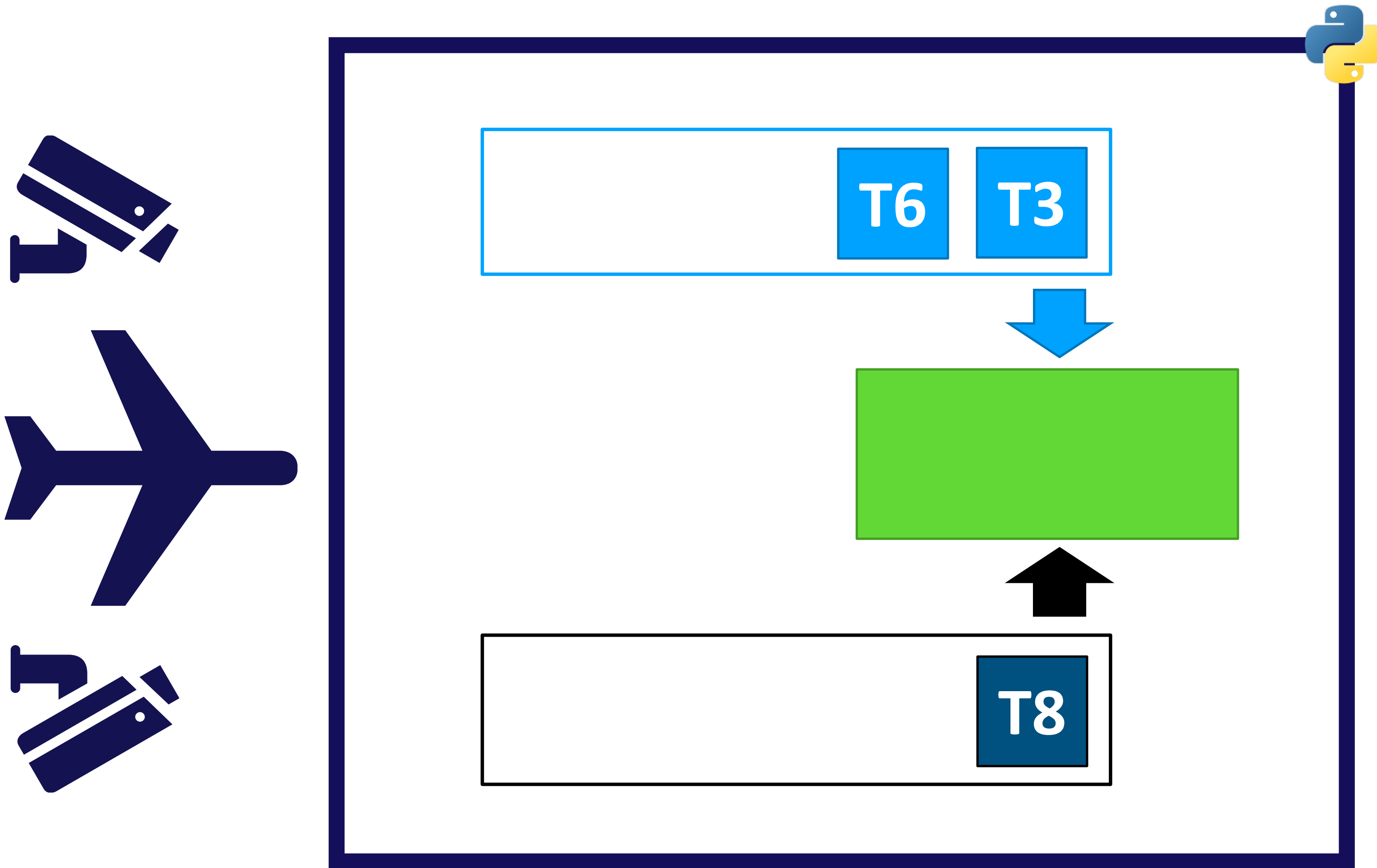




# Unification of camera's

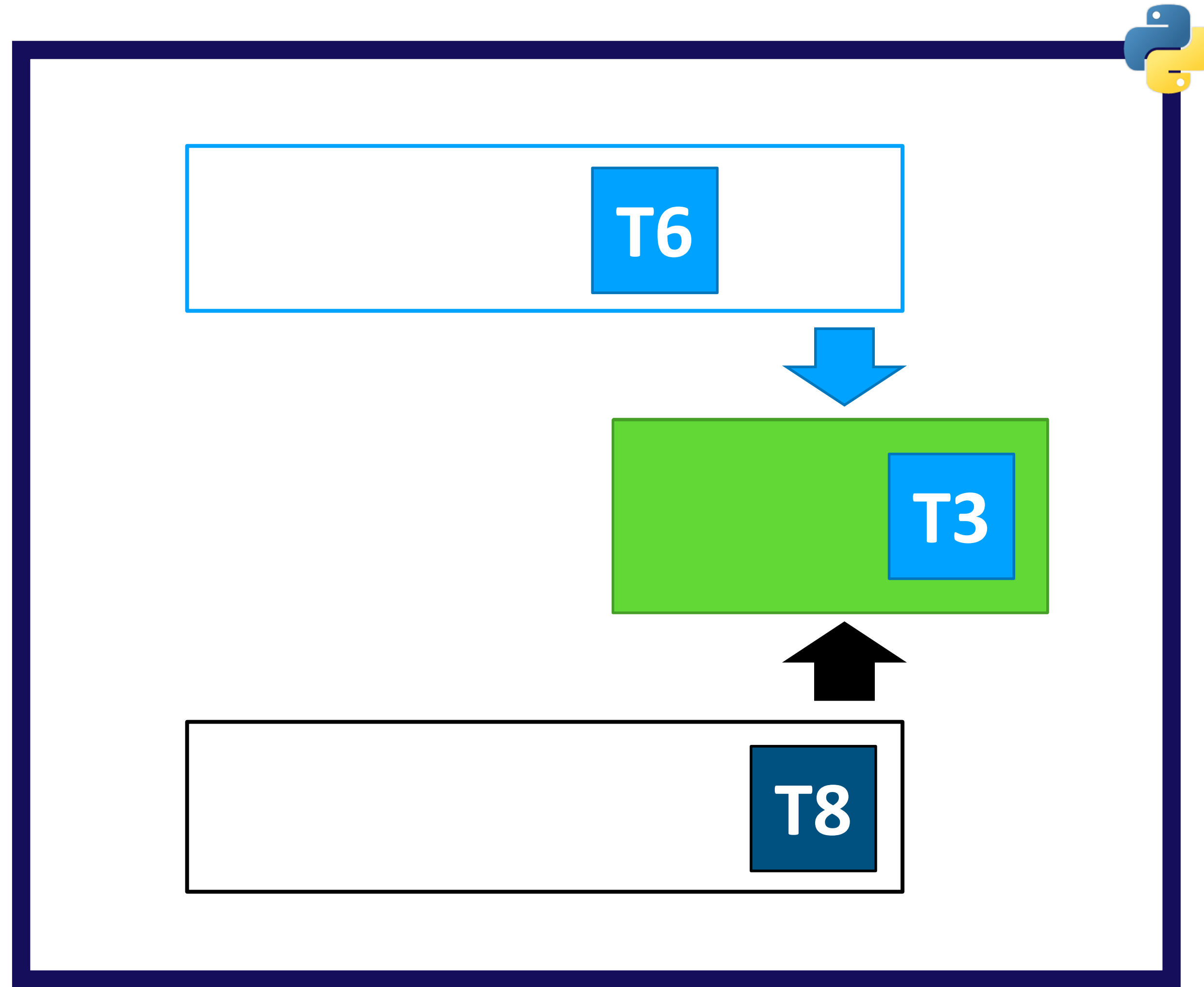


# Unification of camera's

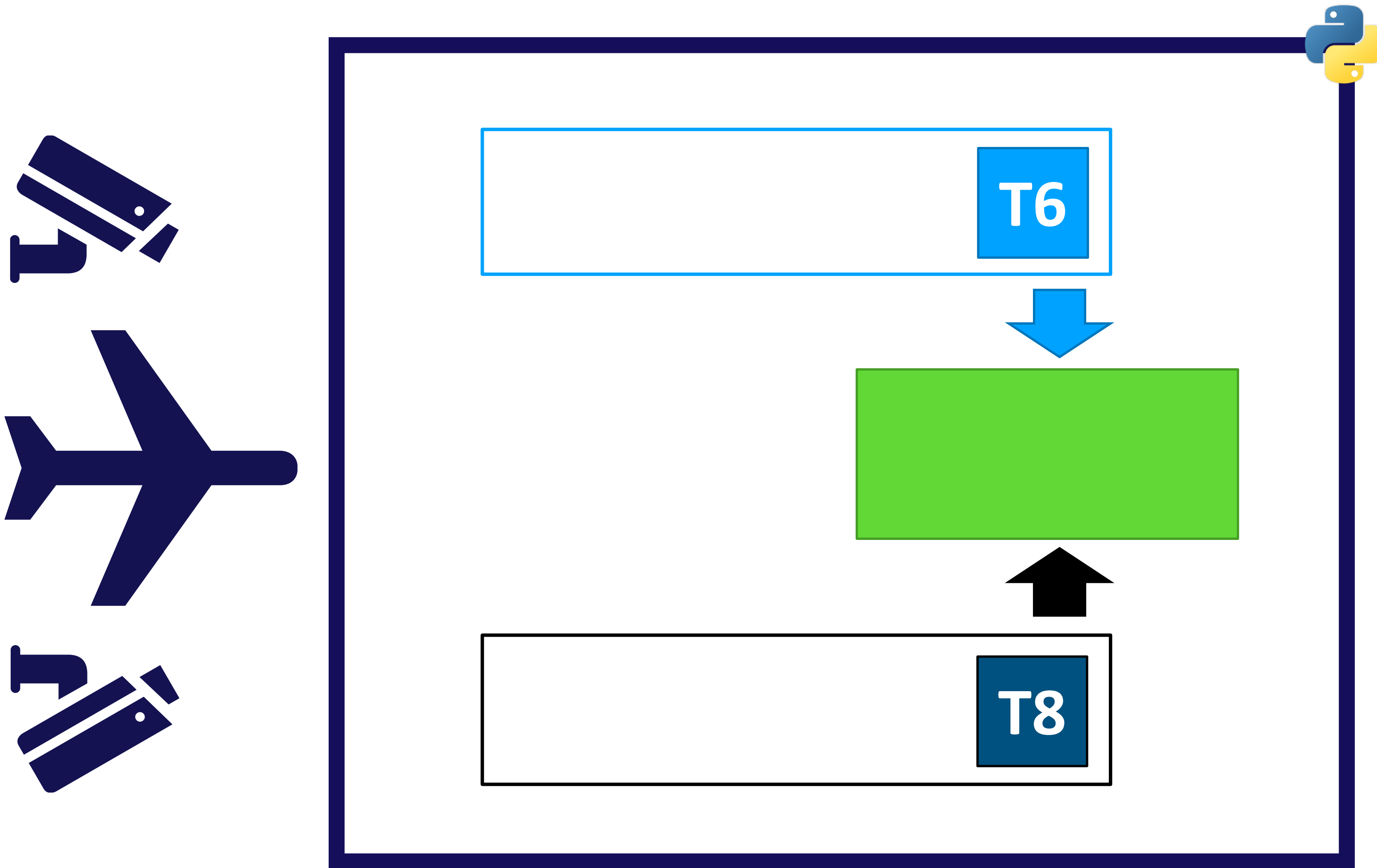




# Unification of camera's

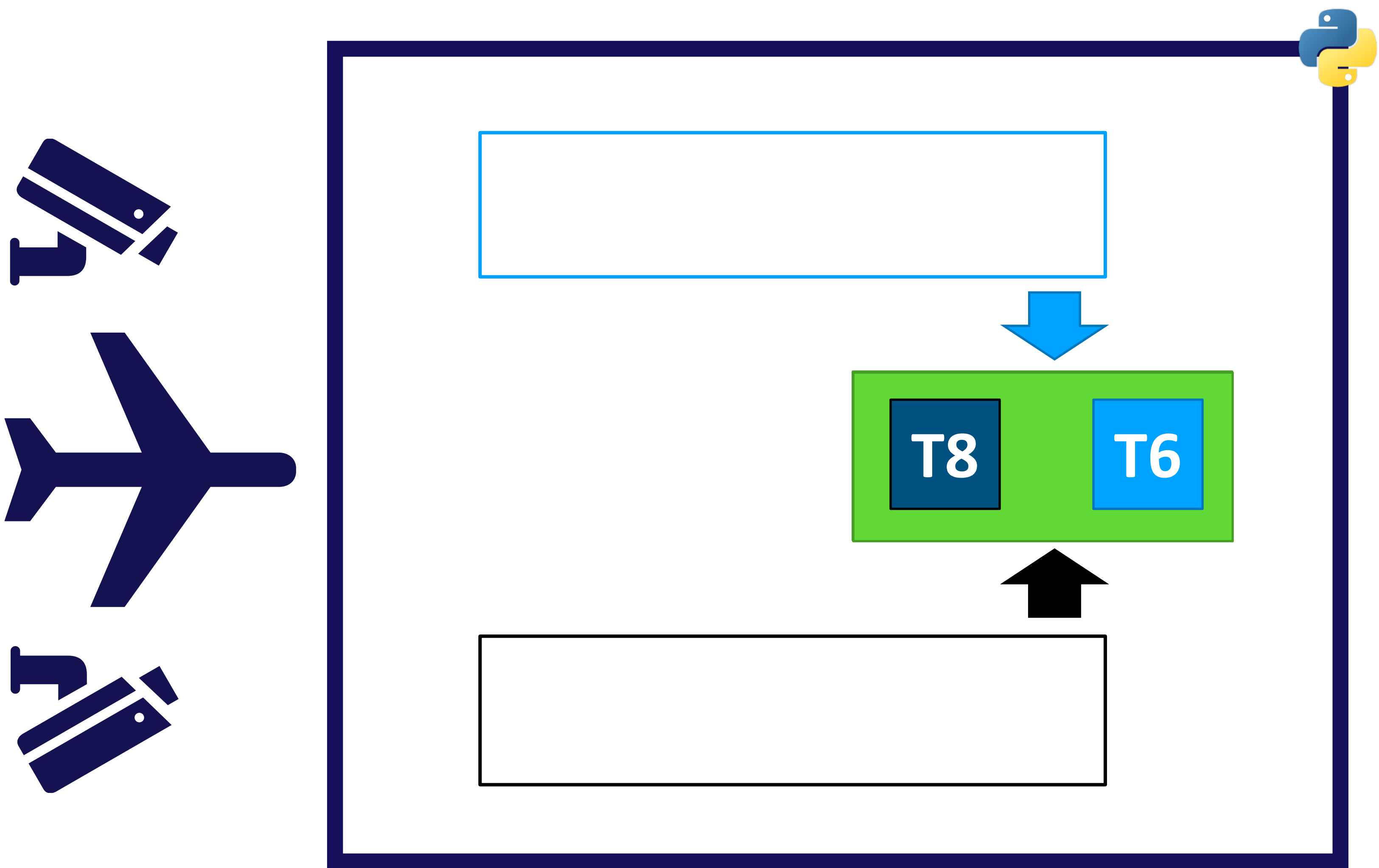


# Unification of camera's

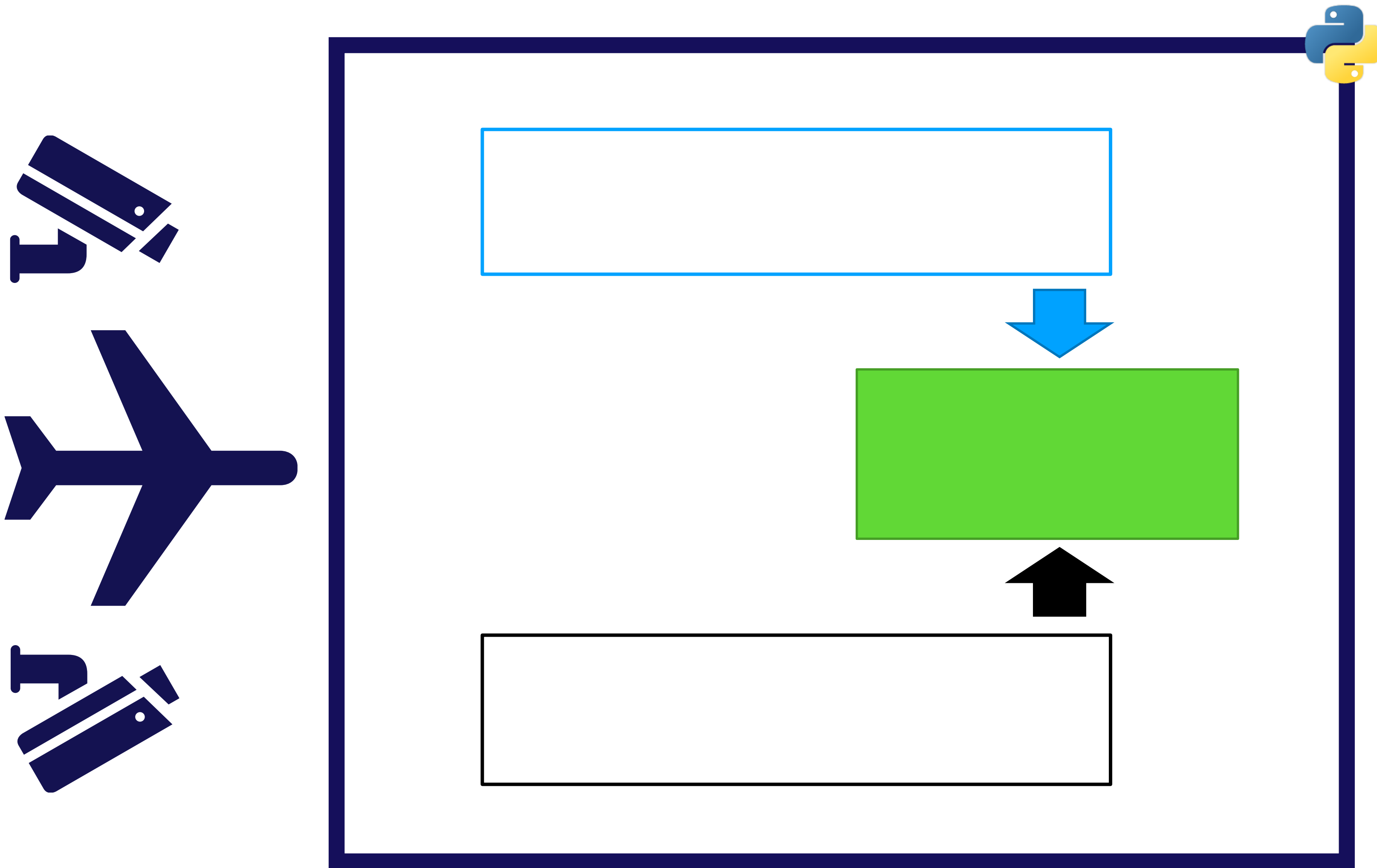




# Unification of camera's

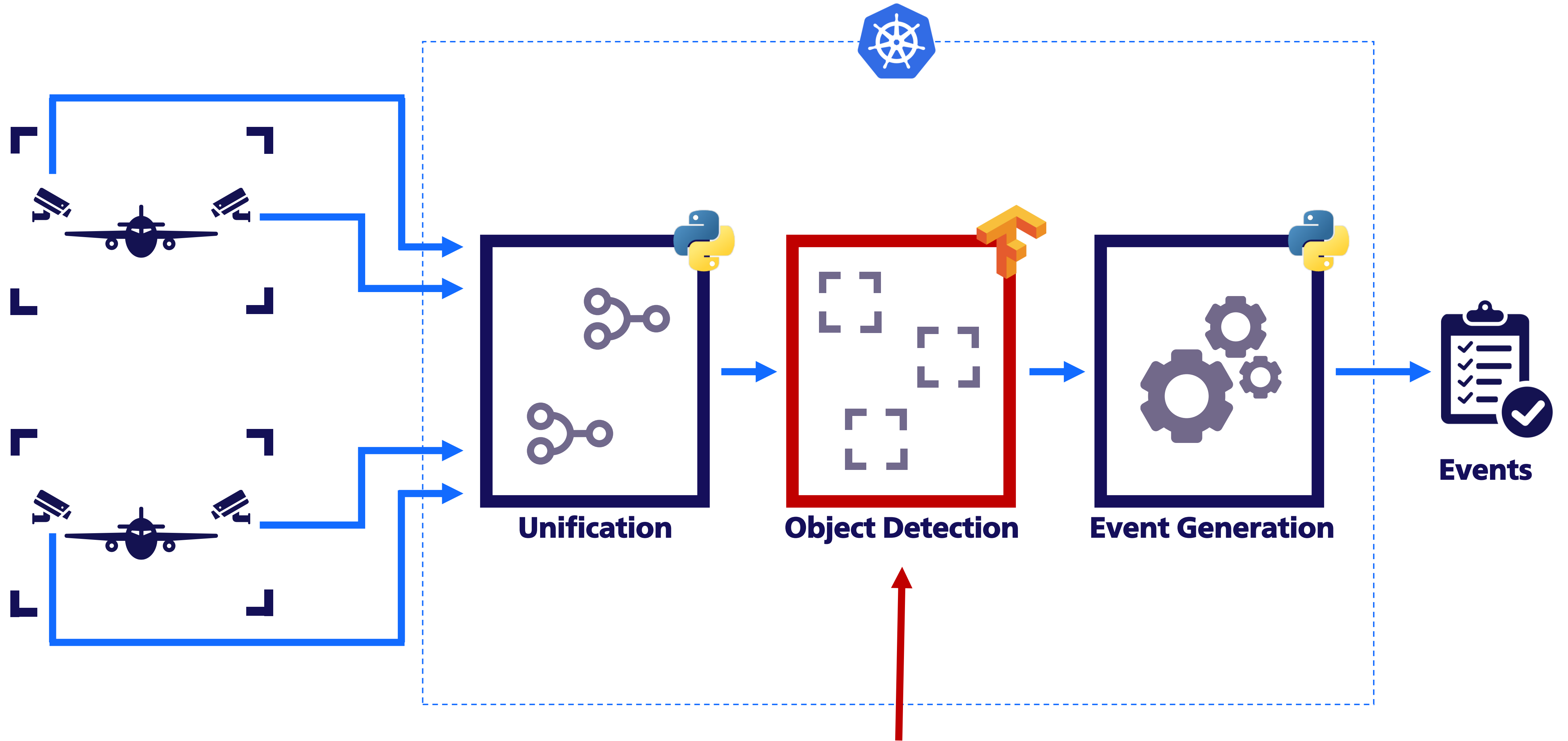


# Unification of camera's





# Streaming!



# Object Detection



GPU

Aircraft

Pallet transfer

Conveyer belt

High loader

Open cargo door

Catering truck

Open PAX door

Lavatory truck

Pushback truck





aircraft



open\_cargo\_door



catering\_truck



conveyor\_belt\_loader



fuel\_tank\_truck



high\_loader



lavatory\_truck



pallet\_transporter



open\_pax\_door



fuel\_pump\_truck



pushback\_truck



container



*"Batches are for Barbecues"*

**Fokko Driesprong**





# Object detection iterations

# Object detection iterations

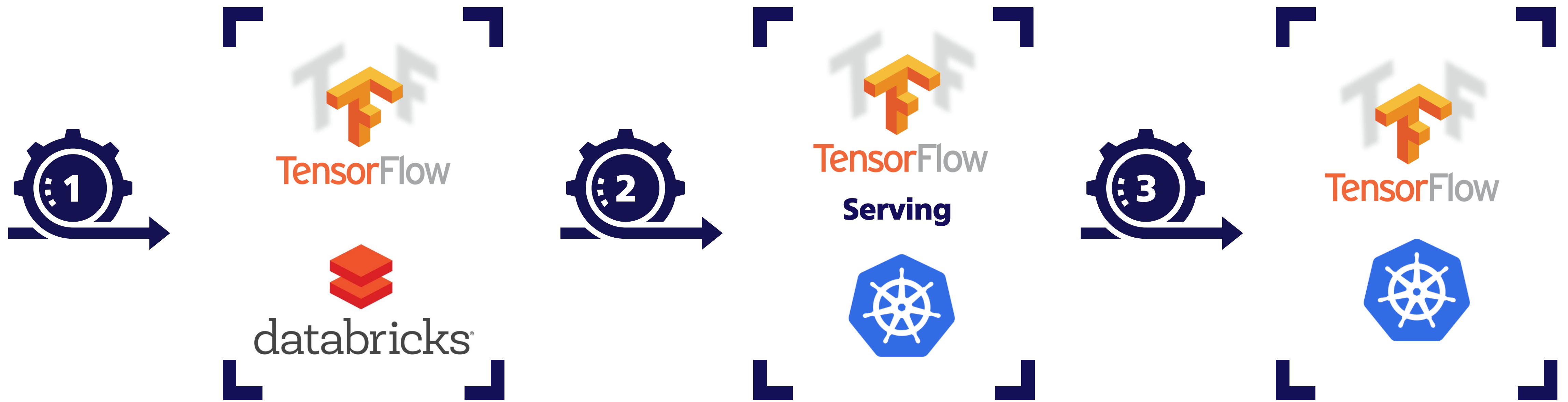




# Object detection iterations



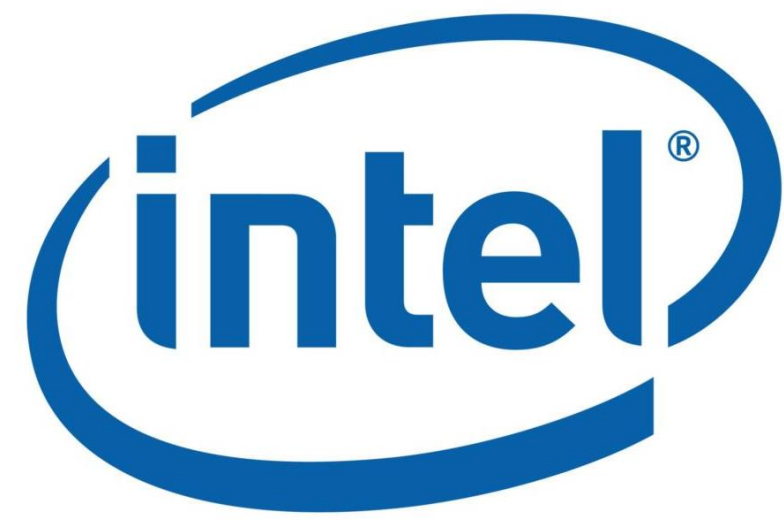
# Object detection iterations







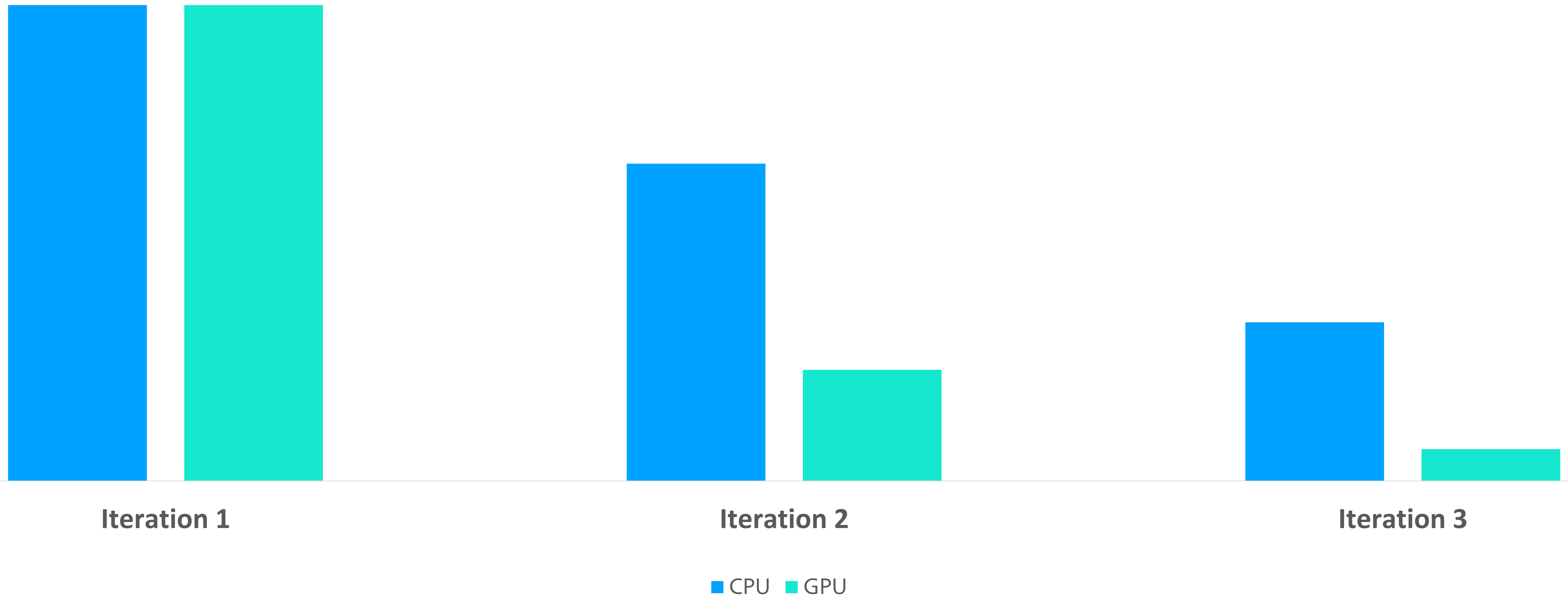




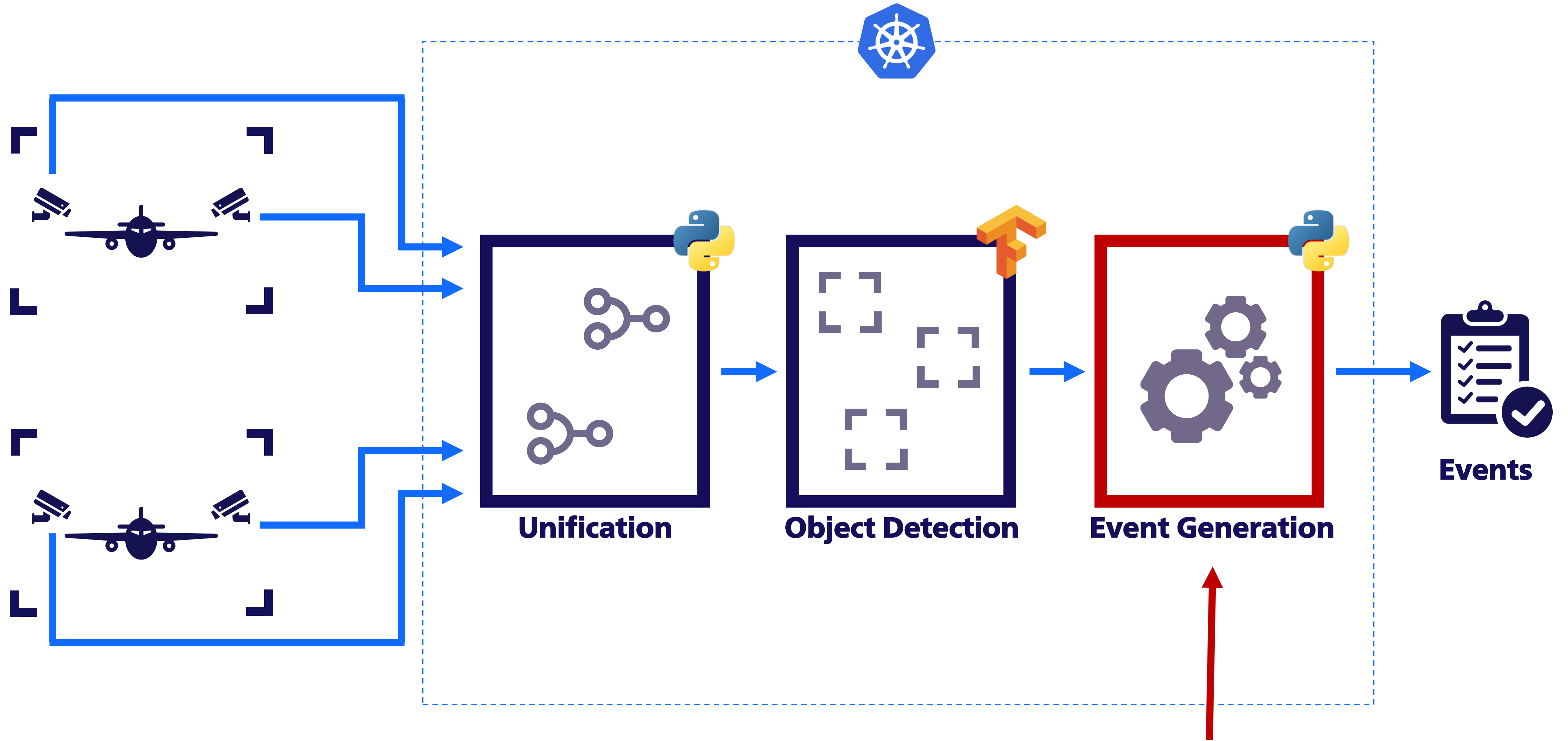


# Object detection: GPUs or CPUs?

Approximate inference time per image(s)



# Streaming!





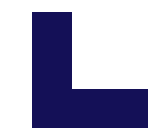
# Why we need Event Generation



**Object  
Detection**



```
{"objects": ["aircraft"], "timestamp": "2019-11-13 09:45:05"}
```



# Why we need Event Generation



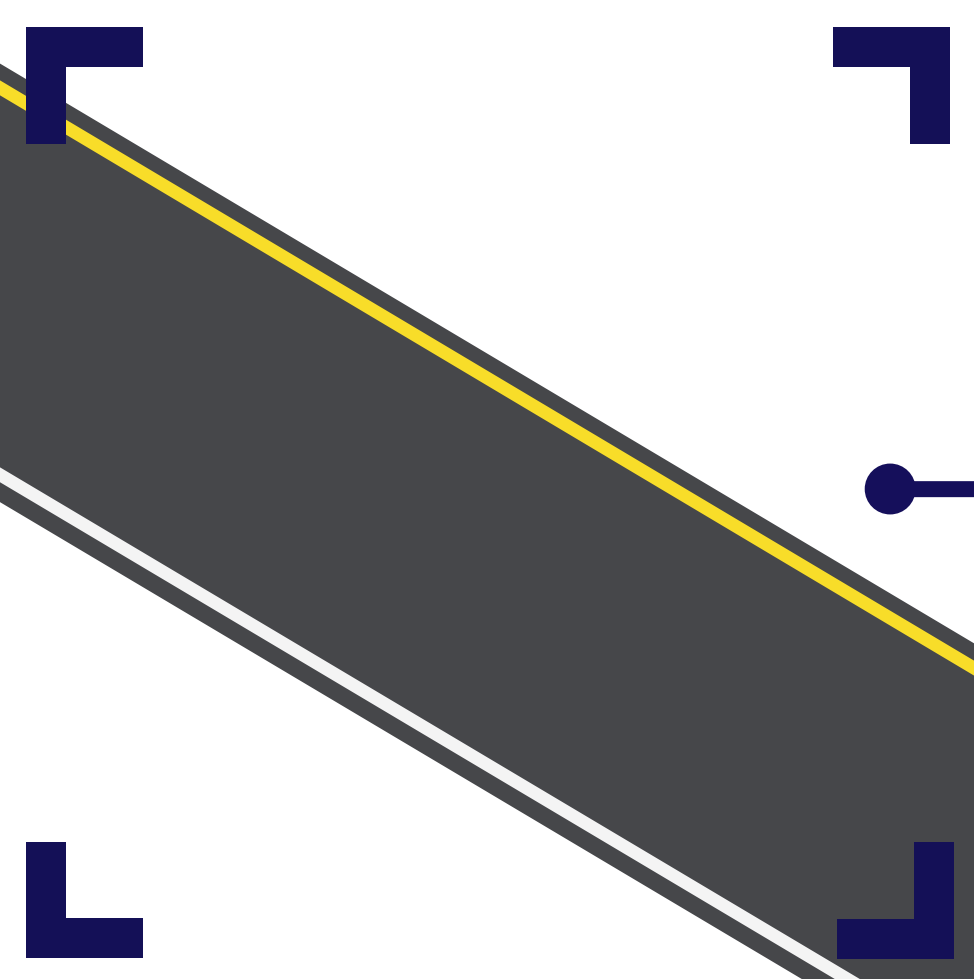
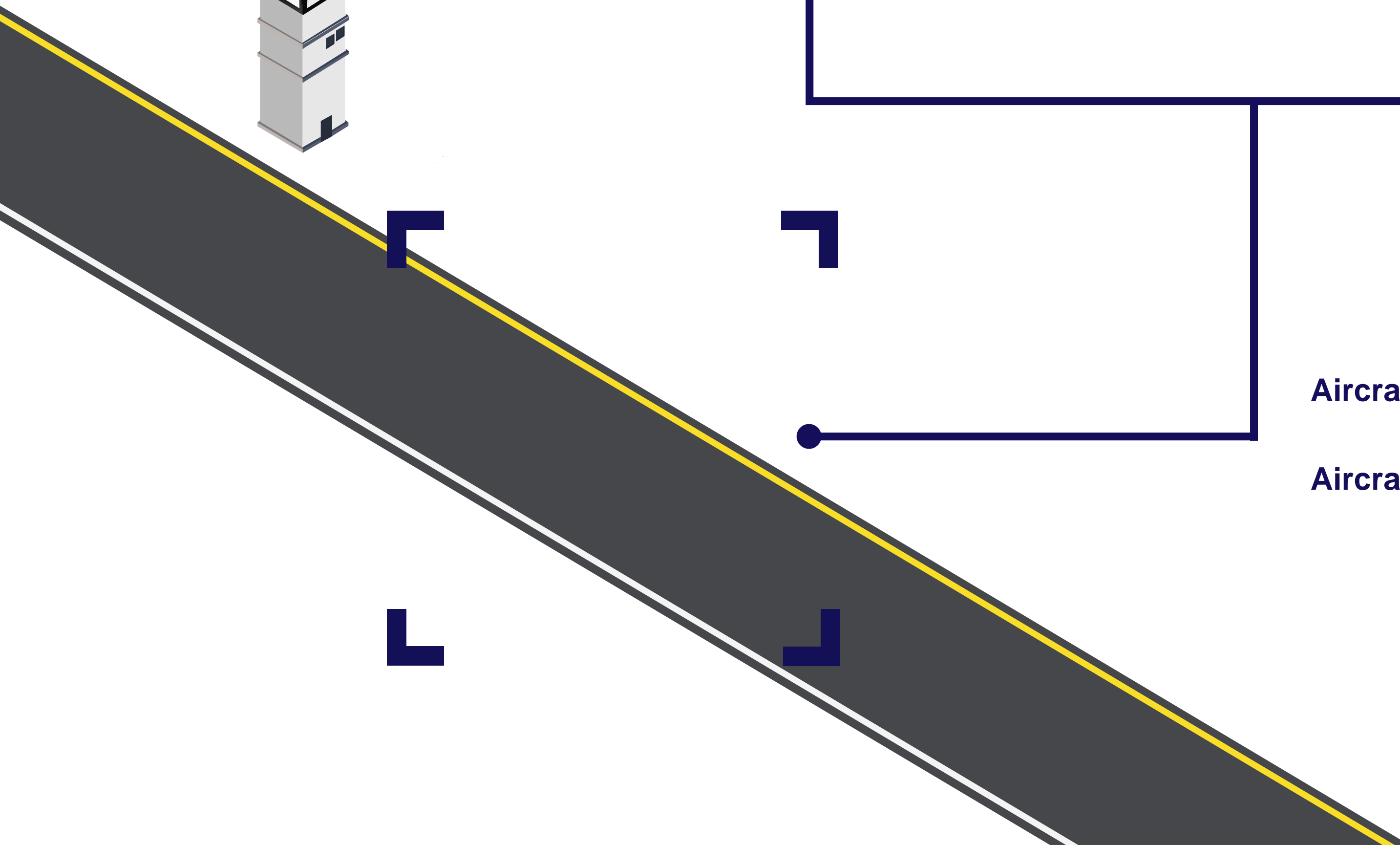
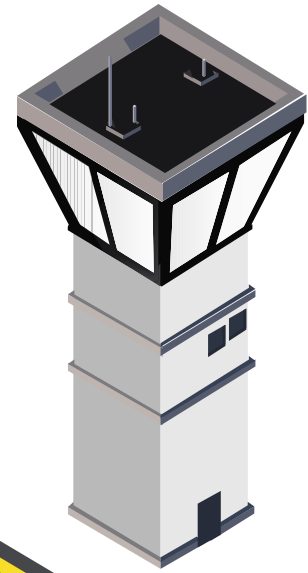
**Object  
Detection**



```
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:05" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:10" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:15" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:20" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:25" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:30" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:35" }  
{ "objects": ["aircraft"], "timestamp": "2019-11-13 09:45:40" }
```

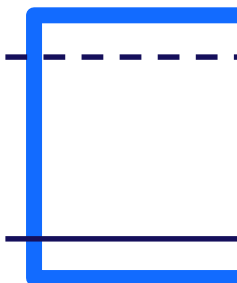


# Event Generation

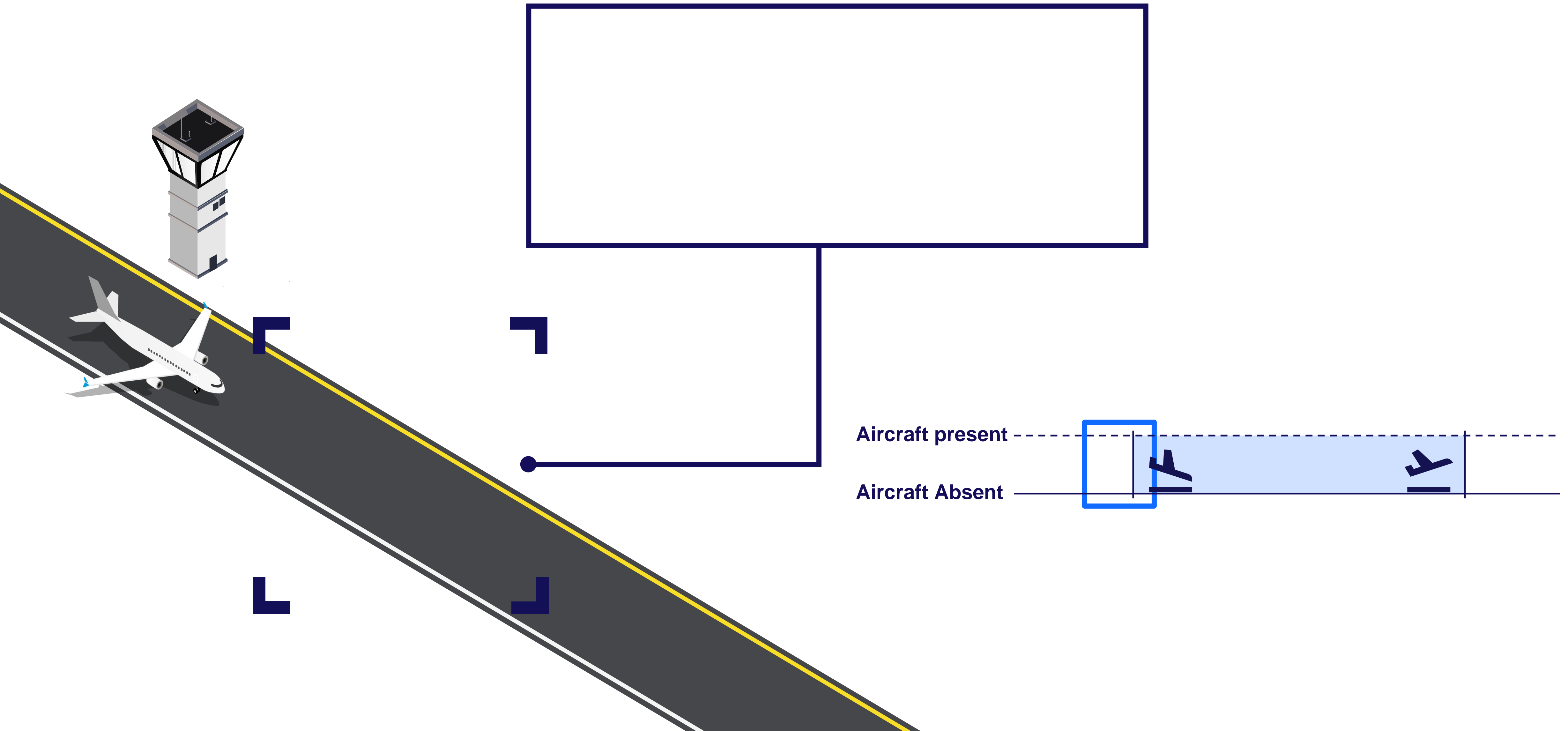


Aircraft present

Aircraft Absent

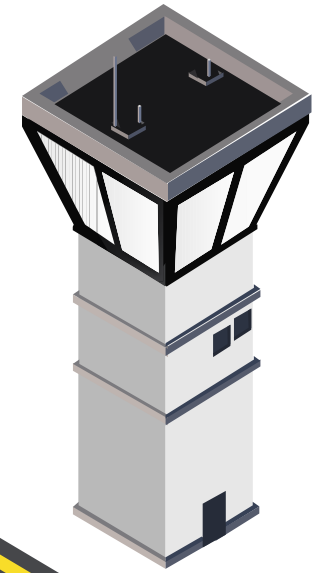


# Event Generation





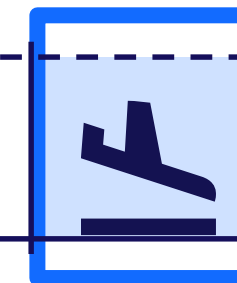
# Event Generation



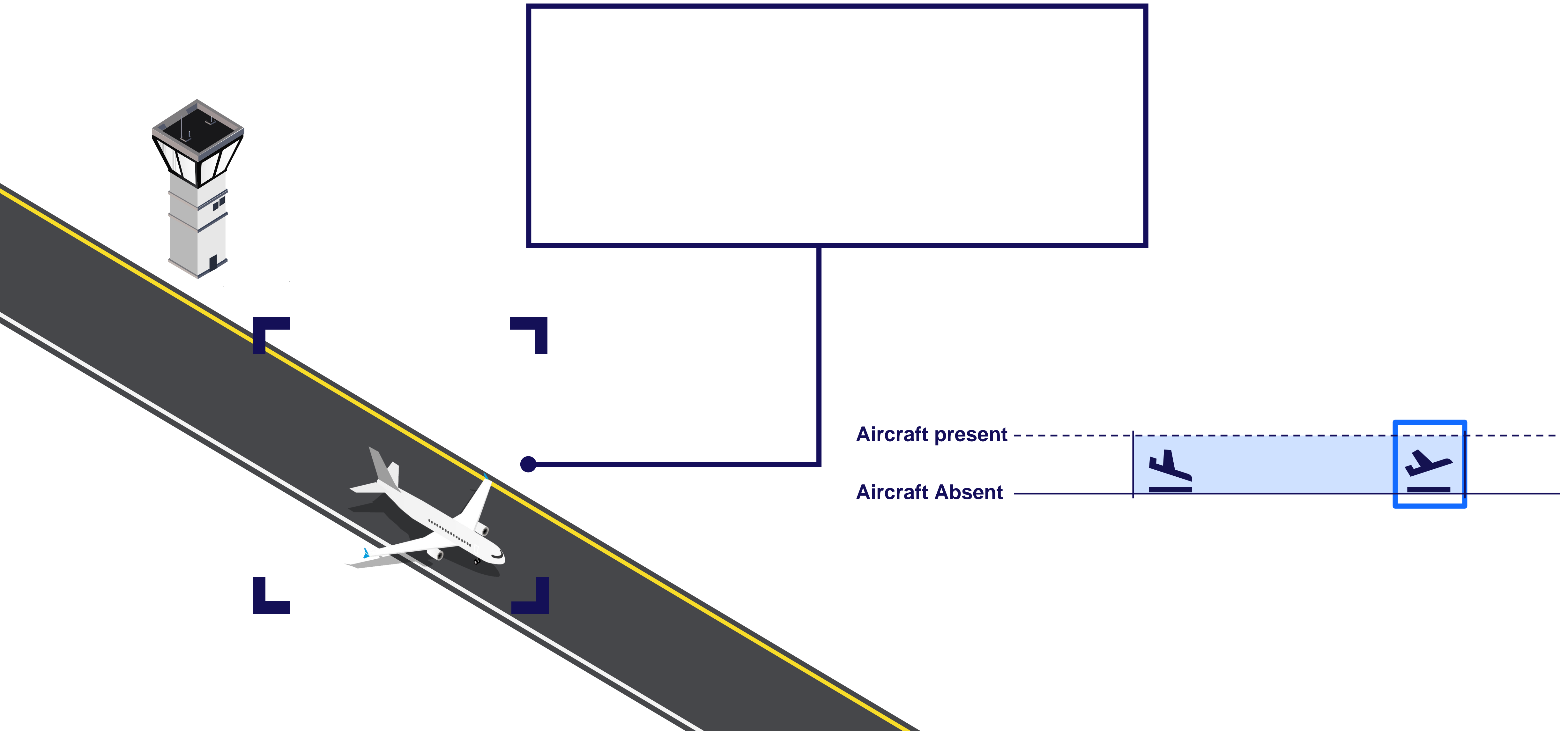
```
{  
  "event": "AircraftArrives",  
  "timestamp": "2019-11-13 09:43:25",  
  "ramp": "X99",  
  "airport": "AMS"  
}
```

Aircraft present

Aircraft Absent

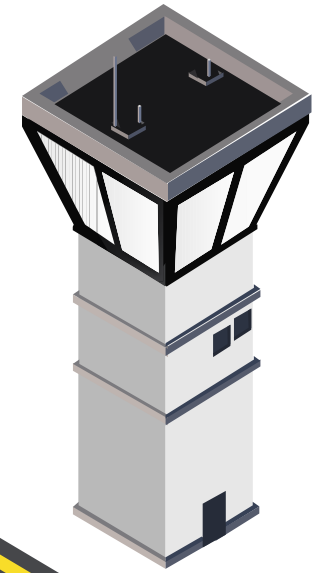


# Event Generation





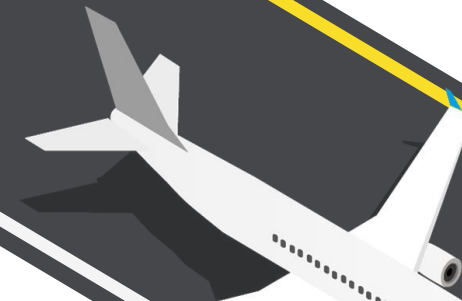
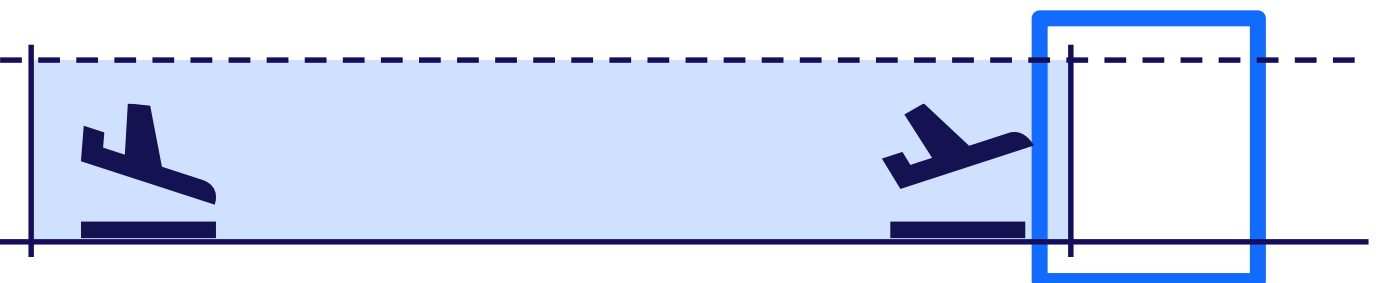
# Event Generation



```
{  
  "event": "AircraftDeparts",  
  "timestamp": "2019-11-13 11:59:10",  
  "ramp": "X99",  
  "airport": "AMS"  
}
```

Aircraft present

Aircraft Absent



# Event Generation “Business Rules”

```
if fuel_truck is present or aircraft is not present:  
    return
```

```
num_present = 0
```

```
for observation in window:
```

```
    if fuel_truck_detected:
```

```
        num_present += 1
```

```
num_present_ratio = num_present / window_size
```

```
if num_present_ratio > presence_threshold_ratio:
```

```
    trigger_event(fuel_truck_arrives)
```



# Other Dragons to Slay



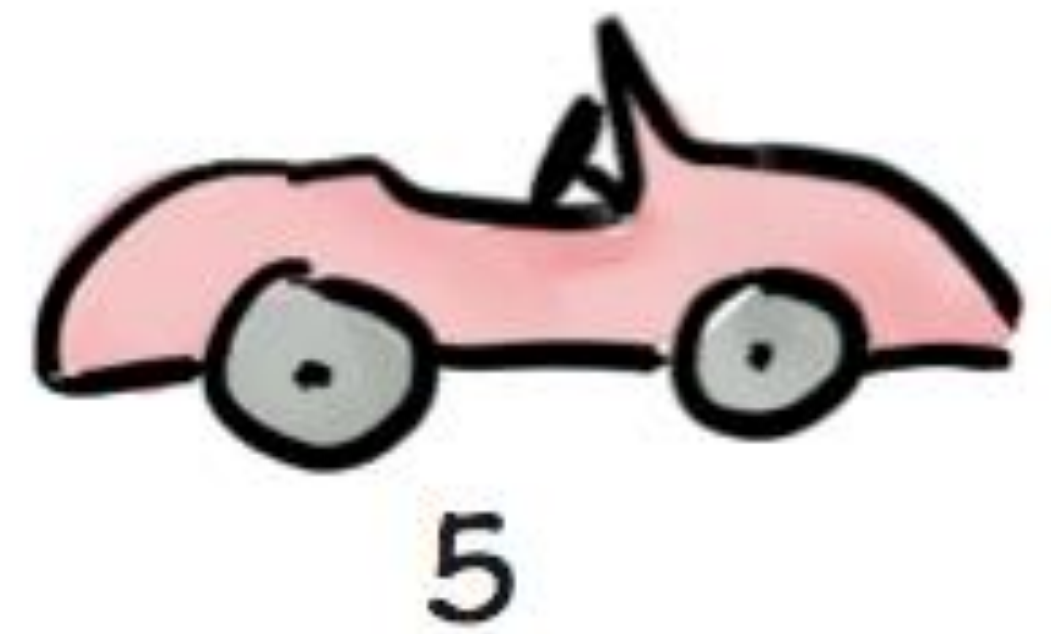


## General Advice





# General Advice





# General Advice





# General Advice





**(General) Advice is welcome**



**15:15 – 16:00**

**Room 568**



# Contact

Deep Turnaround Team



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Product Owner

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