BPMN and Camunda

Alessandro Bocci
name.surname@unipi.it

Advanced Software Engineering (Lab)
19/11/2023

What will you do?

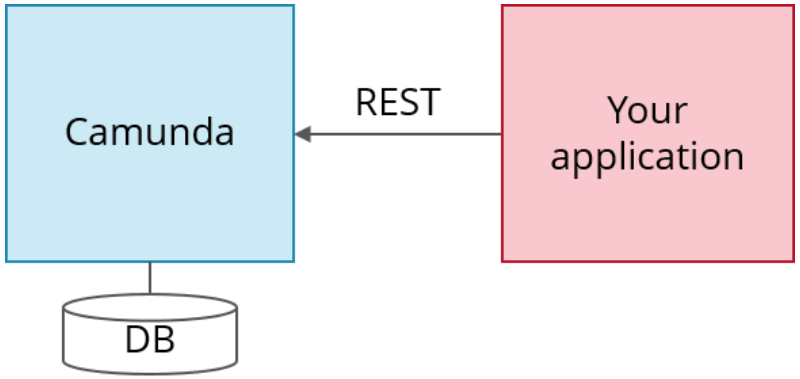
- Use Camunda Modeler to design a business process.
- Implement tasks of the process.
- Deploy and run the process with Camunda.

Software Prerequisites

- Camunda Modeler
- Camunda docker image
- Python code (.zip from Moodle)

camunda

- Camunda is a framework supporting BPMN for workflow and process automation.
- It provides a RESTful API which allows you to use your language of choice.



- Workflows are defined in BPMN which can be graphically modeled using the Camunda Modeler.

Camunda has got 2 «usage patterns» (A & B later on…)

(A) aka **endpoint-based** integration
(B) aka **queue-based** integration

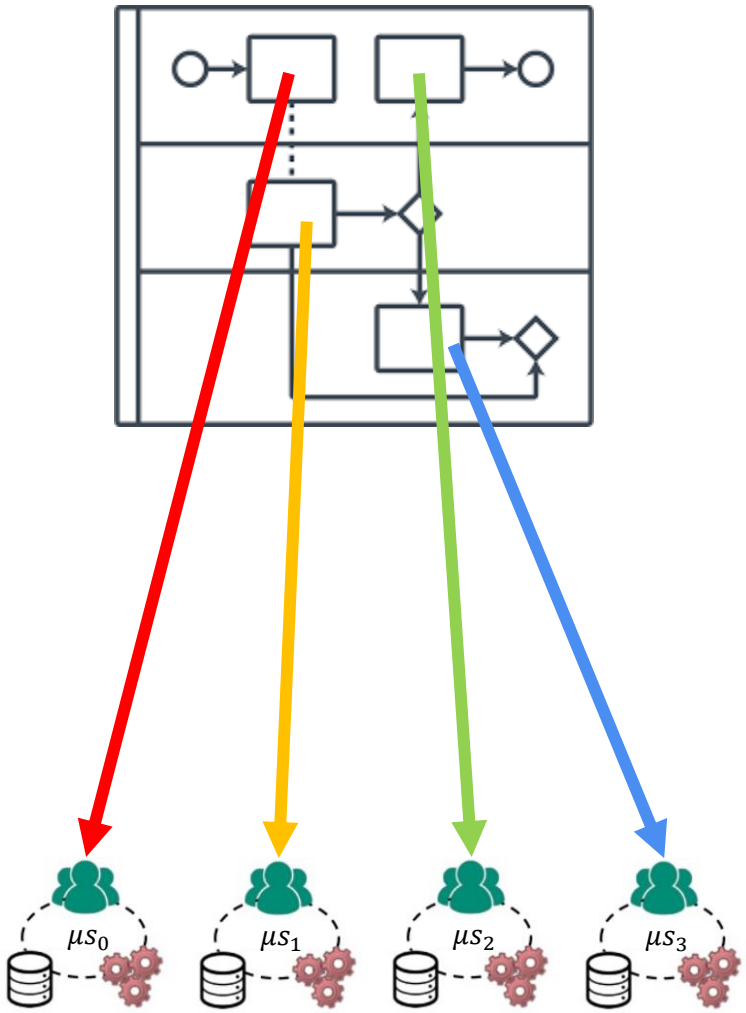
Be sure you understand these patterns, ask questions now if you don't.

It is among the exam questions…

How does it work? (Pattern A)

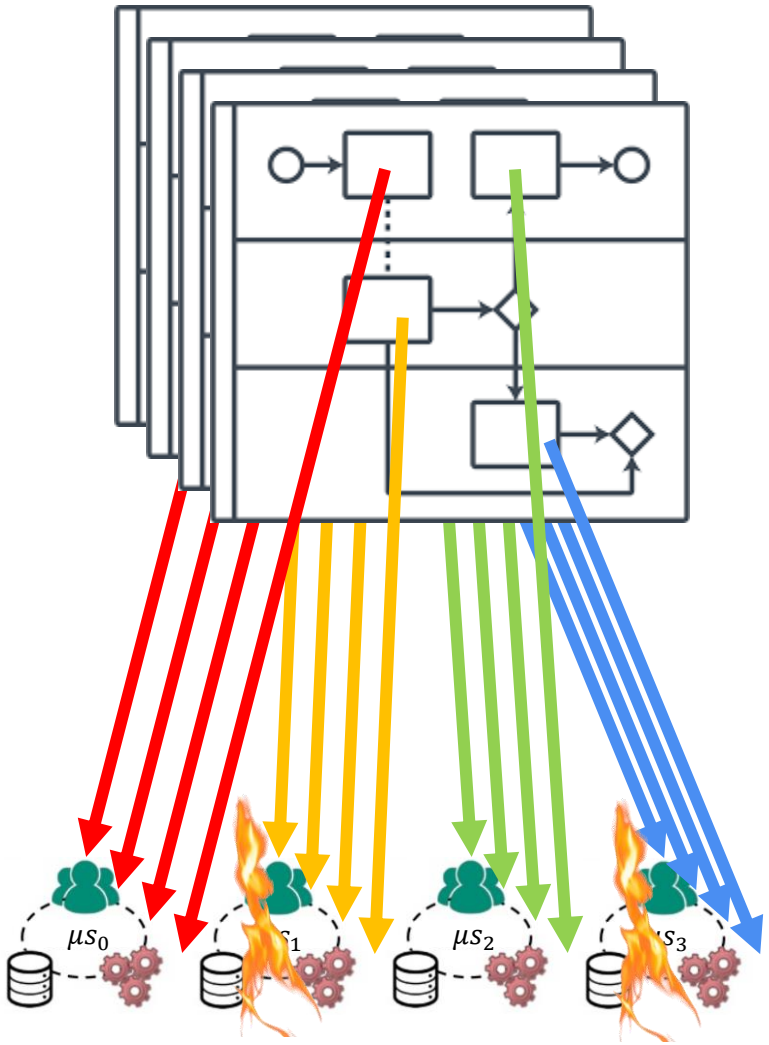
After defining a BPMN process, Camunda can directly call services via built-in *connectors*.

It supports REST



Scaling (Pattern A)

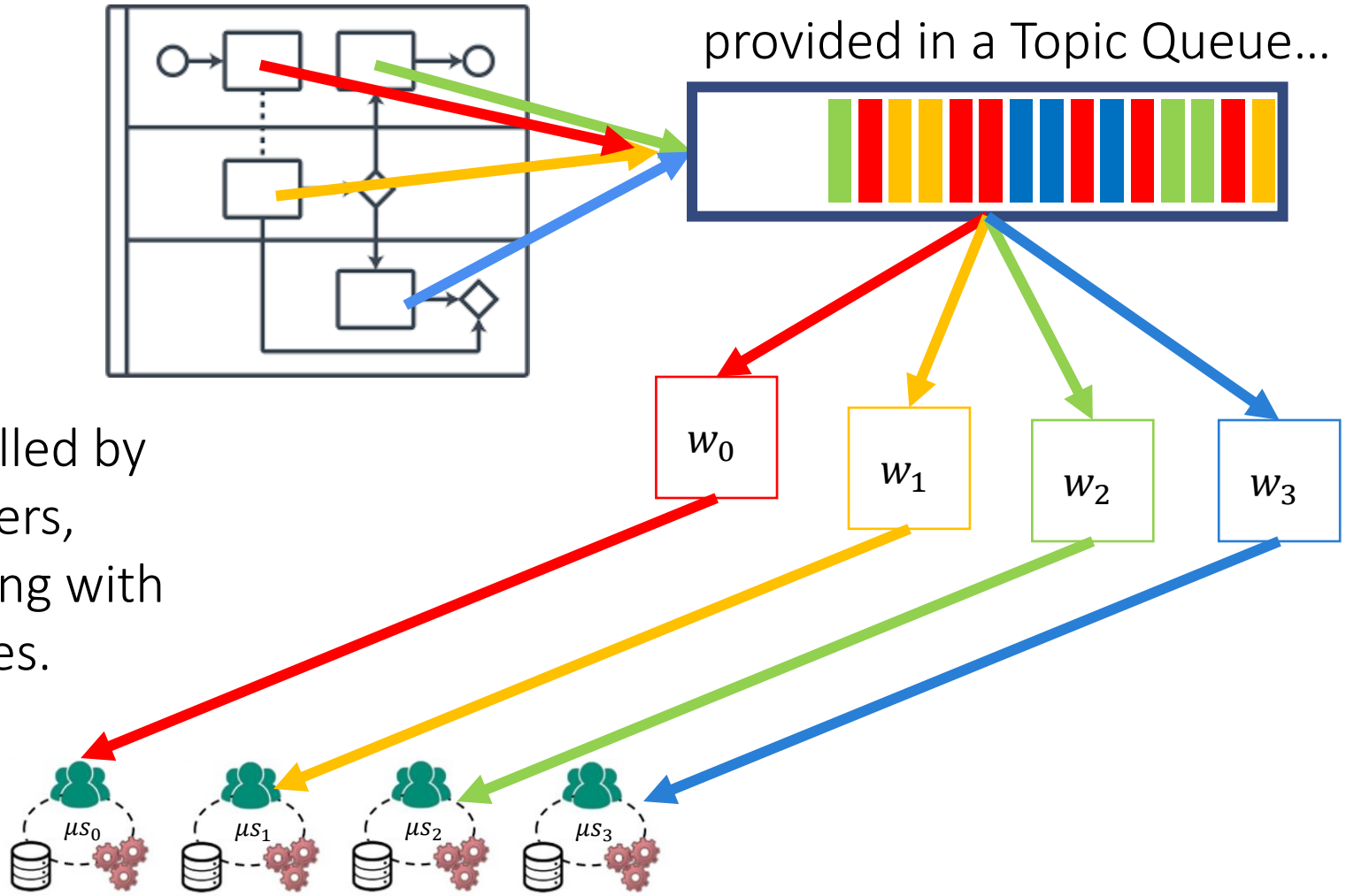
However, it only allows scaling on process instances, NOT on microservices.



How does it work? (Pattern B)

A more interesting pattern is known as *External Task*.

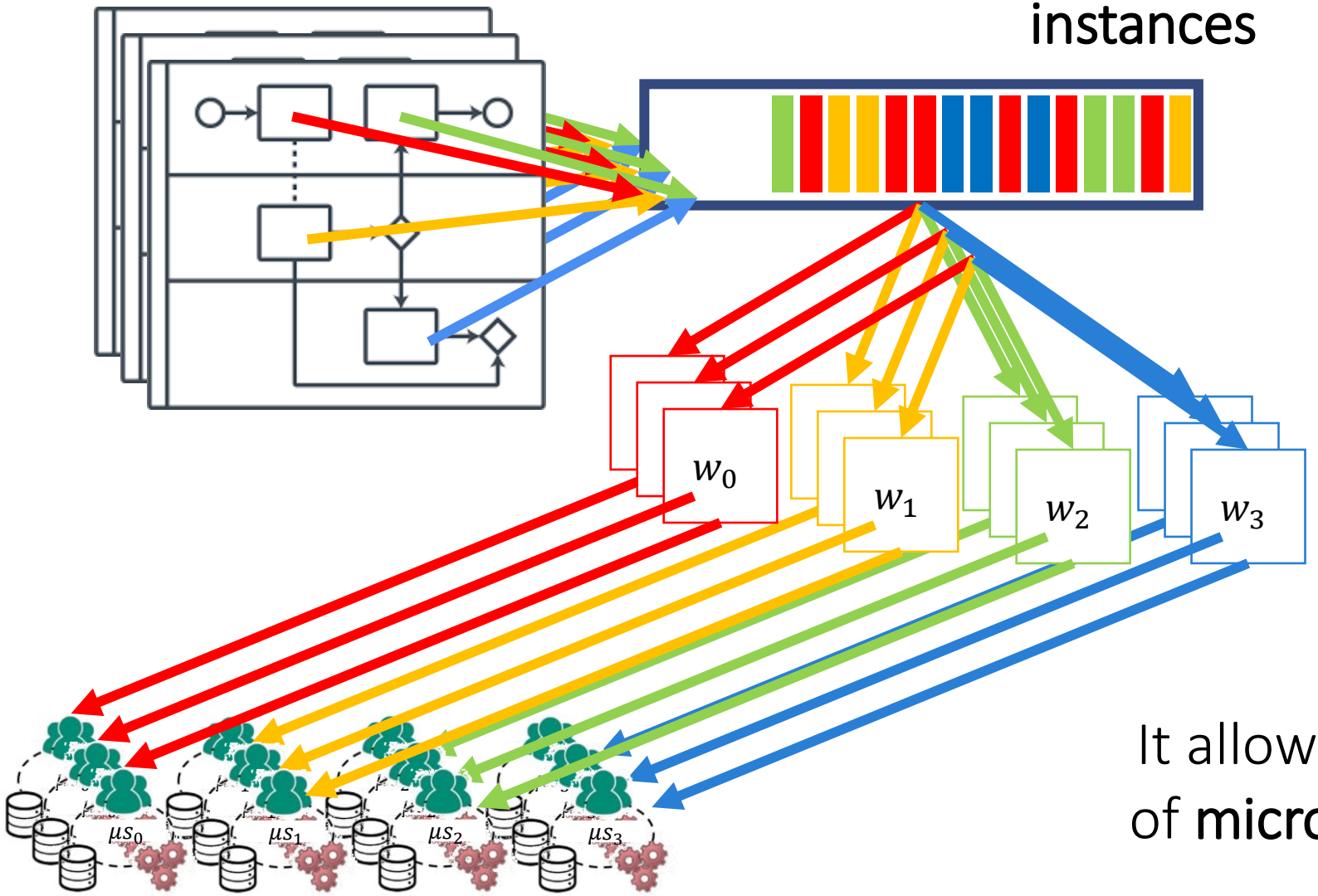
Units of work (Tasks) are provided in a Topic Queue…



…that can be polled by RESTful workers, possibly interacting with microservices.

Scaling (Pattern B)

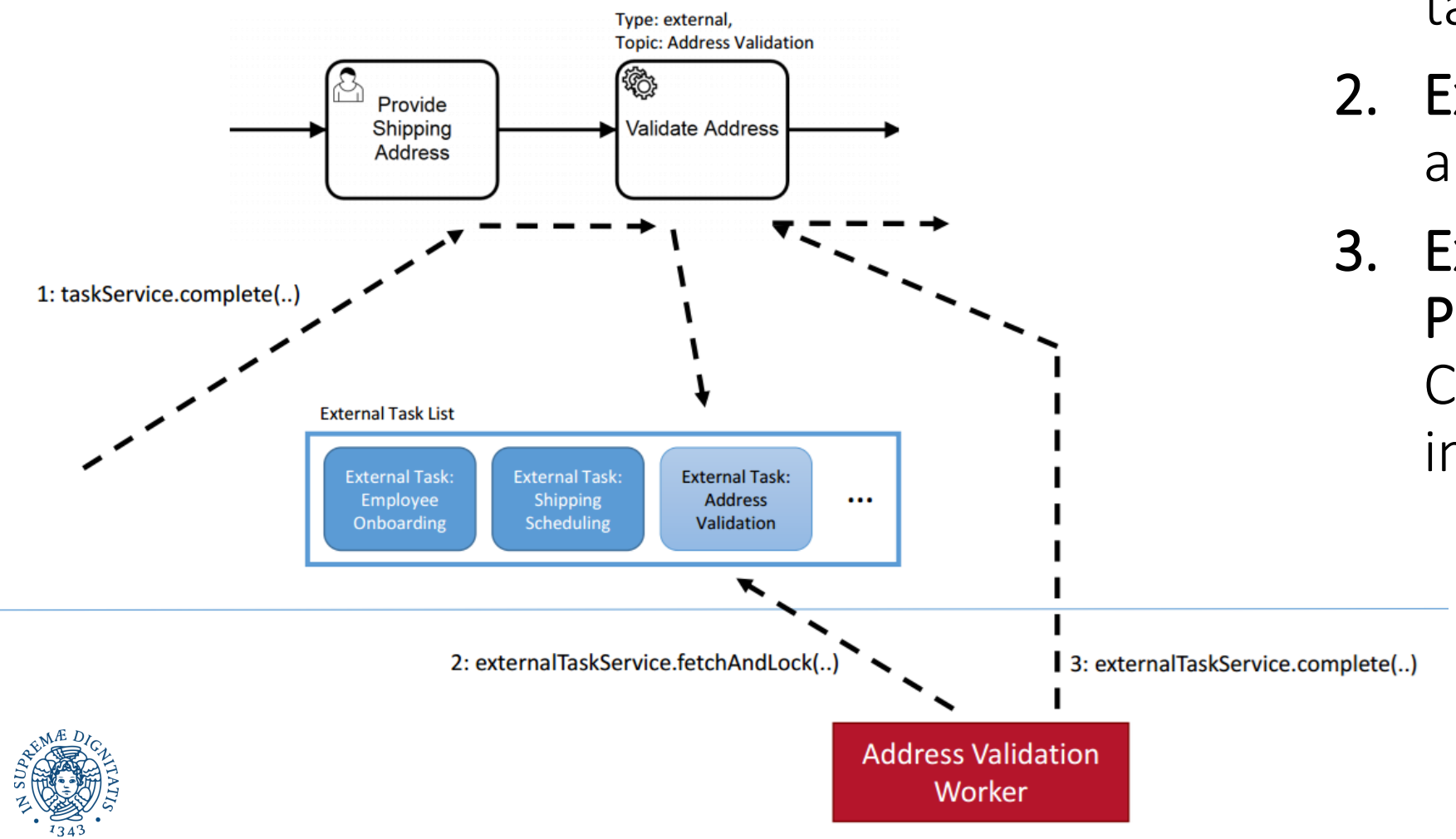
It allows scaling of **process instances**



It allows scaling of **workers**

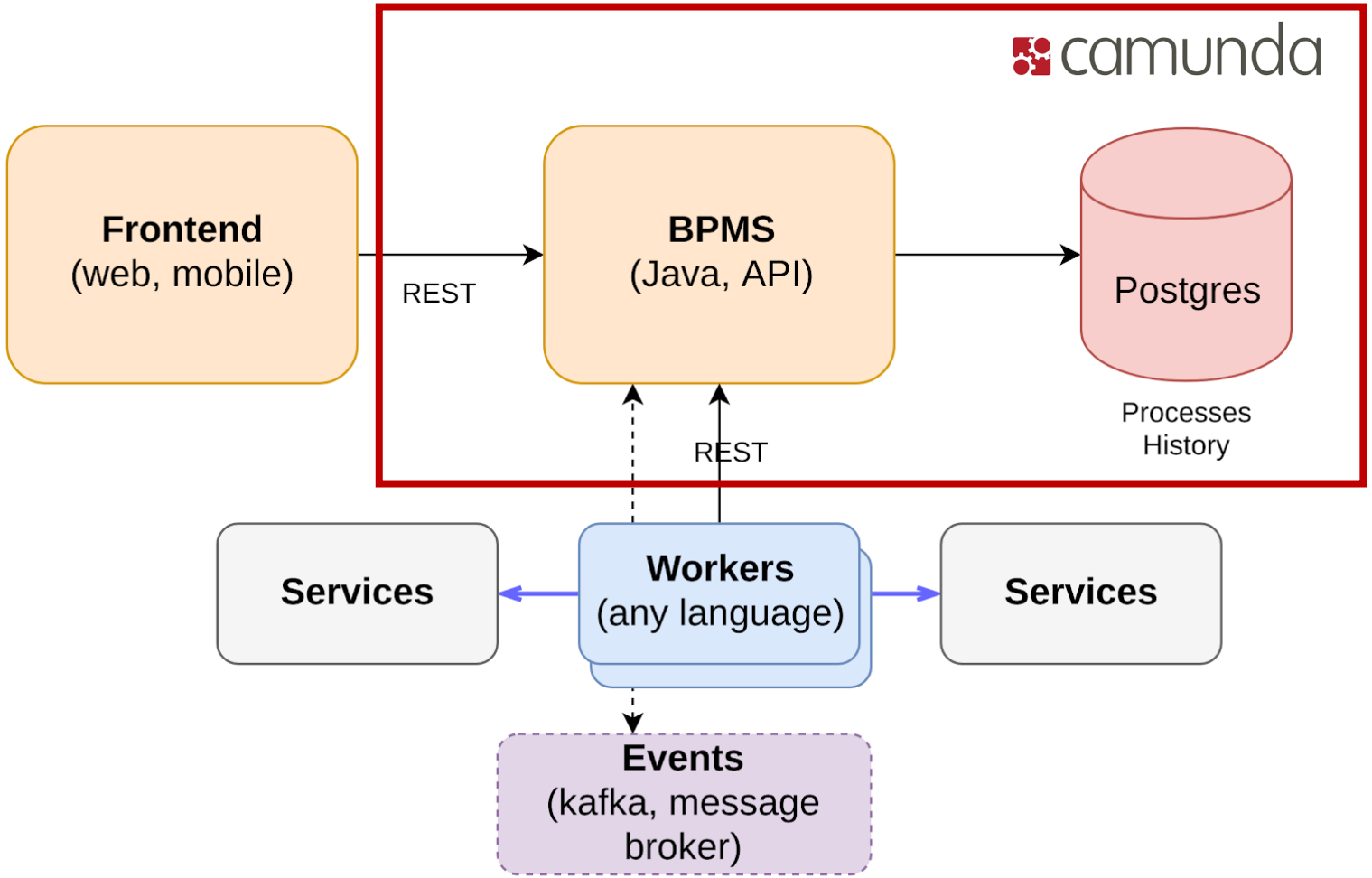
It allows scaling of **microservices**

Step-by-step



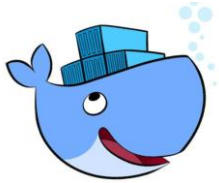
1. **Process Engine**: Creation of an external task instance
2. **External Worker**: Fetch and lock external tasks
3. **External Worker & Process Engine**: Complete external task instance

Software with Camunda



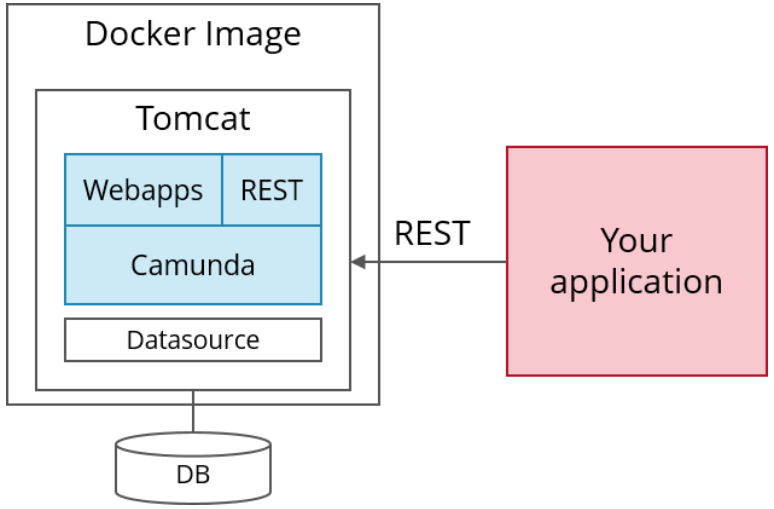
camunda in Docker

- We can use Docker to run **Camunda BPM Platform**:



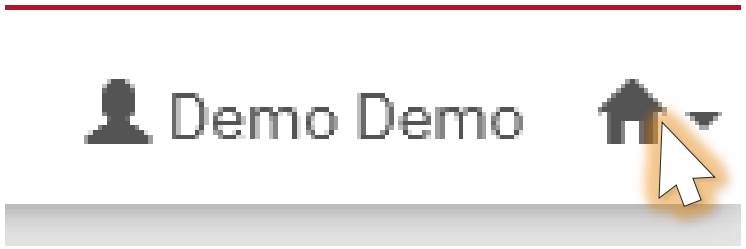
```
First time:
docker run -d --name camunda -p 8080:8080 camunda/camunda-bpm-platform:latest
From the second time:
docker start camunda
```

- Browse `127.0.0.1:8080/camunda` and enter credentials `demo demo`.



Three Menu Entry

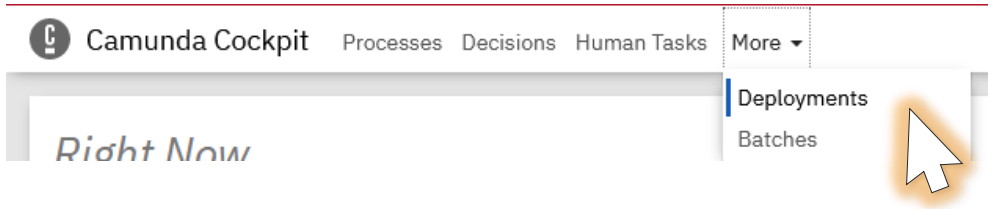
- Cockpit: to check process, instances and depolyment
- Tasklist: to check list of manual tasks
- Admin: admin stuff, we don not need it



Click on the home icon top-right to switch between them (only when you are not on the main menu)

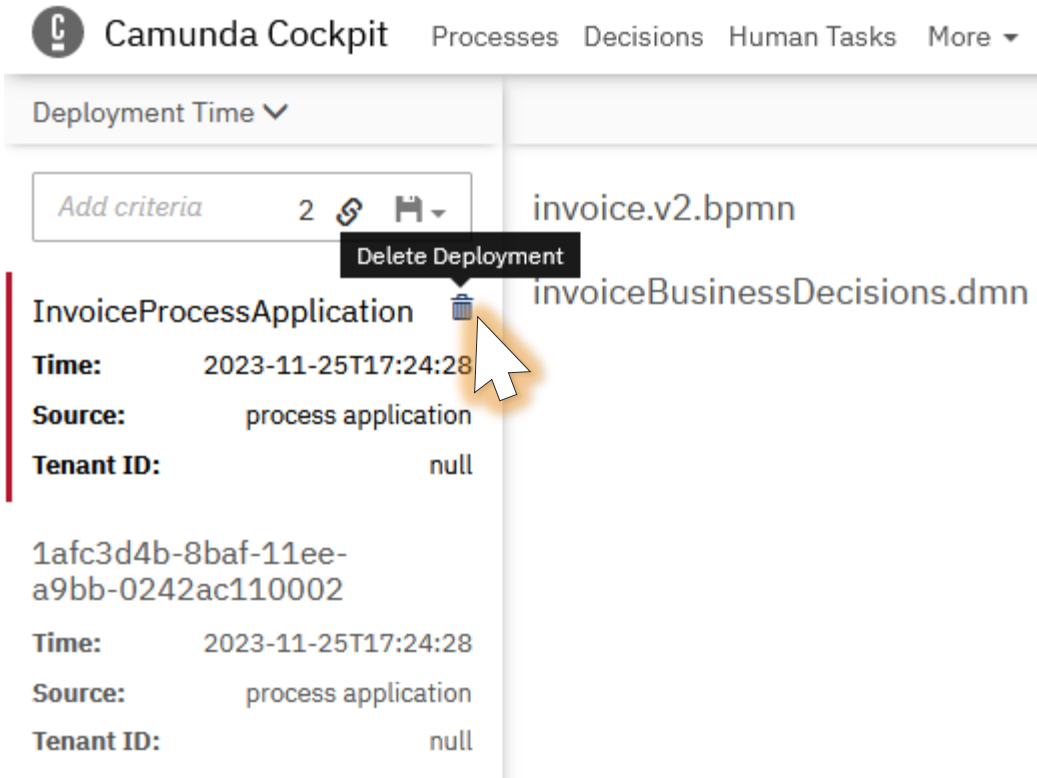
Erase default deployments and process

1. From the Cockpit, open the deployments



2. Delete all the the deployments

3. Tick on ‘cascade’ and confirm



Today’s Lab


117 AD
Caledonia
Hiberni
Mare Germanicum
Mare Suebicum
Britannia
Eburacum
Deva
Camulodunum
Londinium
Frisii
Chauci
Langobardi
Cherusci
Chamavi
Suebi
Noviomagus
Colonia Agrippina
Tencteri
Chatti
Burgundiones
Lugii
Oceanus Atlanticus
Hermunduri
Buri
Marcomanni
Quadi
Cotini
Costoboci
Gesoscribate
Condate
Lutetia Parisiorum
Argentoratum
Mogontiacum
Augusta Treverorum
Juliobona
Rotomagus
Augustodurum
Durioriguum
Portus Namnetum
Gallia
Vesontio
Augusta Raurica
Raetia
Ratiobona
Augusta Vindelicum
Vindobona
Lauriacum
Carnuntum
Aquincum
Noricum
Pannonia
Dacia
Porolissum
Carpi
Bastarnae
Tanais
Maeotae
Aorsi
Siraci
Alani
Olbia
Panticipaeum
Phanagoria
Tyras
Chersonnesos
Bosporan Kingdom
Mare Caspium
Iberia
Albania
Colchis
Mare Cantabricum
Avaricum
Mediolanum
Aquitania
Lugdunum
Burdigala
Aquileia
Tarsatica
Sirmium
Viminacium
Singidunum
Bononia
Sarmizegetusa
Roxolani
Novodunum
Istrus
Axiupolis
Tomis
Dorostorum
Pontus Euxinus
Ardahan
Armavir
Gardman
Vagharshapat
Artashat
Armenia
Brigantium
Lucus Asturum
Lucus Augusti
Legio
Asturica
Lapurdum
Bracara
Pallantia
Portus Cale
Numantia
Hispania
Tarraconensis
Emporiae
Narbo
Arelate
Massilia
Forum Julii
Genua
Pisae
Ravenna
Italia
Roma
Dalmatia
Salona
Naissus
Serdica
Moesia
Ratiaria
Novae
Sigope
Trapezus
Pontus
Thrace
Byzantium
Bithynia
Nicaea
Ancyra
Cappadocia
Gordyene
Adiabene
Olisipo
Lusitania
Emerita Augusta
Toletum
Tarraco
Scalabis
Corsica
Aleria
Turris
Sardinia
Calaris
Dyrrachium
Macedonia
Thessalonica
Epirus
Brundisium
Tarentum
Neapolis
Abydos
Pergamon
Smyrna
Ephesus
Galatia
Iconium
Cilicia
Antioch
Edessa
Nisibis
Osrhoene
Assyria
Parthian Empire
Valentia
Saguntum
Palma
Saetabis
Dianium
Ebusus
Pax Julia
Corduba
Hispalis
Baetica
Ossonoba
Gades
Malaca
Carteia
Carthago Nova
Thebae
Athenae
Corinthus
Chalcis
Achaea
Pamphylia
Lycia
Halicarnassos
Rhodos
Salamis
Paphus
Cyprus
Emesa
Palmyra
Tripolis
Mesopotamia
Ctesiphon
Seleucia
Babylon
Babylonia
Susa
Charax
Sinus Persicus
Messana
Rhegium
Sicilia
Syracusae
Cydonia
Creta
Tingis
Septum
Lixus
Banasa
Sala
Volubilis
Numerus Syrorum
Rusaddir
Portus Magnus
Carterna
Icosium
Caesarea
Tigava
Siga
Tigit
Saldae
Thabraca
Hippo Regius
Auzia
Sitifis
Diana Veterum
Africa
Carthago
Hadrumetum
Thapsus
Thevestе
Thysdrus
Capsa
Tacape
Girba
Gaetuli
Mauri
Mussulamii
Mare Internum
Cyrene
Berenice
Cyrenaica
Lepcis Magna
Tripolitania
Garamantes
Nasamones
Alexandria
Paraetonium
Naucratis
Pelusium
Clysma
Memphis
Posidium
Nilus
Ammonium
Oxyrhynchus
Ægyptus
Ptolemais
Thebae
Hibis
Elephantine Island
Syene
Berenice
Sinus Arabicus
Pselchis
Hierasycaminus
Petra
Aelana
Dumatha
Leuce Come
Modiana
Hegra
Myus Hormus
Philotera
Hegra Come
Leucos Limen
Nechesia
Judaea
Jerusalem
Sidon
Tyrus
Bostra

Today’s Lab

Download the .zip file from the Moodle

LAB TODO

1. Create the BPMN process for a legion campaign against an enemy capital.
2. Complete `fight.py`, `capital.py` and `result.py` workers.
3. Deploy and run the process with Camunda.

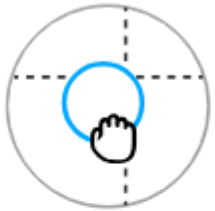
Today’s Lab


Ram
6
1000/1000
300
20
47
12
Game time: 00:23:12
Elimination
Unit under attack
Military score
Tzar Sartor
Bomilcar (AI)
154/154
105/105

Camunda Modeler

- Install the Camunda Modeler from https://camunda.com/download/modeler/

- To draw the process, choose Camunda 7



Model

Create BPMN workflow diagrams and DMN decision tables in an editor that both business users and developers love to use.

Execute

Execute your workflows and decisions in powerful engines that are paired with essential applications for process automation projects.

Enjoy

Never fear Business Process Management again as you will love Camunda. If you find that hard to believe, you should just give it a try.

Our business process

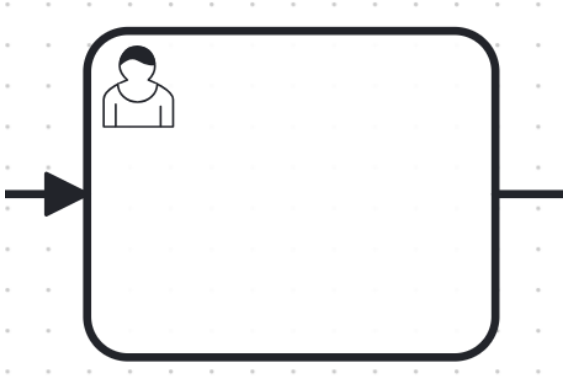
1. Setup information.
2. Battle outside the capital.

If the legion wins the battle:

   3. Attack the capital!

4. In the end: see the result of the campaign.

Setup information



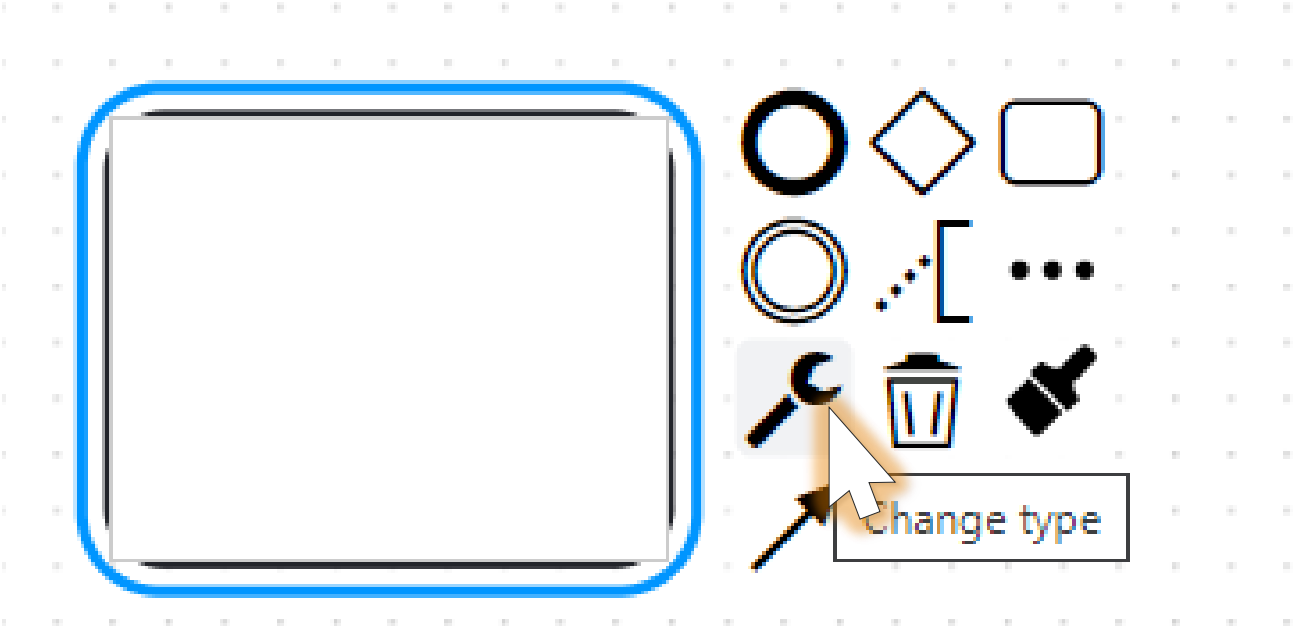
Create a User task with a form asking for:

- The number of men of the legion
- Its strength value (number between 0-100)
- The number of defendants outside the capital
- Their strength value (number between 0-100)
- The number of defendants in the capital
- Their strength value (number between 0-100)

Choose meaningful variable names.

Change element’s type

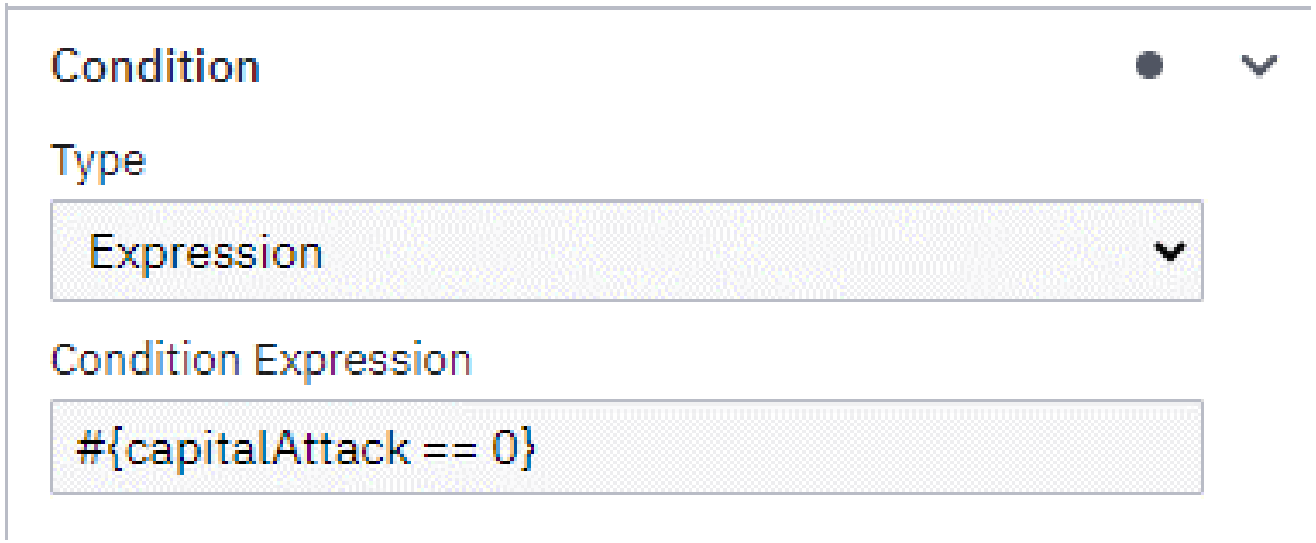
- After drawing an element



- Click it and using the wrench icon you can change its type

Conditions' expression

- When you have to take a choice, you could use an expression to guide a condition.

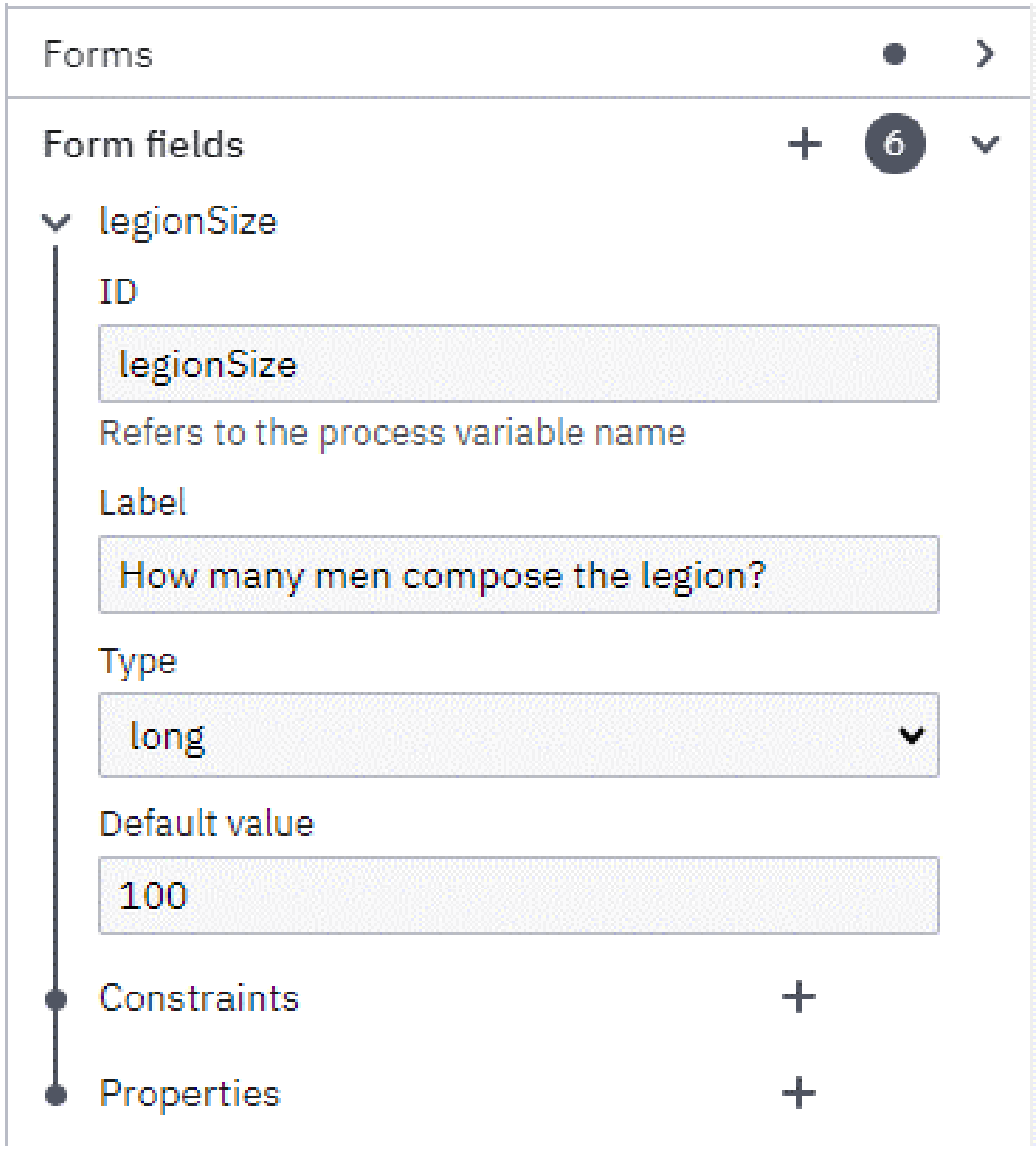


- With `#{condition}` you can insert a condition with variables involved in the process.

Forms

In the panel on the right:

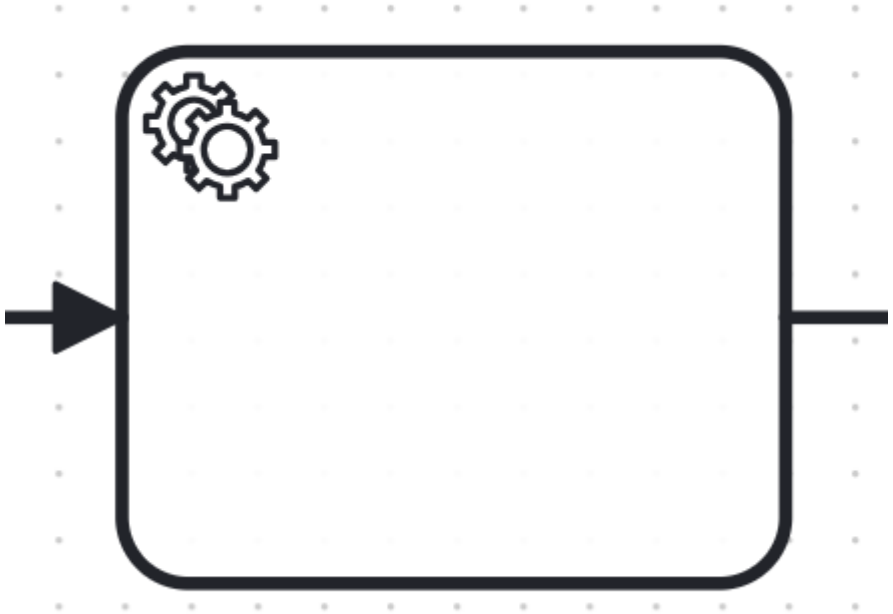
- Click on + and add a variable with
  - ID - `legionSize`
  - Label - `How many men compose the legion?`
  - Type - `long`
  - Default Value - `100`



Battle outside the capital

Create a Service task, and in Implementation:

- Type: External
- Topic: choose a meaningful name

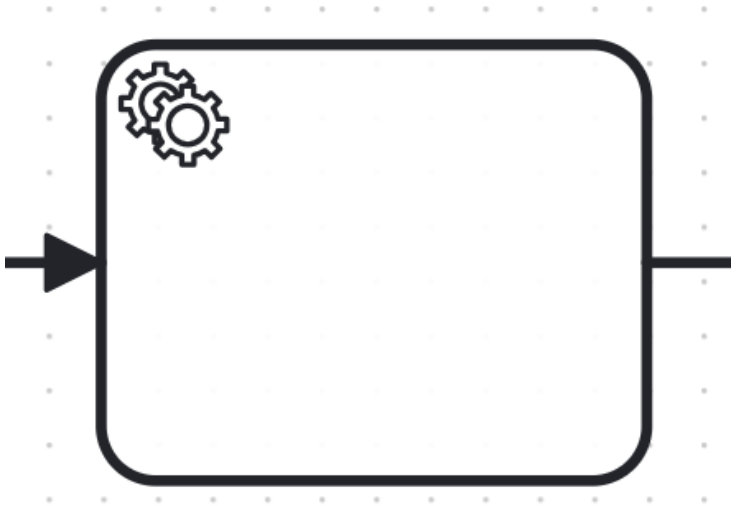


Attack the capital

If the legion survivors are more than half of the capital defendants, the legion attacks the capital.

Like before, create a Service task with:

- Type: External
- Topic: choose a meaningful name

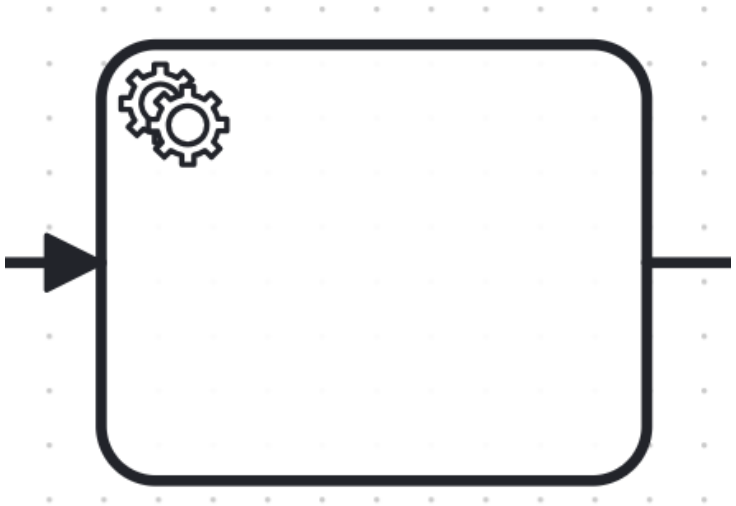


Result

Either the legion lost the first battle or attacked the capital, we ended up collecting the result.

Like before, create a Service task with:

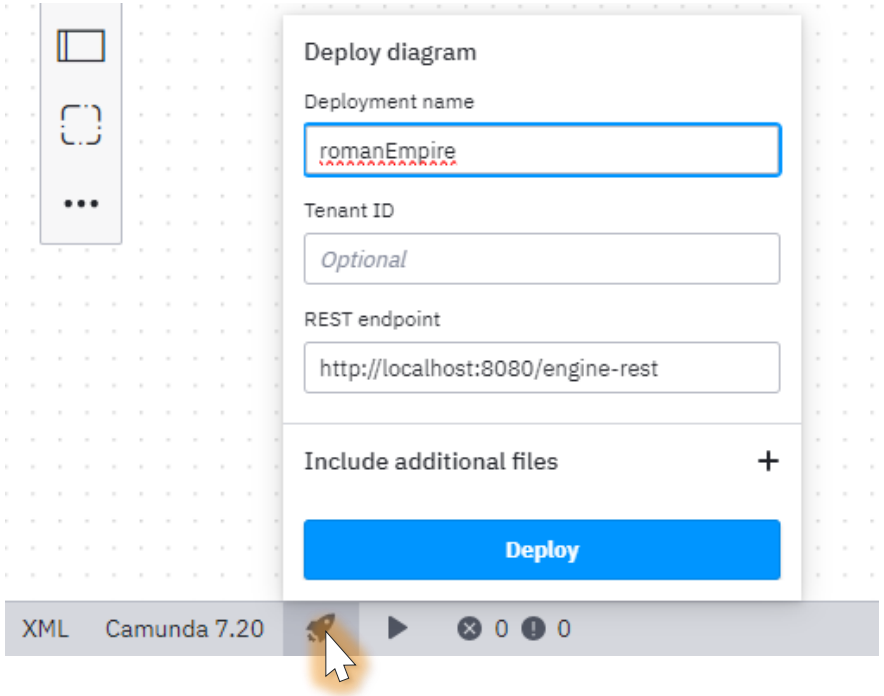
- Type: External
- Topic: choose a meaningful name



Deploy

- Give the whole process a name by clicking in any empty part of the window and completing the Properties of the process.

- **Save** and click on **Deploy Current Diagram**



External Tasks

- They exploit the REST API of Camunda [https://docs.camunda.org/manual/7.9/reference/rest/external-task/]
- Particularly:

Fetch and Lock

POST `/external-task/fetchAndLock`

Ask for a task to compute (and lock it to prevent other worker from doing the job)

Complete

POST `/external-task/{id}/complete`

Tell that a task has been completed to Camunda ☺

Service task implementation

Implement the service tasks with python programs.

- Battle outside the capital: **`battle.py`**
- Capital attack: **`capital.py`**
- Final result: **`result.py`**

With the library **`pycamunda`** REST calls are transparent.

```
pip install pycamunda
```

Service task implementation

We supply also the Worker class to improve the worker's life cycle:

1. Worker object creation
2. Worker subscribe to the topic(s)
3. Worker run

Service task implementation

You have to:

- Complete the code by matching topics and variable names with the BPMN diagram (substitute the comments).
- Implement the fight logic of the two battles.
- Return the correct variables to the process.

You can add prints to understand what is happening (you will see them in the terminal executing each service task)

Fight logic

$$\text{Sur} = \frac{L \cdot Ls \cdot Rs - D \cdot Ds \cdot Rd}{Ls}$$

In each battle, you have:

- Legion number (L) and strength (Ls)
- Defendants number (Ds) and strength (Ds)

1. Multiply each side number and strength.
2. Multiply also for a random value between 0 and 1 (Rs and Rd)
3. Do: legion value minus defendants value
4. Divide by the legion strength to obtain the legion survivors (Sur)

First battle

The legion wins the battle if the survivors are more than half the capital defendants.

If the legion won the battle, add a third of the survivors to the legion as reinforcement.

The Python function handler should return a dictionary (string, integer) with

- the final value of the survivors and
- the result of the battle (0 if lost and 1 if won). The result value should be used in the BPMN decision to attack the capital.

Second battle

The legion attacks with the survivors (and reinforcements) of the previous one.

The capital is conquered if the legion has survivors.

The Python function handler should return a dictionary with the type as before having only the survivor number.

Run the business process

- Launch the python programs in three different terminals

```
python3 <file_name>.py
```

- Click on the ‘play’ symbol in Camunda Modeler and start the service instance.
- Go to the Tasklist page of Camunda and under ‘All tasks’ you should find your form.
- Claim the task, fill out the form to launch the battle and go to the terminal of the result to see how the campaign went.

Some adviced values for the form

Set follow-up date | Set due date | Add groups | Claim

Form | History | Diagram | Description

How big is the legion?

100

How big is the defendant army?

80

How many defenders in the capital?

50

How much is strong the legion?

100

How much are strong the defendants?

40

How much is strong the capital defence?

60

Save | Complete

Lab take away

- ❑ Learn the relation between business processes and microservices.
- ❑ Draw a non-trivial BPMN diagram.
- ❑ Understand and implement external services.
- ❑ Deploy and run a business process with Camunda.

(a possible) BMPN solution