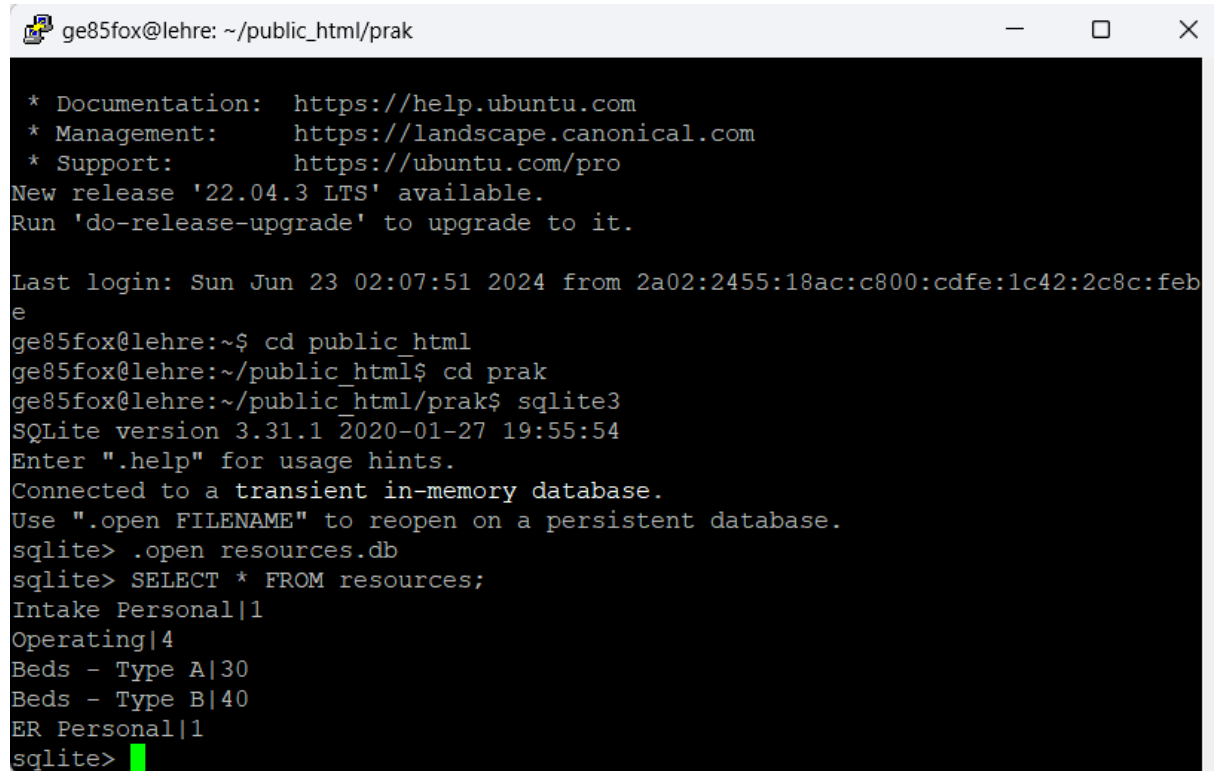**Task**: generate, replan, and simulate new patients

Simulator: mysimulator.py, Main.xml , resources,db

1) resources.db:

   To initiate the simulator, we start off by creating the database in sqlite, the database is called resources, the table is called resources. This is what my database looks like:

   while it may not reflect the whole truth, it serves the purpose of checking for resources count if greater than 0 or not. Intake task checks for "Intake Personal" and ER task checks for "ER Personal"...etc

   In order to simulate other scenarios (such as having 0 ER personal when we start the simulator), the UPDATE sql commands are used:

   UPDATE resources SET count = 1 WHERE Role = 'ER Personal';

   This database also gets updated depending on if the patient is utilizing it during the task using the same UPDATE method but with incrementations and decrementations.

2) Main.xml:
   The main focus of this simulator will be the following tasks: Patient Admission, Replan patient, Intake, ER treatment, and Releasing. The tasks (surgery and Nursing) will have the same implementation as ER treatment and Intake in CPEE and in python (same endpoint: simulator, but different routes).
   Three endpoints exist: generate, replan, simulator
   Method: GET
   Output handling: depends on the endpoint
   Arguments: depends on endpoint
   Dataelements: only status is initialized

3) **mysimulator.py:**

Running this file starts the entire generation and simulation:
The for loop creates 5 instances based off of Main.xml, the only dataelement created at this point is the diagnosis/type of patient:

```
#a_diagnosis= ["A1", "A1", "A1", "A1", "A2", "A2", "A3", "A4", "B1", "B1",
"B1", "B1", "B2", "B2", "B3", "B4", "ER"]
```

This list was created based on the probabilities displayed in the table of the BPO challenge.
Next endpoint callled: https://lehre.bpm.in.tum.de/ports/7773/generate/
Arguments: diagnosis/patient type
Output: fills in all the dataelements either based on random choices or based on the probabilities of the table

Note: <mark>original</mark> is the original time of arrival or the time that the patient arrives for the first time

As an initial step, to simulate resources being both True and False, I have randomized the variable resources seen above in the patient_data. According to this dataelement, we will replan the patient or not. However, in all later stages, resources flag reflects the truth of the database.

Some scenarios:

Resources == False
Next endpoint callled: https://lehre.bpm.in.tum.de/ports/7773/replan/

Arguments

✕ ↕ id	⇒	!data.patient_id
✕ ↕ originalarrival	⇒	!data.original
✕ ↕ patienttype	⇒	!data.patienttype

Output: creates a new instance after 20 seconds (20 seconds instead of 1 day to simplify simulation for me), sets status as old patient, keeps the same patient ID, keeps original arrival time for later priority, fills in all the dataelements either based on random choices or based on the probabilities of the table

```
please come back in 20 seconds (nextday), we will keep your original arrival tim
e saved
Patient replanned: {"CPEE-INSTANCE":"50209","CPEE-INSTANCE-URL":"https://cpee.or
g/flow/engine/50209","CPEE-INSTANCE-UUID":"9405797a-83b8-4856-bc4d-5b101f1d14a7"
,"CPEE-BEHAVIOR":"fork_running"}
::1 - - [23/Jun/2024 12:22:58] "GET /replan?id=e826d1fe-2841-454a-868c-9c828301b
e19&originalarrival=2024-06-23%2012%3A22%3A38%20%2B0200&patienttype=A4 HTTP/1.0"
 200 0
```

Instance created can be monitored here: Main (50209) (cpee.org)

▽ Data Elements	Endpoints	Attributes

✕ ↕ patient_data	⇒	{"patienttype":"A4","complications":true,"phantompain":false,"ertreatment":true,"resources":true,"surgery":true,"nursing":
✕ ↕ phantompain	⇒	false
✕ ↕ patientid	⇒	value
✕ ↕ status	⇒	oldpatient
✕ ↕ ertreatment	⇒	true
✕ ↕ timeofarrival	⇒	value
✕ ↕ resources	⇒	true
✕ ↕ surgery	⇒	true
✕ ↕ complications	⇒	true
✕ ↕ patient_id	⇒	e826d1fe-2841-454a-868c-9c828301be19
✕ ↕ original	⇒	2024-06-23 12:22:38 +0200
✕ ↕ duration	⇒	value
✕ ↕ patienttype	⇒	A4

Considering patienttype != 'ER', and 'Intake Personal' is greater than zero, then the patient will go to intake, the duration of the task is taken from a normal distribution and the task sleeps according to this value:

```
Intake patient is admitted
::1 - - [23/Jun/2024 12:23:01] "GET /simulator?id=e826d1fe-2841-454a-868c-9c8283
01be19&task=intake&arrival=2024-06-23%2012%3A22%3A38%20%2B0200 HTTP/1.0" 200 0
{'id': 'e826d1fe-2841-454a-868c-9c828301be19', 'task': 'release'}
This is the duration of the task
0.5452856219365283
THE PATIENT IS RELEASED FORM THE HOSPITAL!
::1 - - [23/Jun/2024 12:23:01] "GET /simulator?id=e826d1fe-2841-454a-868c-9c8283
01be19&task=release HTTP/1.0" 200 0
Intake patient is discharged after duration
```

Resources == True AND patienttype == ER:

Next endpoint callled: https://lehre.bpm.in.tum.de/ports/7773/simulator

Arguments

✕	id	⇒	!data.patient_id
✕	task	⇒	er
✕	arrival	⇒	!data.original

Create Argument Pair

Considering 'ER Personal' is greater than zero, we can admit the patient, task is slept according to duration

Instance: Main (50203) (cpee.org)

```
2024-06-23T12:22:15.936768
::1 - - [23/Jun/2024 12:22:15] "GET /generate?type=ER HTTP/1.0" 200 141
{'id': '276a2a52-0804-4339-8e77-565d8b2cb7d9', 'task': 'er', 'arrival': '2024-06
-23 12:22:16 +0200'}
This is the duration of the task
0.31206907295540115
ER patient is admitted
::1 - - [23/Jun/2024 12:22:16] "GET /simulator?id=276a2a52-0804-4339-8e77-565d8b
2cb7d9&task=er&arrival=2024-06-23%2012%3A22%3A16%20%2B0200 HTTP/1.0" 200 0
{'id': '276a2a52-0804-4339-8e77-565d8b2cb7d9', 'task': 'release'}
This is the duration of the task
0.7732382942607712
THE PATIENT IS RELEASED FORM THE HOSPITAL!
::1 - - [23/Jun/2024 12:22:16] "GET /simulator?id=276a2a52-0804-4339-8e77-565d8b
2cb7d9&task=release HTTP/1.0" 200 0
ER patient is discharged after duration
```

Resources == True AND patienttype != ER:

Next endpoint callled: https://lehre.bpm.in.tum.de/ports/7773/simulator

Arguments

✕	id	⇒	!data.patient_id
✕	task	⇒	intake
✕	arrival	⇒	!data.original

Create Argument Pair

Considering 'Intake Personal' is greater than zero, we can admit the patient, task is slept according to duration

Instance: Main (50205) (cpee.org) , Main (50403) (cpee.org)

```
2024-06-23T12:22:58.718062
::1 - - [23/Jun/2024 12:22:58] "GET /generate?type=B4 HTTP/1.0" 200 141
{'id': '7924e6e6-d77b-41a3-b61f-76062f96c5b0', 'task': 'intake', 'arrival': '202
4-06-23 12:22:17 +0200'}
This is the duration of the task
0.0785294652662032
Intake patient is admitted
::1 - - [23/Jun/2024 12:22:59] "GET /simulator?id=7924e6e6-d77b-41a3-b61f-76062f
96c5b0&task=intake&arrival=2024-06-23%2012%3A22%3A17%20%2B0200 HTTP/1.0" 200 0
Intake patient is discharged after duration
```

Many ER Patients, only 1 'ER Personal' to demonstrate how the queue and callbacks work

First ER patient is admitted, following ER patients get queued (with their ids, callback url, and original arrival time), when resources are available again (released from the first ER patient by an SQL decrement query), the patient whom waited the longest will pass first and get popped from the queue. To process this popped patient, we do a put request to the call back URL.

```
ER patient is admitted
::1 - - [23/Jun/2024 14:44:57] "GET /simulator?id=cee2fe2c-219b-482f-9b7e-15ca4adf32eb&task=er&arrival=2024-06-23%2014
%3A44%3A57%20%2B0200 HTTP/1.0" 200 0
{'id': '4911bbf0-3c64-45ed-9af9-4e308e2517f3', 'task': 'er', 'arrival': '2024-06-23 14:44:57 +0200'}
This is the duration of the task
0.8042900579371661
CallBack-url
https://cpee.org/flow/engine/50404/callbacks/b6e4c66c6b2ae0764a902d691ed63cb5/
er queue before sorting
[{'patient_id': '4911bbf0-3c64-45ed-9af9-4e308e2517f3', 'callback_id': 'https://cpee.org/flow/engine/50404/callbacks/b
6e4c66c6b2ae0764a902d691ed63cb5/', 'original_arrival_time': '2024-06-23 14:44:57 +0200'}]
er queue after sorting
[{'patient_id': '4911bbf0-3c64-45ed-9af9-4e308e2517f3', 'callback_id': 'https://cpee.org/flow/engine/50404/callbacks/b
6e4c66c6b2ae0764a902d691ed63cb5/', 'original_arrival_time': '2024-06-23 14:44:57 +0200'}]
ER patient is rescheduled
::1 - - [23/Jun/2024 14:44:57] "GET /simulator?id=4911bbf0-3c64-45ed-9af9-4e308e2517f3&task=er&arrival=2024-06-23%2014
%3A44%3A57%20%2B0200 HTTP/1.0" 200 0
HON
A3
2024-06-23T14:44:57.663627
::1 - - [23/Jun/2024 14:44:57] "GET /generate?type=A3 HTTP/1.0" 200 141
{'id': '0f583e55-5ba9-450d-89df-b0094877211f', 'task': 'intake', 'arrival': '2024-06-23 14:44:57 +0200'}
This is the duration of the task
1.305639745754229
Intake patient is admitted
::1 - - [23/Jun/2024 14:44:57] "GET /simulator?id=0f583e55-5ba9-450d-89df-b0094877211f&task=intake&arrival=2024-06-23%
2014%3A44%3A57%20%2B0200 HTTP/1.0" 200 0
ER patient is discharged after duration
Processing ER queue for patient 4911bbf0-3c64-45ed-9af9-4e308e2517f3
HON
ER
2024-06-23T14:44:58.473045
::1 - - [23/Jun/2024 14:44:58] "GET /generate?type=ER HTTP/1.0" 200 141
{'id': 'f147d7e0-6d69-40fa-874a-c589d5fb6f42', 'originalarrival': '2024-06-23 14:44:58 +0200', 'patienttype': 'ER'}
Finished processing ER patient 4911bbf0-3c64-45ed-9af9-4e308e2517f3
Intake patient is discharged after duration
please come back in 20 seconds (nextday), we will keep your original arrival time saved
Patient replanned: {"CPEE-INSTANCE":"50408","CPEE-INSTANCE-URL":"https://cpee.org/flow/engine/50408","CPEE-INSTANCE-UUID":"d9545f43-fb02-4013-92
AVIOR":"fork_running"}
::1 - - [23/Jun/2024 14:45:18] "GET /replan?id=f147d7e0-6d69-40fa-874a-c589d5fb6f42&originalarrival=2024-06-23%2014%3A44%3A58%20%2B0200&patientt
HON
ER
2024-06-23T14:45:21.472045
::1 - - [23/Jun/2024 14:45:21] "GET /generate?type=ER HTTP/1.0" 200 141
{'id': 'f147d7e0-6d69-40fa-874a-c589d5fb6f42', 'task': 'er', 'arrival': '2024-06-23 14:44:58 +0200'}
This is the duration of the task
0.6054166293842533
```

This also holds true for the rest of the simulator tasks, every task will have it's own queue that checks its own resources

Instances of ER patients:
Main (50404) (cpee.org)
Main (50407) (cpee.org)
Main (50408) (cpee.org) (patient replaned)
.....

Demonstration of how the queue is sorted according to who arrives first is admitted first:

```
intake queue after sorting
[{'patient_id': 'b7486653-18c0-46c8-812c-78b5da275909', 'callback_id': 'https://cpee.org/flow/engine/52573/callbacks/1aa9be1b4333d77ca5b6625802256b04/', 'original_arrival
_time': '2024-06-23 17:22:06 +0200'}]
Intake patient is rescheduled
::1 - - [23/Jun/2024 17:22:29] "GET /simulator?id=b7486653-18c0-46c8-812c-78b5da275909&task=intake&arrival=2024-06-23%2017%3A22%3A06%20%2B0200 HTTP/1.0" 200 0
HON
B4
2024-06-23T17:22:29.958216
::1 - - [23/Jun/2024 17:22:29] "GET /generate?type=B4 HTTP/1.0" 200 140
{'id': '368cbc44-e375-445d-9531-b54209314cd6', 'task': 'intake', 'arrival': '2024-06-23 17:21:42 +0200'}
This is the duration of the task
0.8273051054534927
No resources. Callback url where we should send put request when resources are available
https://cpee.org/flow/engine/52605/callbacks/09aebda37ffead0b77680fa9458f7f78/
intake queue before sorting
[{'patient_id': 'b7486653-18c0-46c8-812c-78b5da275909', 'callback_id': 'https://cpee.org/flow/engine/52573/callbacks/1aa9be1b4333d77ca5b6625802256b04/', 'original_arrival
_time': '2024-06-23 17:22:06 +0200'}, {'patient_id': '368cbc44-e375-445d-9531-b54209314cd6', 'callback_id': 'https://cpee.org/flow/engine/52605/callbacks/09aebda37ffead0b
77680fa9458f7f78/', 'original_arrival_time': '2024-06-23 17:21:42 +0200'}]
intake queue after sorting
[{'patient_id': '368cbc44-e375-445d-9531-b54209314cd6', 'callback_id': 'https://cpee.org/flow/engine/52605/callbacks/09aebda37ffead0b77680fa9458f7f78/', 'original_arrival
_time': '2024-06-23 17:21:42 +0200'}, {'patient_id': 'b7486653-18c0-46c8-812c-78b5da275909', 'callback_id': 'https://cpee.org/flow/engine/52573/callbacks/1aa9be1b4333d77c
a5b6625802256b04/', 'original_arrival_time': '2024-06-23 17:22:06 +0200'}]
Intake patient is rescheduled
::1 - - [23/Jun/2024 17:22:30] "GET /simulator?id=368cbc44-e375-445d-9531-b54209314cd6&task=intake&arrival=2024-06-23%2017%3A21%3A42%20%2B0200 HTTP/1.0" 200 0
Intake patient is discharged after duration
Processing Intake queue for patient 368cbc44-e375-445d-9531-b54209314cd6
HON
B1
2024-06-23T17:22:34.284894
::1 - - [23/Jun/2024 17:22:34] "GET /generate?type=B1 HTTP/1.0" 200 142
{'id': '06abaf22-3b53-4689-97ae-f4fdc9fa2a17', 'originalarrival': '2024-06-23 17:22:06 +0200', 'patienttype': 'B1'}
Finished processing inatke patient 368cbc44-e375-445d-9531-b54209314cd6
Processing Intake queue for patient b7486653-18c0-46c8-812c-78b5da275909
Finished processing inatke patient b7486653-18c0-46c8-812c-78b5da275909
please come back in 20 seconds (nextday), we will keep your original arrival time saved
Patient replanned: {"CPEE-INSTANCE":"52641","CPEE-INSTANCE-URL":"https://cpee.org/flow/engine/52641","CPEE-INSTANCE-UUID":"6bebe5a1-5bf1-4d5e-b79a-6ef2e640d864","CPEE-BEH
AVIOR":"fork_running"}
```