AI4EU Experiments
Sudoku Hello World - Tutorial

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Sudoku Hello World

- A simple ”Hello World” example of an AI4EU Experiment.
- The purpose is to show how to use the Platform.
- The example is …
  - … Open Source: https://github.com/peschue/ai4eu-sudoku/
  - … Public Domain: MIT License
- You can use it as a template for your own Experiments.
- You can use parts of it.
- A Cheatsheet (all steps/commands) is available in the video description and in the above repository

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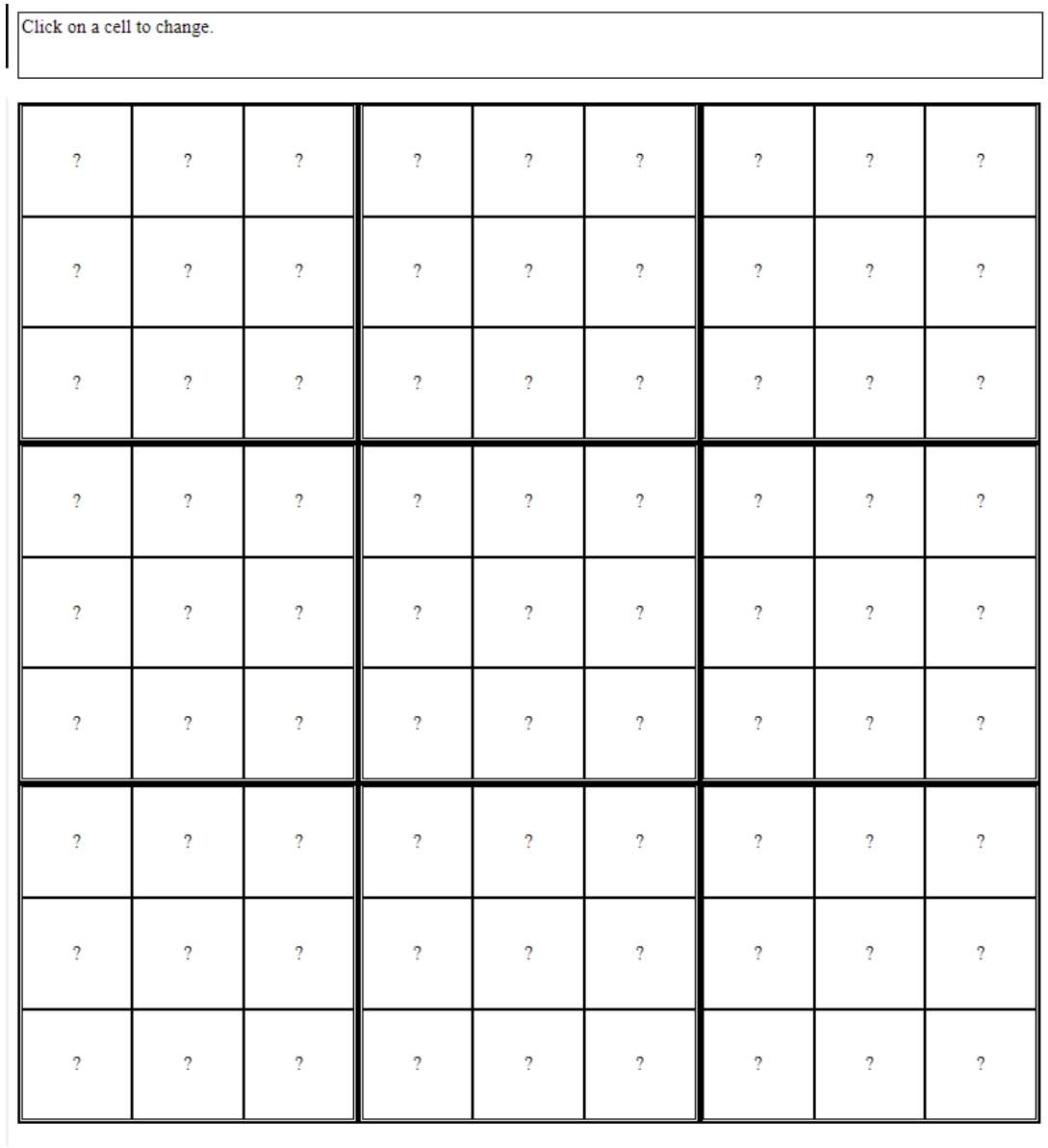
User Interface

- Status Text on top
- Sudoku Field below



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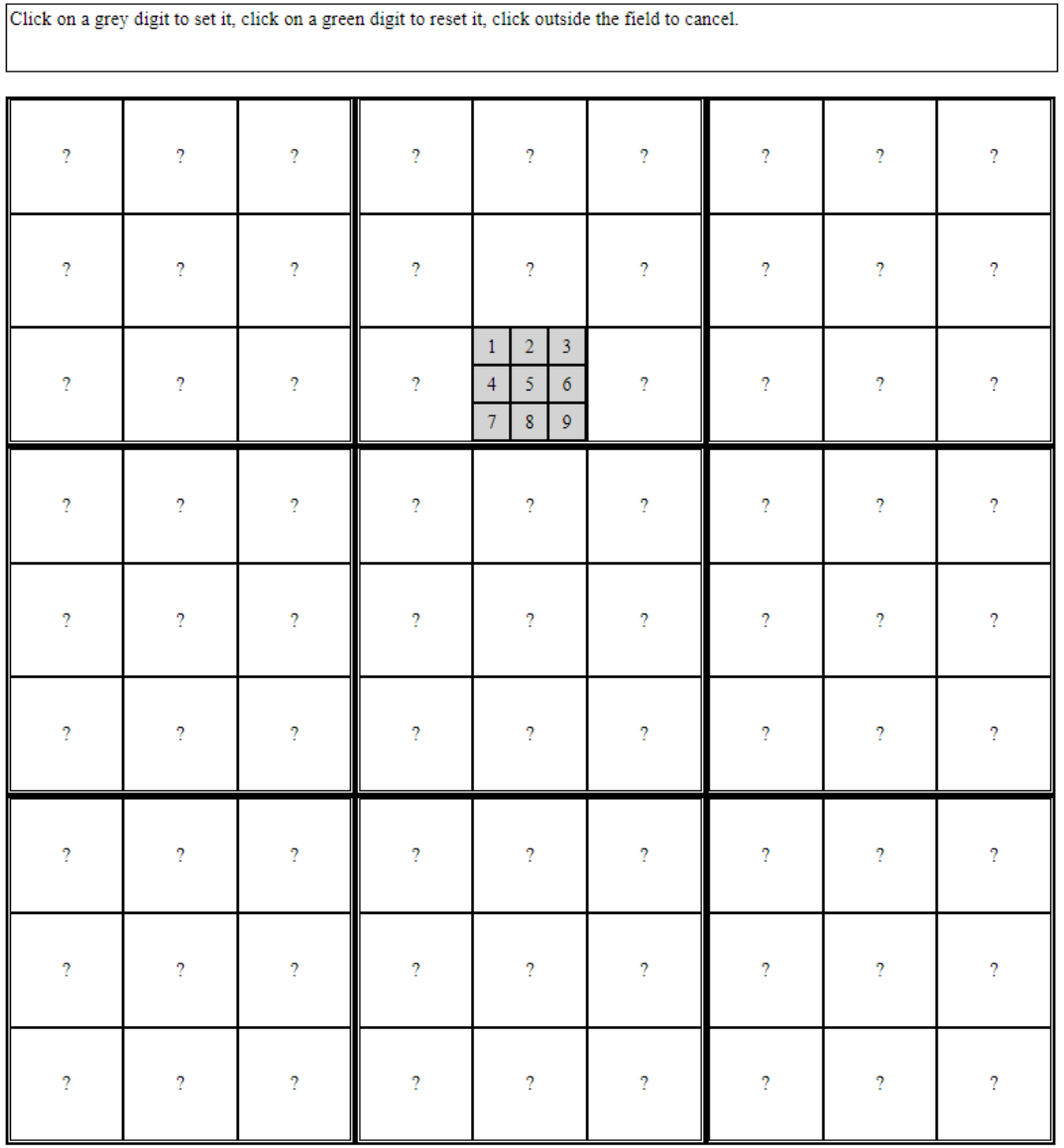

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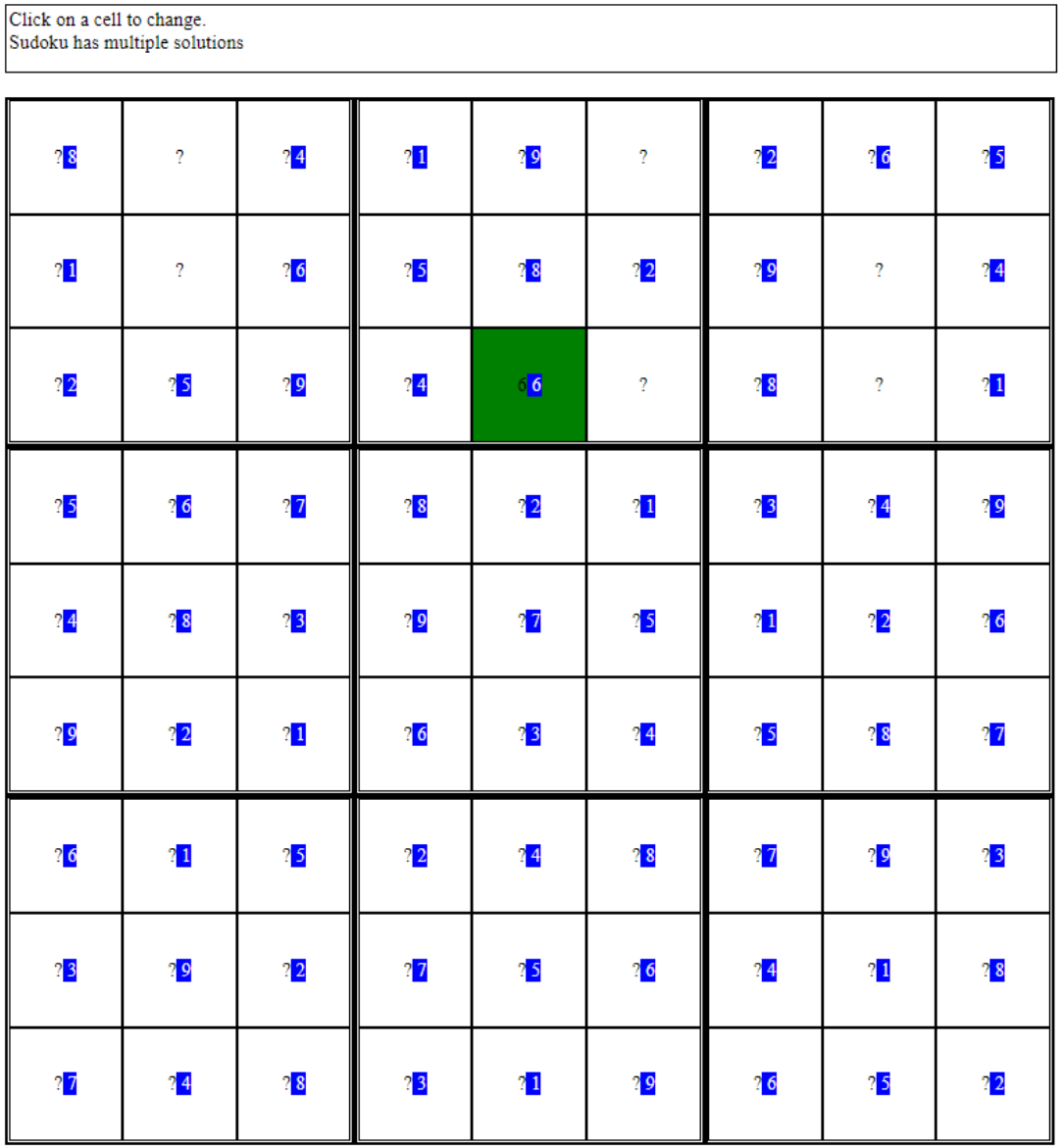

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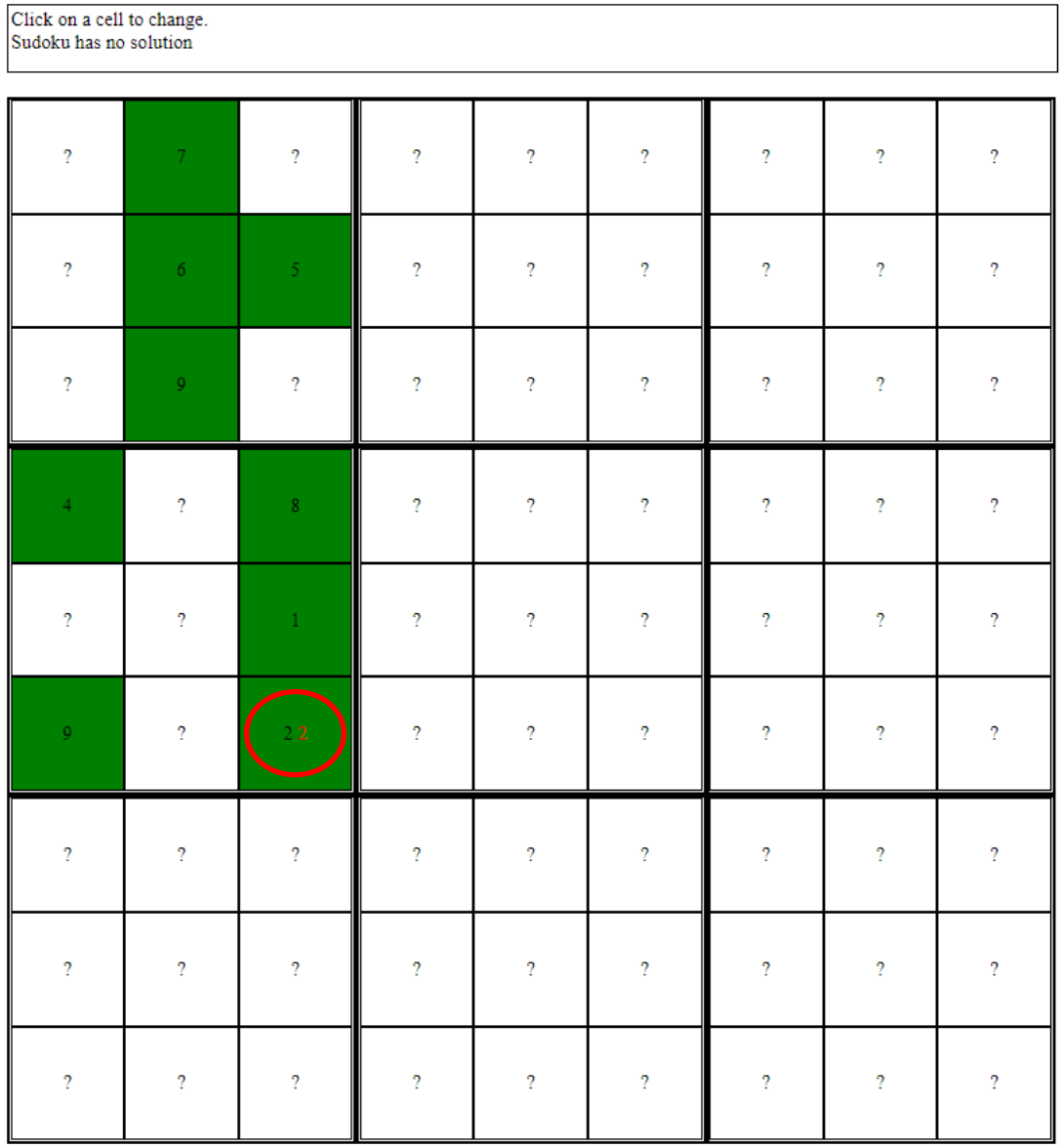

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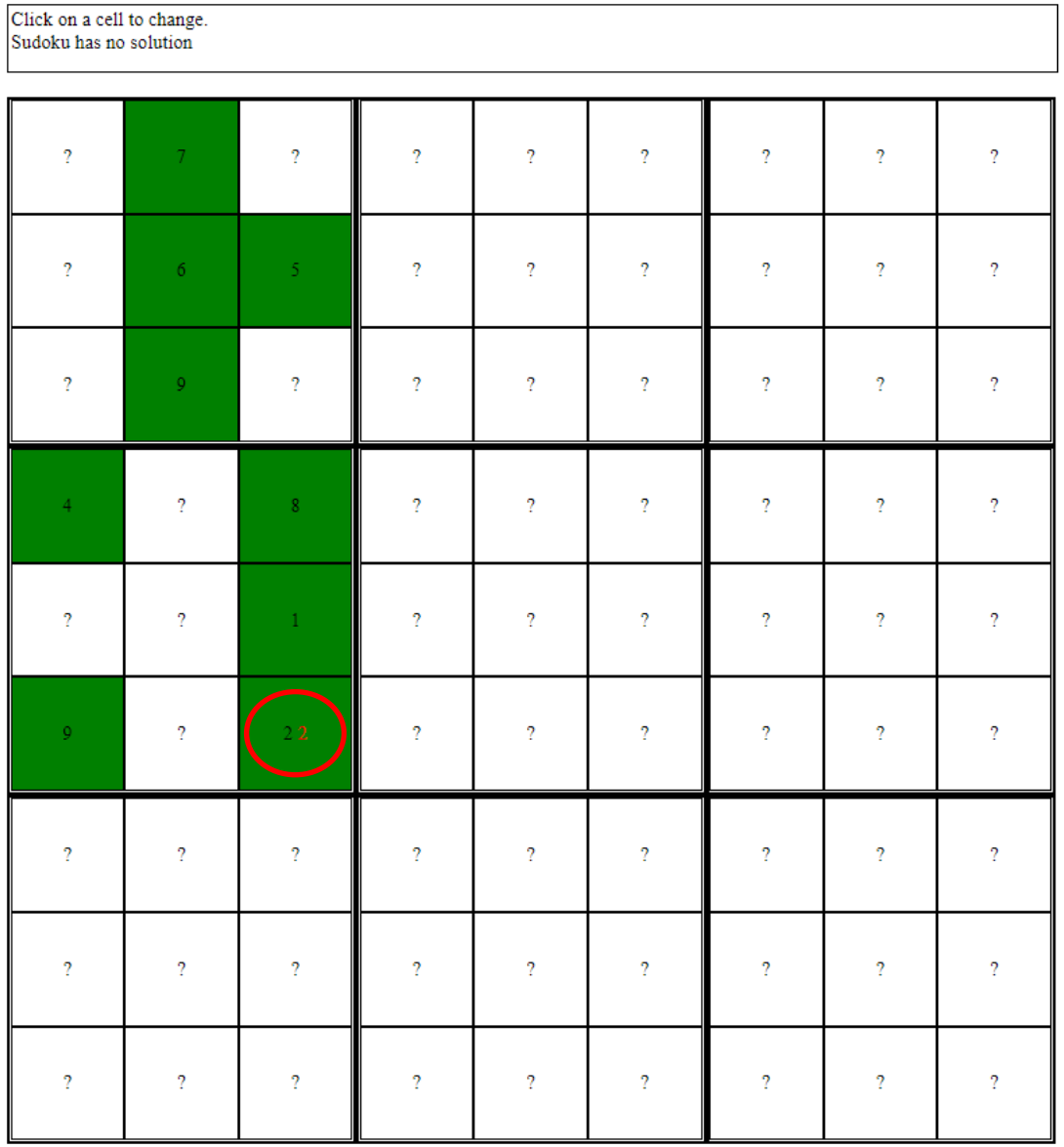
- How to set a cell to “?”:
  set the cell to the same number



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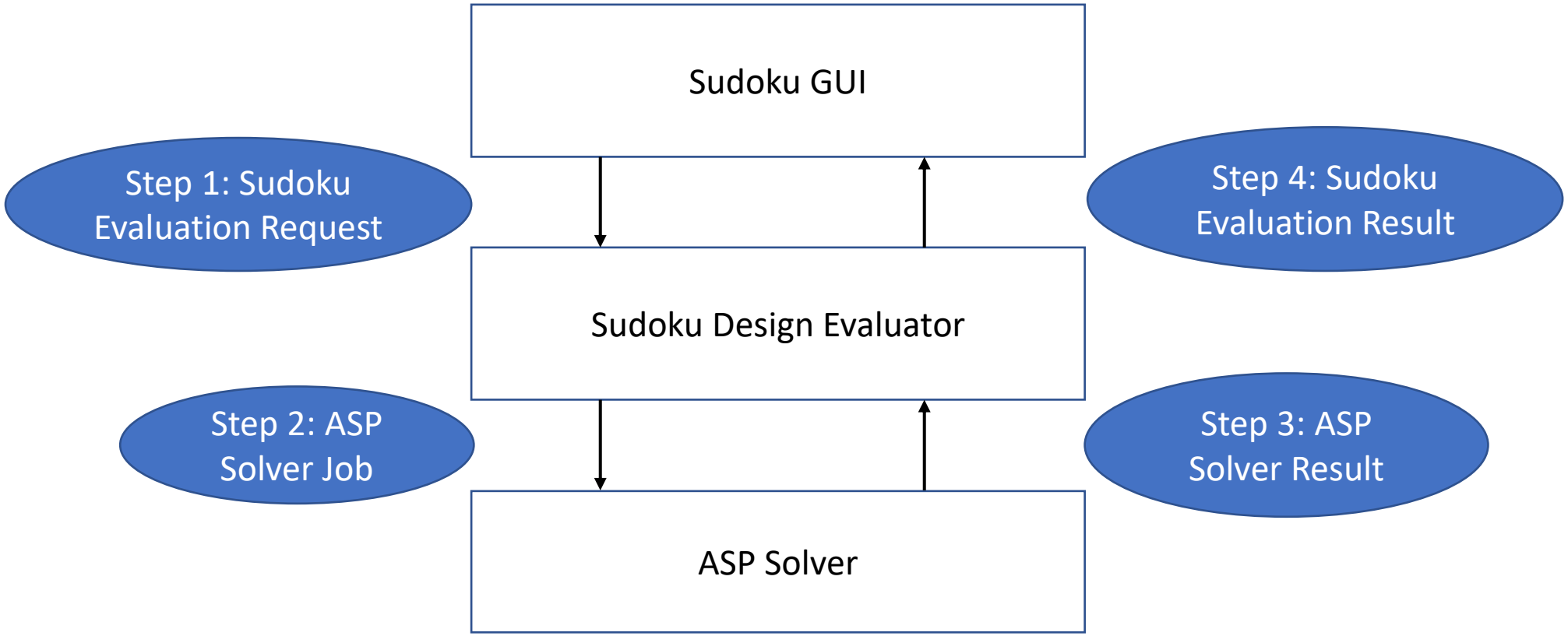
Components and Messages



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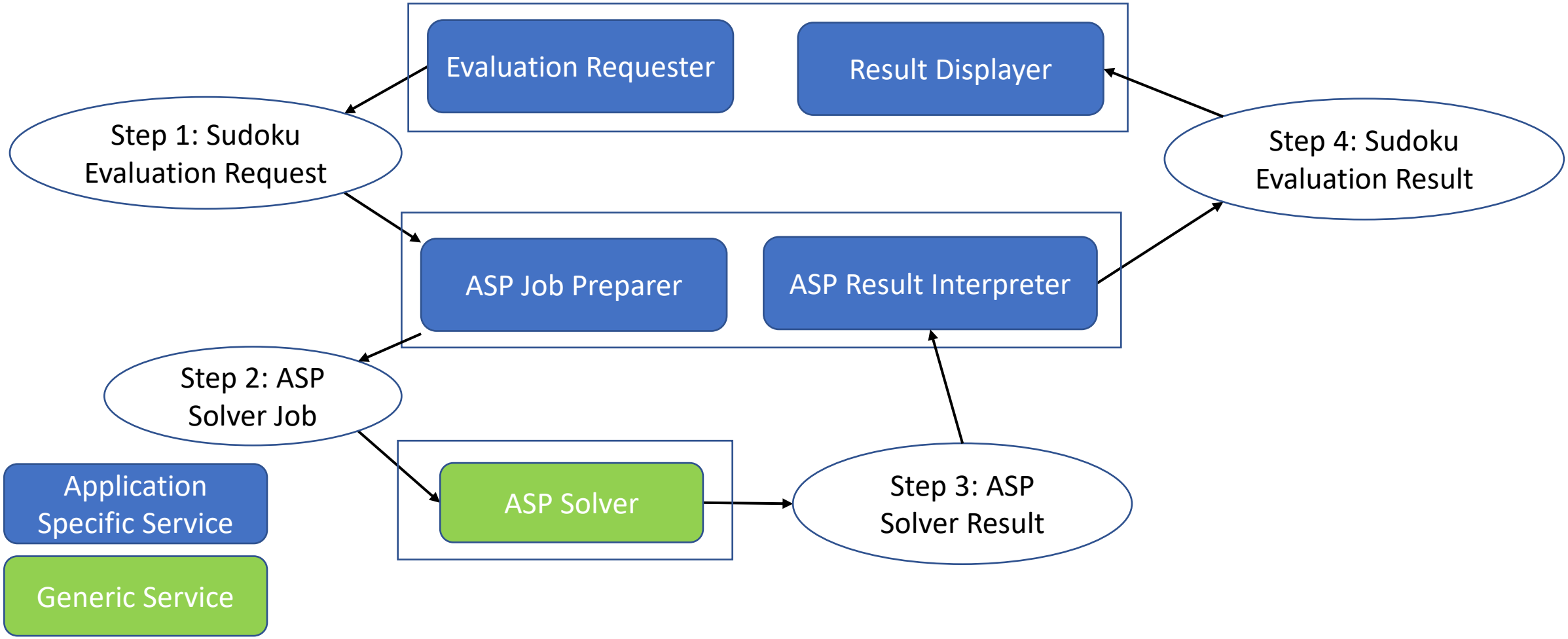
Services – Generic and Application-Specific



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Protobuf Services

```
service SudokuGUI {
  rpc requestSudokuEvaluation(Empty)
       returns(SudokuDesignEvaluationJob);
  rpc processEvaluationResult(SudokuDesignEvaluationResult)
       returns(Empty);
}

service SudokuDesignEvaluator {
  rpc evaluateSudokuDesign(SudokuDesignEvaluationJob)
       returns (SolverJob);
  rpc processSolverResult(SolveResultAnswersets)
       returns(SudokuDesignEvaluationResult);
}

service OneshotSolver {
    rpc solve(SolverJob) returns (SolveResultAnswersets);
}
```


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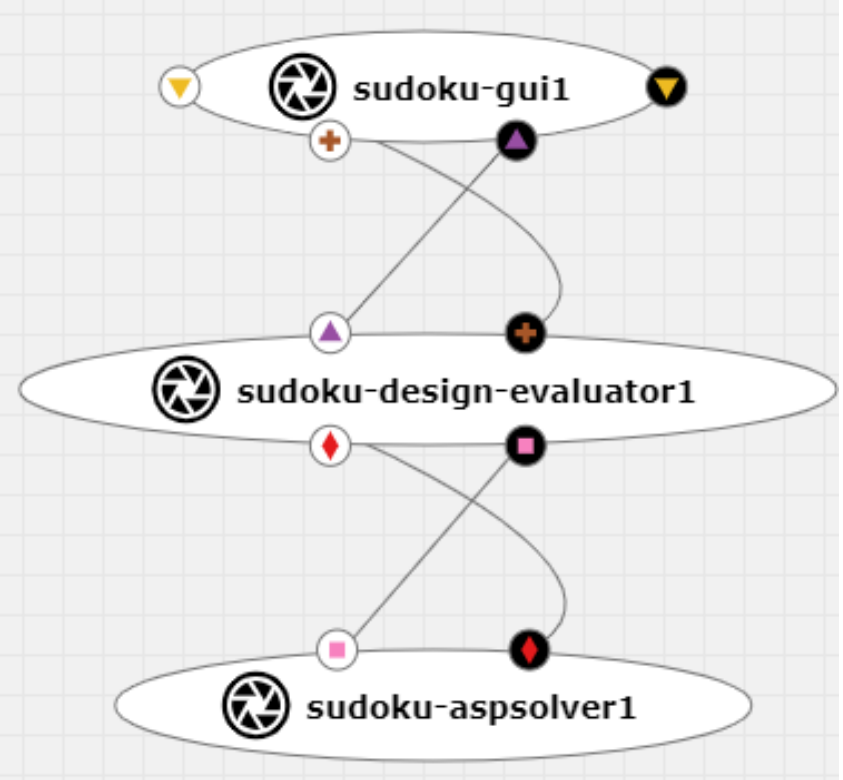

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Prerequisites

- Building and Onboarding
  - Git: clone https://github.com/peschue/ai4eu-sudoku/
  - Python
  - Docker: https://docs.docker.com/
- Deployment and Running
  - Python
  - Kubernetes environment, for example Minikube https://minikube.sigs.k8s.io/docs/start/

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Building

- Configure your docker repository in `helper.py`
  This demo uses the AI4EU internal docker image repository.
  Please contact Martin Welß if you think that you should get an account.
- Log in to your docker repository
  ```
  $ docker login <your-repository>
  ```
- Build 3 docker images for the 3 components:
  ```
  $ ./helper.py build
  ```
- Tag and push the images to the repository:
  ```
  $ ./helper.py tag-and-push
  ```


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Onboarding

- Sign in to the AI4EU Experiments Platform.
- Choose “On-boarding Model” on the left.
- For each component:
  - Choose a model name.
  - Enter Host and Port of the docker registry.
  - Enter Path (image) and Tag of the docker image.
  - Browse for the Protobuf File <u>and click “Upload”</u>.
- <u>Wait until the Status is green before uploading the next Component!</u>

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Orchestrator

- The directory “orchestrator” in the repository
  - is useful for development
  - does not need to be onboarded
    (cannot be onboarded)
- AI4EU Experiments Platform
  - will automatically add an orchestrator to the solution
    (if it contains more than one component)
  - That generic orchestrator is publicly available:
    https://github.com/ai4eu/generic-serial-orchestrator

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Using dockerhub as a repository

- Building: omit the server name and port:
  - configure "`<username>/<repository>`" for `REMOTE_REPO` in `helper.py`
  - login without specifying a server name:
    `$ docker login`
- Onboarding:
  - Use `hub.docker.com` as `host`
  - Omit the `port` number (leave the field empty)
- Deployment should then work just fine

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Configure Onboarded Models

- Choose “My Models” on the left.
- For each model:
  - Click “Manage My Model”
    ➔ “Publish to Marketplace”
    ➔ “Model Category”
  - Select “Data Transformer” and “Scikit-learn”.
    Because we must choose something for the next step, and this combination is known to work.

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Assemble Solution

- Choose “Design Studio” ➔ “Launch” Acu-Compose
- Drag the components to the Canvas and connect matching ports
  - Input ports are circles with white background.
  - Output ports are circles with black background.
  - Symbols indicate matching ports.
- Click “Save” and enter a solution name and version.
- Click “Validate”.

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Congratulations!

- Your solution is ready
  - to be deployed,
  - to be automatically executed/orchestrated/run, and
  - to be published or privately shared.

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Deployment – Getting solution.zip

- Load the Solution in Design Studio / Acu-Compose
- Click “Deploy”
  ➔ “Deploy to local”
  ➔ “Export To Local”
  ➔ “Download Solution Package”
- Store solution.zip to a new folder
- Unzip the file.

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Deployment - Kubernetes

- Create a new namespace for Sudoku
```
$ kubectl create namespace sudoku
```
- Run deployment script:
```
$ python kubernetes-client-script.py -n sudoku
```
- Observe the end of the output:
```
Node IP-address : 192.169.49.2
Orchestrator Port is : 30002
```


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Deployment - Orchestrator

- Recall the output of the deployment script:

```
Node IP-address : 192.168.49.2
Orchestrator Port is : 30002
```

- Run the orchestrator:

```
$ cd orchestrator_client
$ python orchestrator_client \
  192.168.49.2:30002
```


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Deployment – Access the GUI

- Get access to the Web-GUI (minikube on Windows/MacOS):

```
$ minikube -n sudoku service \
  --url sudoku-gui1webui
```

  - Navigate to the address given by the command.
- Get access to the Web-GUI (in general):
  - List Node, PODs, and Services

```
$ kubectl -n sudoku get \
  node,service,pod -o wide
```

  - Navigate to

```
http://<node-IP>:<sudoku-gui1webui-port>/
```


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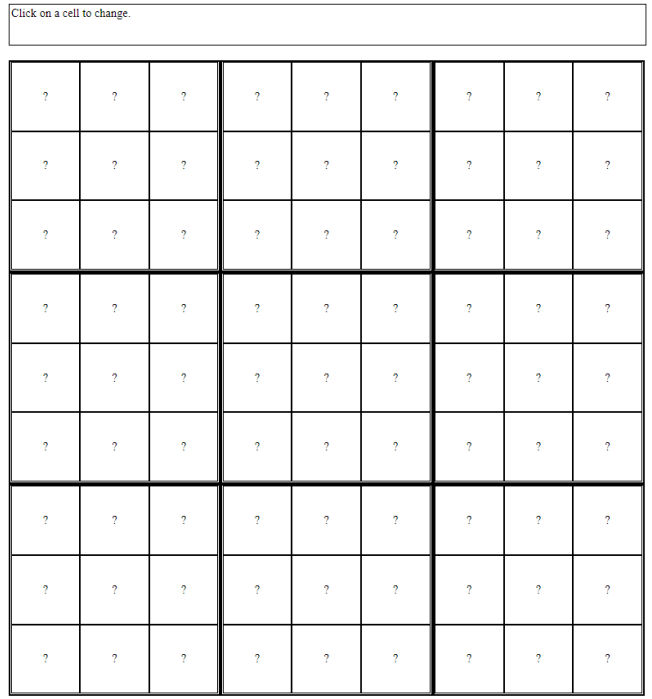
Test it

- You should see the Sudoku GUI.
- Click on one field and select a number.
- You should see a partial solution of the Sudoku that respects your input.
- For each click, the orchestrator client must be started again.

```
$ while sleep 1; do \
  python orchestrator_client…;\
  done
```



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Final Comments

- This is the status of the March 2021 Release.
- The easiest way might be minikube on native Ubuntu LTS, e.g., Ubuntu 20.04 / “Focal Fossa”.
- This demo was created with minikube in WSL2 (Windows Subsystem for Linux Version 2):
  - docker was installed within WSL2 (not Docker Desktop)
  - minikube was installed within WSL2 (not the Windows Installer)
- Contact: peter.schueller@tuwien.ac.at
  contact@peterschueller.com

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