

PACC

Prefect Associate
Certification Course



Norms reminder

Zoom

- Camera on
- Mute unless asking a question
- Use hand raise in Zoom to ask a question

Slack

- Use threads
- Emoji responses 😊



104 - Work pool-based deployments

104 Agenda

- Create work pool-based deployments with *.deploy()*
- Flow code storage
- Prefect managed work pools
- Hybrid work pools with workers
- Push work pools



Why use a work pool-based deployment?

Infrastructure is a pain, Prefect makes it better. 😊

- Run a deployment on a variety of infrastructure
- Provide a template for deployments
- Ability to prioritize work
- Options to scale infrastructure to 0 (serverless)



Create deployment with `.deploy()`

Very similar syntax to `.serve()`

Differences:

- need to specify a work pool
- doesn't start a server



First work pool-based deployment

- create with `.deploy()`
- specify flow code stored in a GitHub repository
- specify an existing *Prefect Managed* workpool



Create deployment with *.deploy()*

```
from prefect import flow

if __name__ == "__main__":
    flow.from_source(
        source="https://github.com/discdiver/pacc-2024.git",
        entrypoint="102/weather2-tasks.py:pipeline",
    ).deploy(
        name="my-first-managed-deployment",
        work_pool_name="managed1",
    )
```



Create deployment with `.deploy()`

Run the script

Successfully created/updated all deployments!

Deployments

Name	Status	Details
pipeline/my-first-managed-deployment	applied	

To schedule a run for this deployment, use the following command:

```
$ prefect deployment run 'pipeline/my-first-managed-deployment'
```

You can also run your flow via the Prefect UI:

<https://app.prefect.cloud/account/9b649228-0419-40e1-9e0d-44954b5c0ab6/workspace/d137367a-5055-44ff-b91c-6f7366c9e4c4/deployments/deployment/d448be8f-2092-47f9-8d0b-ee06ce182480>



Create a deployment with *.deploy()*

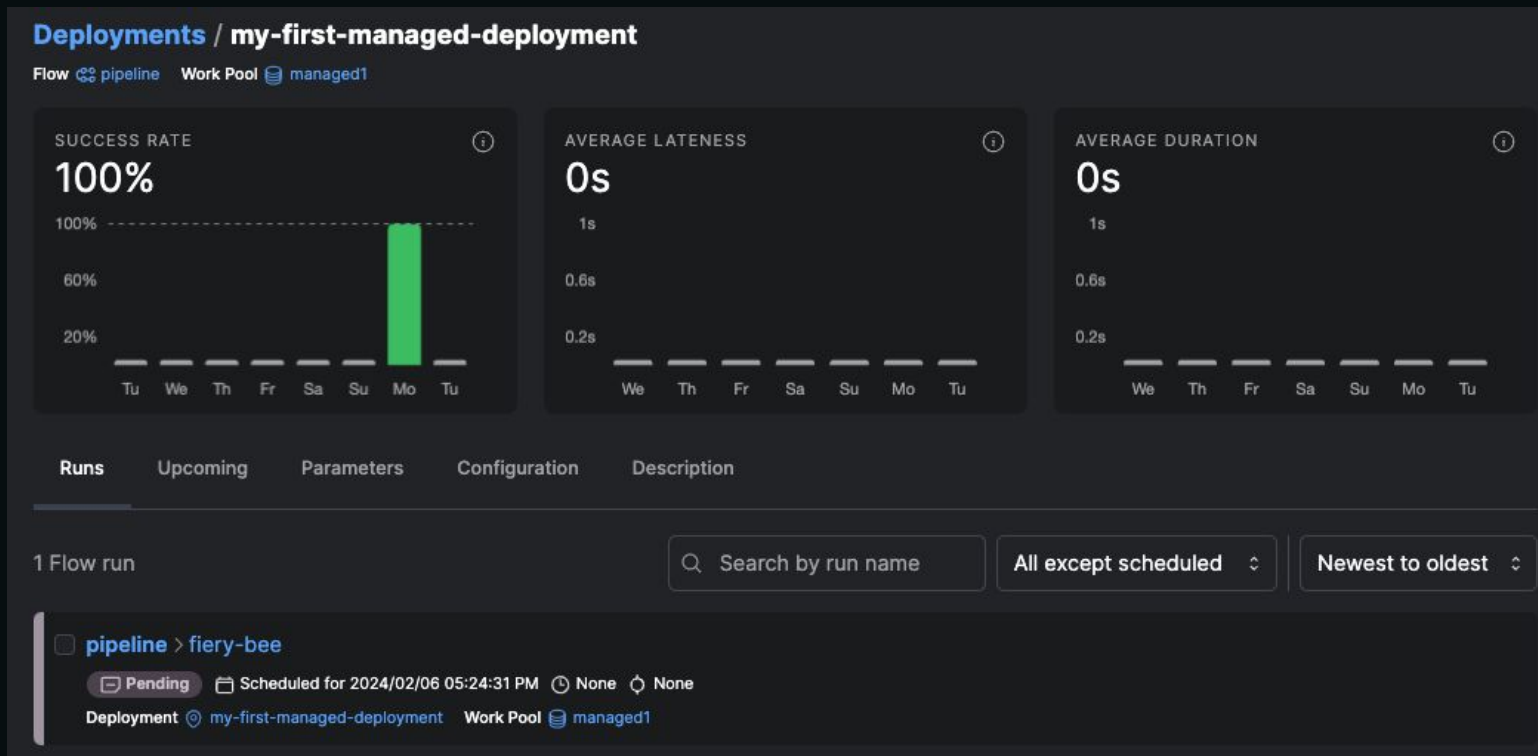
Run the deployment from the UI or the CLI:

prefect deployment run
'pipeline/my-first-managed-deployment'

Takes a moment to start infra and pull base Docker image



See the deployment and flow run in the UI



Let's break this down



Flow code storage



Flow code storage options

1. Git-based remote repository (e.g. GitHub)
2. Bake your code into a Docker image
3. Cloud provider storage

We specified a public GitHub repo with `.from_source()` class method.

Provide the source URL to the repo and the entrypoint path:flow function name.



Work pools



Work pools

Provide default infrastructure configuration for deployments



Create a work pool of type **Prefect Managed**

Managed

Managed work pools execute flow runs on Prefect Cloud infrastructure.



Prefect Managed

Beta

Execute flow runs within containers on Prefect managed infrastructure.

With a **Prefect Managed** pool, Prefect runs your flow code on our infrastructure in a Docker container.

👉 Only available with Prefect Cloud



Create a Prefect Managed work pool

Work Pools / Create

✓ Infrastructure Type

✓ Details

03 Configuration

Below you can configure workers' behavior when executing flow runs from this work pool. You can use the editor in the **Advanced** section to modify the existing configuration options if you need additional configuration options.

If you don't need to change the default behavior, hit **Create** to create your work pool!

Base Job Template

Defaults Advanced

🔔 The fields below control the default values for the base job template. These values can be overridden by deployments.

Pip Packages (Optional)

A list of python packages that will be installed via `pip` at runtime (this will occur prior to any pull steps configured on the deployment).

1

2

3

prefect>=2.0.0, marvin

Format

Environment Variables (Optional)

Environment variables to set when starting a flow run.

1

2

3

Format

Image (Optional)

The prefect image to use for your flow run execution environment.

prefecthq/prefect:2-latest

Job Timeout (Optional)

The length of time (in seconds) that Prefect will wait for a run to complete before crashing the flow run.

600

Cancel

Previous

Create



Create a Prefect Managed work pool



- Don't modify the job template for now
- You can specify environment variables, packages to install at runtime, etc.
- All deployments that use this work pool inherit these settings




At runtime, Prefect:

1. Pulls the Docker image specified
2. Installs any specified packages
3. Pulls your flow code from GitHub
4. Runs your code in the container
5. Monitors state
6. Exits and cleans up 🧹





Hybrid model - hybrid work pools with workers

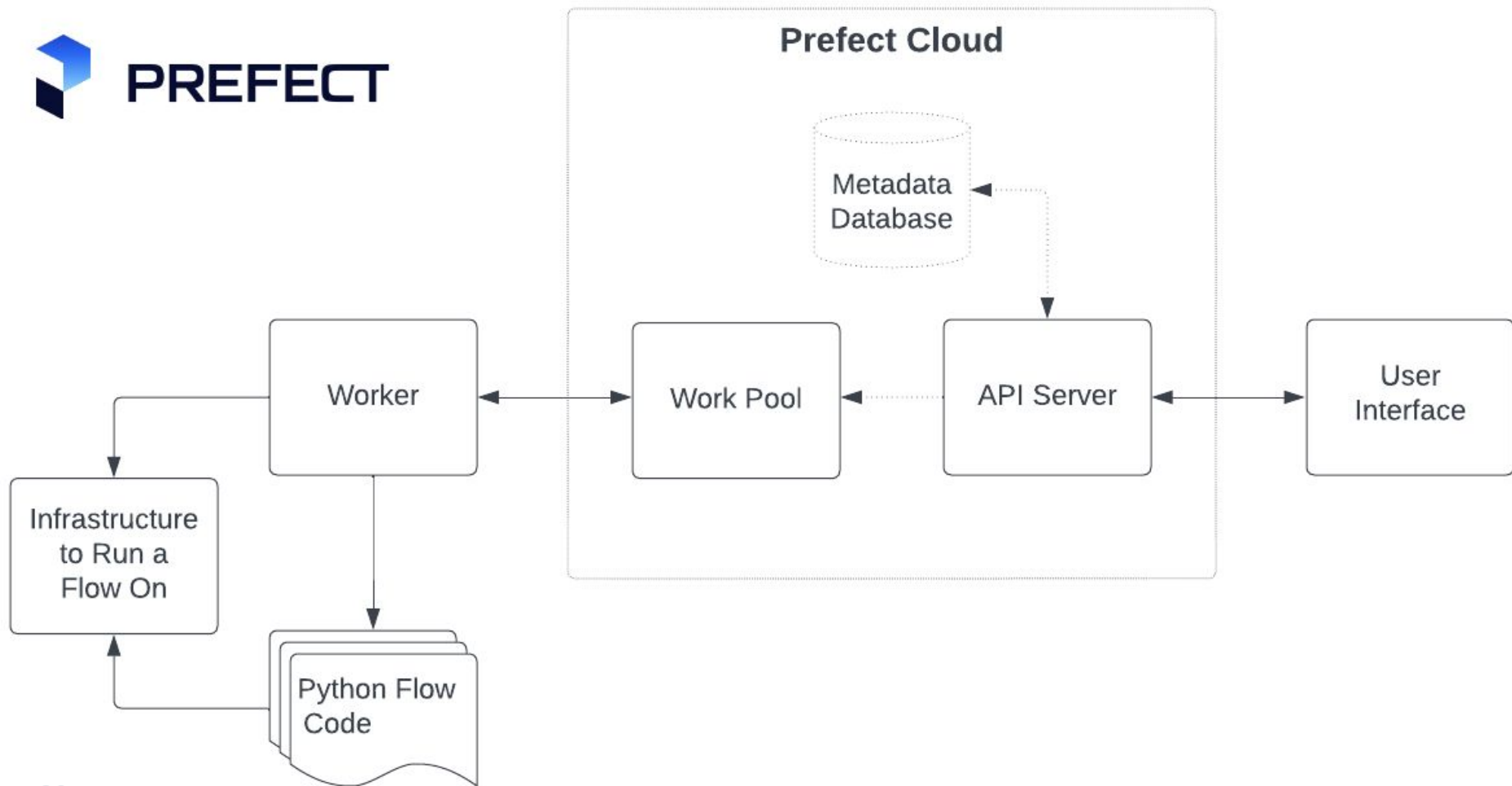


Hybrid model = separation

- Your flow code runs on your infrastructure
- Your flow code is stored on your storage (GitHub, AWS, Docker image, etc)
- Prefect Cloud stores metadata, logs, artifacts, etc.
- Data encrypted at rest
- Prefect Technologies, Inc. is SOC2 Type II compliant

<https://www.prefect.io/security>





Workers

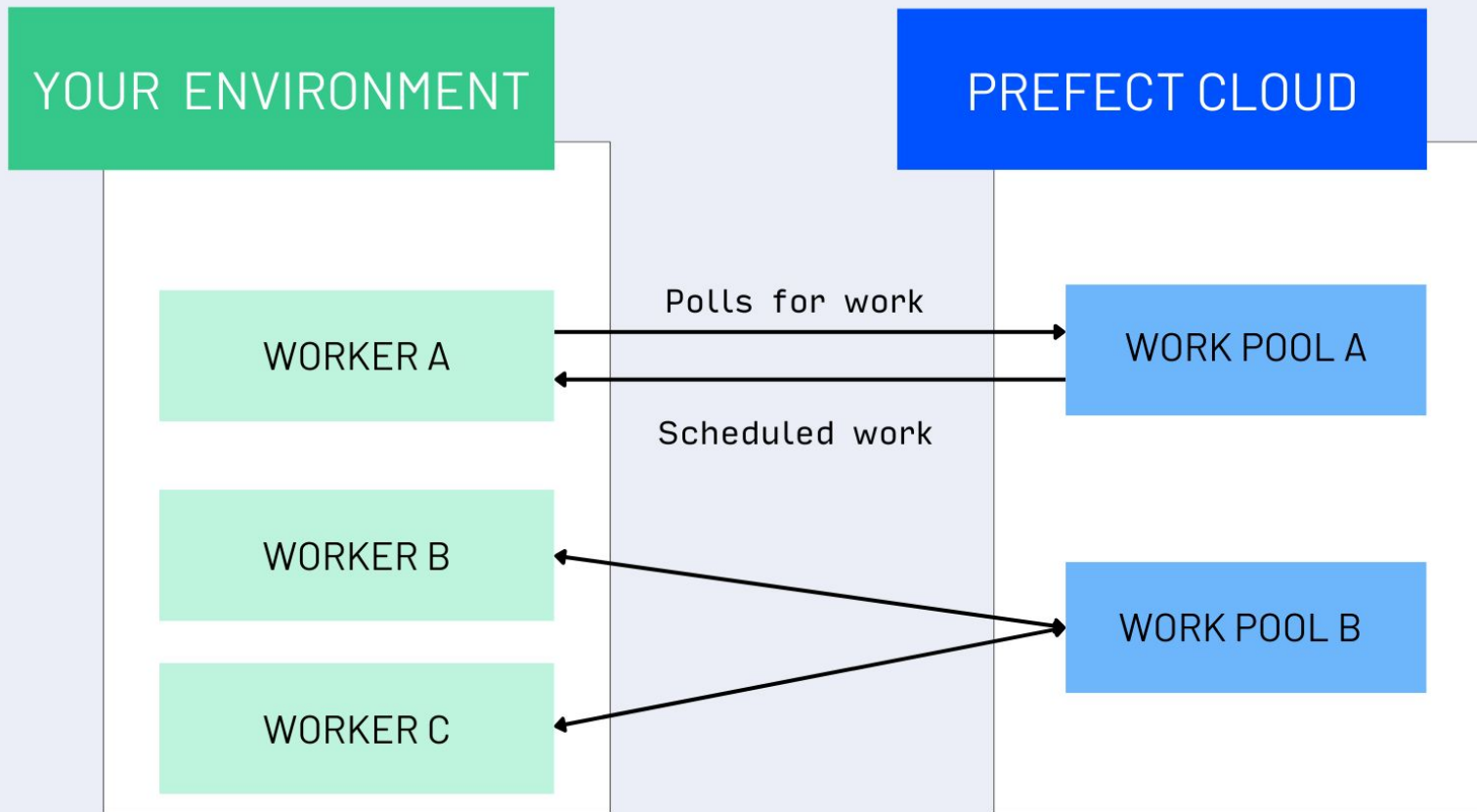


Workers

- Long-running process on the client
- Poll for scheduled flow runs from work pools
- Must match a work pool to pick up work



WORKERS & WORK POOLS



Docker work pool & worker



Why use Docker?

- Same operating environment everywhere
- Lighter weight than a VM
- Linux (generally)
- Portable
- Very popular
- Almost all Prefect work pools use it



Docker work pool

Run a flow in a Docker container

1. Install: *pip install -U prefect-docker*
2. Start Docker on your machine
3. Create a Docker type work pool
4. Start a worker that polls the work pool
5. Create a deployment that specifies the work pool
6. Run the deployment



Create a Docker work pool

Hybrid

Hybrid work pools require workers to poll for and execute flow runs in your infrastructure.



AWS Elastic Container Service

Execute flow runs within containers on AWS ECS. Works with EC2 and Fargate clusters. Requires an AWS account.



Azure Container Instances

Execute flow runs within containers on Azure's Container Instances service. Requires an Azure account.



Docker

Execute flow runs within Docker containers. Works well for managing flow execution environments via Docker images. Requires access to a running Docker daemon.



Google Cloud Run

Execute flow runs within containers on Google Cloud Run. Requires a Google Cloud Platform account.



Google Cloud Run V2

Execute flow runs within containers on Google Cloud Run (V2 API). Requires a Google Cloud Platform account.



Google Vertex AI

Execute flow runs within containers on Google Vertex AI. Requires a Google Cloud Platform account.



Kubernetes

Execute flow runs within jobs scheduled on a Kubernetes cluster. Requires a Kubernetes cluster.



Package flow code into a Docker image with *.deploy()*

```
from prefect import flow

@flow(log_prints=True)
def buy():
    print("Buying securities")

if __name__ == "__main__":
    buy.deploy(
        name="my-code-in-an-image-deployment",
        work_pool_name="my-docker-pool",
        image="discdiver/local-image:1.0",
        push=False,
    )
```

.from_source() method not needed if baking flow code into image



`.deploy()` method

Creates a Docker image with your flow code baked in by default!

- specify the image name
- specify `push=False` to not push image to registry
- can create a `requirements.txt` file with packages to install into the image (or add package names to work pool or at deployment creation time)



Docker type worker

Start a Docker type worker to connect to a work pool named *my-docker-pool*

prefect worker start -p my-docker-pool



Dockerfile used to create your image (under the hood)

```
FROM prefecthq/prefect:2-latest  
COPY requirements.txt /opt/prefect/104/requirements.txt  
RUN python -m pip install -r requirements.txt  
COPY . /opt/prefect/pacc-2024/  
WORKDIR /opt/prefect/pacc-2024/
```



Docker

- Prefect provides base Docker images
- Can customize base image
- Read about choosing images at docs.prefect.io/concepts/infrastructure/#standard-python



Docker

- Run your deployment
- Worker pulls image and spins up Docker container
- Flow code runs in Docker container and exits 🚀



Docker

See container in Docker Desktop if running locally

Containers

[Give feedback](#) 

A container packages up code and its dependencies so the application runs quickly and reliably from one computing environment to another. [Learn more](#)

☐ Only show running containers

 Search



NAME

IMAGE

STATUS

PORT(S)

STARTED

ACTIONS



nano-tortoise

26fed9f8e268



[prefecthq/p](#) Exited



Docker

Prerequisites reminder:

- Docker installed & **running**
- prefect-docker package installed



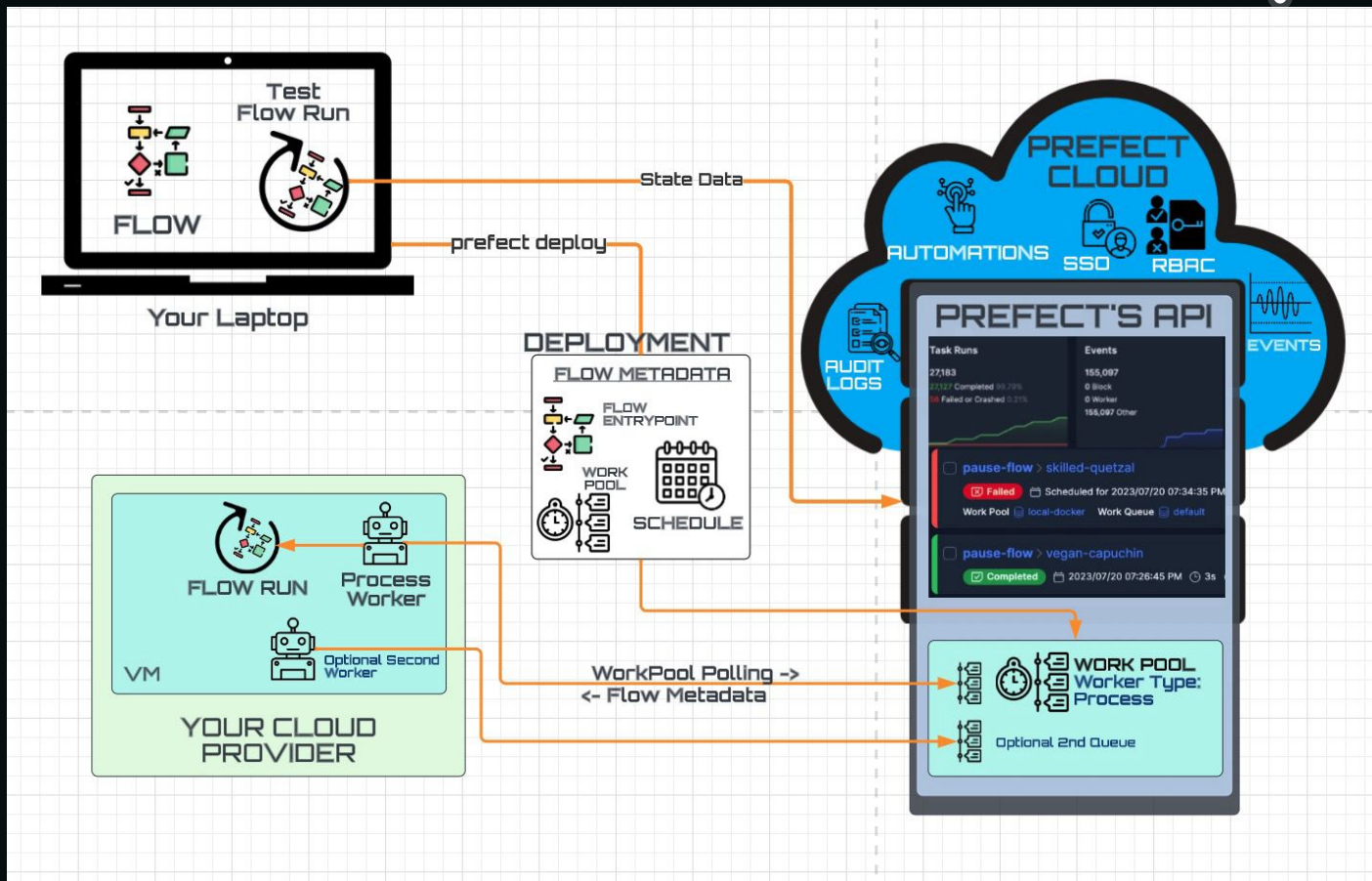
Hybrid work pool types

1. Kubernetes
2. Docker
3. Serverless options such as ECS, ACI, GCR, VertexAI
4. Process (local subprocess)

* Worker required for all



Process hybrid work pool with Prefect Cloud example





Push work pools



Push work pools

Serverless options with no worker required

Options:

- AWS ECS, Google Cloud Run, Azure Container Instances

Create from CLI:

```
prefect work-pool create --type modal:push --provision-infra my-modal-pool
```



Push work pools

Prefect will create everything for you with *--provision-infra*

Prerequisites to use:


- Cloud provider account
- CLI tool installed
- Authenticated locally

```
prefect work-pool create --type modal:push --provision-infra my-modal-pool
```




What's a work queue for?

- Prioritize work
- Limit concurrent runs



 default work queue created automatically


Pause work pools or work queues


basic-k8s ●


 Kubernetes





Concurrency Limit Unlimited


 



1 Work Queue 

 Search

Name	Concurrency Limit	Priority 	Status
default		1	 Unhealthy  



104 Recap


You've seen how to

- Create work-pool based deployments! 🎉
- Create a deployment that uses a Prefect managed work pool and flow code stored on GitHub
- Use the hybrid model with workers
- Bake flow code into Docker images
- Create push work pools with a single command
- Pause and resume work pools and work queues





Lab 104



Reminder: breakout room norms

1. 😊 Introduce yourselves
2. 📹 Camera on (if possible)
3. 💻 One person shares screen
4. 🧑💻 Everyone codes
5. 🧑🗣️ Each person talks
6. 😌 Low-pressure, welcoming environment: lean in

Breakout rooms with lots of participation =
more fun + more learning! 😎



104 Lab

- Create a Prefect Managed work pool.
- Create and run a deployment that uses the work pool.
- Use flow code stored in your own GitHub repository with a deployment.
- Pause and resume the work pool from the UI.



104 Lab Extensions


- Stretch 1: bake your flow code into a Docker image with `.deploy()`.
- Don't push the image to a remote repository (or do log in and push it to DockerHub).

Don't forget to:

- Start Docker on your machine
 - `pip install -U prefect-docker`
 - Make a Docker work pool
 - Start a Docker type worker that polls the pool
- Stretch 2: create a push work pool with `provision-infra` and use it in a deployment.
- Stretch 3: add an environment variable to a work pool and use it.



Lab 104: a solution

One person from each group, share your code in
Slack 

Discuss

Questions?



If you give an engineer a job...

Could you just fetch this data and save it? Oh, and ...

1. set up logging?
2. do it every hour?
3. visualize the dependencies?
4. automatically retry if it fails?
5. create an artifact for human viewing?
6. add caching?
7. add collaborators to run and view - who don't code?
8. send me a message when it succeeds?
9. run it in a Docker container-based environment?
10. pause for input?
11. automatically declare an incident when a % of workflows fail?
12. automatically run a workflow in response to an event?



105 - Interactive workflows & incidents

105 Agenda

- Interactive workflows
 - Human in the loop
- Incidents
- Metric triggers
- Prefect Runtime
- State change hooks



Interactive workflows



Interactive workflows

Pause a flow run to wait for input from a user via a web form (human-in-the-loop) 😊

pause_flow_run function



Human-in-the-loop: basic

```
from prefect import flow, pause_flow_run

@flow(log_prints=True)
def greet_user():
    name = pause_flow_run(str)
    print(f"Hello, {name}!")

if __name__ == "__main__":
    greet_user()
```



Human-in-the-loop: basic

Flow Runs / energetic-stallion

Paused 2024/01/30 02:03:03 PM 1s None

Resume Cancel

Flow greet-user

▼ Events

Logs

Task Runs

Subflow Runs

Results

Artifacts

Details

Parameters

Level: all

Oldest to newest

Jan 30th, 2024

INFO

Pausing flow, execution will continue when this flow run is resumed.

02:03:03 PM
prefect.flow_runs



Human-in-the-loop: basic

Jan 30th, 2024

INFO Pausing flow, execution will continue when this flow run is resumed.

Resume Flow Run

×

Current Flow Run State

Paused

Flow requires input. Please fill out the form below to resume.

Do you want to resume energetic-stallion?

Value

Jeff

Cancel

Submit



Human-in-the-loop: basic

Jan 30th, 2024

INFO	Pausing flow, execution will continue when this flow run is resumed.	02:03:03 PM prefect.flow_runs
INFO	Resuming flow run execution!	02:06:06 PM prefect.flow_runs
INFO	Hello, Jeff!	02:06:06 PM prefect.flow_runs
INFO	Finished in state Completed()	02:06:07 PM prefect.flow_runs



Human-in-the-loop

- For validation: can use *RunInput* class, which is a subclass of Pydantic's *BaseModel* class
- Able to specify a default value or create a dropdown
- Can create a default value at runtime



Human-in-the-loop: default value

```
import asyncio
from prefect import flow, pause_flow_run
from prefect.input import RunInput

class UserNameInput(RunInput):
    name: str

@flow(log_prints=True)
async def greet_user():
    user_input = await pause_flow_run(
        wait_for_input=UserNameInput.with_initial_data(name="anonymous")
    )

    if user_input.name == "anonymous":
        print("Hello, stranger!")
    else:
        print(f"Hello, {user_input.name}!")

if __name__ == "__main__":
    asyncio.run(greet_user())
```



Human-in-the-loop: default value

Flow Runs / glistening-penguin

Paused 2024/01/11 02:12:35 PM 1s None Resume ▶

Flow greet-user

Resume Flow Run

×

Current Flow Run State

Paused

Flow requires input. Please fill out the form below to resume.

Do you want to resume glistening-penguin?

Name (Optional)

anonymous

Cancel

Submit

Details Pa

all Old

Jan 11th, 2024

INFO Pausing flow, execution will continue when this flow run is resumed.



Human-in-the-loop: custom validation

```
from typing import Literal
import pydantic
from prefect import flow, pause_flow_run
from prefect.input import RunInput

class ShirtOrder(RunInput):
    """Shirt order options"""

    size: Literal["small", "medium", "large", "xlarge"]
    color: Literal["red", "green", "black"]

    @pydantic.validator("color")
    def validate_shirt(cls, value, values, **kwargs):
        """Validate that shirt combo exists"""

        if value == "green" and values["size"] == "small":
            raise ValueError("We don't carry that combination.")
        return value
```



Human-in-the-loop: custom validation

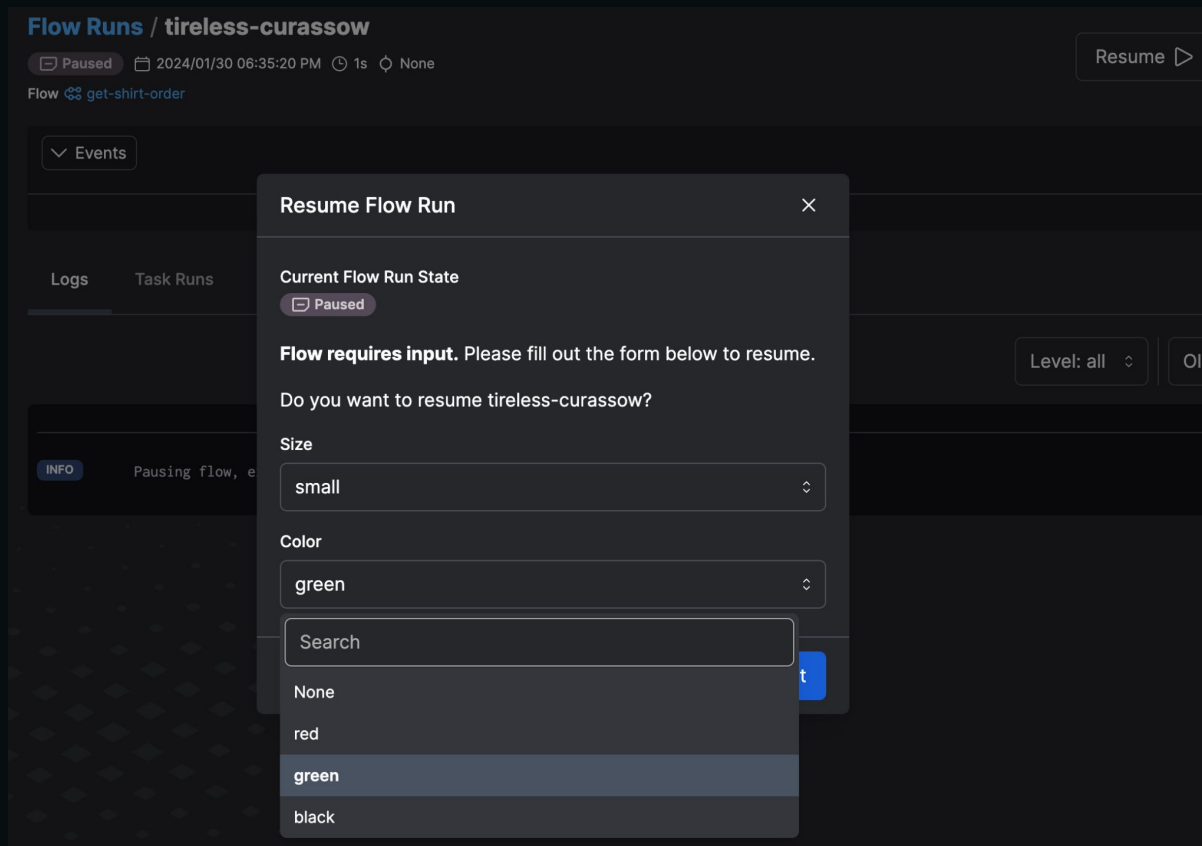
```
@flow(log_prints=True)
def get_shirt_order():
    """Get shirt selection from user via UI"""
    shirt_order = None

    while shirt_order is None:
        try:
            shirt_order = pause_flow_run(wait_for_input=ShirtOrder)
            print(f"We'll send you your shirt in {shirt_order} ASAP!")
        except pydantic.ValidationError:
            print(f"Invalid size and color combination.")

if __name__ == "__main__":
    get_shirt_order()
```



Human-in-the-loop: custom validation



Human-in-the-loop: custom validation

Jan 30th, 2024

INFO

Pausing flow, execution will continue when this flow run is resumed.

INFO

Resuming flow run execution!

INFO

Invalid size and color combination.

INFO

Pausing flow, execution will continue when this flow run is resumed.

INFO

Resuming flow run execution!

INFO

We'll send you your shirt in size='medium' color='red' ASAP!

INFO

Finished in state Completed()

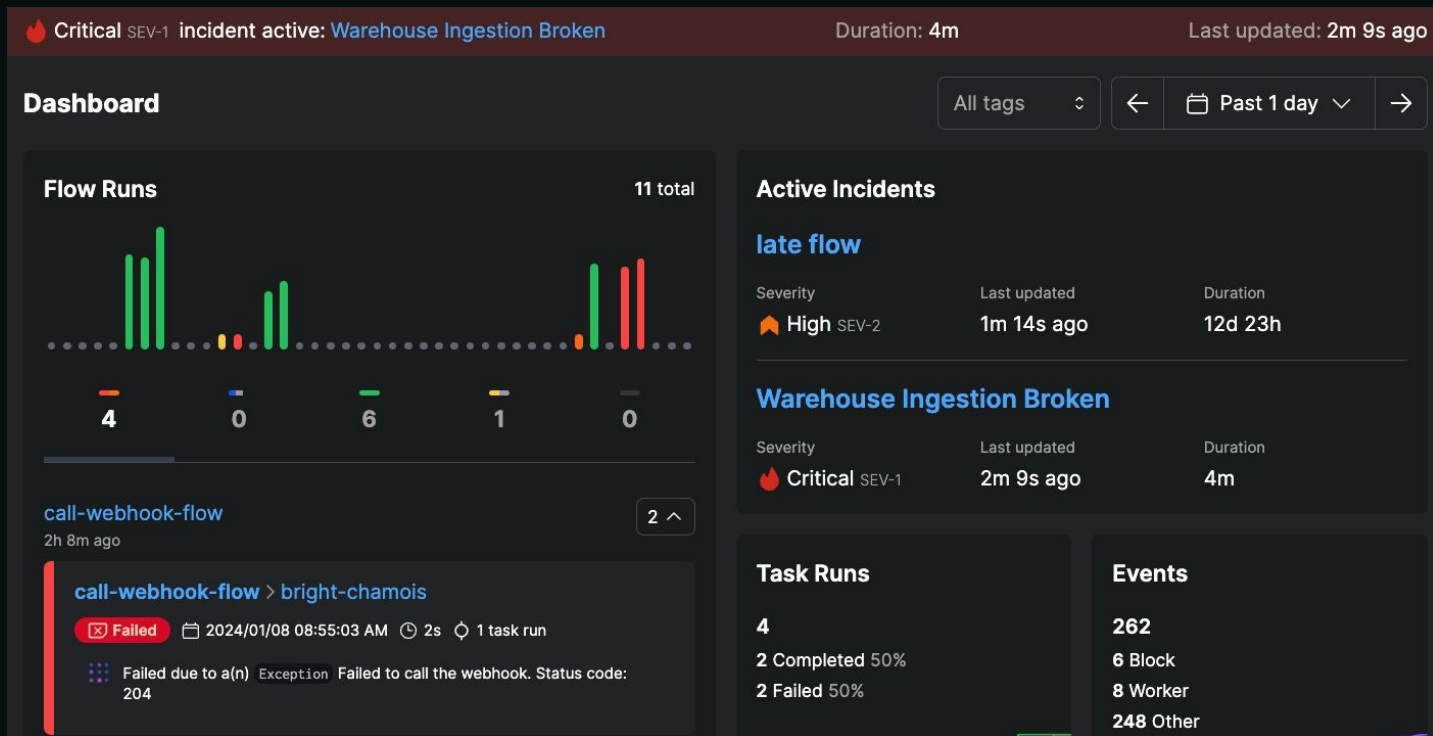


Incidents



Incidents

Formal declarations of disruptions to a workspace



Incidents

- visible workspace-wide
- keeps team updated for faster resolution
- creates record for analysis and compliance
- Custom plan tier only



Incidents

Declare an incident manually or automatically through an automation when an event occurs

Critical SEV-1 incident active: Warehouse Ingestion Broken

Duration: 10m

Last updated: 2m 33s ago

Incidents / Warehouse Ingestion Broken Beta

Mark resolved

Status	Severity	Started	Duration
Active	Critical SEV-1	2024/01/08 11:00 AM	10m

Timeline

2024/01/08

Incident declared manually by Taylor Curran at 11:00:00 AM

Severity
 Critical SEV-1

Taylor Curran added **belligerent-junglefowl** to the related resources list 8m 22s ago

Taylor Curran added **bright-chamois** to the related resources list and removed **belligerent-junglefowl** from the related resources list 8m 9s ago

Taylor Curran commented 4m 13s ago
Client A reported bad data quality.

Summary

None

Tags

None

Related resources

Block document
[geo-data-warehouse](#)
Flow run
[belligerent-junglefowl](#)
[bright-chamois](#)

71



Metric triggers

Metric triggers

Create an automation that uses a metric as a trigger

Automations / Create [Documentation](#)

01 Trigger 02 Actions 03 Details

Trigger Type

Metric

Metric Over the last

Average success percentage 10 Minutes

Threshold For

< 70 % 1 Minutes

Flows

train-model × validation-flow ×

Cancel Previous Next



Metric triggers

When a pattern is detected, then take an action

- send a notification
- toggle on a work pool
- create an incident
- run a deployment



Other trigger types

- can use status of many Prefect objects as triggers
- incidents can act as a trigger

Trigger Type

Select trigger

Deployment status

Flow run state

Metric

Work pool status

Work queue status

Incident

Custom





prefect.runtime



prefect.runtime

Module for runtime context access.

Useful for labeling, logs, etc.

Includes:

- ***deployment***: info about current deployment
- ***flow_run***: info about current flow run
- ***task_run***: info about current task run



prefect.runtime

```
from prefect import flow, task
from prefect import runtime

@flow(log_prints=True)
def my_flow(x):
    print("My name is", runtime.flow_run.name)
    print("I belong to deployment", runtime.deployment.name)
    my_task(2)

@task
def my_task(y):
    print("My name is", runtime.task_run.name)
    print("Flow run parameters:", runtime.flow_run.parameters)

if __name__ == "__main__":
    my_flow(x=1)
```



prefect.runtime

Useful for labeling, logs, etc.

```
15:04:48.223 | INFO | prefect.engine - Created flow run 'radical-duck' for flow 'my-flow'
15:04:48.224 | INFO | Flow run 'radical-duck' - View at https://app.prefect.cloud/account/9b649228
366c9e4c4/flow-runs/flow-run/7bdce263-37dc-4c08-bb46-38dd534878de
15:04:48.488 | INFO | Flow run 'radical-duck' - My name is radical-duck
15:04:48.490 | INFO | Flow run 'radical-duck' - I belong to deployment None
15:04:49.267 | INFO | Flow run 'radical-duck' - Created task run 'my_task-0' for task 'my_task'
15:04:49.267 | INFO | Flow run 'radical-duck' - Executing 'my_task-0' immediately...
15:04:49.449 | INFO | Task run 'my_task-0' - My name is my_task-0
15:04:49.450 | INFO | Task run 'my_task-0' - Flow run parameters: {'x': 1}
15:04:49.585 | INFO | Task run 'my_task-0' - Finished in state Completed()
```





State change hooks



State change hooks

Execute code in response to flow run or task run state changes

```
from prefect import flow

def my_success_hook(flow, flow_run, state):
    print(f"Flow run {flow_run.id} succeeded!")

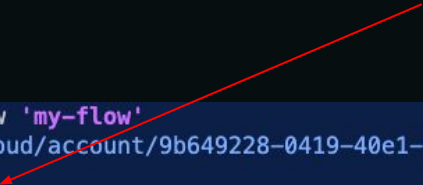
@flow(on_completion=[my_success_hook])
def my_flow():
    return 42

if __name__ == "__main__":
    my_flow()
```



State change hooks

```
15:12:49.063 | INFO | prefect.engine - Created flow run 'opal-marmot' for flow 'my-flow'
15:12:49.064 | INFO | Flow run 'opal-marmot' - View at https://app.prefect.cloud/account/9b649228-0419-40e1-9e0d-44954b5
66c9e4c4/flow-runs/flow-run/c914257b-d5a3-4e7e-a4a7-324d5f2a2851
15:12:49.807 | INFO | Flow run 'opal-marmot' - Running hook 'my_success_hook' in response to entering state 'Completed'
Flow run succeeded!
c914257b-d5a3-4e7e-a4a7-324d5f2a2851
<class 'prefect.client.schemas.objects.FlowRun'>
15:12:49.817 | INFO | Flow run 'opal-marmot' - Hook 'my_success_hook' finished running successfully
15:12:49.817 | INFO | Flow run 'opal-marmot' - Finished in state Completed()
```



State change hooks

Type	Flow	Task	Description
<code>on_completion</code>	✓	✓	Executes when a flow or task run enters a <code>Completed</code> state.
<code>on_failure</code>	✓	✓	Executes when a flow or task run enters a <code>Failed</code> state.
<code>on_cancellation</code>	✓	-	Executes when a flow run enters a <code>Cancelling</code> state.
<code>on_crashed</code>	✓	-	Executes when a flow run enters a <code>Crashed</code> state.



105 Recap


You've seen how to:

- Create an interactive workflow that pauses a flow run for input from a user
- Use a metric trigger in an automation
- Get current info into a flow with *prefect_runtime*
- Use a state change hook





Lab 105




105 Lab

- Create an interactive workflow that pauses a flow run for input from a user.
- Print the flow run name in your code with *`prefect_runtime`*
- Use a state change hook to run code when a flow run state is reached.
- Stretch1: Use a metric trigger in an automation.
- Stretch2: Check out the send and receive input examples in the course repo for the module



Lab 105: a solution

One person from each group, share your code in
Slack 

Discuss

Questions?



If you give an engineer a job...

Could you just fetch this data and save it? Oh, and ...

1. set up logging?
2. do it every hour?
3. visualize the dependencies?
4. automatically retry if it fails?
5. create an artifact for human viewing?
6. add caching?
7. add collaborators to run and view - who don't code?
8. send me a message when it succeeds?
9. run it in a Docker container-based environment?
10. pause for input?
11. automatically declare an incident when a % of workflows fail?
12. automatically run a workflow in response to an event?



106 - Workflow patterns & event-based workflows

106 Agenda

Workflow patterns with

- subflows
- *run_deployment*
- automations

Automation triggers

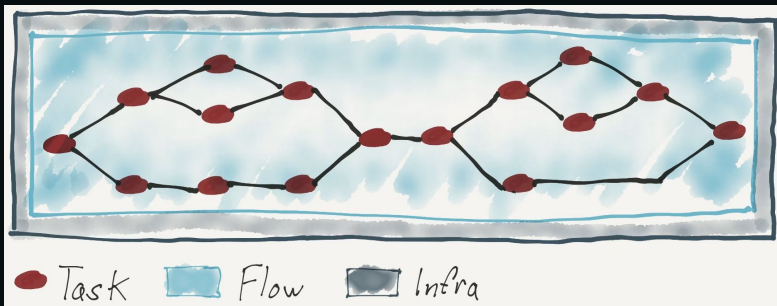
- custom events
- webhooks
- deployment triggers



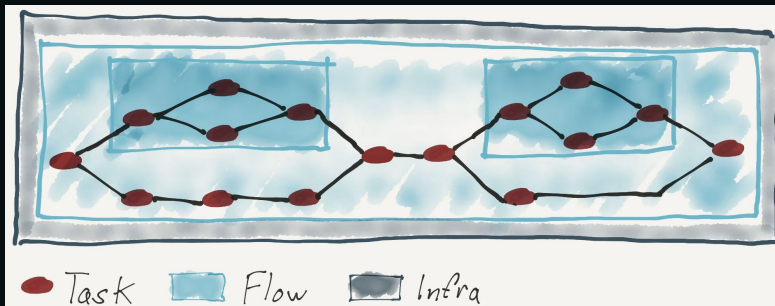


Workflow patterns

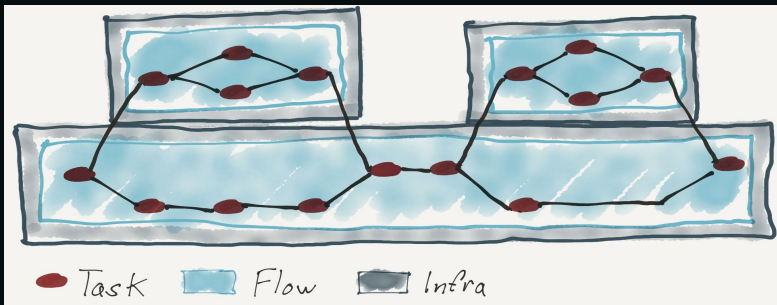
Workflow patterns - prefect.io/blog/workflow-design-patterns



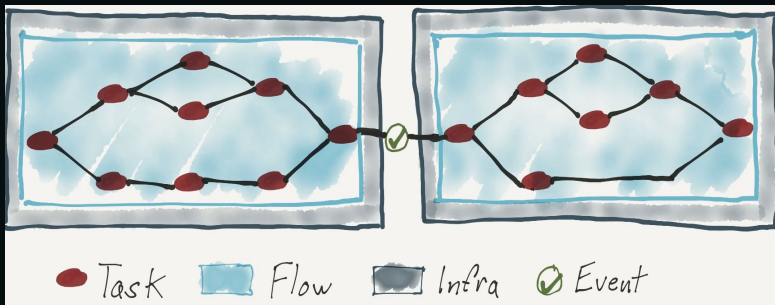
Monoflow



Flow of subflows

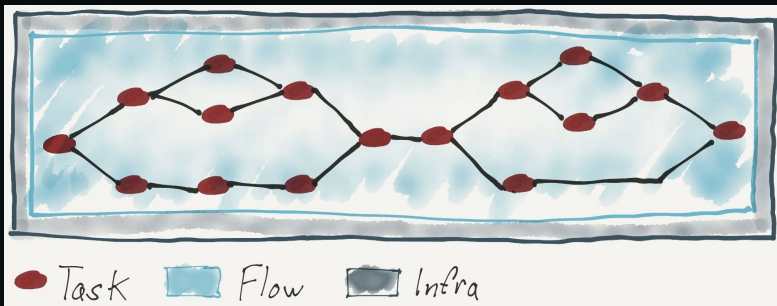


Flow of deployments

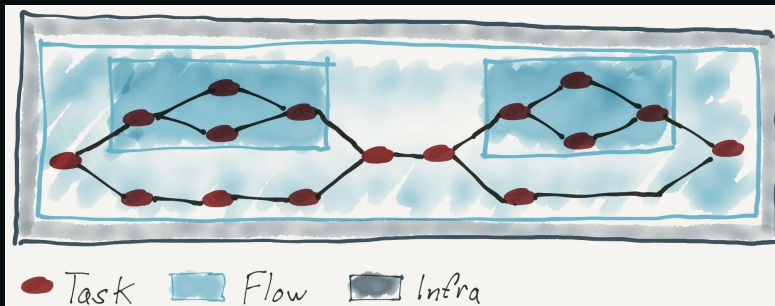


Event triggered flow

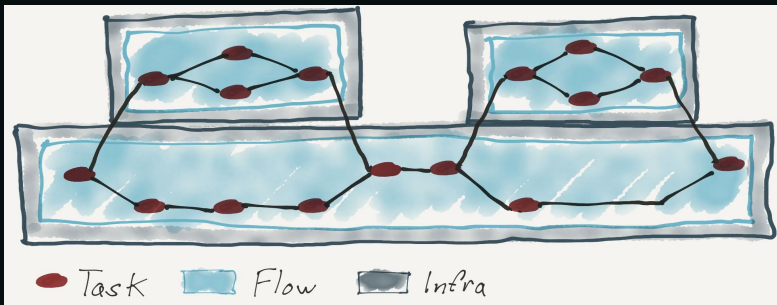
You have seen **this pattern**



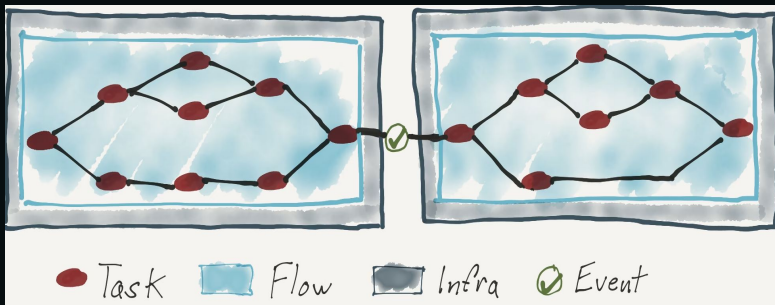
Monoflow



Flow of subflows



Flow of deployments



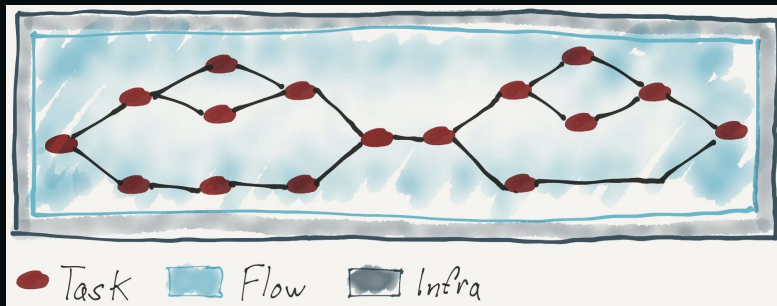
Event triggered flow



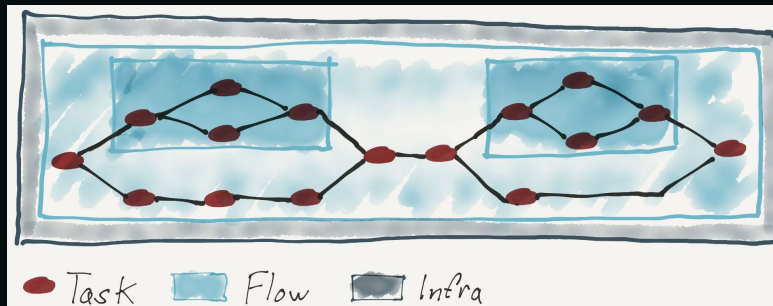


Subflows

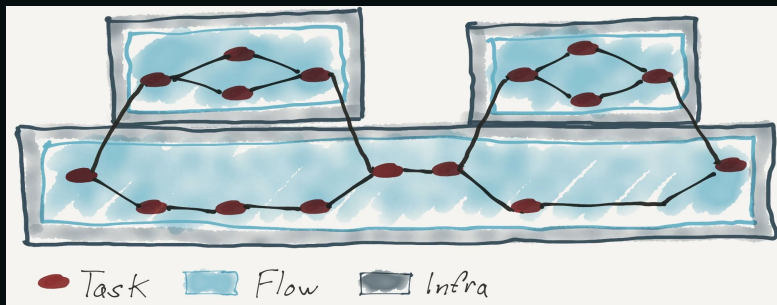
Workflow patterns - Flow of subflows



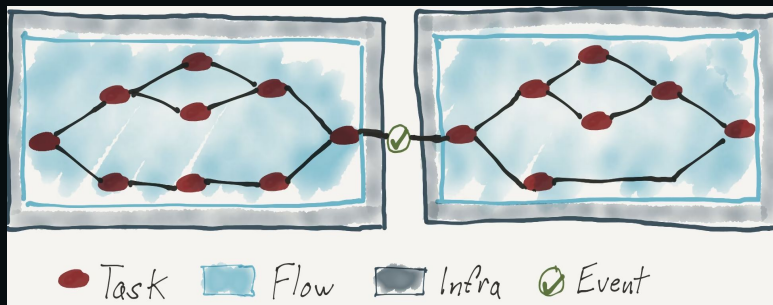
Monoflow



Flow of subflows



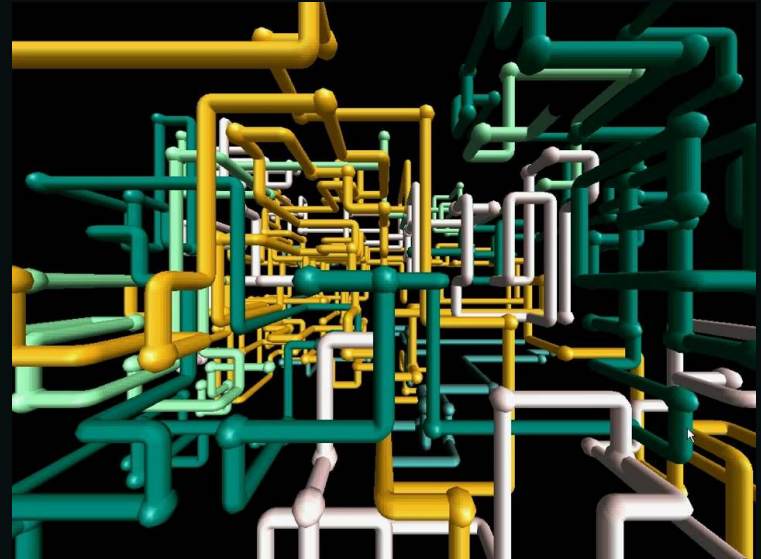
Flow of deployments



Event triggered flow

Subflow

- A flow that calls another flow
- Useful for grouping related tasks



Subflows

```
import httpx
from prefect import flow

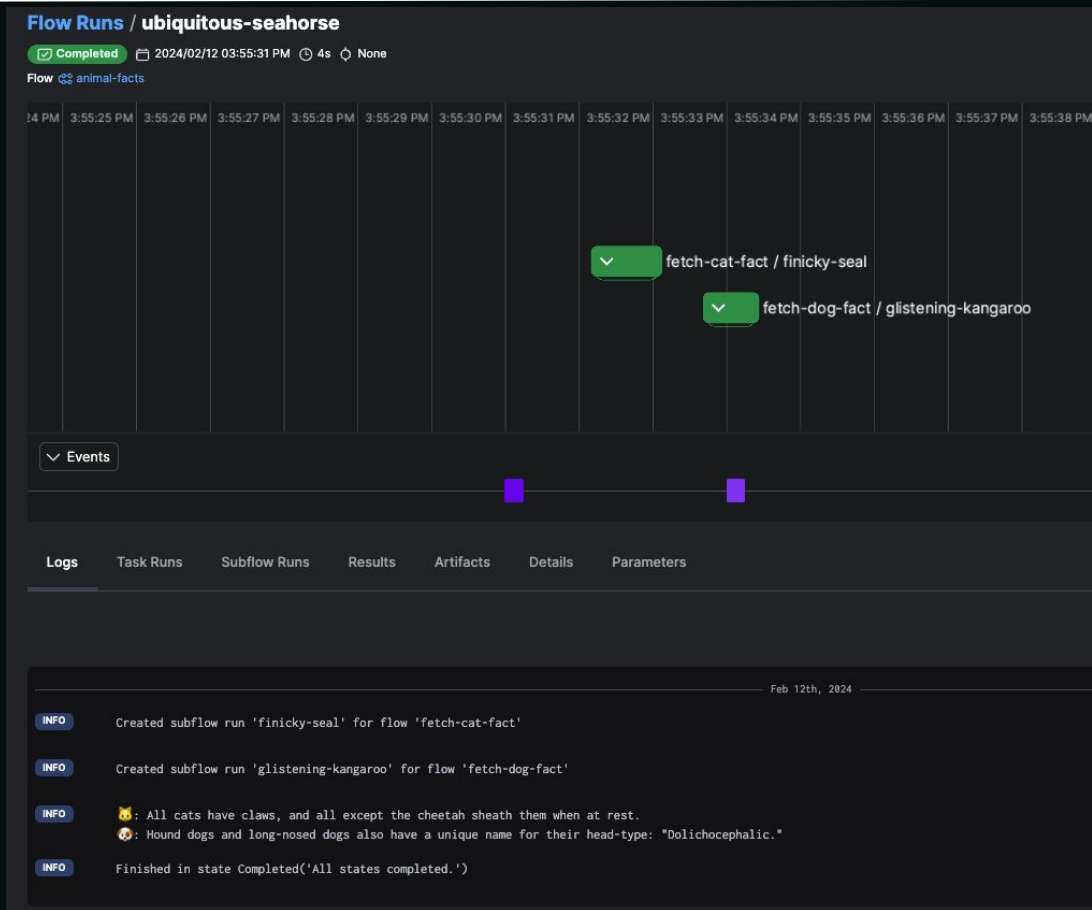
@flow
def fetch_cat_fact():
    return httpx.get("https://catfact.ninja/fact?max_length=140").json()["fact"]

@flow
def fetch_dog_fact():
    return httpx.get(
        "https://dogapi.dog/api/v2/facts",
        headers={"accept": "application/json"},
    ).json()["data"][0]["attributes"]["body"]

@flow(log_prints=True)
def animal_facts():
    cat_fact = fetch_cat_fact()
    dog_fact = fetch_dog_fact()
    print(f"🐱: {cat_fact} \n🐶: {dog_fact}")

if __name__ == "__main__":
    animal_facts()
```

Timeline view

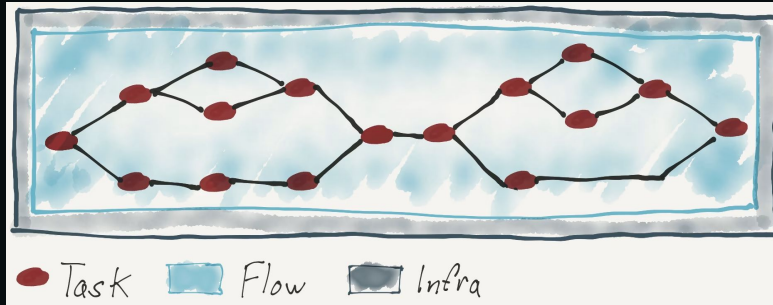




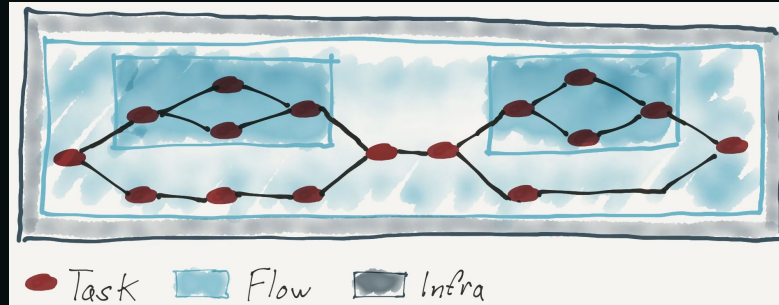
run_deployment



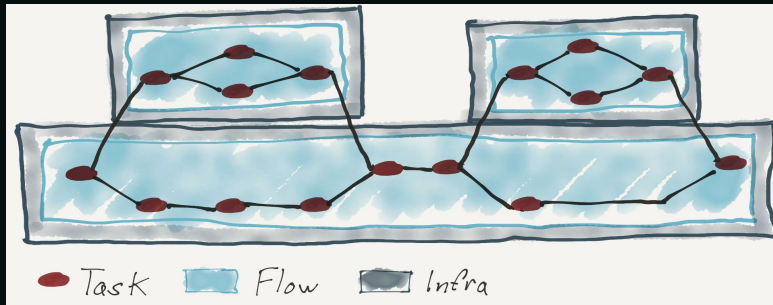
Workflow patterns - Flow of deployments (*run_deployment*)



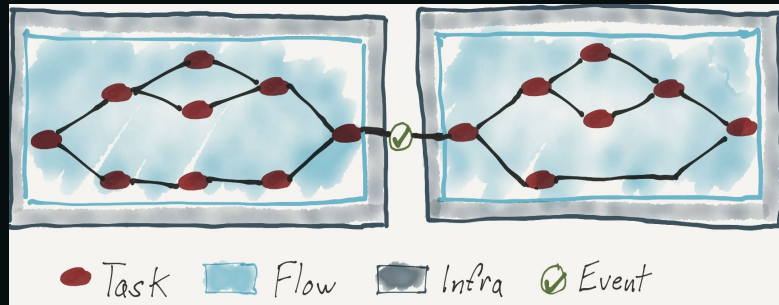
Monoflow



Flow of subflows



Flow of deployments



Event triggered flow

run_deployment

`run_deployment` `async` 

Create a flow run for a deployment and return it after completion or a timeout.

This function will return when the created flow run enters any terminal state or the timeout is reached. If the timeout is reached and the flow run has not reached a terminal state, it will still be returned. When using a timeout, we suggest checking the state of the flow run if completion is important moving forward.

Parameters:

Name	Type	Description	Default
<code>name</code>	<code>Union[str, UUID]</code>	The deployment id or deployment name in the form: <code><slugified-flow-name>/<slugified-deployment-name></code>	<i>required</i>
<code>parameters</code>	<code>Optional[dict]</code>	Parameter overrides for this flow run. Merged with the deployment defaults.	<code>None</code>



run_deployment

```
from prefect.deployments import run_deployment

run_deployment(
    name="pipeline/my-first-managed-deployment", parameters={"lat": 1, "lon": 2}
)
```



run_deployment

```
INFO      Opening process...                                04:52:08 PM
                                                    prefect.flow_runs.runner

INFO      Created task run 'fetch_weather-0' for task 'fetch_weather' 04:52:15 PM
                                                    prefect.flow_runs

INFO      Executing 'fetch_weather-0' immediately...                04:52:15 PM
                                                    prefect.flow_runs

INFO      Finished in state Completed()                             04:52:16 PM
                                                    fetch_weather-0
                                                    prefect.task_runs

INFO      Created task run 'save_weather-0' for task 'save_weather'    04:52:16 PM
                                                    prefect.flow_runs

INFO      Executing 'save_weather-0' immediately...                04:52:16 PM
                                                    prefect.flow_runs

INFO      Finished in state Completed()                             04:52:17 PM
                                                    save_weather-0
                                                    prefect.task_runs

INFO      Finished in state Completed()                             04:52:17 PM
                                                    prefect.flow_runs

INFO      Process for flow run 'sparkling-earthworm' exited cleanly. 04:52:20 PM
                                                    prefect.flow_runs.runner
```

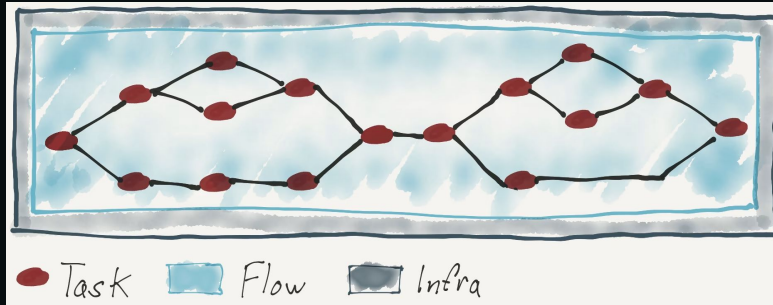




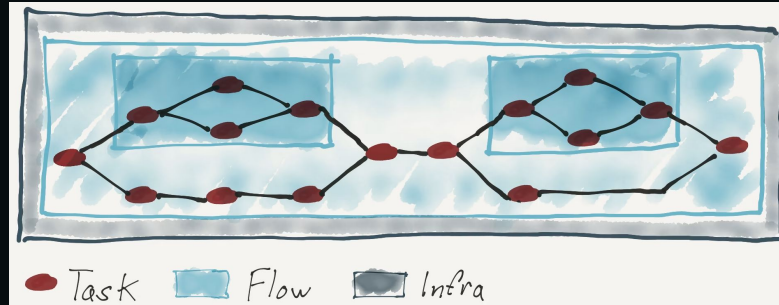
Event-triggered workflows



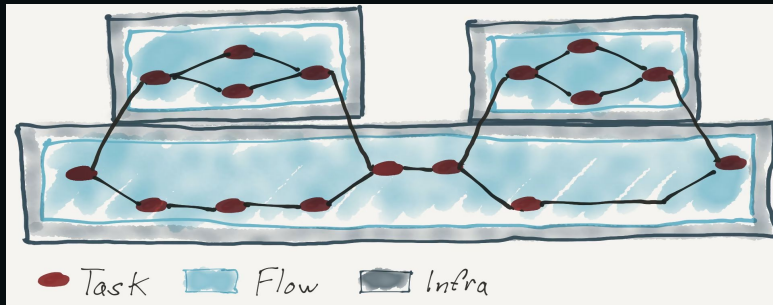
Workflow patterns - Event-triggered



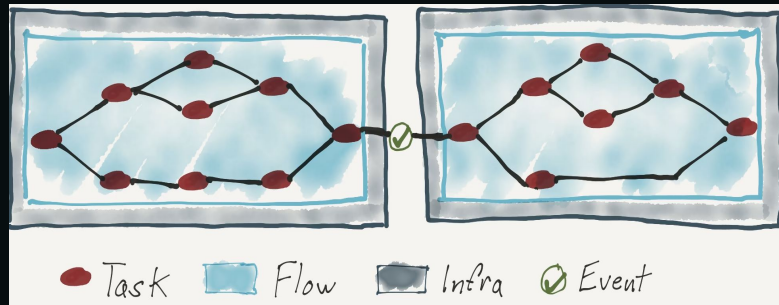
Monoflow





Flow of subflows




Flow of deployments



Event-triggered flow



Custom events in Python



Custom events

Great when working in Python land and want to get data into an automation 🐍



Create custom event to be emitted when code runs

emit_event must provide two args: *event* and

resource= {"prefect.resource.id": val}"}

```
from prefect.events import emit_event

def emit_name_event(name: str = "kiki"):
    """Emit a basic Prefect event with a dynamically populated name"""
    print(f"Hi {name}!")
    emit_event(
        event=f"{name}.sent.event!",
        resource={"prefect.resource.id": f"developer.{name}"},
        payload={"name": name},
    )

if __name__ == "__main__":
    emit_name_event()
```



Run code and head to the **Event Feed** page

12:43:37 PM
Mar 1st, 2024

Kiki sent event!
kiki.sent.event!

Resource
developer.kiki

Click link to see event page

Workspace Events / Kiki sent event!

Details

Raw

Event

kiki.sent.event!

Occurred

2024/03/01 12:43:37 PM

Resource

developer.kiki

Related Resources

None



See event details on the **Raw** tab

Workspace Events / Kiki sent event!

Details **Raw**

```
{
  "id": "e7daff3e-5ed7-4a29-ba5f-fc9965772ce9",
  "account": "9b649228-0419-40e1-9e0d-44954b5c0ab6",
  "event": "kiki.sent.event!",
  "occurred": "2024-03-01T17:43:37.151Z",
  "payload": {
    "name": "kiki"
  },
  "received": "2024-03-01T17:43:37.415Z",
  "related": [],
  "resource": {
    "prefect.resource.id": "developer.kiki"
  },
  "workspace": "d137367a-5055-44ff-b91c-6f7366c9e4c4"
}
```



Data from event can be used in an automation action

For example: Populate a flow param via a Run Deployment action

Use *emit_event*'s *payload* parameter



Example: custom event with detailed payload

```
from prefect.events import emit_event
```

```
emit_event(  
    event=f"bot.{bot.name.lower()}.responded",  
    resource={"prefect.resource.id": f"bot.{bot.name.lower()}"},  
    payload={  
        "user": event.user,  
        "channel": event.channel,  
        "thread_ts": thread,  
        "text": text,  
        "response": response.content,  
        "prompt_tokens": prompt_tokens,  
        "response_tokens": response_tokens,  
        "total_tokens": prompt_tokens + response_tokens,  
    },  
)
```



Event webhooks



Event webhooks

- expose a URL endpoint
- provides consistent interface for integrating external applications with Prefect
- when webhook URL is pinged, creates a Prefect event - can be used as a trigger in an automation
- great when **not** in Python land



Event webhooks

Add Event Webhook

Name

Description

Your template should produce valid json with an event name and resource id. You can use jinja to include dynamic values.

Docs

Template presets

Static

Dynamic

CloudEvent

Template

```
{
  "event": "{{body.event_name}}",
  "resource": {
    "prefect.resource.id": "product.models.{{ body.m
    "prefect.resource.name": "{{ body.friendly_name
    "producing-team": "Data Science"
  }
}
```

Cancel

Create



Event webhooks

- use Jinja2 for dynamic templating
- template should be valid JSON
- create from UI or CLI



Event webhooks

Hit the endpoint provided by Prefect:

```
curl https://api.prefect.cloud/hooks/your_slug_here
```



Event webhooks

See the event that is created under **Event Feed** in the UI

10:24:54 PM

Jun 19th, 2023

Demo event

demo.event

Resource

demo.alert.2

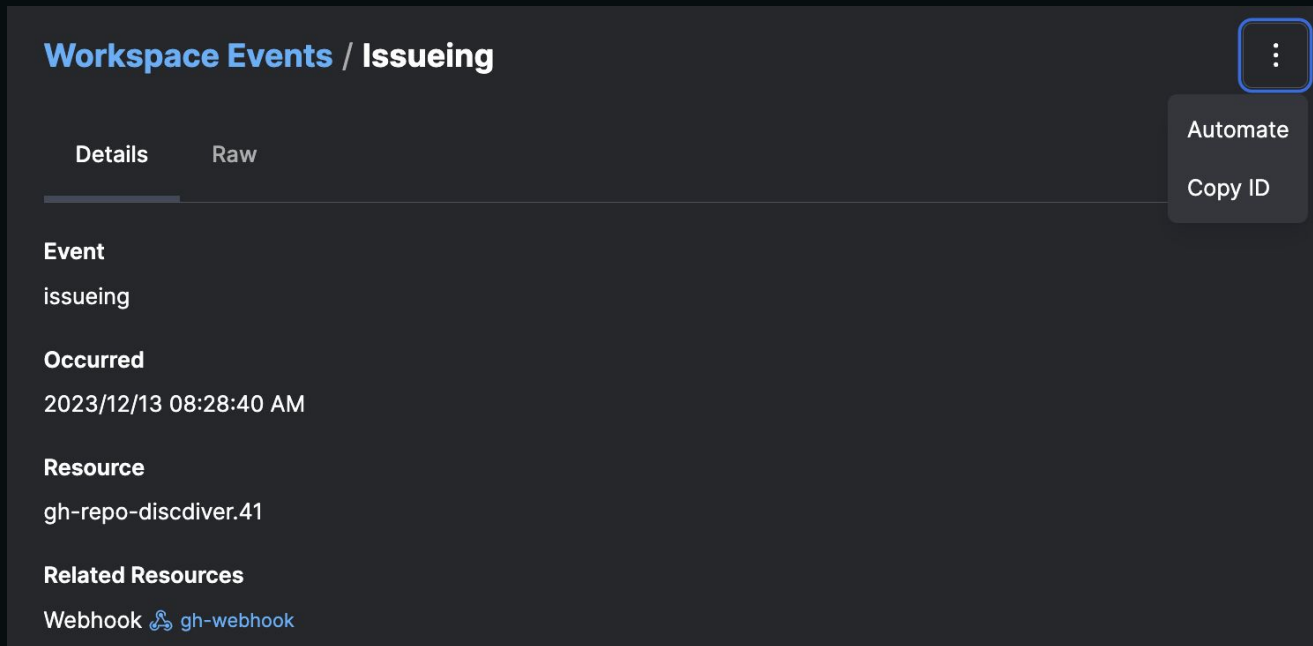
Related Resources

prefect-cloud.webhook.791b2034-892f-41eb-81a3-dc9dfbff133c



Event webhooks

⚡ Use this event as a custom trigger in an automation!



The screenshot displays the 'Workspace Events / Issueing' interface. At the top, there are tabs for 'Details' and 'Raw'. Below the tabs, the event details are listed: 'Event' is 'issuing', 'Occurred' is '2023/12/13 08:28:40 AM', and 'Resource' is 'gh-repo-discdiver.41'. Under 'Related Resources', there is a 'Webhook' link pointing to 'gh-webhook'. On the right side, there is a vertical menu with a blue square button containing three vertical dots. A red arrow points to this button, which has opened a dropdown menu with two options: 'Automate' and 'Copy ID'.

Workspace Events / Issueing

Details Raw

Event
issuing

Occurred
2023/12/13 08:28:40 AM

Resource
gh-repo-discdiver.41

Related Resources
Webhook [gh-webhook](#)

Automate
Copy ID





Composite triggers

Composite trigger types

Compound trigger

- Event B
- Event A
- Event C

Sequential trigger

1. Event A
2. Event B
3. Event C

Composite triggers

An automation trigger made of more than one event

Compound: any order

Sequential: must occur in prescribed order

Optional: set a time period for them to fire



Composite triggers - example JSON

```
{
  "type": "compound",
  "require": "all",
  "within": 3600,
  "triggers": [
    {
      "type": "event",
      "posture": "Reactive",
      "expect": ["prefect.block.remote-file-system.write_path.called"],
      "match_related": {
        "prefect.resource.name": "daily-customer-export",
        "prefect.resource.role": "flow"
      }
    },
    {
      "type": "event",
      "posture": "Reactive",
      "expect": ["prefect.block.remote-file-system.write_path.called"],
      "match_related": {
        "prefect.resource.name": "daily-revenue-export",
        "prefect.resource.role": "flow"
      }
    }
  ]
}
```





Deployment triggers



Deployment triggers

Alternative approach for creating an automation:

- define an automation in code
- specify the trigger condition in a *DeploymentTrigger* object and pass to *.deploy()*
- creates the automation when the deployment is created



Deployment triggers - the flow to be triggered

```
from prefect import flow
from prefect.events.schemas import DeploymentTrigger

@flow(log_prints=True)
def downstream_flow(ticker: str = "AAPL") -> str:
    print(f"got {ticker}")
```



Deployment triggers - the trigger

Create a *DeploymentTrigger* object

```
downstream_deployment_trigger = DeploymentTrigger(  
    name="Upstream Flow - Pipeline",  
    enabled=True,  
    match_related={  
        "prefect.resource.id": "prefect.flow.5c933ae4-dd43-4705-90eb-cfdeb4c028fb"  
    },  
    expect={"prefect.flow-run.Completed"},  
)
```

See the event specification docs:

docs.prefect.io/cloud/events/#event-specification



Deployment triggers - create

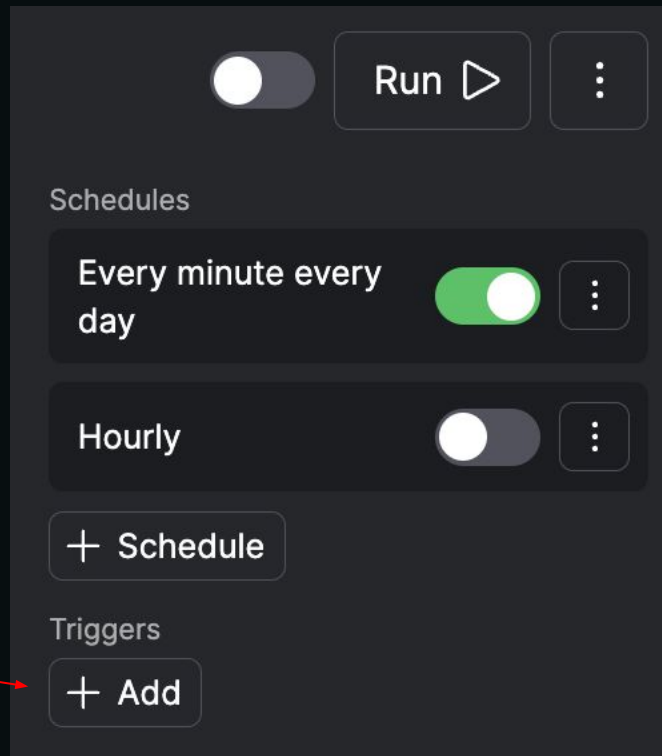
Pass the trigger object to *.deploy* and run the script

```
if __name__ == "__main__":
    downstream_flow.from_source(
        source="https://github.com/discdiver/pacc-2024.git",
        entrypoint="106/deployment-trigger.py:downstream_flow",
    ).deploy(
        name="ticker-deploy",
        work_pool_name="managed1",
        triggers=[downstream_deployment_trigger],
    )
```



Another way to begin automation creation in the UI:

- start from a deployment page
- click the **+ Add** button under **Triggers**
- pre-populates the automation action with the deployment run



Specifying an automation trigger

To create a custom trigger check out an event in the UI (**Raw** tab)

You can copy/paste and adjust in the trigger JSON.

See the Events docs.

Workspace Events / Automation created

Details Raw

```
{
  "id": "a17bae41-71fd-4ca1-9f10-3d7ea2aea54e",
  "account": "9b649228-0419-40e1-9e0d-44954b5c0ab6",
  "event": "prefect-cloud.automation.created",
  "occurred": "2024-02-13T19:47:25.680Z",
  "payload": {
    "name": "Upstream Flow - Sell",
    "description": "",
    "enabled": true,
    "trigger": {
      "match": {},
      "match_related": {
        "prefect.resource.id": "prefect.flow.5c933ae4-dd43-4705-90eb-cfdeb4c028fb"
      },
      "after": [],
      "expect": [
        "prefect.flow-run.Completed"
      ],
      "for_each": [],
      "posture": "Reactive",
      "threshold": 1,
      "within": 0,
      "metric": null
    }
  }
},
```



106 Recap

You've seen how to use several workflow patterns with

- subflows
- *run_deployment*
- automations
 - custom events defined in Python
 - webhooks
 - trigger defined in code at deployment creation



106 Lab

- Create a deployment that uses a subflow
- Create a second deployment that uses *run_deployment*
- Stretch: Create a webhook and an automation that runs a deployment when that webhook fires
- Stretch: Create a custom event in Python that triggers a notification action in an automation
- Super-stretch: Create a deployment that contains a trigger defined in Python code



If you give an engineer a job...

Could you just fetch this data and save it? Oh, and ...

1. set up logging?
2. do it every hour?
3. visualize the dependencies?
4. automatically retry if it fails?
5. create an artifact for human viewing?
6. add caching?
7. add collaborators to run and view - who don't code?
8. send me a message when it succeeds?
9. run it in a Docker container-based environment?
10. pause for input?
11. automatically declare an incident when a % of workflows fail?
12. automatically run a workflow in response to an event?





Wrap



Brief feedback survey

Please let us know what went well and what could be improved. 🎉



Congratulations!!!



PREFECT ASSOCIATE
CERTIFICATION

Bonus content

Bonus content

- Prefect variables
- Task runners & async code
- Prefect REST API
- Turn shell commands into flows
- Testing
- Upload data to AWS S3
- Self hosted server instance
- Prefect profiles
- Deploy multiple flows
- Guided deployment creation with *prefect deploy*
- Deployments with *prefect.yaml*
- CI/CD with GitHub Actions
- Helm chart
- Terraform provider





Variables



Prefect variables

- String values evaluated at runtime
- Store and reuse non-sensitive, small data
- Create via UI or CLI



Prefect variables

Only string values

New variable

×

Name

my_variable

Value

3.14159

Tags

Cancel

Create



Prefect variables

Flow Runs

Flows

Deployments

Work Pools

Blocks

(x) Variables

Notifications

Task Run Concurrency

Variables +

3 Variables


Search variables

A to Z ▾



Filter by tags

<input type="checkbox"/>	Name	Value	Updated	Tags
<input type="checkbox"/>	age	twenty-two	2023/04/13 03:36:53 PM	⋮
<input type="checkbox"/>	height	72	2023/04/13 04:00:32 PM	⋮
<input type="checkbox"/>	url	abc123.com	2023/04/13 04:01:15 PM	⋮





Task runners for concurrency



Concurrency

- Helpful when waiting for external systems to respond
- Allows other work to be done while waiting
- Prefect's *ConcurrentTaskRunner* replaces need for using Python's *async*, *await*, etc.





Concurrency & Parallelism: via task runners



Concurrency & Parallelism

- **Concurrency:** single-threaded, interleaving, GIL locked
- **Parallelism:** multiple events run at the same time

Your Prefect code runs **sequentially** by default





Concurrency



Concurrency

- Helpful when waiting for external systems to respond (IO / network-bound work)
- Prefect's *ConcurrentTaskRunner* allows you to concurrently execute code without *async* syntax



Concurrency

```
from prefect import flow, task
from prefect.task_runners import ConcurrentTaskRunner

@task
def stop_at_floor(floor):
    print(f"elevator moving to floor {floor}")
    print(f"elevator stops on floor {floor}")

@flow(task_runner=ConcurrentTaskRunner())
def elevator():
    for floor in range(3, 0, -1):
        stop_at_floor.submit(floor)

elevator()
```



Concurrency

```
elevator moving to floor 3  
elevator stops on floor 3  
elevator moving to floor 1  
elevator stops on floor 1  
elevator moving to floor 2  
elevator stops on floor 2
```




Task Runners

- Specify in *flow* decorator
- *ConcurrentTaskRunner* is ready by default
- Use *.submit()* when call a task to return a *PrefectFuture* instead of direct result





Task runners for true parallelism



Parallelism

- Two or more operations happening at the same time on one or more machines
- Helpful when operations limited by CPU
- Many machine learning algorithms parallelizable



Task Runners for parallelism

- DaskTaskRunner
- RayTaskRunner

Both require an integration package:

- *prefect-dask*
- *prefect-ray* packages



DaskTaskRunner for parallelism

```
from prefect import flow, task
from prefect_dask.task_runners import DaskTaskRunner

@task
def say_hello(name):
    print(f"hello {name}")

@task
def say_goodbye(name):
    print(f"goodbye {name}")

@flow(task_runner=DaskTaskRunner())
def greetings(names):
    for name in names:
        say_hello.submit(name)
        say_goodbye.submit(name)

if __name__ == "__main__":
    greetings(["arthur", "trillian", "ford", "marvin"])
```



DaskTaskRunner for parallelism

- Can see the Dask UI if have *bokeh* package installed: *pip install bokeh*
- UI will be linked in the terminal at run time





Prefect REST API



If you want to talk to the API without Python

Cloud and server REST API interactive docs:

docs.prefect.io/latest/api-ref/rest-api

curl or use an HTTP client (*httpx*, *requests*)



PrefectClient to interact with the REST API

Or use the built-in *PrefectClient* for convenience

```
from prefect import get_client

async with get_client() as client:
    response = await client.hello()
    print(response.json()) # 🙌
```

docs.prefect.io/guides/using-the-client





Common methods

- *create_flow_run_from_deployment*
- *read_flow_run / read_flow_runs*
- *update_deployment*
- *delete_flow_run*

github.com/PrefectHQ/prefect/blob/main/src/prefect/client/orchestration.py





Turn shell commands into flows



prefect shell

Turn a shell command into a flow:

prefect shell watch "curl <http://wttr.in/Chicago?format=3>"

```
09:38:01.587 | INFO      | prefect.engine - Created flow run 'outrageous-octopus' for flow 'Shell Command'
09:38:01.588 | INFO      | prefect.engine - Flow run 'outrageous-octopus' - View at https://app.prefect.cloud/account/55c7f5e5-2da9-426c-8123-2948d5e5d94b/workspace/0c527f43-4688-4a1c-bc65-4856ea3a52a5/flow-runs/flow-run/978ca87e-6670-4a56-ad3b-2065d1ac8994
09:38:02.431 | INFO      | prefect.engine - Flow run 'outrageous-octopus' - Chicago: 🌤️ +47°F
09:38:03.018 | INFO      | prefect.engine - Flow run 'outrageous-octopus' - Finished in state Completed()
```

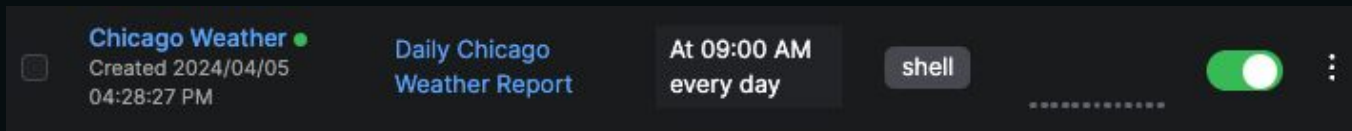
No Python required!



prefect shell serve

Or create a long running serve process and deploy shell commands with *prefect shell serve*

```
prefect shell serve "curl http://wttr.in/Chicago?format=3" --flow-name "Daily Chicago Weather Report" --cron-schedule "0 9 * * *" --deployment-name "Chicago Weather"
```



This deployment runs on a schedule and can be run manually!





Testing

Testing

- Context manager for unit tests provided
- Run flows against temporary local SQLite db

```
from prefect import flow
from prefect.testing.utilities import prefect_test_harness

@flow
def my_favorite_flow():
    return 42

def test_my_favorite_flow():
    """basic test running the flow against a temporary testing database"""
    with prefect_test_harness():
        assert my_favorite_flow() == 42
```




Testing

- Use in a Pytest fixture


```
from prefect import flow
import pytest
from prefect.testing.utilities import prefect_test_harness

@pytest.fixture(autouse=True, scope="session")
def prefect_test_fixture():
    with prefect_test_harness():
        yield
```





Upload data to AWS S3



Steps

1. Install prefect-aws
2. Register new blocks
3. Create S3 bucket
4. Create S3Bucket block from UI or CLI
5. Use in a flow



Install prefect-aws

```
pip install -U prefect-aws
```



Register new blocks

prefect blocks register -m prefect_aws

Successfully registered 5 blocks

Registered Blocks
AWS Credentials
AWS Secret
ECS Task
MinIO Credentials
S3 Bucket




See block types & blocks from CLI

prefect block type ls

prefect block ls



Make an *S3Bucket* block

 ***S3Bucket* block from prefect-aws != S3 block that ships with Prefect**

- Both block types upload and download data
- *S3Bucket* block has many methods
- We are showing how to use *S3Bucket* block



Create S3 Bucket

Amazon S3 > Buckets > Create bucket

Create bucket [Info](#)

Buckets are containers for data stored in S3. [Learn more](#) 

General configuration

Bucket name

Bucket name must be globally unique and must not contain spaces or uppercase letters. [See rules for bucket naming](#) 

AWS Region

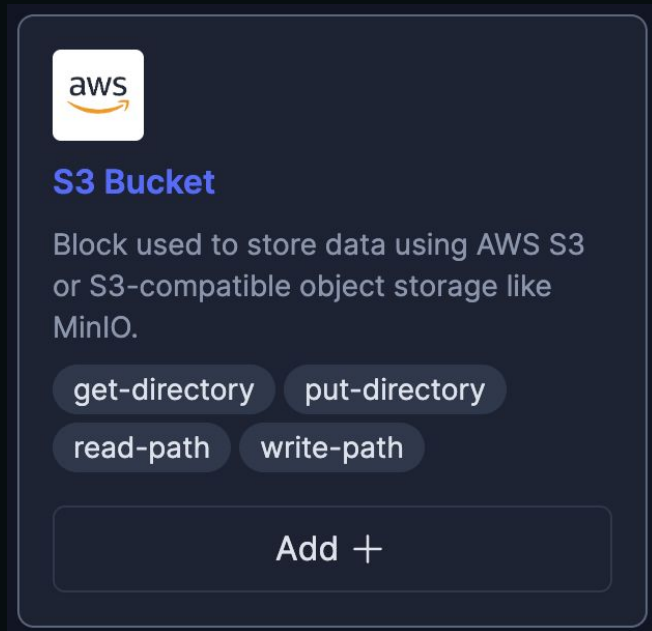
Copy settings from existing bucket - *optional*

Only the bucket settings in the following configuration are copied.

Choose bucket



Create S3Bucket block from UI



Create S3Bucket block from UI

Blocks / Choose a Block / S3 Bucket / Create

Block Name

Bucket Name

Name of your bucket.

Credentials

AwsCredentials

MinIOCredentials

A block containing your credentials to AWS or MinIO.

AwsCredentials (Optional)

Block used to manage authentication with AWS. AWS authentication is handled via the `boto3` module. Refer to the [boto3 docs](#) for more info about the possible credential configurations.

aws

Add +

Bucket Folder (Optional)

A default path to a folder within the S3 bucket to use for reading and writing objects.

aws

S3 Bucket

Block used to store data using AWS S3 or S3-compatible object storage like MinIO.

get-directory

put-directory

read-path

write-path

Cancel

Create

175

The Docker logo, which is a stylized white 'D' inside a dark blue square.

AWS Credentials block from UI

Use the nested AWS Credentials block as needed

Blocks / Choose a Block / AWS Credentials / Create

Block Name

Region Name (Optional)

The AWS Region where you want to create new connections.

Profile Name (Optional)

The profile to use when creating your session.

AWS Access Key ID (Optional)

A specific AWS access key ID.



AWS Credentials

Block used to manage authentication with AWS. AWS authentication is handled via the `'boto3'` module. Refer to the [boto3 docs]...



AWS Credentials block from UI

Leave most fields blank.

Probably use *AWS Access Key ID* & *AWS Access Key Secret*.

AWS Access Key Secret (Optional)

A specific AWS secret access key.

Cancel

Create



Or create blocks with Python code

```
from time import sleep
from prefect_aws import S3Bucket, AwsCredentials

def create_aws_creds_block():
    # environment variables can be helpful for creating credentials blocks
    # do not store credential values in public locations (e.g. GitHub public repo)
    my_aws_creds_obj = AwsCredentials(
        aws_access_key_id="123abc",
        aws_secret_access_key="ab123",
    )
    my_aws_creds_obj.save(name="my-aws-creds-block", overwrite=True)

def create_s3_bucket_block():
    aws_creds = AwsCredentials.load("my-aws-creds-block")
    my_s3_bucket_obj = S3Bucket(
        bucket_name="my-first-bucket-abc", credentials=aws_creds
    )
    my_s3_bucket_obj.save(name="s3-bucket-block", overwrite=True)

if __name__ == "__main__":
    create_aws_creds_block()
    sleep(5) # ensure server has time to create credentials block before loading
    create_s3_bucket_block()
```




View block in the UI

Blocks / my-aws-creds-block

May 3rd, 2023
12:00 AM

May 3rd, 2023
11:59 PM

Block document  my-aws-creds-block 2 events

Paste this snippet into your flows to use this block. Need help? [View Docs](#)

```
from prefect_aws import AwsCredentials

aws_credentials_block = AwsCredentials.load("my-aws-creds-block")
```

Region Name
None


Profile Name
None

AWS Access Key ID
123abc

AWS Session Token
None

AWS Client Parameters
{ "config": null, "verify": true, "use_ssl": true, "api_version": "", "endpoint_url": "", "verify_cert_path": "" }

AWS Access Key Secret

**AWS Credentials**

Block used to manage authentication with AWS. AWS authentication is handled via the `'boto3'` module. Refer to the [boto3 docs]...



Flow code loads S3 block and uploads data file

```
from pathlib import Path
from prefect import flow
from prefect_aws.s3 import S3Bucket

@flow()
def upload_to_s3(color: str, year: int, month: int) -> None:
    """The main flow function to upload taxi data"""
    path = Path(f"data/{color}/{year}/{color}_tripdata_{year}-{month:02}.parquet")
    s3_block = S3Bucket.load("s3-bucket-block")
    s3_block.upload_from_path(from_path=path, to_path=path)

if __name__ == "__main__":
    upload_to_s3(color="green", year=2020, month=1)
```


Use your flow code!

- Can test with *python my_script.py*
- Then create a deployment and run it! 🎉



See file in S3 bucket

Amazon S3 > Buckets > prefect-aws-demos > data/ > green/ > 2020/

2020/

Copy S3 URI

Objects | Properties

Objects (1)

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

Refresh

Copy S3 URI

Copy URL

Download

Open

Delete


Actions

Create folder

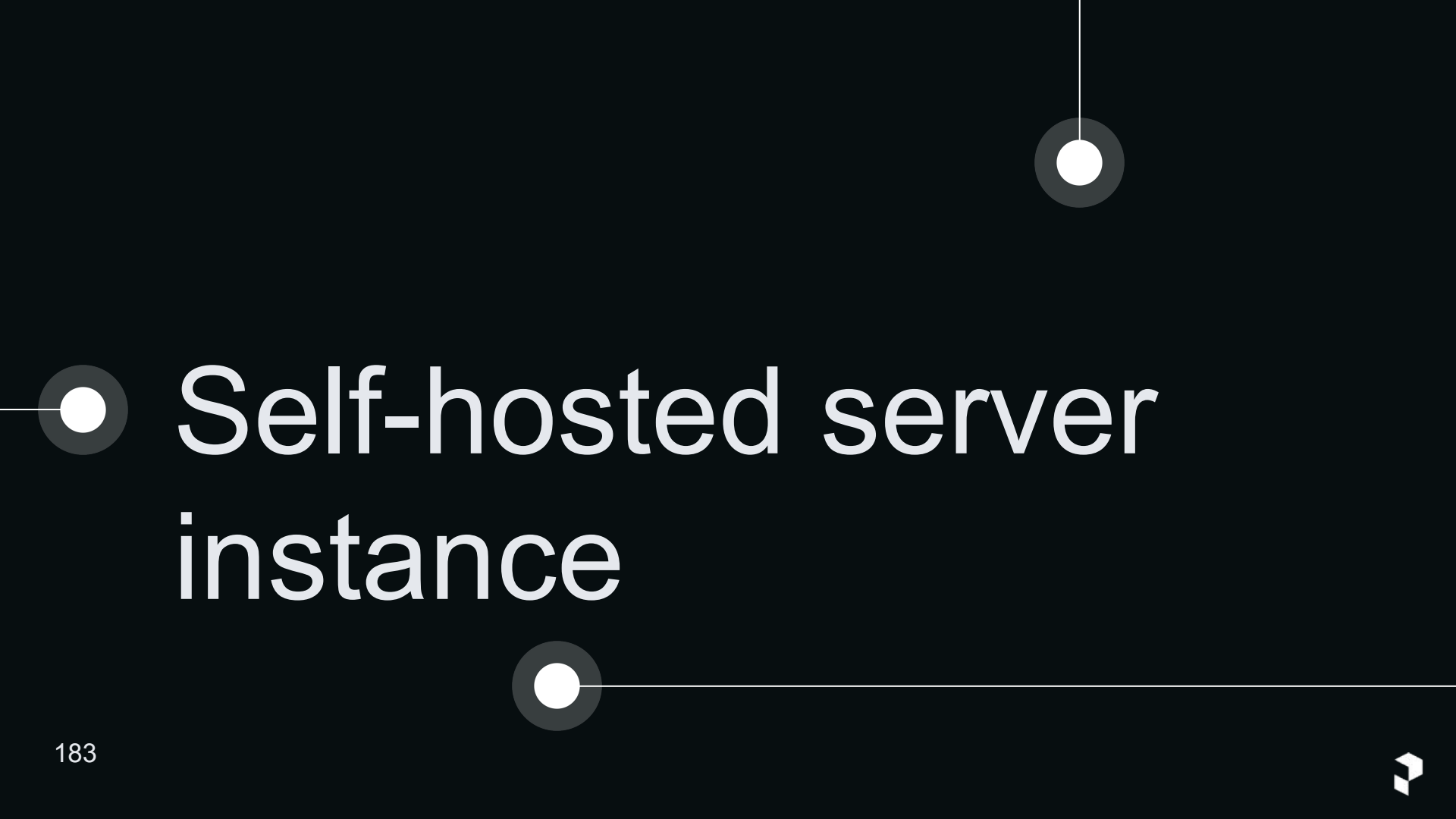
Upload

Find objects by prefix

< 1 > ⚙

<input type="checkbox"/>	Name ▲	Type ▼	Last modified ▼	Size ▼	Storage class ▼
<input type="checkbox"/>	 green_tripdata_2020-01.parquet	parquet	May 3, 2023, 17:31:04 (UTC-04:00)	6.9 MB	Standard

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Self-hosted server instance

Self-hosted server instance

Alternative to Prefect Cloud: host your own Prefect server instance

- Backed by SQLite db by default
- Or use PostgreSQL in production
- Similar UI
- No events, push work pools, email server, authentication, user management, error summaries, etc.



Self-hosted server instance

- Switch to a new profile
- Use an ephemeral API (default) or set the API endpoint (required if in a Docker container)



Self-hosted server instance

Start a server in another terminal with:

prefect server start



Configure Prefect to communicate with the server with:

```
prefect config set PREFECT_API_URL=http://127.0.0.1:4200/api
```

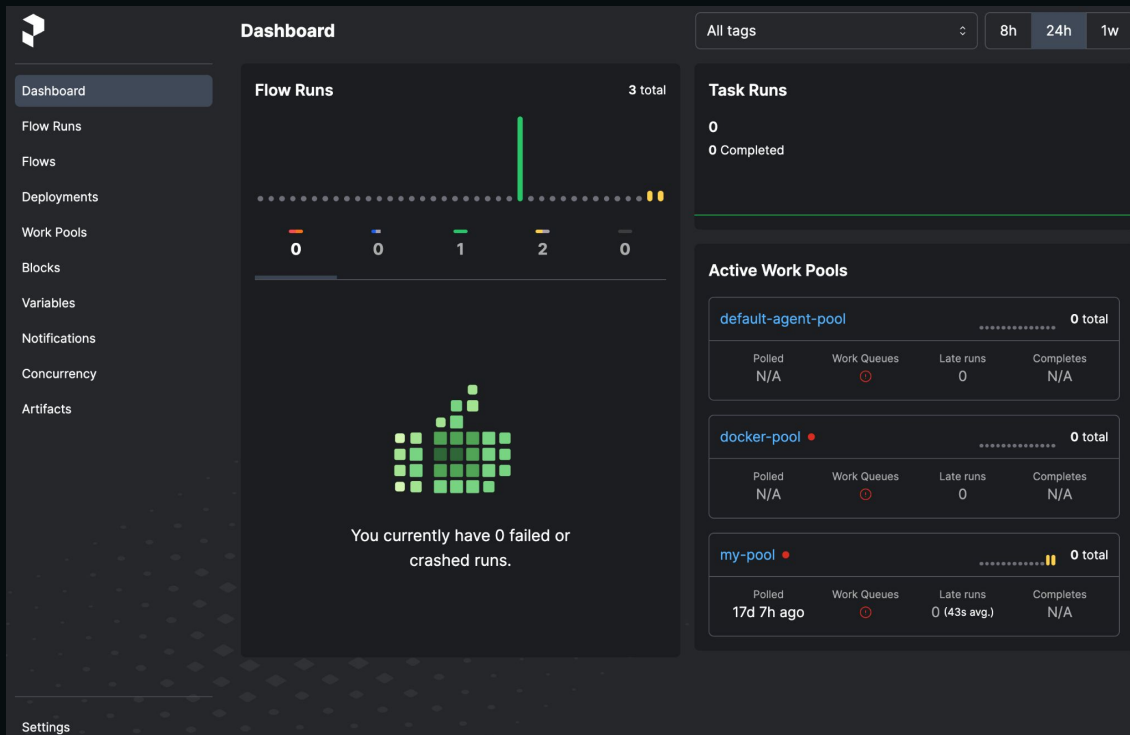
View the API reference documentation at <http://127.0.0.1:4200/docs>

Check out the dashboard at <http://127.0.0.1:4200>



Self-hosted server instance

Head to the UI at <http://127.0.0.1:4200>



Self-hosted server instance

Required when running Prefect inside a container:

PREFECT_API_URL="<http://127.0.0.1:4200/api>"

See Prefect Helm Chart if running on Kubernetes

github.com/PrefectHQ/prefect-helm





Prefect profiles



Prefect profiles

If you don't already have a profile with Prefect Cloud you want to use for this course, create a new profile

Create: *prefect profile create my_cloud_profile*



Prefect profiles

Inspect: *prefect profile inspect my_cloud_profile*

Select: *prefect profile use my_cloud_profile*





Deploy multiple flows with *serve*



Deploy multiple flows

```
import time
from prefect import flow, serve

@flow
def slow_flow(sleep: int = 60):
    "Sleepy flow - sleeps the provided amount of time (in seconds)."
    time.sleep(sleep)

@flow
def fast_flow():
    "Fastest flow this side of the Atlantic."
    return


if __name__ == "__main__":
    slow_deploy = slow_flow.to_deployment(name="sleeper-scheduling")
    fast_deploy = fast_flow.to_deployment(name="fast-scheduling")
    serve(slow_deploy, fast_deploy)
```






Deploy multiple flows

- import *serve*
- use *to_deployment()* method
- use *serve* function and pass it the deployment objects





Guided deployment creation



Deployments: ETL code

```
@task
def fetch_cat_fact():
    return httpx.get("https://catfact.ninja/fact?max_length=140").json()["fact"]

@task
def formatting(fact: str):
    return fact.title()

@task
def write_fact(fact: str):
    with open("fact.txt", "w+") as f:
        f.write(fact)
    return "Success!"
```



Deployments: ETL code

```
@flow
def pipe():
    fact = fetch_cat_fact()
    formatted_fact = formatting(fact)
    msg = write_fact(formatted_fact)
    print(msg)
```



Send deployment to server

From the **root of your repo** run:

prefect deploy

Choose the flow you want to put into a deployment

```
? Select a flow to deploy [Use arrows to move; enter  
to select; n to select none]
```

	Flow Name	Location
>	pipe	104/flows.py
	hello_flow	102/caching1.py
	log_it	102/logflow.py



Send deployment to server

Enter a deployment name and then *n* for no schedule.

```
? Deployment name (default): first_deploy  
? Would you like to schedule when this flow runs? [y/n] (y): n
```



Create a work pool

```
? Looks like you don't have any work pools this flow can be deployed to. Would you like to
create one? [y/n] (y): y
? What infrastructure type would you like to use for your new work pool? [Use arrows to
move; enter to select]
```

	Type	Description
>	process	Execute flow runs as subprocesses on a worker. Works well for local execution when first getting started.
	ecs	Execute flow runs within containers on AWS ECS. Works with existing ECS clusters and serverless execution via AWS Fargate. Requires an AWS account.



Work pools

Give your work pool a name.

Or, if you have existing work pools, choose one

? Which work pool would you like to deploy this flow to? [Use arrows to move; enter to select]

	Work Pool Name	Infrastructure Type	Description
>	docker-work local-work my-pool prod-pool staging-pool zoompool	docker process process kubernetes kubernetes process	



Specify flow code storage

Prefect auto-detects if you are in a git repo.

No auto-push.

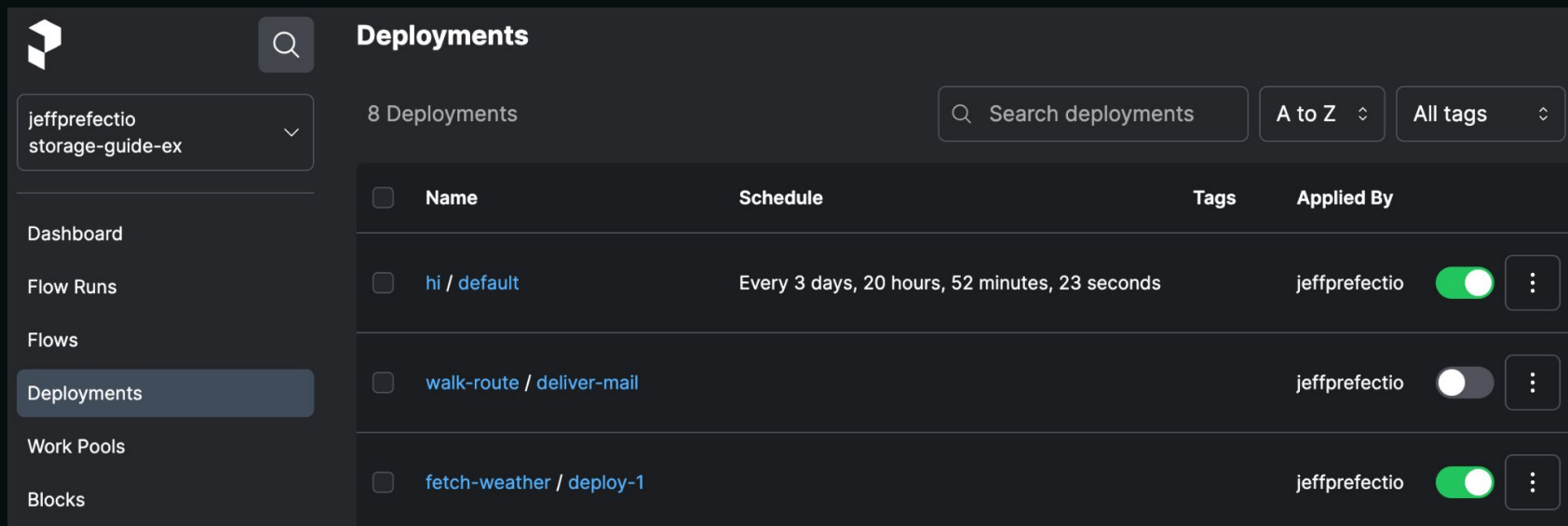
```
? Your Prefect workers will need access to this flow's code in order to run
it. Would you like your workers to pull your flow code from its remote
repository when running this flow? [y/n] (y): y
? Is https://github.com/discdiver/pacc-2023.git the correct URL to pull your
flow code from? [y/n] (y): y
? Is main the correct branch to pull your flow code from? [y/n] (y): y
? Is this a private repository? [y/n]: n
```

```
Deployment 'pipe/first_deploy' successfully created with id
'0f45657b-86d7-4141-a56a-e1ce47b90f1d'.
```



Deployments in the UI

The deployment lives on the server. See it in the UI.



The screenshot shows the Prefect UI's 'Deployments' page. On the left is a sidebar with navigation links: Dashboard, Flow Runs, Flows, Deployments (highlighted), Work Pools, and Blocks. The main content area is titled 'Deployments' and shows '8 Deployments'. At the top right of this area are filters: a search bar labeled 'Search deployments', a sort dropdown set to 'A to Z', and a tag filter set to 'All tags'. Below these is a table with columns: Name, Schedule, Tags, and Applied By. The table lists three deployments: 'hi / default' with a schedule of 'Every 3 days, 20 hours, 52 minutes, 23 seconds', 'walk-route / deliver-mail', and 'fetch-weather / deploy-1'. Each row has a checkbox on the left, the deployment name, the schedule, the tags, the user 'jeffprefectio', a toggle switch, and a three-dot menu icon.

<input type="checkbox"/>	Name	Schedule	Tags	Applied By
<input type="checkbox"/>	hi / default	Every 3 days, 20 hours, 52 minutes, 23 seconds	jeffprefectio	<input checked="" type="checkbox"/>
<input type="checkbox"/>	walk-route / deliver-mail		jeffprefectio	<input type="checkbox"/>
<input type="checkbox"/>	fetch-weather / deploy-1		jeffprefectio	<input checked="" type="checkbox"/>

Save deployment configuration to *prefect.yaml*

```
? Would you like to save configuration for this deployment for  
faster deployments in the future? [y/n]: y
```

```
Deployment configuration saved to prefect.yaml! You can now deploy  
using this deployment configuration with:
```

```
$ prefect deploy -n first_deploy
```

```
You can also make changes to this deployment configuration by  
making changes to the prefect.yaml file.
```


Recap of our setup



- Deployment & work pool created on Prefect Cloud
- Worker runs on local machine
- Worker polls Prefect Cloud, looking for scheduled work in the *my_pool* work pool
- Deployment configuration saved to *prefect.yaml*



Schedule a run - what happened?

- Running worker finds scheduled work in *my_pool* work pool.
- Worker and work pool are typed. *Local subprocess* in this case.
- Worker creates a local subprocess to kick off flow run.
- Flow code cloned from GitHub into temporary directory.
- Flow code runs.
- Metadata and logs sent to Prefect Cloud.
- Temporary directory deleted.





Deployment creation with `prefect.yaml`



prefect.yaml

```
# Generic metadata about this project
name: pacc-2023
prefect-version: 2.10.18

# build section allows you to manage and build docker images
build: null

# push section allows you to manage if and how this project is
push: null

# pull section allows you to provide instructions for cloning
pull:
- prefect.deployments.steps.git_clone:
    repository: https://github.com/discdiver/pacc-2023.git
    branch: main
```



prefect.yaml

Configuration for creating deployments

- ***pull*** step (repository & branch): from git repo



- ***deployments:***

Config for one or more deployments

Required keys:

- *name*
- *entrypoint*
- *work_pool* -> *name*

```
deployments:  
  
- name: deployment1  
  entrypoint: 202/flows.py:pipe  
  work_pool:  
    name: local-work  
  
- name: deployment2  
  entrypoint: 202/flows2.py:pipe2  
  work_pool:  
    name: local-work
```



Can override steps above on per-deployment basis

```
deployments:
  - name: prod-deployment
    entrypoint: 202/flows.py:pipe
    work_pool:
      name: prod-pool
    schedule:
      interval: 600
    pull:
      - prefect.deployments.steps.git_clone:
          repository: https://github.com/discdiver/pacc-london-2023.git
          branch: prod
          access_token: "{{prefect.blocks.secret.gh-secret}}"

      - name: staging-deployment
        entrypoint: 202/flows.py:pipe
        work_pool:
          name: staging-pool
        pull:
          - prefect.deployments.steps.git_clone:
              repository: https://github.com/discdiver/pacc-london-2023.git
              branch: staging
```



Re-deploy a deployment

Requires a *prefect.yaml* file

prefect deploy

```
? Would you like to use an existing deployment configuration? [Use arrows to  
move; enter to select; n to select none]
```

	Name	Entrypoint	Description
>	first_deploy	104/flows.py:pipe	



Deploy multiple deployments at once

Deploy all deployments in a *prefect.yaml* file:

```
prefect deploy --all
```



prefect deploy

If choose *docker* typed work pool you will be asked docker-related questions

	Work Pool Name	Infrastructure Type	Description
>	docker-pool my-pool	docker process	

? Would you like to build a custom Docker image for this deployment? [y/n]
(n):



Method 1: *prefect deploy*

Use the defaults for the work pool

OR

Build a custom Docker image with flow code

- Push image to a Docker registry
 - Use existing Dockerfile
 - Auto-includes packages in *requirements.txt*

Follow the prompts. 😊



Resulting *prefect.yaml*

```
- name: dock-interact
  version:
  tags: []
  description:
  entrypoint: 104/flows.py:pipe
  parameters: {}
  work_pool:
    name: docker-pool
    work_queue_name:
    job_variables:
      image: '{{ build-image.image }}'
  schedule:
  build:
- prefect_docker.deployments.steps.build_docker_image:
  requires: prefect-docker>=0.3.1
  id: build-image
  dockerfile: auto
  image_name: discdiver/dock-interact
  tag: 0.0.1
```





CI/CD with GitHub Actions



GitHub Actions with deployments

- CI/CD - when you push code or make a PR automatically take an action
- Pre-built Github Action to deploy a Prefect deployment
- github.com/marketplace/actions/deploy-a-prefect-flow



GitHub Action

```
name: Deploy a Prefect flow
on:
  push:
    branches:
      - main
jobs:
  deploy_flow:
    runs-on: ubuntu-latest
    steps:
      - uses: checkout@v3

      - uses: actions/setup-python@v4
        with:
          python-version: '3.10'

      - name: Run Prefect Deploy
        uses: PrefectHQ/actions-prefect-deploy@v1
        with:
          prefect-api-key: ${ secrets.PREFECT_API_KEY }
          prefect-workspace: ${ secrets.PREFECT_WORKSPACE }
          requirements-file-path: ./examples/simple/requirements.txt
          entrypoint: ./examples/simple/flow.py:call_api
          additional-args: --cron '30 19 * * 0'
```





Helm Chart



Prefect Helm Chart for K8s

Provides a variety of functionality

Creating workers is a popular use case.

See more in the docs:

github.com/PrefectHQ/prefect-helm/tree/main/charts/prefect-worker





Terraform provider



Prefect Cloud Terraform Provider

registry.terraform.io/providers/PrefectHQ/prefect/latest/docs



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