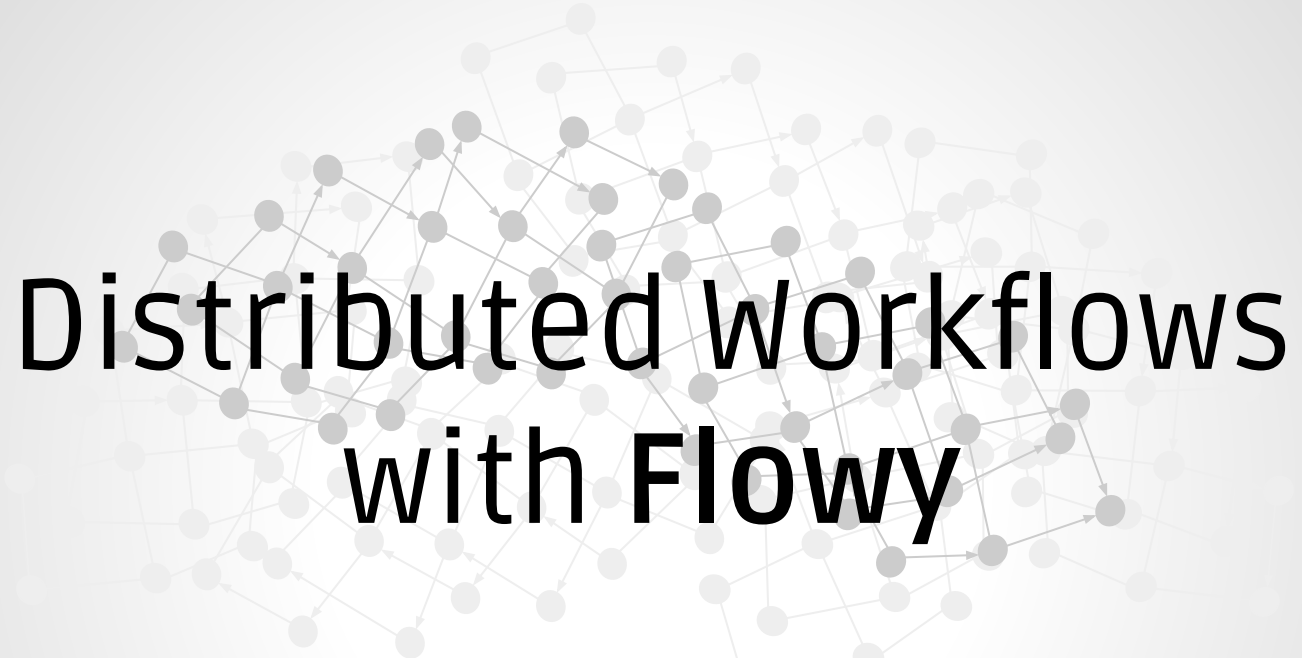


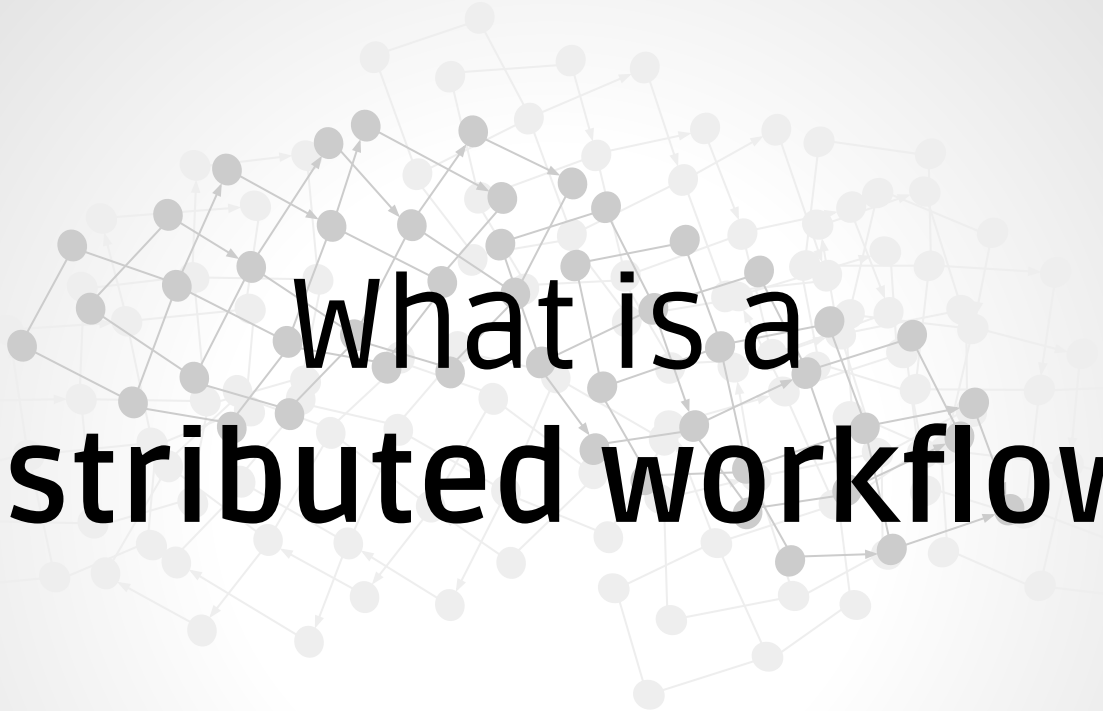
Distributed Workflows with **Flowy**

EuroPython 2015

Sever Banesiu @severb

Overview

1. Distributed Workflows
2. Code + Demo
3. Workflow Engine
4. Execution Model
5. More Examples
6. Scaling



What is a **distributed workflow?**

Hint

*A process composed of a mix of independent and interdependent units of work called **tasks**.*

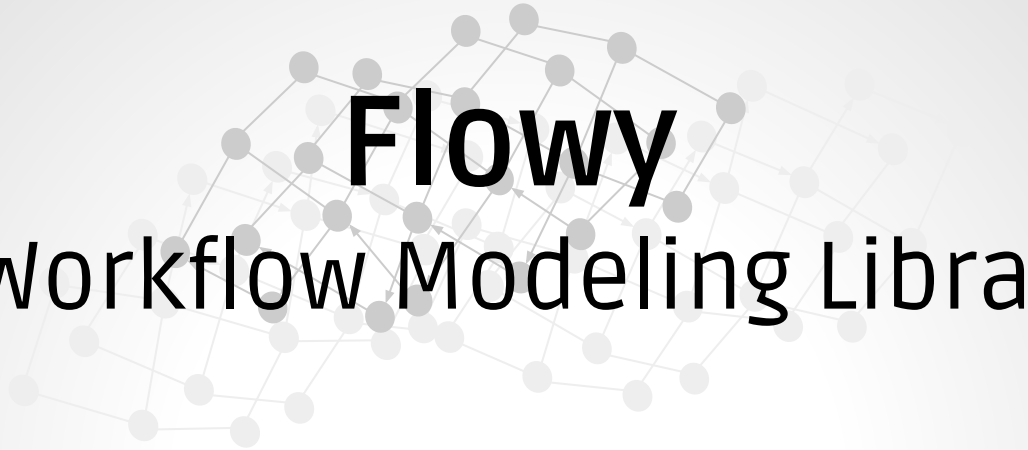
Workflows are usually modeled with **DAGs** or **ad-hoc** code

Note

Neither provide a satisfactory solution.

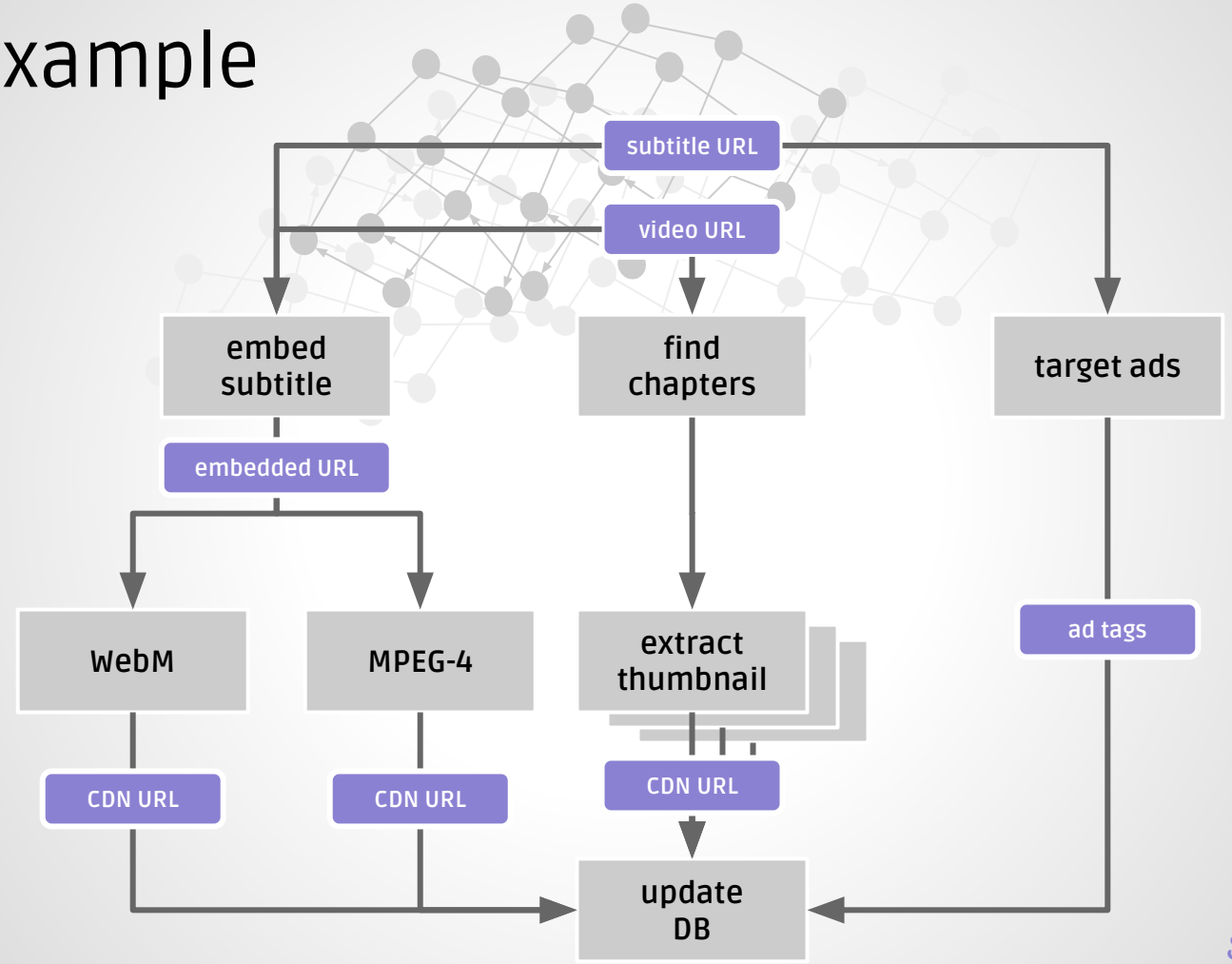
Flowy

A Workflow Modeling Library

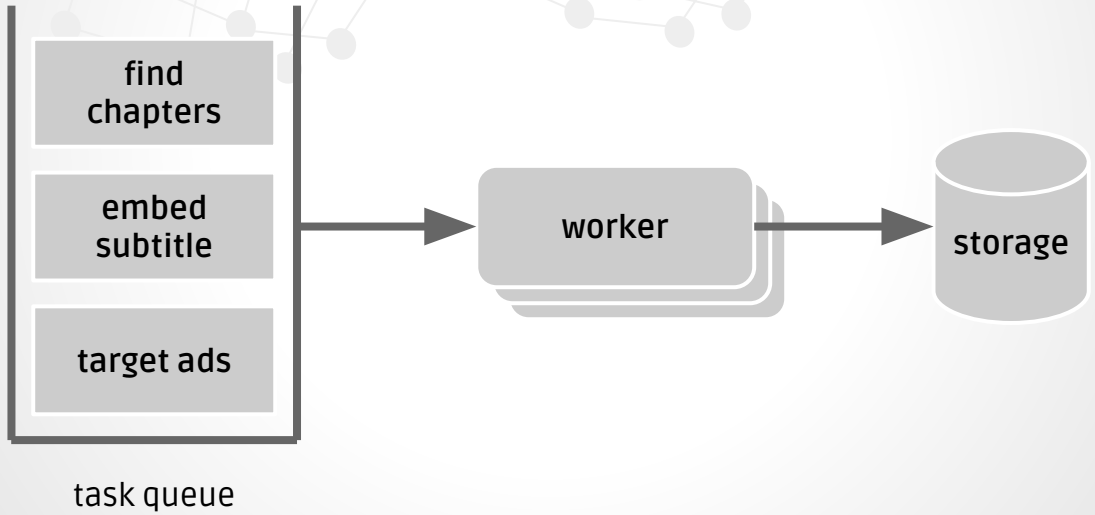


It uses **single-threaded**-looking Python code and **gradual concurrency inference**.

An Example


subtitle URL
video URL
embed subtitle
find chapters
target ads
embedded URL
WebM
MPEG-4
extract thumbnail
ad tags
CDN URL
CDN URL
CDN URL
update DB

An **Ad-hoc** Solution, using task queues



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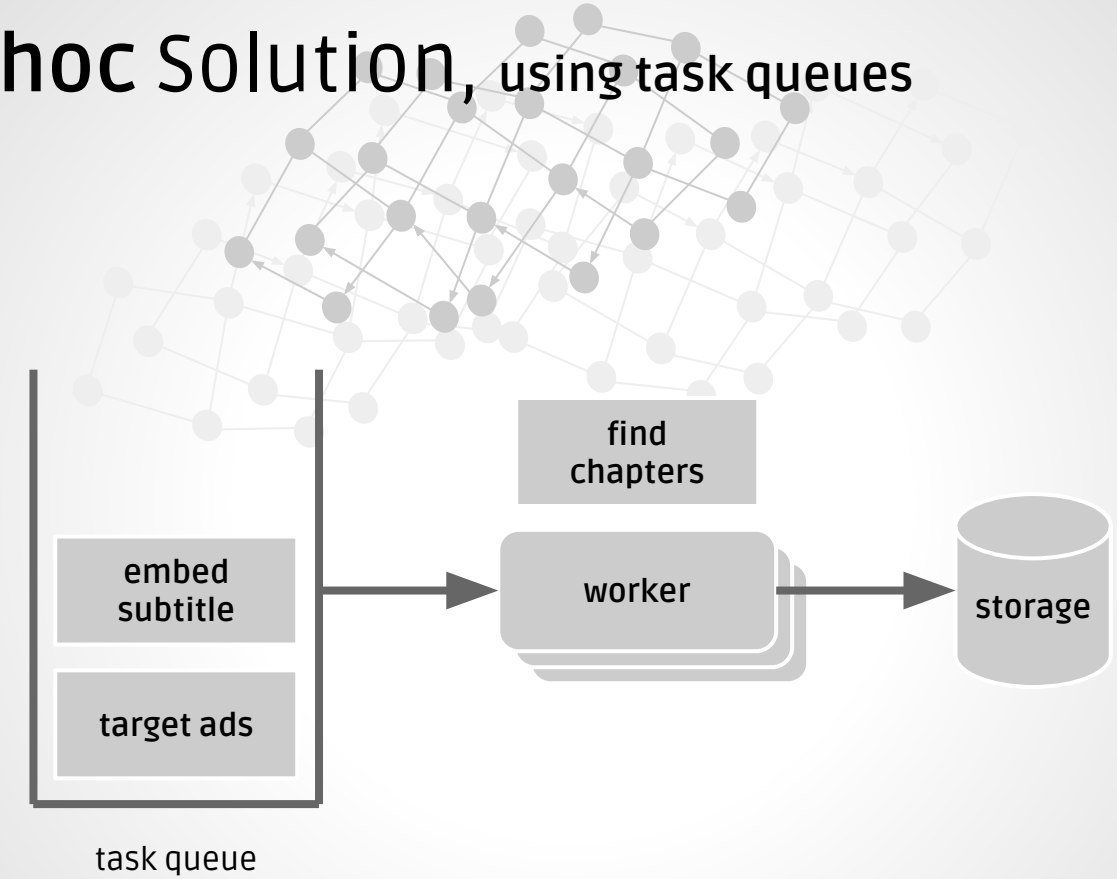

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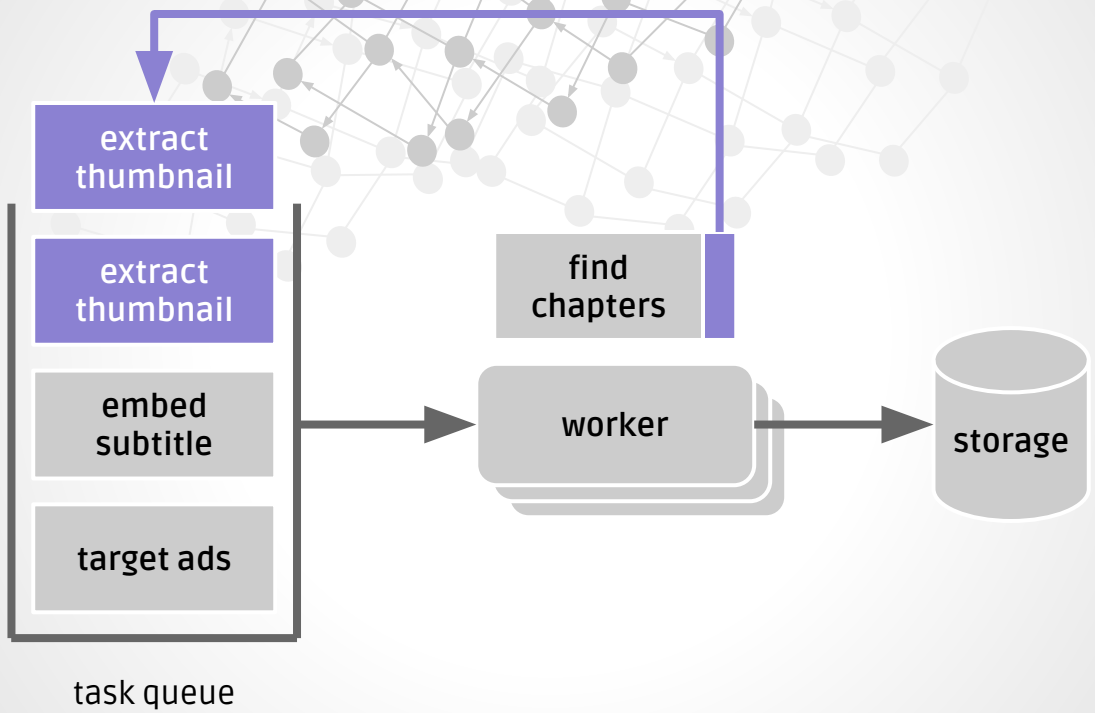

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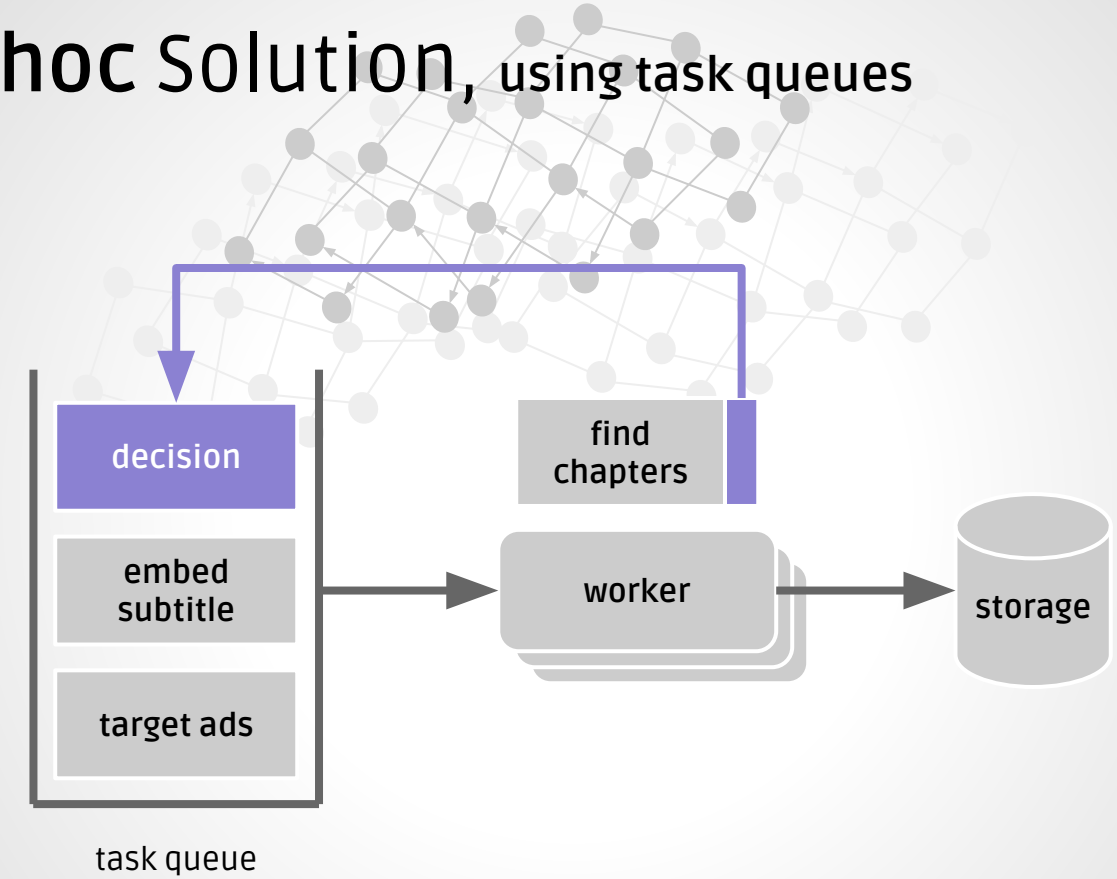

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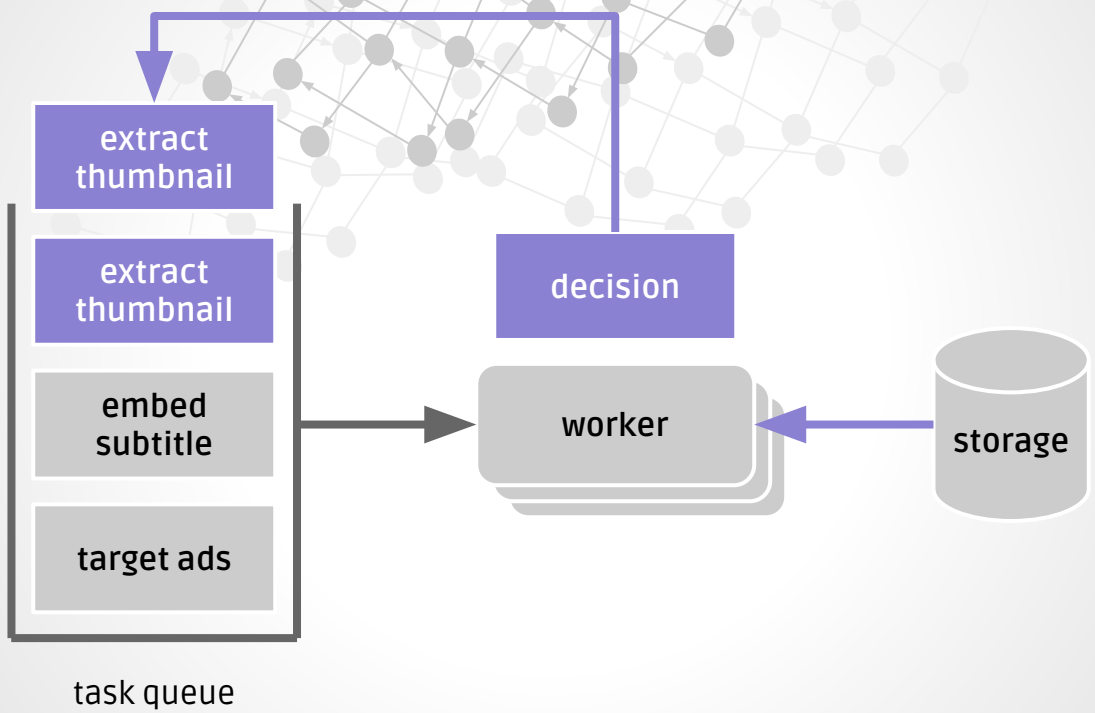


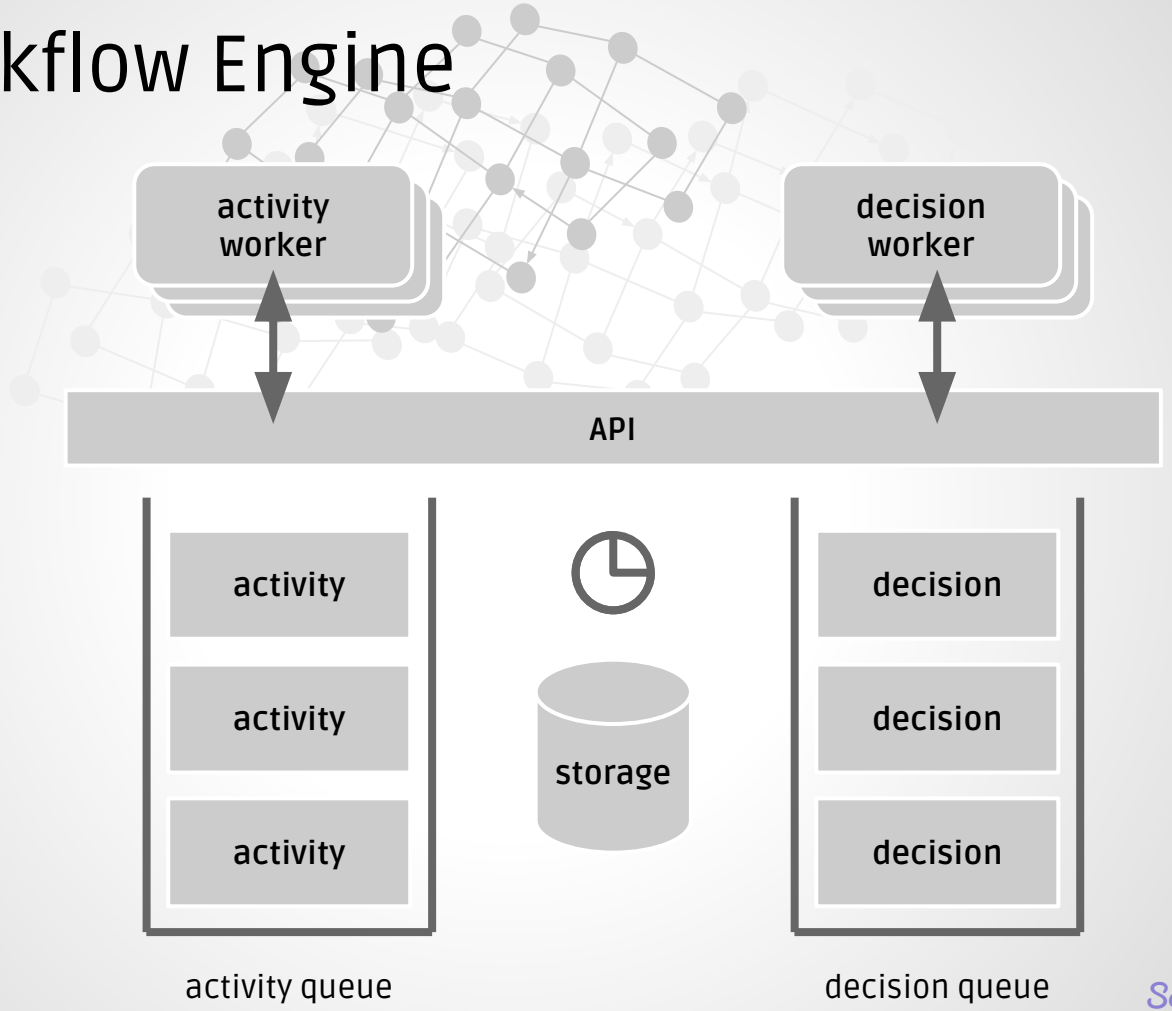
The Workflow Engine

* automatically schedule the **corresponding decision type** when an activity is finished

* ensure all decisions *for the same workflow execution* are **sequential**

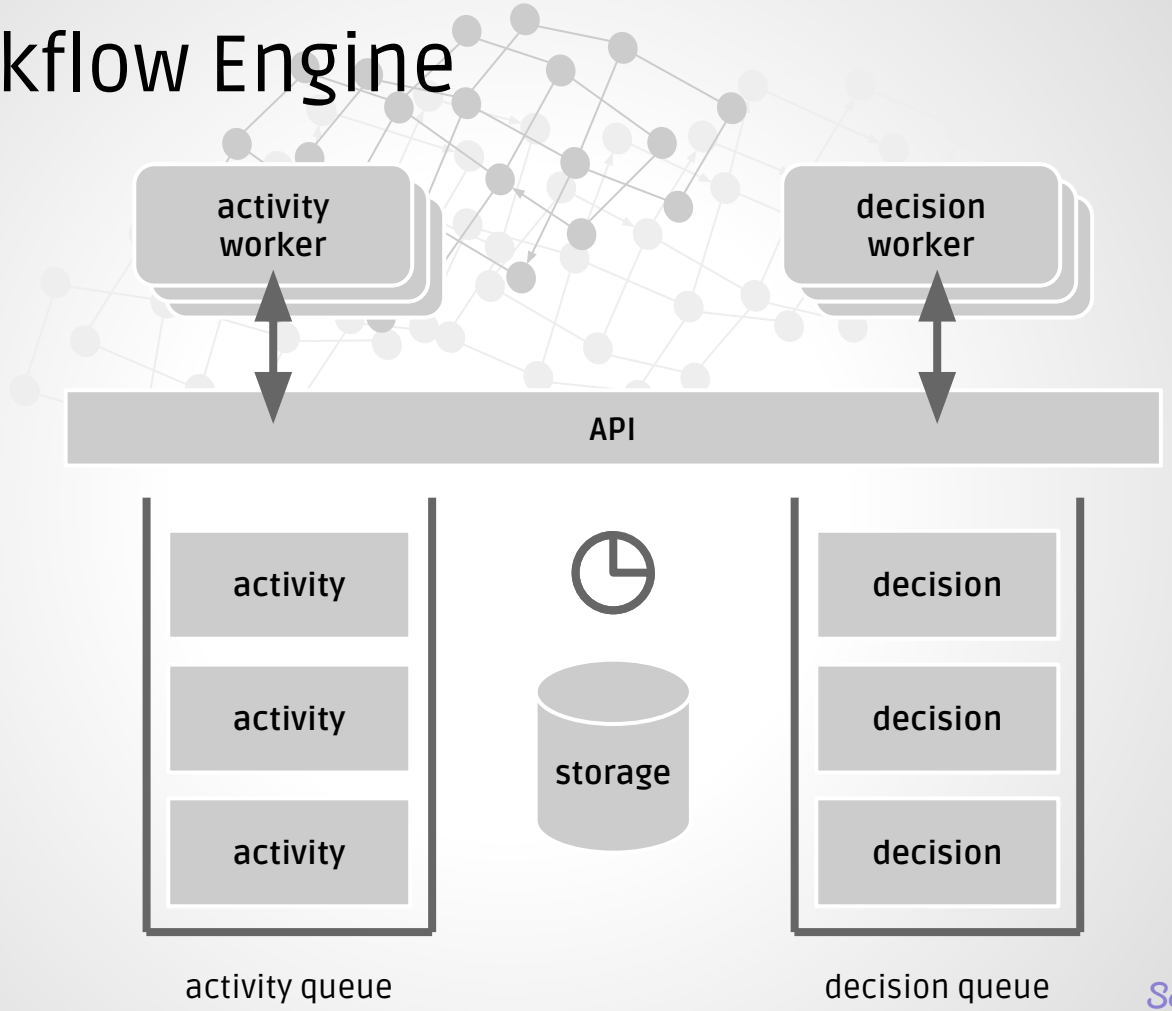
* **merge** multiple queued decisions *for the same workflow execution* into one

* provide **fault tolerance** with timers



The Workflow Engine

Not something new



Execution Model

```
def process_video(embed_subtitle, find_chapters, ...):
        def workflow(video_URL, subtitle_URL):
                new_URL = embed_subtitle(video_URL, subtitle_URL)
                webm_URL = encode_video(new_URL, 'webm')
                mpeg4_URL = encode_video(new_URL, 'mpeg4')
                ad_tags = target_ads(subtitle_URL)
                chapters = find_chapters(video_URL)
                thumbnails = [extract_thumbnail(video_URL, c) for c in chapters]
                return video_URL, webm_URL, mpeg4_URL, thumbnails, ad_tags
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                return video_URL, webm_URL, mpeg4_URL, thumbnails, ad_tags
        return workflow
```

Side Effects

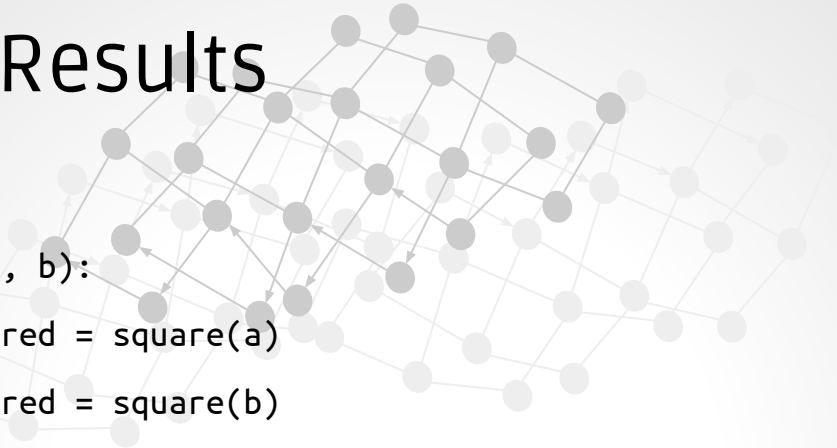
The execution path must not change between invocations.

Use only pure functions inside the workflow code.

Use input data or dedicated activities for random values, current date, external reading, etc.

Avoid complex computations in the workflow code.

Using Task Results



```
def example(square):
        def workflow(a, b):
                a_squared = square(a)
                b_squared = square(b)
                if a_squared + b_squared > 100:
                    return math.copysign(a_squared, a)
                return math.copysign(b_squared, b)
        return workflow
```

Using Task Results

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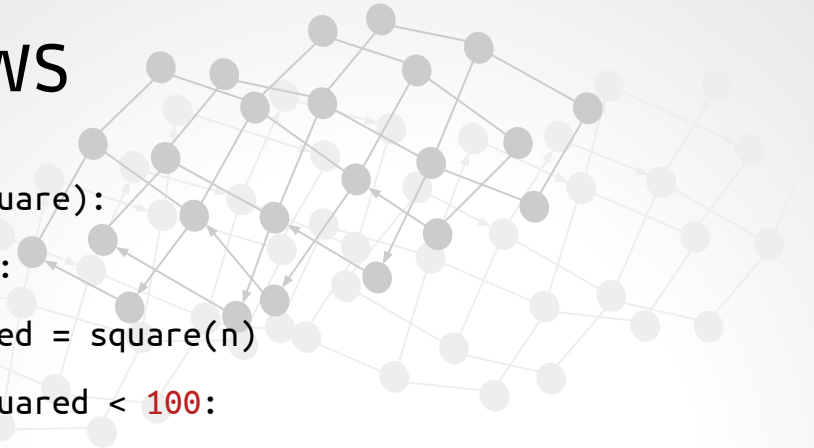
                return video_URL, webm_URL, mpeg4_URL, thumbnails, ad_tags
        return workflow
```

Using Task Results

```
def example(sum, square):
        def workflow(a, b):
                a_squared = square(a)
                b_squared = square(b)
                if a_squared < 100:
                    a_squared = sum(a_squared, 100)
                if b_squared > 100:
                    b_squared = sum(b_squared, 100)
                return sum(a_squared, b_squared)
        return workflow
```

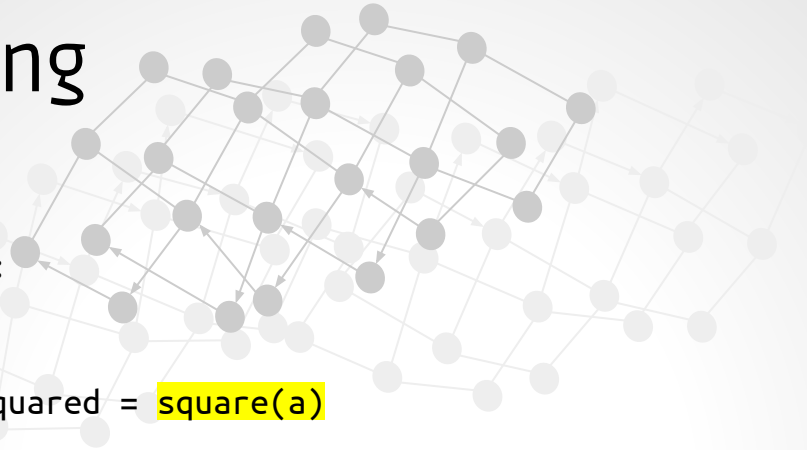
Subworkflows



```
def subworkflow(sum, square):
        def workflow(n):
                n_squared = square(n)
                if n_squared < 100:
                    n_squared = sum(n_squared, 100)
        return workflow


def example(sum, example_sub):
        def workflow(a, b):
                return sum(example_sub(a_squared), example_sub(b_squared))
        return workflow
```

Error Handling

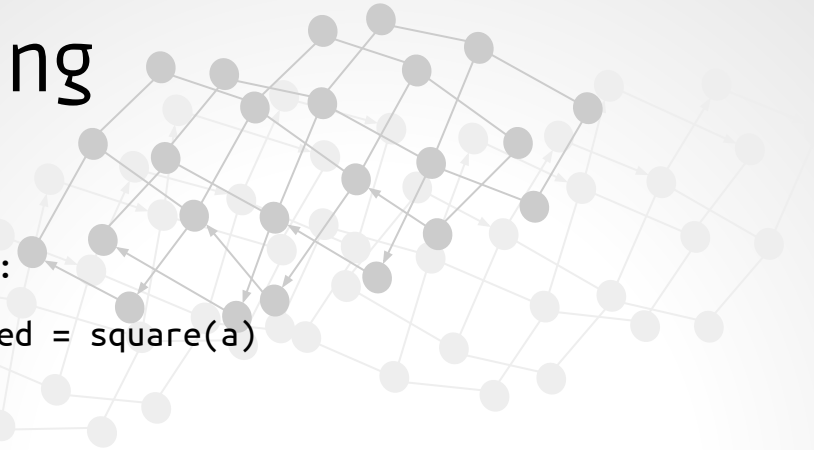


```
def example(square):
        def workflow(a):
                try:
                    a_squared = square(a)
                except:
                    return 0
                else:
                    return a_squared + 100
        return workflow
```

Error Handling

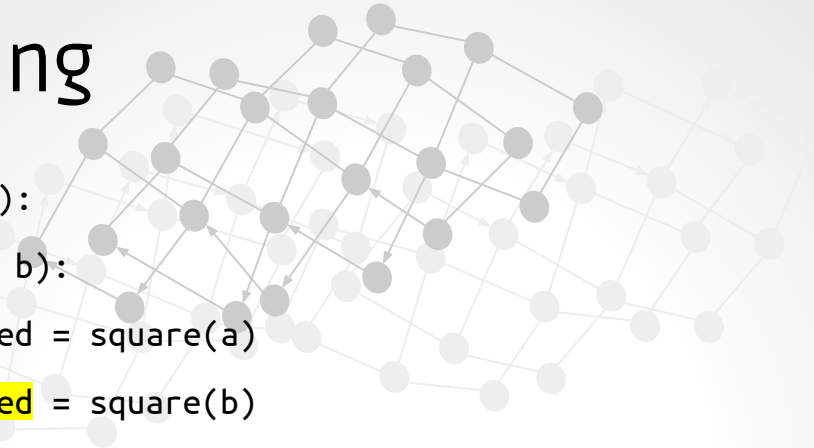
```
def example(square):
        def workflow(a):
                a_squared = square(a)
                try:
                    return a_squared + 100
                except TaskError:
                    return 0
        return workflow
```

Error Handling



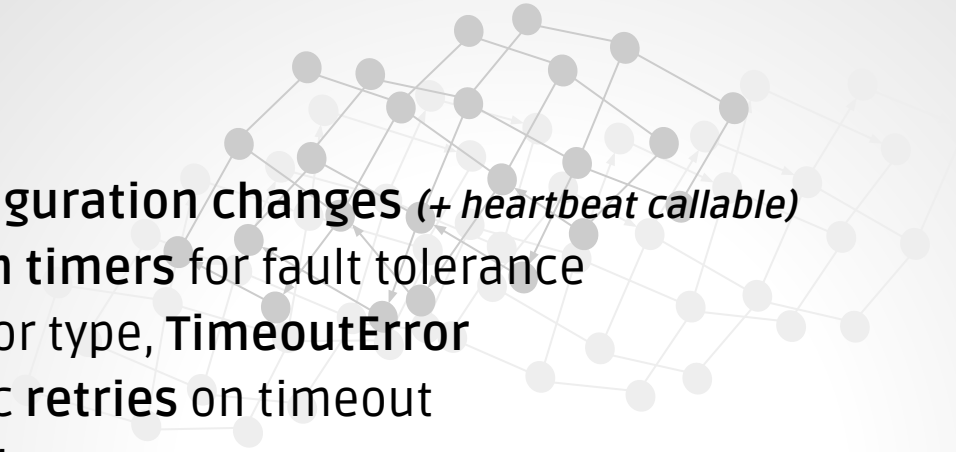
```
def example(square):
        def workflow(a):
                a_squared = square(a)
                try:
                    wait(a_squared)
                except TaskError:
                    return 0
                else:
                    return a_squared + 100
        return workflow
```

Error Handling



```
def example(sum, square):
        def workflow(a, b):
                a_squared = square(a)
                b_squared = square(b)
                return sum(a_squared, b_squared)
        return workflow
```

Scaling



* only **configuration changes** *(+ heartbeat callable)*
* **execution timers** for fault tolerance
* a new error type, **TimeoutError**
* automatic **retries** on timeout
* **heartbeats**
* **idempotent** activities
* activities in **other languages**
* results and input data **size restrictions**
* each worker is **single threaded**/process *(use process managers)*
* **use subworkflows** if history gets too large
* can **scale up and down** with ease *(overall progress is not lost)*

Thank you,
Questions?

github.com/severb/flowy/