NextFlow

CMSE 890-602

NextFlow

- Written in Groovy, a Python-like Java variant
  - Requires use of { } to define code blocks!
- Uses “Channels” and “Processes”
- Handles conda and containers well
- Runs processes on local or remote systems as requested
  - Note: the main NextFlow process has to be able to run for the full time of the workflow!

https://training.nextflow.io/latest/hello_nextflow/

NextFlow Channels and Processes

Channels

- Transfer information between processes
- Can be explicitly or implicitly created
- Can operate on channels
- Two types:
  - Queue- First in, first out asynchronous and unidirectional. Items are removed once used by a process.
  - Value- has a single value and can be read unlimited times.

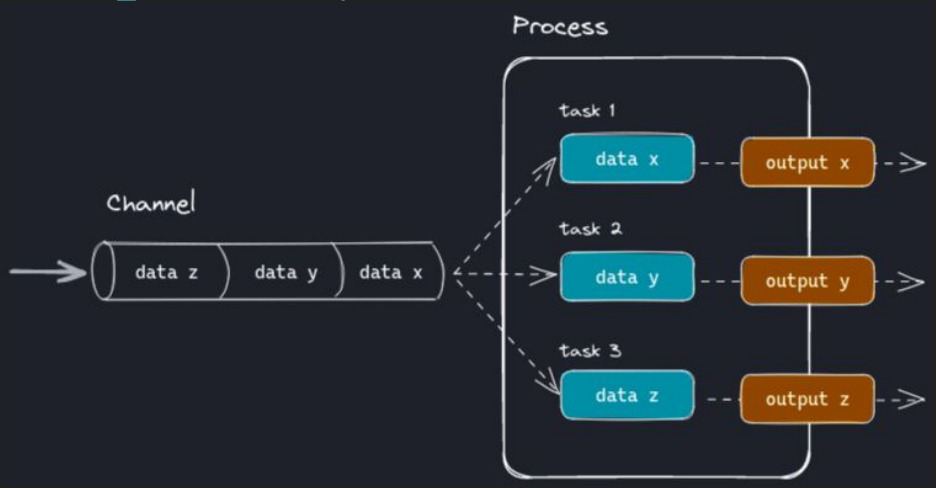
Can be thought of as the data flow in a DFD

https://training.nextflow.io/latest/hello_nextflow/02_hello_channels/

Processes

- Perform external operations on channels
- Runs scripts, software, etc

https://training.nextflow.io/latest/hello_nextflow/01_hello_world/#12-the-process-definition



NextFlow syntax

Queue Channel

```
ch1 = Channel.of(1, 2, 3)
```

Value Channel

Often implicitly created from variables

Explicitly:

```
ch1 = Channel.value()
ch2 = Channel.value('Hello there')
ch3 = Channel.value([1, 2, 3, 4, 5])
```

Process

```
process < name > {
    [ directives ]

    input:
    < process inputs >

    output:
    < process outputs >

    when:
    < condition >

    [script|shell|exec]:
    """
    < user script to be executed >
    """
}
```

Operators

- Perform some transformation on a Channel

- View its contents (print to screen), `view()`
- Apply a function to all elements of the Channel, `map()`
- Combine Channel elements together, `mix()`
- Join elements by a key, `join()`
- Split channel elements using boolean logic, `branch()`

https://training.nextflow.io/latest/hello_nextflow/02_hello_channels/#3-use-an-operator-to-transform-the-contents-of-a-channel

Modular NextFlow

- NextFlow scripts can be loaded with the `include { }` statement to bring in processes from other scripts
- Entire workflows can be defined in `workflow` blocks and called in the final `workflow` block of the script
- Workflows can take specific inputs and outputs to connect them to other workflows or processes

https://training.nextflow.io/latest/hello_nextflow/04_hello_modules/

Best practices

- Use the `-resume` option to use existing results and avoid re-running processes
- Use containers for processes (singularity on most HPCC, Docker for cloud)
- Use an unnamed `process { }` block to define resource requirements for all processes

```
process {
    executor = 'slurm'
    queue = 'short'
    memory = '10 GB'
    time = '30 min'
    cpus = 4
}
```

In-class assignment

We will go through the Nextflow “Hello world” workshop together:

https://training.nextflow.io/latest/hello_nextflow/

Click “Open in GitHub Codespaces”

Sign up with your GitHub account, or just watch along as I go through

Homework

Work on your semester project!