dispel4py in detail

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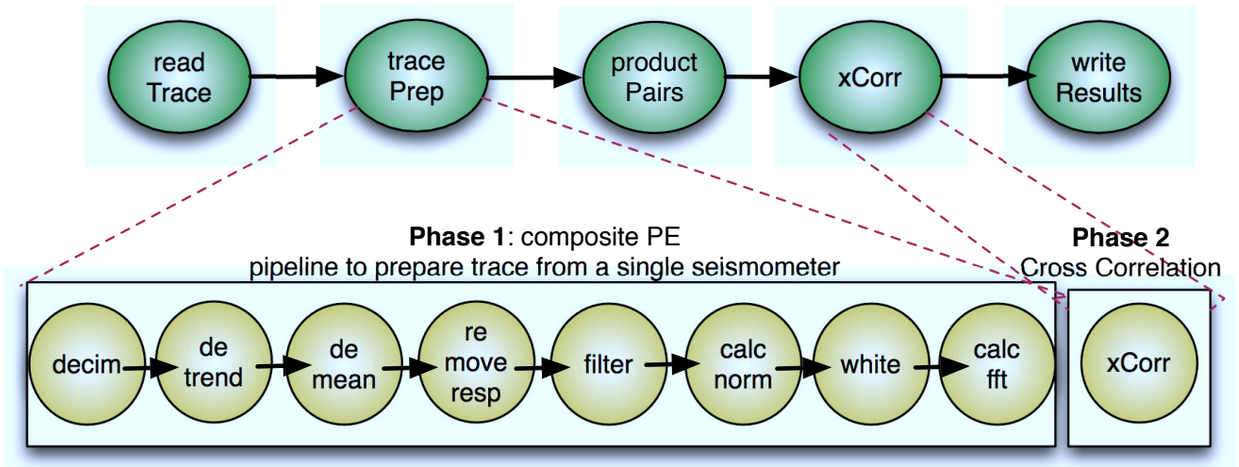
Outline

- Installation and links
- dispel4py workflows
    - Seismology
    - Astrophysics
    - Social Computing
- Graph examples
- Composite PEs
- Chains
- Groupings
- Mappings to execution platforms

Installation & links

- This is all you need:
  - **pip install dispel4py**
- GitHub: https://github.com/dispel4py/dispel4py
- Documentation: http://www2.epcc.ed.ac.uk/~amrey/dispel4py
- **Exercises**: http://effort.is.ed.ac.uk/dispel4py_exercises.tar

dispel4py workflows- Seismology

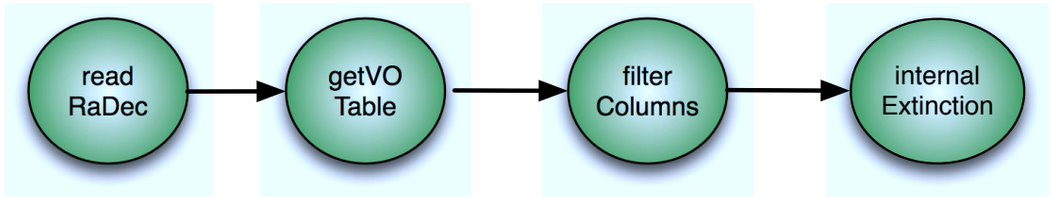


- **Phase 1- Preprocess**: Time series data (traces) from seismic stations are preprocessed in parallel
- **Phase 2: Cross-Correlation**: Pairs all of the stations and calculates the cross-correlation for each pair (complexity O(n2)).
- **Input data**: 1000 stations as input data (150 MB)
- **Output data**: 499,500 cross-correlations (39GB)

11th IEEE eScience 2015 paper

dispel4py: An Agile Framework for Data-Intensive eScience

dispel4py workflows- Astrophysics

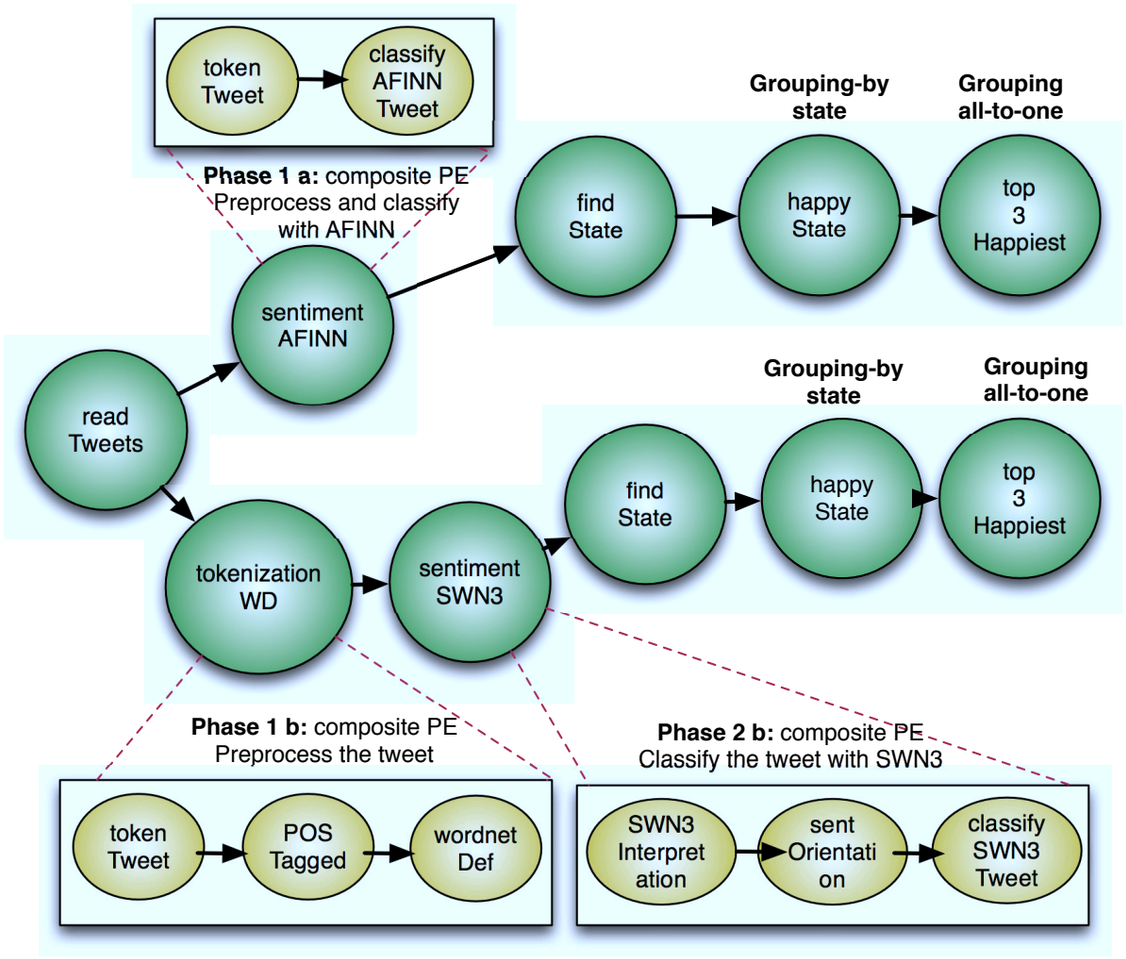


- Calculates the *Internal Extinction of the Galaxies* from the AMIGA catalogue[1]
- This property represents the dust extinction within the galaxies and is a correction coefficient needed to calculate the optical luminosity of a galaxy.
- The first PE **reads an input file** (*coordinates.txt* size 19KB) that contains the **right ascension (Ra) and declination** (Dec) values for **1051 galaxies.**
- The second PE **queries** a **VO service for each galaxy** in the input file using the Ra and Dec values.
- The results of these queries are filtered by filterColumns PE. It selects:
  - morphological type (Mtype)
  - apparent flattening (logr25)
- Their internal extinction is calculated by the internalExtinction PE.

11th IEEE eScience 2015 paper

dispel4py: An Agile Framework for Data-Intensive eScience

dispel4py workflows- Social Computing



- Two basic sentiment analyses by applying two lexicons:
  - **AFINN** (2477 English words)
  - **SentiWordNet** (155,287 English words and 117,659 synsets)
- After tweets findState PE, which searches the US state from which the tweet originated
- The HappyState PE applies a grouping by based on the state and aggregates the sentiment scores of tweets from the same state
- The last PE applies all-to-one grouping and determines which are the top three happiest states.
- 126,826 tweets (500MB)

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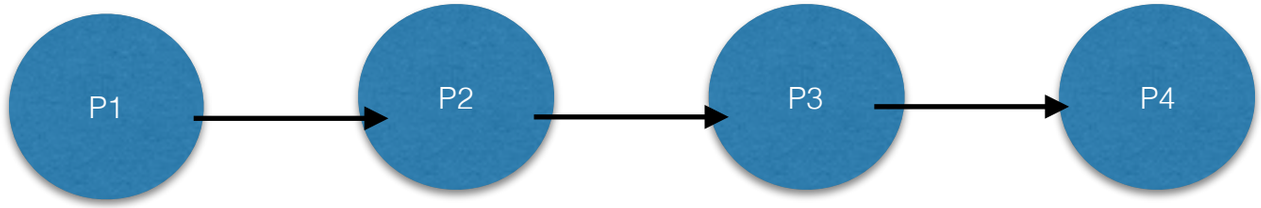
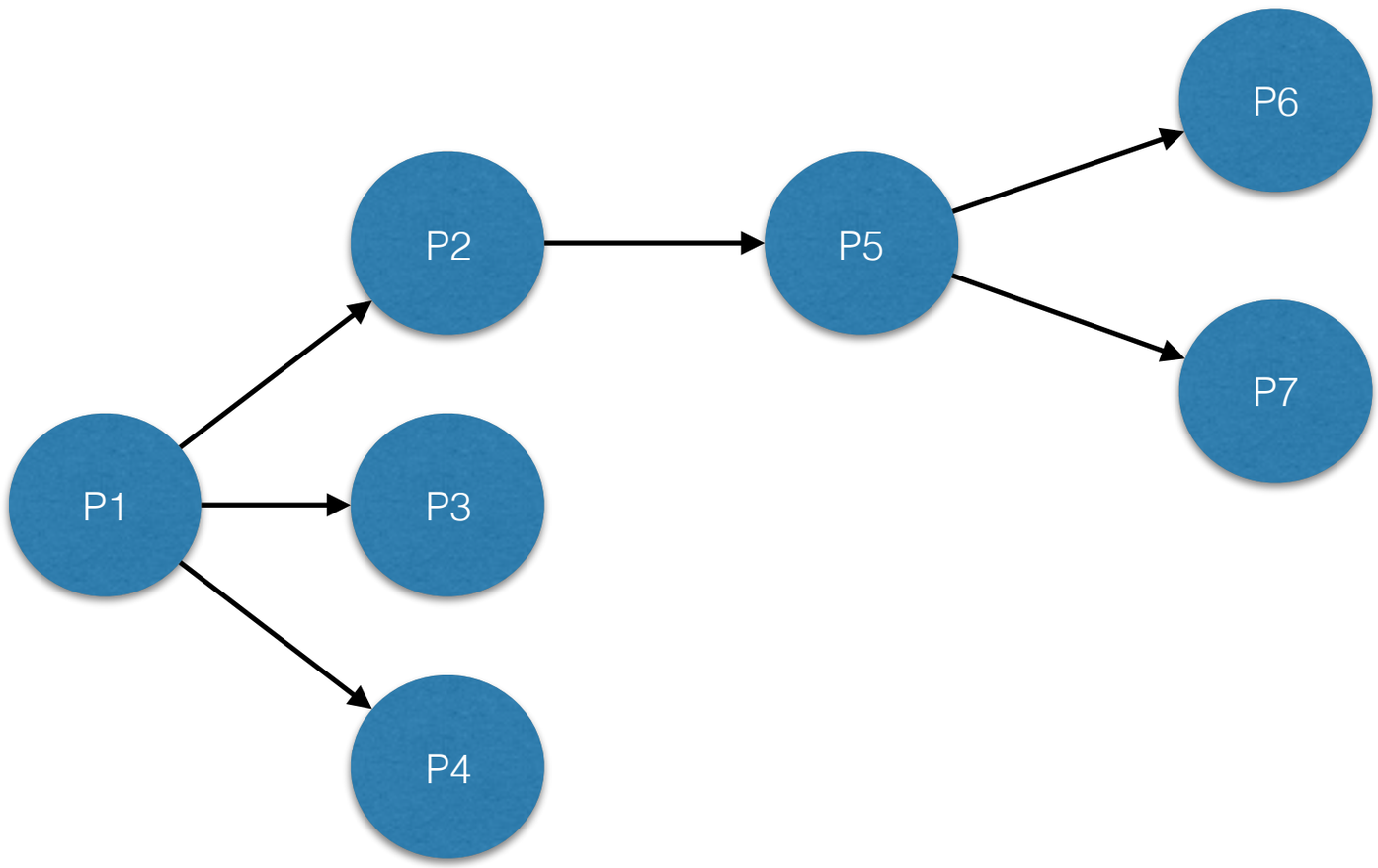
dispel4py: An Agile Framework for Data-Intensive eScience

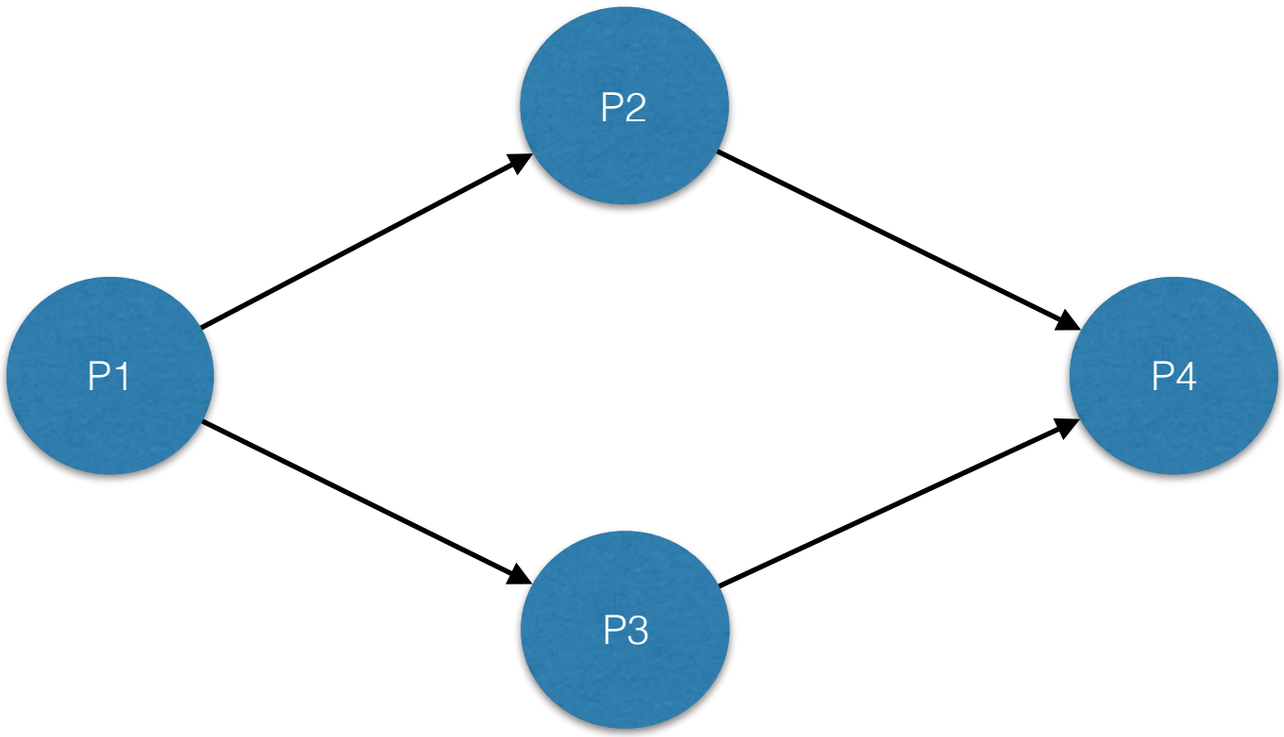
Pipeline



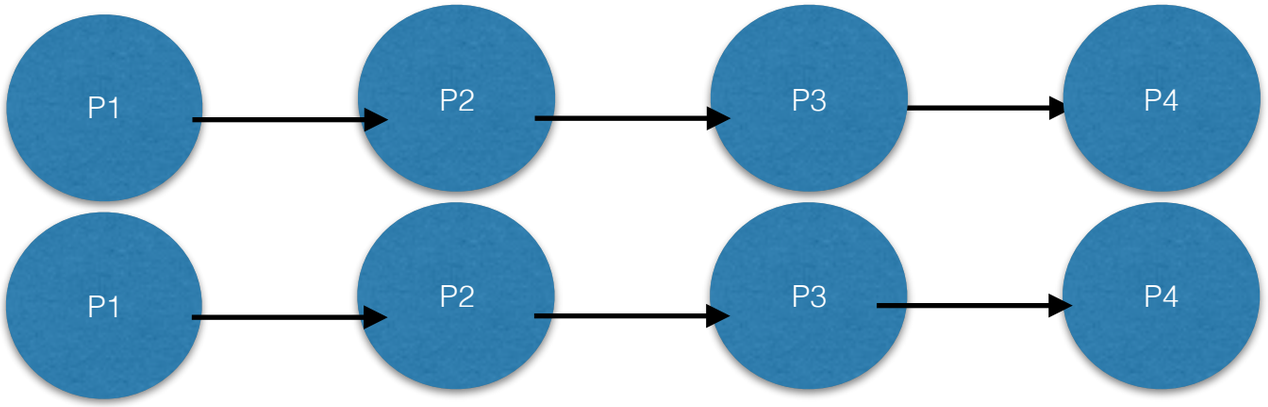
Tree



Split and Merge

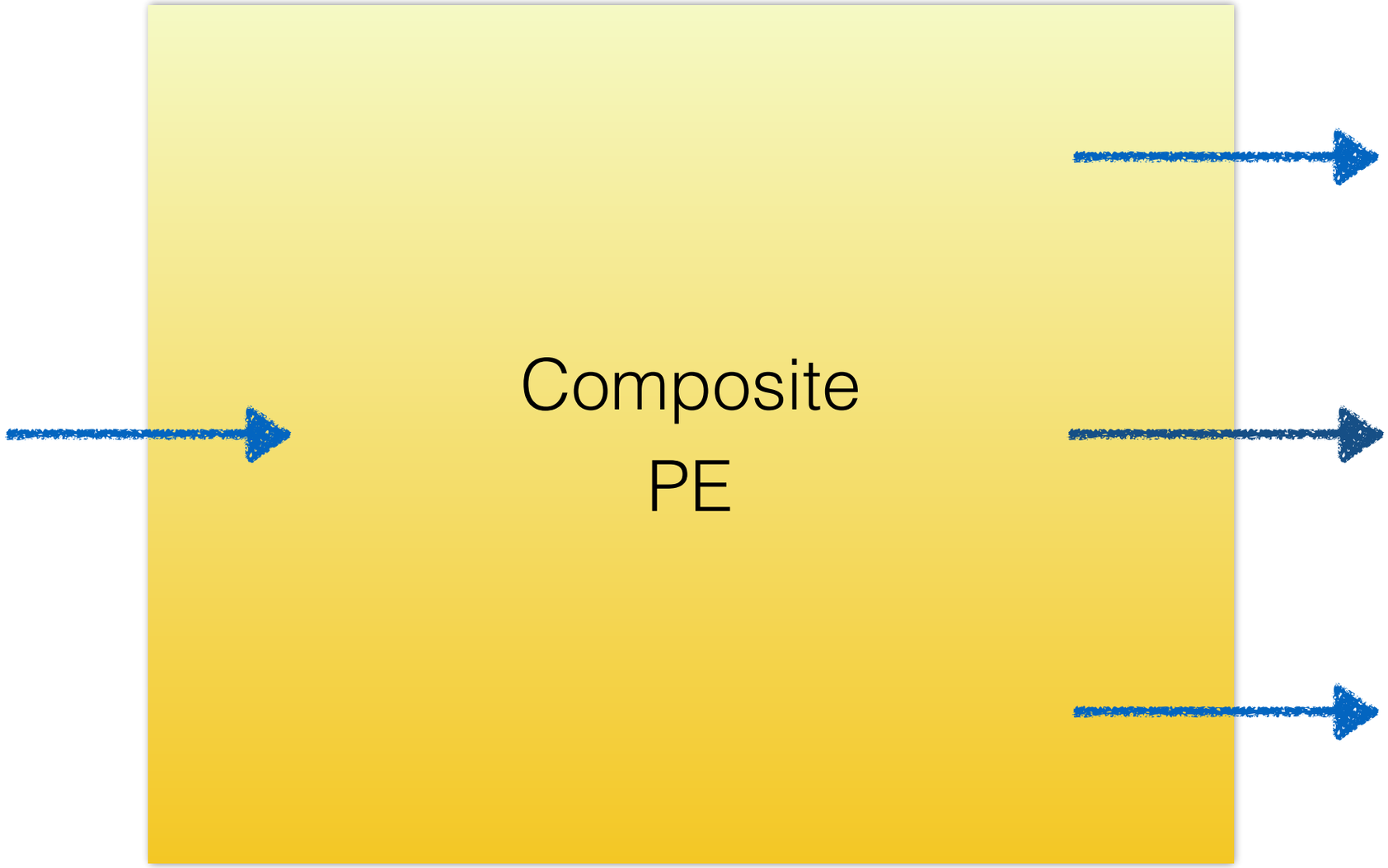


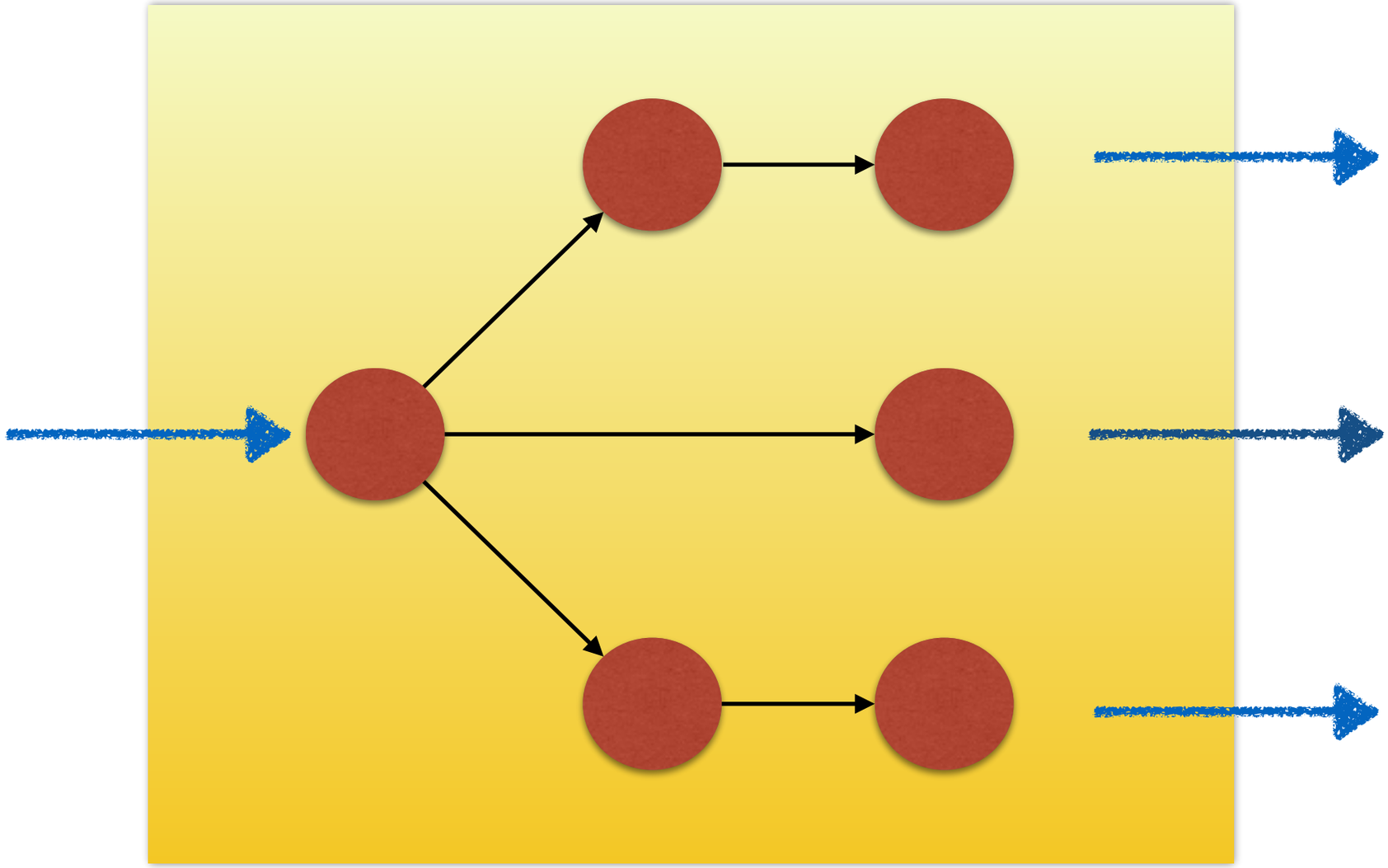
Unconnected

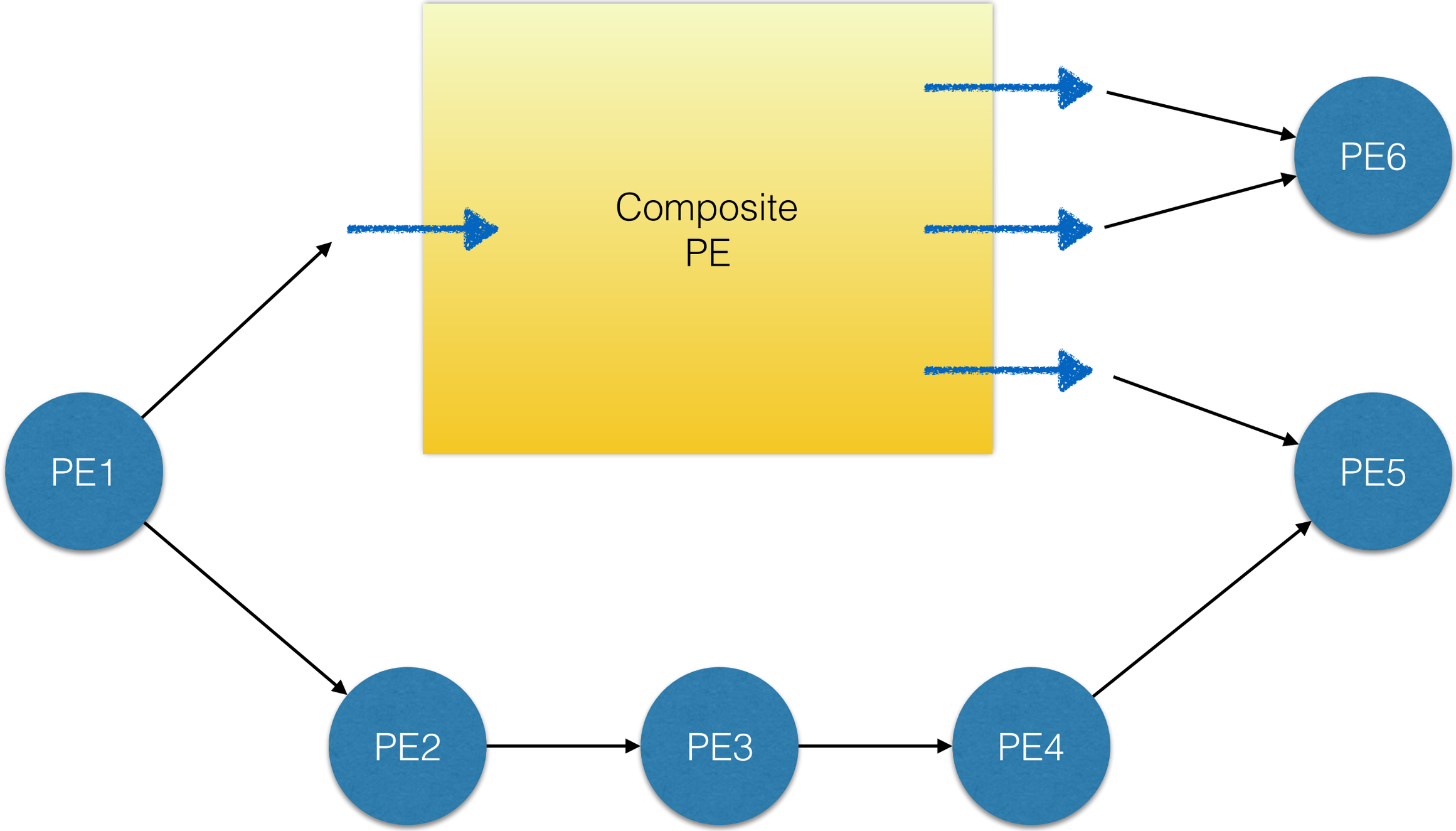


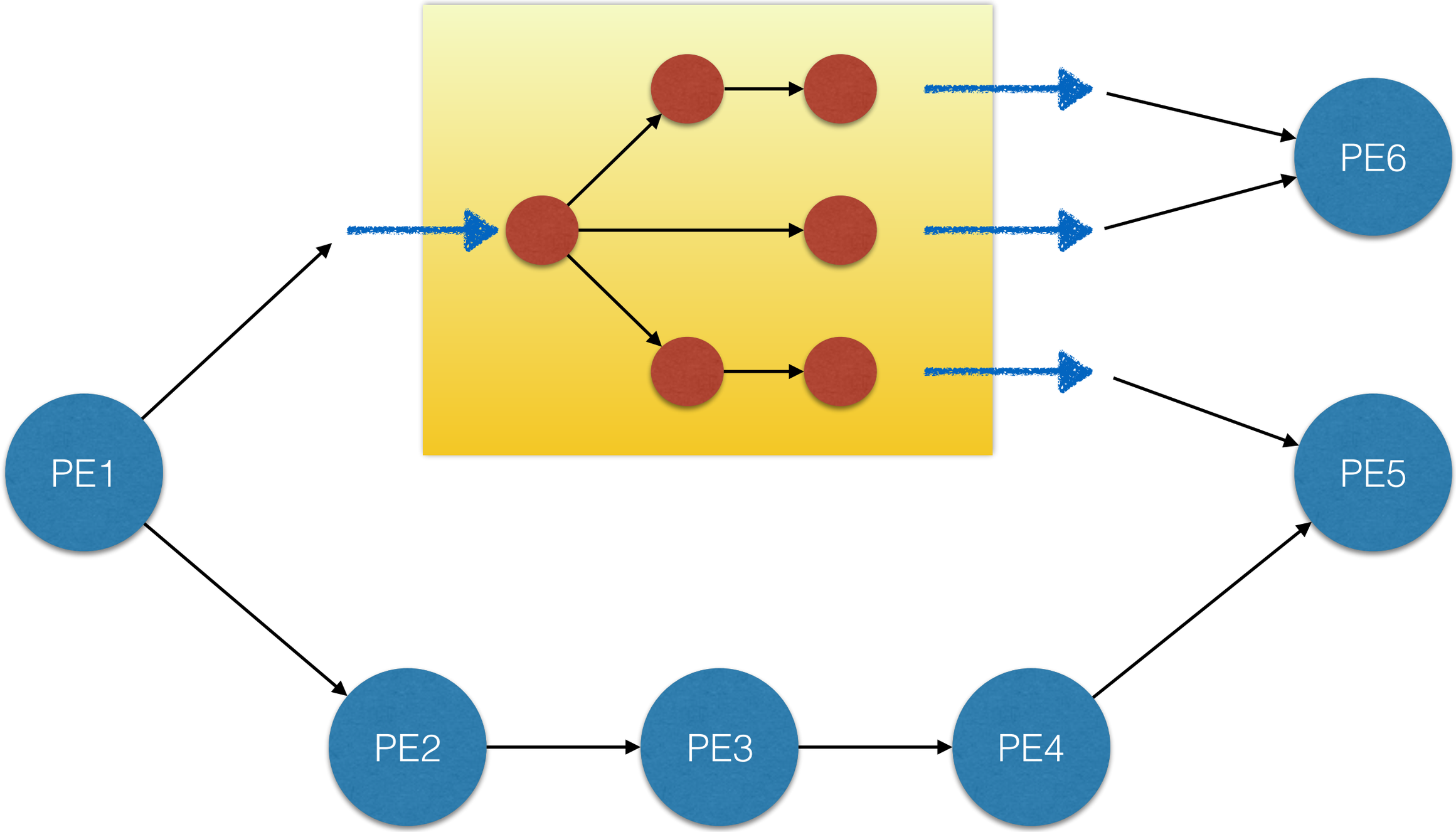
Composite PEs

- A composite PE is a nested graph
- Looks like a PE but contains other PEs
- Hides the complexity of an underlying process
- When creating a graph, a composite PE is treated like any other PE


Composite
PE

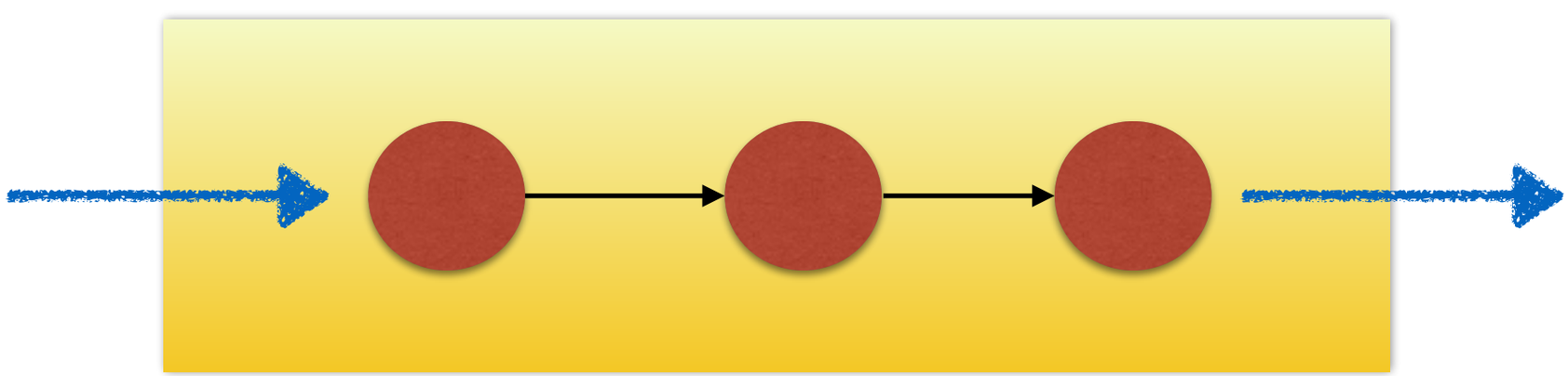



Composite
PE
PE1
PE2
PE3
PE4
PE5
PE6

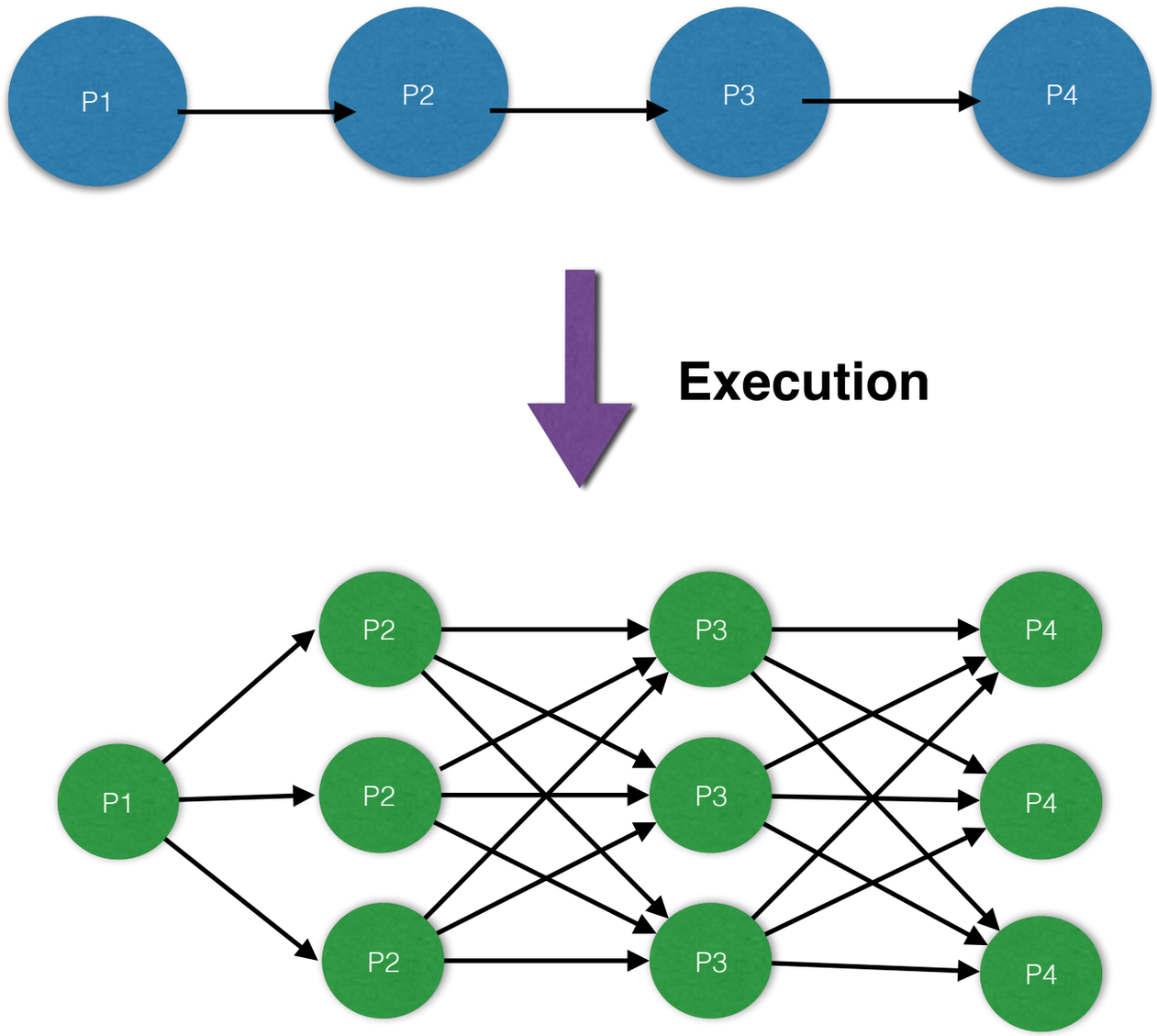

PE1
PE2
PE3
PE4
PE5
PE6

```
def add_value(num, value):
    num += value
    return num
def subtract_value(num, value):
     num -= value
     return num
pipeline = [ add_value, subtract_value, … ]
```

```
compositePE = create_iterative_chain(pipeline)
```

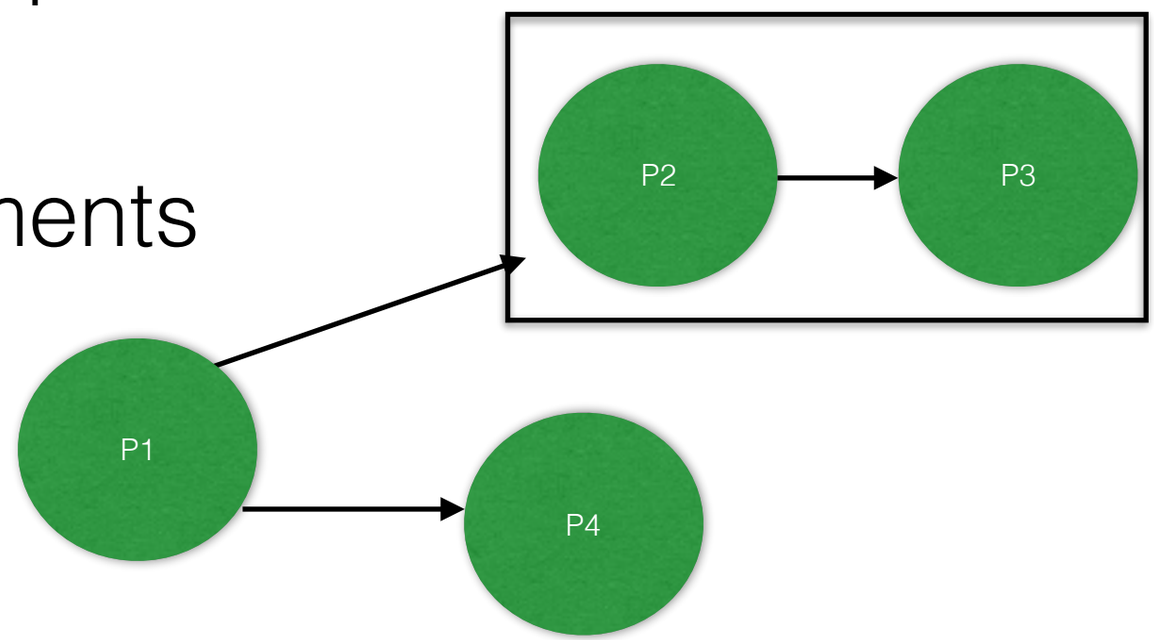


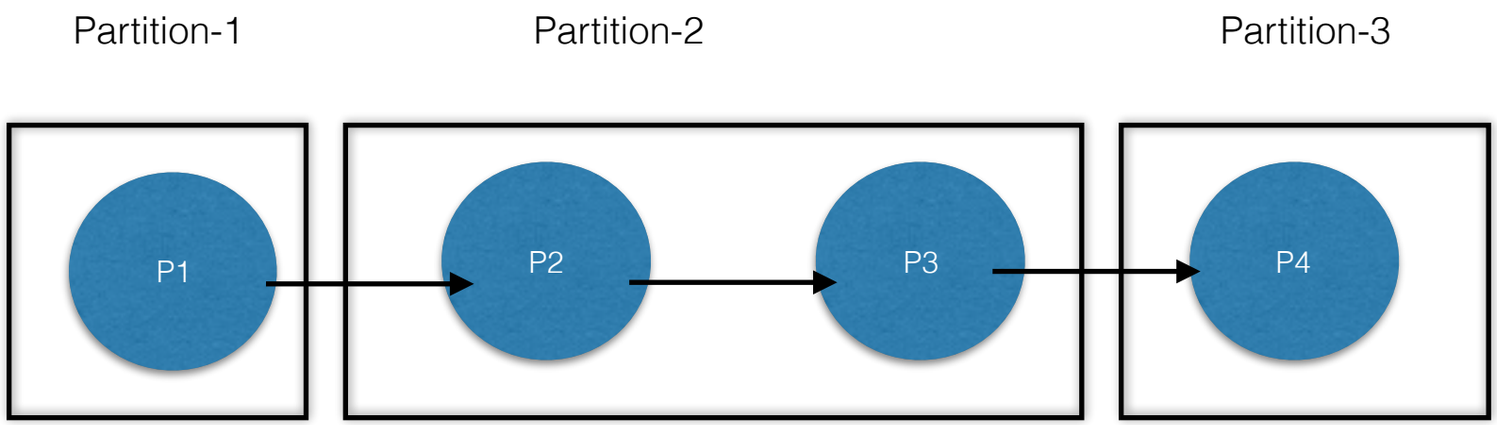
Executing graphs



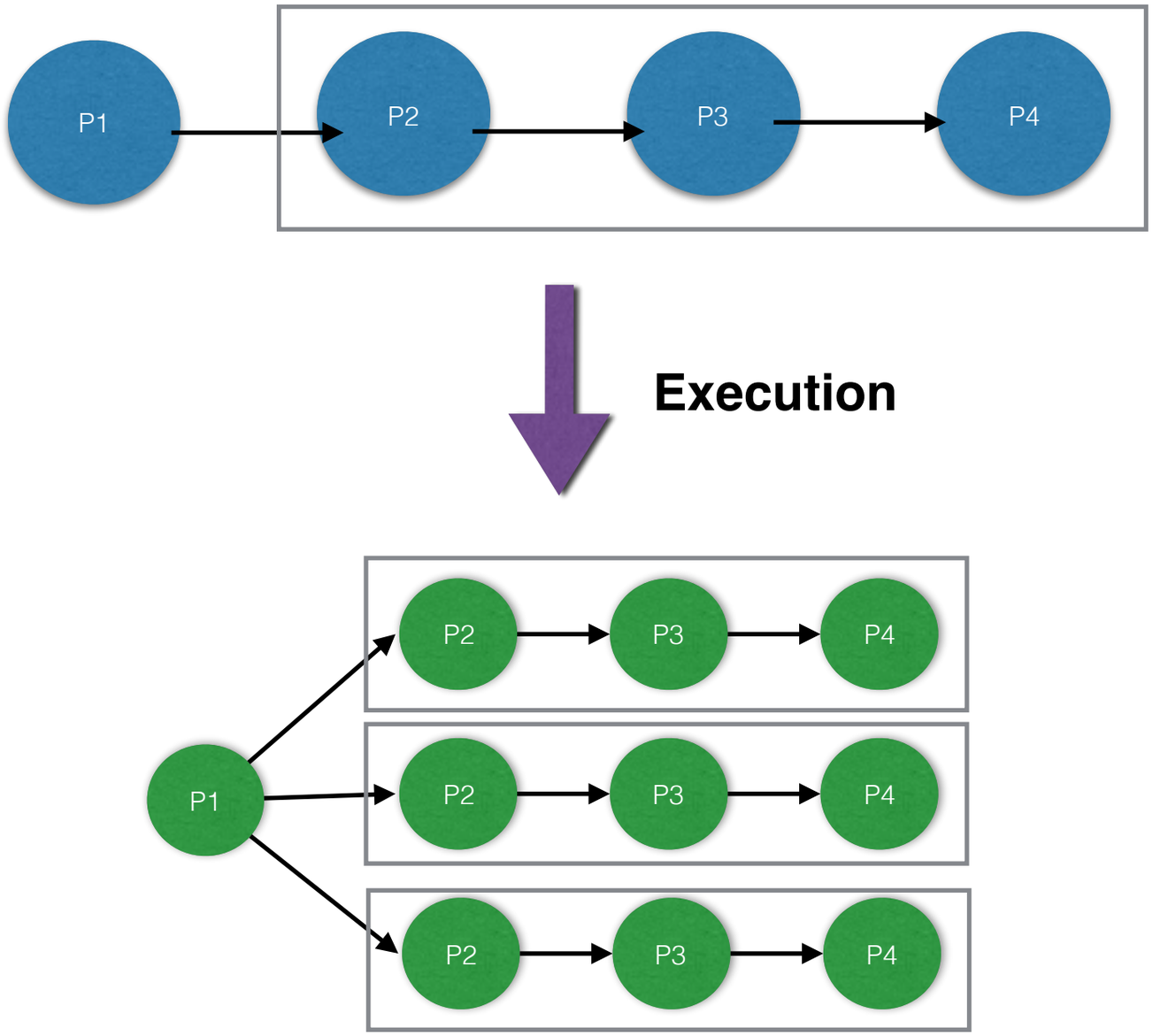
Partitions

- Run several PEs in a single process
- User defined
- Applies to parallel environments





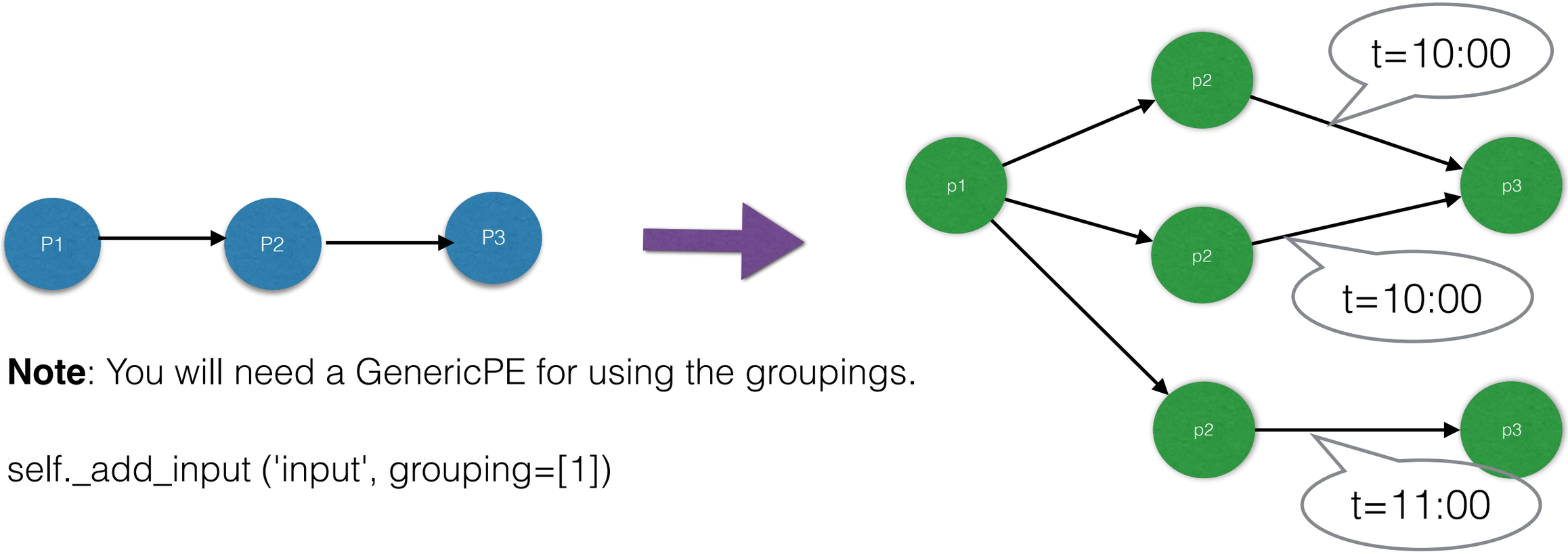
Partitioned Pipeline



Groupings

“Grouping by” a feature (MapReduce)

All data items that satisfy the same feature are guaranteed to be delivered to the same **instance** of a PE



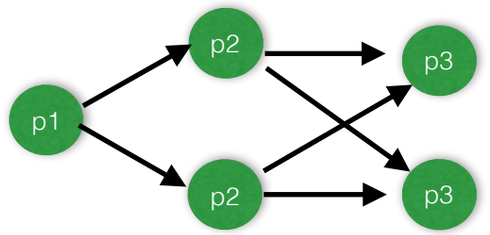
Note: You will need a GenericPE for using the groupings.

self._add_input ('input', grouping=[1])

Other groupings

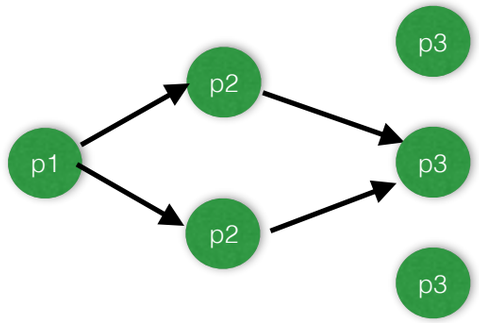
One-To-All

P3 - grouping “all”:
P2 instances send copies of their output data to **all** the connected instances



Global

P3 - grouping “global”:
All the instances of P2 send all the data to **one** instance of P3



Mappings

Simple process

- Sequential mapping for local testing

Multi process

- Parallelism based on processes, using Python's multiprocessing library
- Shared memory

MPI

- Distributed Memory, message-passing parallel programming model
- Practical, portable, efficient, flexible and stable
- Many HPC centres support it, and it has been widely used in the HPC community

STORM:

- Distributed Real-Time computation System
- Fault-tolerant and scalable

Running graphs

Sequential mapping

>> dispel4py simple <name_dispy_graph> <-f input_file in JSON format>

E.g: dispel4py simple dispel4py.examples.graph_testing.pipeline_test

Multi-process mapping

>> dispel4py multi <name_dispy_graph> -n <number mpi_processes> <-f input_file in JSON format> <-s>

E.g : dispel4py multi dispel4py.examples.graph_testing.pipeline_test -n 6

MPI mapping

>> mpiexec -n <number mpi_processes> dispel4py mpi <name_dispy_graph> <-f input_file in JSON format> <-s>

E.g : mpiexec -n 6 dispel4py mpi dispel4py.examples.graph_testing.pipeline_test

STORM mapping

>> python storm_submission.py <name_dispy_graph> <-m mode: [remote, local, create]>

E.g : dispel4py storm dispel4py.examples.graph_testing.pipeline_test -m remote

Extra useful dispel4py information

- dispel4py commands:
  - dispel4py -h
  - -h, --help show this help message and exit
  - -a attribute, --attr attribute >> name of graph variable in the module
  - -f inputfile, --file inputfile >> file containing input dataset in JSON format
  - -d inputdata, --data inputdata >> input dataset in JSON format
  - -i iterations, --iter iterations >> number of iterations

Extra useful dispel4py information

- inputs to the workflow:
  - dispel4py simple workflow.py -d ‘{“PE NAME CLASS" : [{"input" : “Hello World World”}]}’
  - dispel4py simple workflow.py -d ‘{"PE NAME CLASS" : [{"input" : "coordinates.txt"}]}’
  - dispel4py simple workflow.py -f coordinates.txt

Thanks!