61A Lecture 36

Wednesday, November 30

Project 4 Contest Gallery

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(Demo)

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Bonus Material

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The big ideas that underly MapReduce:

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- Pure functions enable an abstraction barrier between data processing logic and distributed system administration

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Hide *complexity*, but retain *flexibility*

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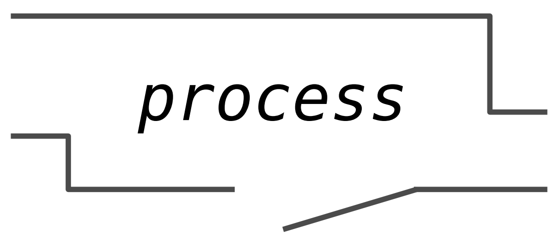

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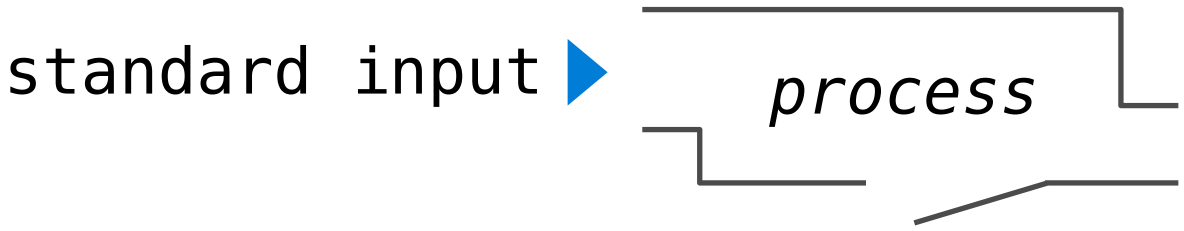

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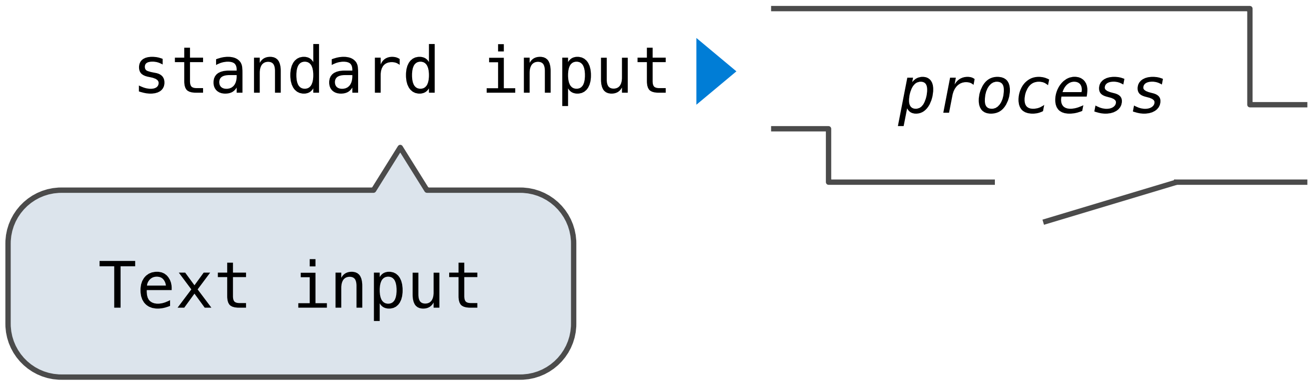

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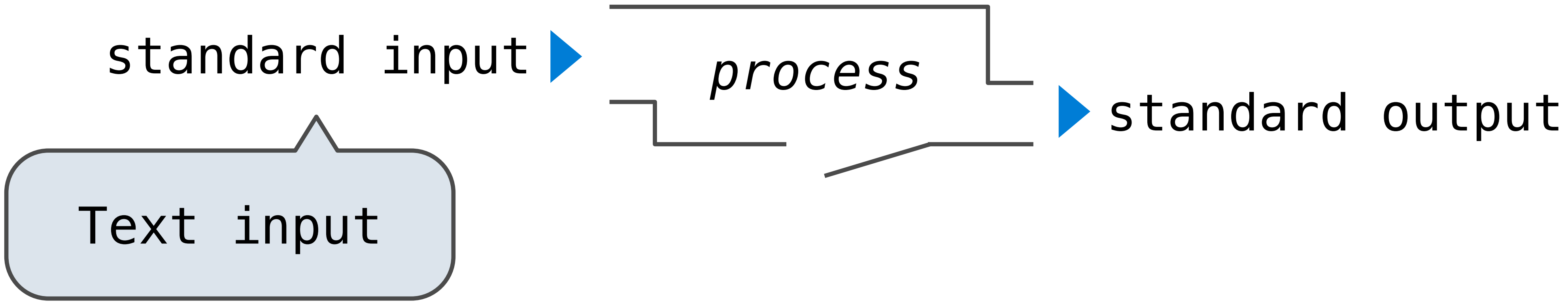

standard input

process

standard output

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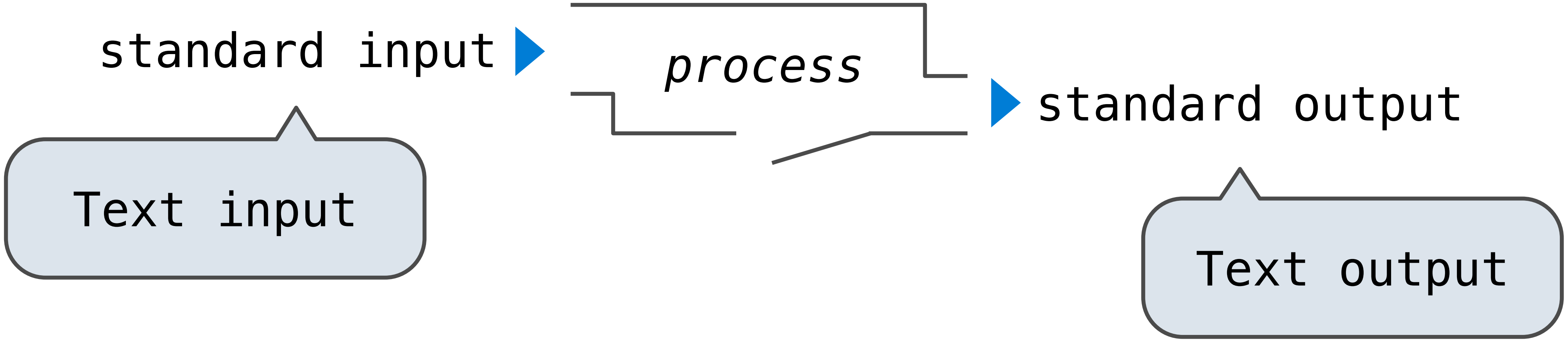

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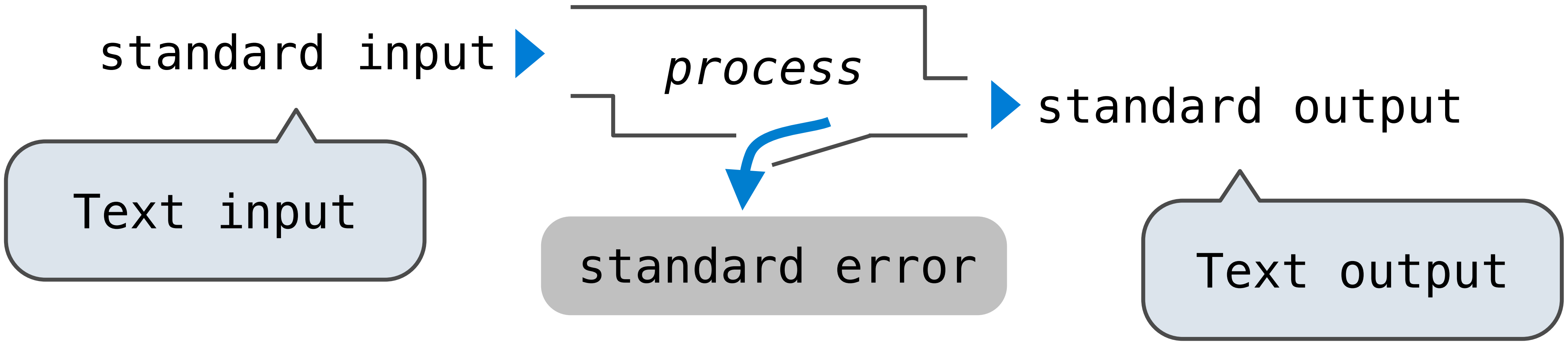

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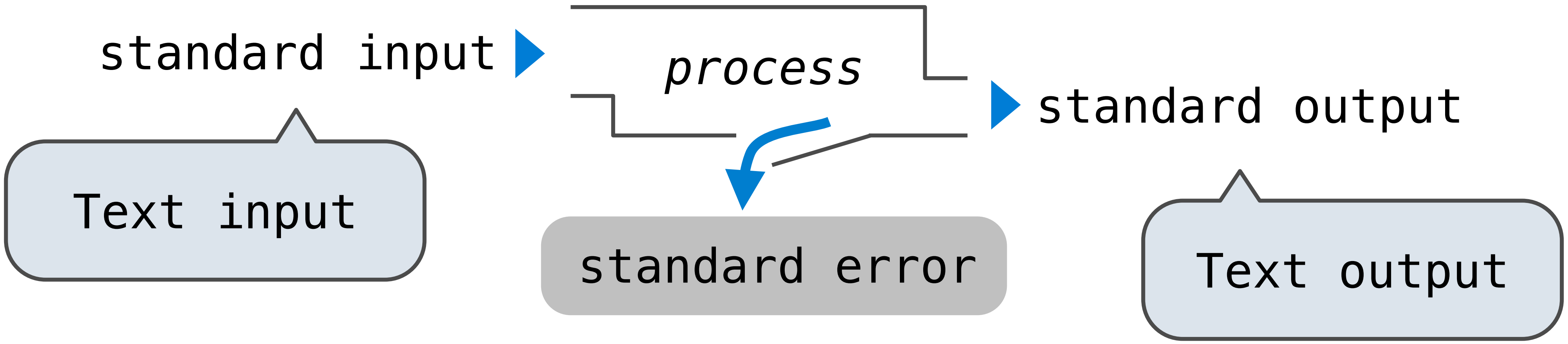

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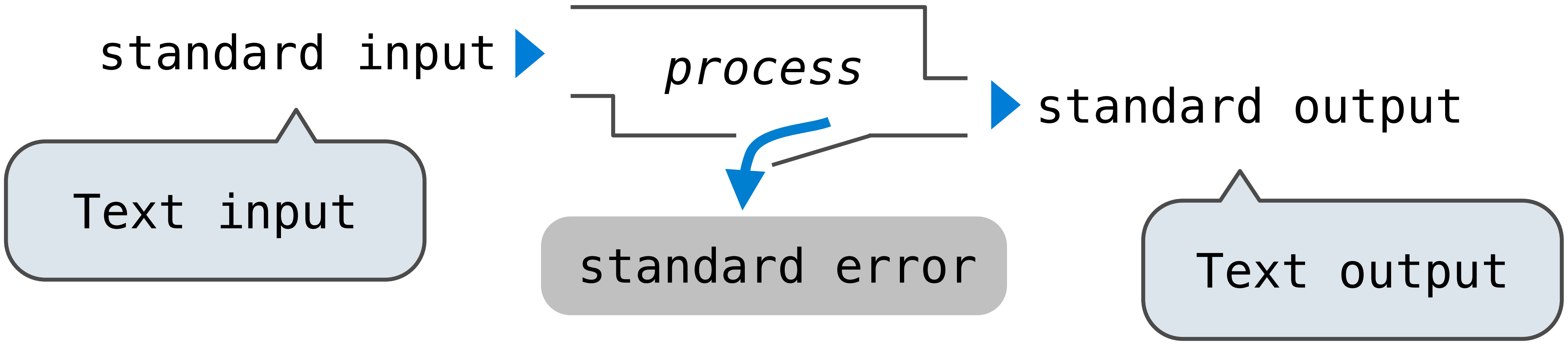

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Is a Big Data framework
For batch processing

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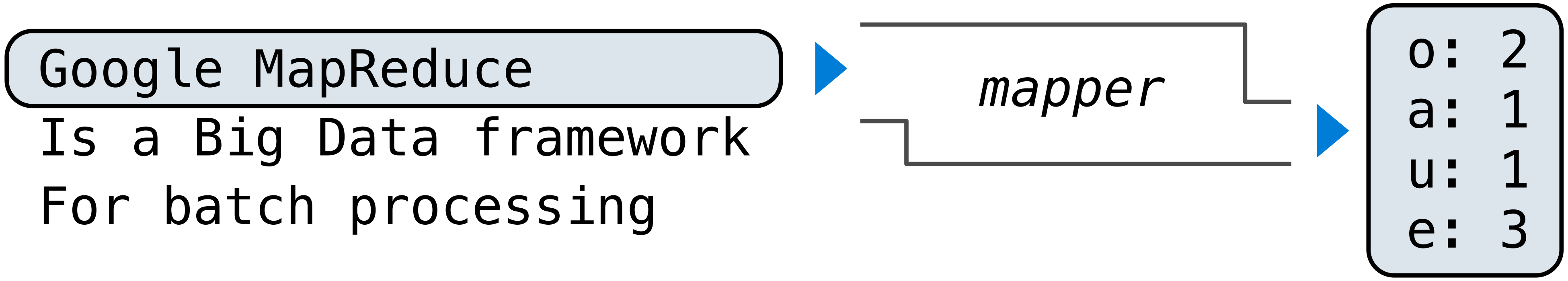

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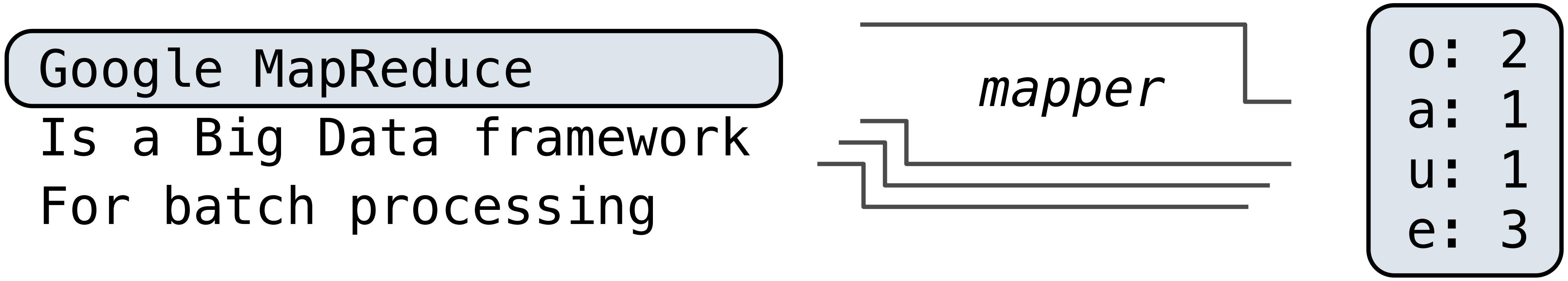

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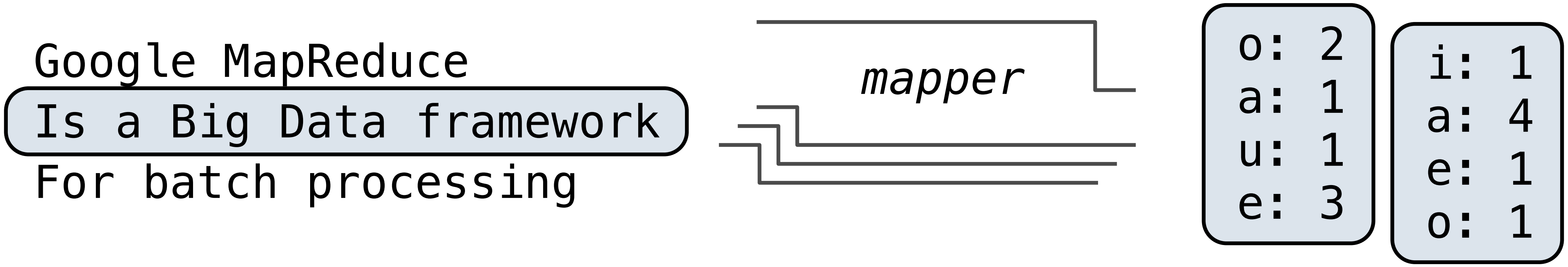

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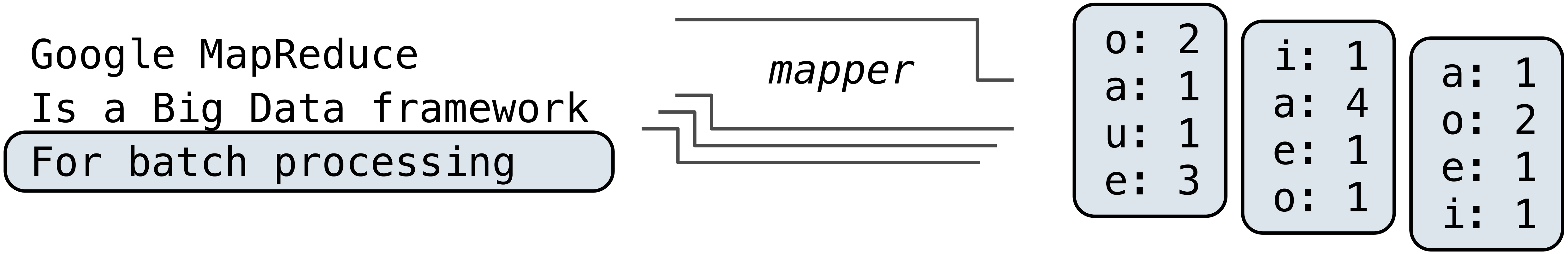

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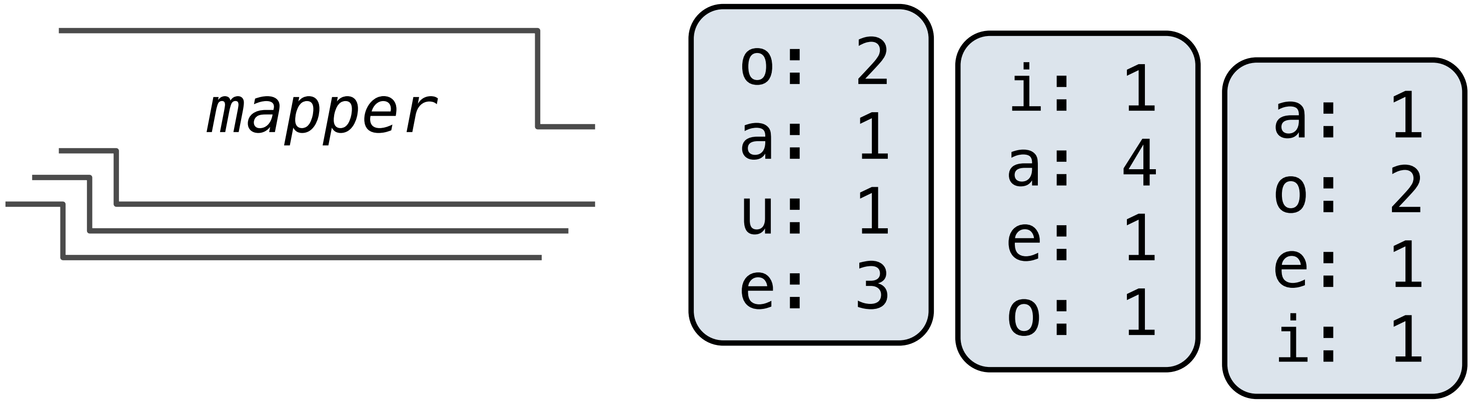

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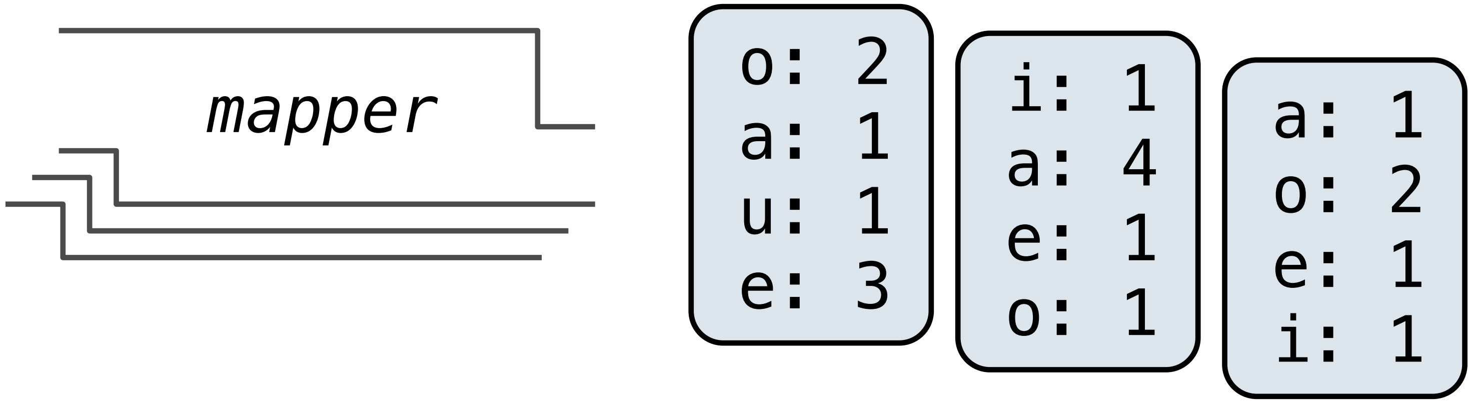

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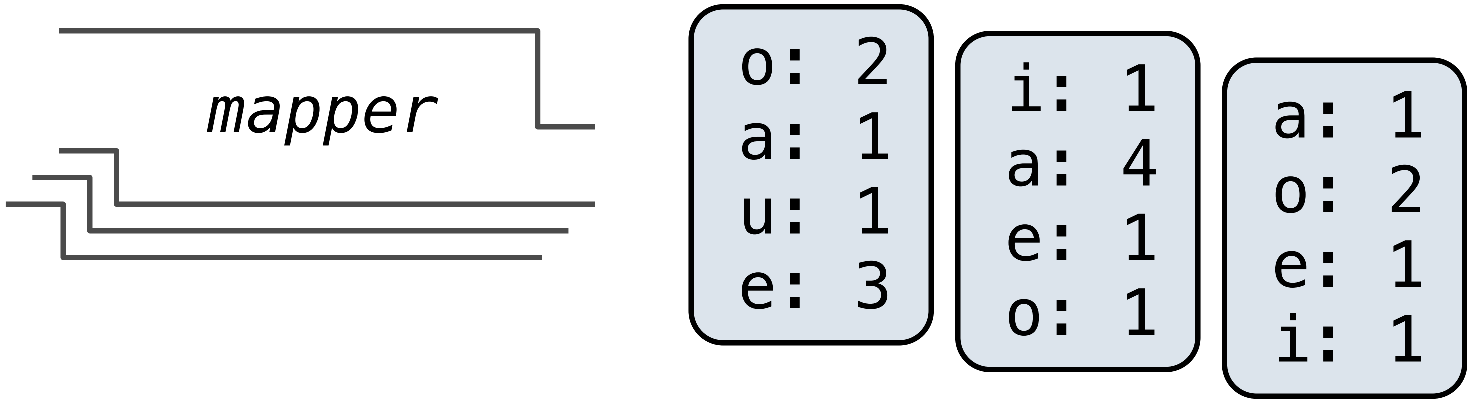

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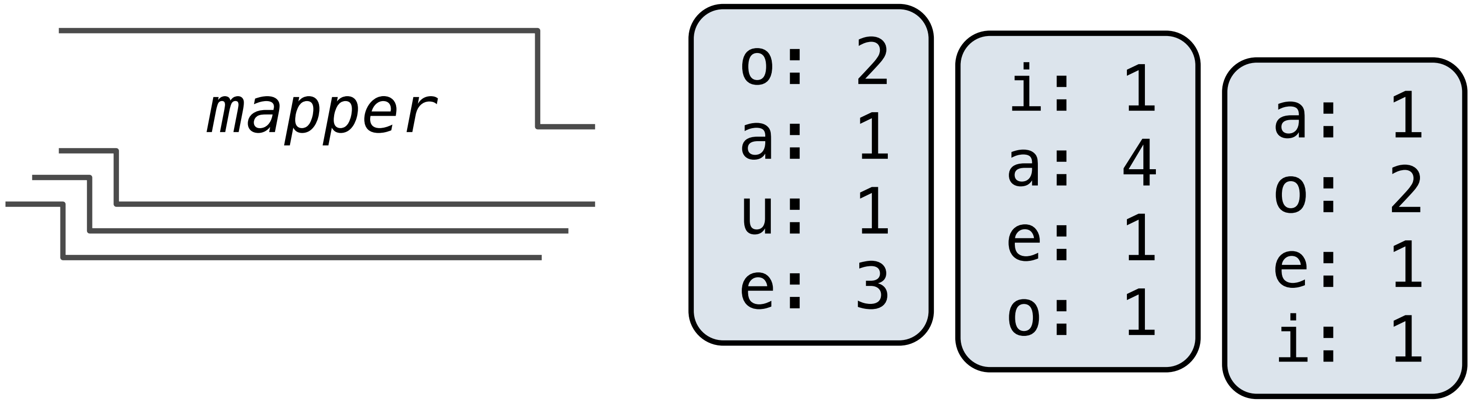

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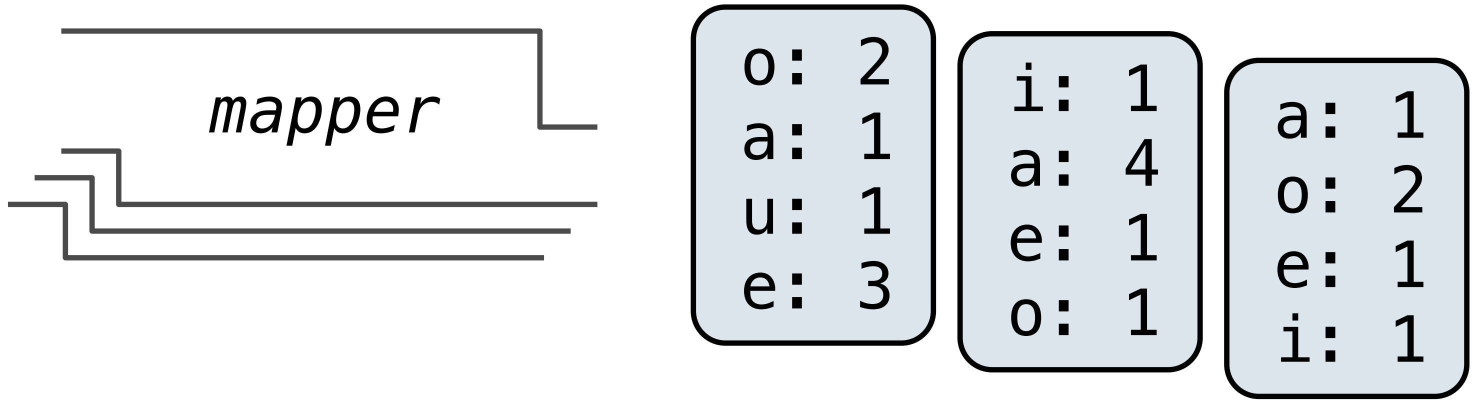

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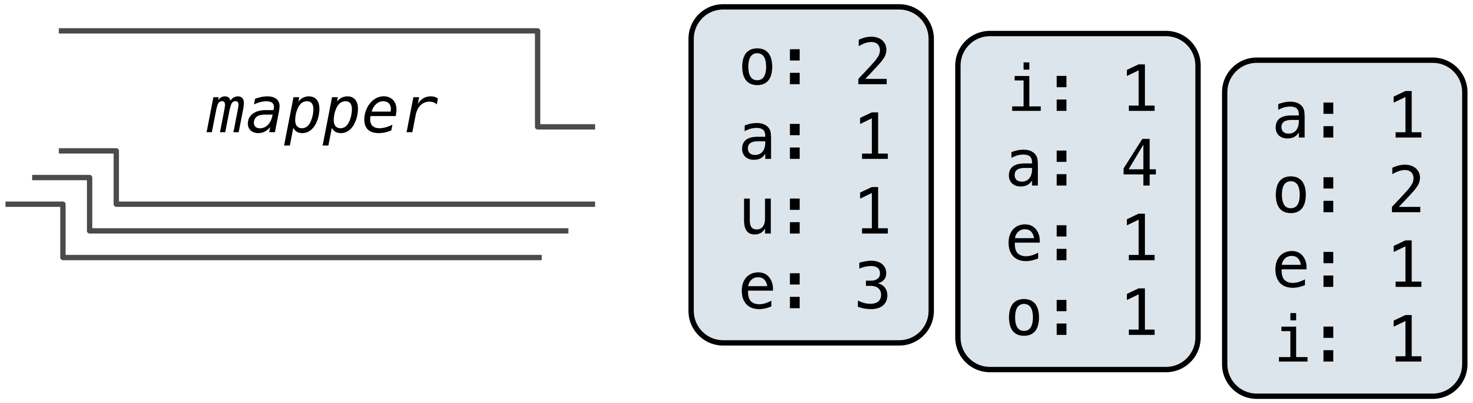

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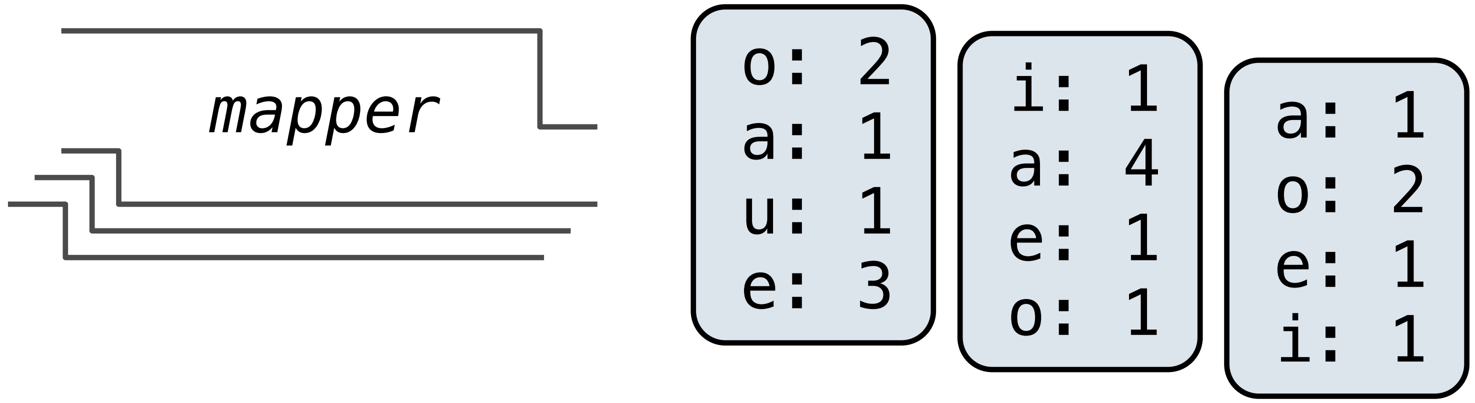

mapper

```
o: 2
a: 1
u: 1
e: 3
```

```
i: 1
a: 4
e: 1
o: 1
```

```
a: 1
o: 2
e: 1
i: 1
```

Reduce phase: For each intermediate key, apply a *reducer* function to accumulate all values associated with that key

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- All pairs with a given key are consecutive
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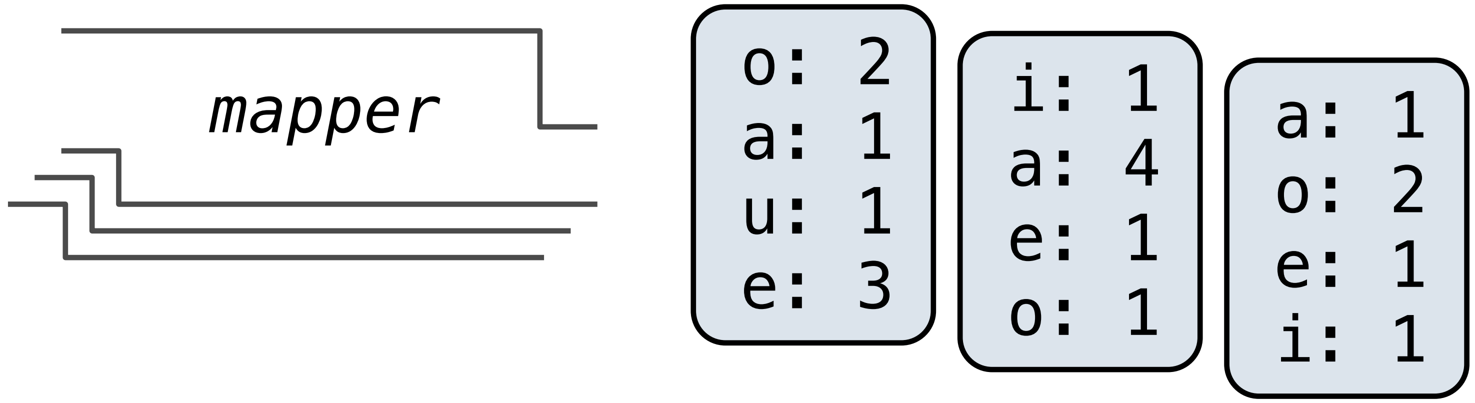
```
a: 4
a: 1
a: 1
e: 1
e: 3
e: 1
...
```

MapReduce Evaluation Model

Google MapReduce
Is a Big Data framework
For batch processing



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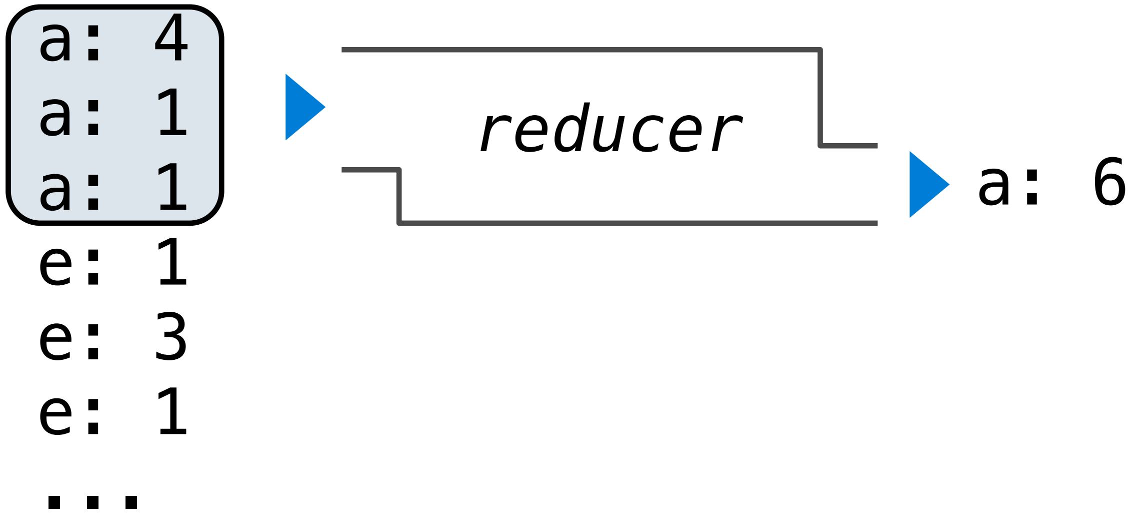

a: 4
a: 1
a: 1
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reducer

a: 6

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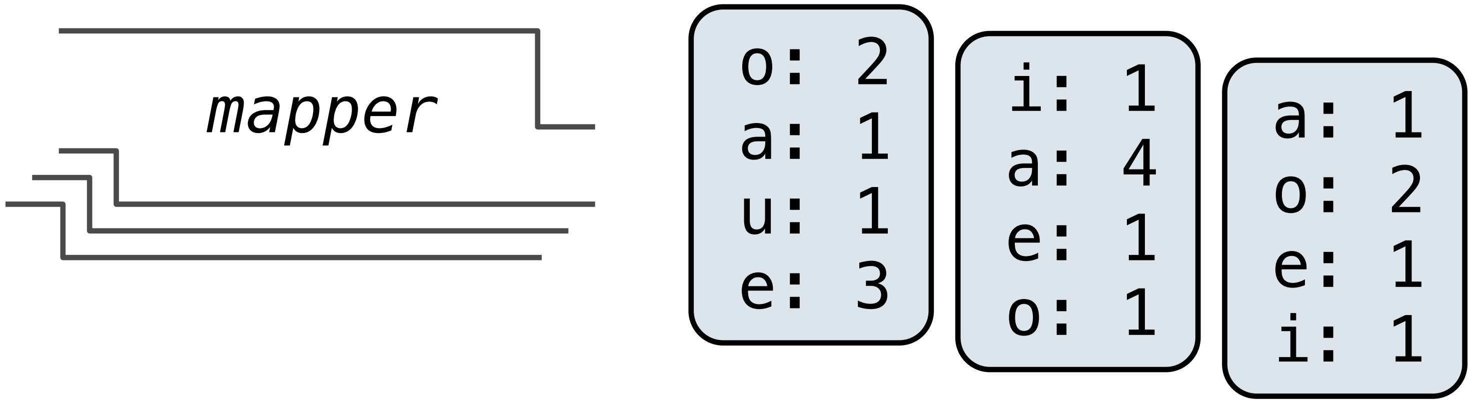

mapper

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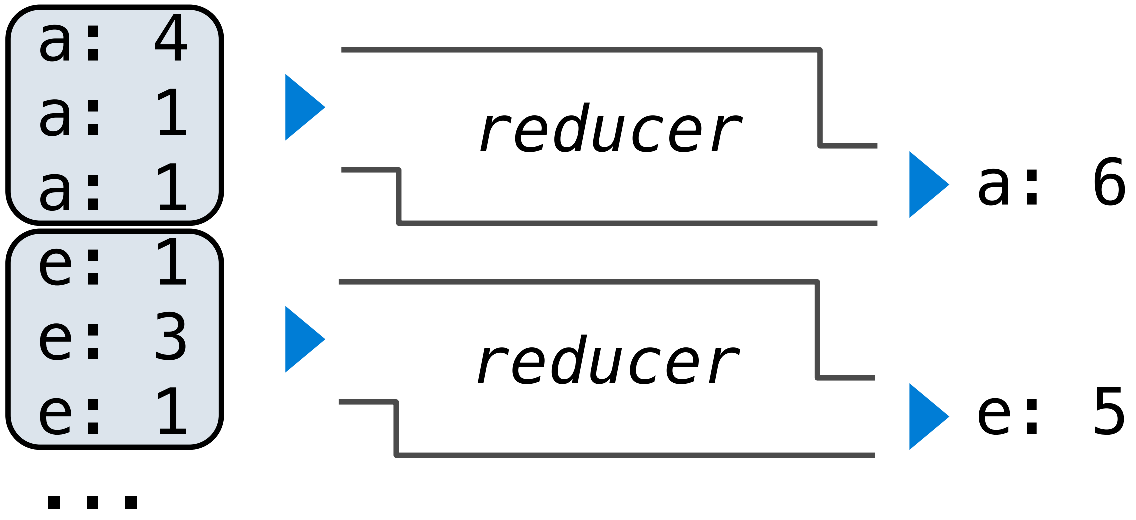

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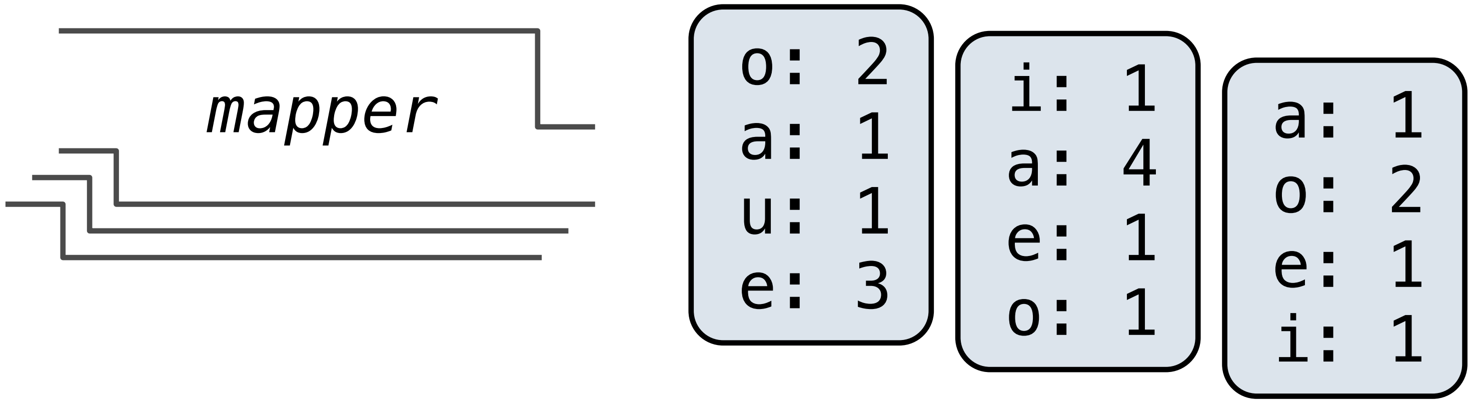

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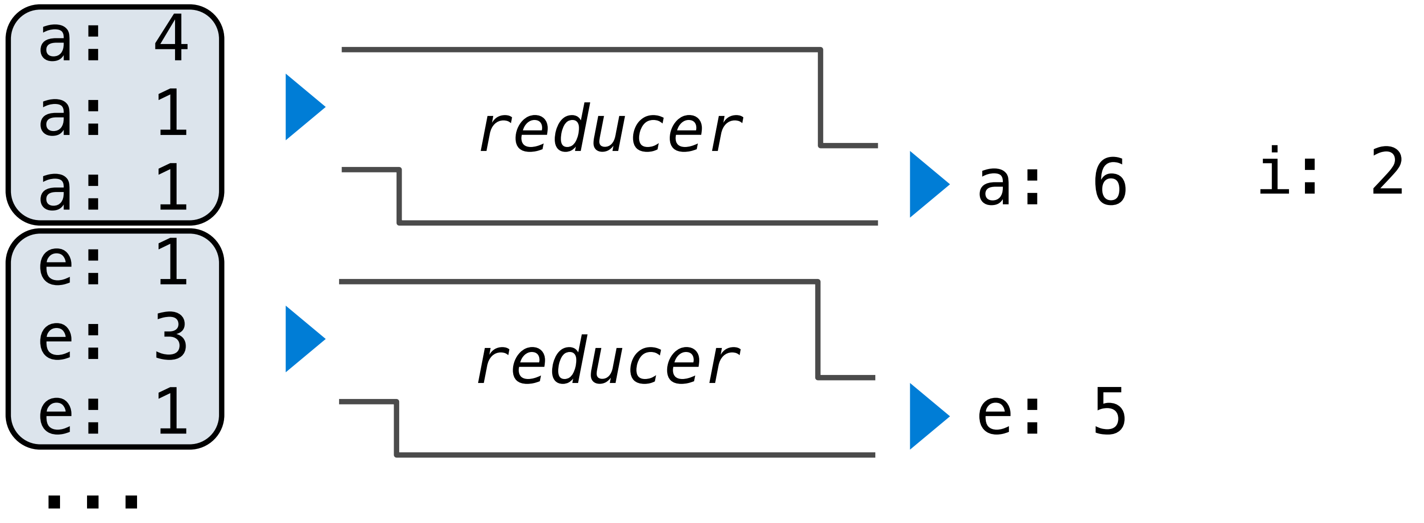

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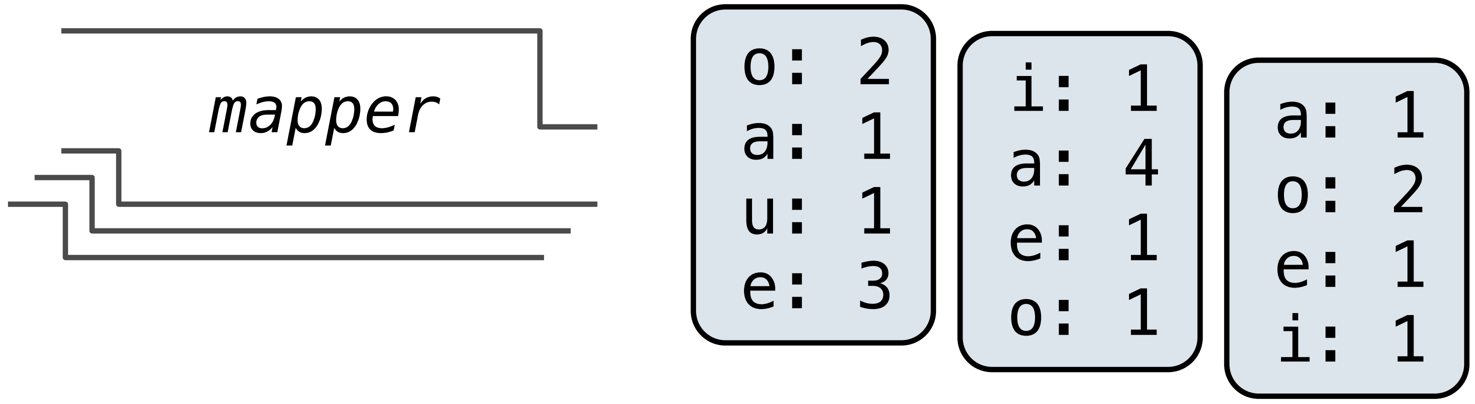

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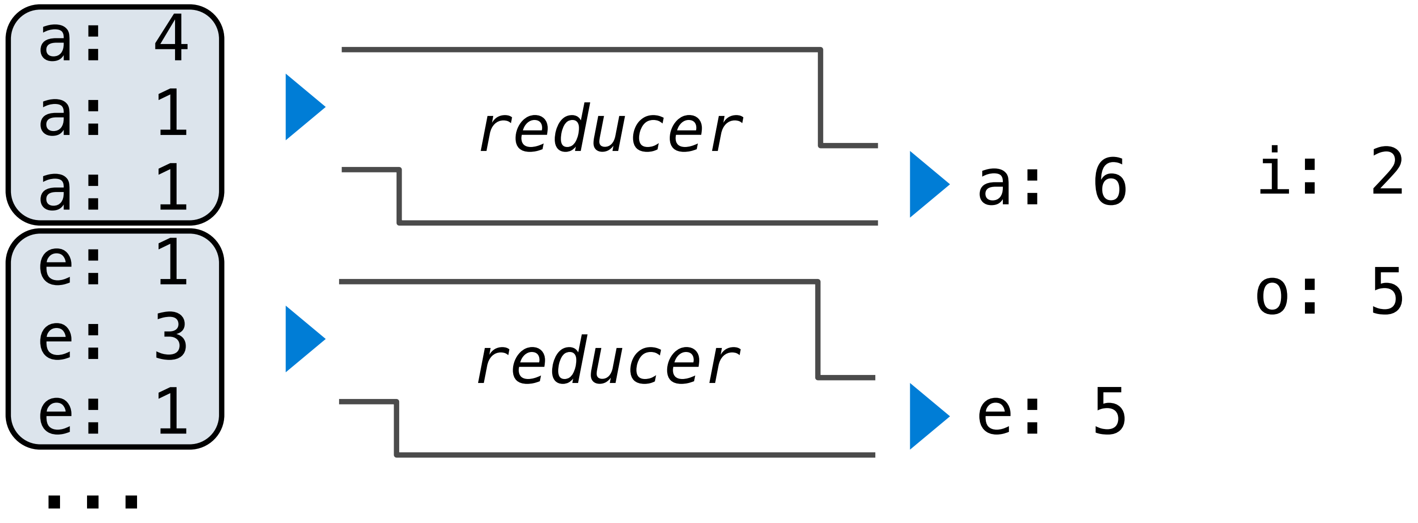

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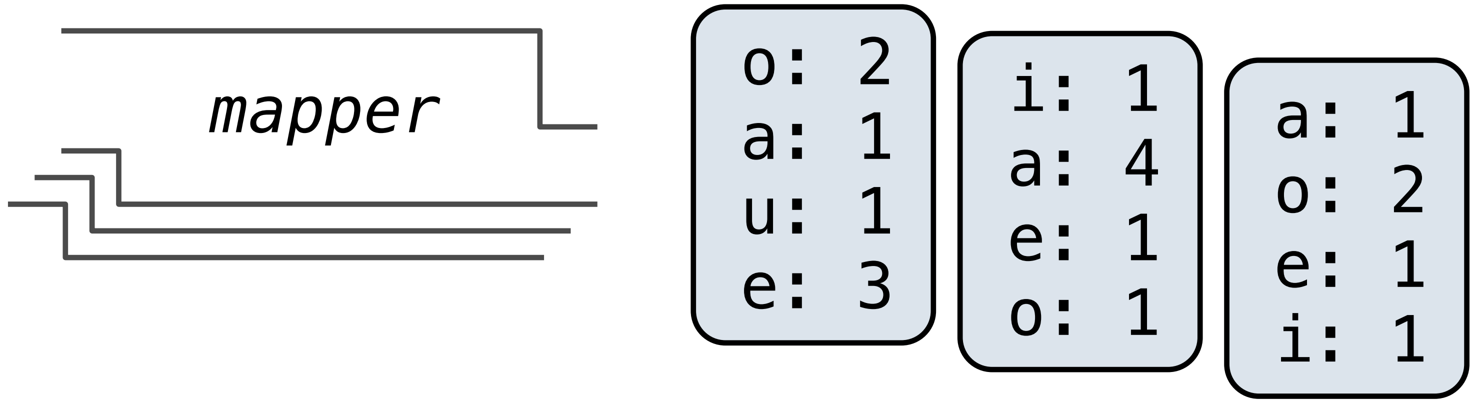

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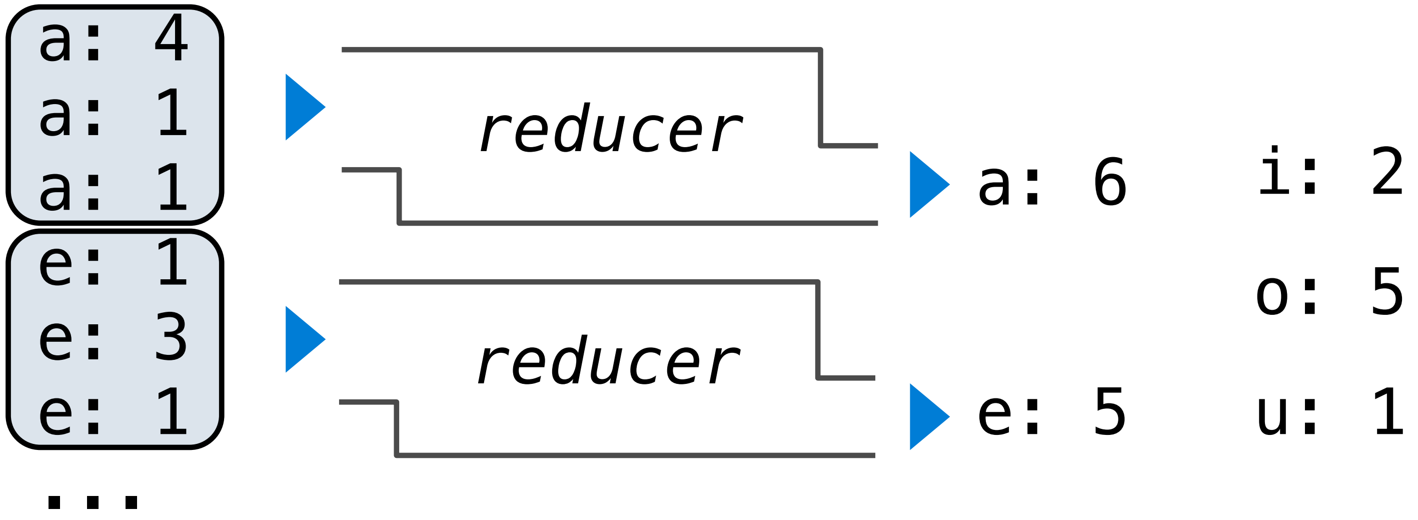
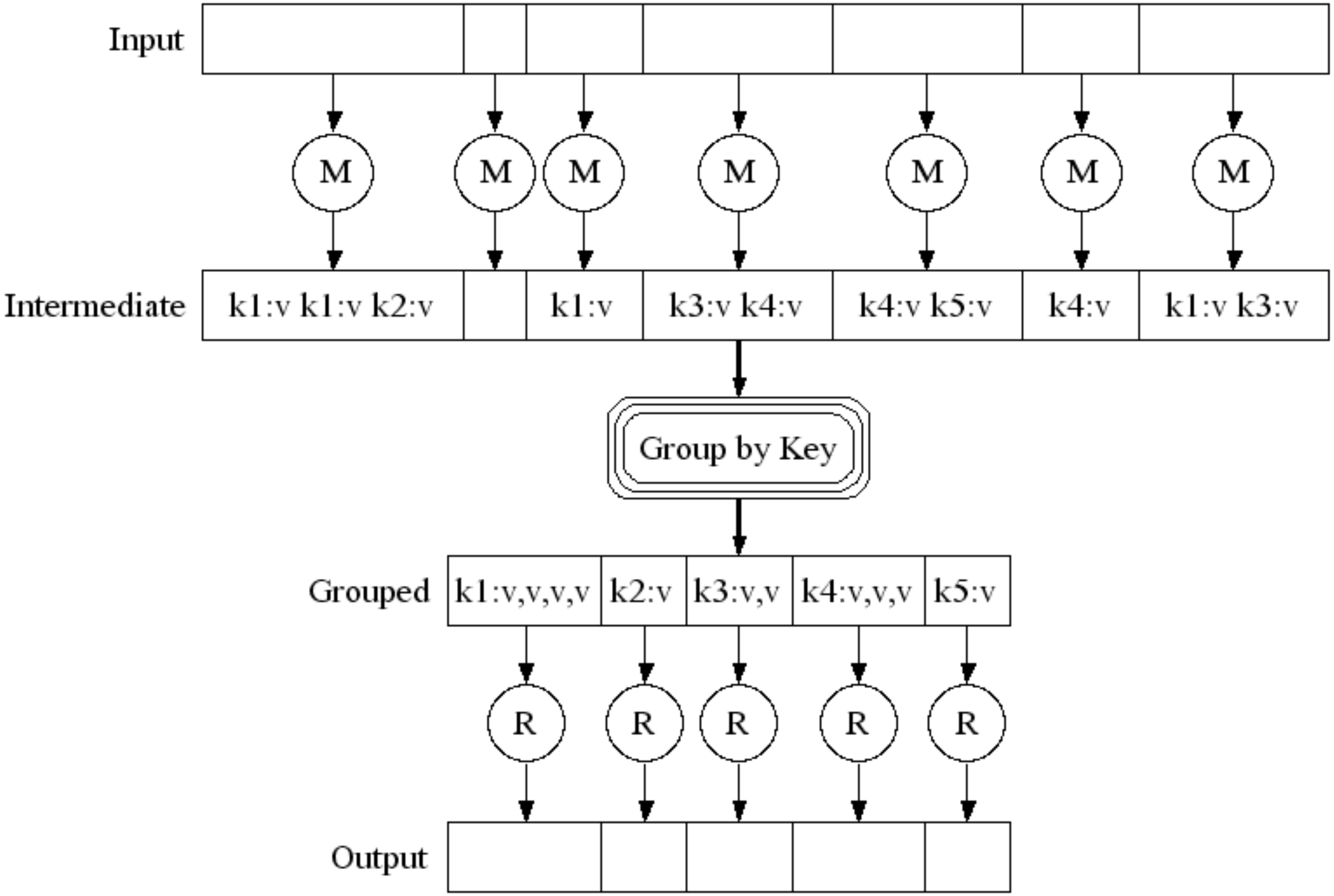
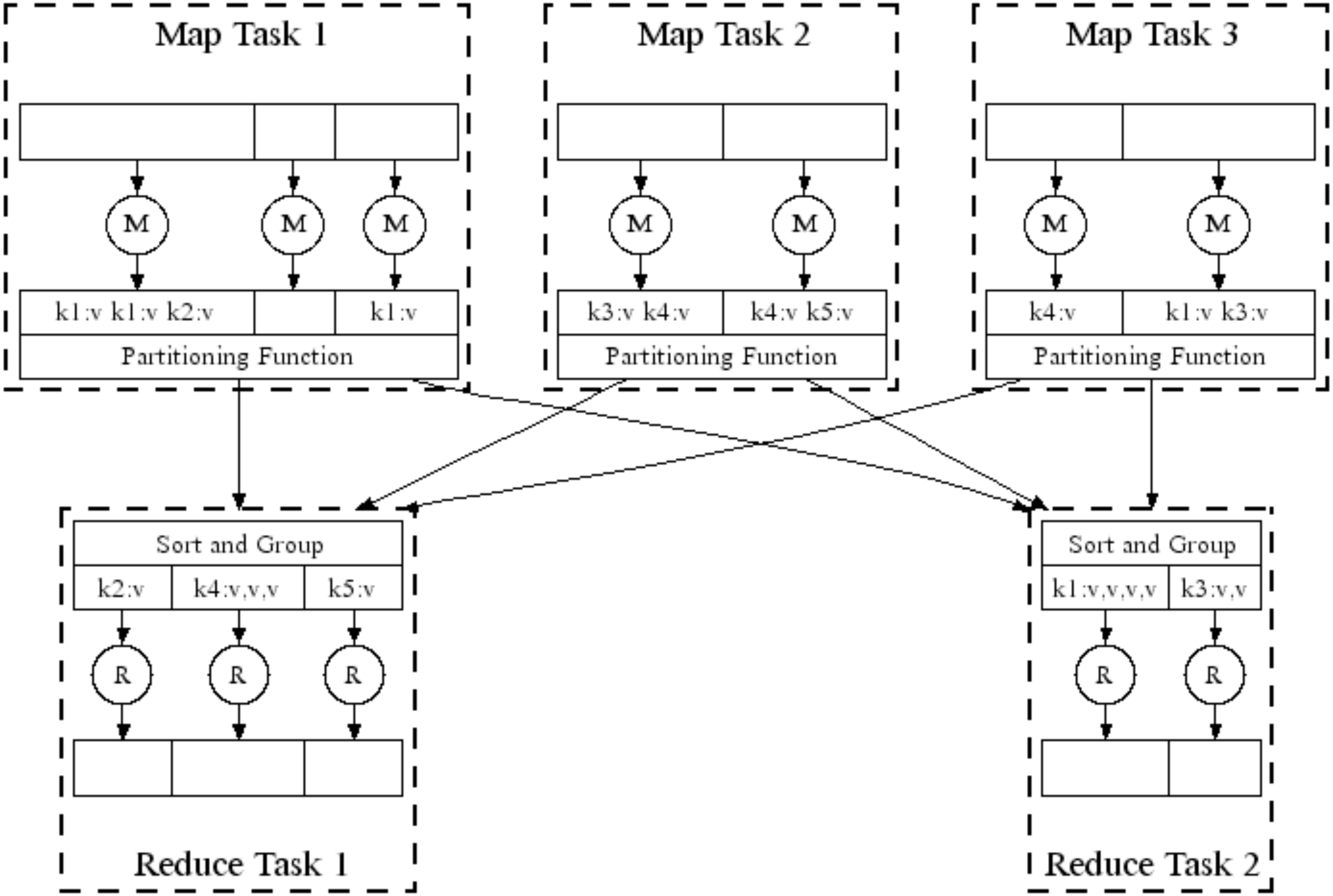


Above-the-Line: Execution model



http://research.google.com/archive/mapreduce-osdi04-slides/index-auto-0007.html

Below-the-Line: Parallel Execution



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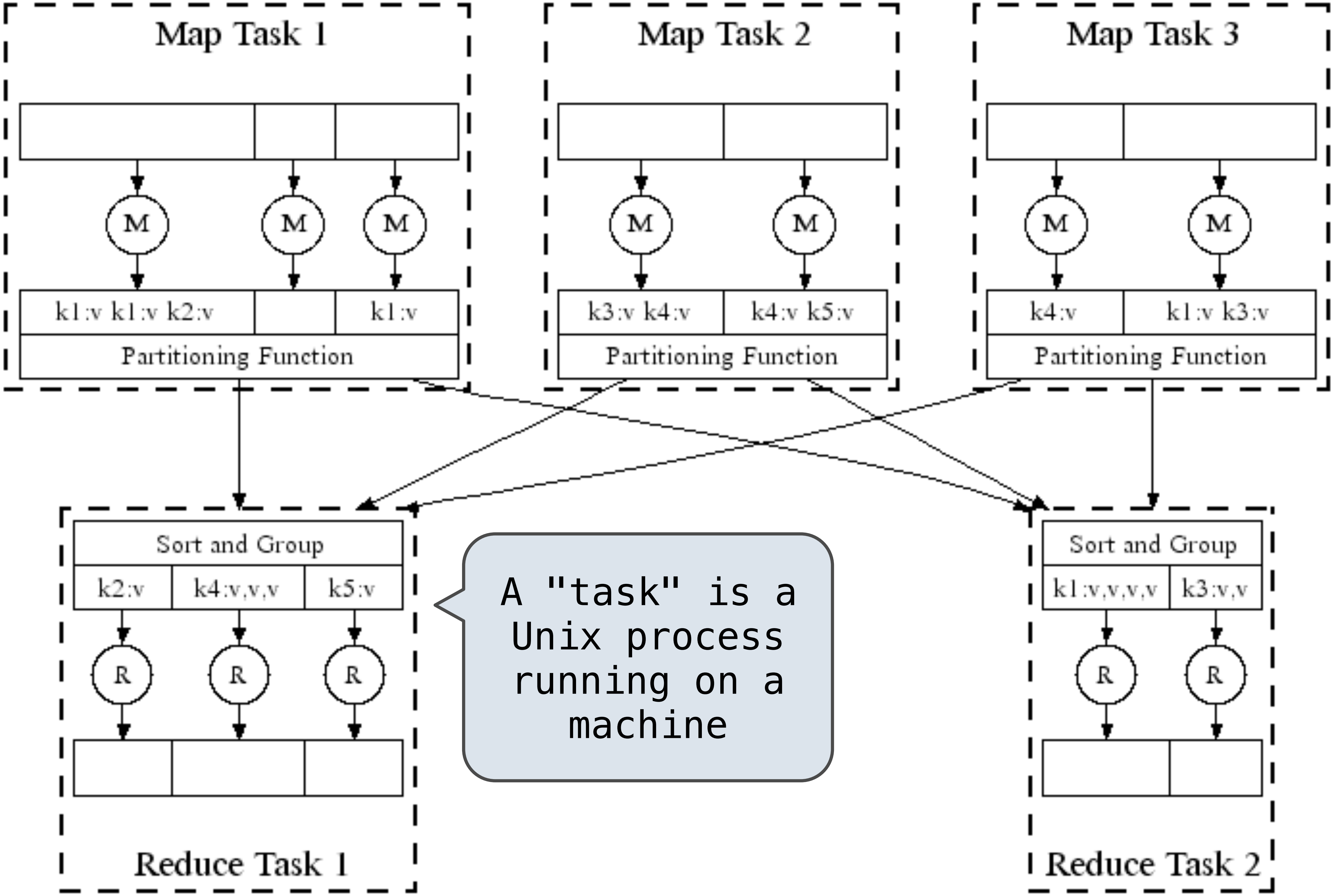

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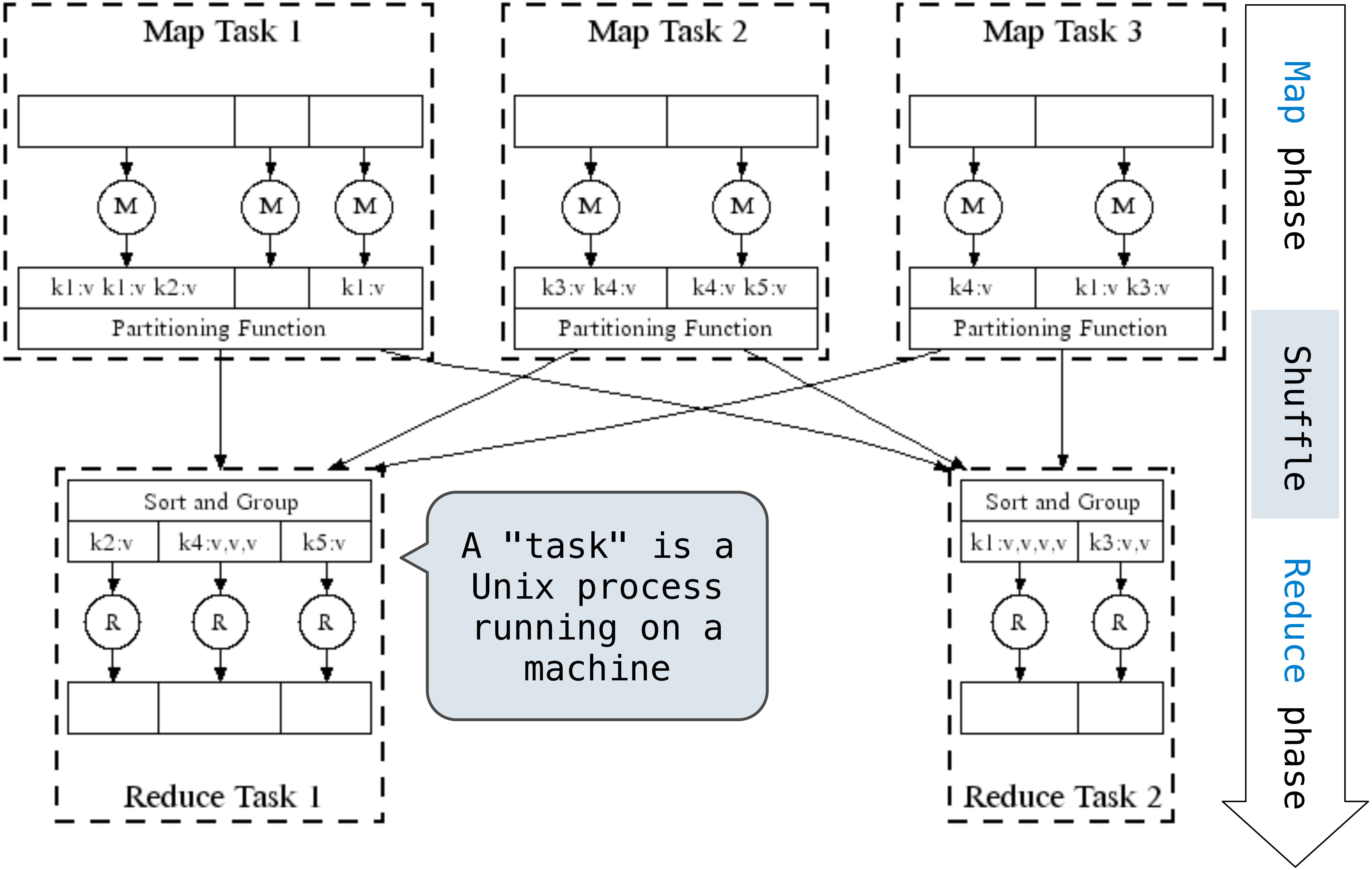

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@main
def run():
    for line in sys.stdin:
        emit_vowels(line)
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Mapper inputs are lines of text provided to standard input

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Reducer

```
#!/usr/bin/env python3

import sys
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from mr import emit, values_by_key
```

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Takes and returns iterators

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Output: Iterator over (key, value_iterator) pairs that give all values for each key

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Reducer

```
#!/usr/bin/env python3

import sys
from ucb import main
from mr import emit, values_by_key

@main
def run():
    for key, value_iterator in values_by_key(sys.stdin):
        emit(key, sum(value_iterator))
```

Takes and returns iterators

Input: lines of text representing key-value pairs, grouped by key

Output: Iterator over (key, value_iterator) pairs that give all values for each key

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- The framework provides a web-based interface describing jobs.