MODERN SOFTWARE ARCHITECTURE

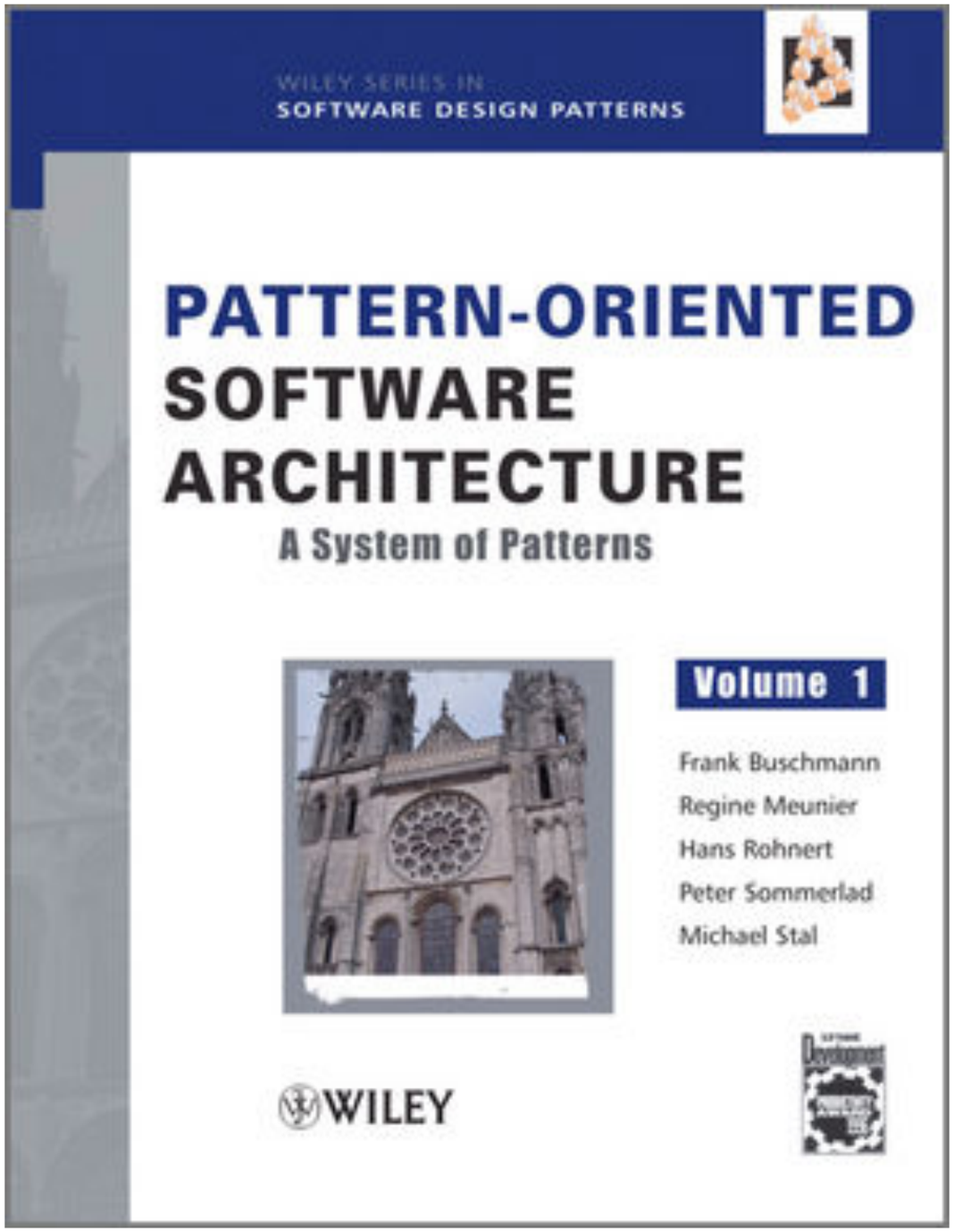
STYLES AND PATTERNS

“an architectural style is a co-ordinated set of architectural constraints that restricts the roles/ features of architectural elements and the allowed relationships among those elements within any architecture that conforms to that style”

– Roy Fielding

R.T.Fielding “Architectural styles and the design of network-based software architectures. PhD thesis, University of California, 2000.

POSA - before and after



Peer-to-Peer

Layered

Blackboard

Client-Server

Pipe-and-Filter

Broker

```
$ cat limerick.txt
There was a young lady of Niger
Who smiled as she rode on a tiger.
They returned from the ride
With the lady inside
And a smile on the face of the tiger.
```

```
$ cat limerick.txt | tr -cs "[:alpha:]" "\n" | awk '{print length(), $0}'  | sort | uniq
1 a
2 as
2 of
2 on
3 And
3 Who
3 she
3 the
3 was
4 They
4 With
4 face
4 from
4 lady
4 ride
4 rode
5 Niger
5 There
5 smile
5 tiger
5 young
6 inside
6 smiled
8 returned
```

```
List<String> lines
      = Files.readAllLines(Paths.get("./limerick.txt"), Charset.defaultCharset());
Map<Integer, List<String>> wordGroups
     = lines.stream()
          .map(line -> line.replaceAll("\\W", "\n").split("\n"))
          .flatMap(Arrays::stream)
          .sorted()
          .distinct()
          .collect(Collectors.groupingBy(String::length));

wordGroups.forEach( (count, words) -> {
    words.forEach(word -> System.out.printf("%d %s %n", count, word));
});
```

```
1 a
2 as
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6 inside
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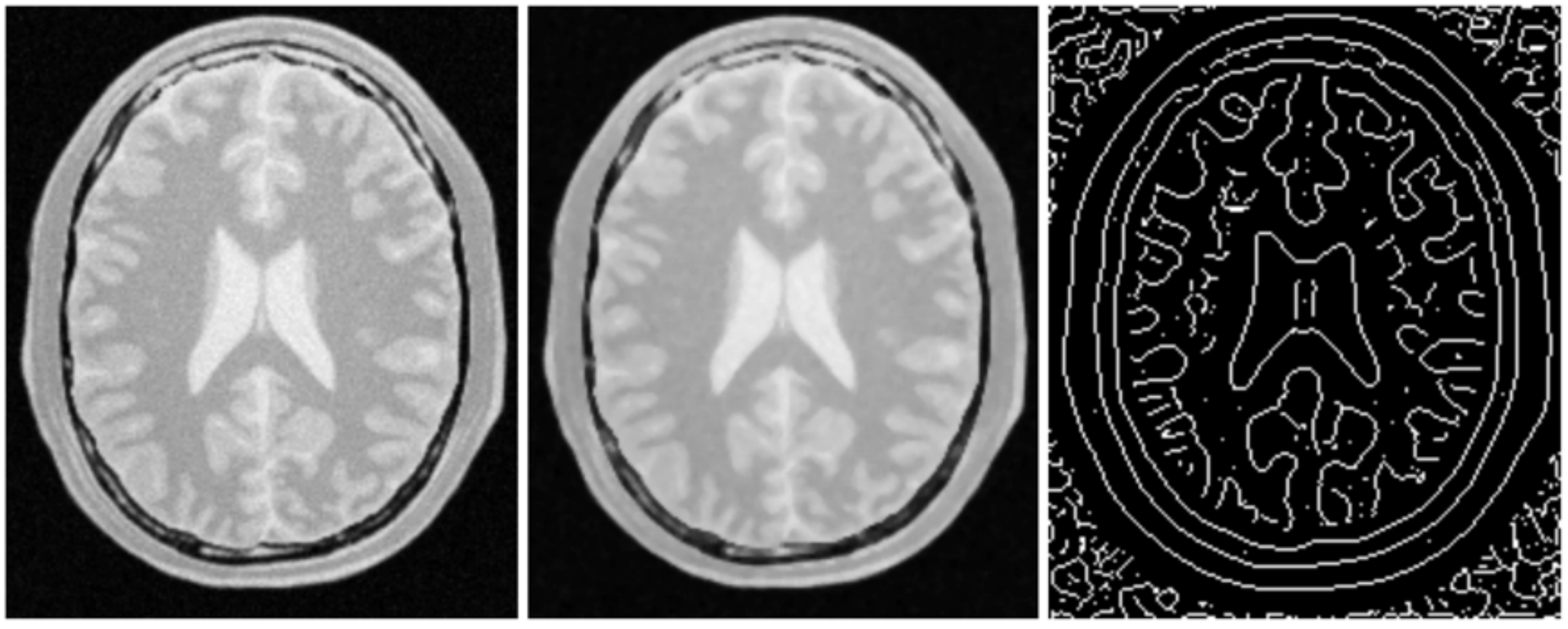
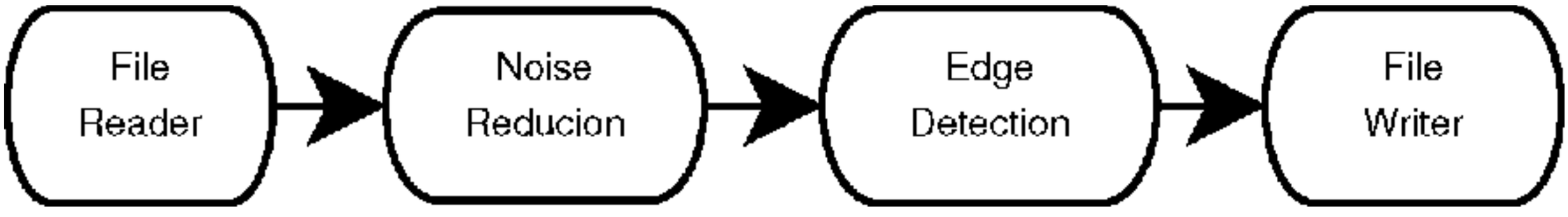
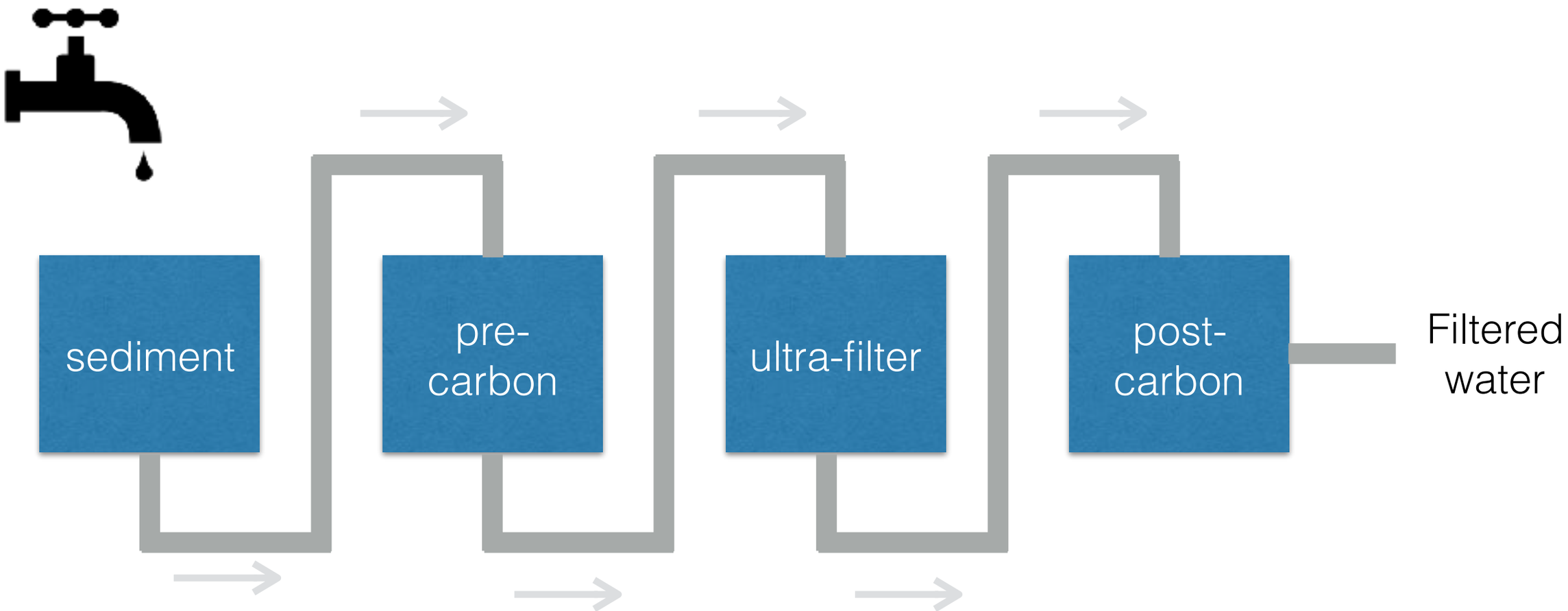
```

What architectural style is this?





Real-world pipes-and-filters



Pipe-and-filter: Benefits

+ Flexibility by filter exchange

+ Flexibility by recombination

+ Reuse of filter components

+ Rapid prototyping of pipelines

Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, and Michael Stal. 1996. *Pattern-Oriented Software Architecture: A System of Patterns*. John Wiley & Sons, Inc., NY, USA.

Pipe-and-filter: Liabilities

- Sharing state information is expensive or inflexible

- Efficiency gain by parallel processing is often an illusion

- Data transformation overhead

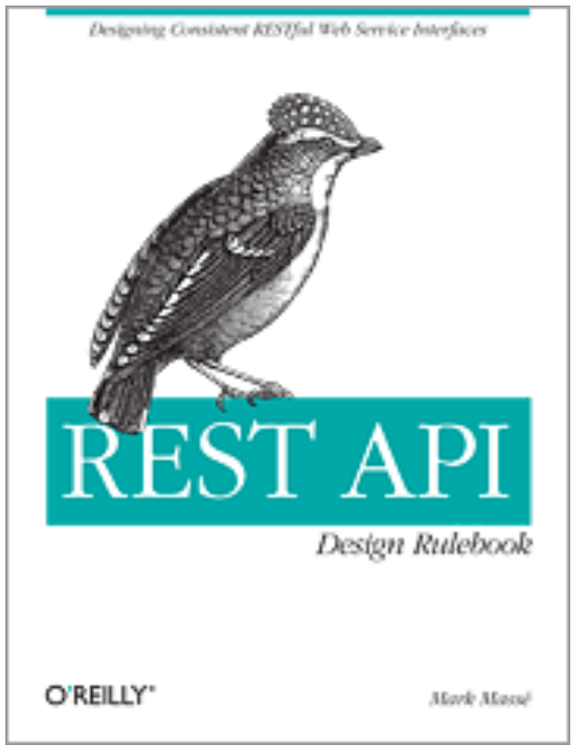
- Difficult to handle errors

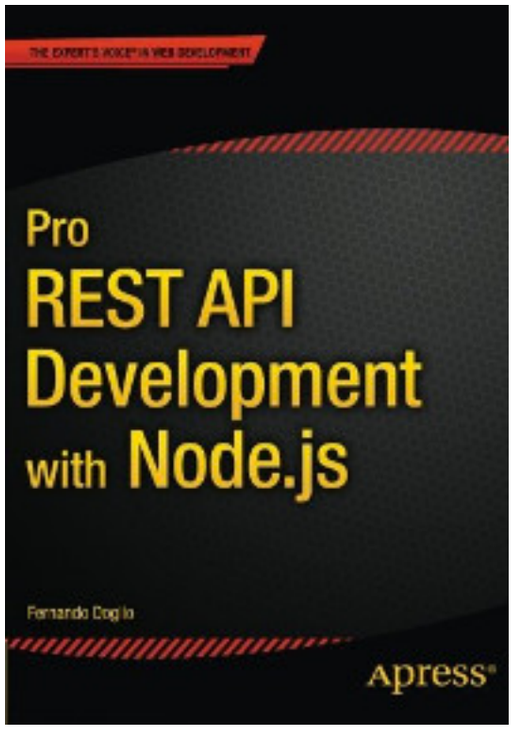
Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, and Michael Stal. 1996. *Pattern-Oriented Software Architecture: A System of Patterns*. John Wiley & Sons, Inc., NY, USA.

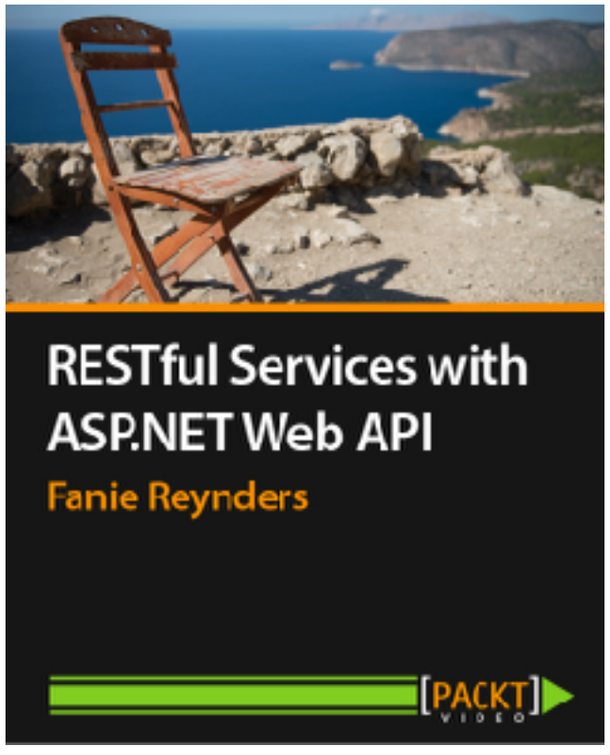
What is the architecture style followed by World Wide Web (WWW)?


Web Services for the Real World
RESTful
Web Services
O'REILLY


Solutions for Improving Scalability and Simplicity
RESTful
Web Services
Cookbook
O'REILLY
YAHOO! PRESS

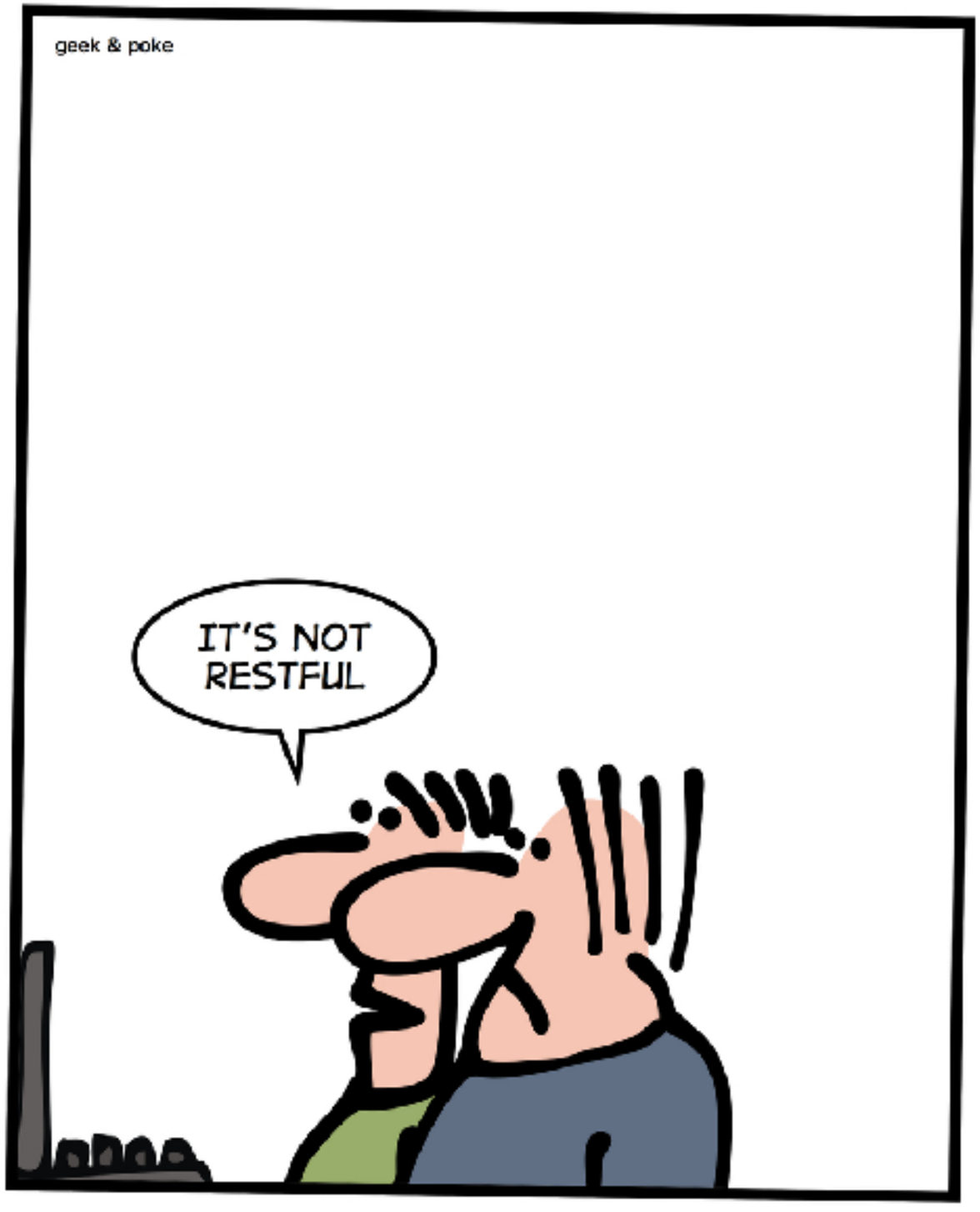

Designing Consistent RESTful Web Service Interfaces
REST API
Design Rulebook
O'REILLY
Mark Massé


Pro
REST API
Development
with Node.js
Fernando Doglio
Apress


RESTful Services with
ASP.NET Web API
Fanie Reynders
[PACKT]
VIDEO


Community Experience Distilled
RESTful Web Services
with Scala
Learn the art of creating scalable RESTful web services
with Scala
Jos Dirksen
[PACKT]

HOW TO INSULT A DEVELOPER



Map-Reduce

Lambda Style

CQRS (Command-Query Responsibility Segregation)

SOA (Service Oriented Architecture)

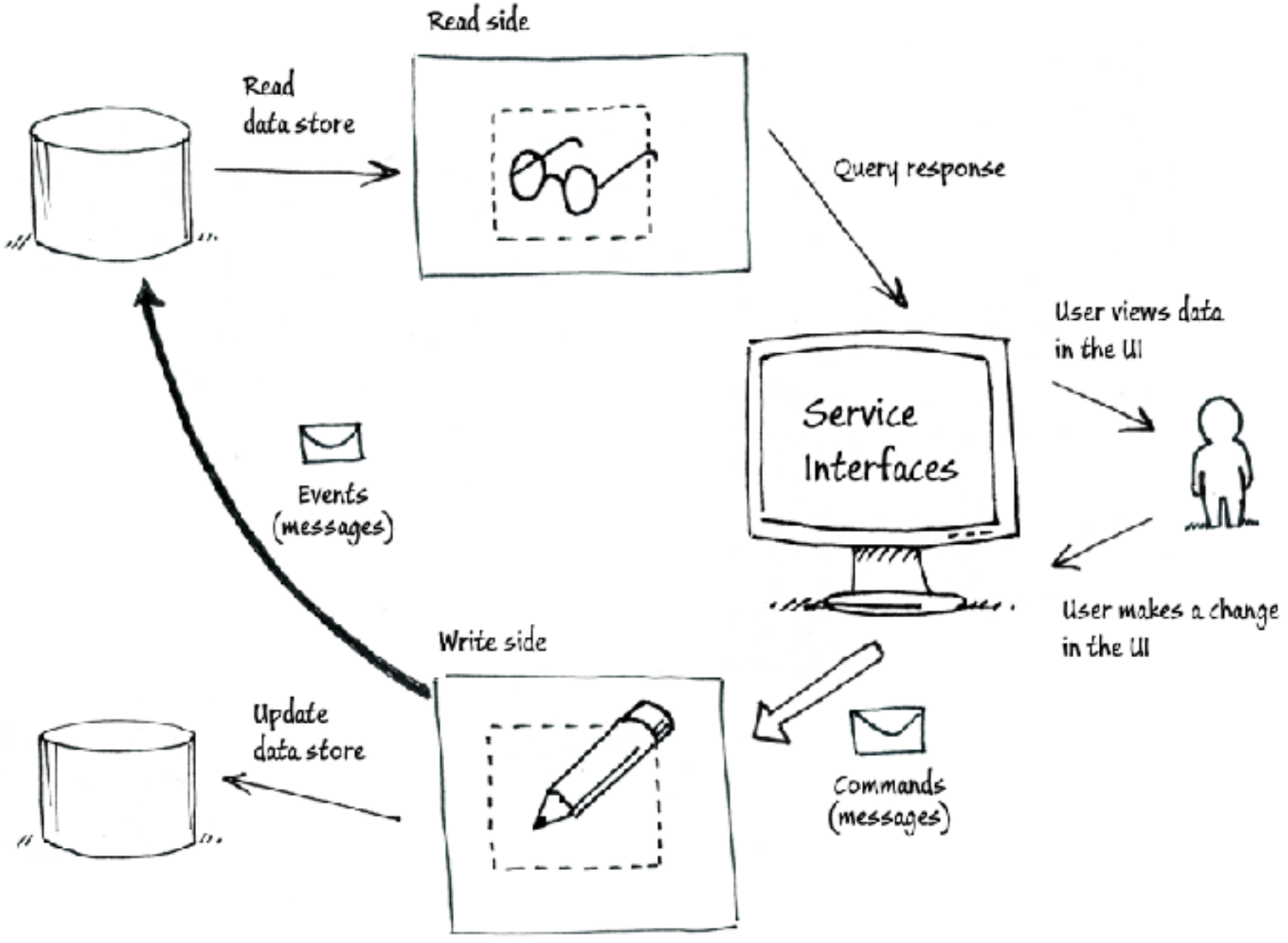
Software Containers

REST (Representational State Transfer)

Microservices

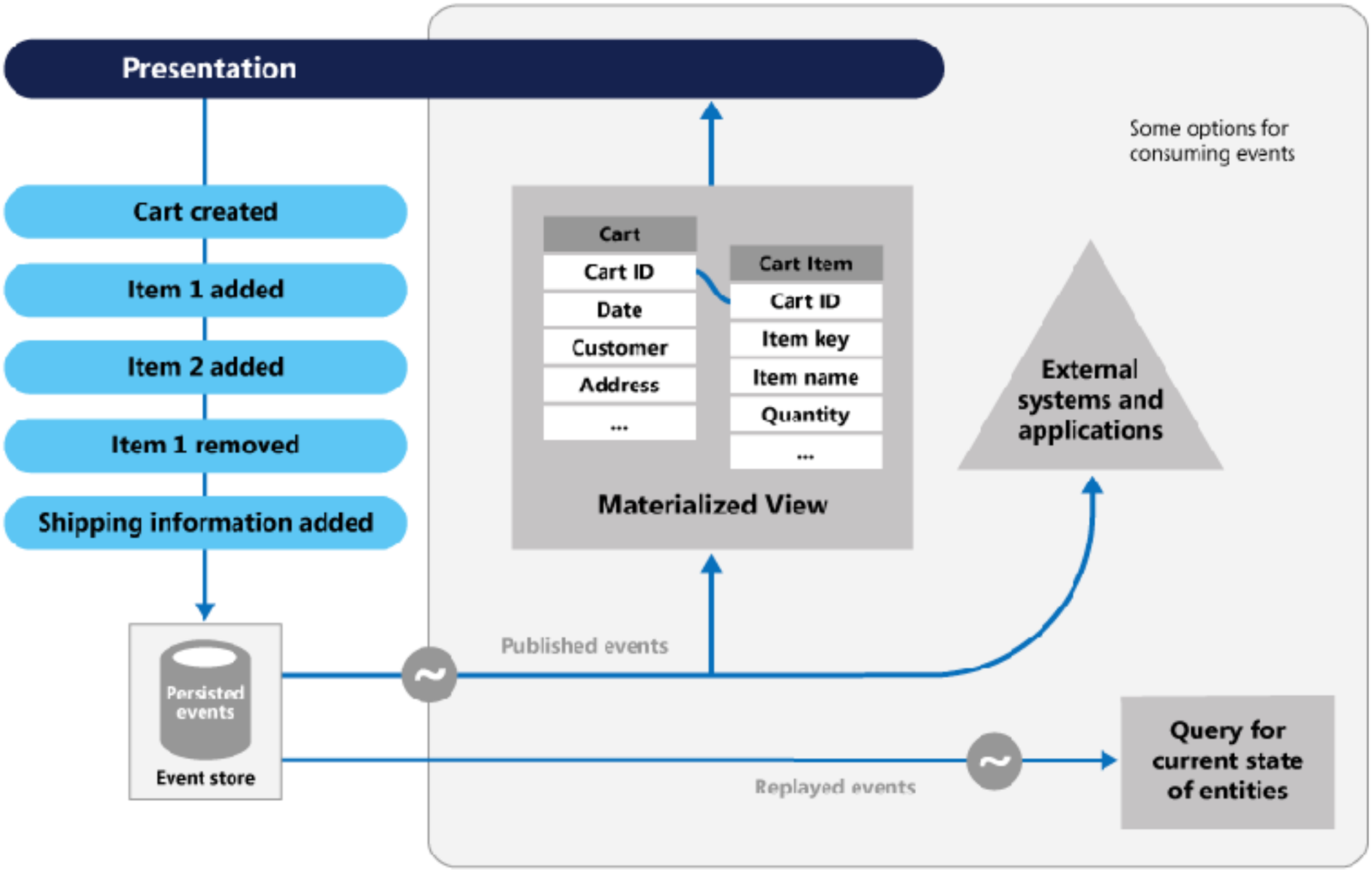
Event Sourcing

Command Query Responsibility Segregation (CQRS) pattern



source: https://msdn.microsoft.com/en-us/library/jj591573.da82141c6f9950d64c1263fa4da825ec(l=en-us).png

Event Sourcing pattern



source: https://msdn.microsoft.com/en-us/library/dn589792.aspx

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5 smile
5 tiger
5 young
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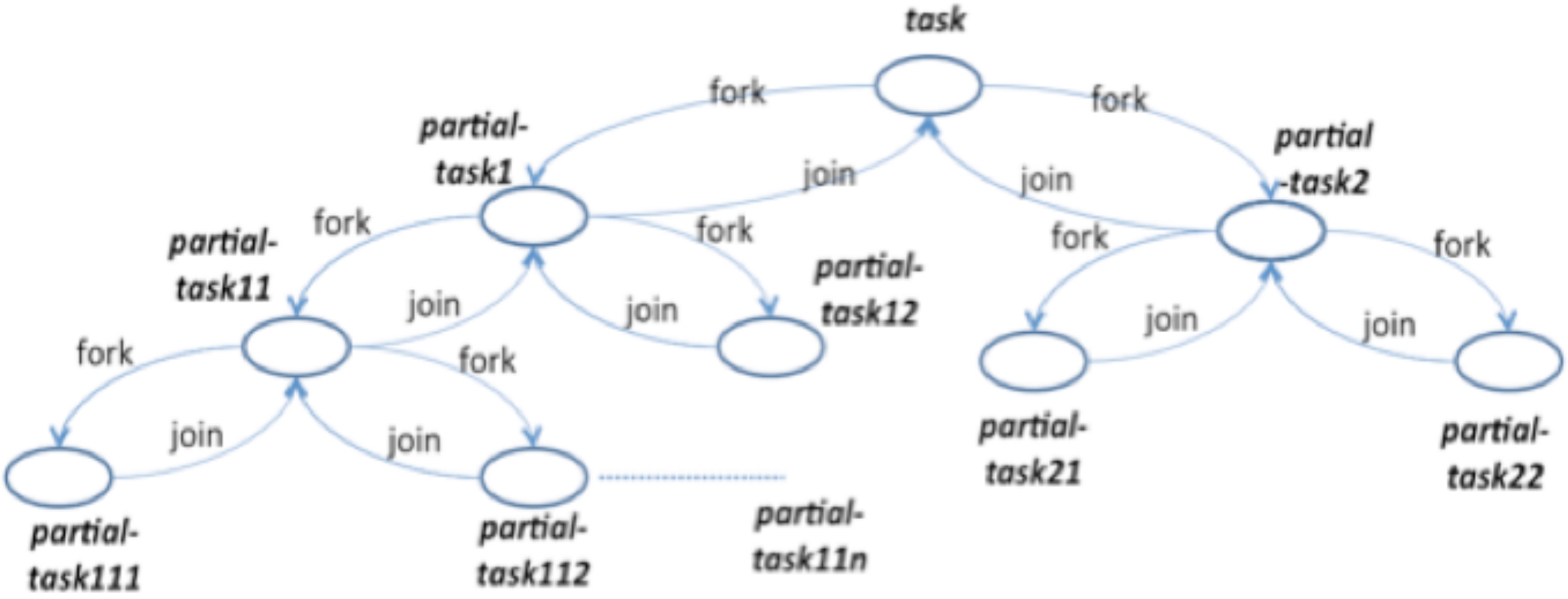
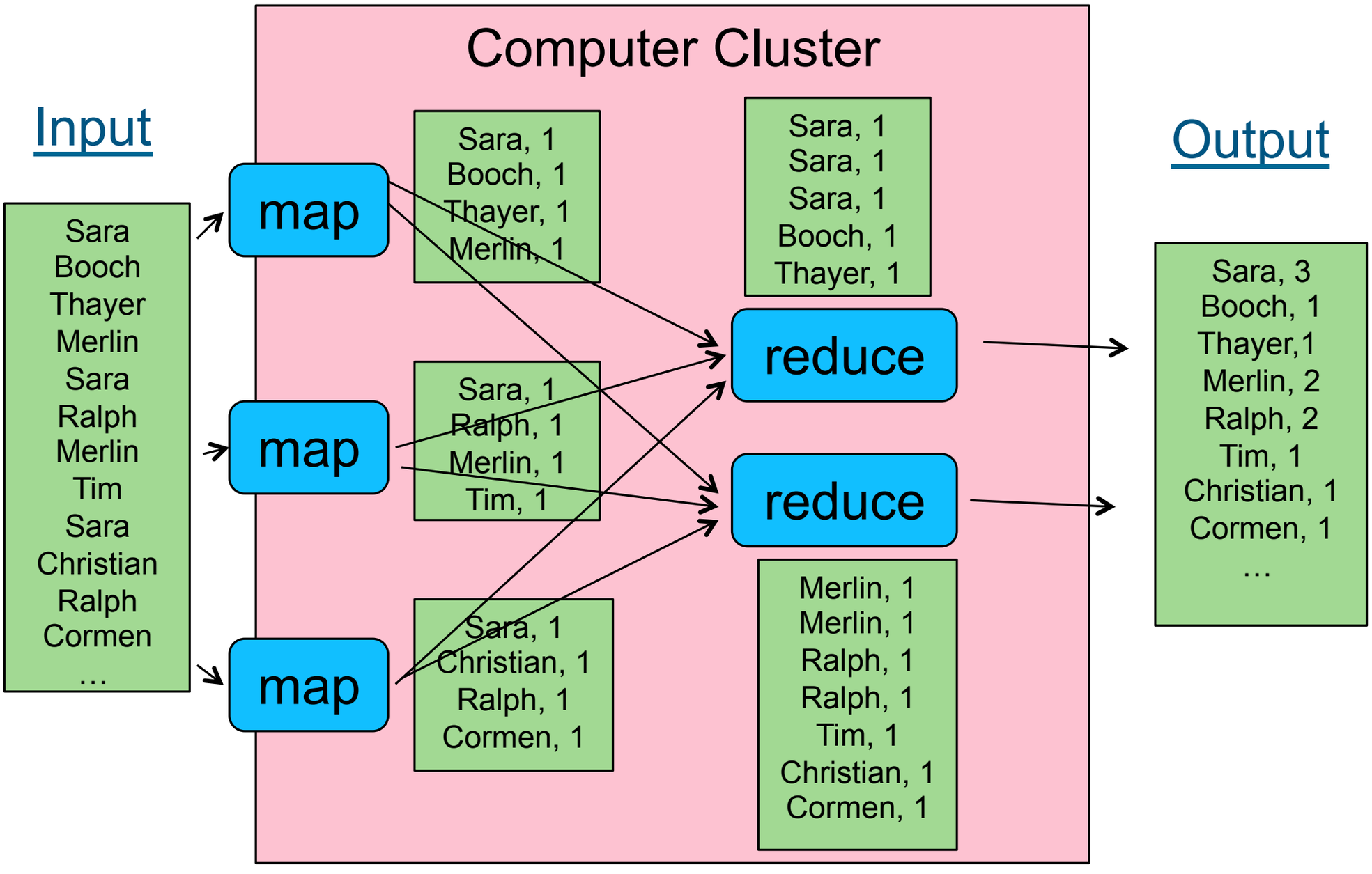
6 smiled
8 returned
```

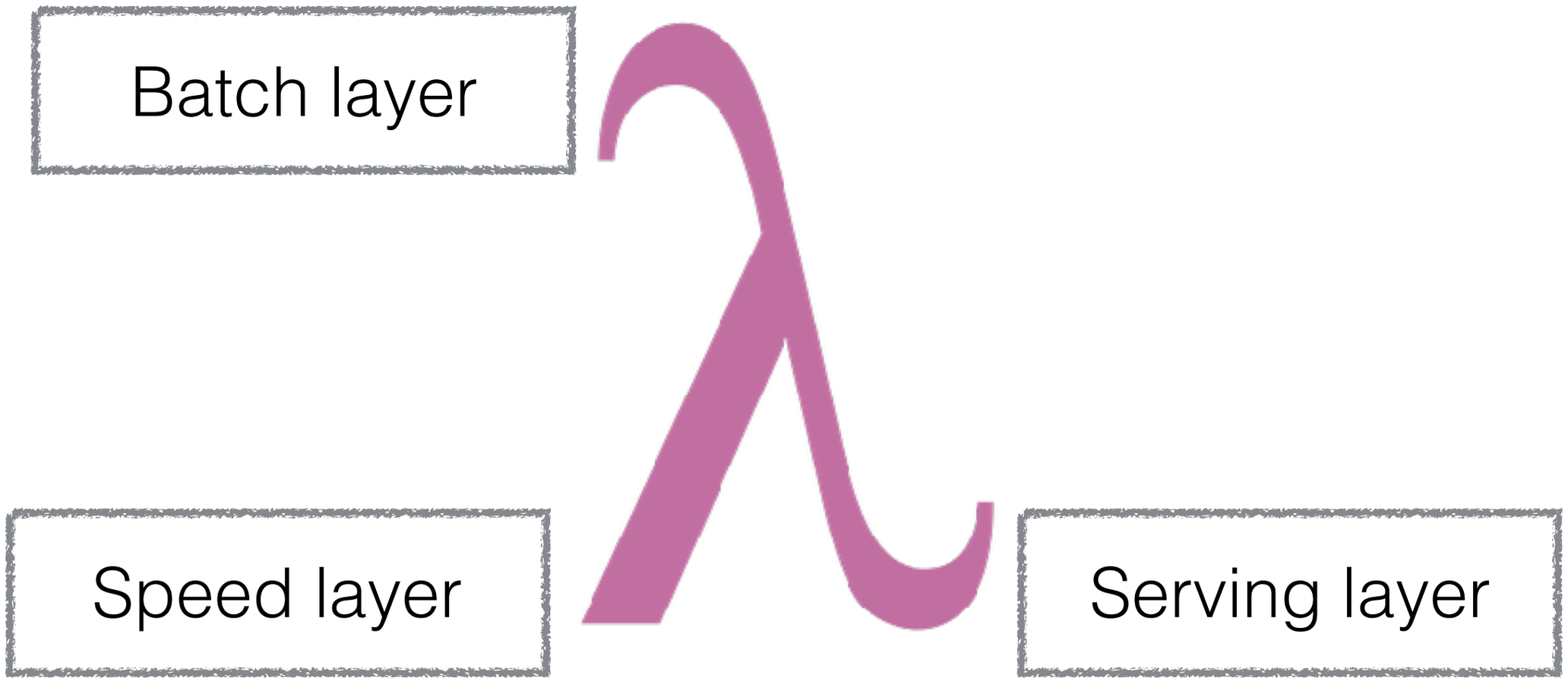
Java: Fork-join framework



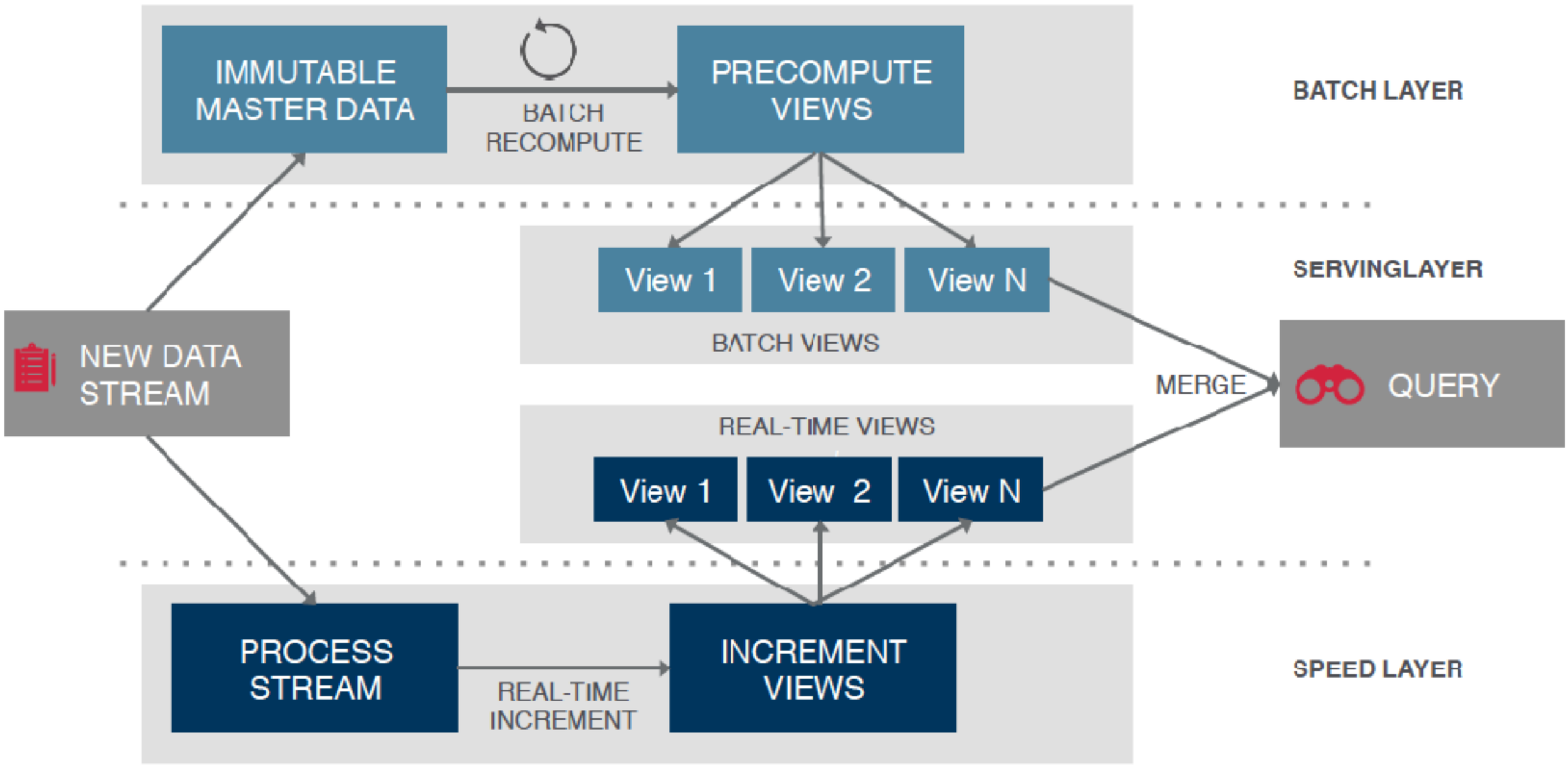
Map-Reduce pattern



What style is this?



Lambda style



source: https://spark-summit.org/2014/wp-content/uploads/2014/07/Lambda-Architecture-Jim-Scott..pdf

client-server

code-on-demand

cache

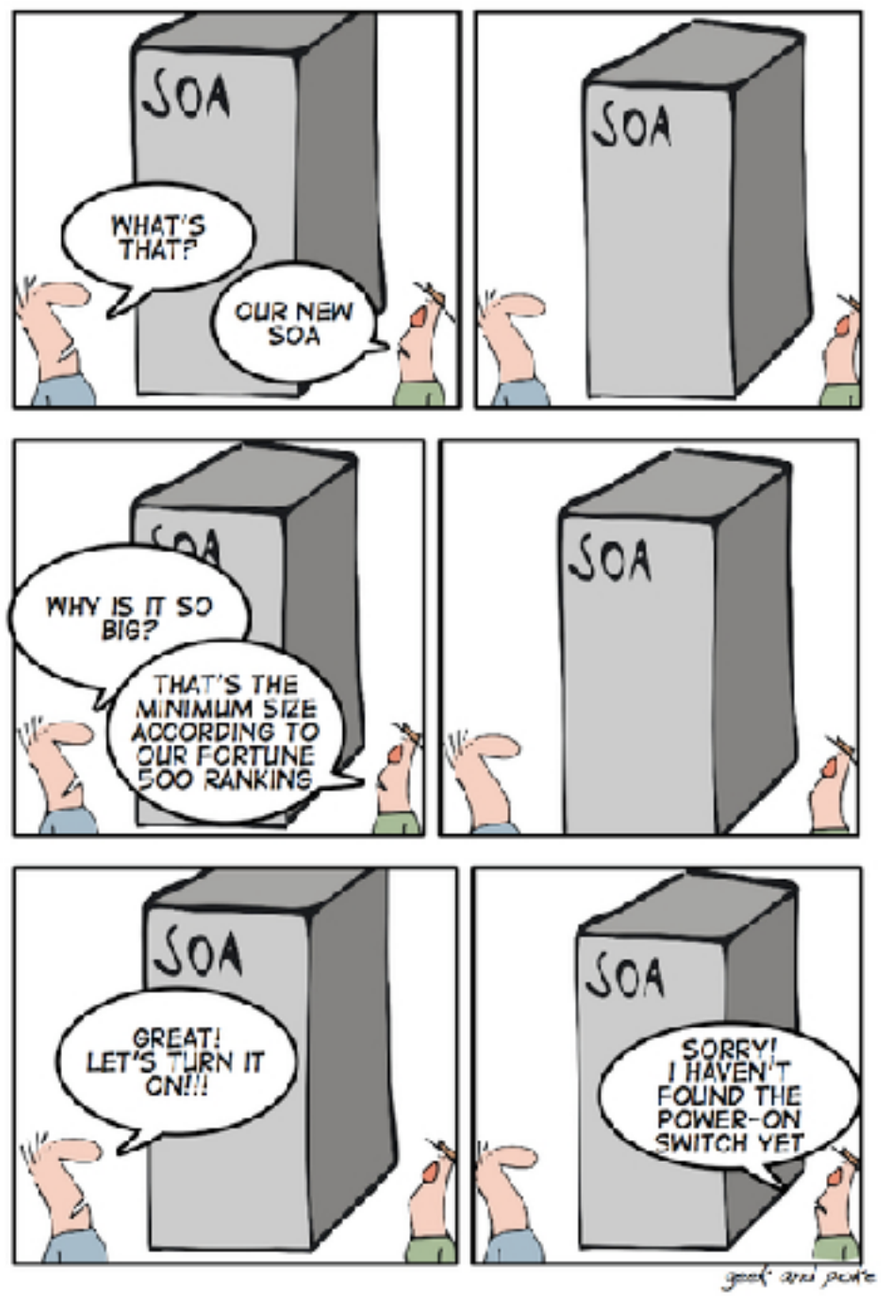
REST constraints (in www)

layered system

stateless

uniform interface

Microservices = “fine grained SOA” or “SOA 2.0”



Amazon case study