SOFTWARE ARCHITECTURES

ARCHITECTURAL STYLES

SCALING UP PERFORMANCE

ARCHITECTURES

SW Architectures usually complex

Often we reduce the abstraction

Architectural Styles

- Layered style

Architectural Patterns

- Model View Controller

ARCHITECTURE STYLES

Basic Characteristics

Quality attributes

ARCHITECTURE STYLES

Data centric

- Databases

Call and return

- Part of this course

Implicit invocation

- Events

Independent components

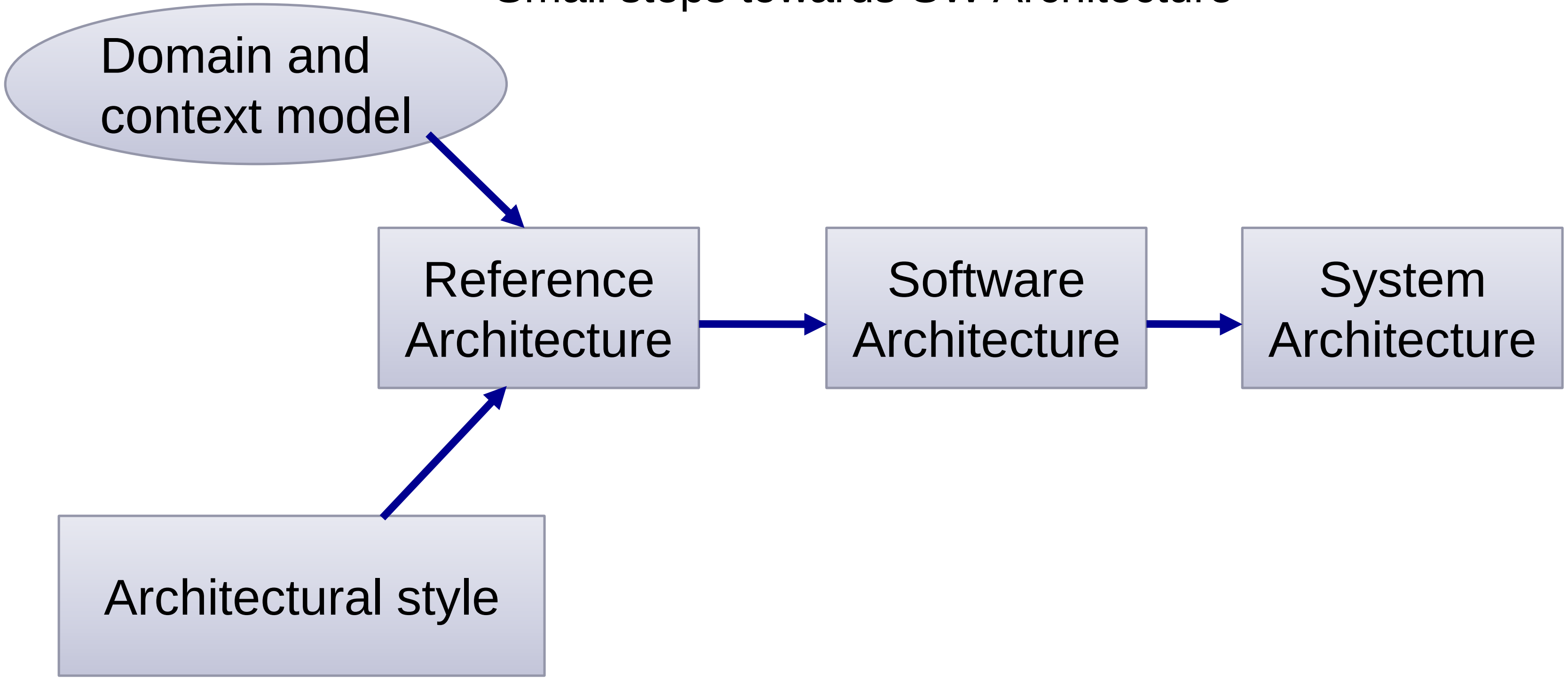
- Peer to peer

Virtual Machines

Pipe and Filter - data flow

OVERVIEW

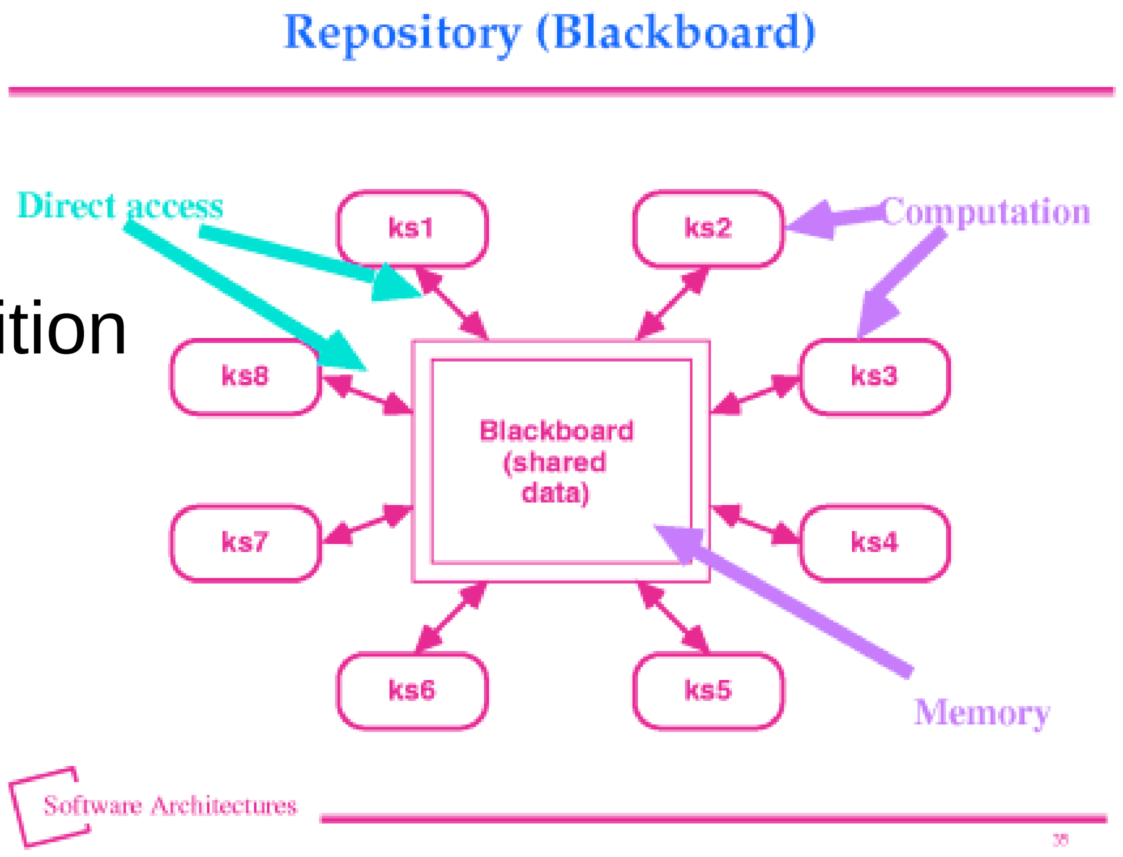
- **Domain and context model**
- **Arch. styles**
- **Reference architecture**
  - Small steps towards SW Architecture



ARCHITECTURE STYLES

Data centric

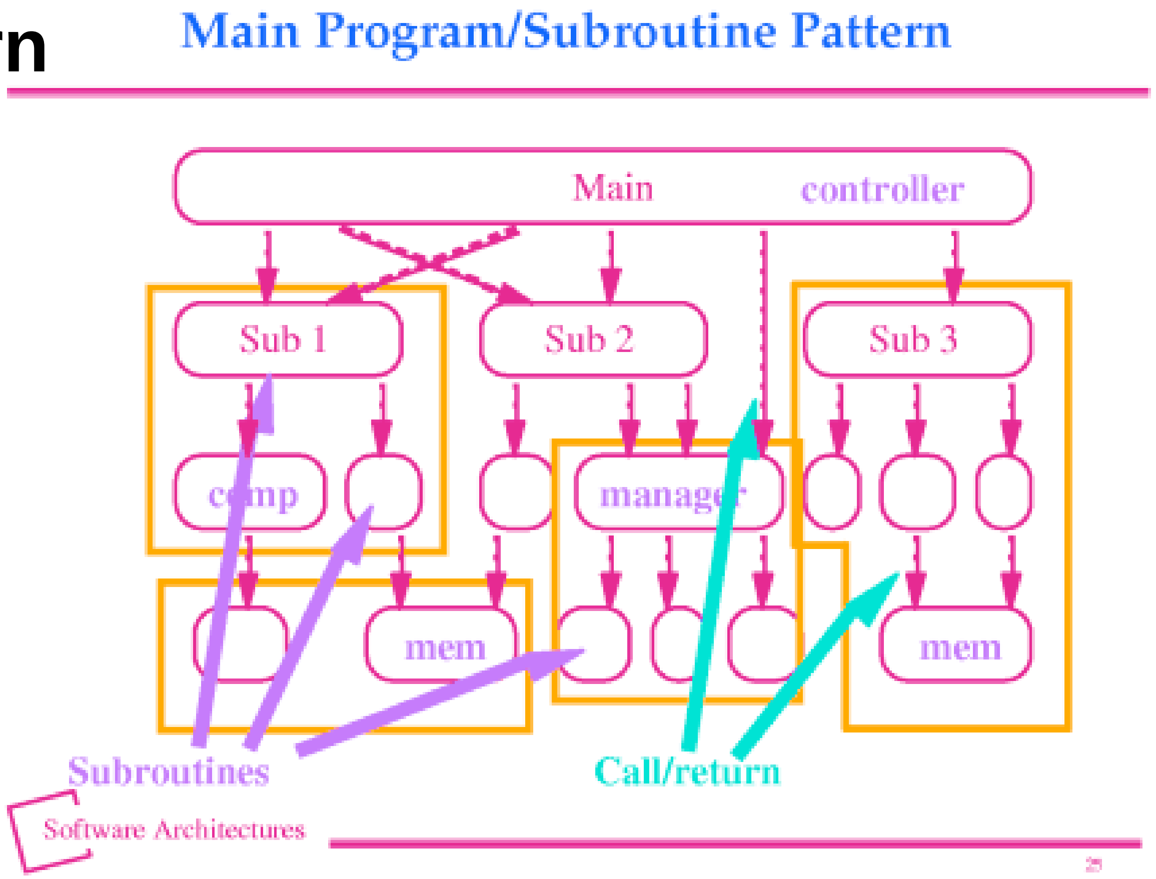
- Databases
- Voice recognition
- Compilers



ARCHITECTURE STYLES

Call and return

- OOD
- Procedural
- RPC
- AOP
- Layers



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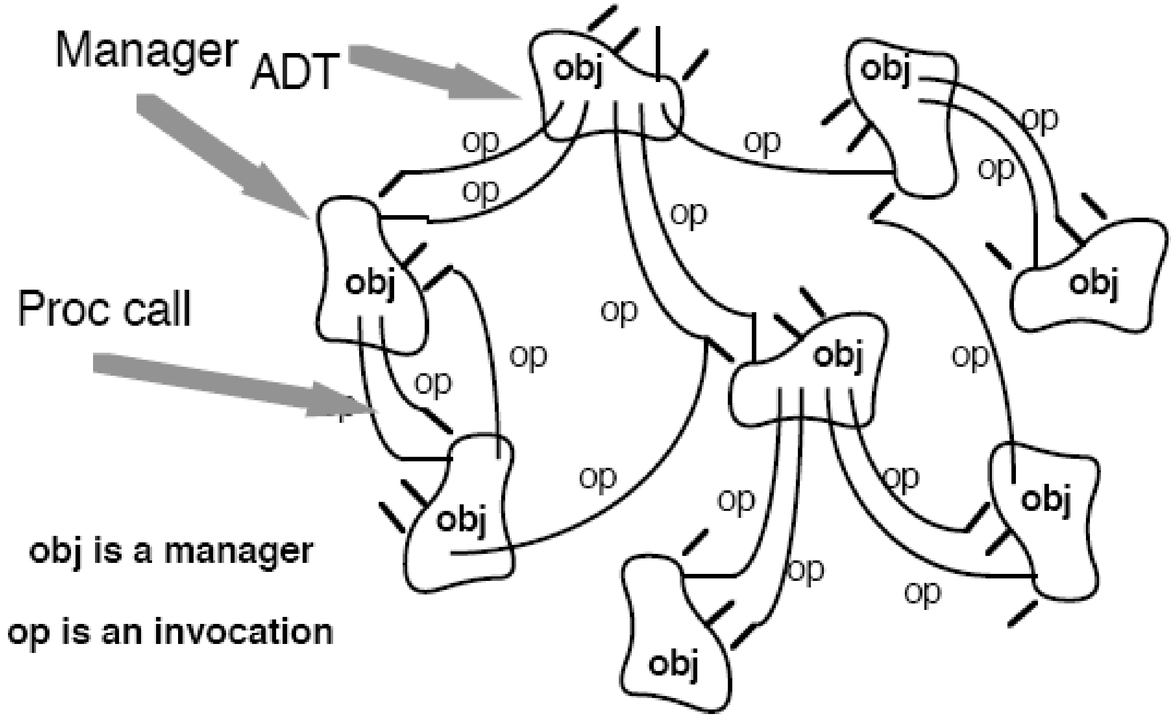

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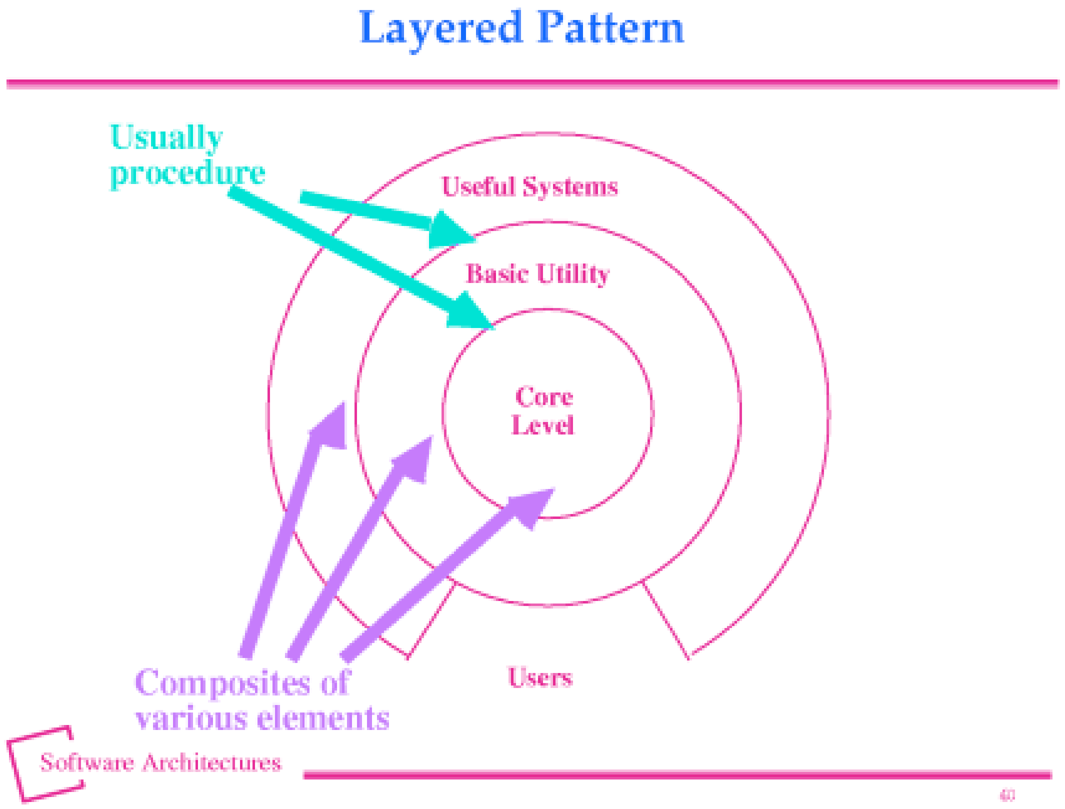

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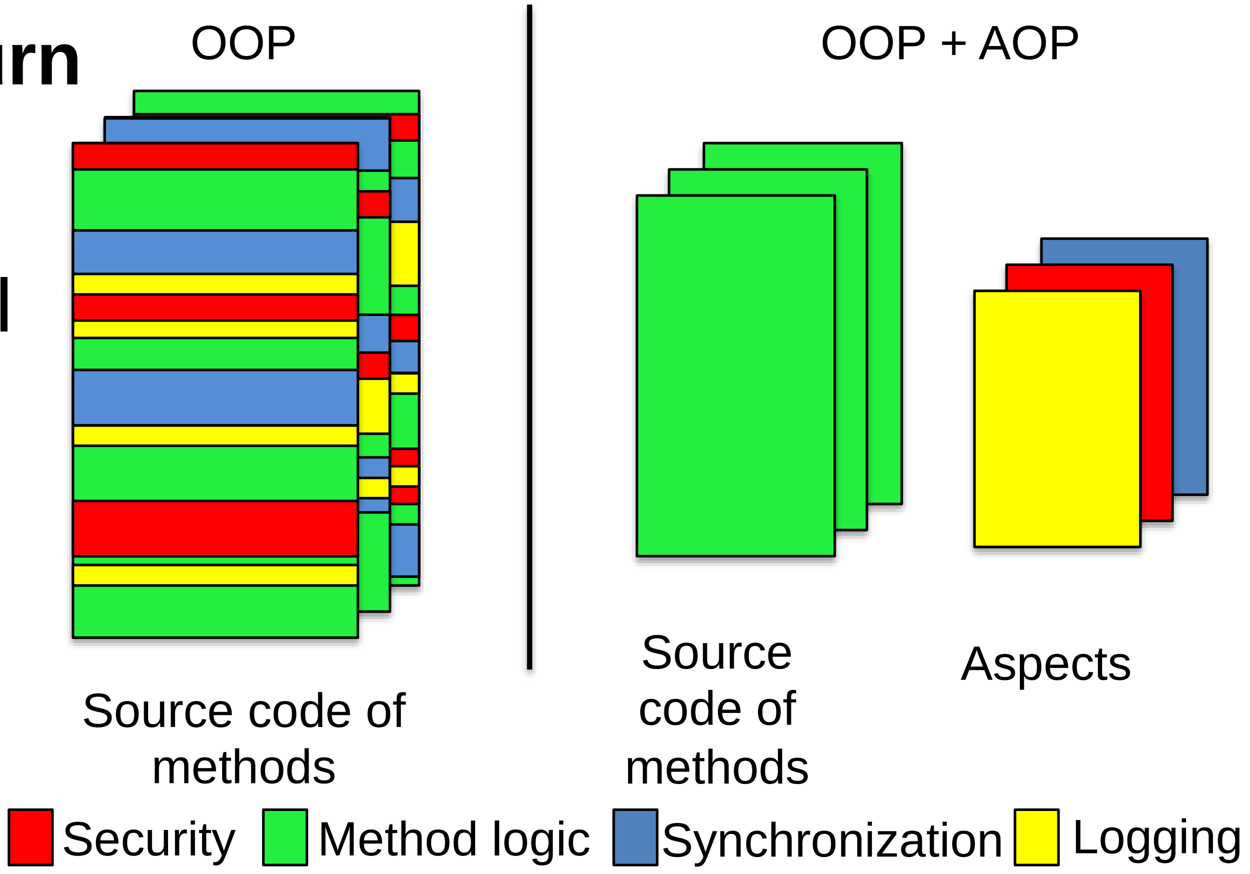

ARCHITECTURE STYLES

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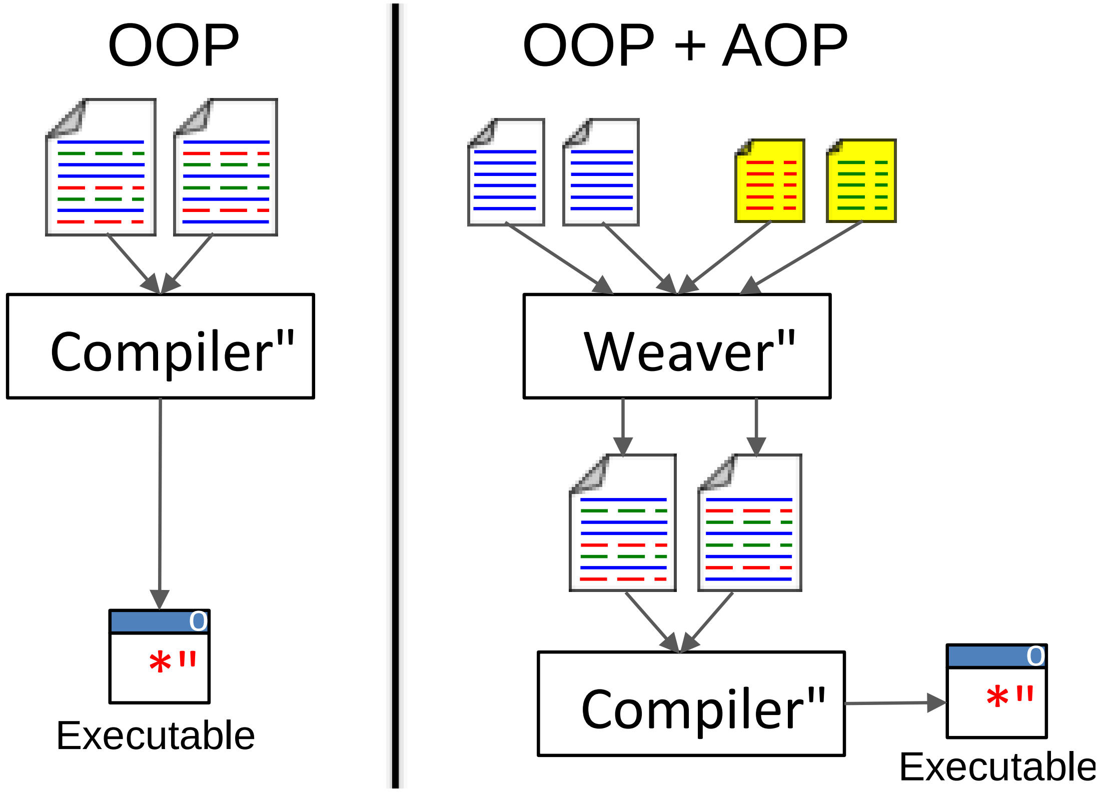
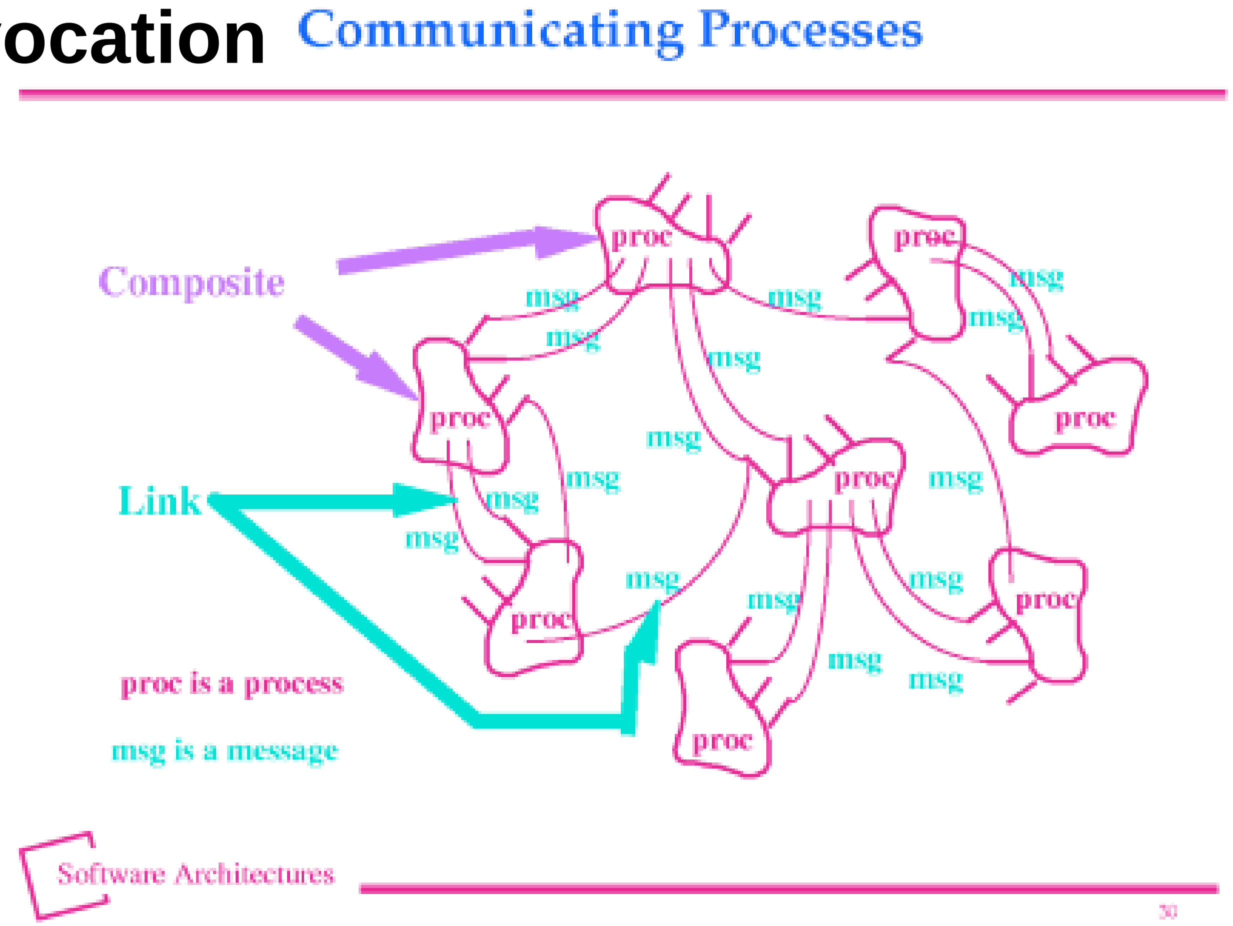


ARCHITECTURE STYLES

Implicit invocation

- Events

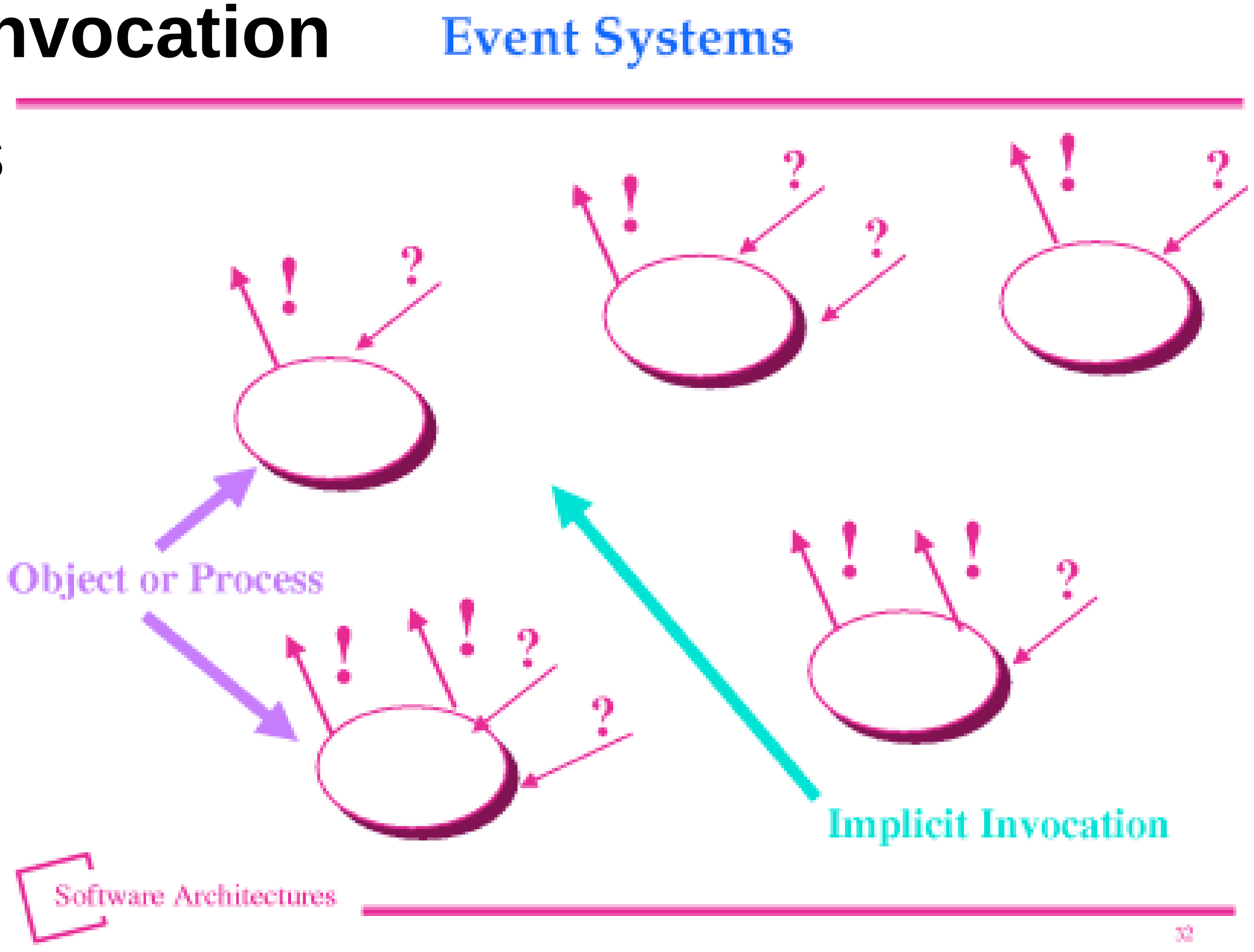


Communicating Processes

ARCHITECTURE STYLES

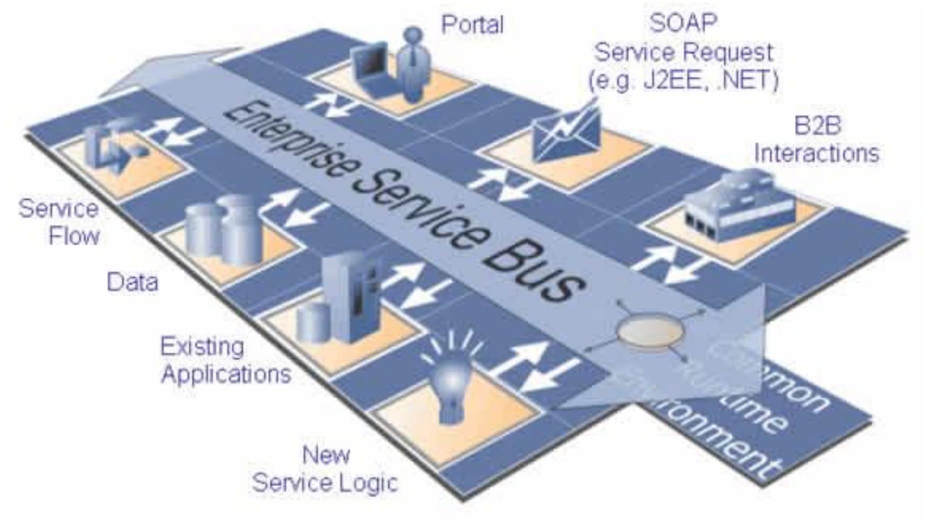
Implicit invocation

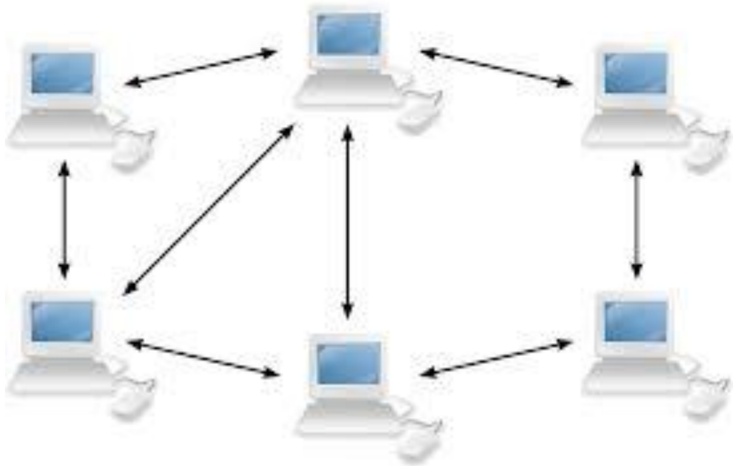
- Events

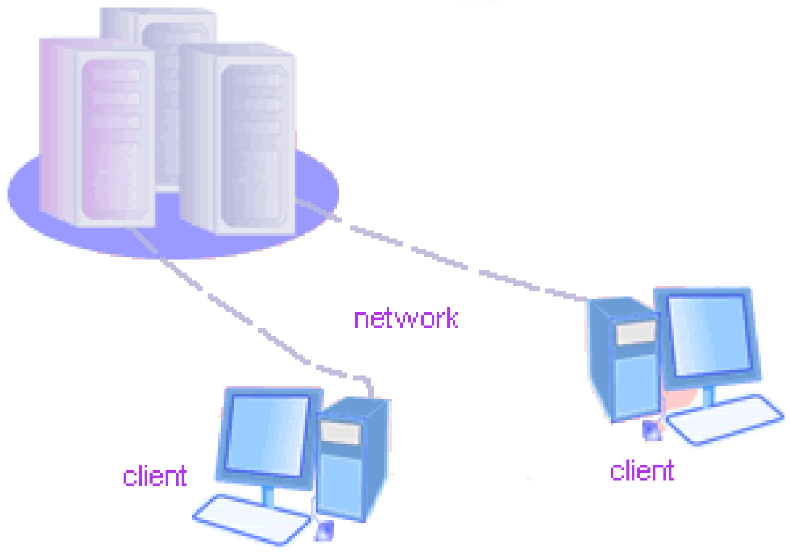


ARCHITECTURE STYLES

Independent components

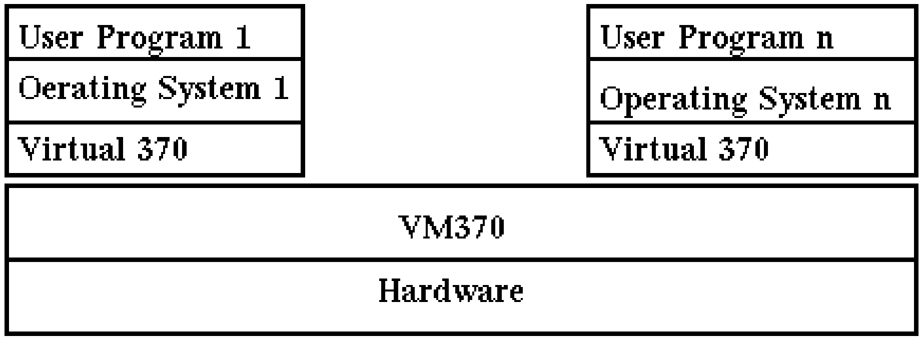




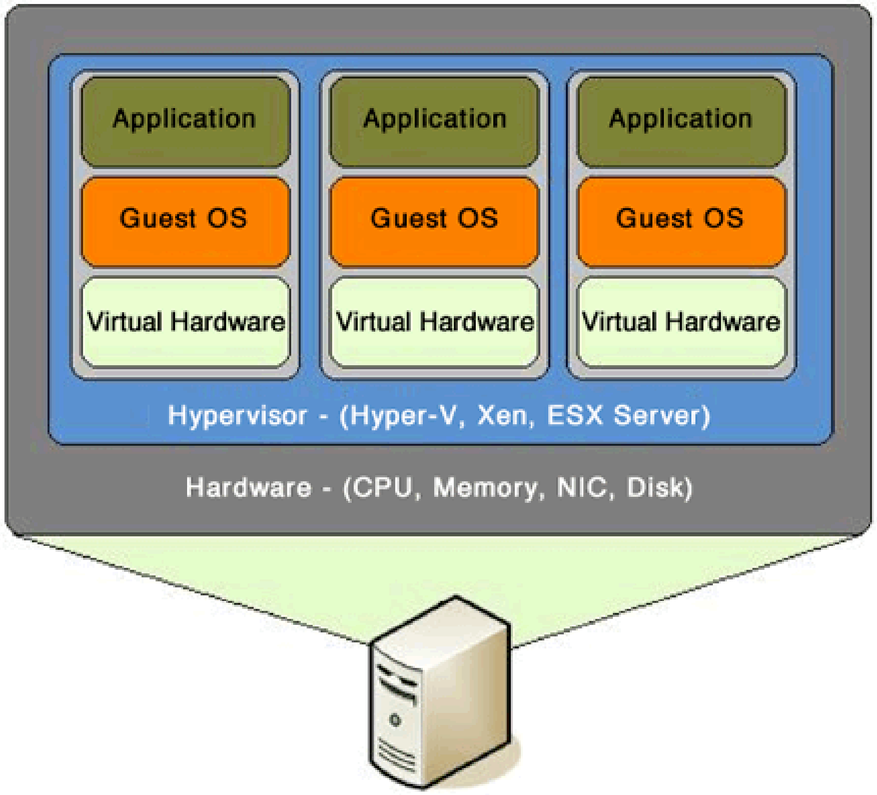


ARCHITECTURE STYLES

Virtual machines

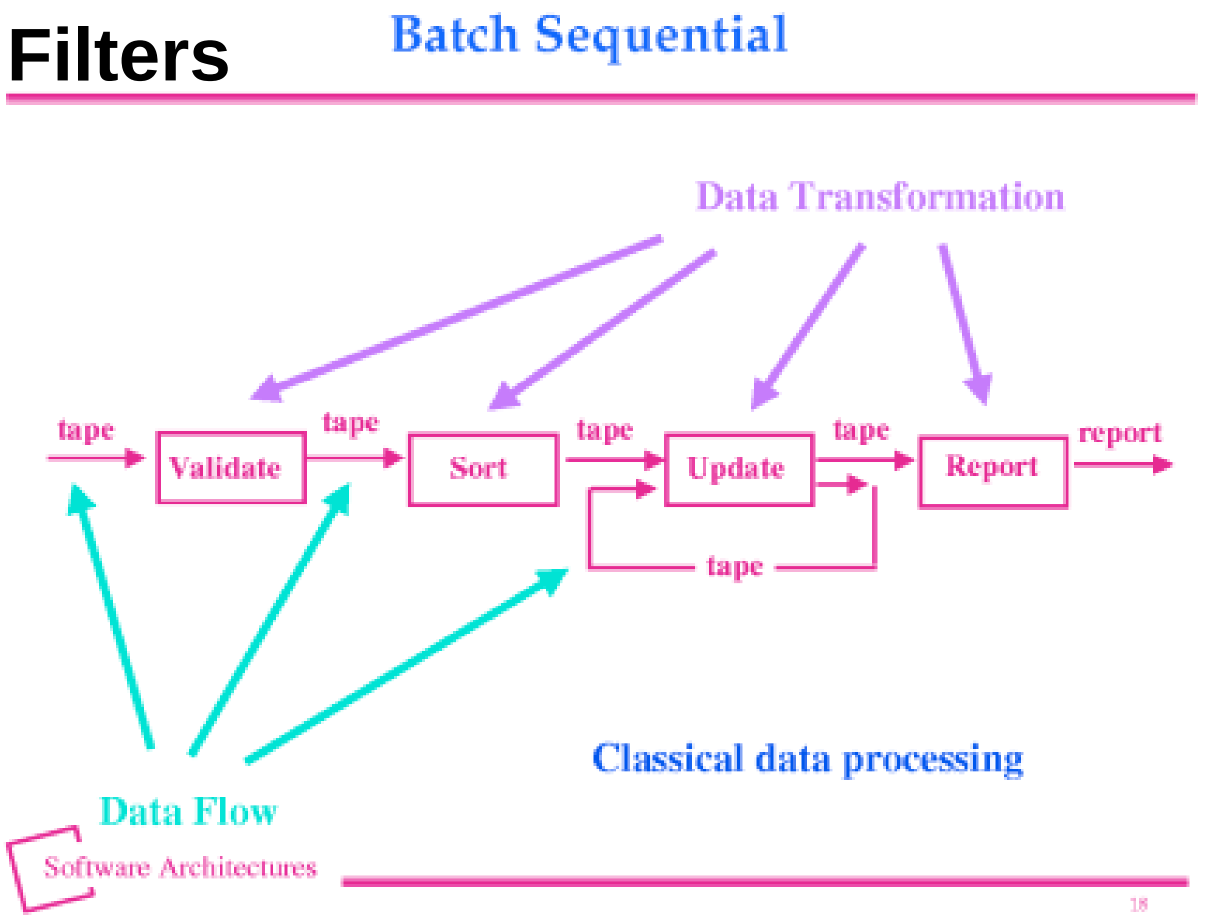


VIRTUAL MACHINE ARCHITECTURE (VM370)



ARCHITECTURE STYLES

Pipes and Filters



ARCHITECTURE STYLES

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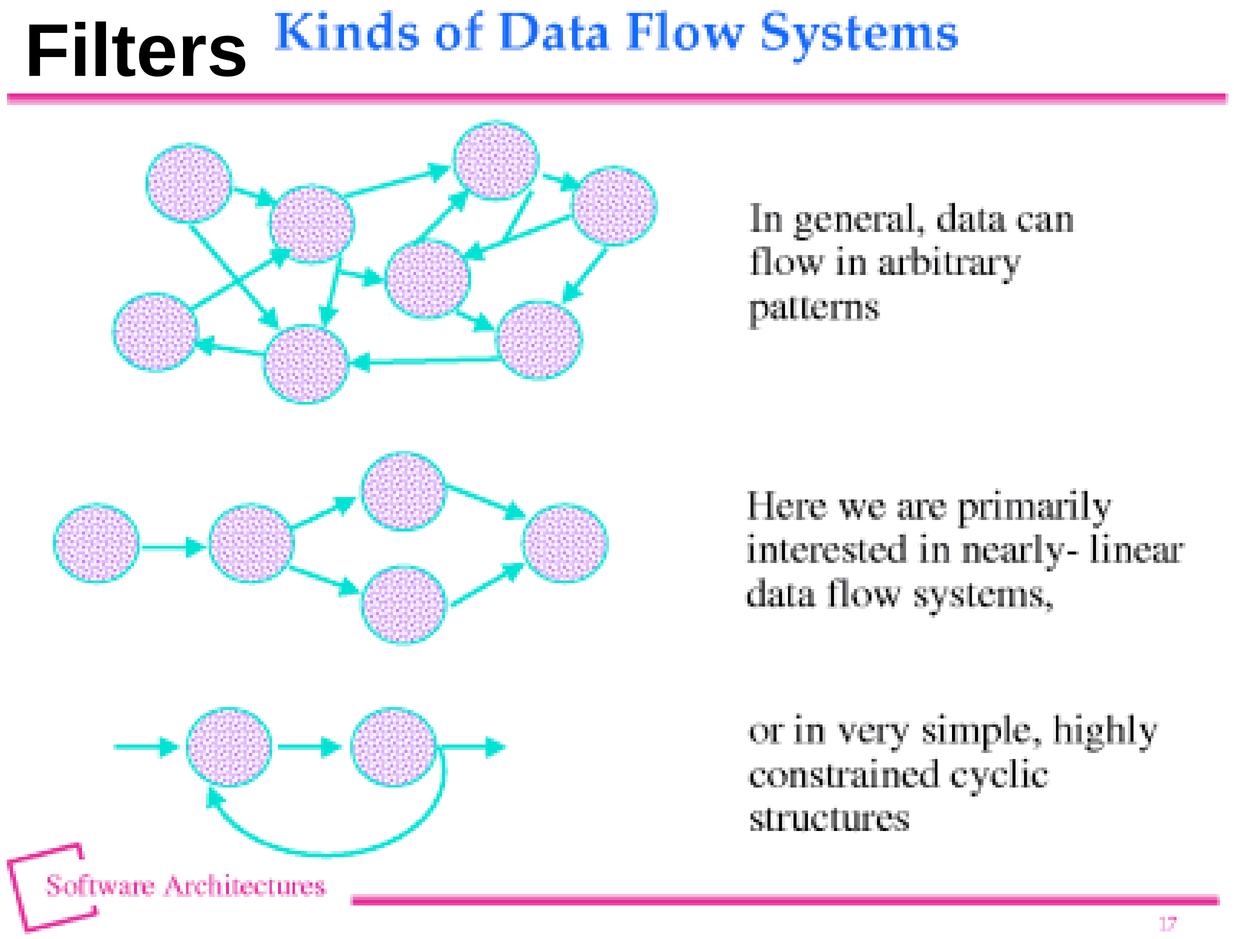


Kinds of Data Flow Systems

In general, data can flow in arbitrary patterns

Here we are primarily interested in nearly- linear data flow systems,

or in very simple, highly constrained cyclic structures

Software Architectures

17

ARCHITECTURE STYLES

Data centric

- Data integration, Distribution, Control, Coordination
- Scalability, Low coupling, Centralization, Reuse, Modifiable,

Call and return

- Modifiable, Reusable, Inf. hiding, Structural decomposition, Separation of concerns

Implicit invocation

- Modifiable, Low coupling, Hard to comprehend,

Independent components

- Integration, Scalability, Reuse, Low coupling, Distribution, Reliability

Virtual Machines

- Simulation, Emulation, Portability!, Flexibility, Lowered Performance, Extended features

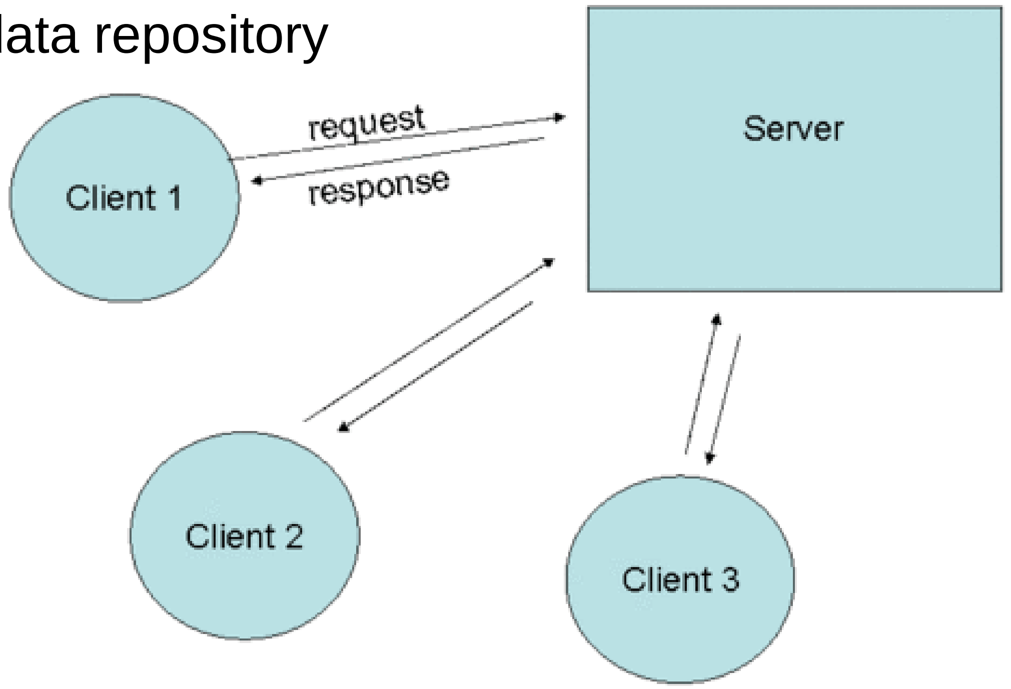
Pipe and Filter

- Modifiable, Reuse, Easy design, Simplicity, Low Coupling,
- Slow, No filter cooperation, Lot of parsing

SCALING PERFORMANCE

Usual approach is to deploy app to a web server and provide access through HTTP/S

- **Client-server architecture**
  - Inside 3-layers and data repository



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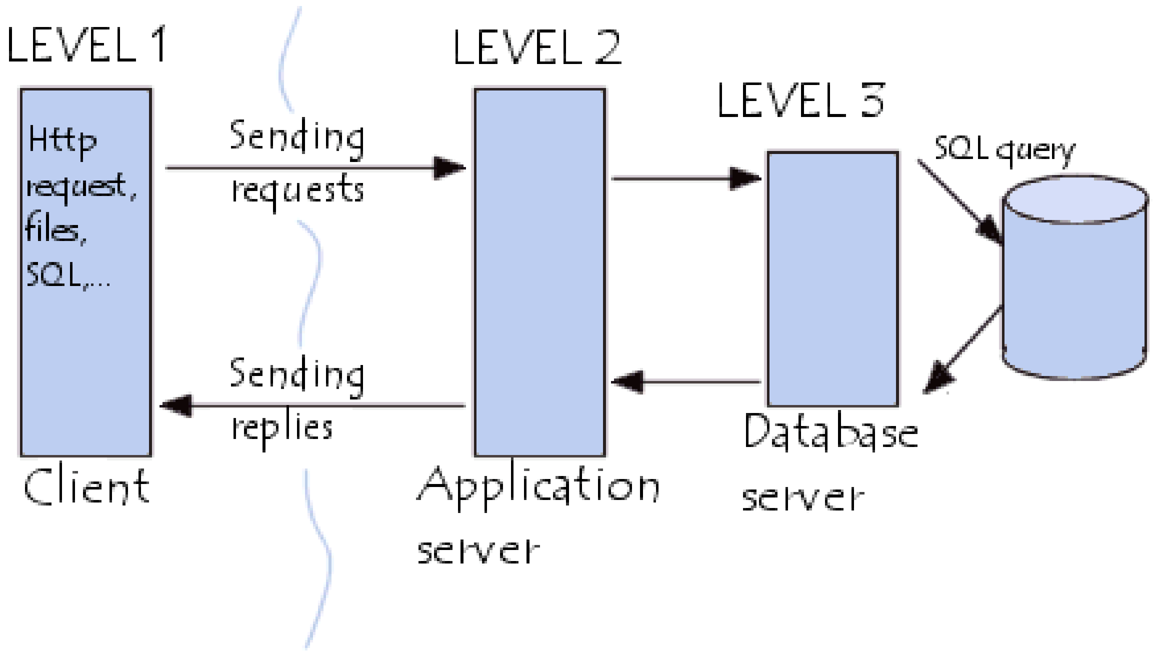
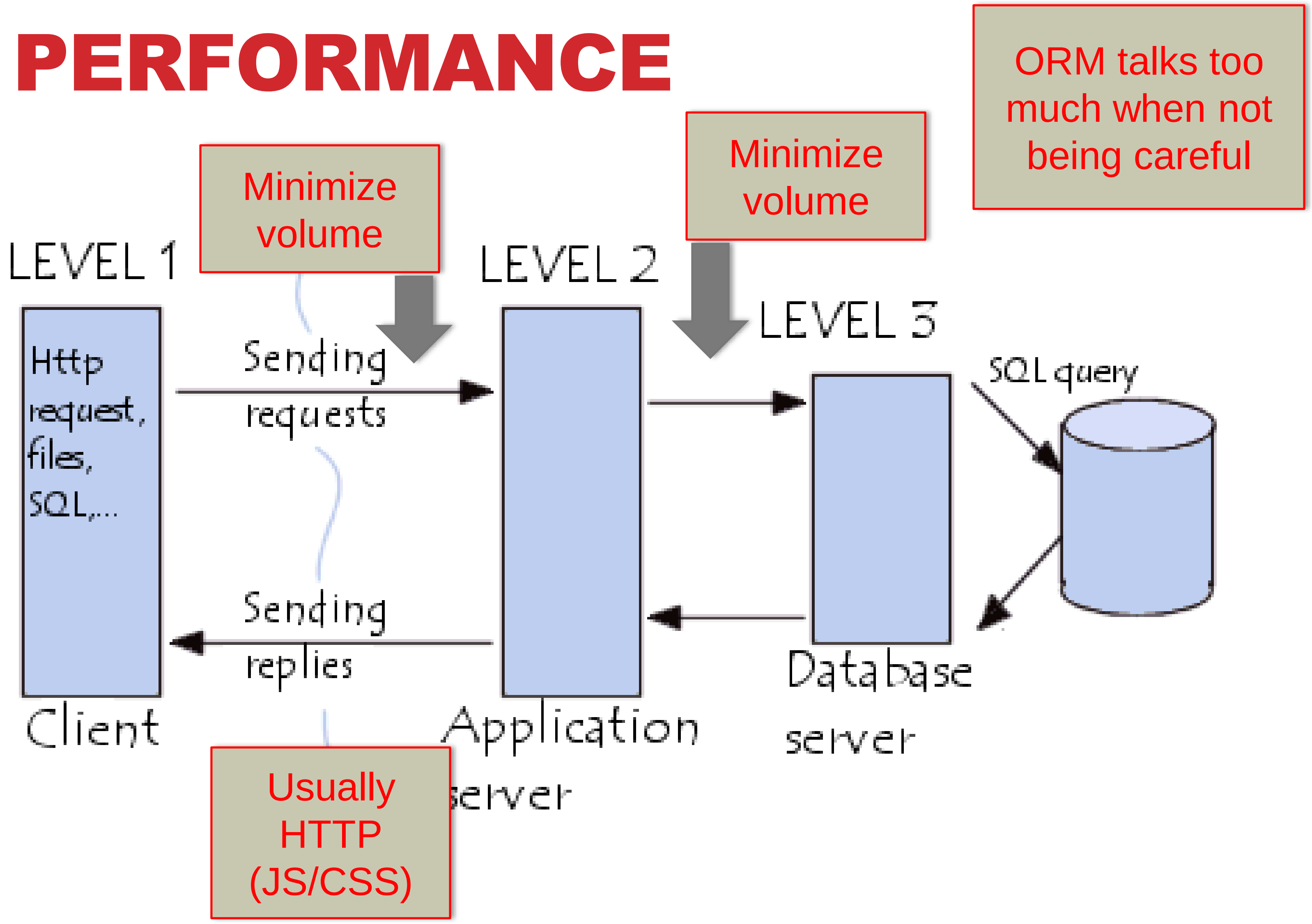
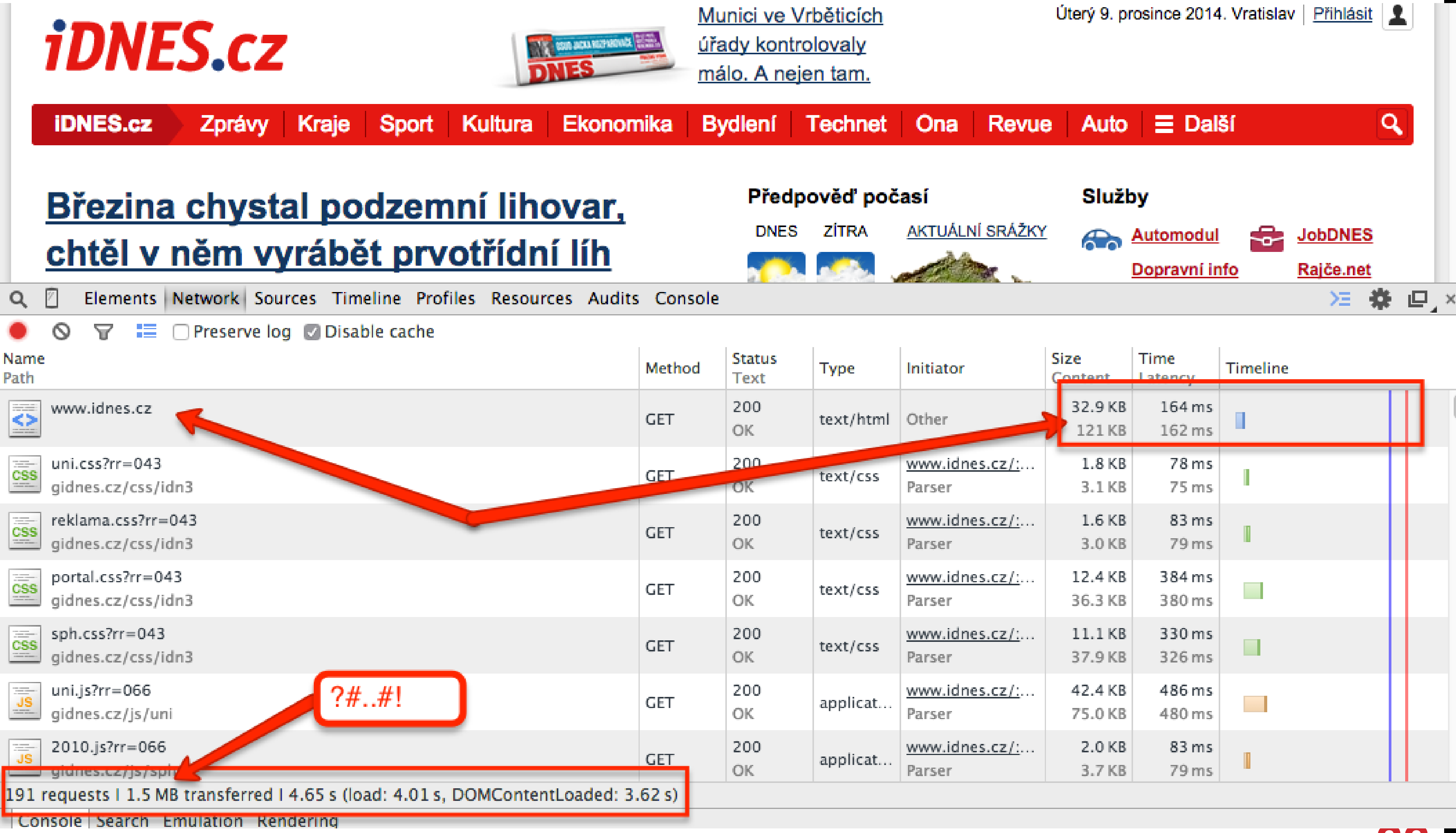


SCALING PERFORMANCE



DEPLOYMENT, MAINTENANCE AND REPORTS



Úterý 9. prosince 2014. Vratislav | Přihlásit

Munici ve Vrběticích úřady kontrolovaly málo. A nejen tam.

iDNES.cz Zprávy Kraje Sport Kultura Ekonomika Bydlení Technet Ona Revue Auto Další

Březina chystal podzemní lihovar, chtěl v něm vyrábět prvotřídní líh

Předpověď počasí: DNES ZÍTRA AKTUÁLNÍ SRÁŽKY

Služby: Automodul JobDNES Dopravní info Rajče.net

Elements Network Sources Timeline Profiles Resources Audits Console

Preserve log | Disable cache

Name / Path	Method	Status / Text	Type	Initiator	Size / Content	Time / Latency
www.idnes.cz	GET	200 OK	text/html	Other	32.9 KB / 121 KB	164 ms / 162 ms
uni.css?rr=043 / gidnes.cz/css/idn3	GET	200 OK	text/css	www.idnes.cz/:... Parser	1.8 KB / 3.1 KB	78 ms / 75 ms
reklama.css?rr=043 / gidnes.cz/css/idn3	GET	200 OK	text/css	www.idnes.cz/:... Parser	1.6 KB / 3.0 KB	83 ms / 79 ms
portal.css?rr=043 / gidnes.cz/css/idn3	GET	200 OK	text/css	www.idnes.cz/:... Parser	12.4 KB / 36.3 KB	384 ms / 380 ms
sph.css?rr=043 / gidnes.cz/css/idn3	GET	200 OK	text/css	www.idnes.cz/:... Parser	11.1 KB / 37.9 KB	330 ms / 326 ms
uni.js?rr=066 / gidnes.cz/js/uni	GET	200 OK	applicat...	www.idnes.cz/:... Parser	42.4 KB / 75.0 KB	486 ms / 480 ms
2010.js?rr=066 / gidnes.cz/js/sph	GET	200 OK	applicat...	www.idnes.cz/:... Parser	2.0 KB / 3.7 KB	83 ms / 79 ms

?#..#!

191 requests | 1.5 MB transferred | 4.65 s (load: 4.01 s, DOMContentLoaded: 3.62 s)

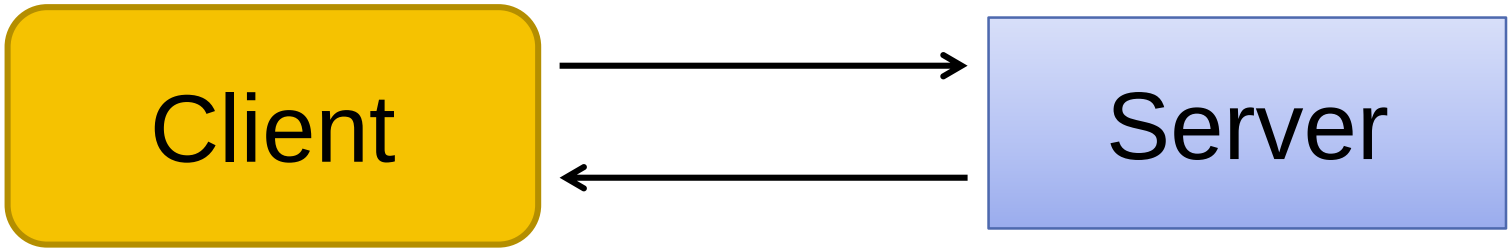
Console Search Emulation Rendering

CLIENT-SERVER ARCHITECTURE

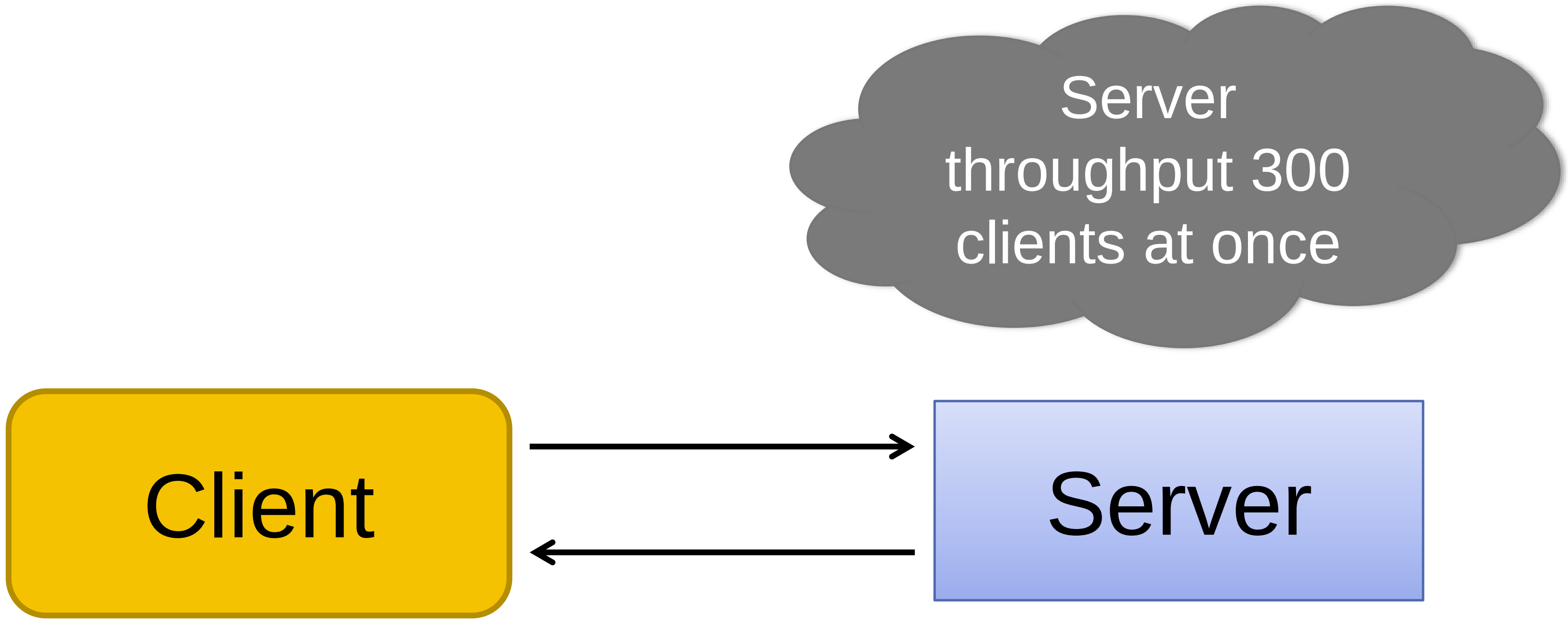
Properties:

- Centralization
- Easy with security
- Easy to locate
- Easy to scale
  - Until we reach the limit
  - Server is the bottleneck
- Performance influenced by the network conditions
  - And virtual distance between client and server
- Server has given throughput
  - Given by HW, our Design, Efficiency, Caching, etc.

CLIENT-SERVER ARCHITECTURE



CLIENT-SERVER ARCHITECTURE



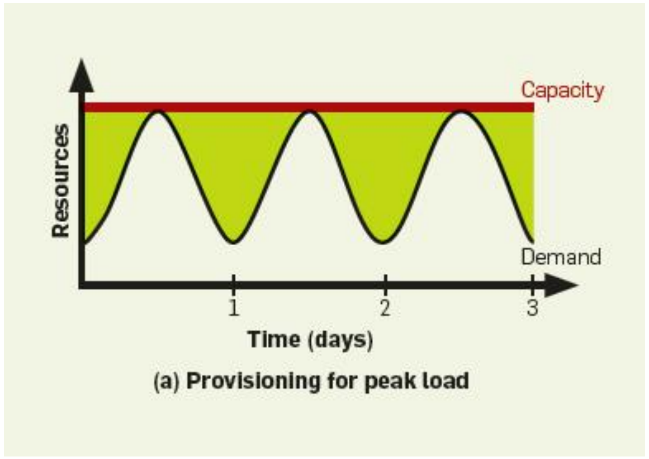
CLIENT-SERVER ARCHITECTURE

Through put 300 clients at once

Client
20..300 peak

Server

Load grows!



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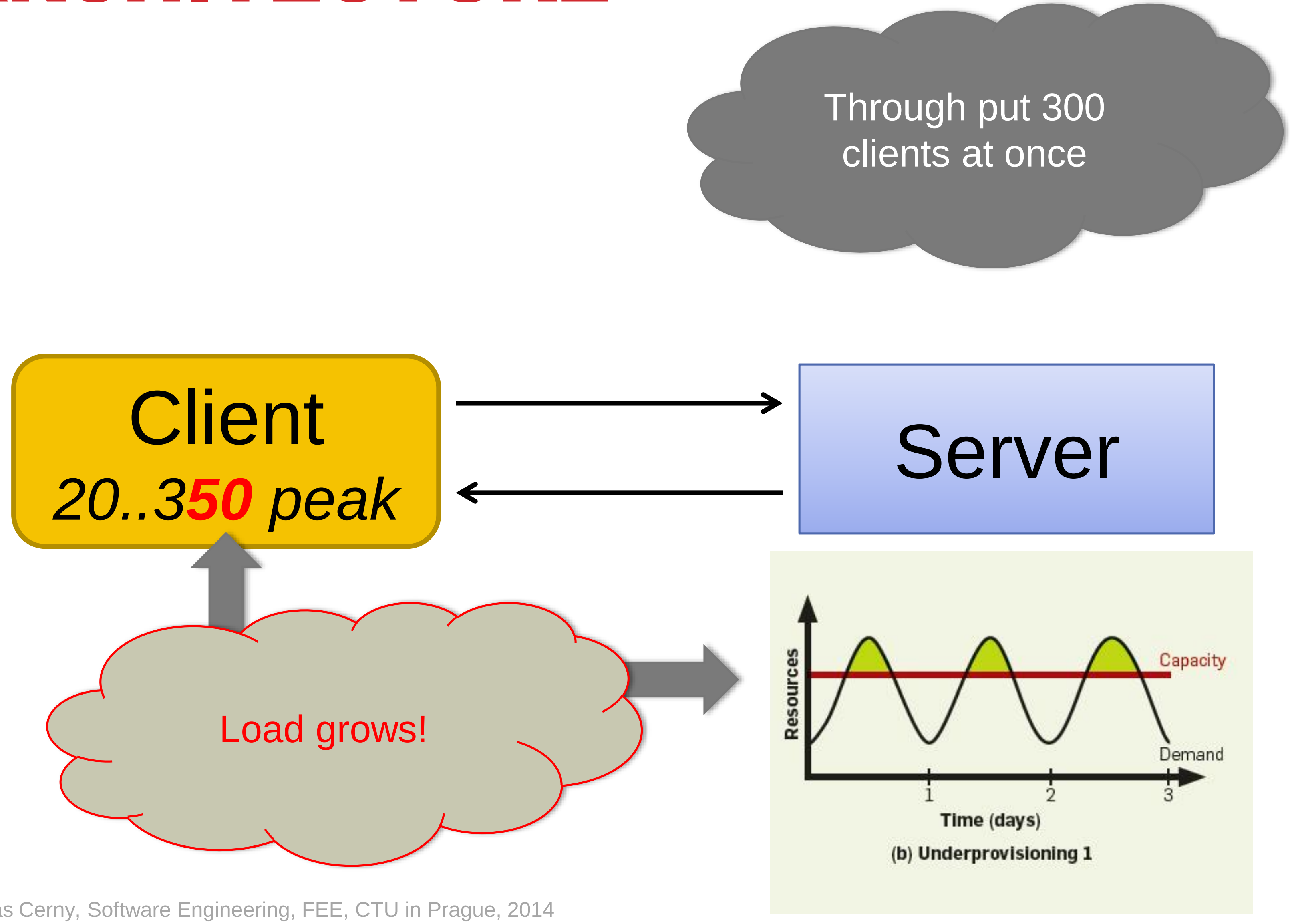

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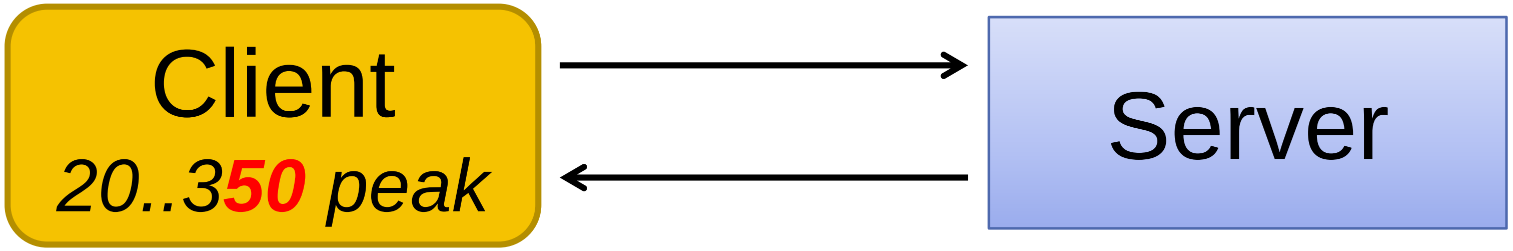
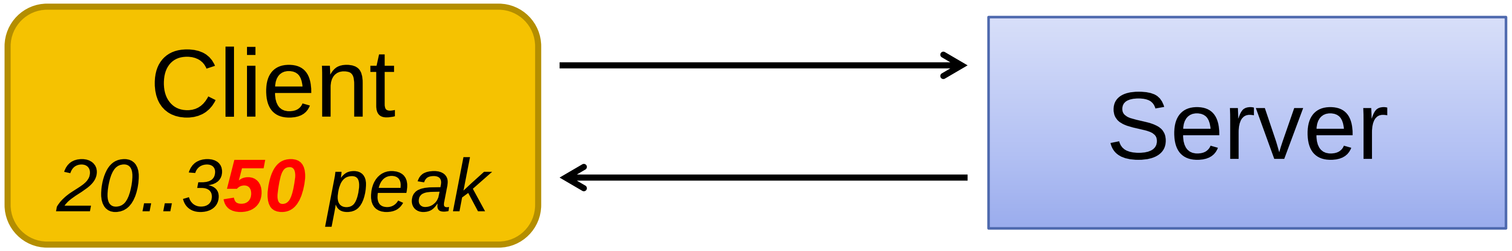


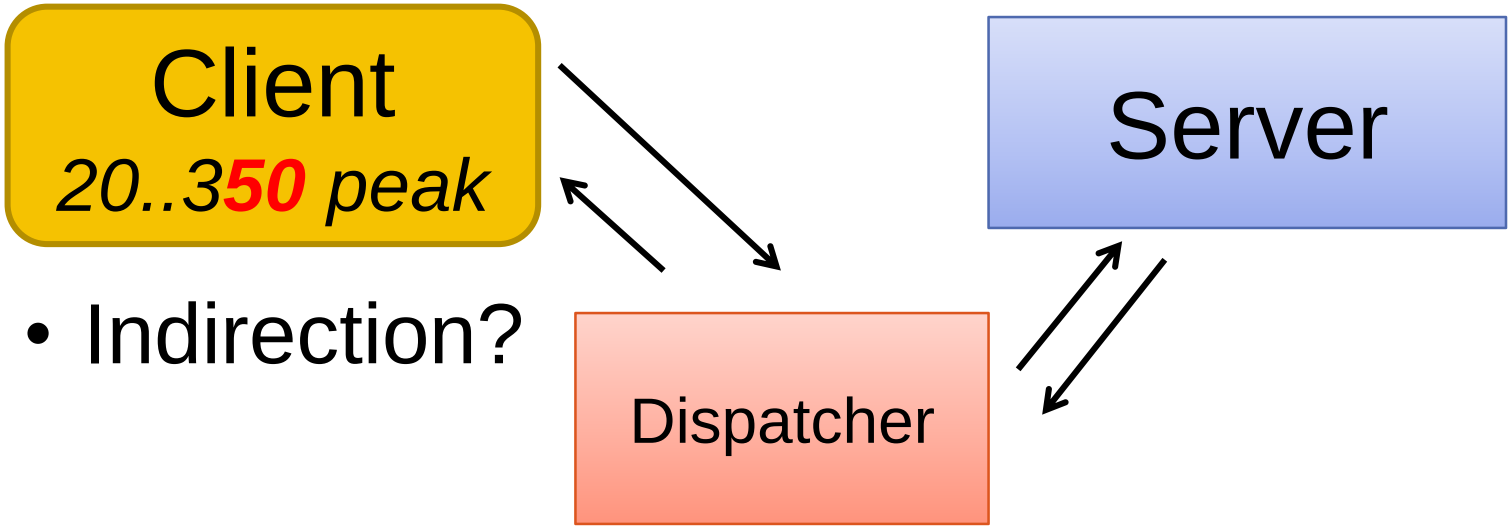
- Caching
- Performance analysis – profiling
- Native/Custom SQL queries for reports
- Better Hardware, more CPU/Mem

CLIENT-SERVER ARCHITECTURE



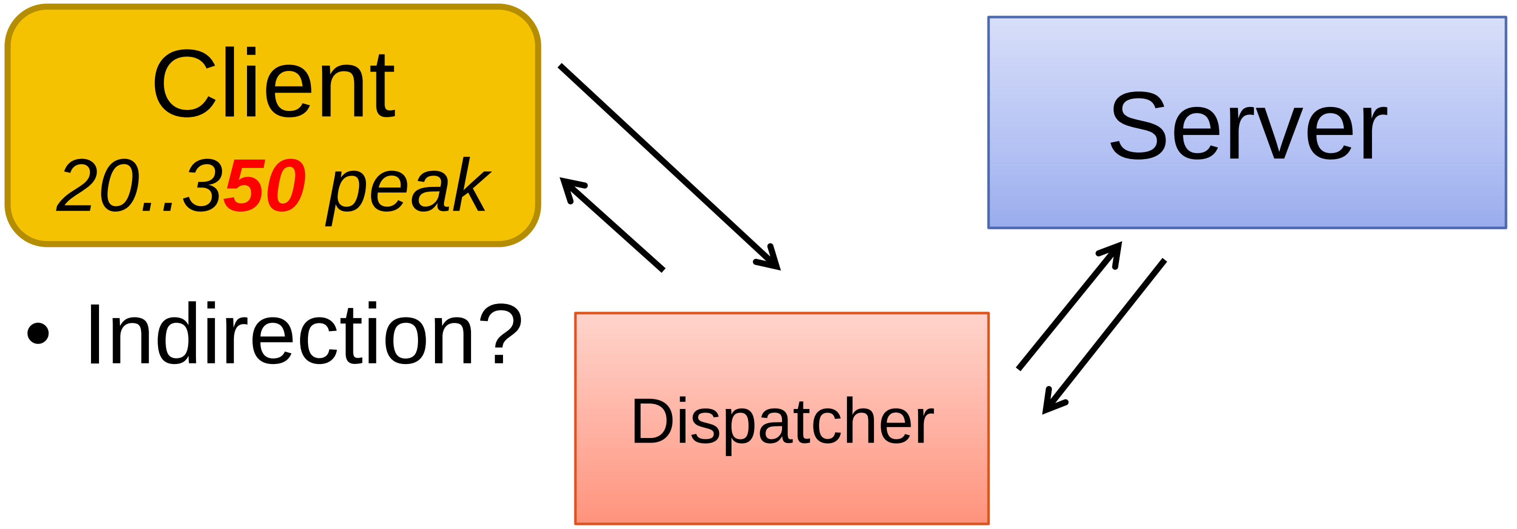
- What if it is not enough?
- Indirection?

CLIENT-SERVER ARCHITECTURE



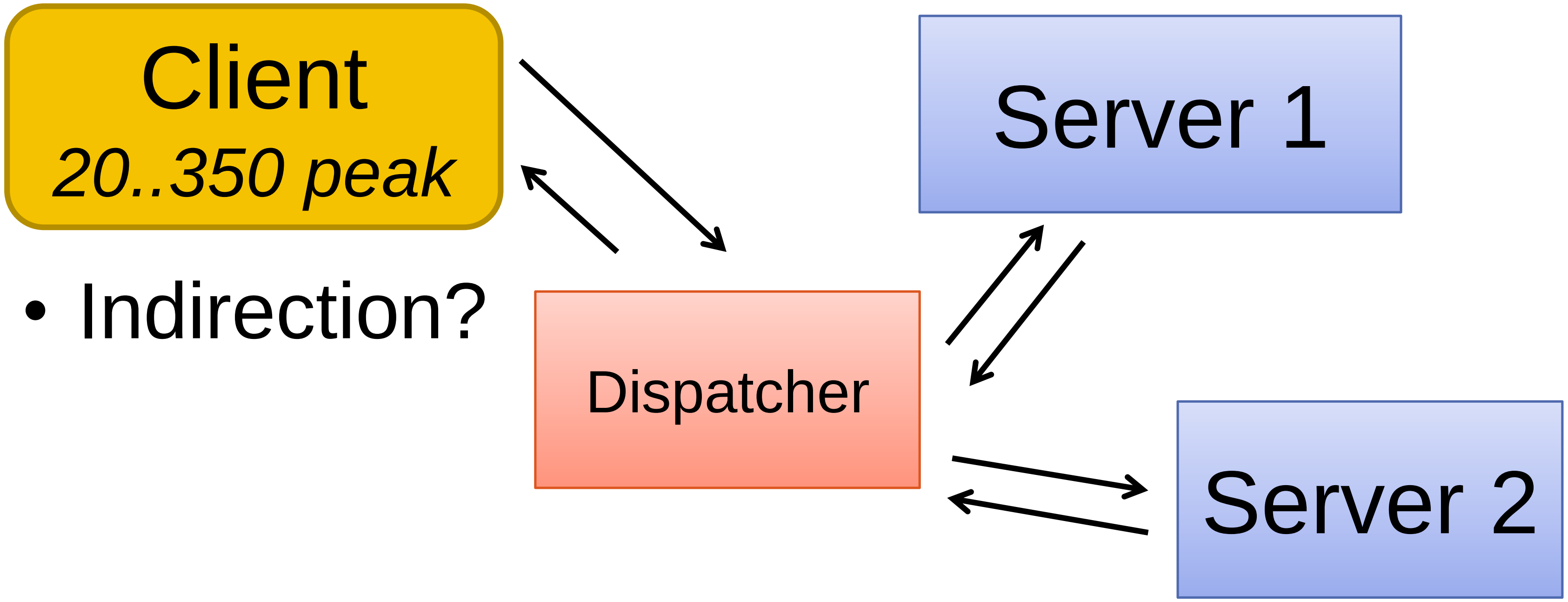
- Indirection?

CLIENT-DISPATCHER-SERVER ARCHITECTURE



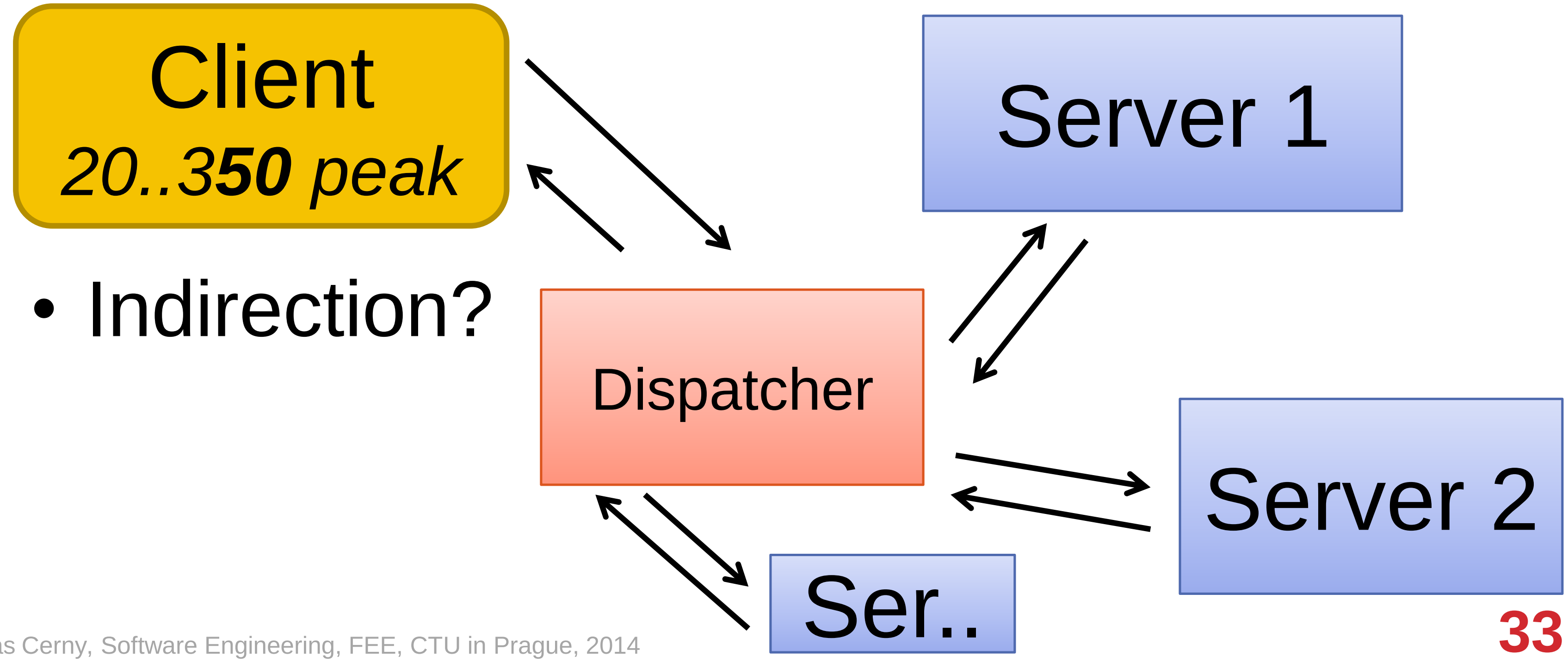
- Indirection?

CLIENT-DISPATCHER-SERVER ARCHITECTURE



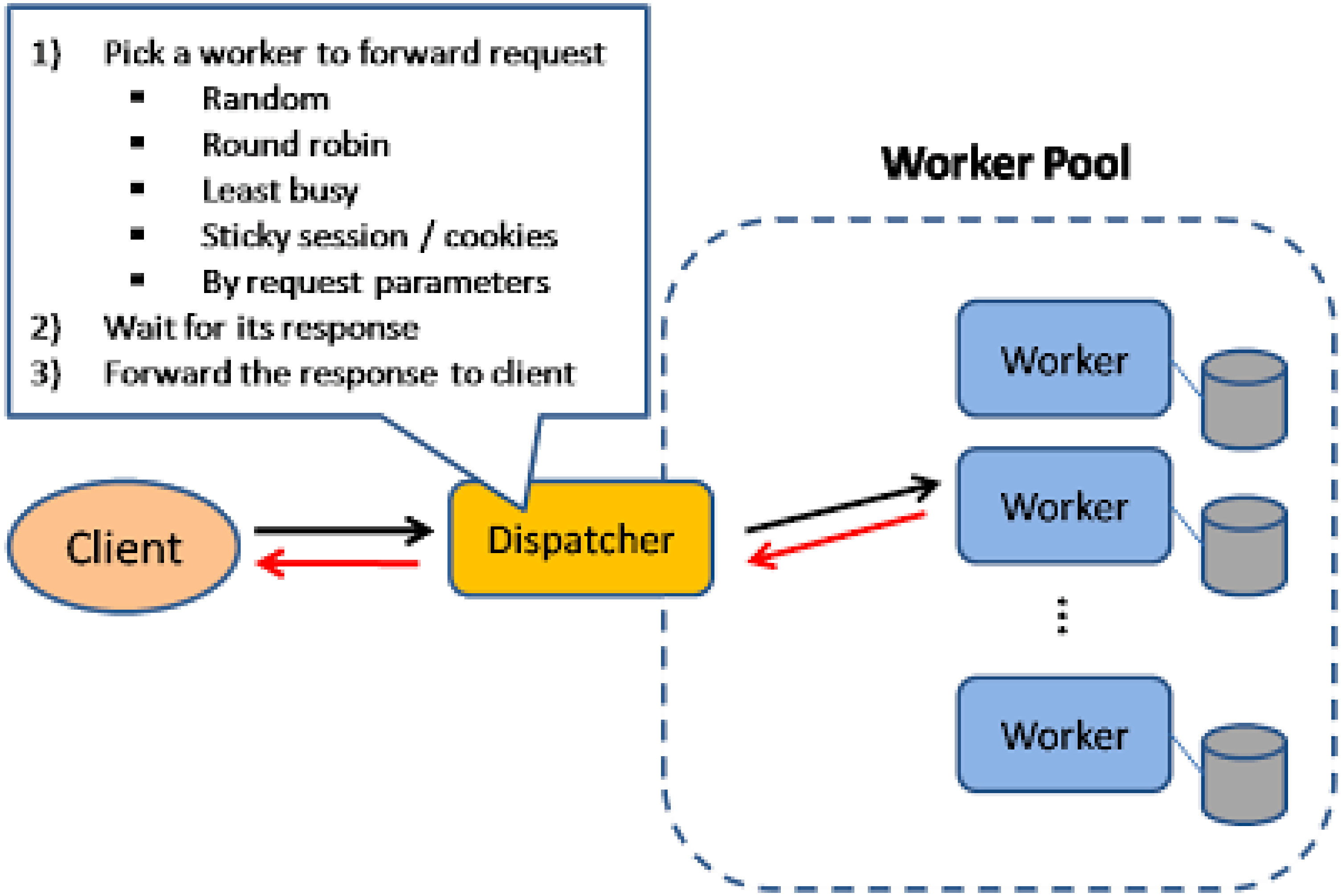
- Indirection?

CLIENT-DISPATCHER-SERVER ARCHITECTURE



- Indirection?

CLIENT-DISPATCHER-SERVER ARCHITECTURE



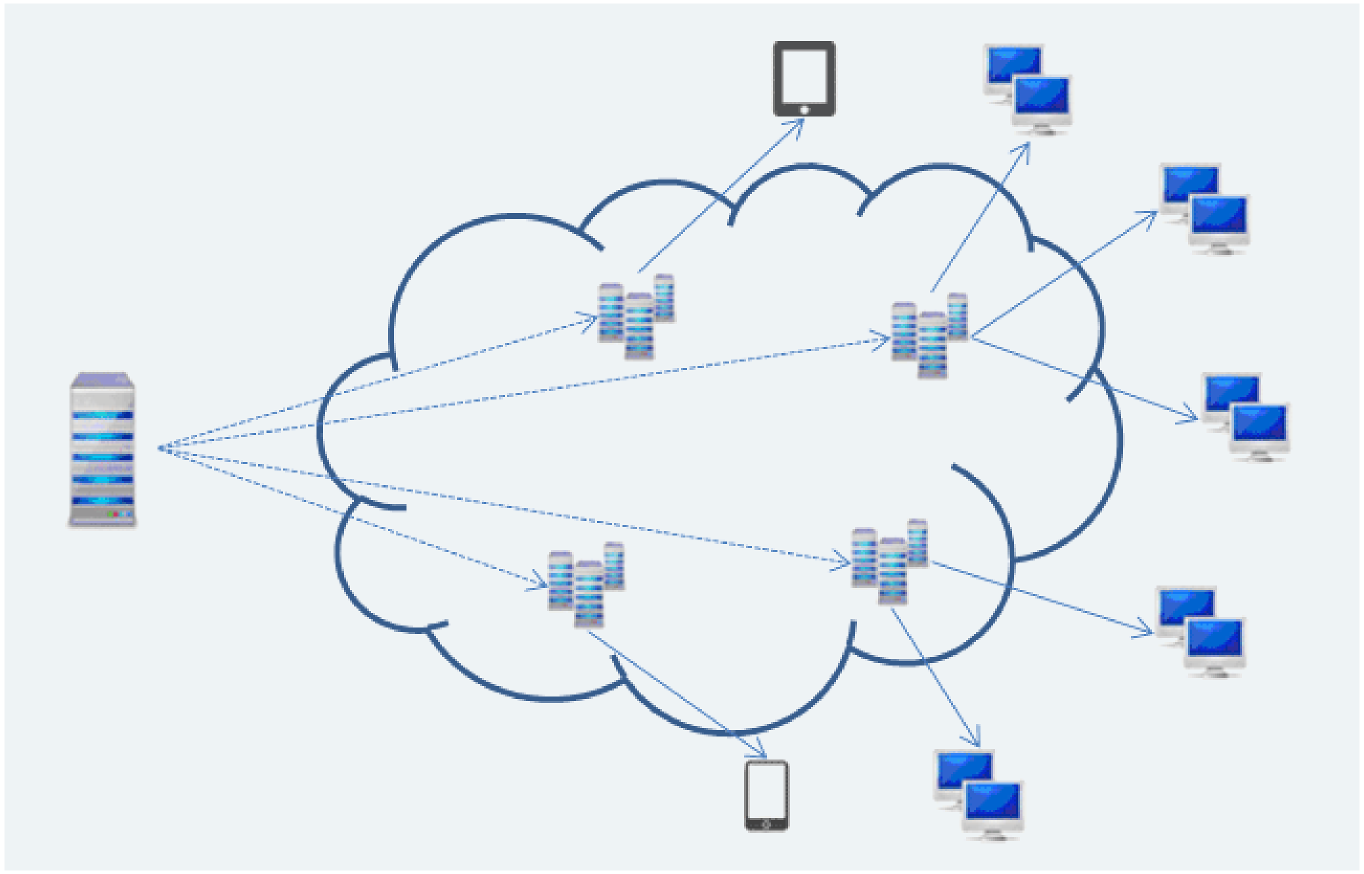
CLIENT-DISPATCHER-SERVER ARCHITECTURE

Most likely we cannot expect to multiply the throughput of the single server

- Balancing overhead
- We can balance different resources
  - Static vs. Dynamic
- Geo-location balancing
  - Content-Delivery-Network (CDN)
    - Static content (Akamai)

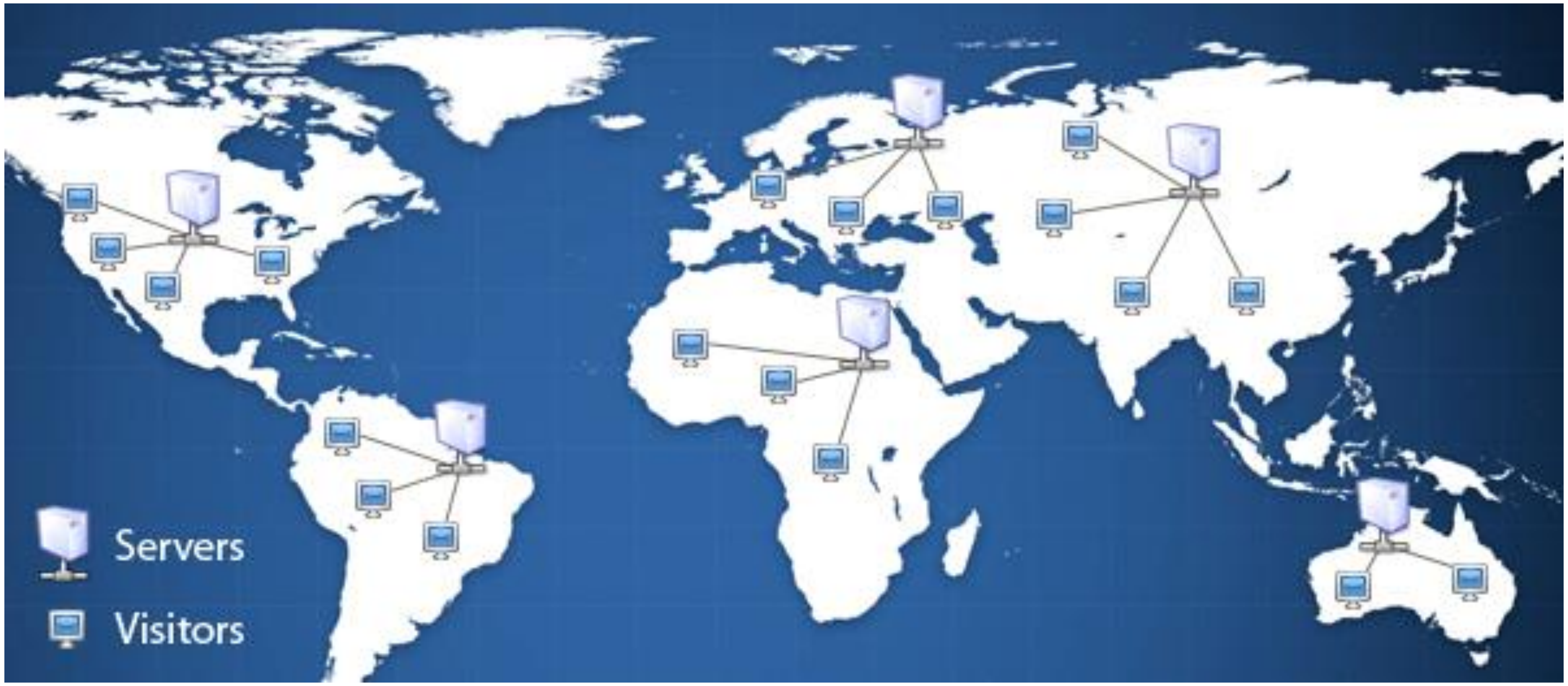
CONTENT DELIVERY NETWORK (CDN)

Example



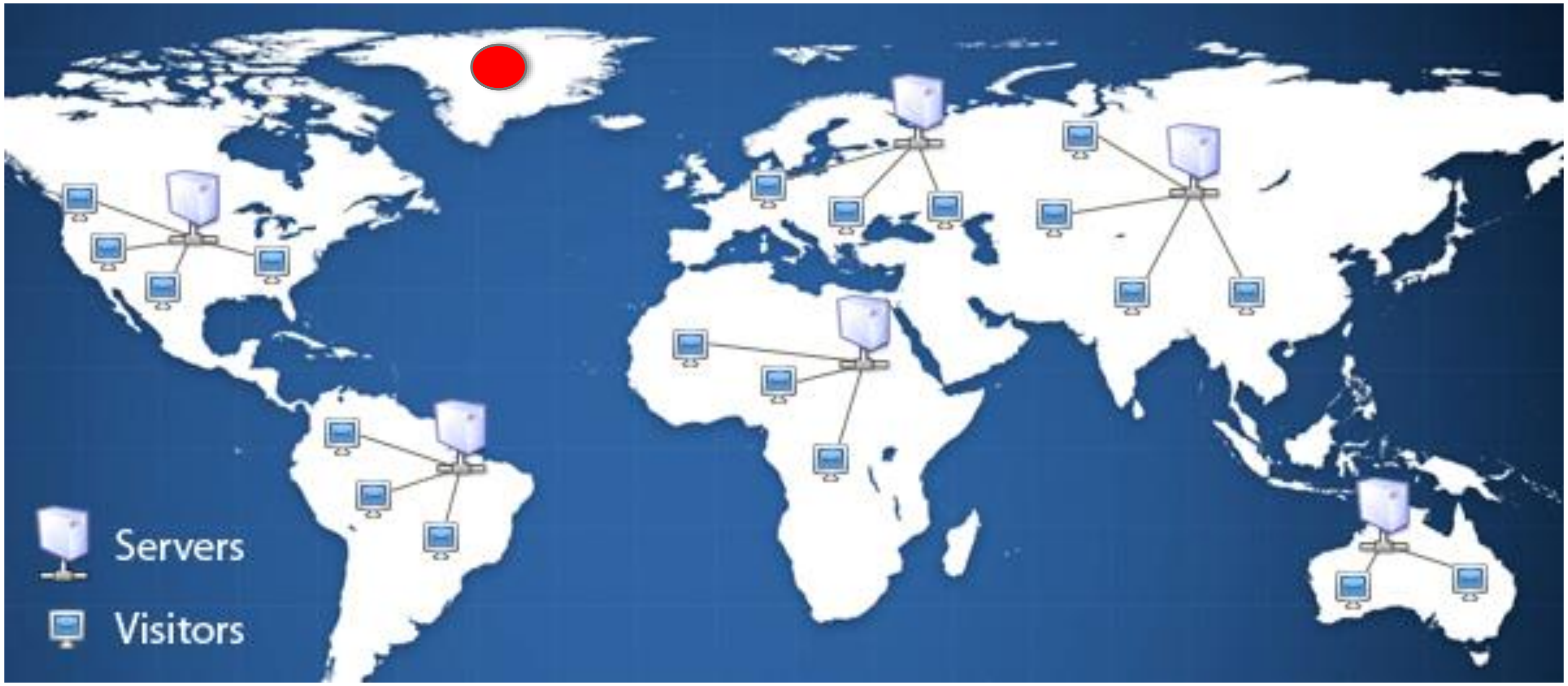
CONTENT DELIVERY NETWORK (CDN)

Example



CONTENT DELIVERY NETWORK

Example



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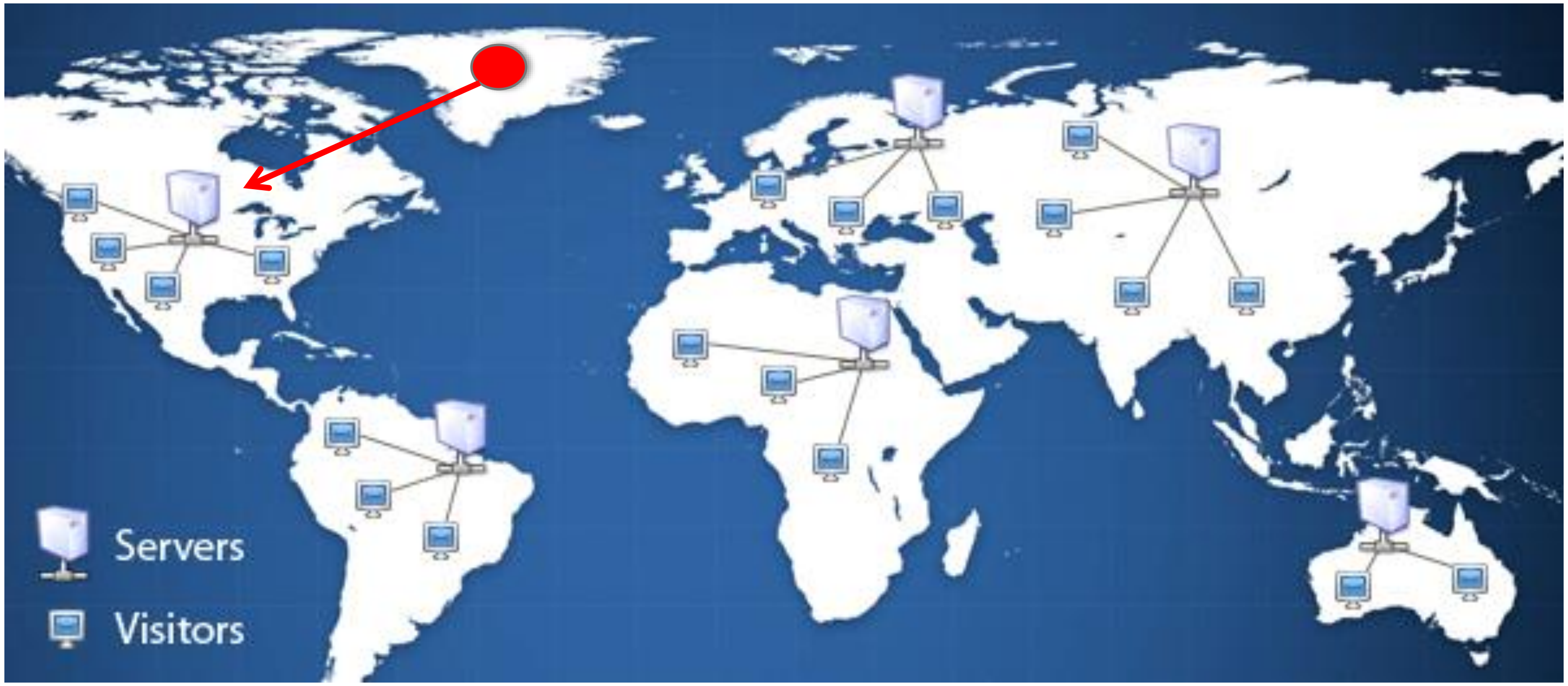

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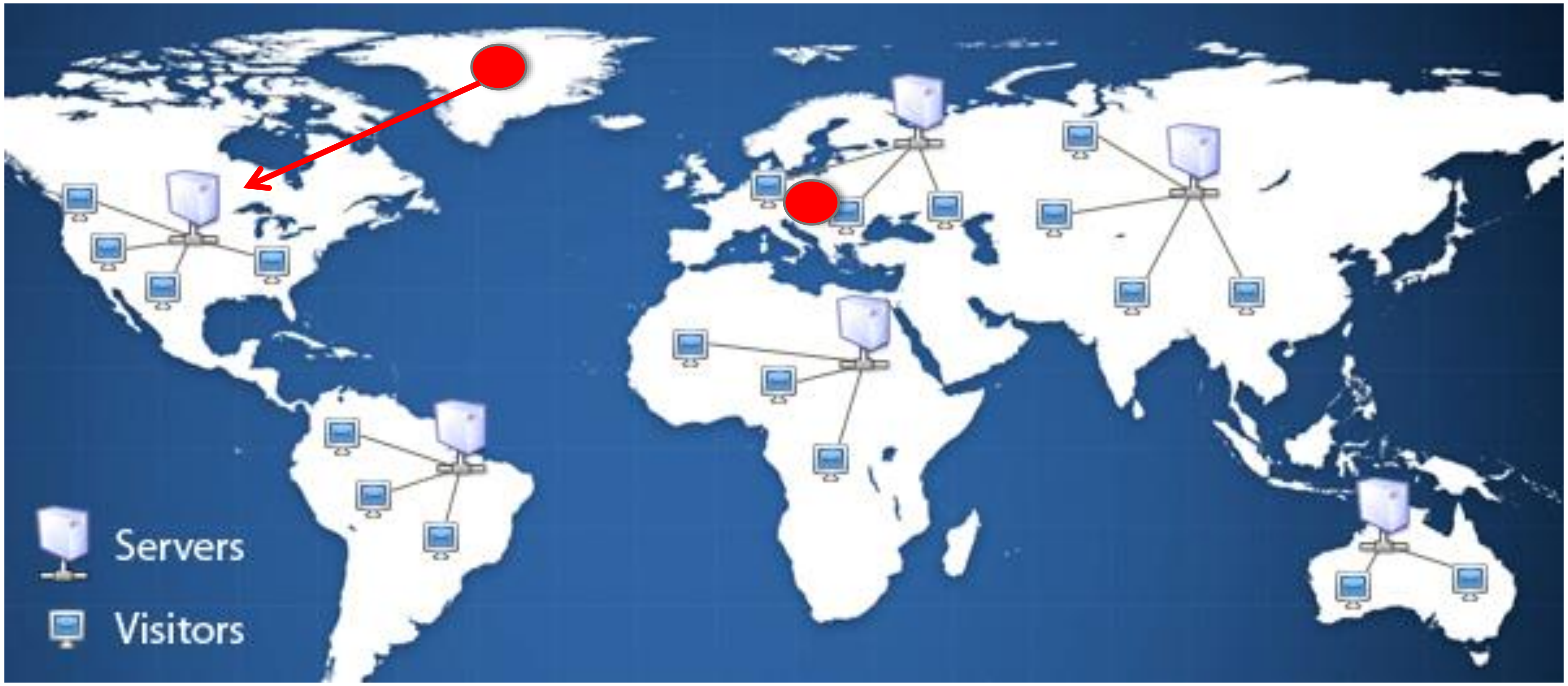

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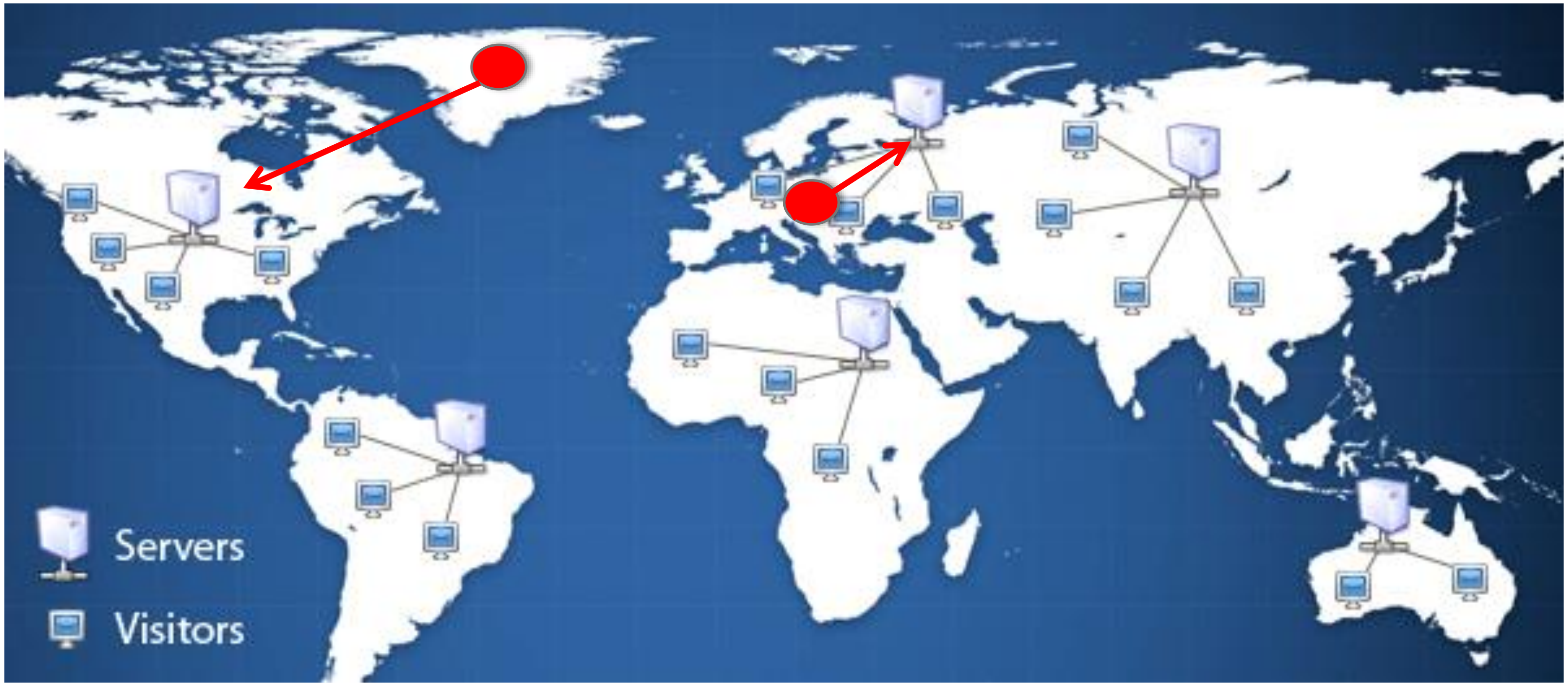
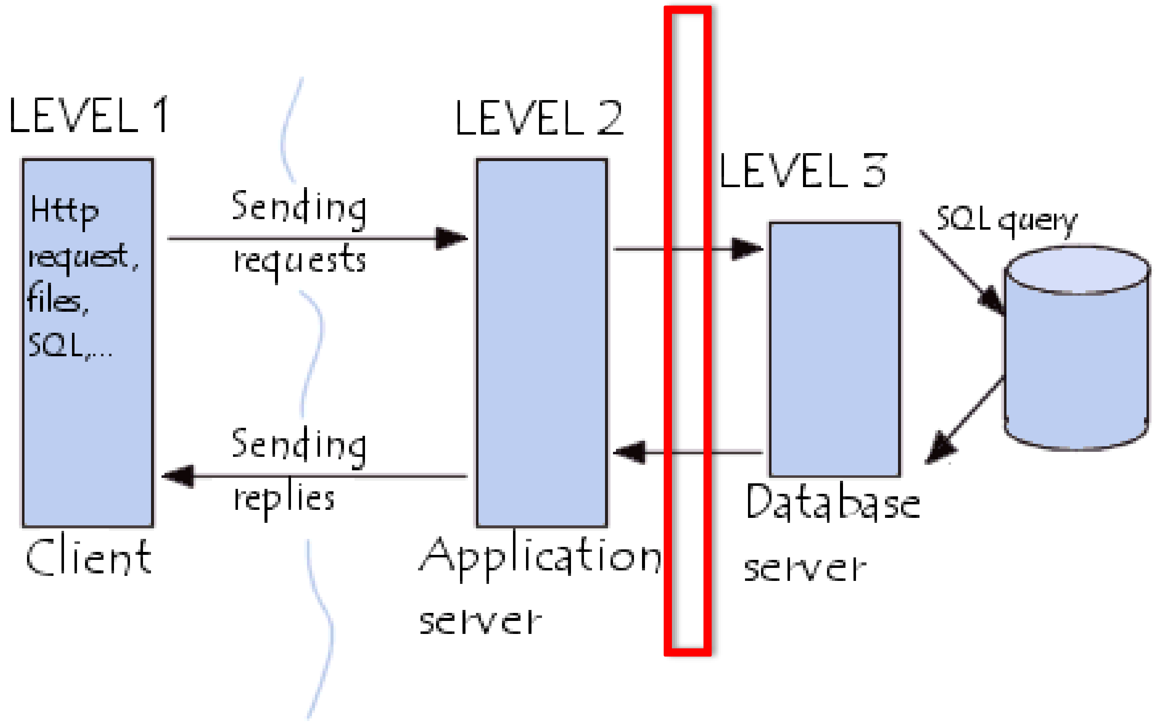


SCALING PERFORMANCE

Database might be the bottleneck

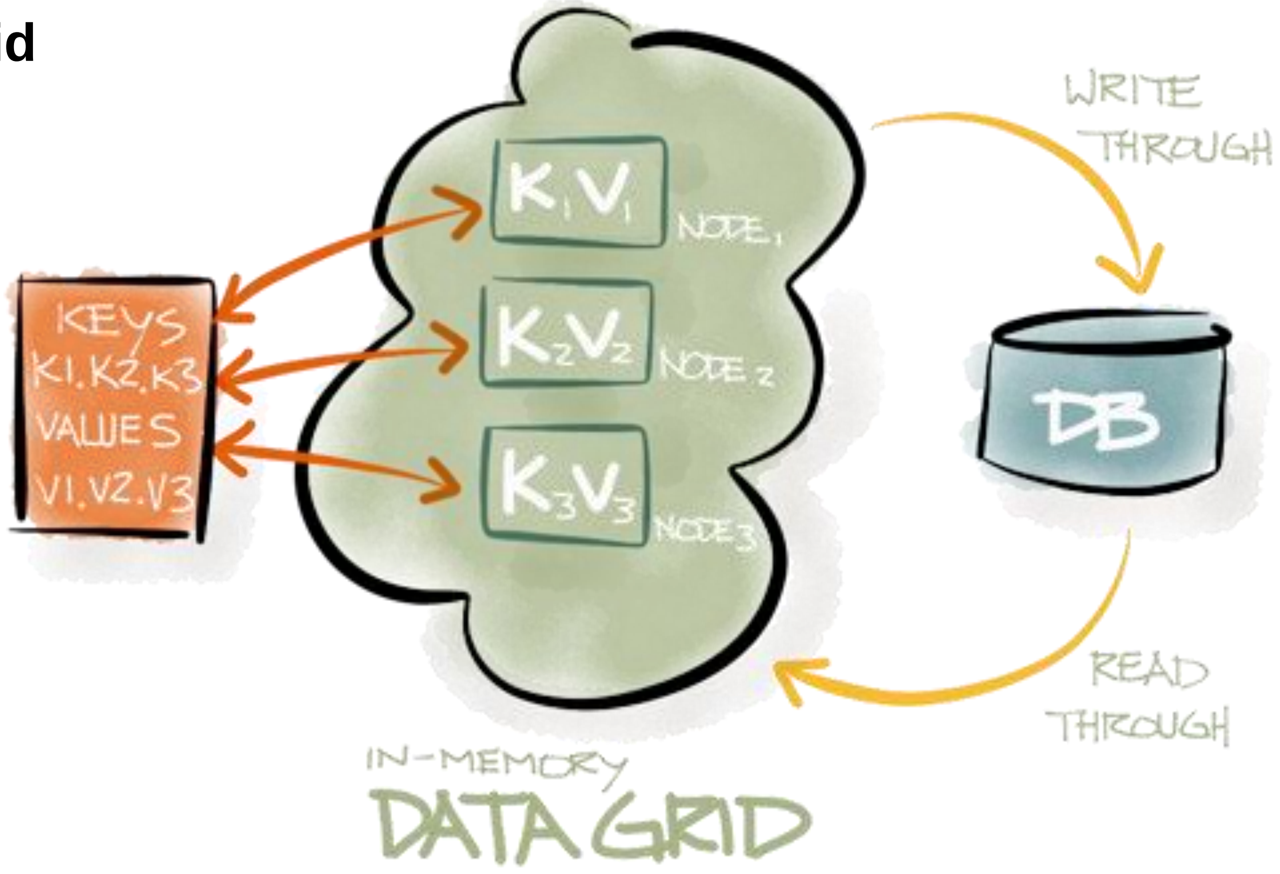
Database replication



SCALING PERFORMANCE

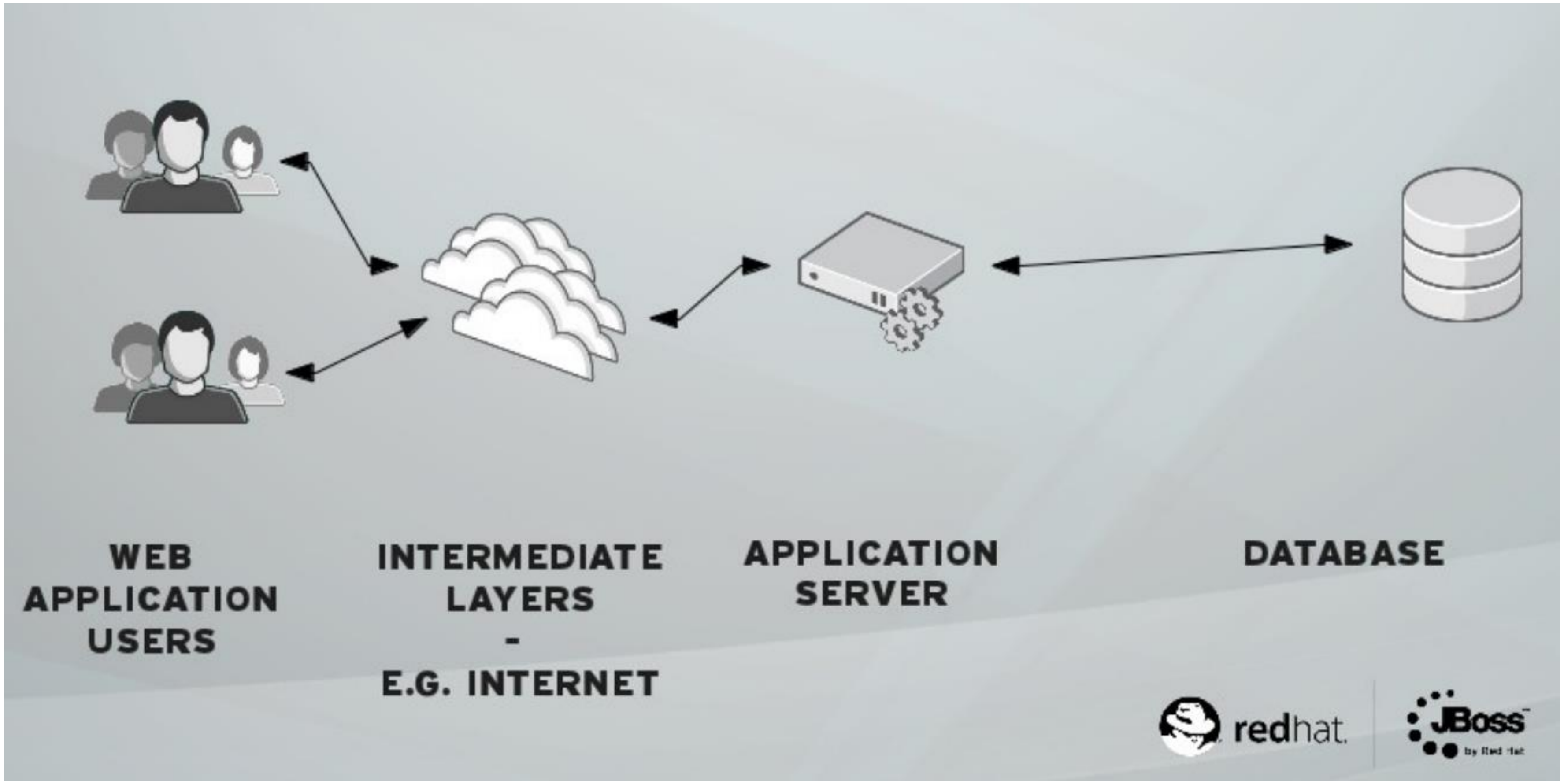
Database might be the bottleneck

Datagrid

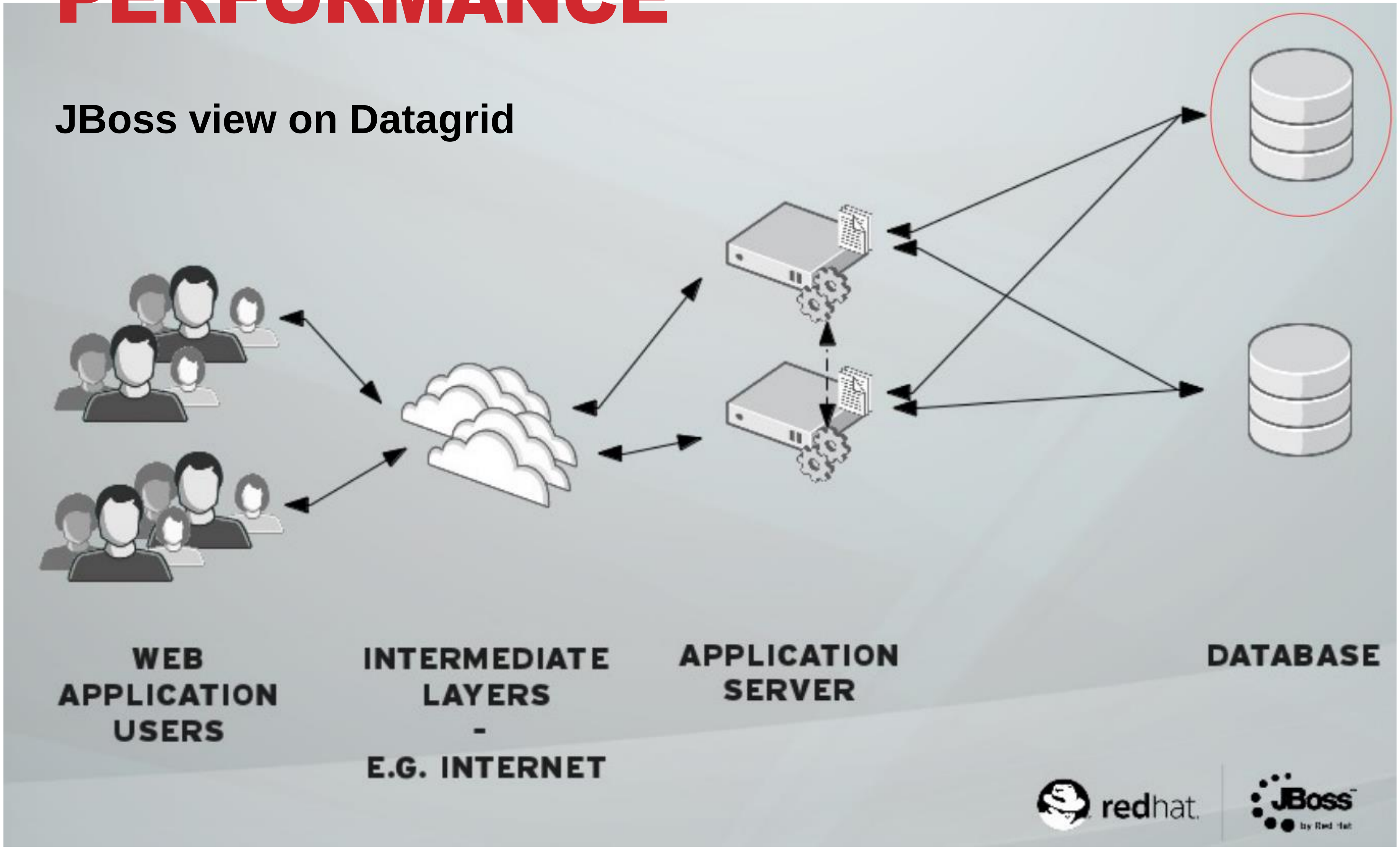


SCALING PERFORMANCE

JBoss view on Datagrid

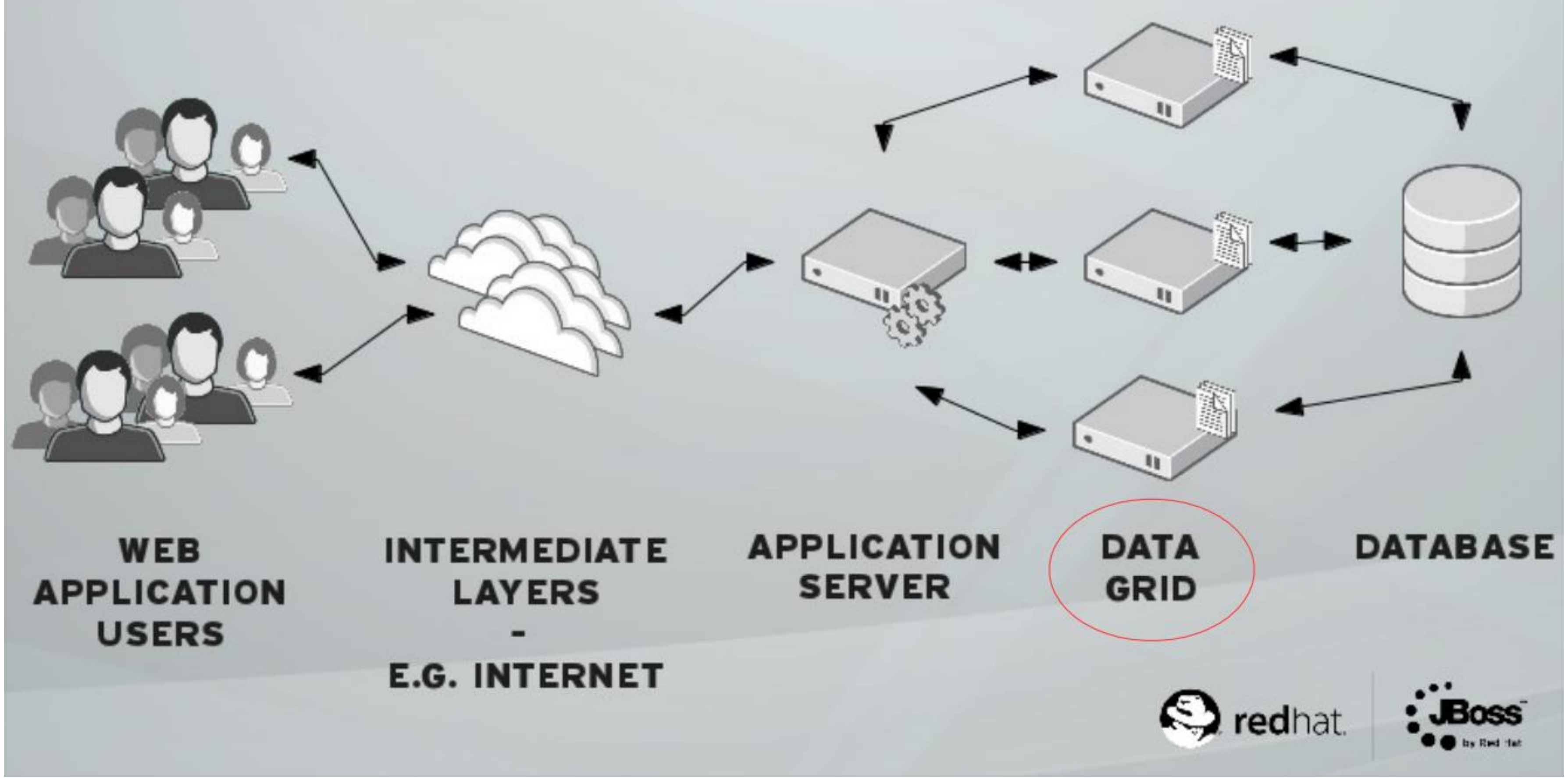


SCALING PERFORMANCE


JBoss view on Datagrid

SCALING PERFORMANCE

JBoss view on Datagrid



SERVICE-ORIENTED ARCHITECTURE (SOA)

So far we considered that server-side app offers data, knowledge and presentation

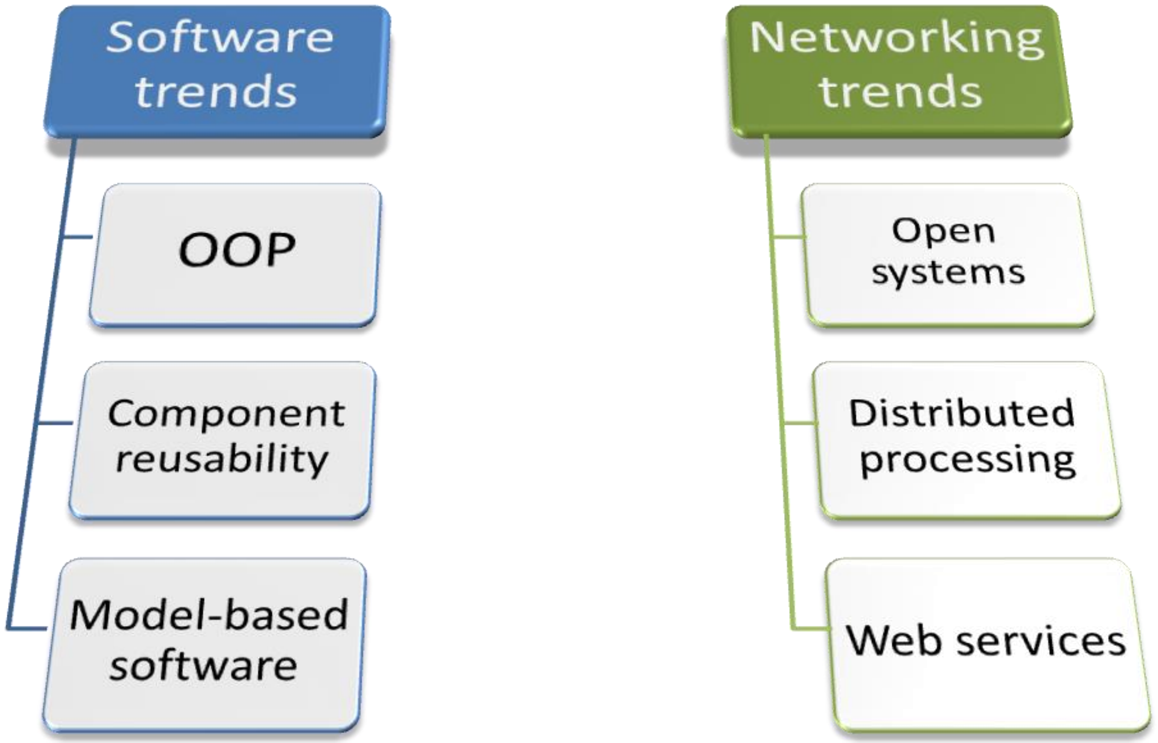
Service does not provide presentation

Well accepted format

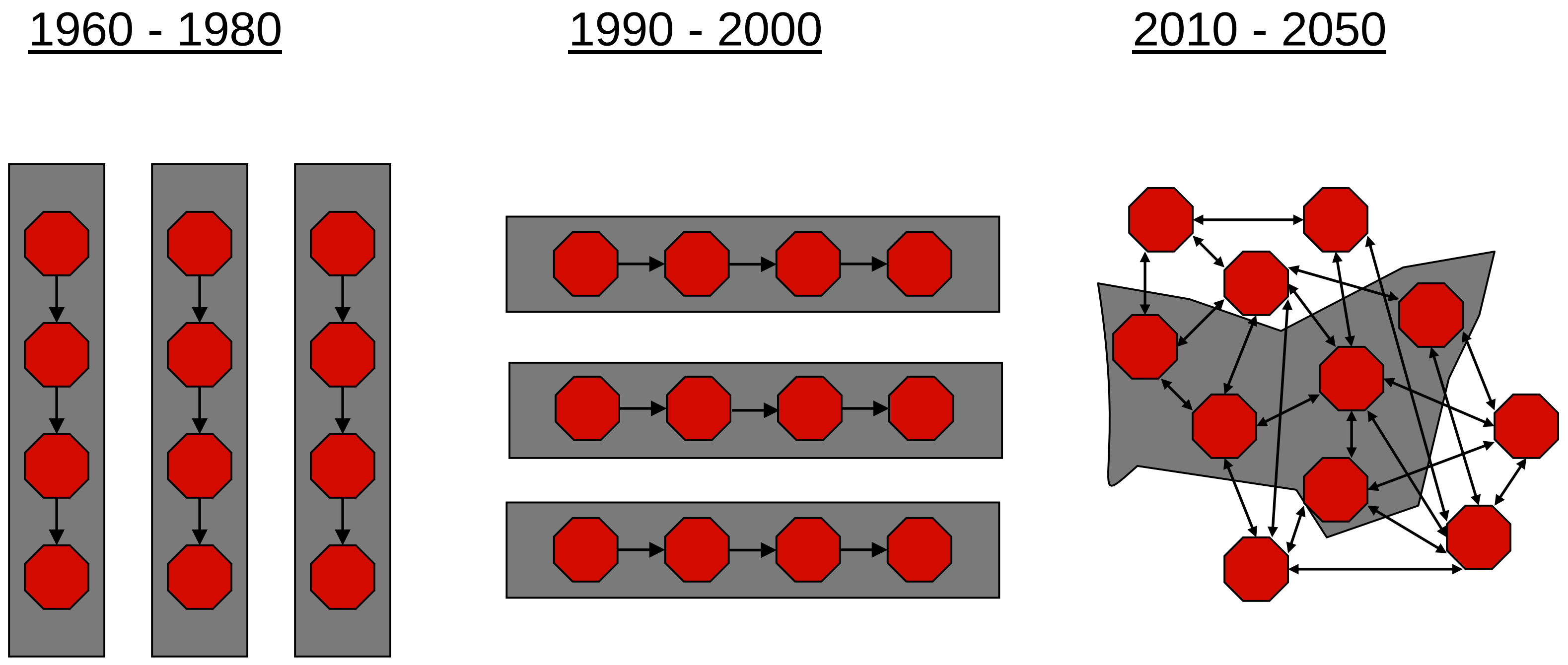
Standard : JSON, SOAP, XML..

SERVICE-ORIENTED ARCHITECTURE

Motivation



SERVICE-ORIENTED ARCHITECTURE

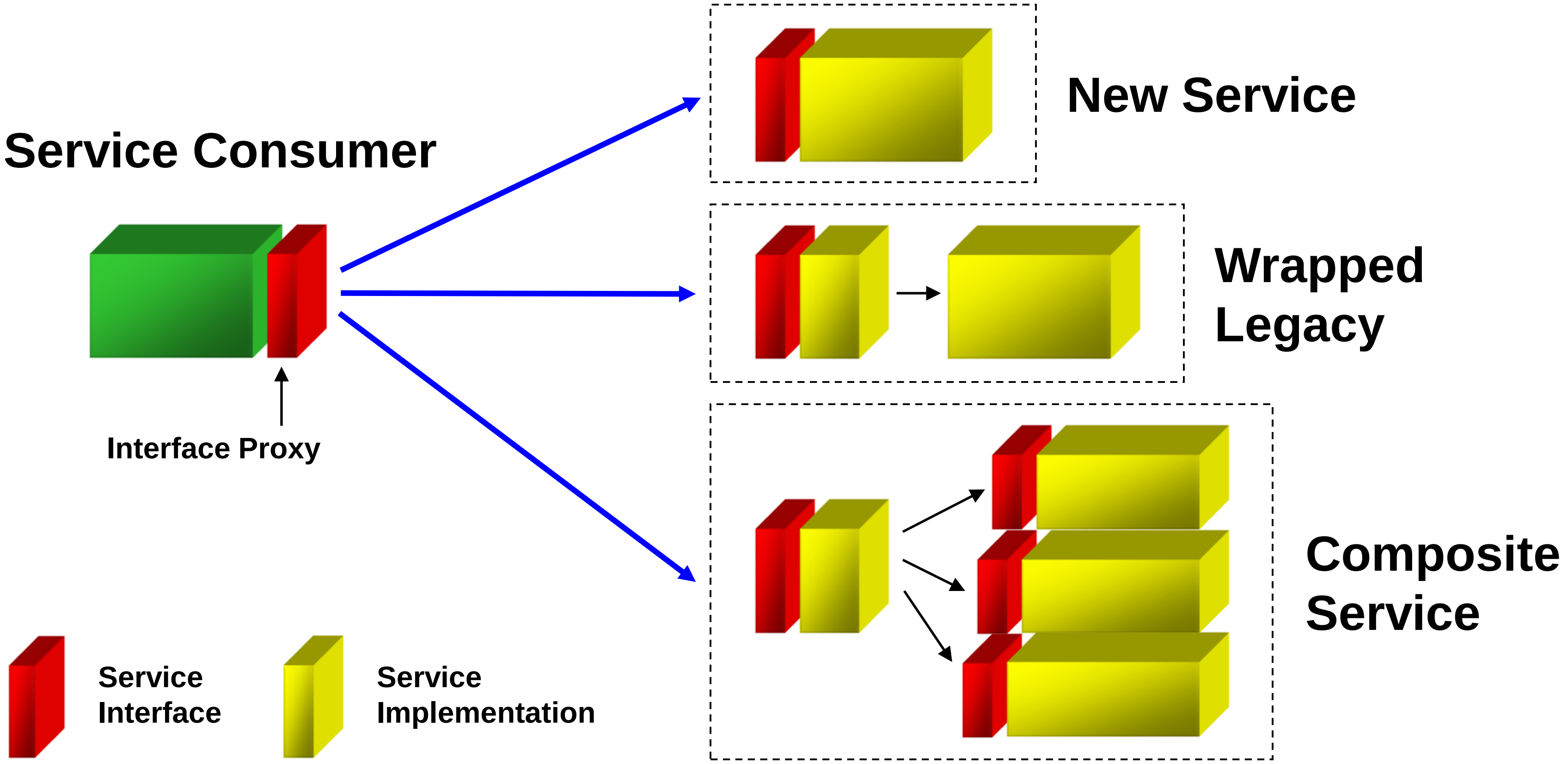


•Organization Focus	•Process Focus	•Distributed Functions
•Mainframe Centric	•Client Server	•Data Centric
•Internal Use	•Partial Connectivity	•Universal Interoperability
•Unique Data	•EDI File Transfer	•Real-time Connectivity

SERVICE

- Loose coupling
- Reusable
- Stateless
- Autonomous (independent)
- Discoverable
- Abstract
- Composable
- Platform independent

ANATOMY OF A SERVICE

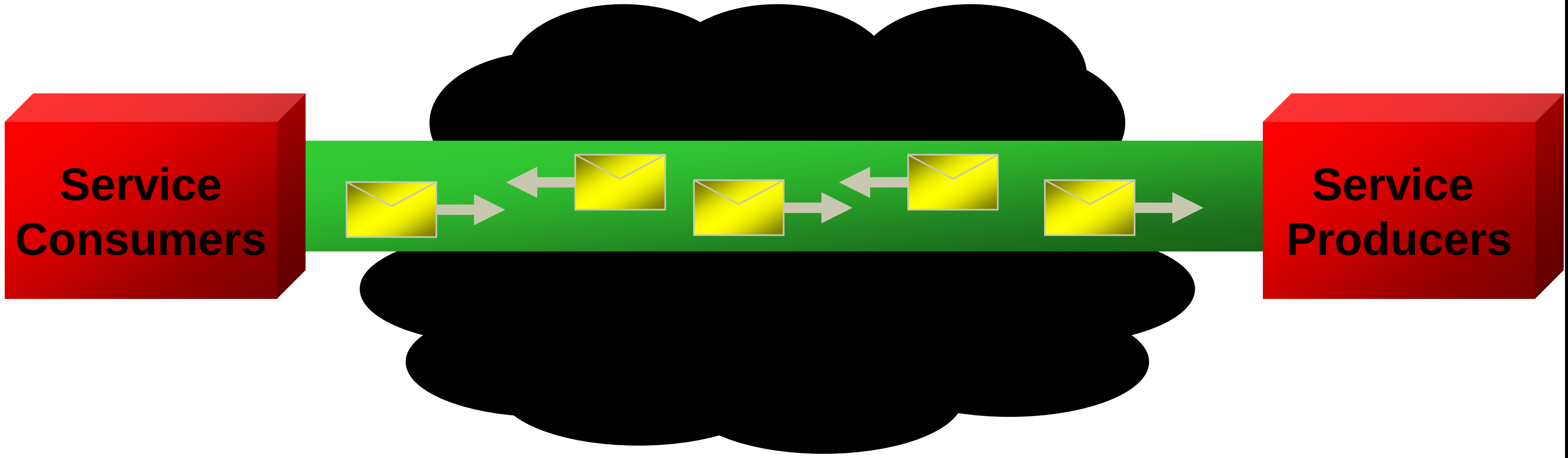


SERVICES COMMUNICATE WITH MESSAGES

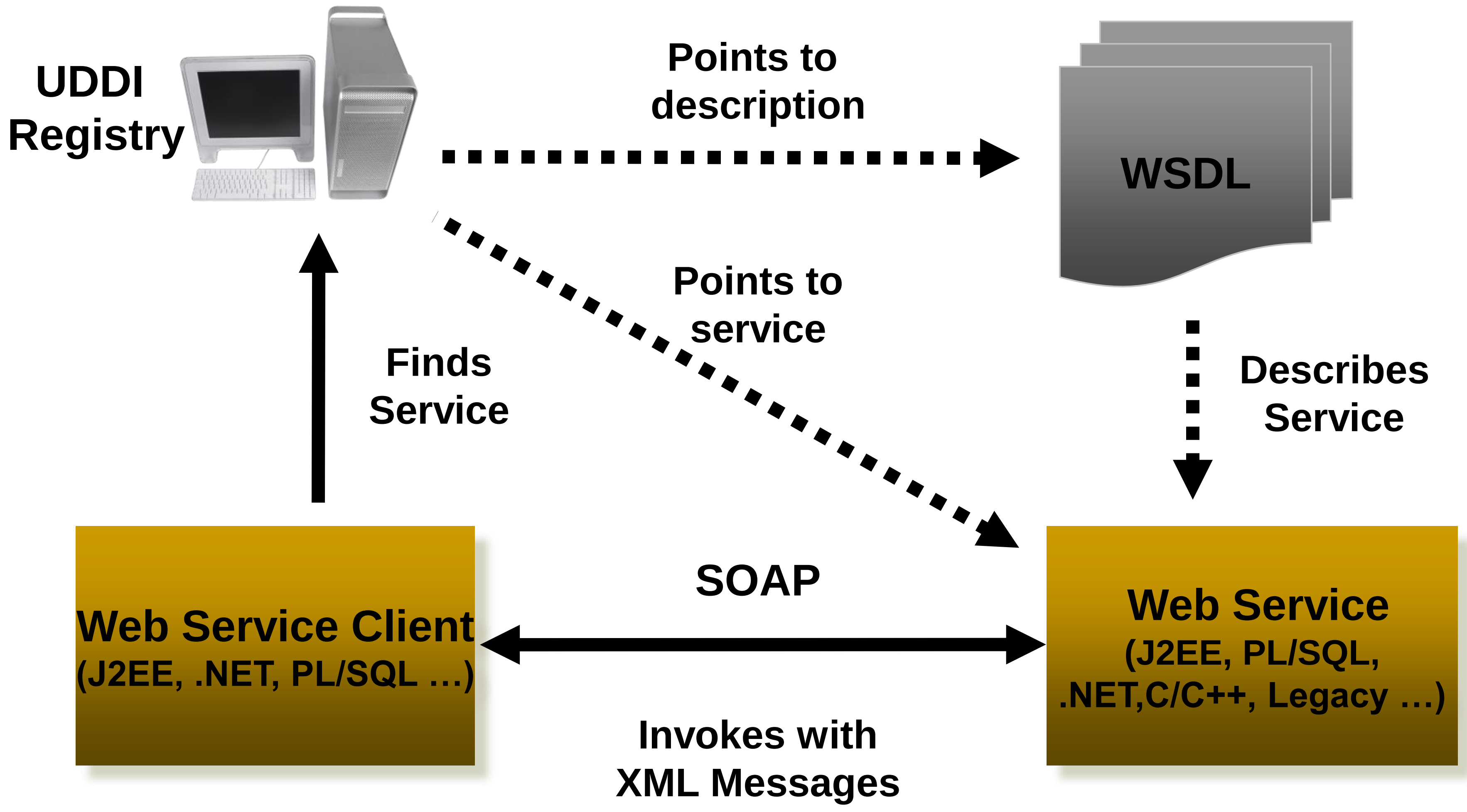
Providing reliability and security to messages

Sending messages across consumers and producers

Service Orchestration



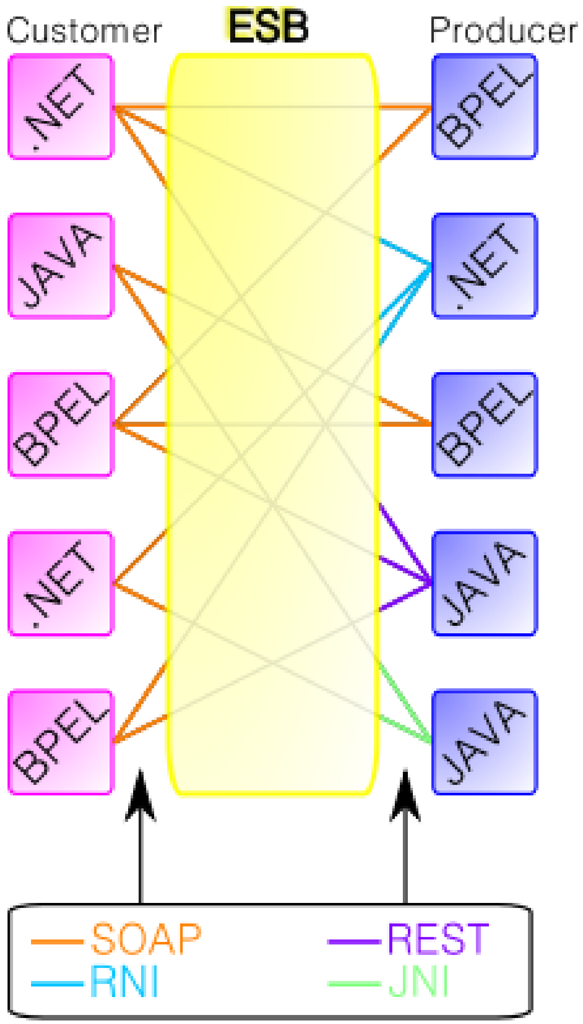
BASIC WEB SERVICES



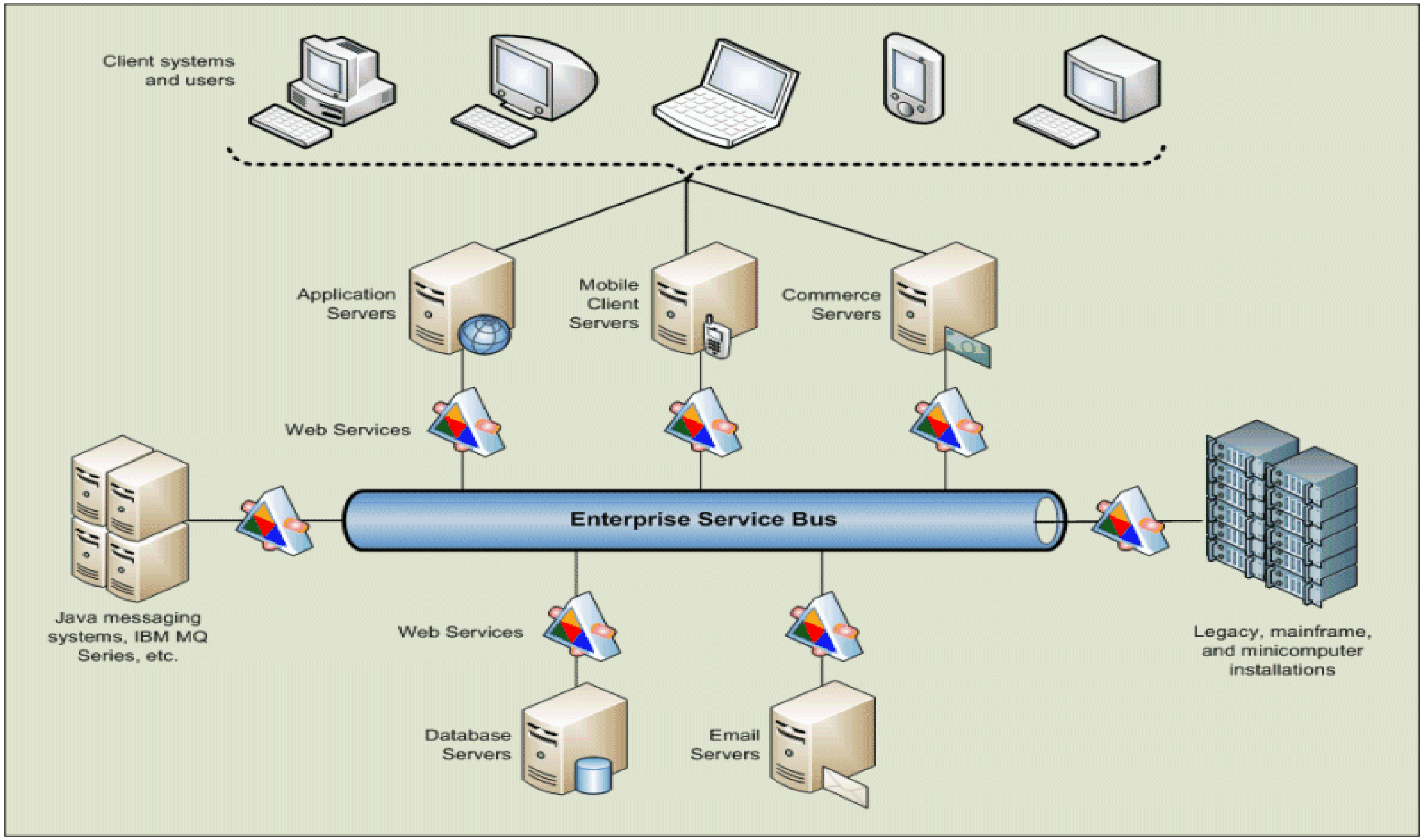
ENTERPRISE SERVICE BUS (ESB)

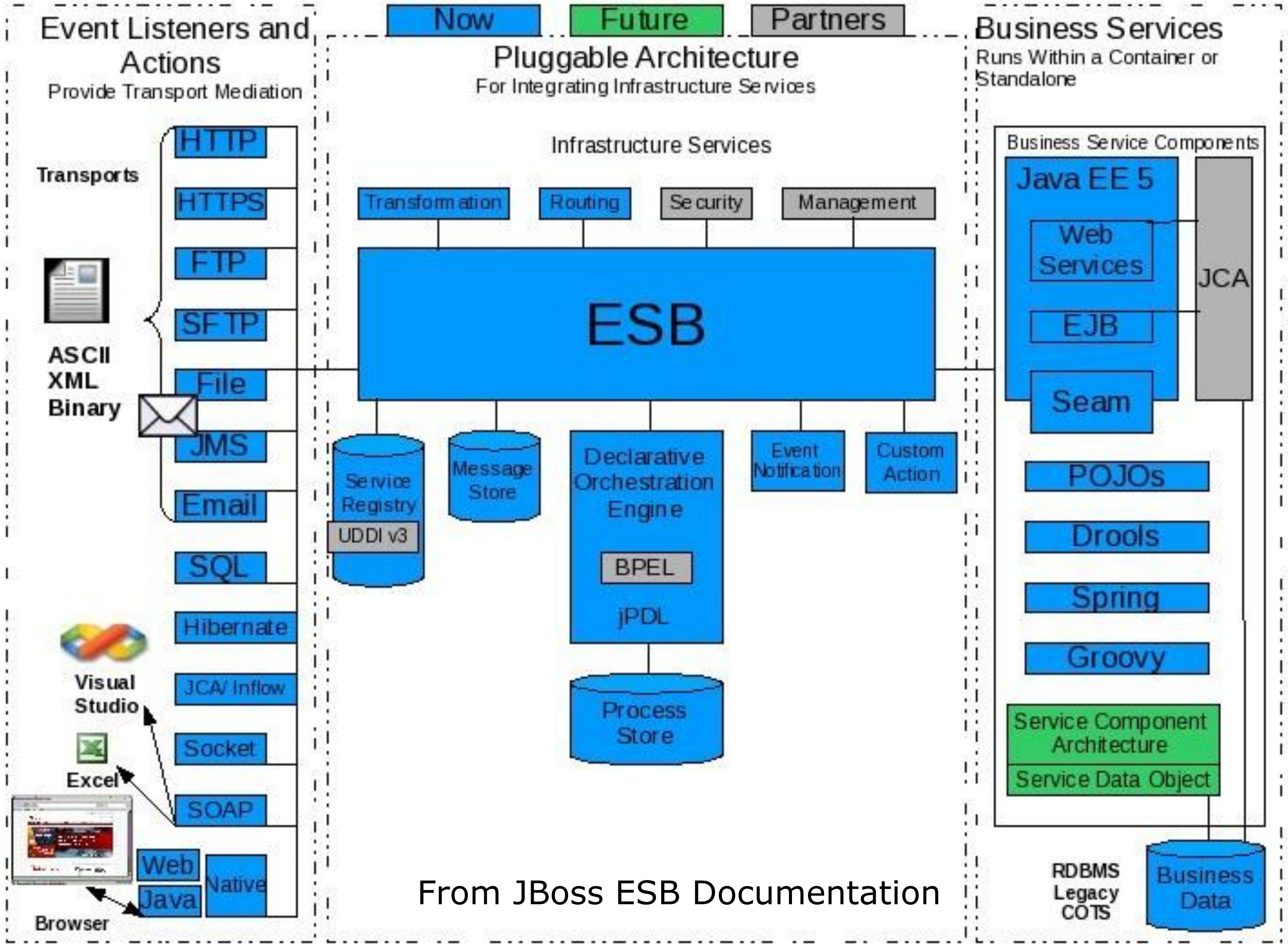
It is **a software architecture model** used for designing and implementing the interaction and **communication** between mutually interacting **software applications in** service-oriented architecture (**SOA**).

- Model for distributed computing
- Variant of client server software architecture model
- Promotes flexibility with regards to communication & interaction between applications.
- Primary use in enterprise application integration (EAI) of heterogeneous and complex landscapes.



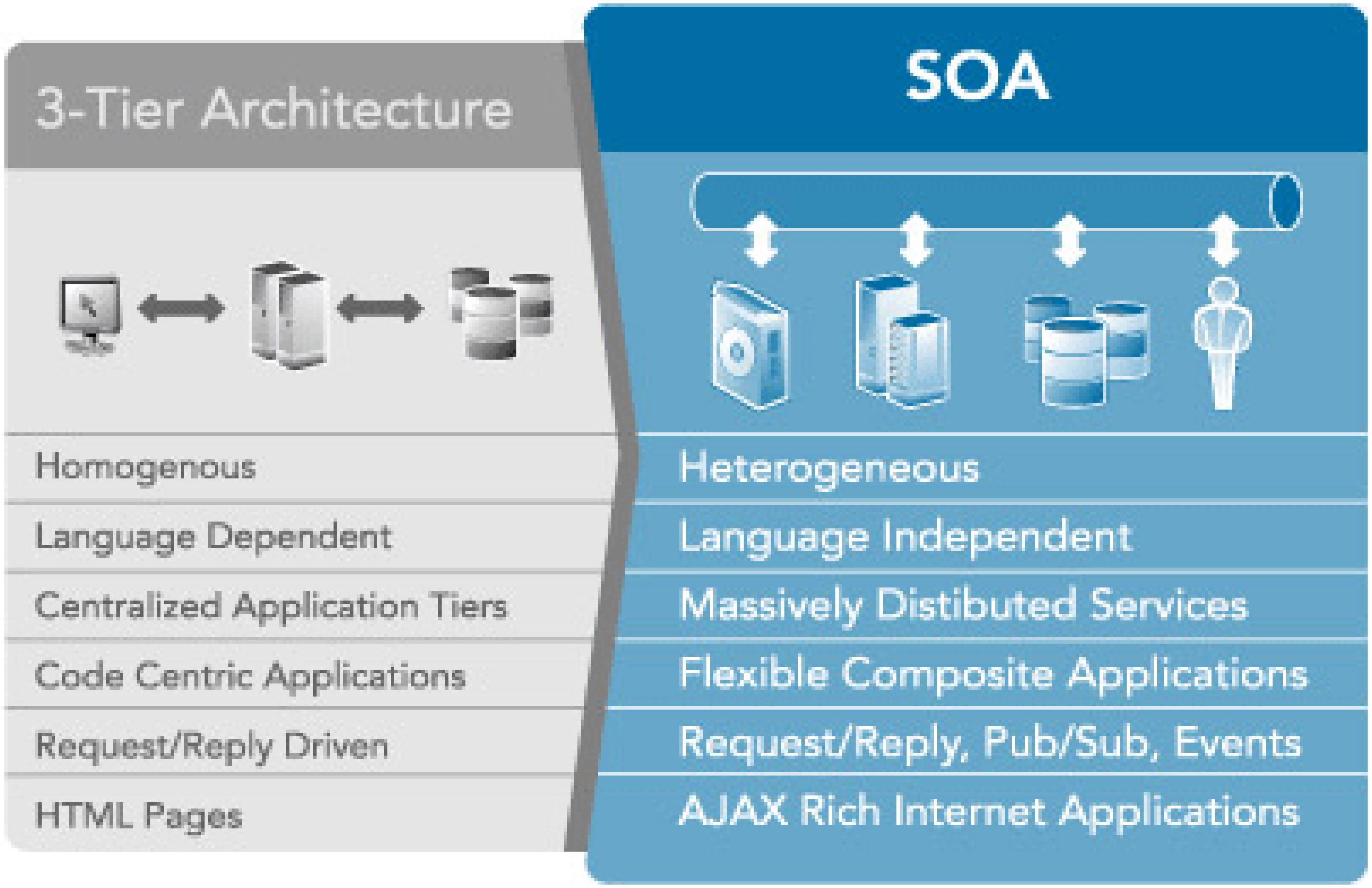
ENTERPRISE SERVICE BUS





From JBoss ESB Documentation

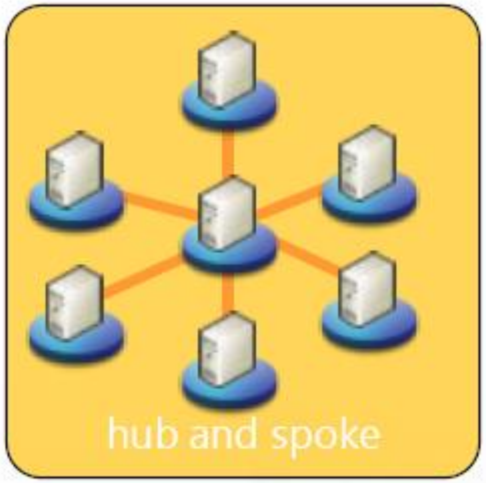
SOA IS AN EVOLUTIONARY STEP



3-Tier Architecture	SOA
Homogenous	Heterogeneous
Language Dependent	Language Independent
Centralized Application Tiers	Massively Distibuted Services
Code Centric Applications	Flexible Composite Applications
Request/Reply Driven	Request/Reply, Pub/Sub, Events
HTML Pages	AJAX Rich Internet Applications

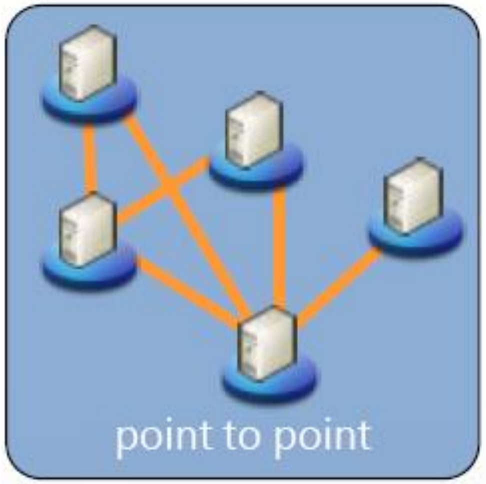
SOA IS AN EVOLUTIONARY STEP

in distributed communications



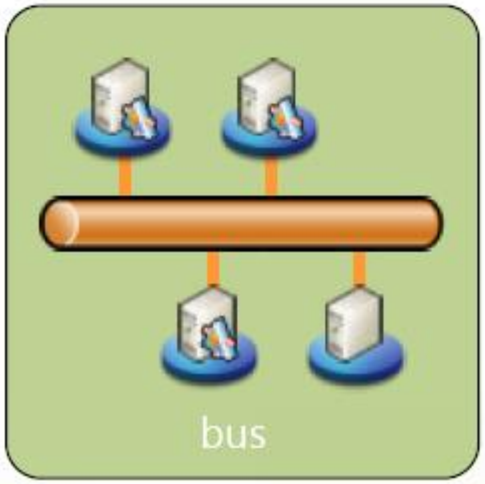
“too centralized

EAI



“too decentralized”

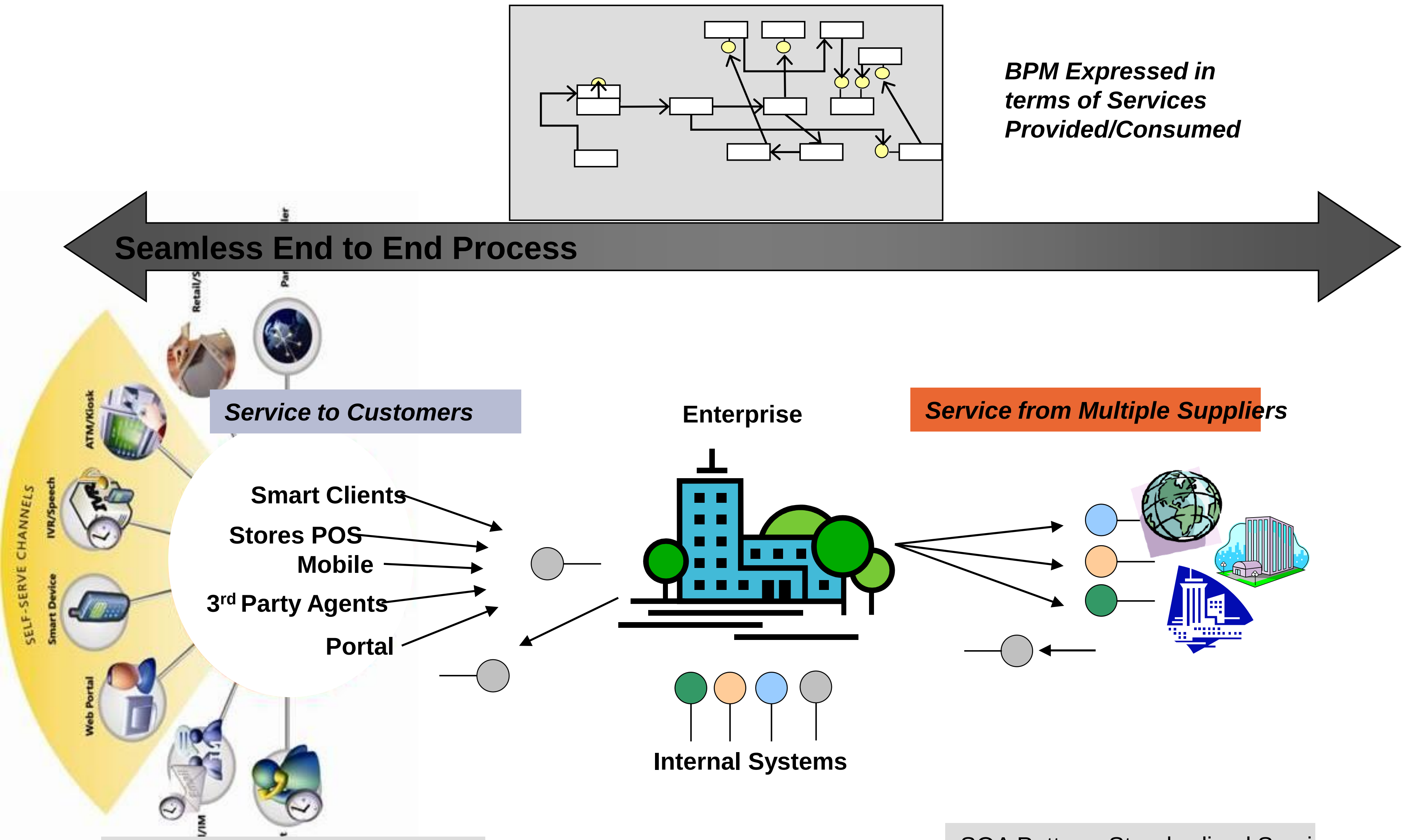
Project-ware



“just right”

SOA

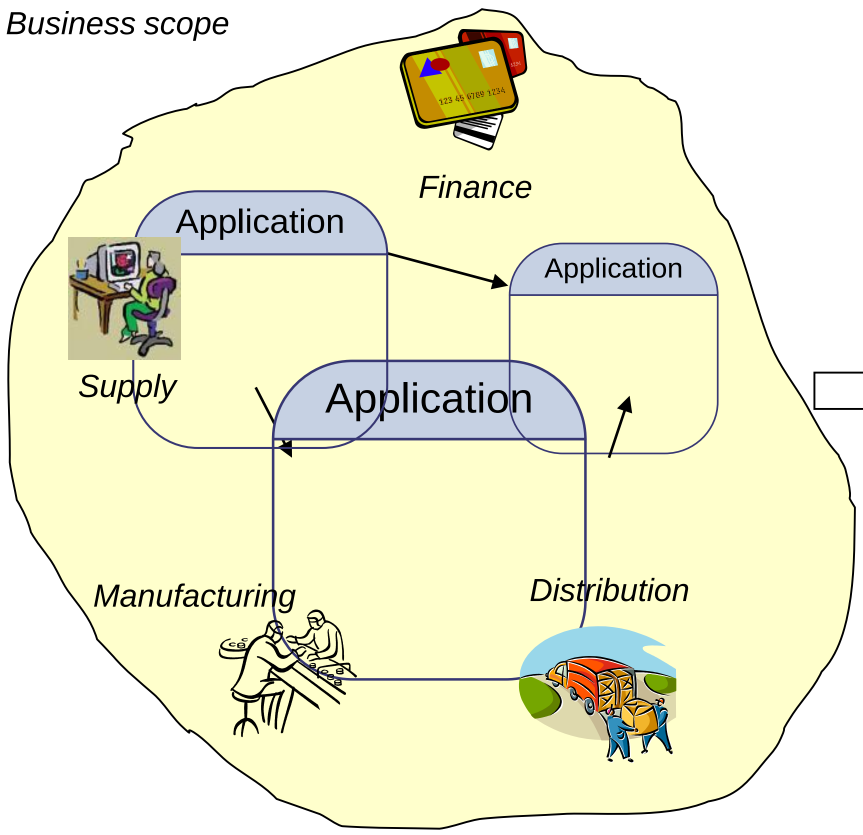
TO ENABLE BUSINESS PROCESS OPTIMIZATION AND THE REAL TIME ENTERPRISE (RTE)

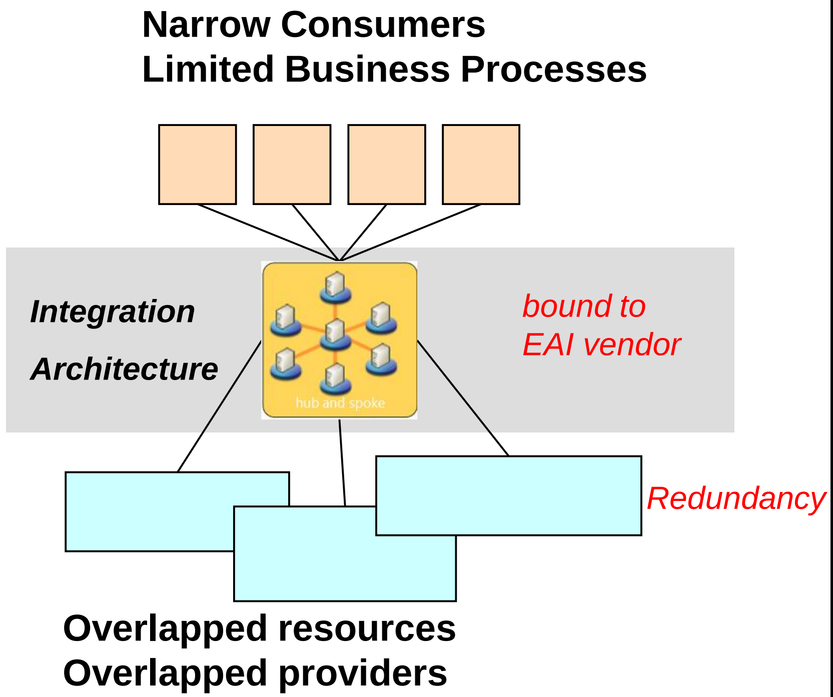


SOA Patterns: Single, Multi-Channel Service for consistency

SOA Pattern: Standardized Service provided by multiple suppliers

APPLICATION CENTRIC

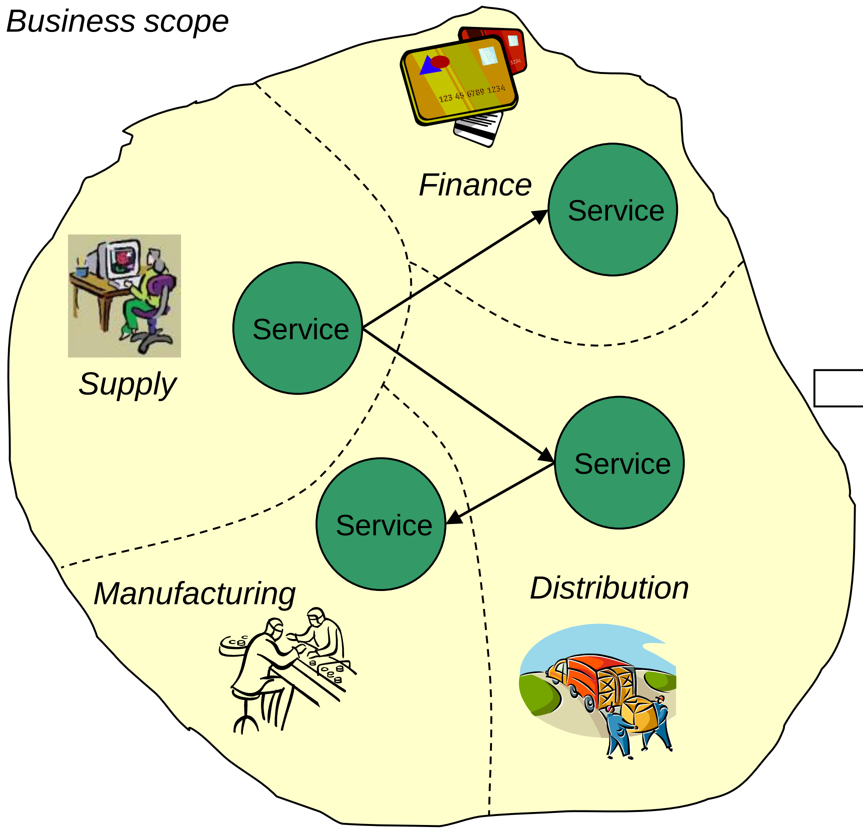


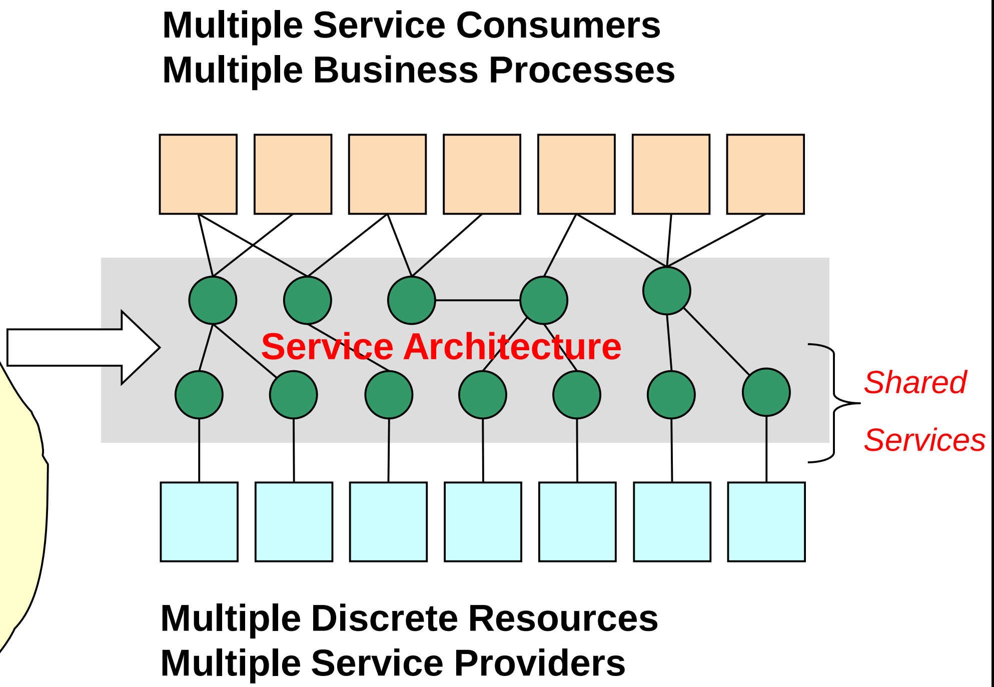


Business functionality is duplicated in each application that requires it.

EAI ‘leverage’ application silos with the drawback of data and function redundancy.

SERVICE CENTRIC




Multiple Service Consumers
Multiple Business Processes
Service Architecture
Shared
Services
Multiple Discrete Resources
Multiple Service Providers

SOA structures the business and its systems as a set of capabilities that are offered as Services, organized into a Service Architecture

Service virtualizes how that capability is performed, and where and by whom the resources are provided, enabling multiple providers and consumers to participate together in shared business activities.

SERVICE CENTRIC APPROACHES

Open your business to extension and evolution!

Natural extension and reuse

- Expedia API, Paypal, Amazon API, Airfare, Heureka..

Open your system to novel needs, requirements, interaction

Reuse by other vendors!