Refactor your applications using Container and Microservices

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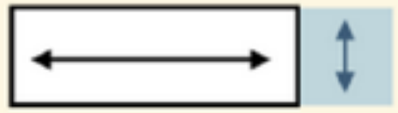
Red Hat

Advantages

Standardization 	ISO standard (modes and equipment). Unique identification number and size type code.
Flexibility 	Commodities, manufactured goods, liquids and refrigerated goods.
Costs 	Low transport costs. Economies of scale at modes and terminals.
Velocity 	Fast transshipment operations. Low terminal turnaround times.
Warehousing 	Own warehouse; simpler and less expensive packaging. Stacking capability.
Security & Safety 	Contents unknown to carriers. Reduced spoilage and losses.

Drawbacks

Site Constraints 	Large consumption of terminal space. Draft issues with larger containerships.
Capital Intensiveness 	Container handling infrastructures and equipment are important investments.
Stacking 	Complexity of arrangement of containers, both on the ground and on modes.
Repositioning 	Divergence between production and consumption; repositioning. 20% of all containers.
Theft and Losses 	High value goods vulnerable to thefts, particularly between terminal and final destination.
Illicit Trade 	Illicit trade of goods, drugs and weapons, as well as for illegal immigration.

http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/table_advantageschallengescont.html

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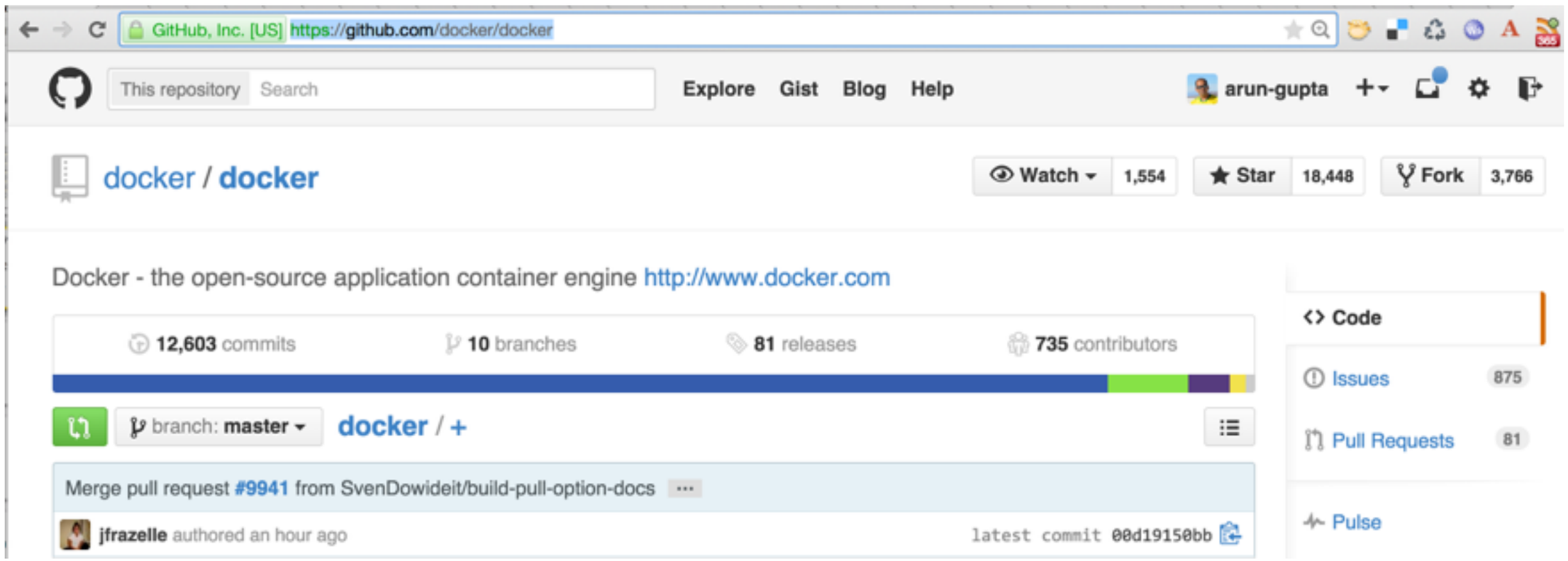

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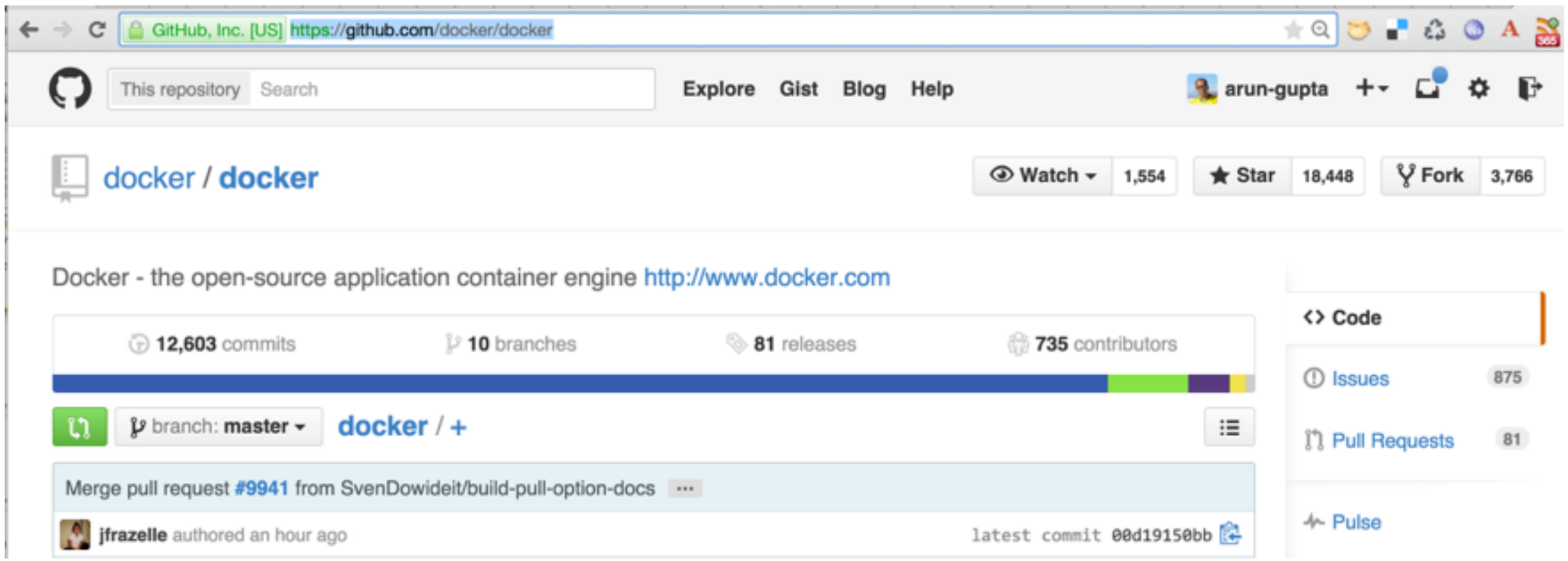

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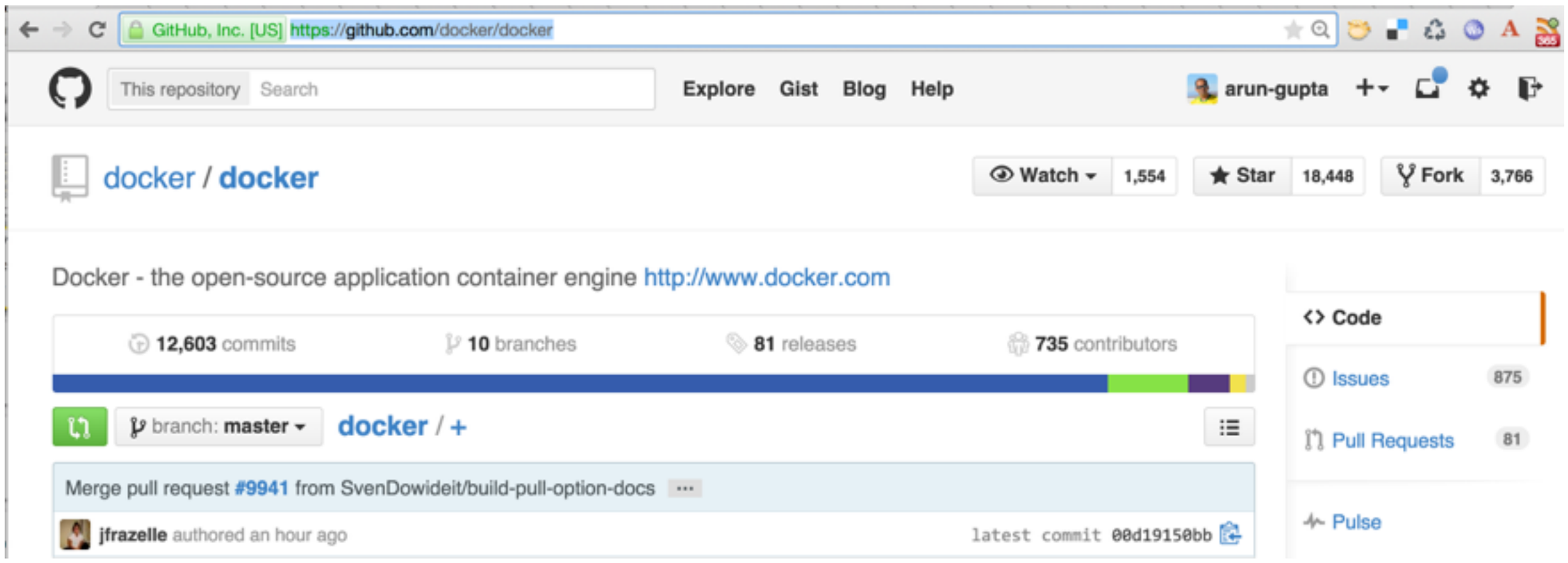
- Package Once Deploy Anywhere (PODA)



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  - **Union File System** makes it light and fast
  - **libcontainer** defines container format

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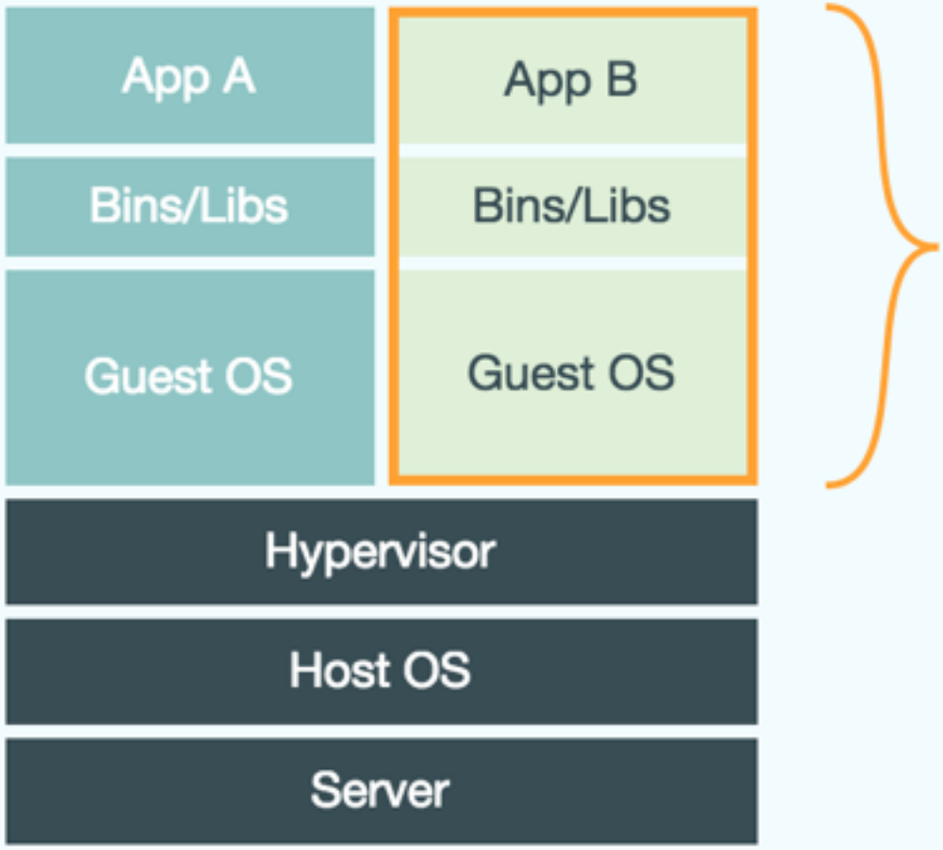
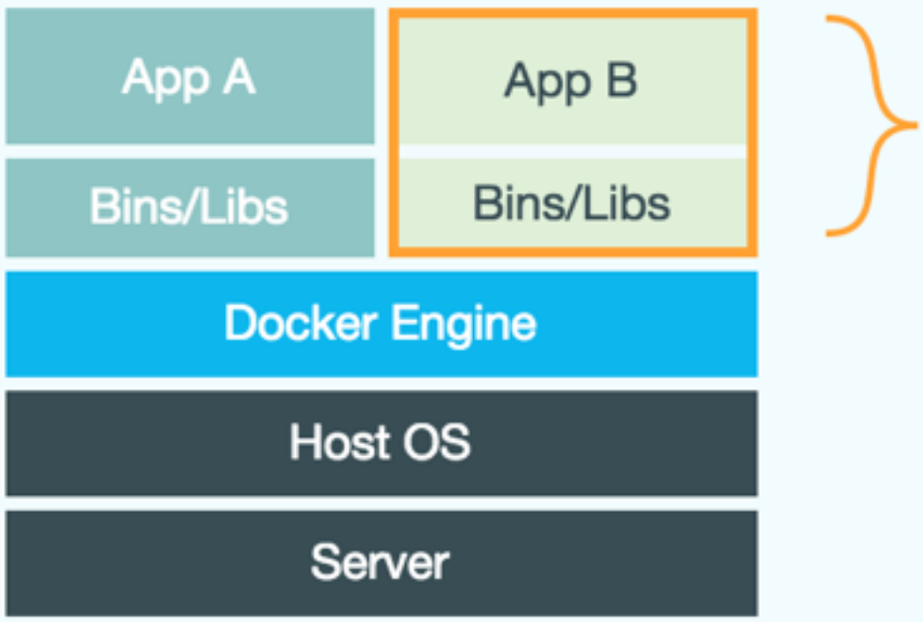
  - Tiny Core Linux VM



Virtual Machines

Each virtualized application includes not only the application - which may be only 10s of MB - and the necessary binaries and libraries, but also an entire guest operating system - which may weigh 10s of GB.

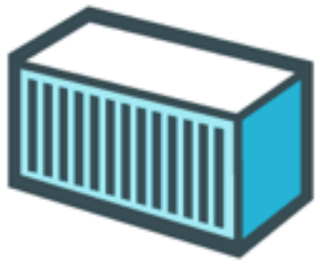


Docker

The Docker Engine container comprises just the application and its dependencies. It runs as an isolated process in userspace on the host operating system, sharing the kernel with other containers. Thus, it enjoys the resource isolation and allocation benefits of VMs but is much more portable and efficient.

Build

Develop an app using Docker containers with any language and any toolchain.



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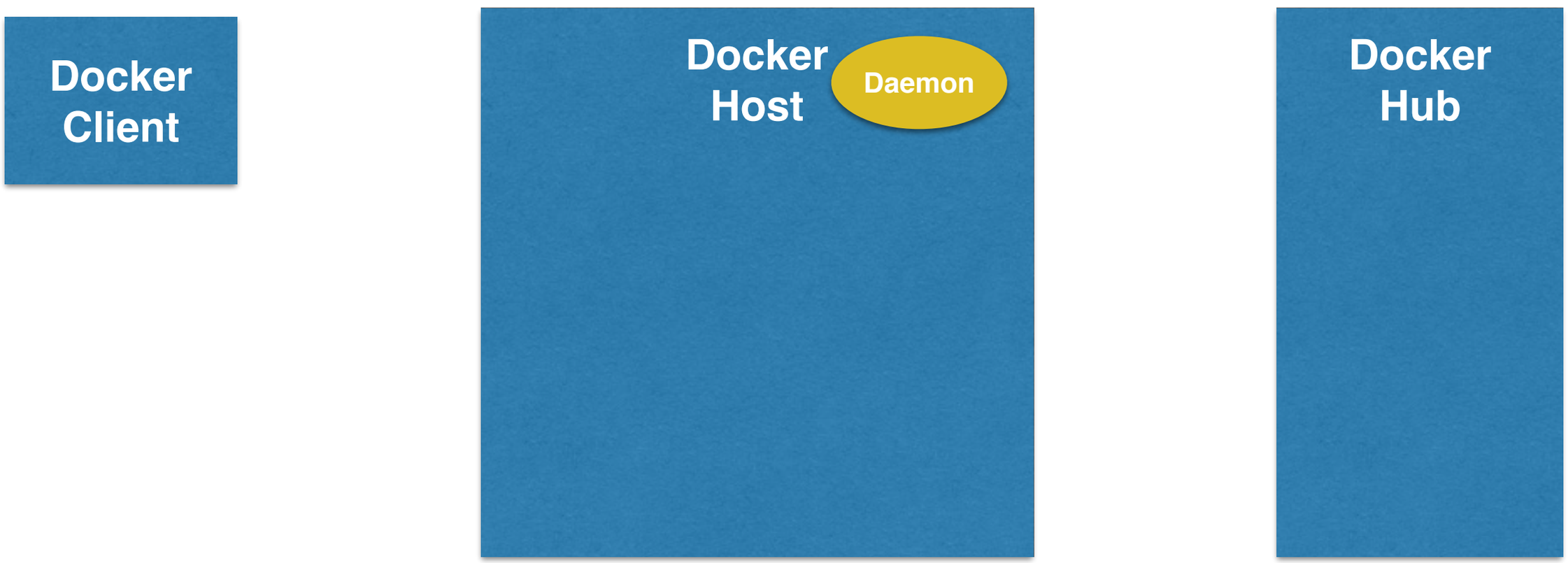

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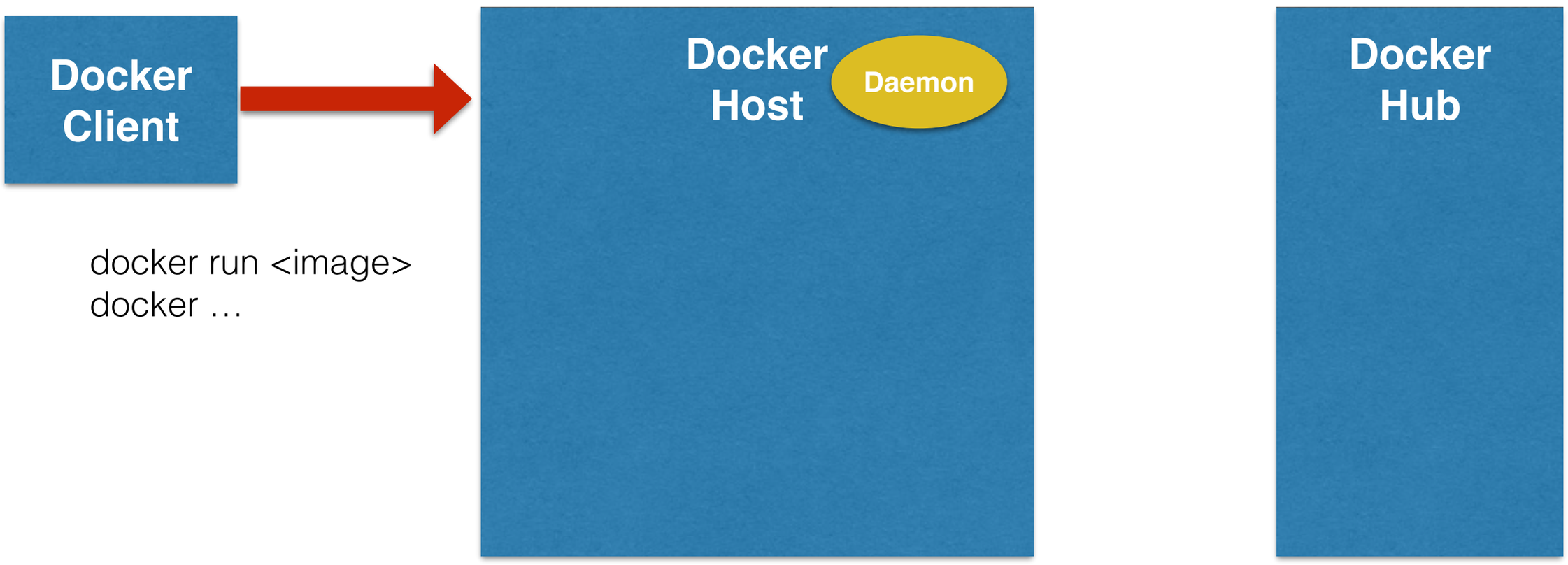

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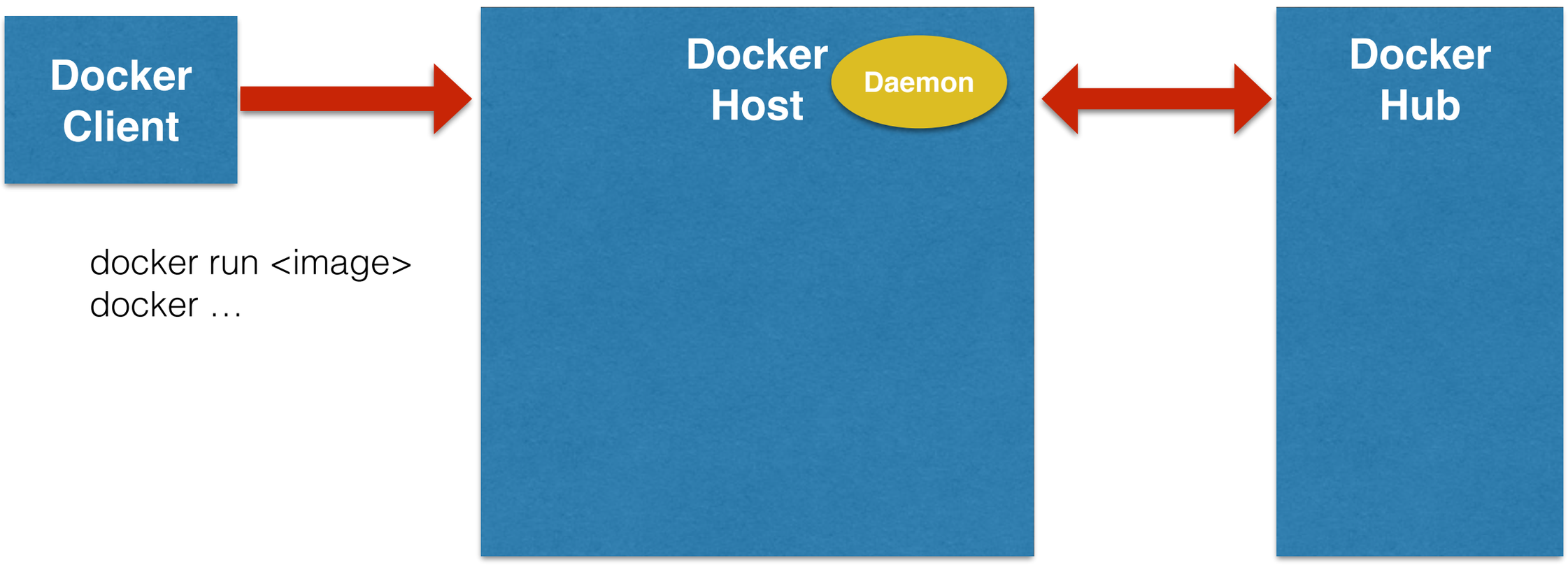

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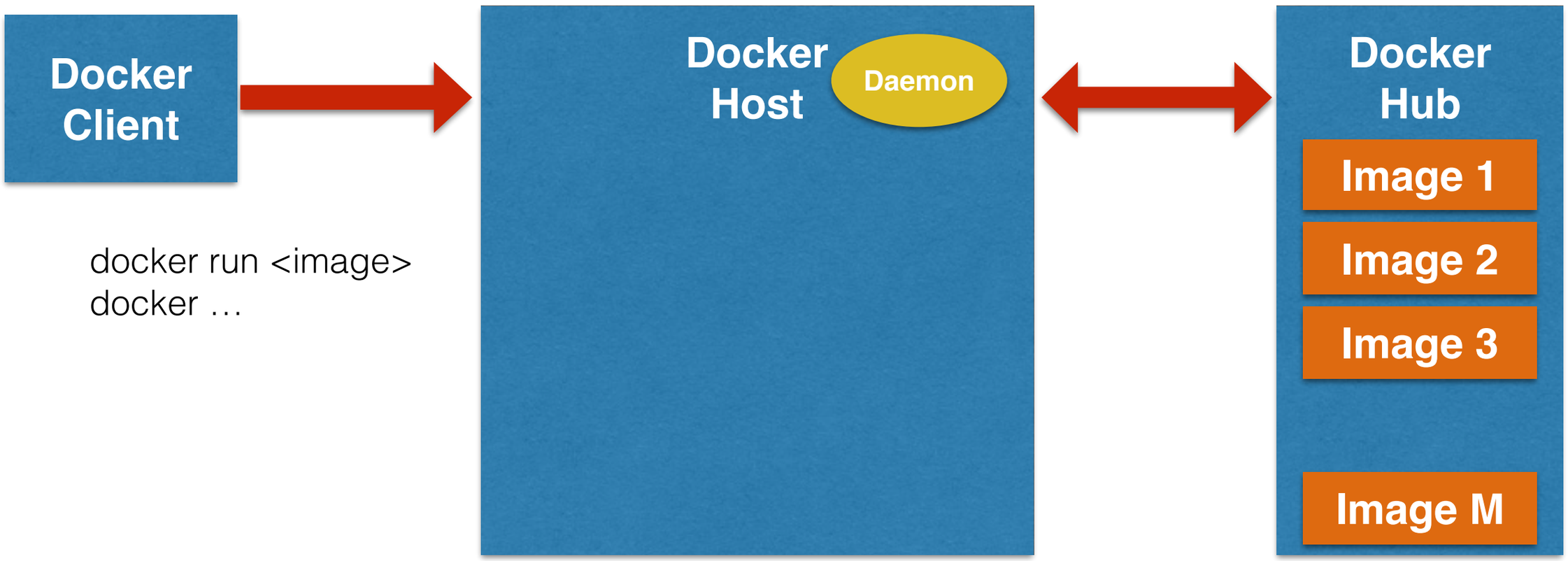

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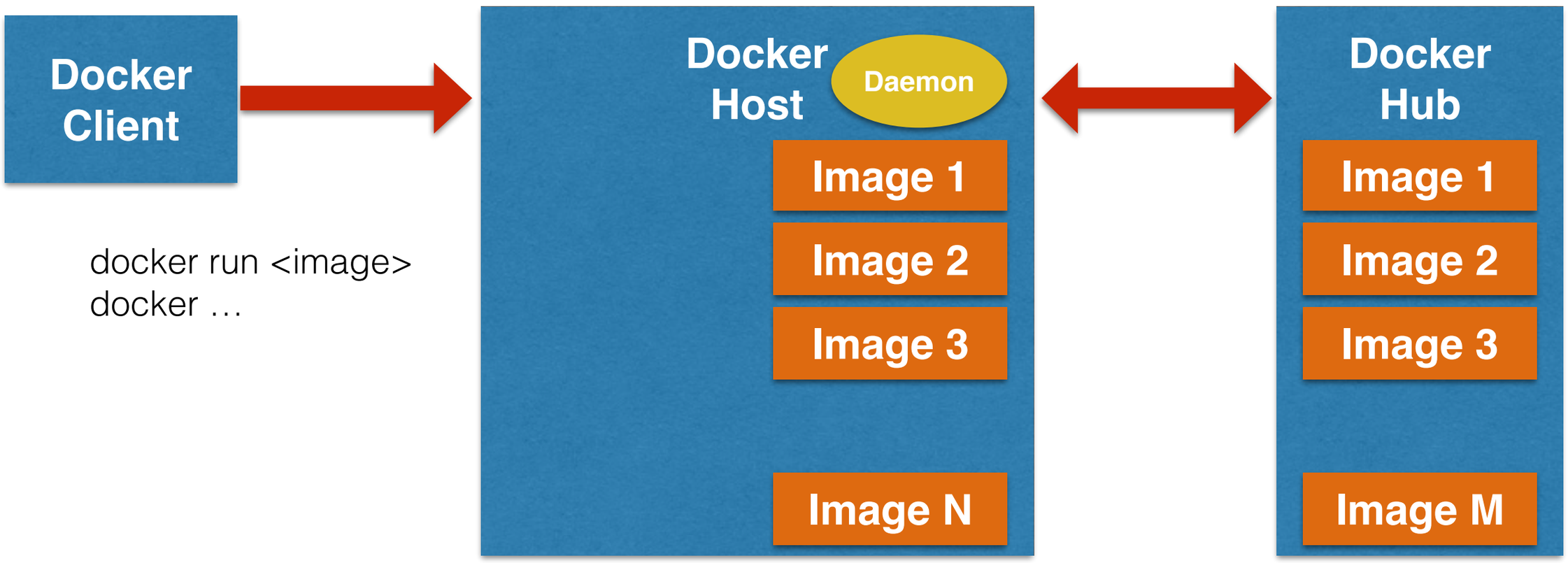

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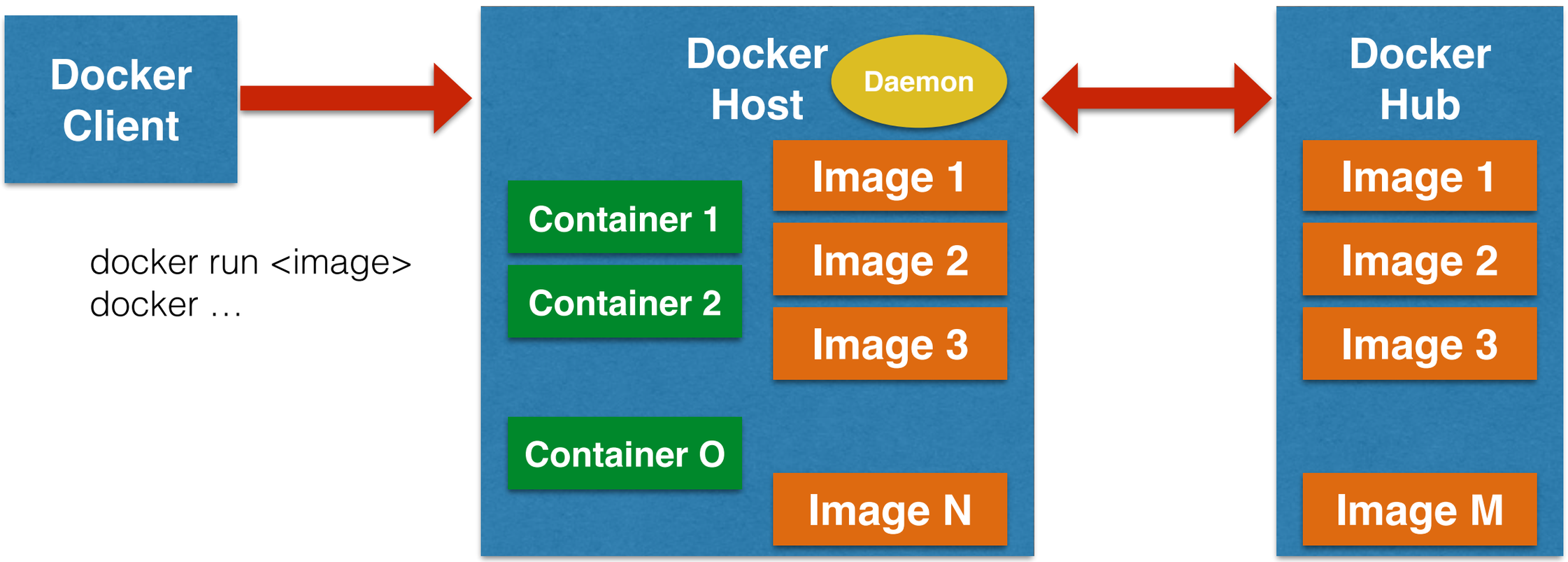

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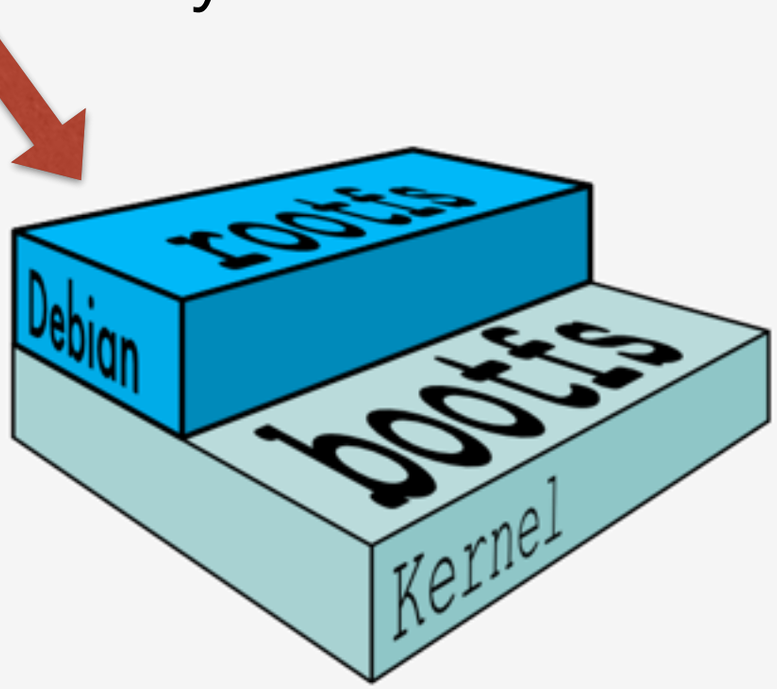
read-only



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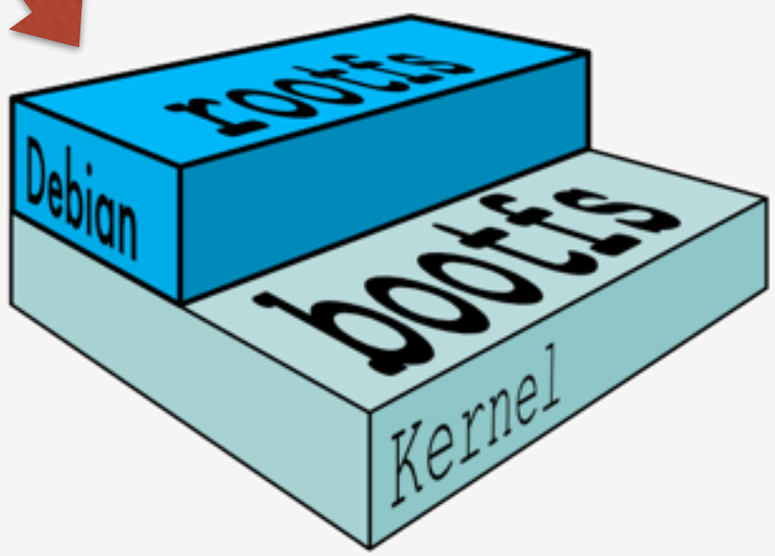

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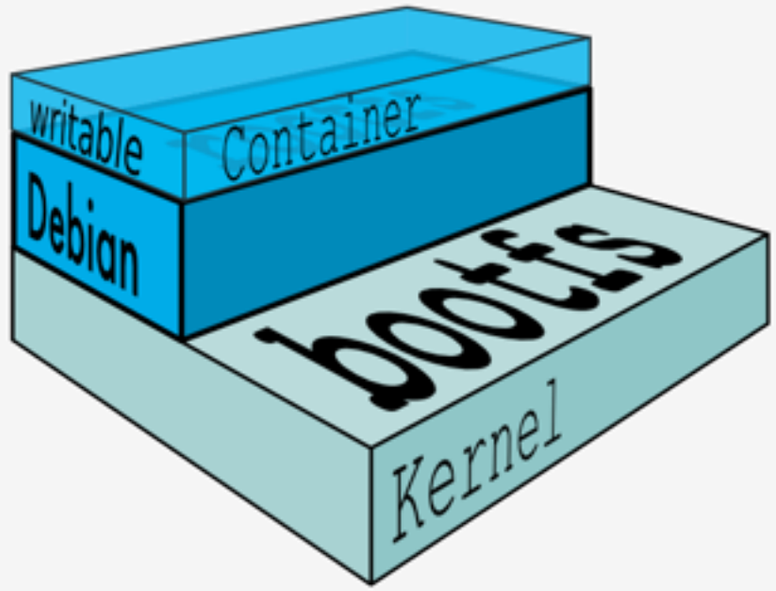

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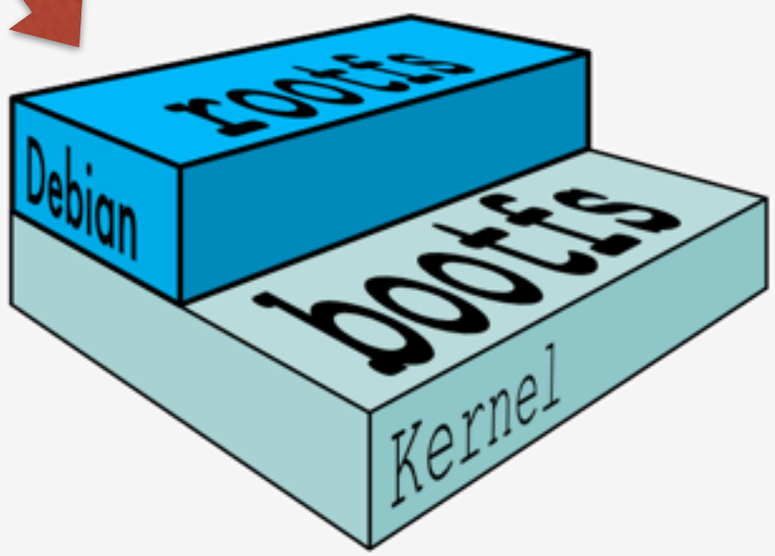

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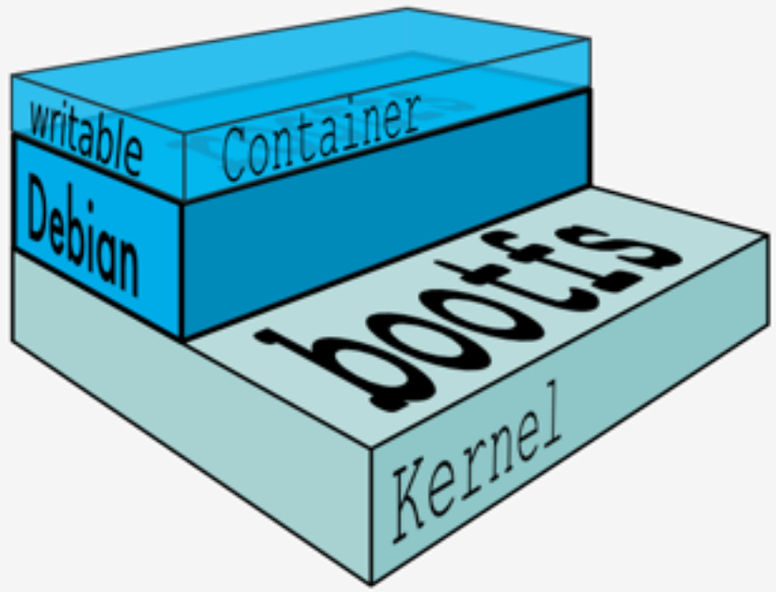

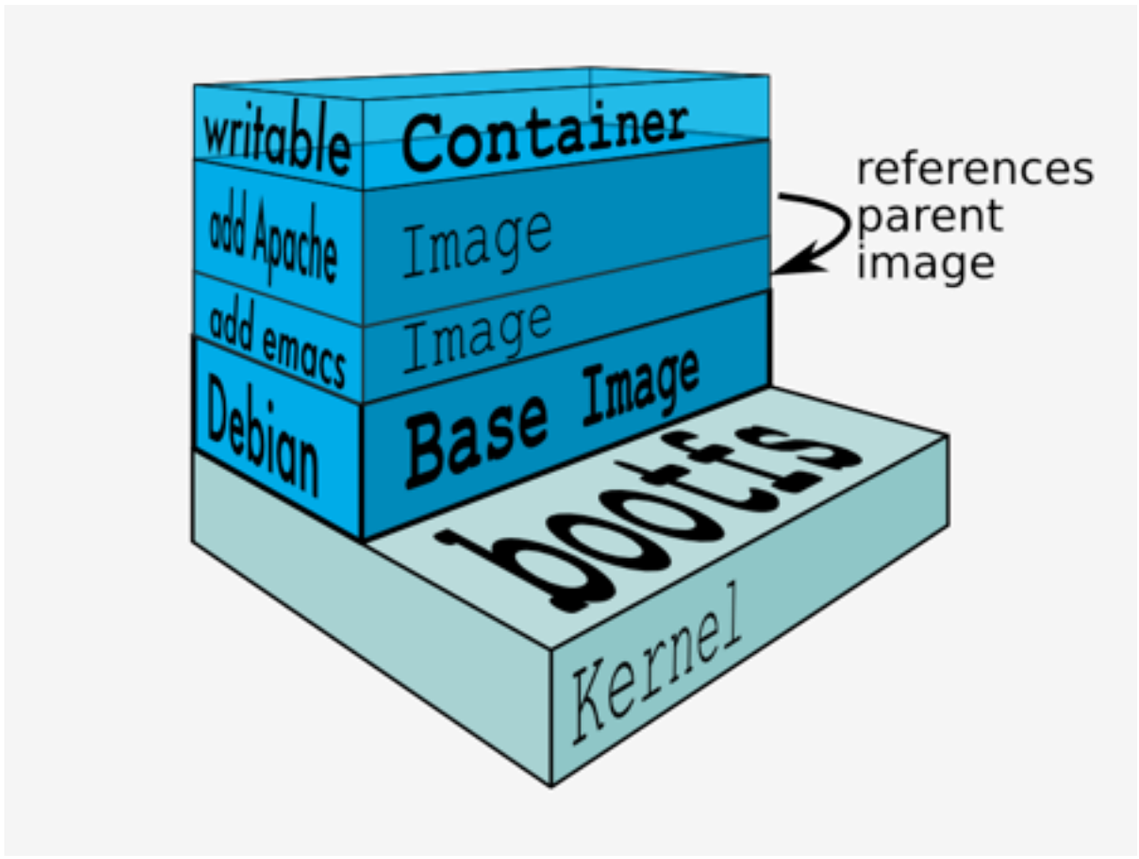

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- `docker build` or `pull`


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```
FROM centos
MAINTAINER Arun Gupta <arungupta@redhat.com>

# Execute system update
RUN yum -y update && yum clean all

# Install packages necessary to run EAP
RUN yum -y install xmlstarlet saxon augeas bsdtar unzip && yum clean all

# Create a user and group used to launch processes
# The user ID 1000 is the default for the first "regular" user on Fedora/RHEL,
# so there is a high chance that this ID will be equal to the current user
# making it easier to use volumes (no permission issues)
RUN groupadd -r jboss -g 1000 && useradd -u 1000 -r -g jboss -m -d /opt/jboss -s /sbin/nologin -c "JBoss user" jboss

# Set the working directory to jboss' user home directory
WORKDIR /opt/jboss

# User root user to install software
USER root

# Install necessary packages
RUN yum -y install java-1.7.0-openjdk-devel && yum clean all
#RUN yum -y install java-1.8.0-openjdk-devel && yum clean all

# Switch back to jboss user
USER jboss

# Set the JAVA_HOME variable to make it clear where Java is located
ENV JAVA_HOME /usr/lib/jvm/java

# Set the WILDFLY_VERSION env variable
ENV WILDFLY_VERSION 8.2.0.Final

# Add the WildFly distribution to /opt, and make wildfly the owner of the extracted tar content
# Make sure the distribution is available from a well-known place
RUN cd $HOME && curl -O http://download.jboss.org/wildfly/$WILDFLY_VERSION/wildfly-$WILDFLY_VERSION.zip && unzip wildfly-$WILDFLY

# Set the JBOSS_HOME env variable
ENV JBOSS_HOME /opt/jboss/wildfly

# Expose the ports we're interested in
EXPOSE 8080 9990

# Set the default command to run on boot
# This will boot WildFly in the standalone mode and bind to all interface
CMD ["/opt/jboss/wildfly/bin/standalone.sh", "-c", "standalone-full.xml", "-b", "0.0.0.0"]
```

https://registry.hub.docker.com/repos/jboss/

docker

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jboss

Repositories

Show: All Sort by: Last Updated

Filter by name...

jboss/forge 8 hours ago — 1 — 17

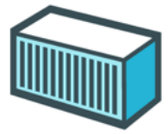
jboss/liveoak-server 4 days ago
Backend as a Service — 3 — 140

jboss/switchyard-wildfly a month ago — 0 — 49

jboss/keycloak a month ago — 0 — 540

jboss/keycloak-adapter-wildfly a month ago — 0 — 195

jboss/infinispan-server 2 months ago — 0 — 87



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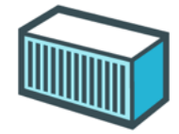

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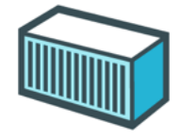

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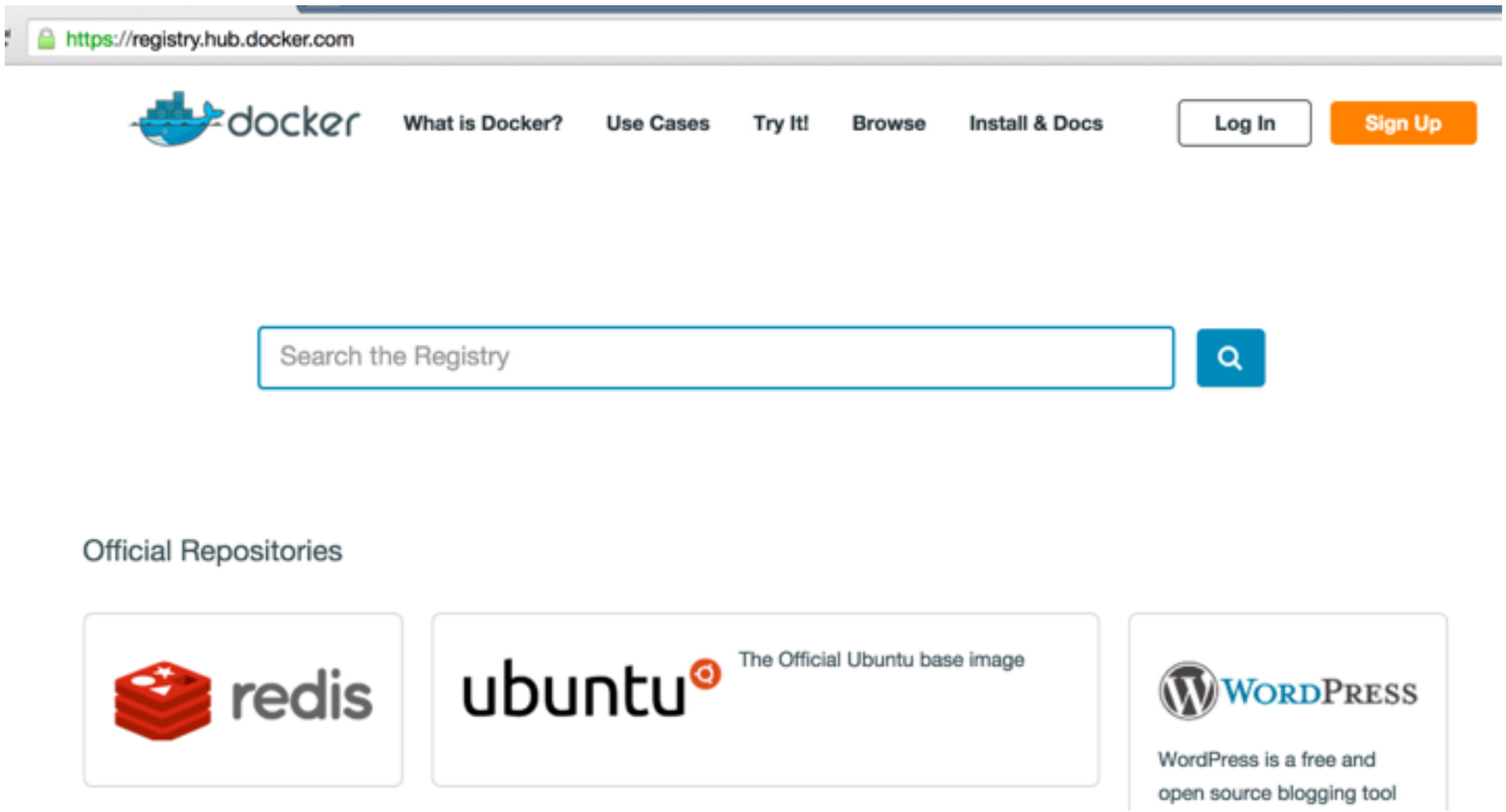

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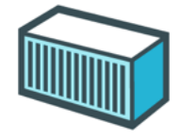

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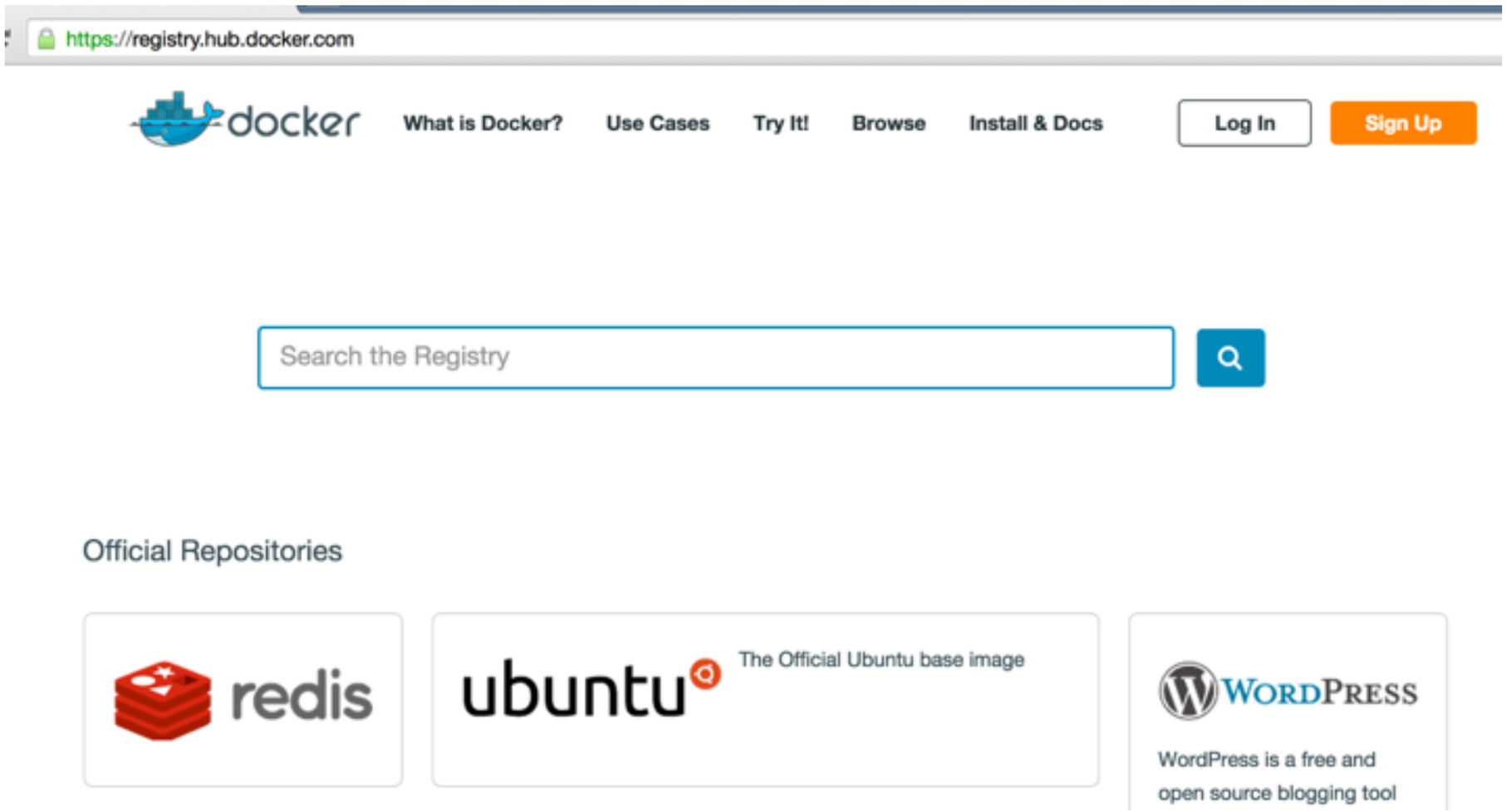

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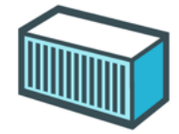
- `docker push` or `pull <IMAGE_ID>`



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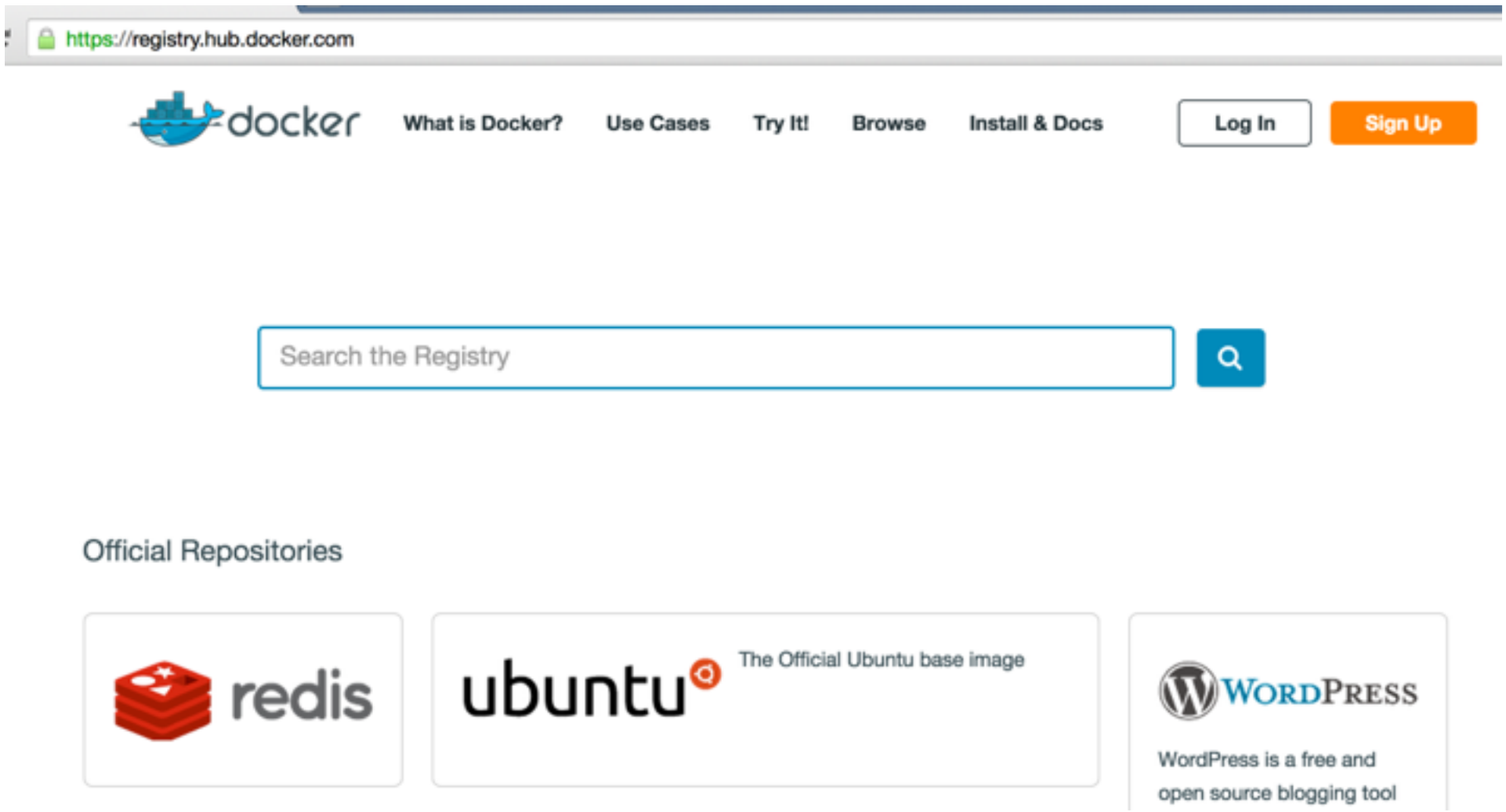

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- **`docker run <IMAGE_ID>`**

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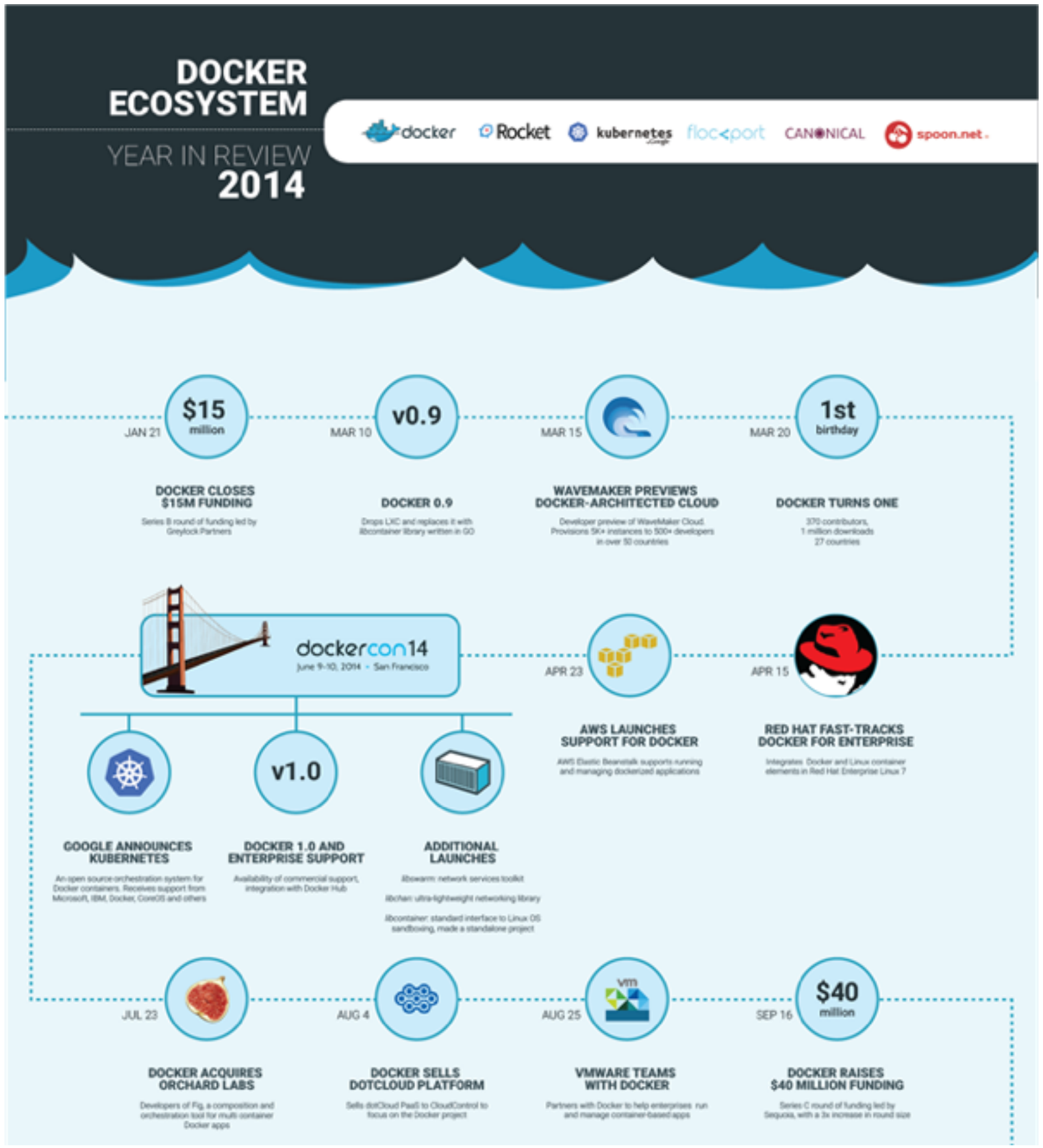
Docker commands

- **docker ps**: List running containers
- **docker stop**: Stop a running container
- **docker rm**: Remove a running container
- **docker rmi**: Remove an image
- …

https://docs.docker.com/reference/commandline/cli/



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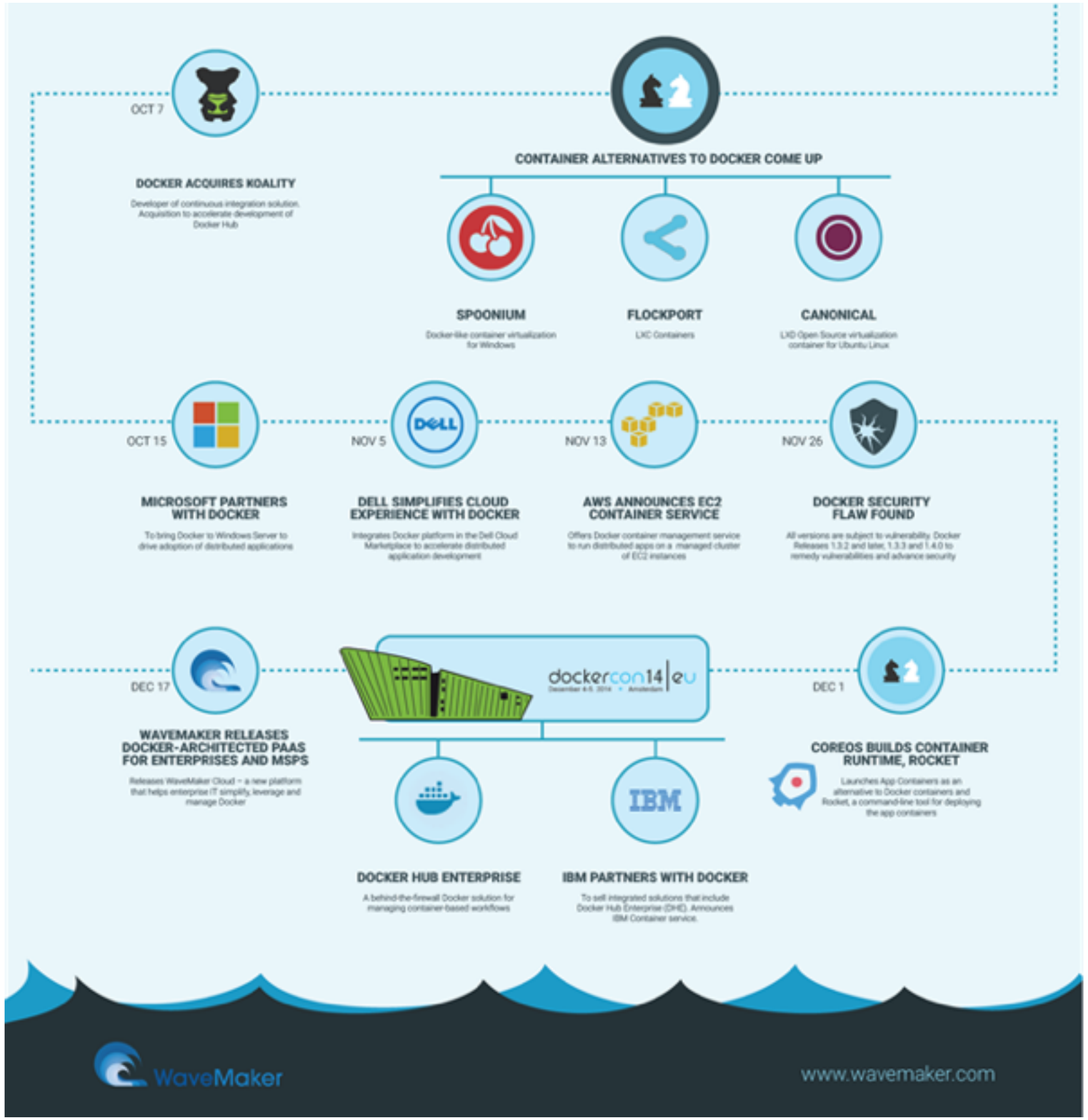

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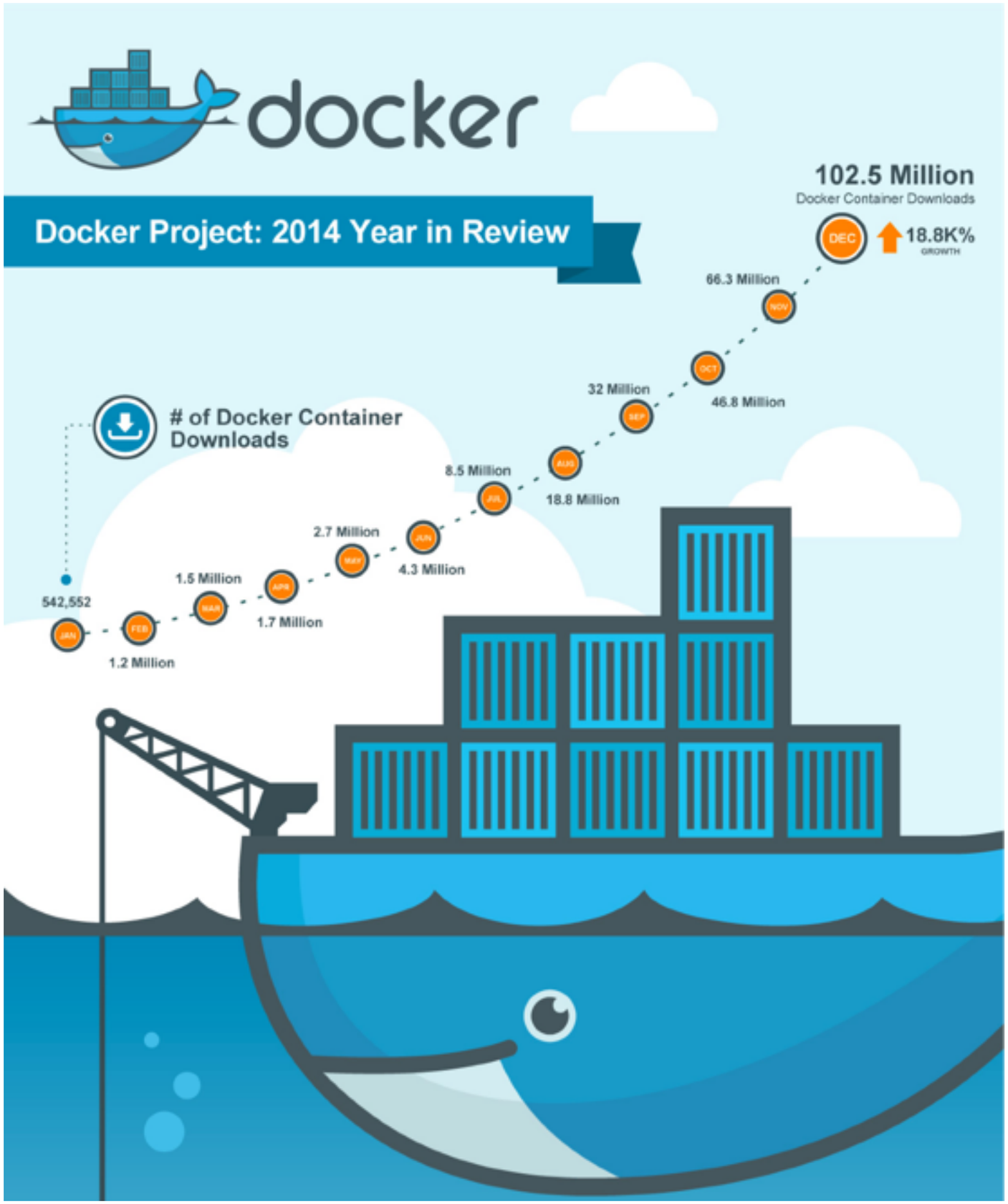

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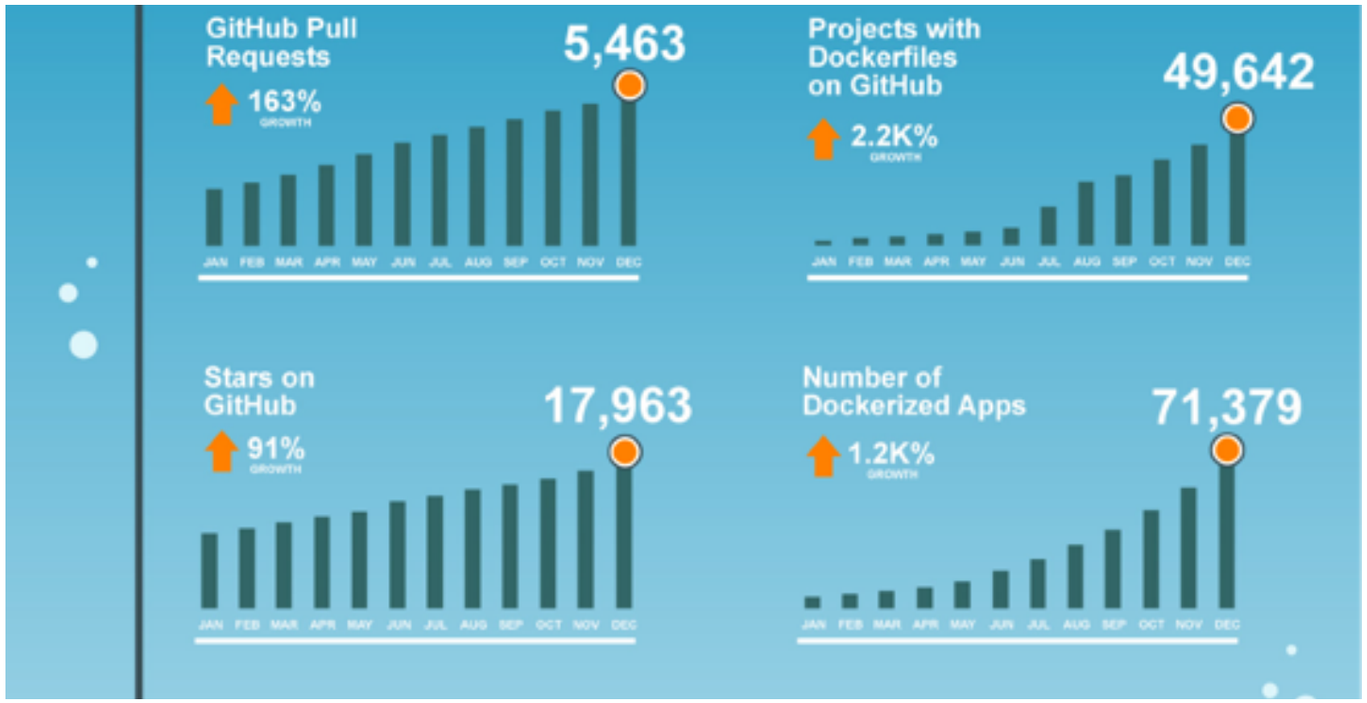

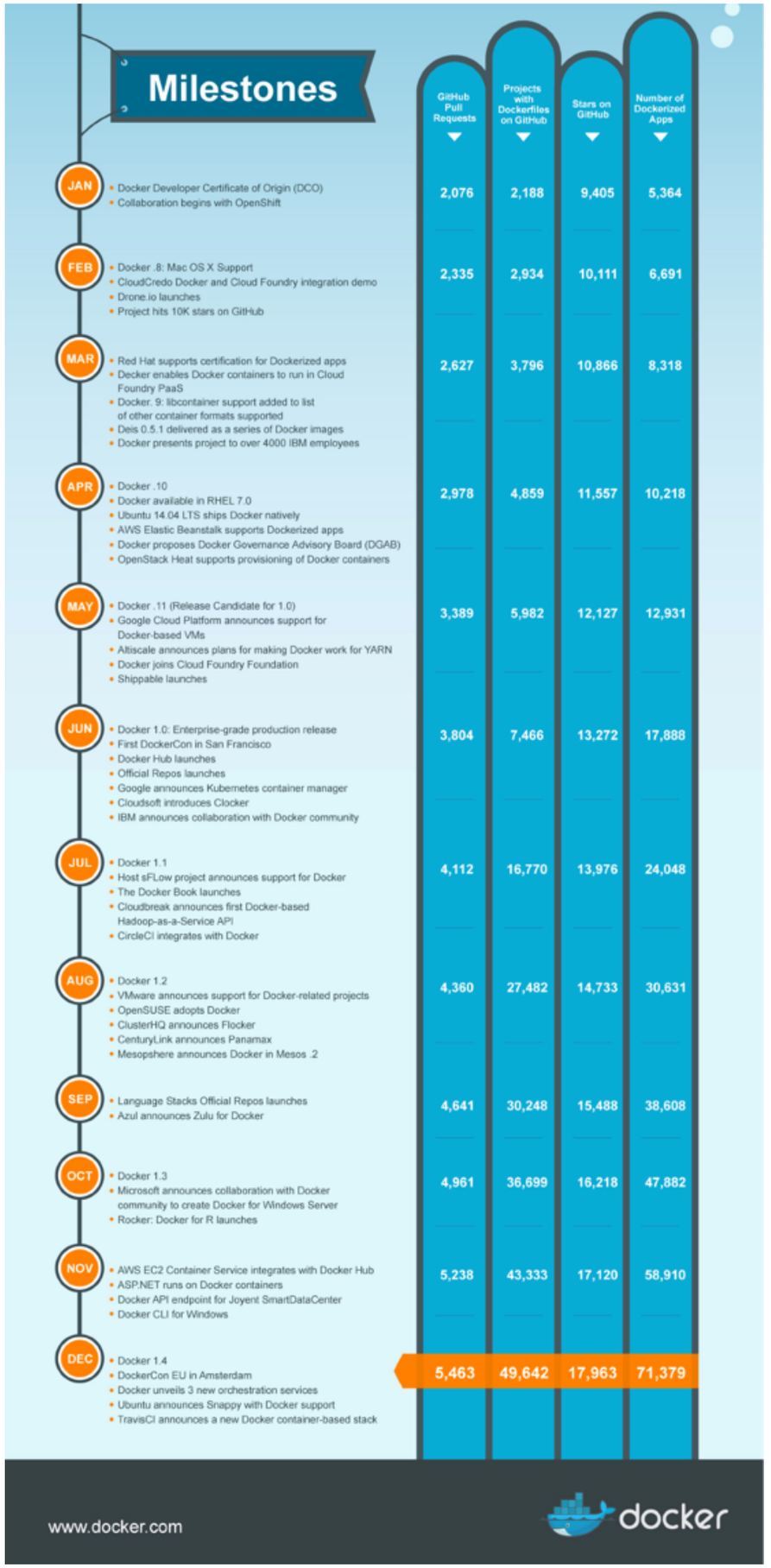

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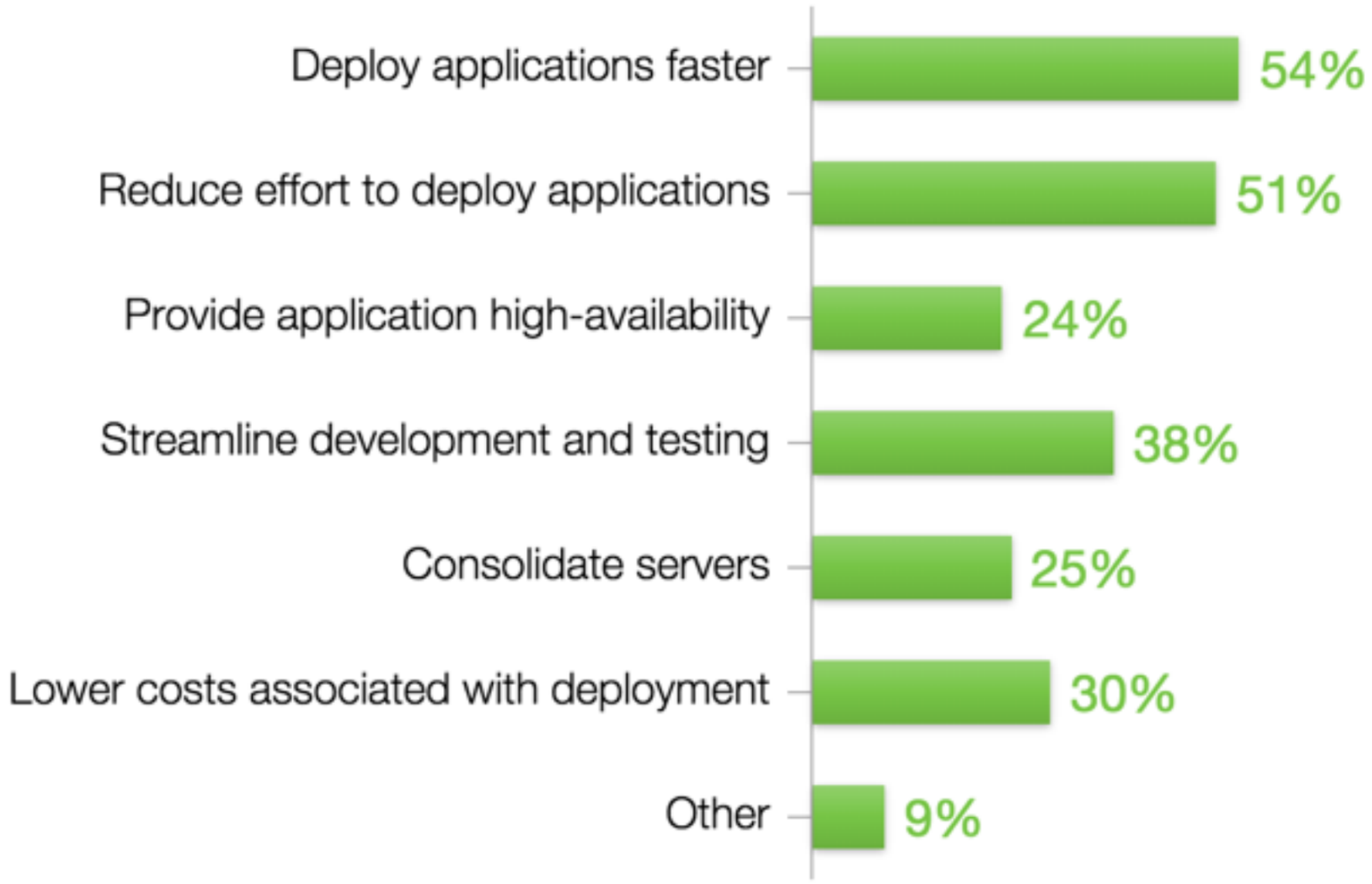
Benefits of containers

What are the top benefits you see with containers?



Note: this is a multiple-choice question – response percentages may not add up to 100.

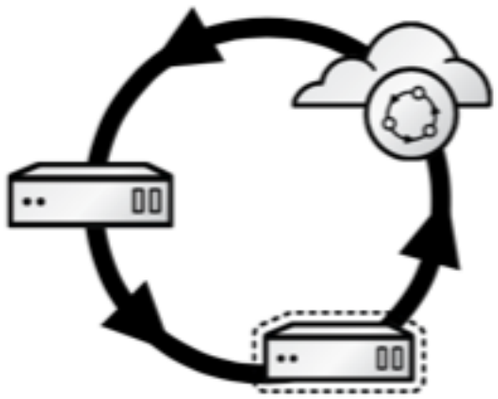
Source: TechValidate survey of 79 IT professionals

http://www.techvalidate.com/product-research/red-hat-enterprise-linux/charts/E21-1EE-BF2

Benefits of Containers

FASTER APP DELIVERY

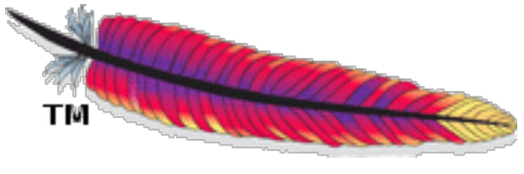
OPERATIONAL EFFICIENCY



DEPLOYMENT FLEXIBILITY

LOWERED DEPLOYMENT COSTS

Application Operating Environment



Kubernetes

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- Open source orchestration system for Docker containers

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- Provide declarative primitives for the “desired state”

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- Schedule across hosts

- Replicating

Key Concepts

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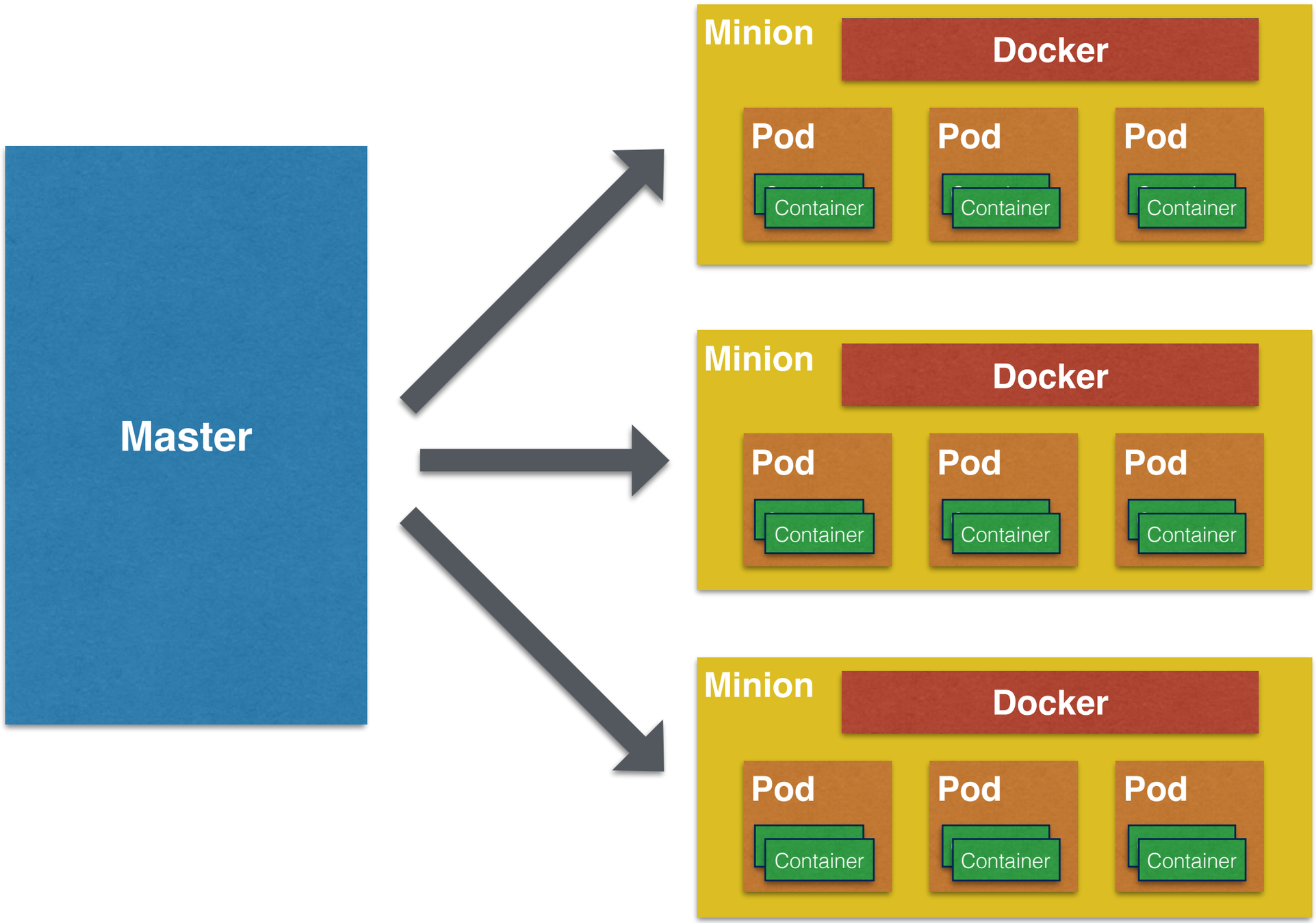
- **Minion**: Run tasks from master

Kubernetes


Master
Minion
Docker
Pod
Container
Pod
Container
Pod
Container
Minion
Docker
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Container
Minion
Docker
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- `kubectl create -f <filename>`
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- `kubectl resize –replicas=3 replicationcontrollers <name>`

Kubernetes Config

```
{
  "id": "mysql",
  "kind": "Pod",
  "apiVersion": "v1beta1",
  "desiredState": {
    "manifest": {
      "version": "v1beta1",
      "id": "mysql",
      "containers": [{
        "name": "mysql",
        "image": "mysql",
        "cpu": 100,
        "ports": [{
          "containerPort": 3306,
          "hostPort": 3306
        }]
      }]
    }
  },
  "labels": {
    "name": "mysql"
  }
}
```

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}
```

```
{
  "id": "wildfly",
  "kind": "Pod",
  "apiVersion": "v1beta1",
  "desiredState": {
    "manifest": {
      "version": "v1beta1",
      "id": "wildfly",
      "containers": [{
        "name": "wildfly",
        "image": "jboss/wildfly",
        "cpu": 100,
        "ports": [{
          "containerPort": 8080,
          "hostPort": 8080
        }]
      }]
    }
  },
  "labels": {
    "name": "wildfly"
  }
}
```

Microservices

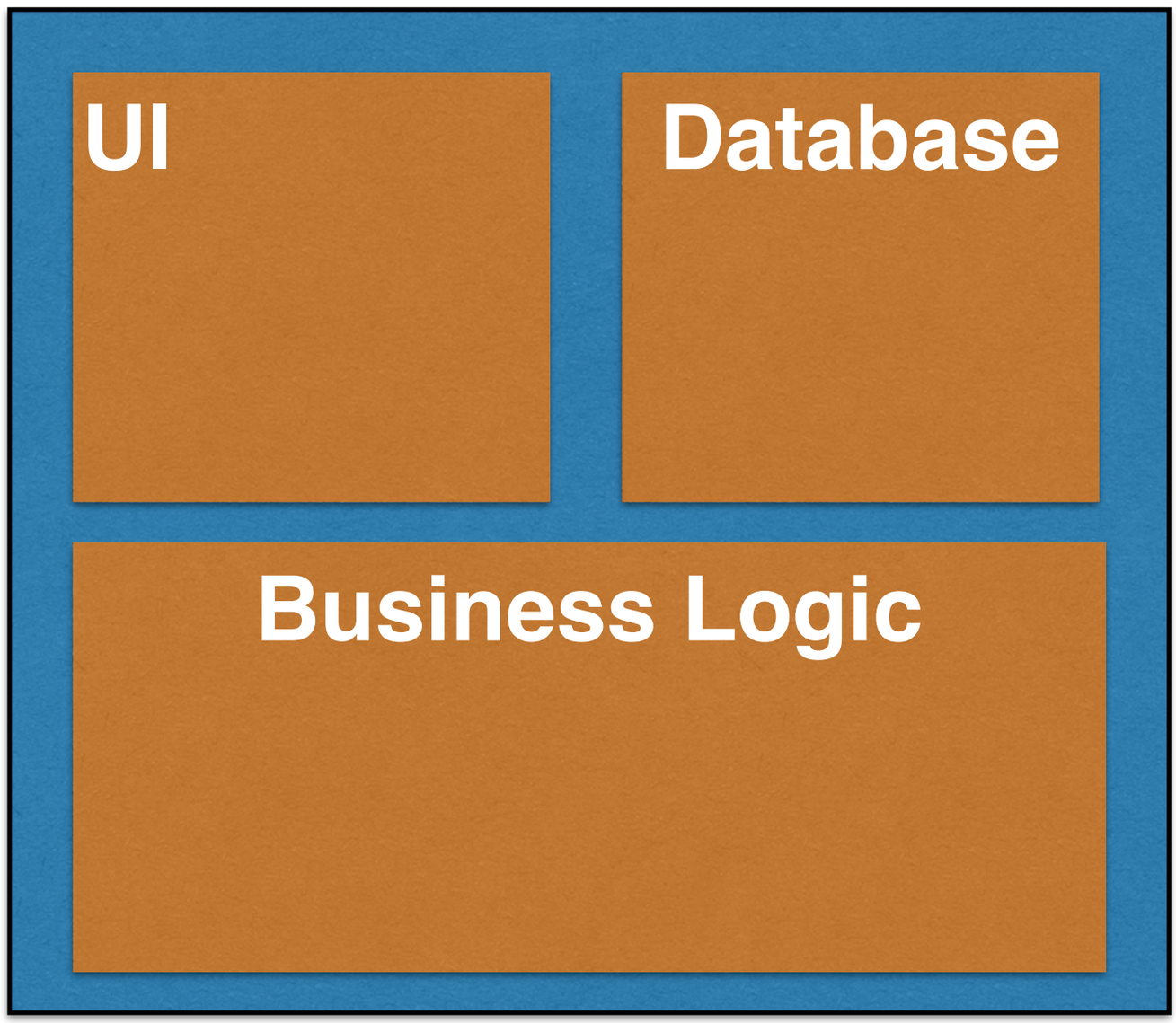
*building applications as **suites of services**. As well as the fact that services are **independently deployable and scalable**, each service also provides a **firm module boundary**, even allowing for different services to be written in **different programming languages**. They can also be **managed by different teams***

http://martinfowler.com/articles/microservices.html

Is it SOA?

- SOA for hipsters?
- Fine-grained SOA?
- Focus on ESBs in SOA?
- SOA done right?

Monolith Application



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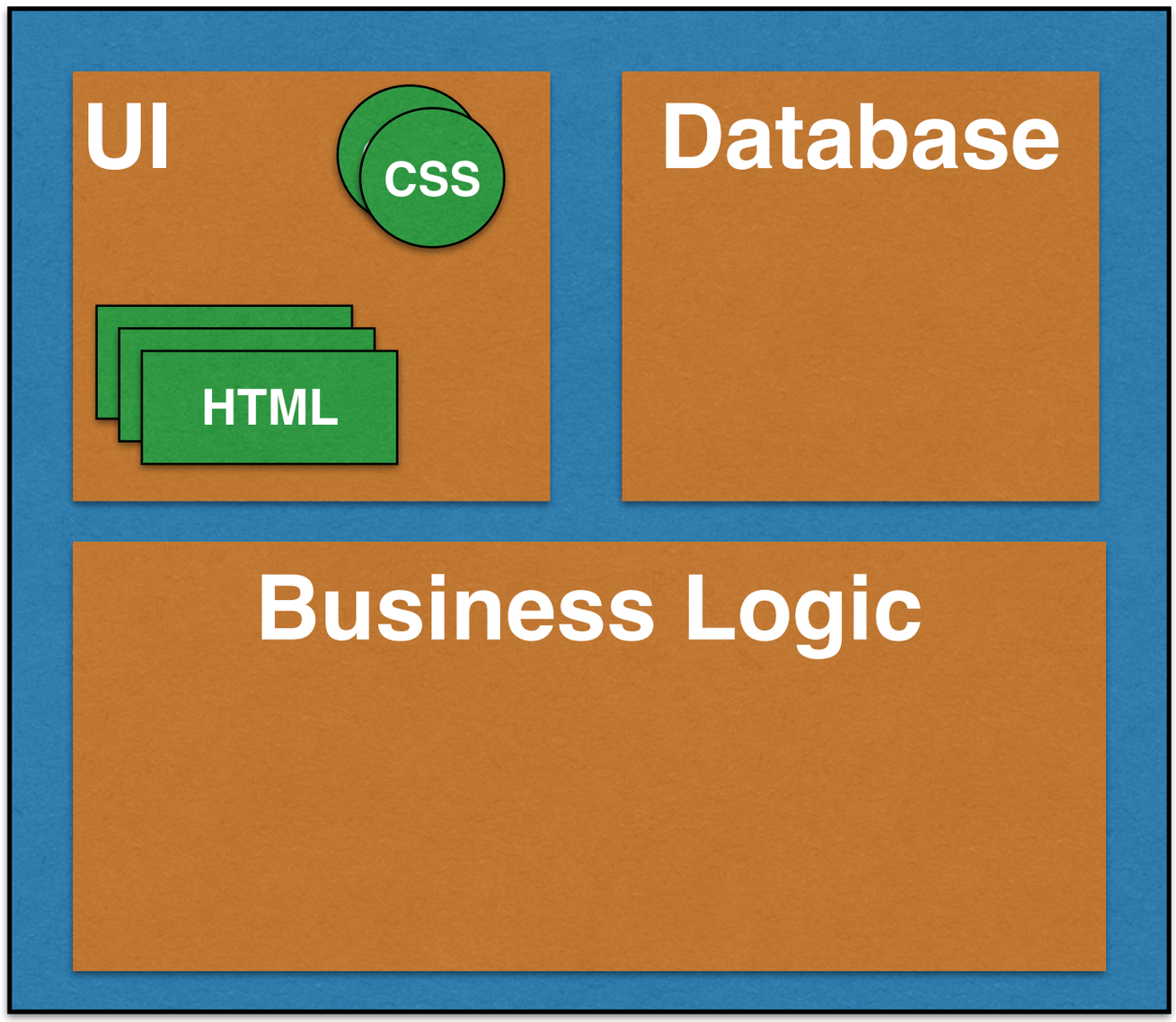

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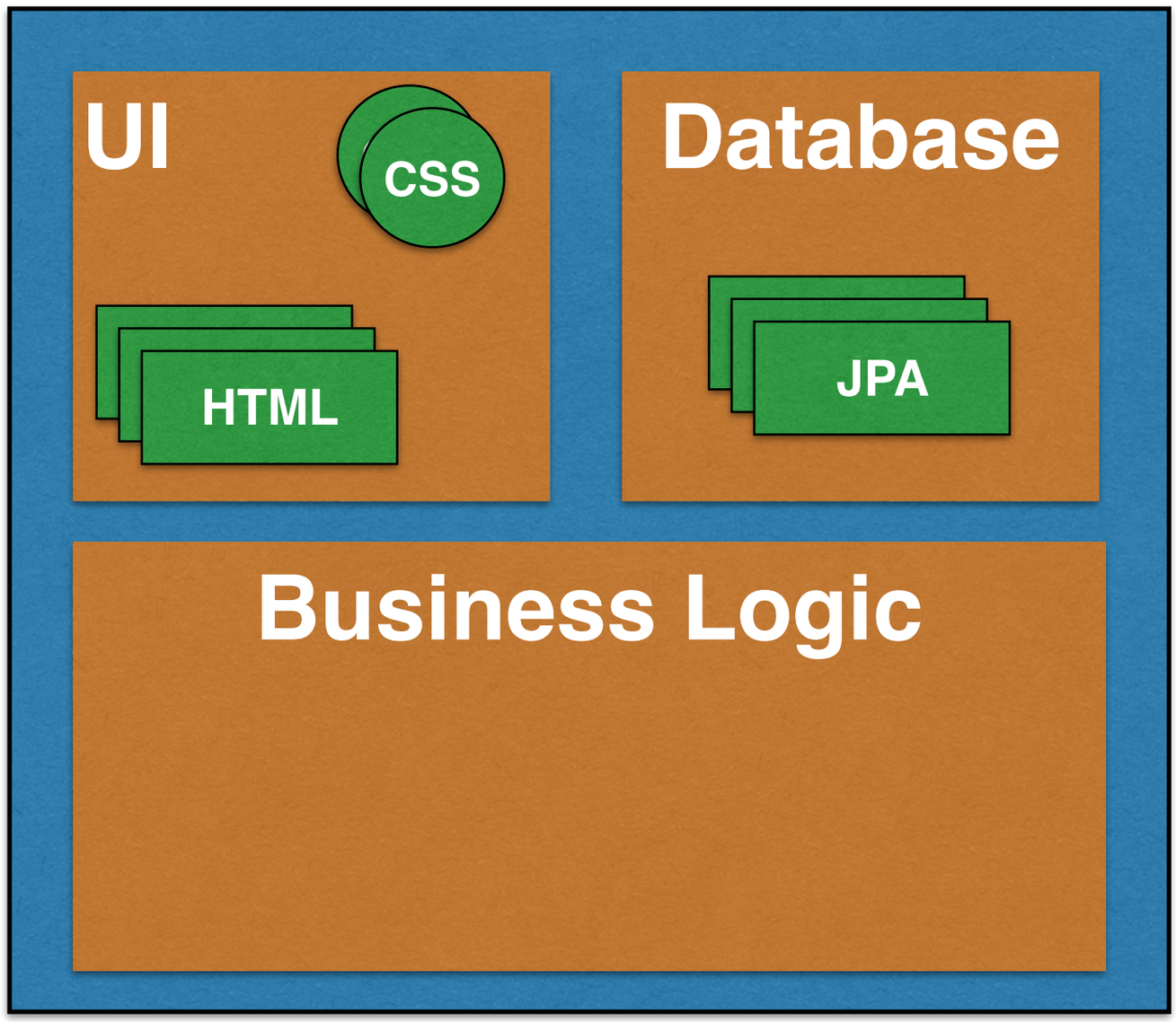

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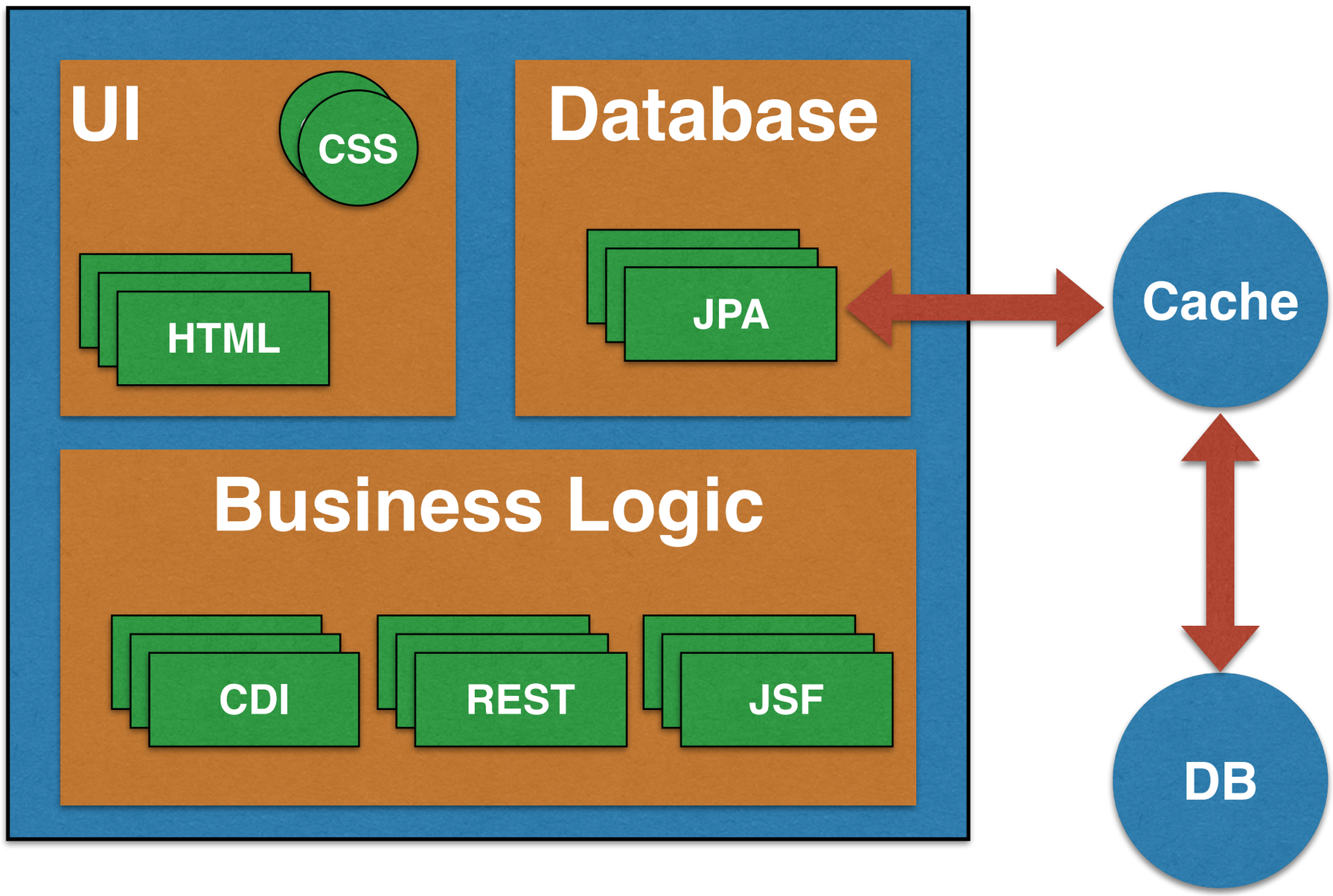

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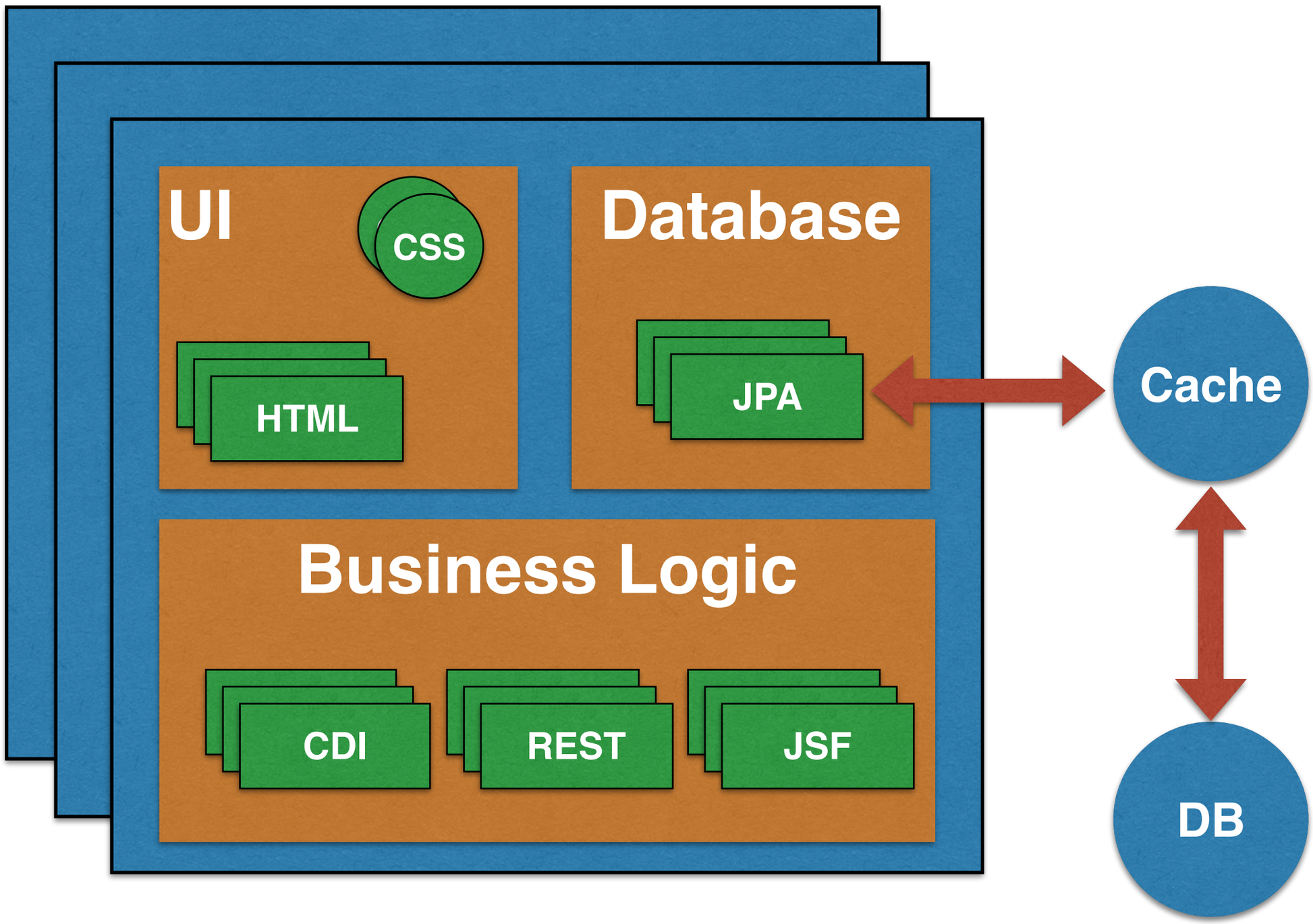

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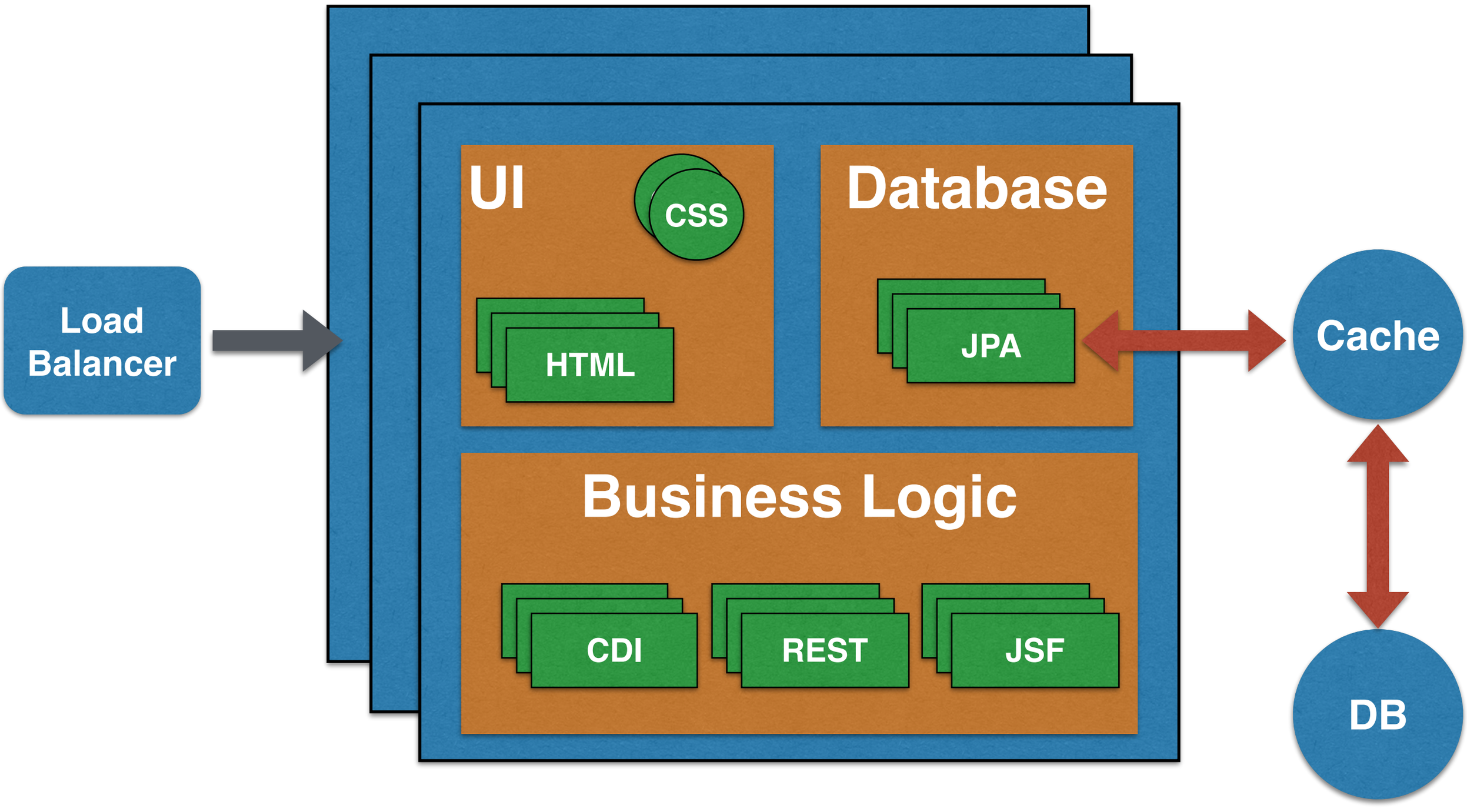
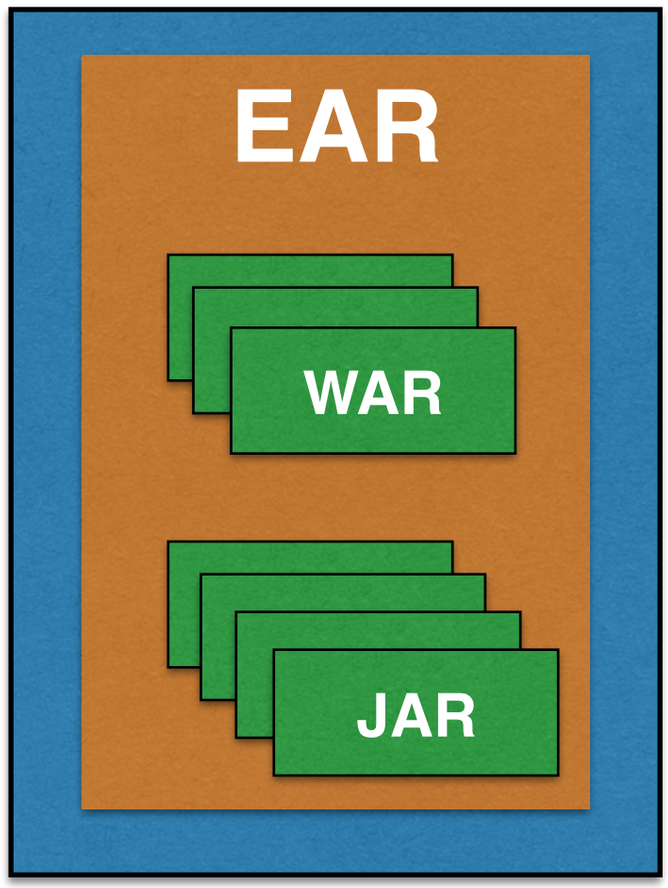


Before Microservices



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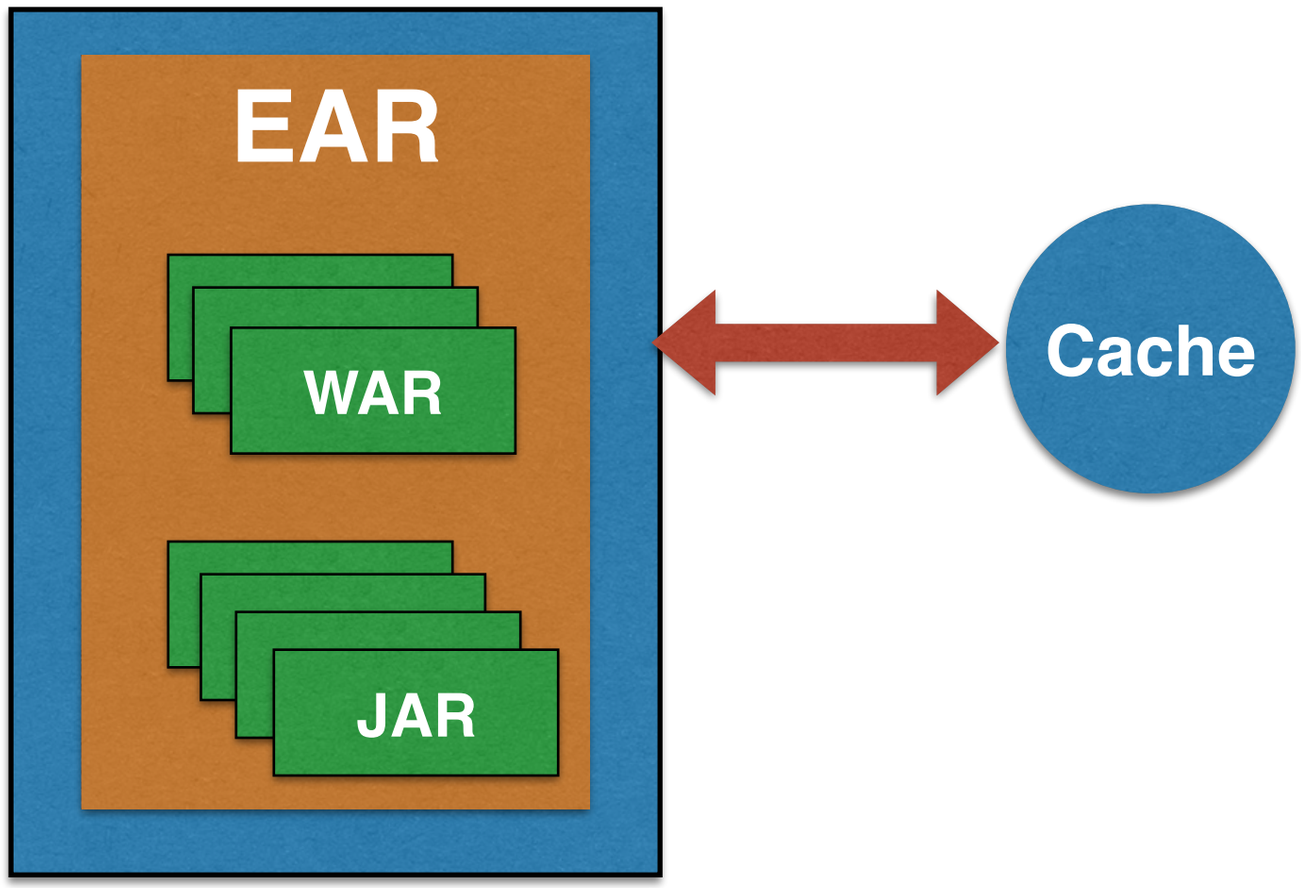
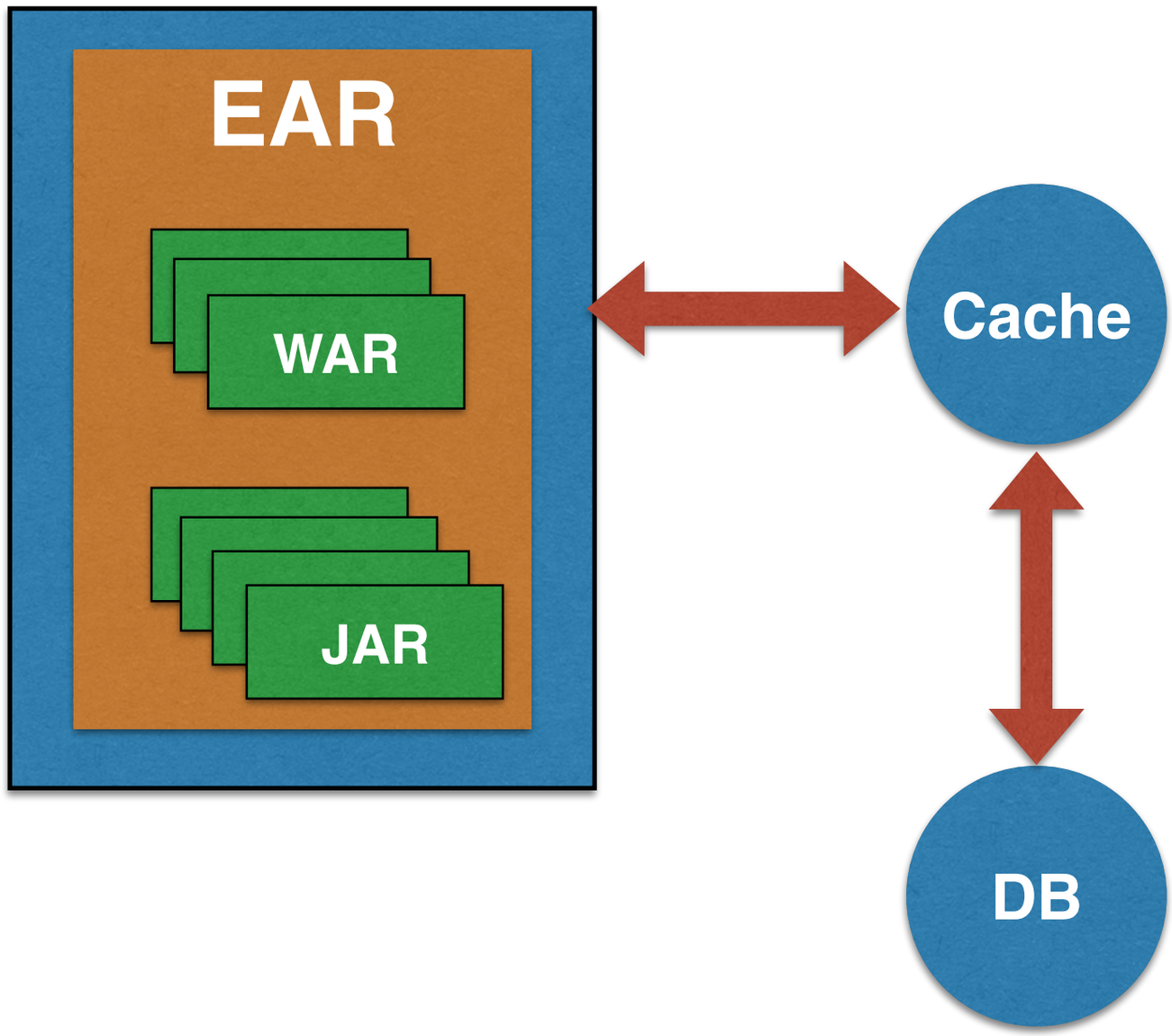


Before Microservices



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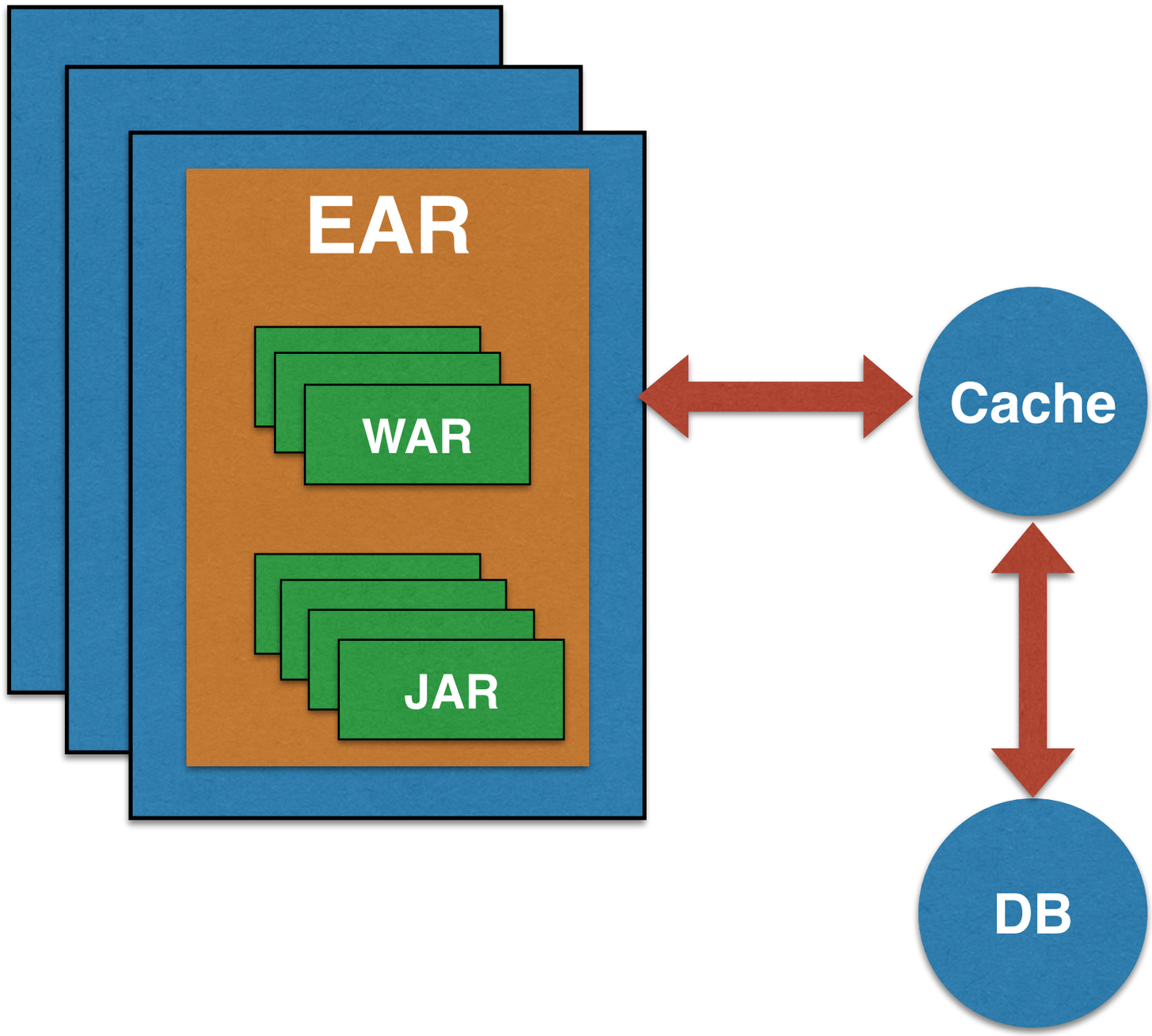

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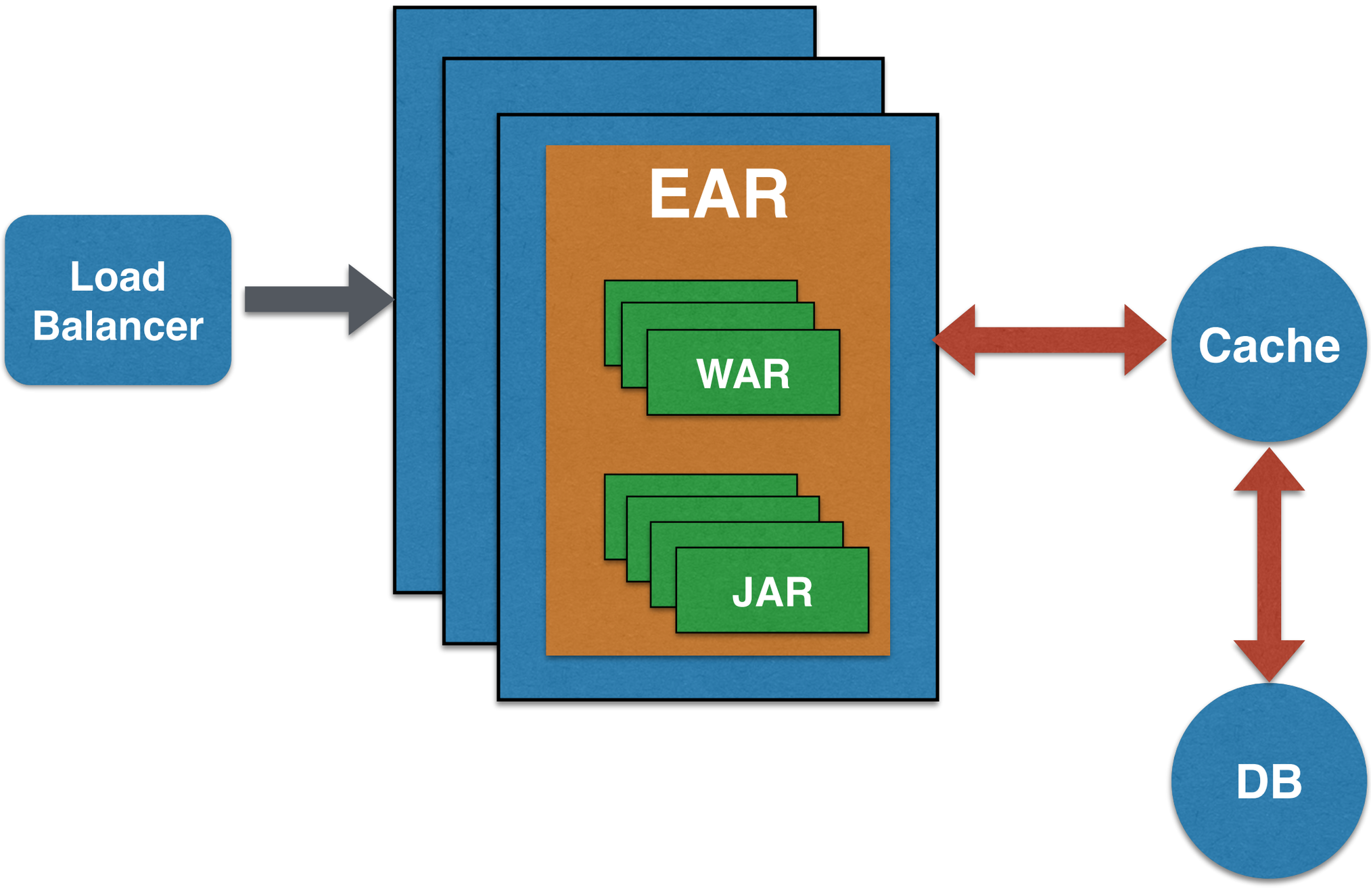

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- Easy to test (all required services are up)

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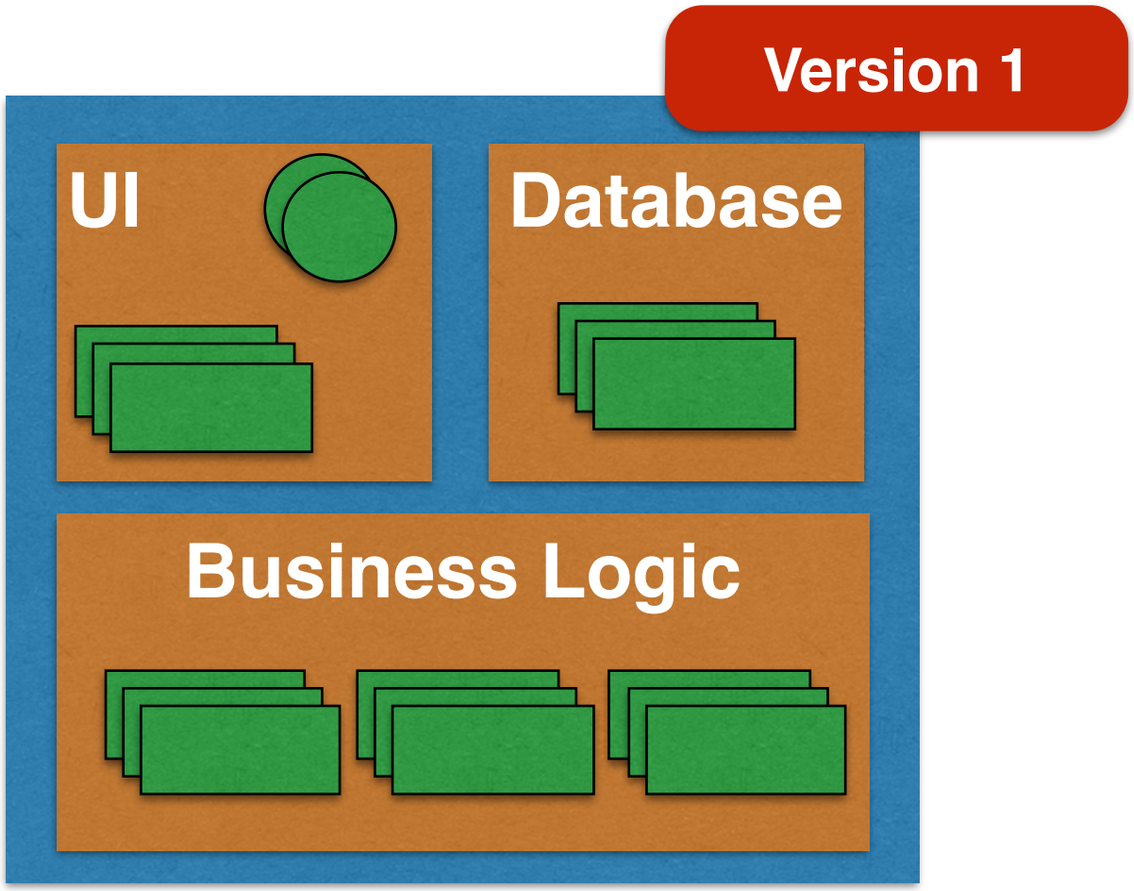
- Makes it difficult to try out new technologies/ framework

Monolith Application



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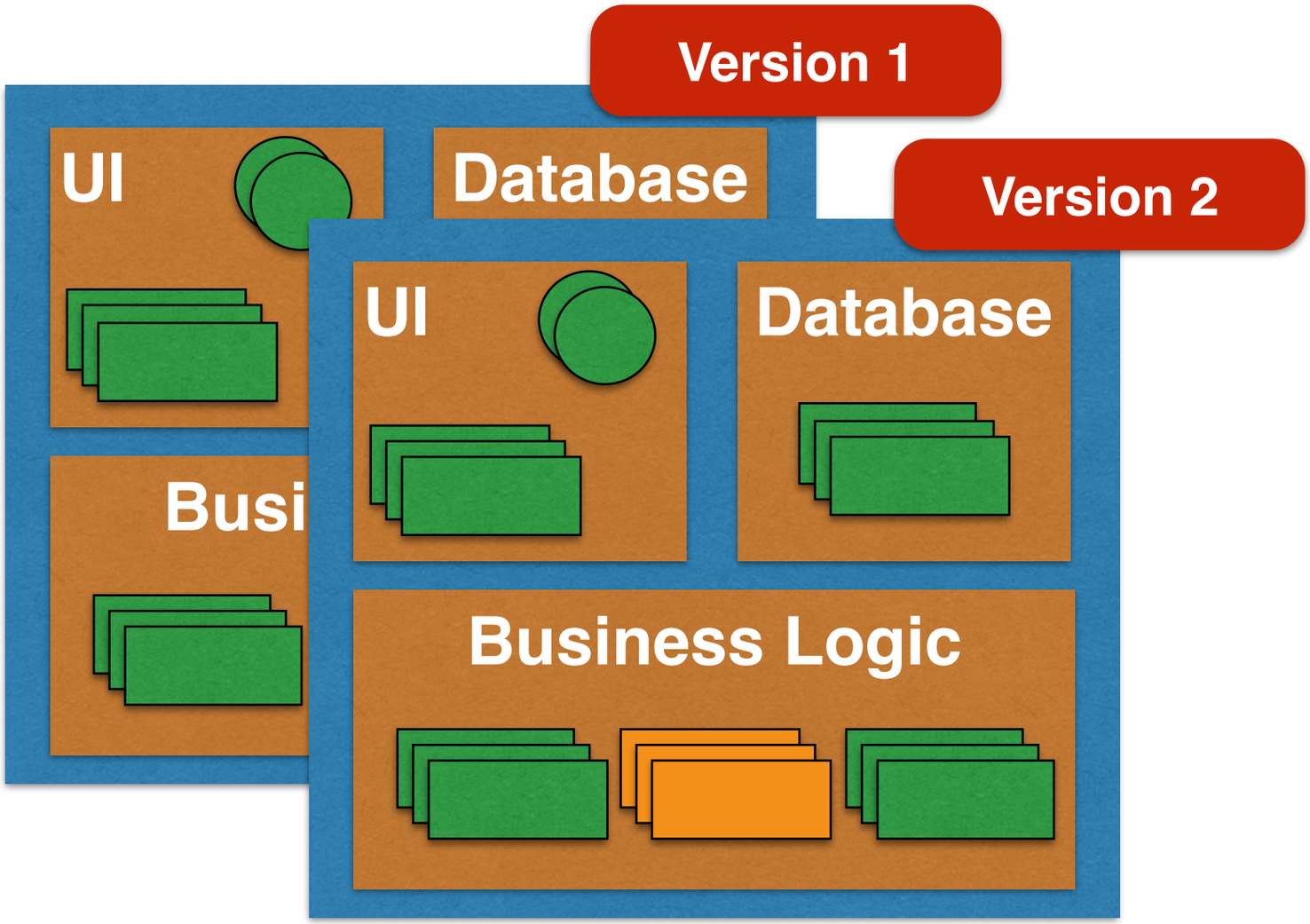

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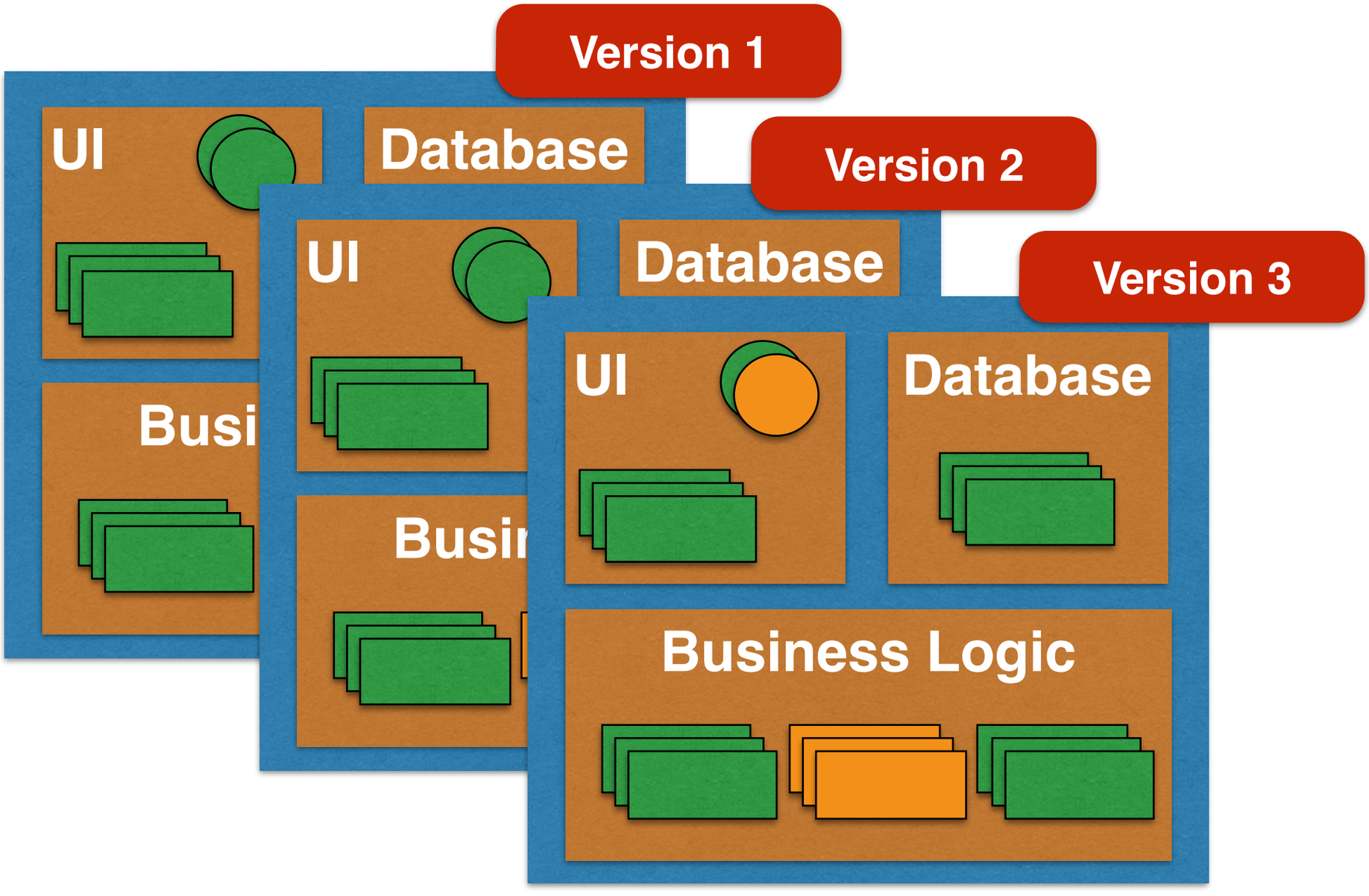

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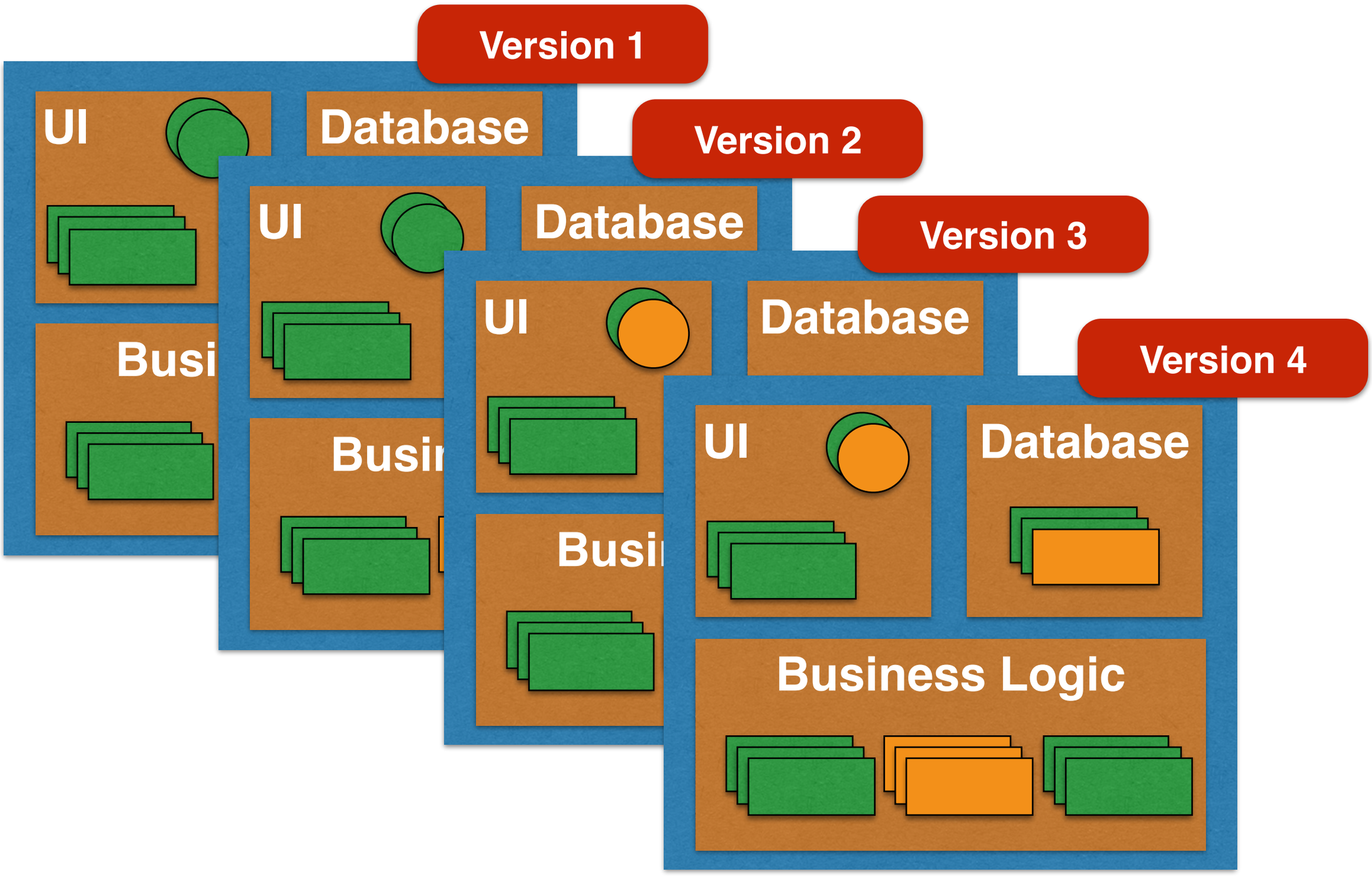
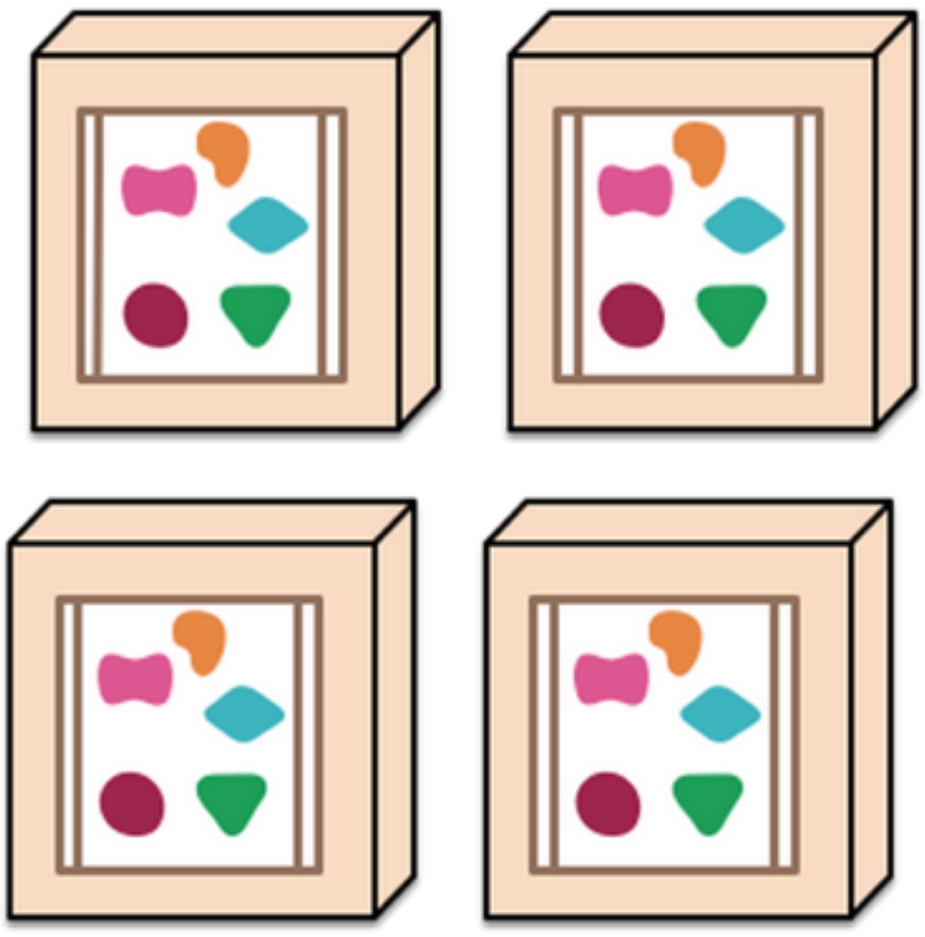
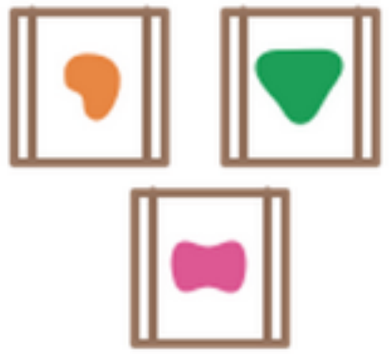


A monolithic application puts all its functionality into a single process...

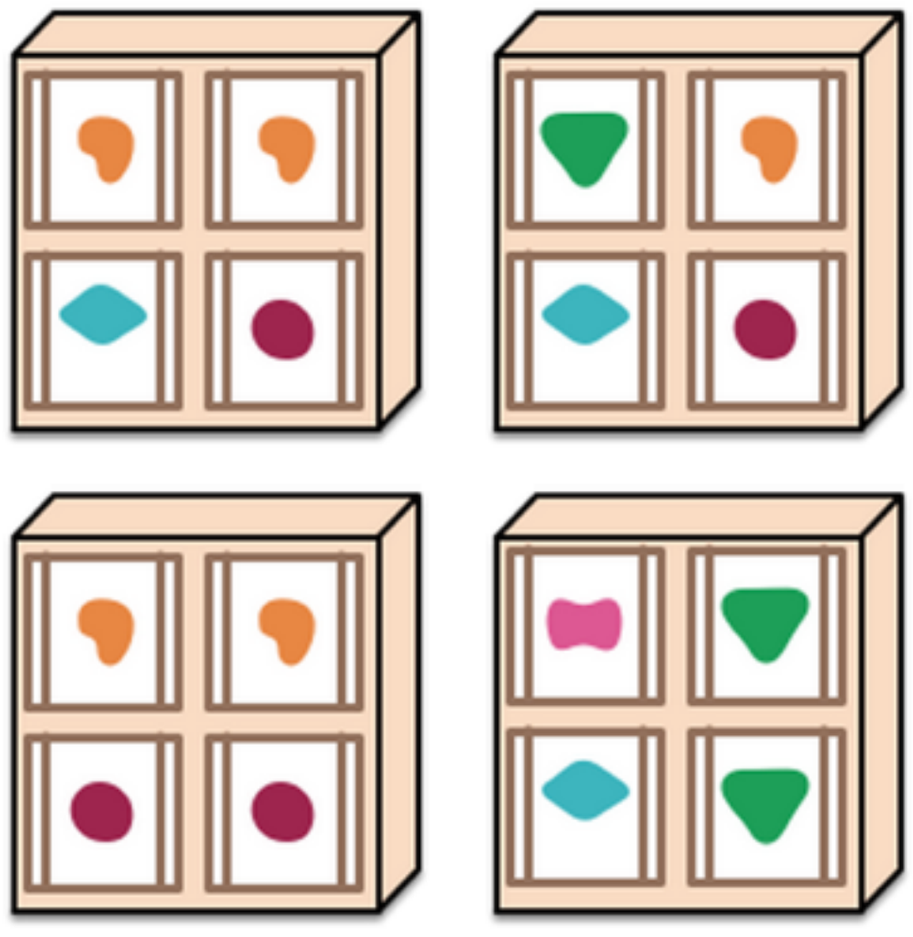
... and scales by replicating the monolith on multiple servers



A microservices architecture puts each element of functionality into a separate service...



... and scales by distributing these services across servers, replicating as needed.



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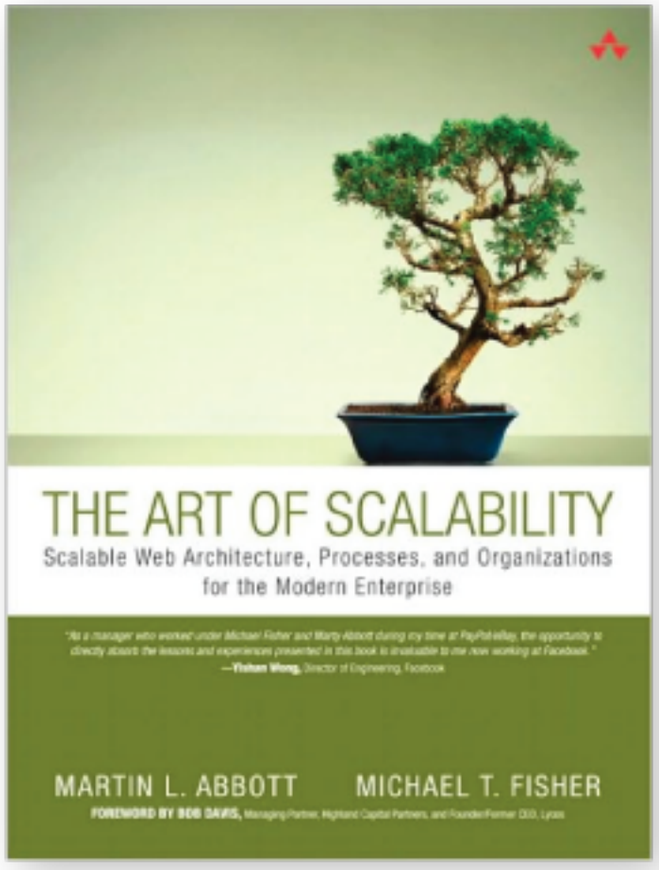
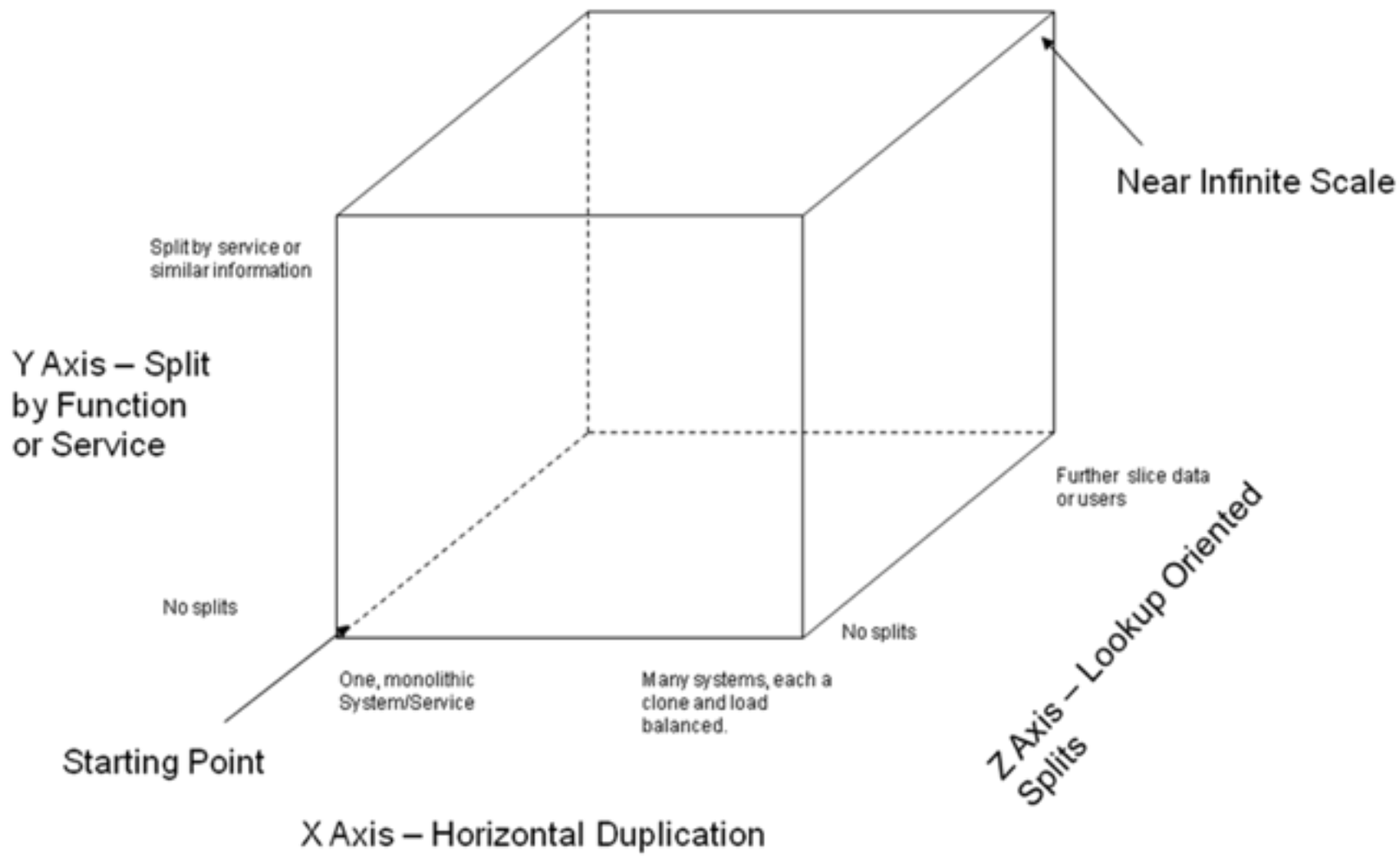
- “Smart endpoints, dumb pipes”

Scaling μservices





http://akfpartners.com/techblog/2008/05/08/splitting-applications-or-services-for-scale/

Strategies for decomposing

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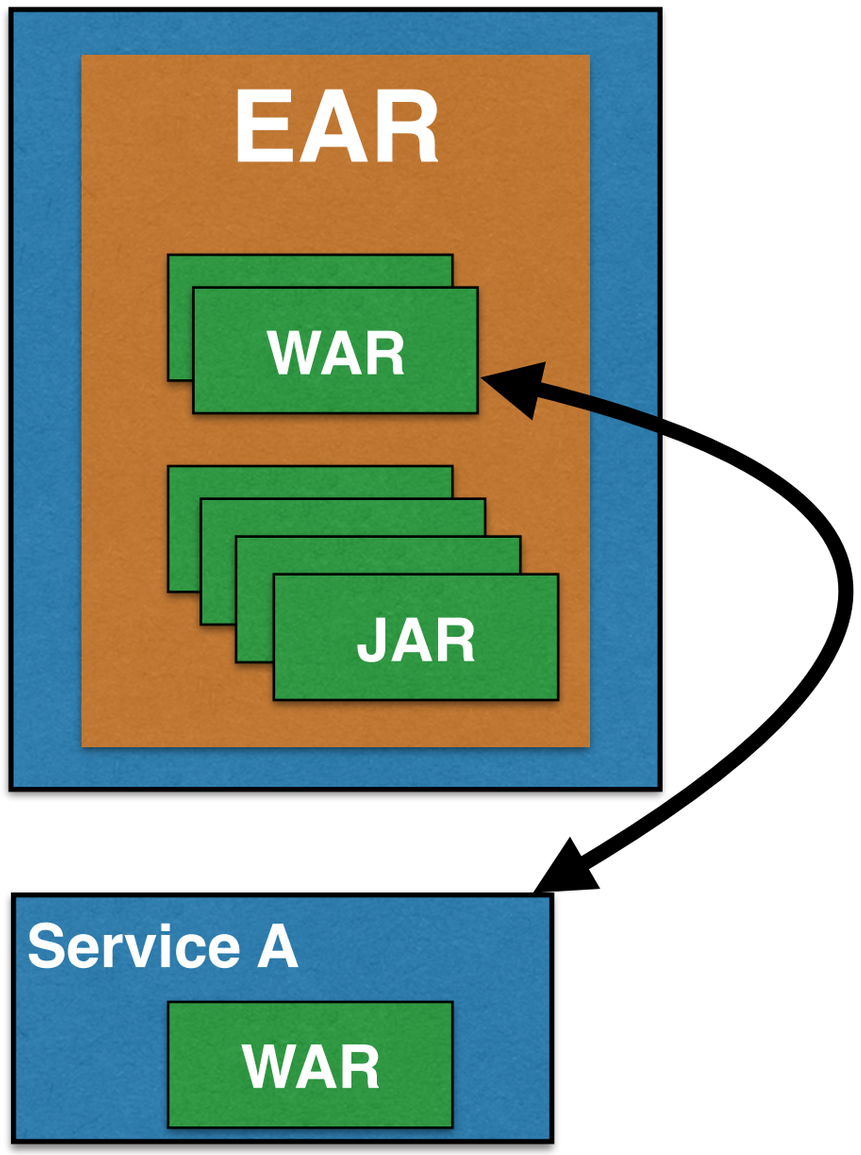
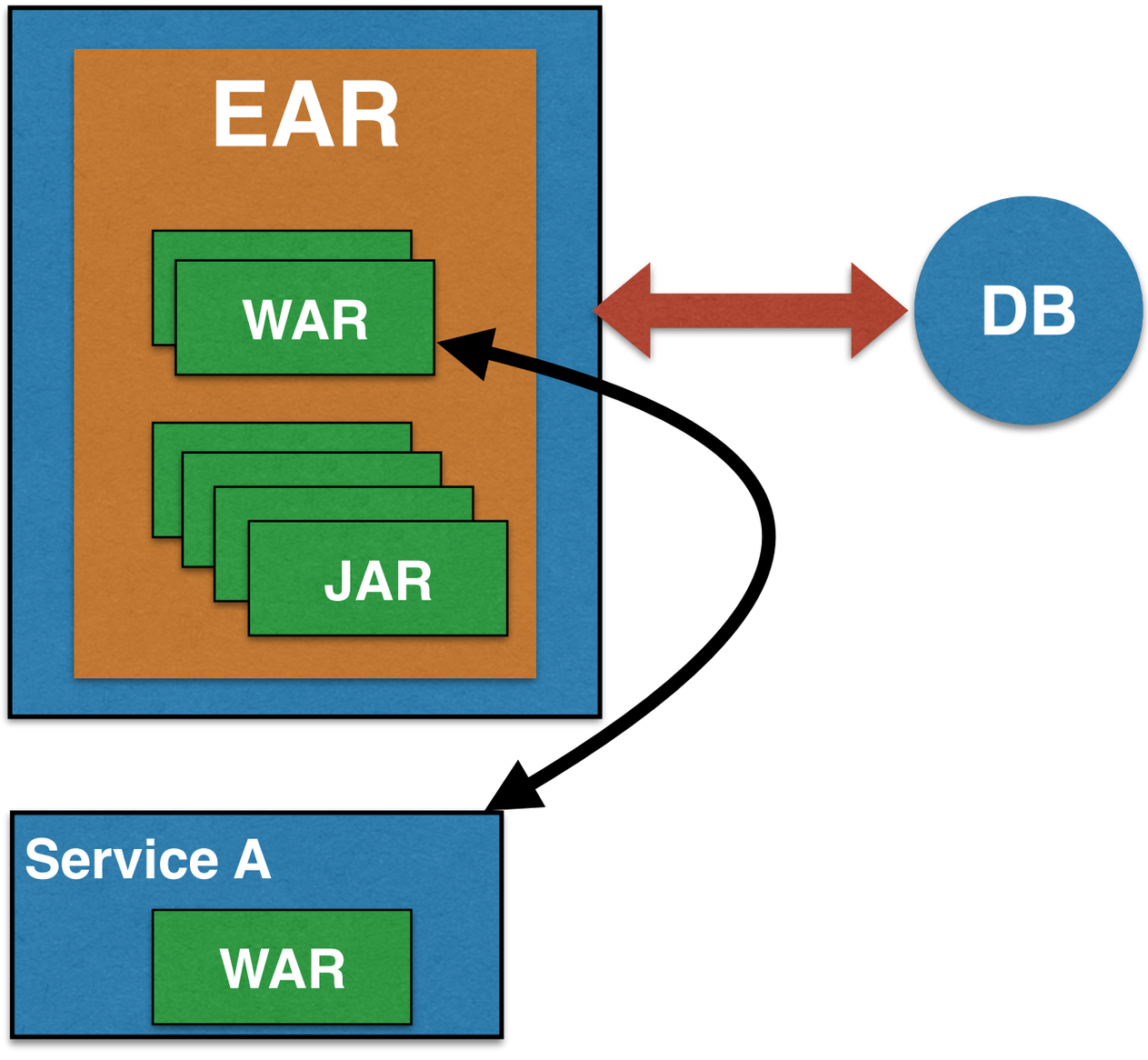
- Single Responsible Principle - e.g. Unix utilities

Towards μservices



Towards μservices



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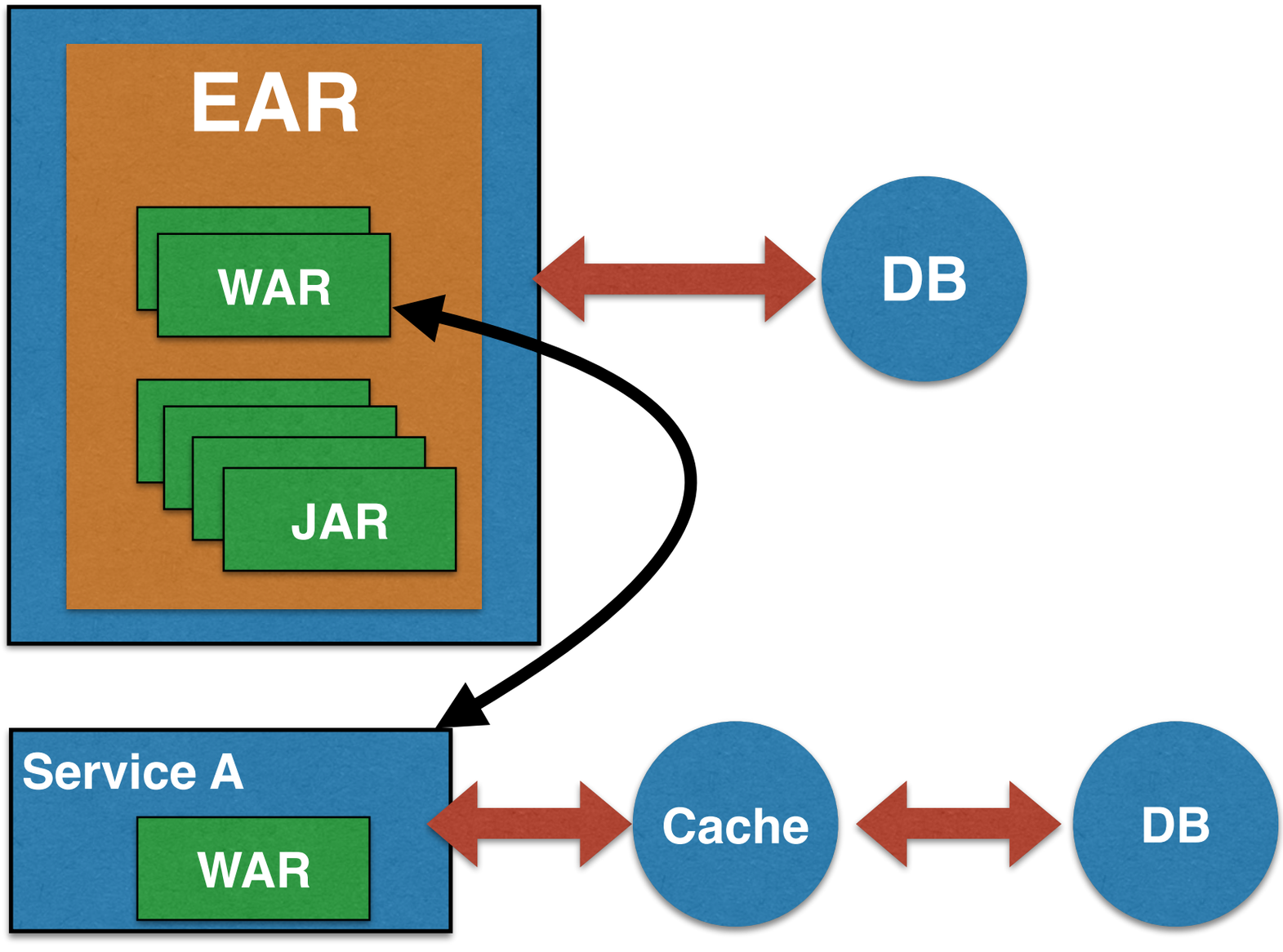

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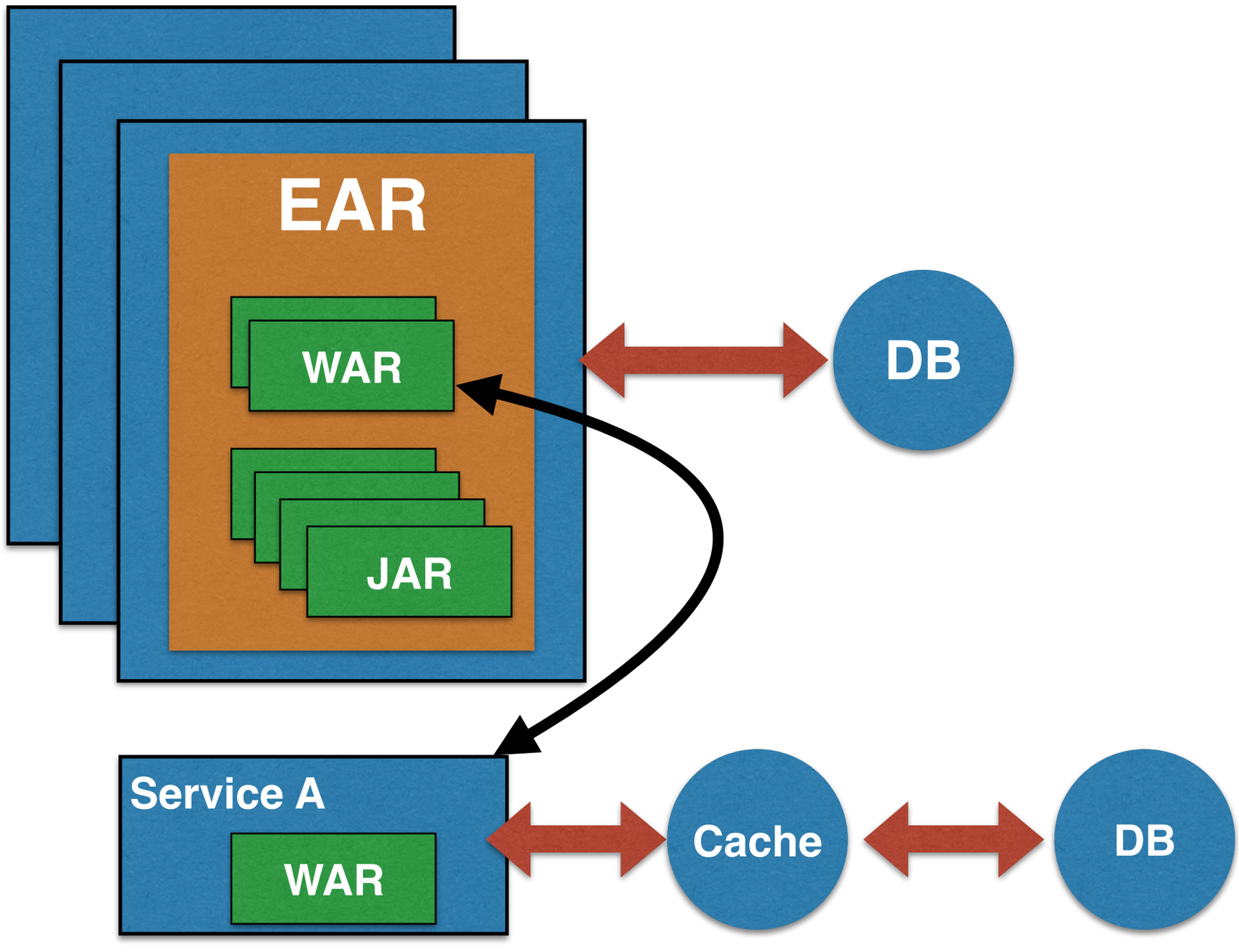

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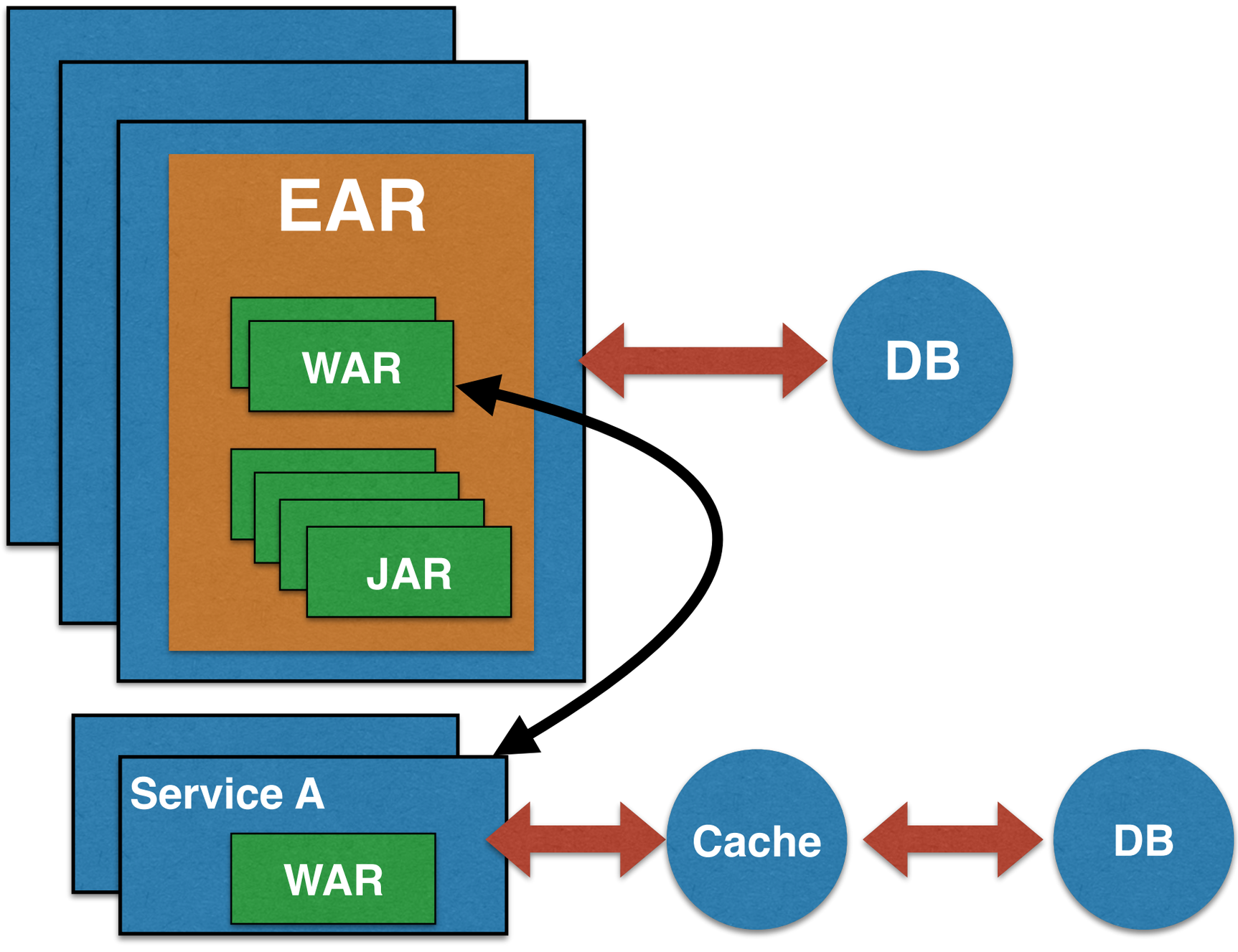

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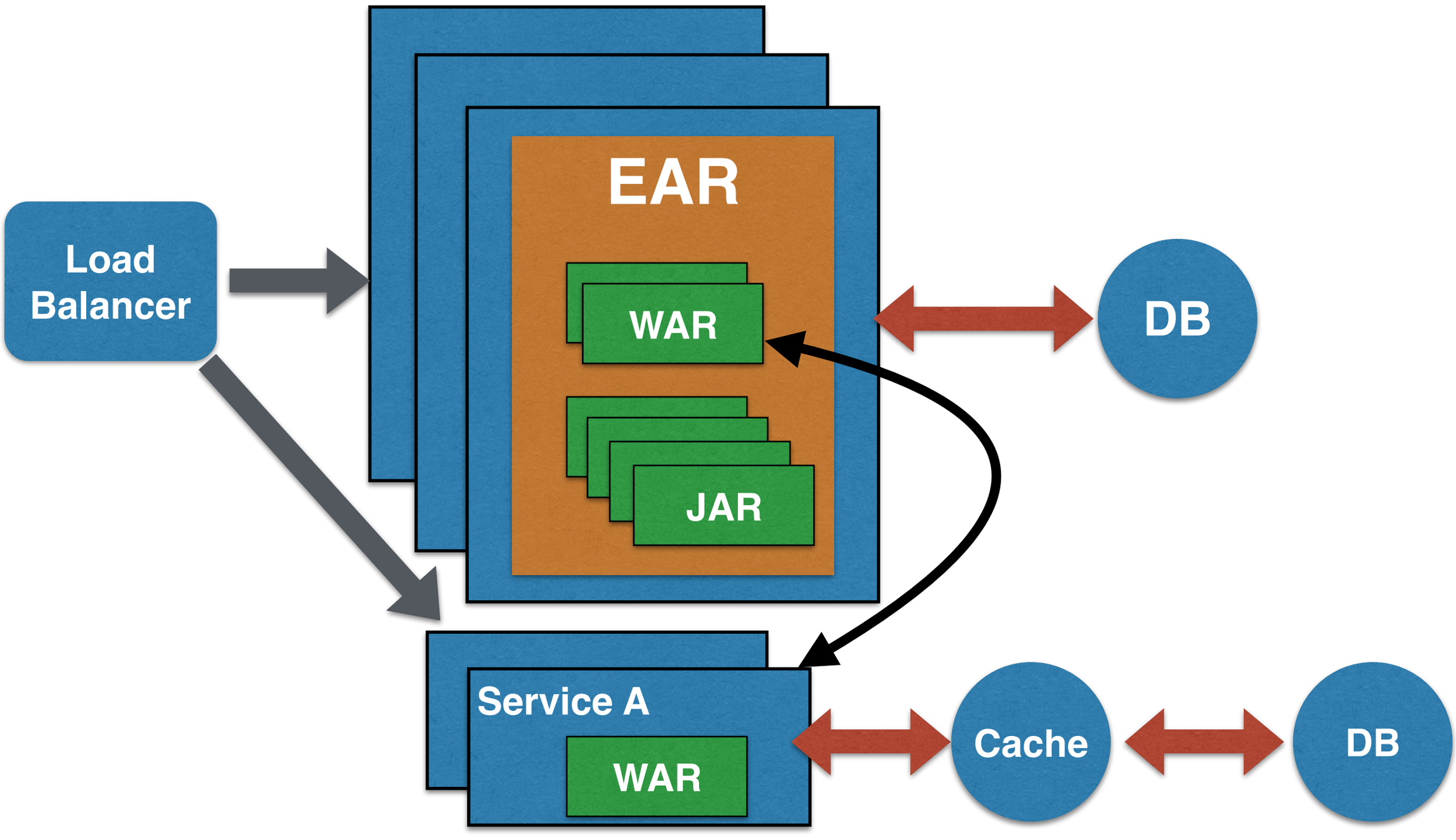
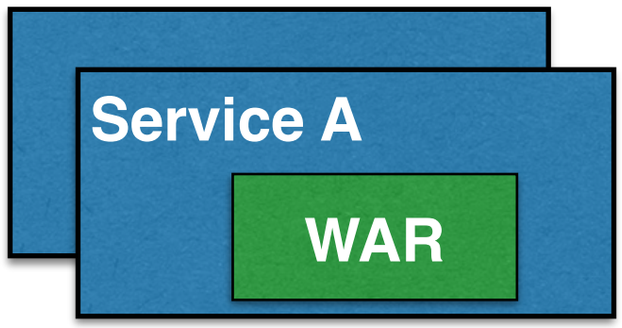
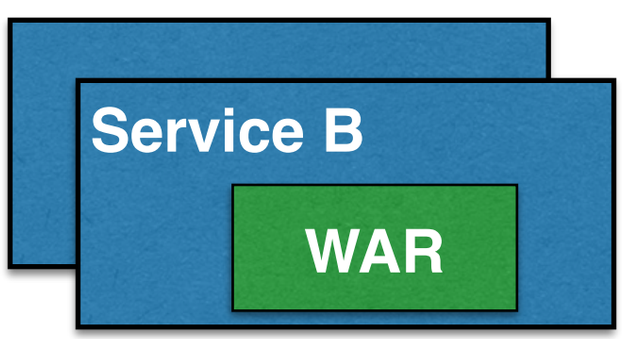
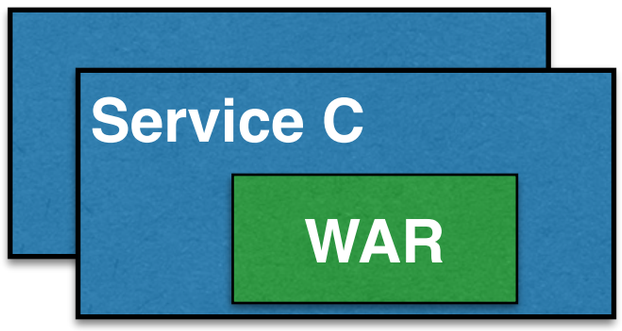


Aggregator Pattern #1







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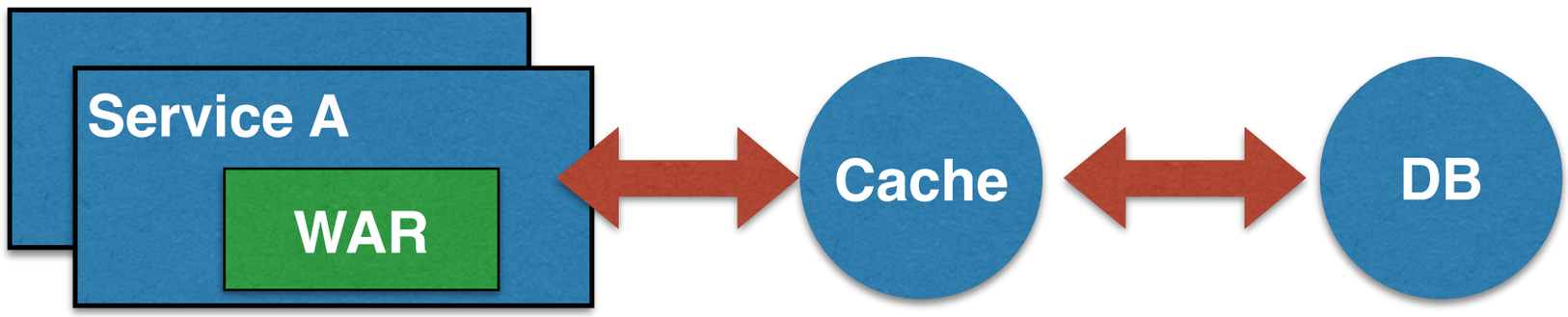

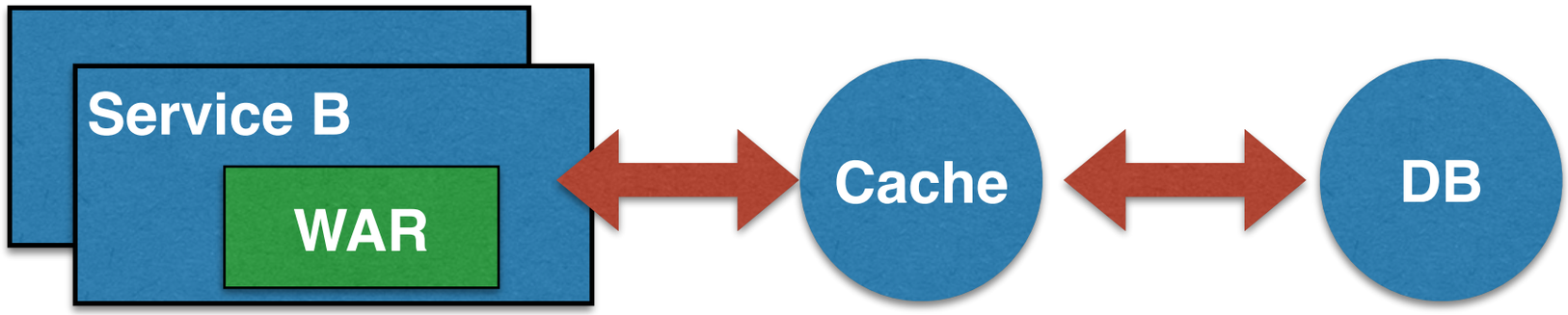

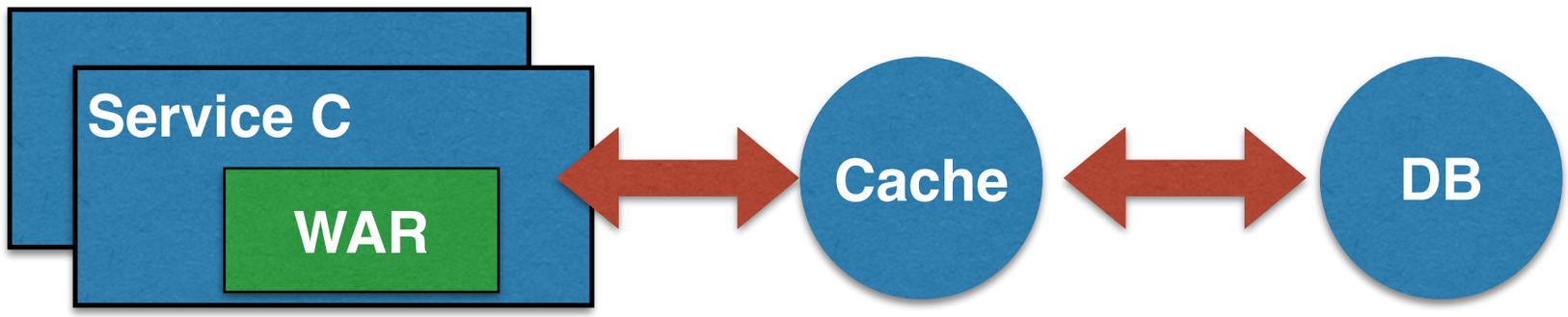

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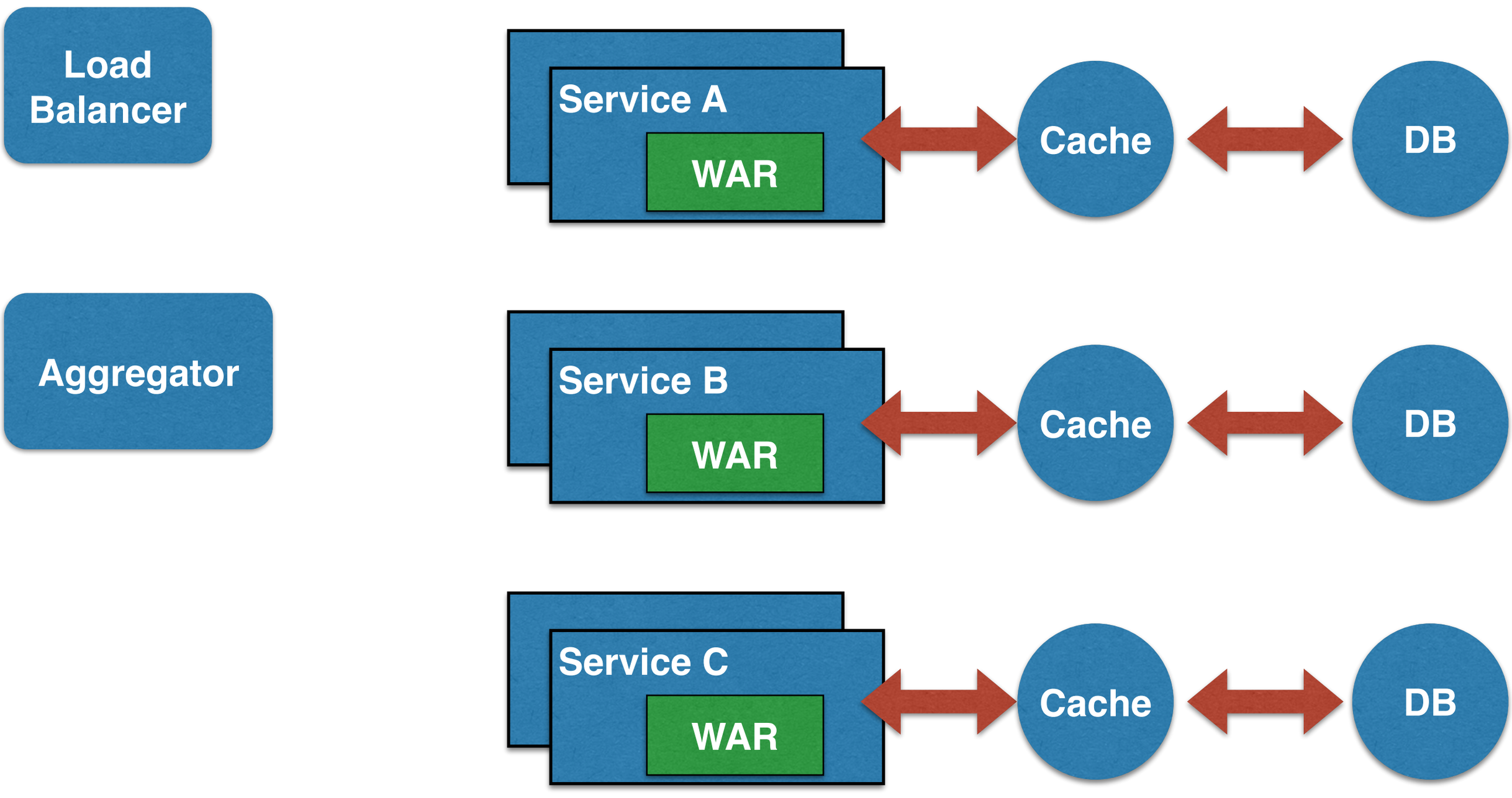

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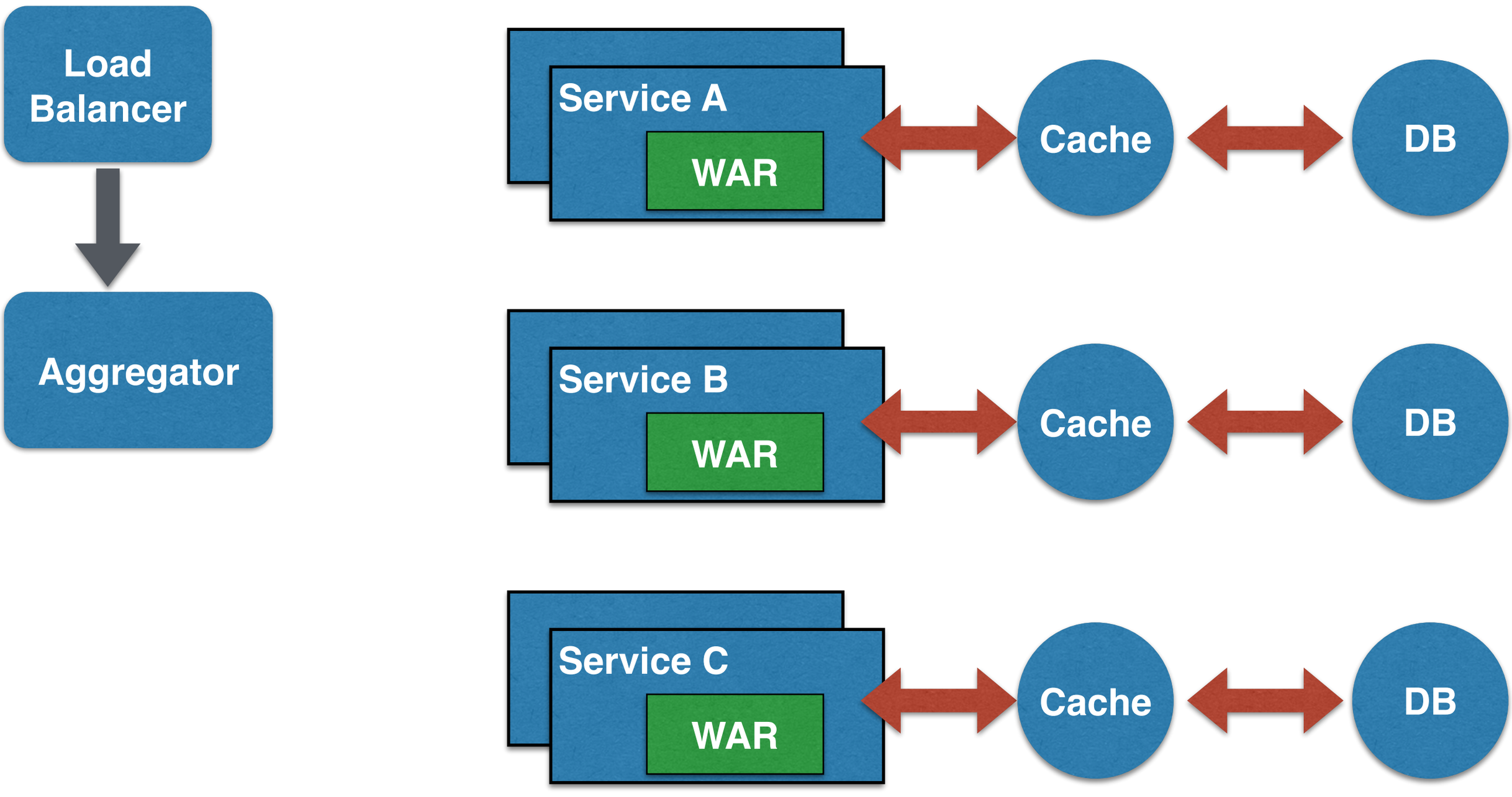

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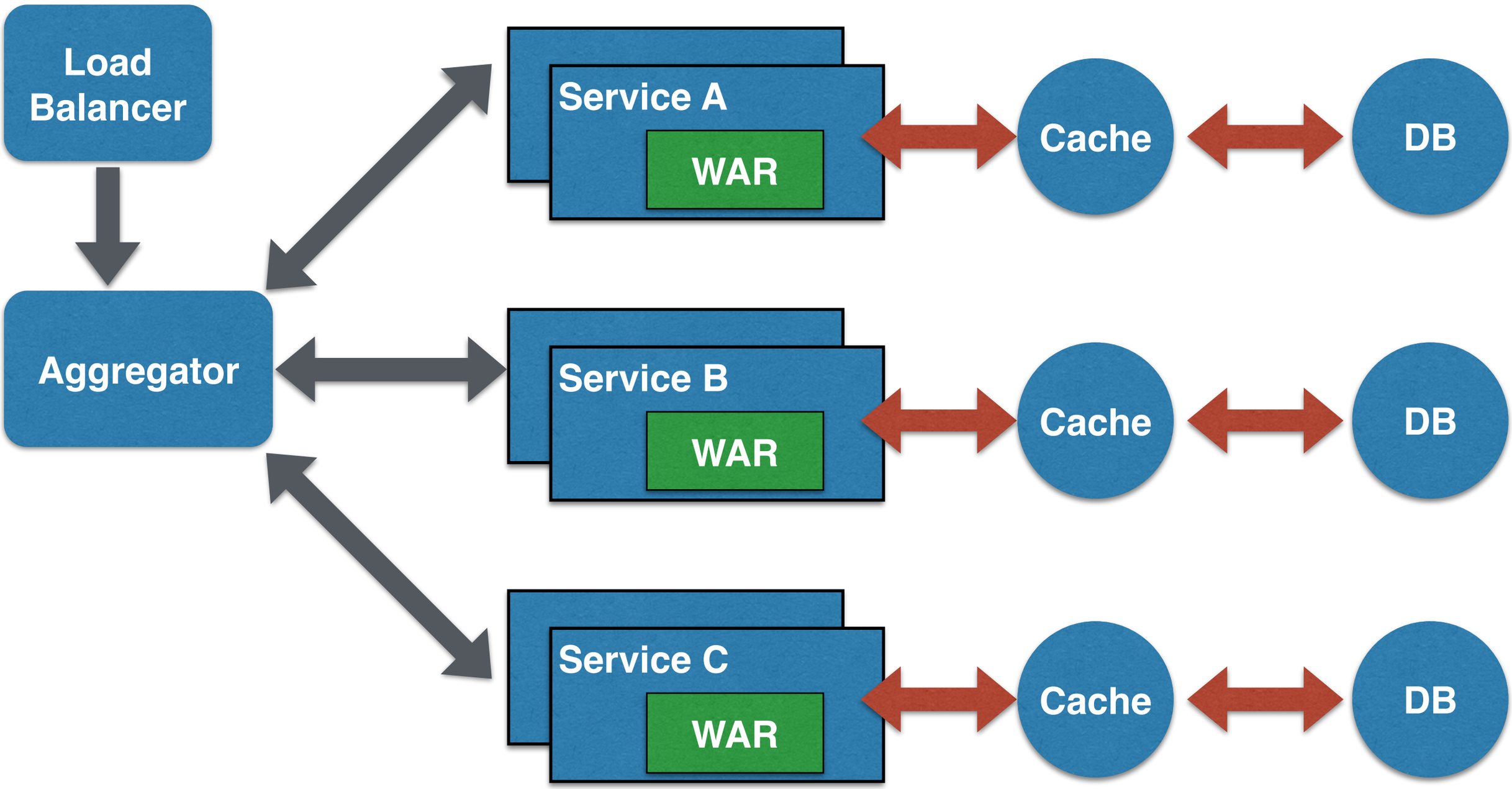
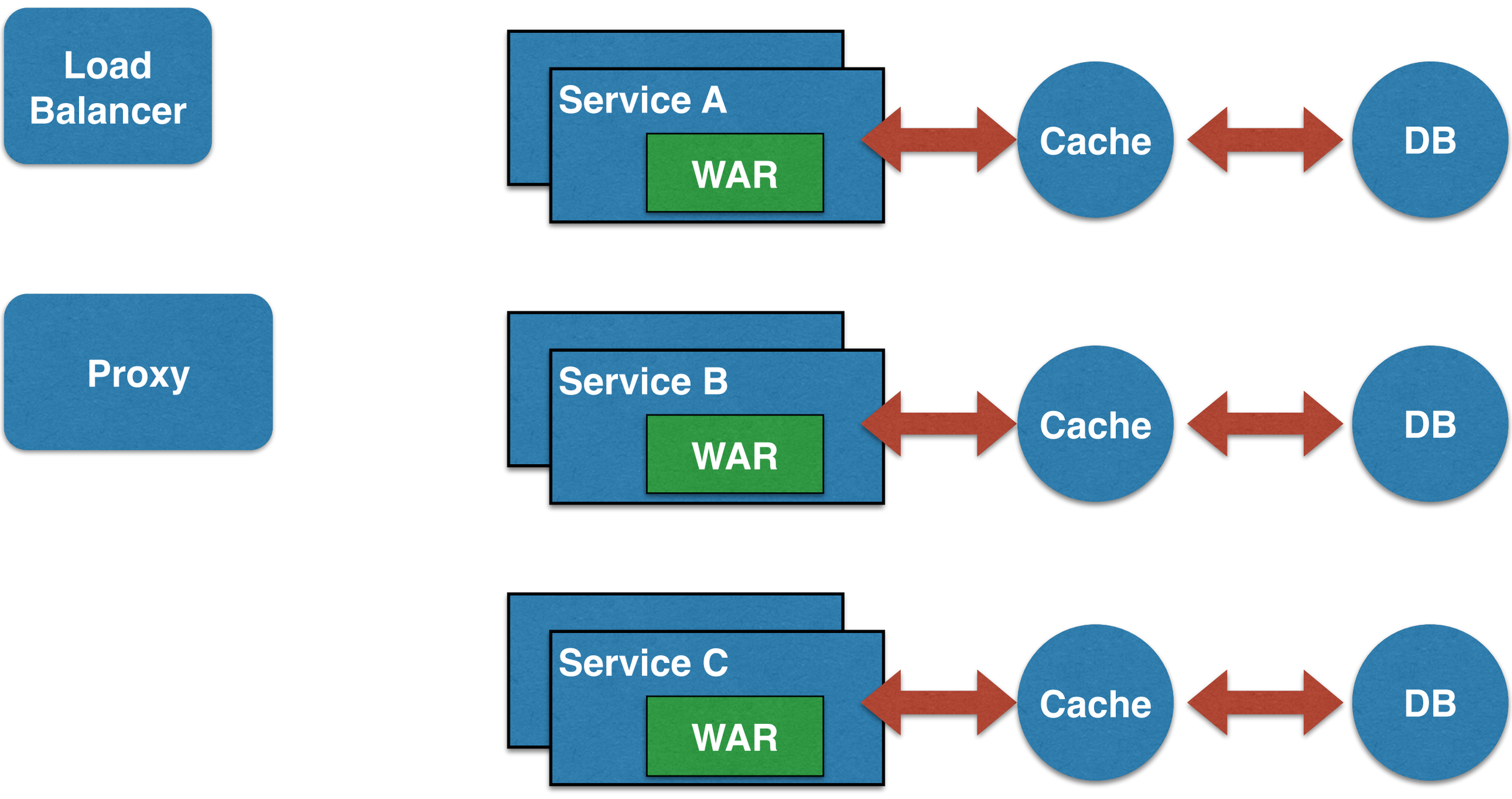
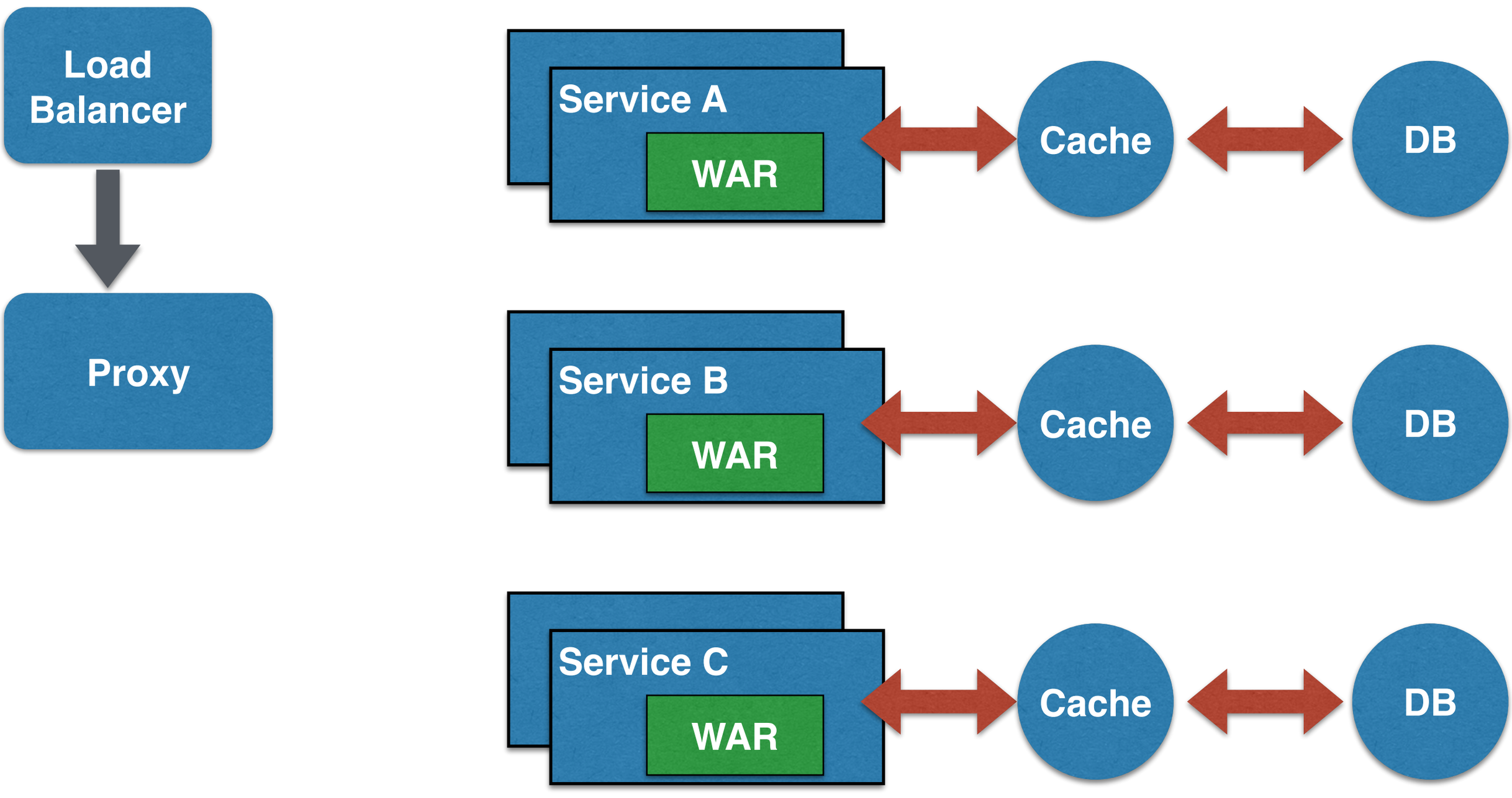


Proxy Pattern #1.5



Proxy Pattern #1.5



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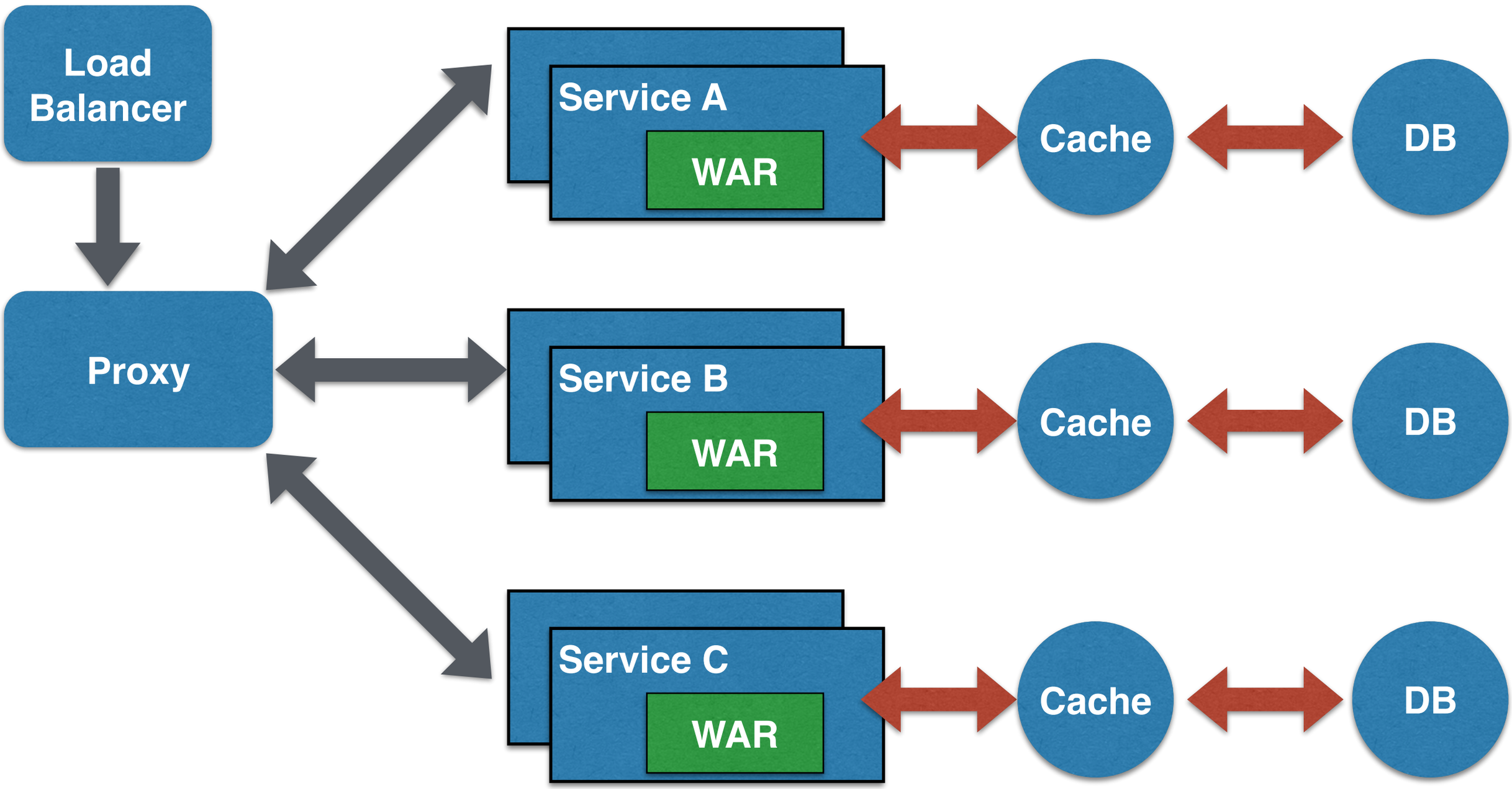
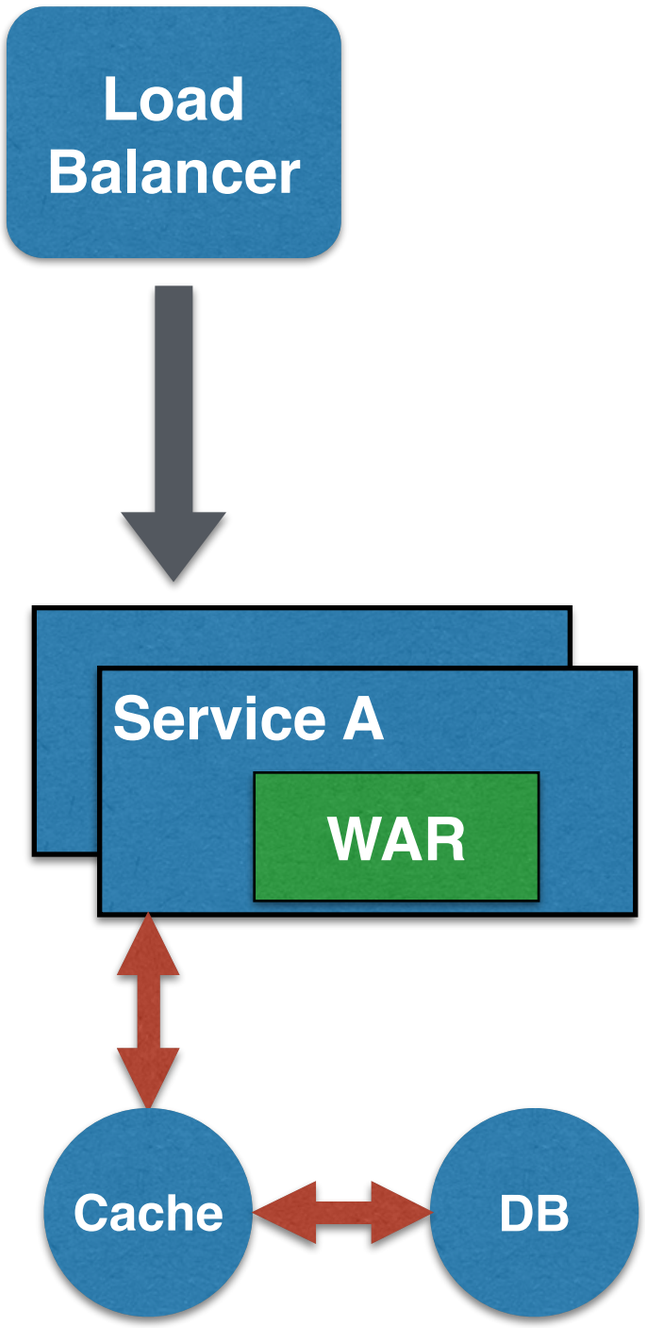
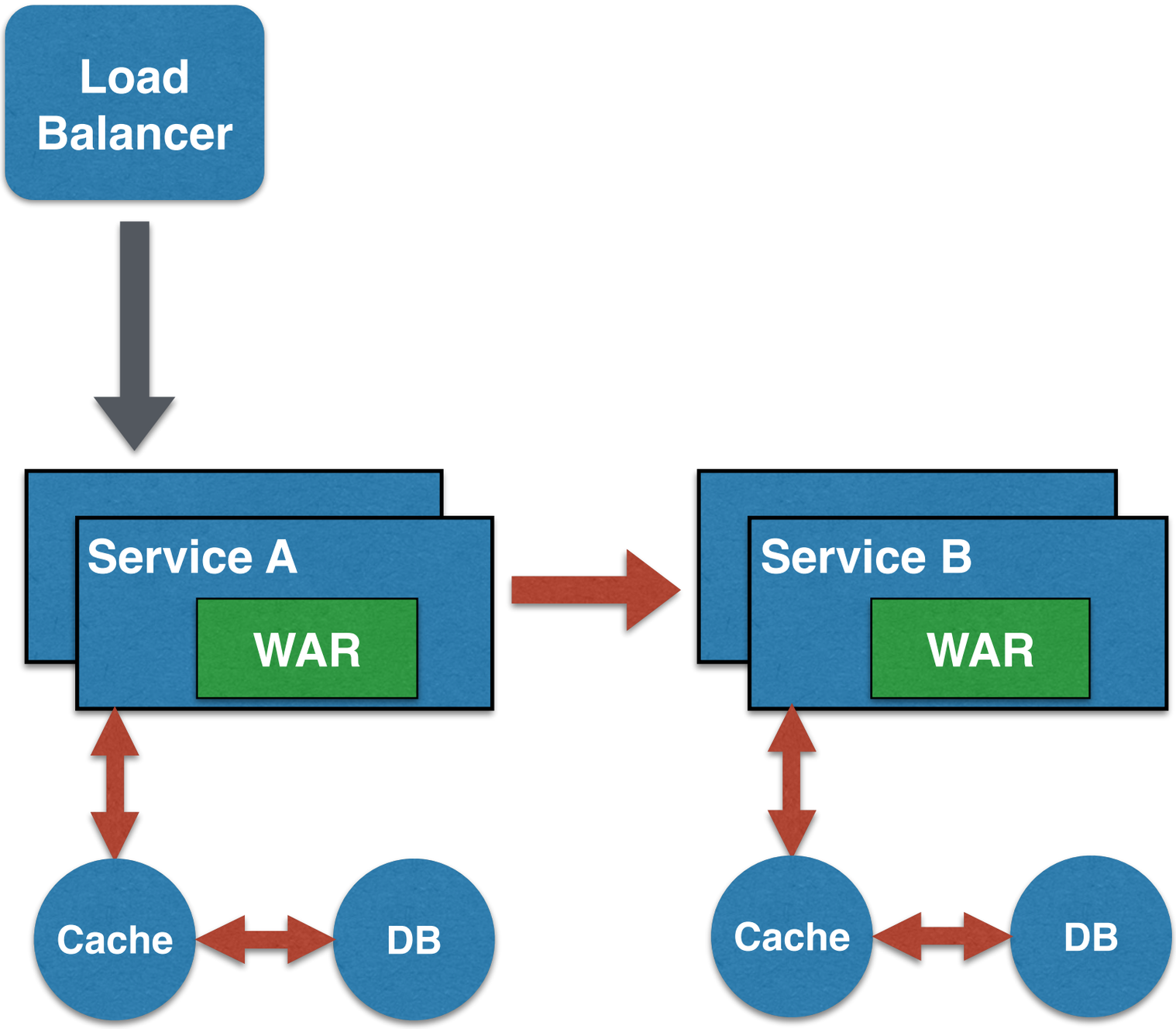


Chained Pattern #2



Chained Pattern #2



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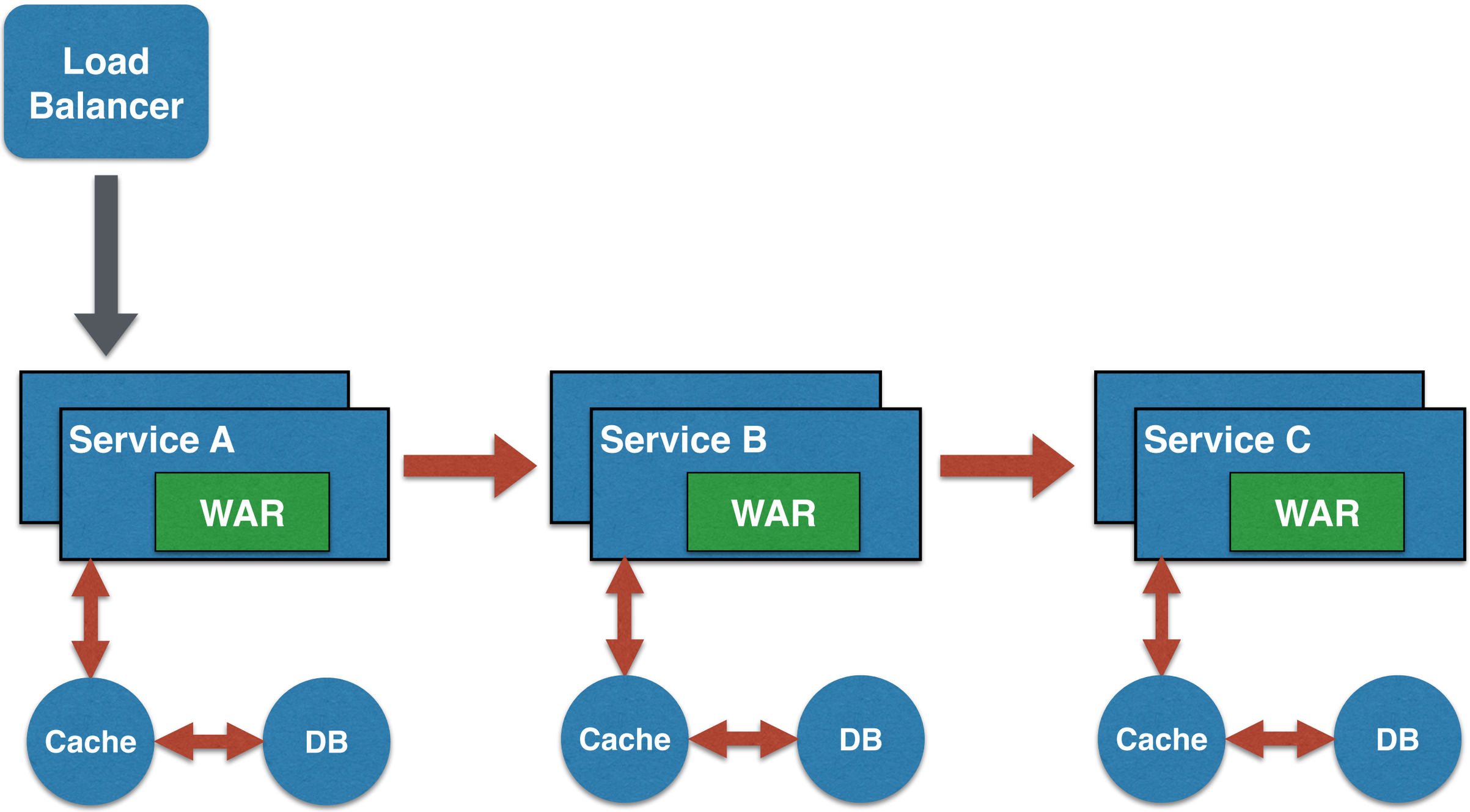
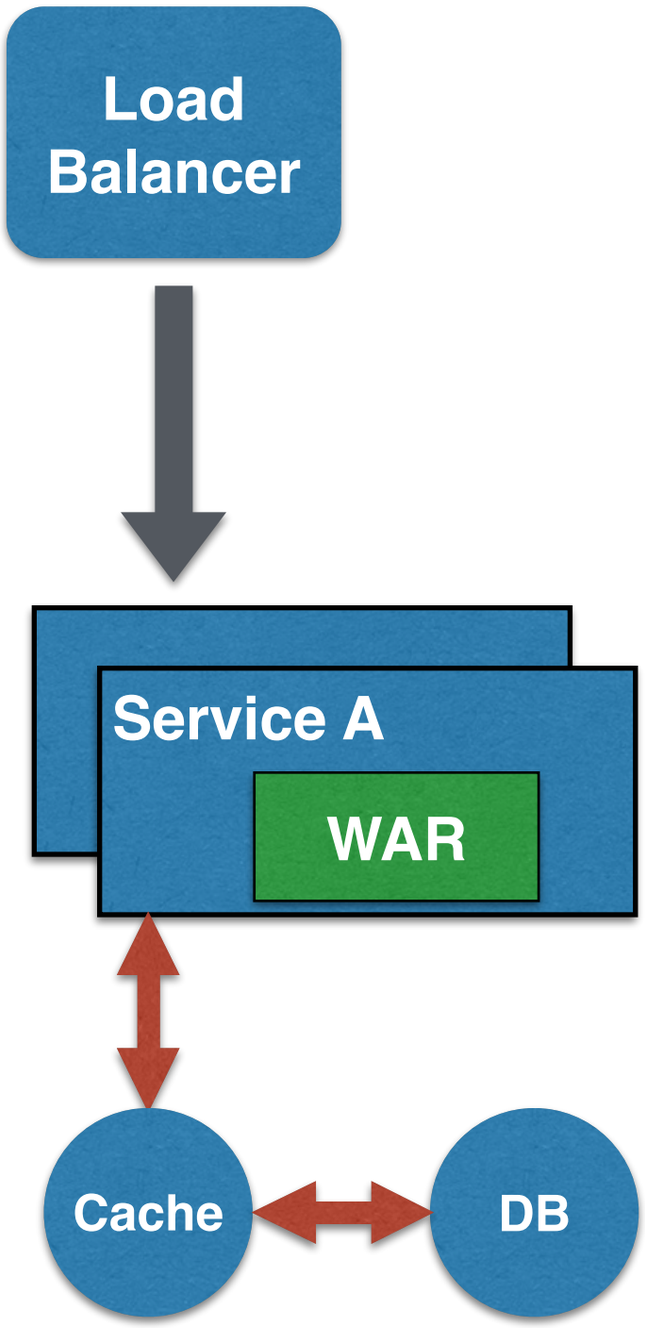


Branch Pattern #3



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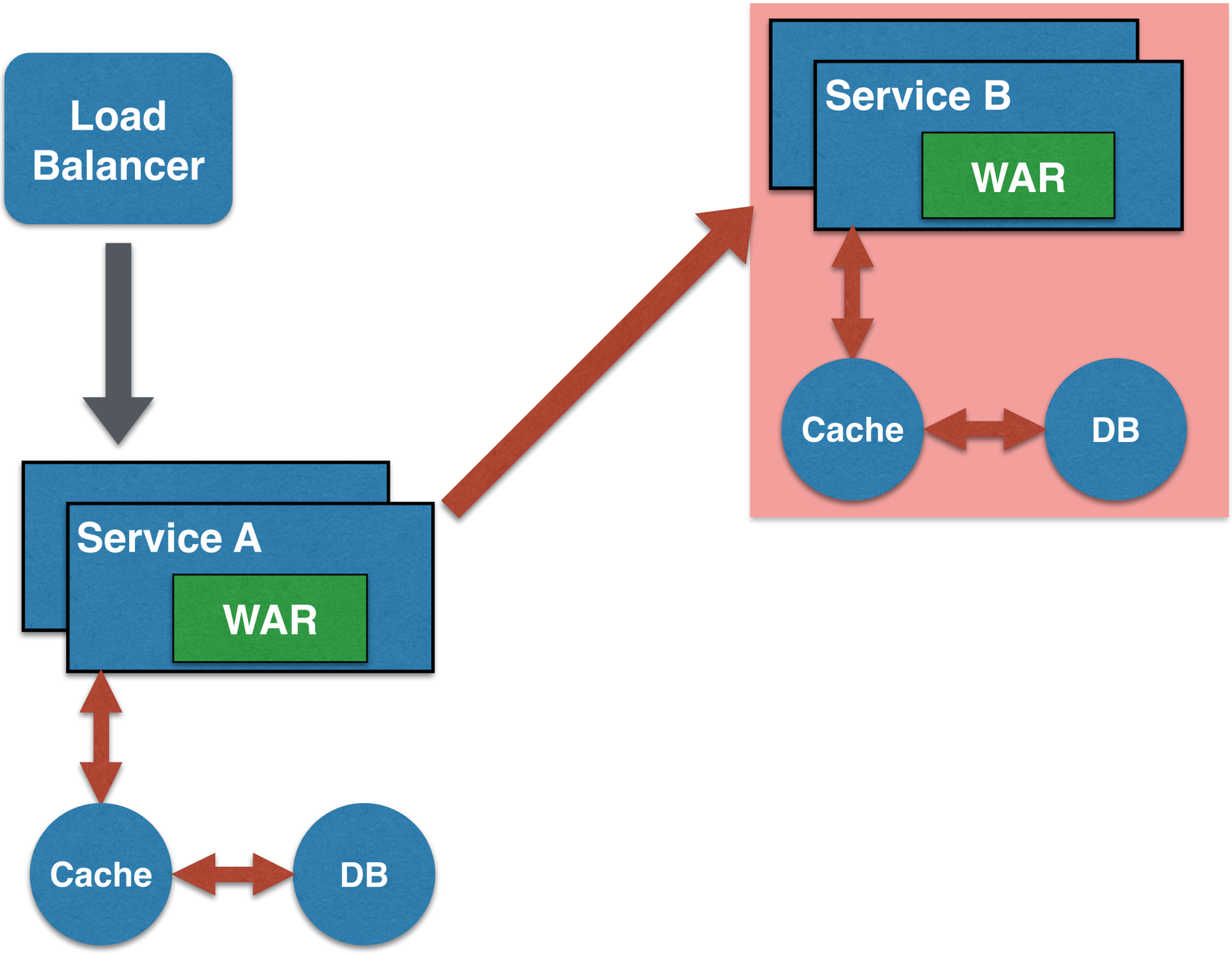

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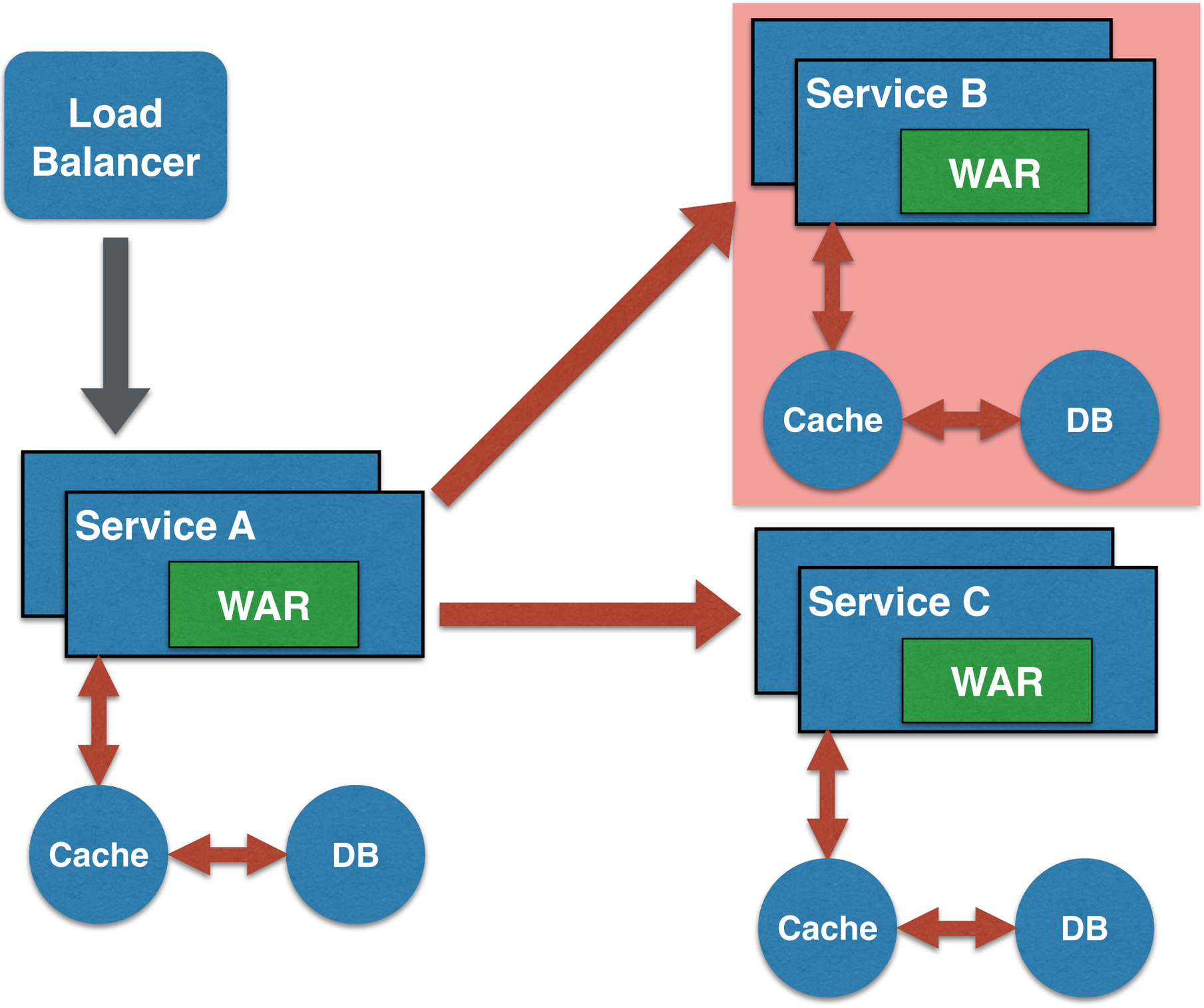

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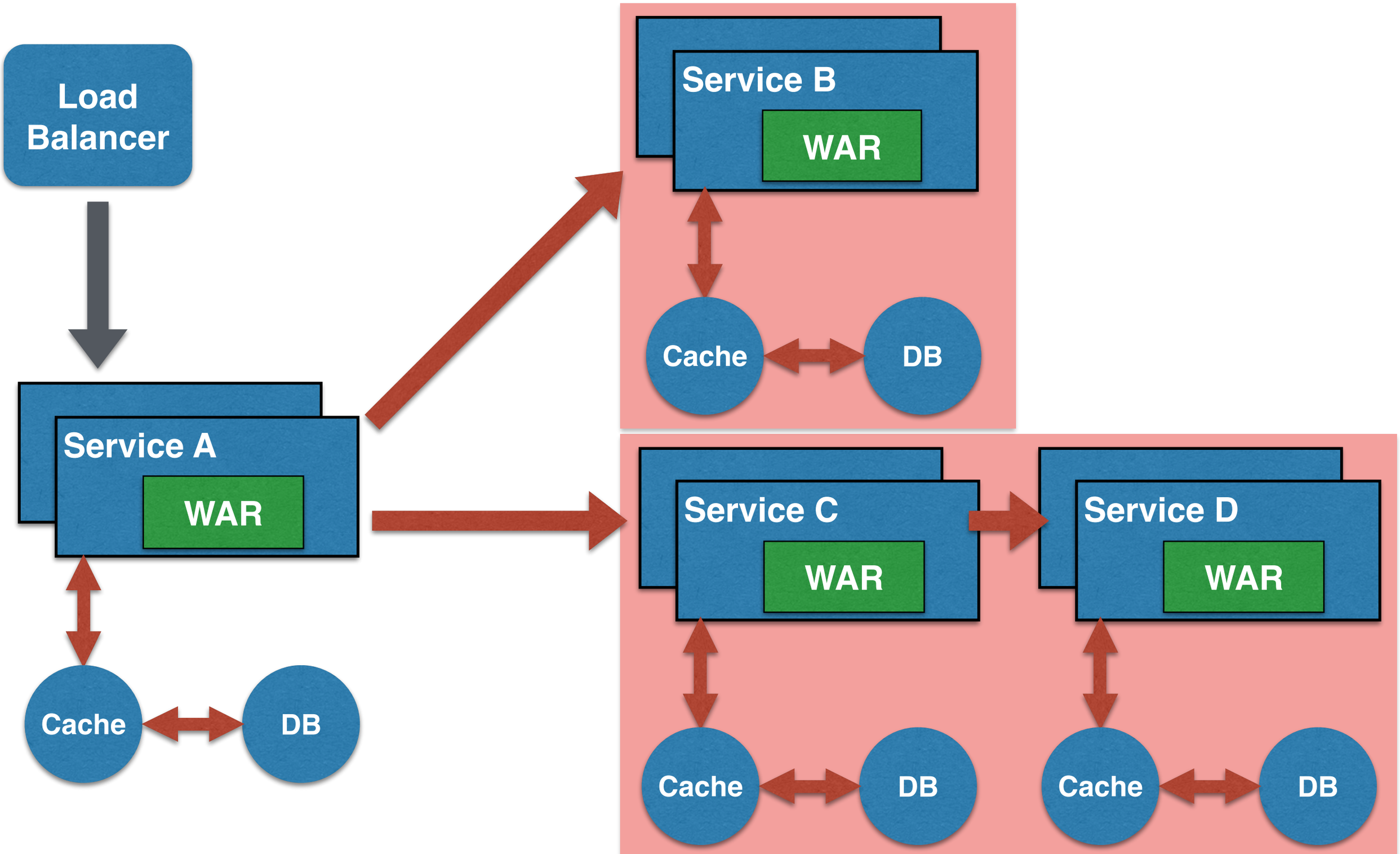
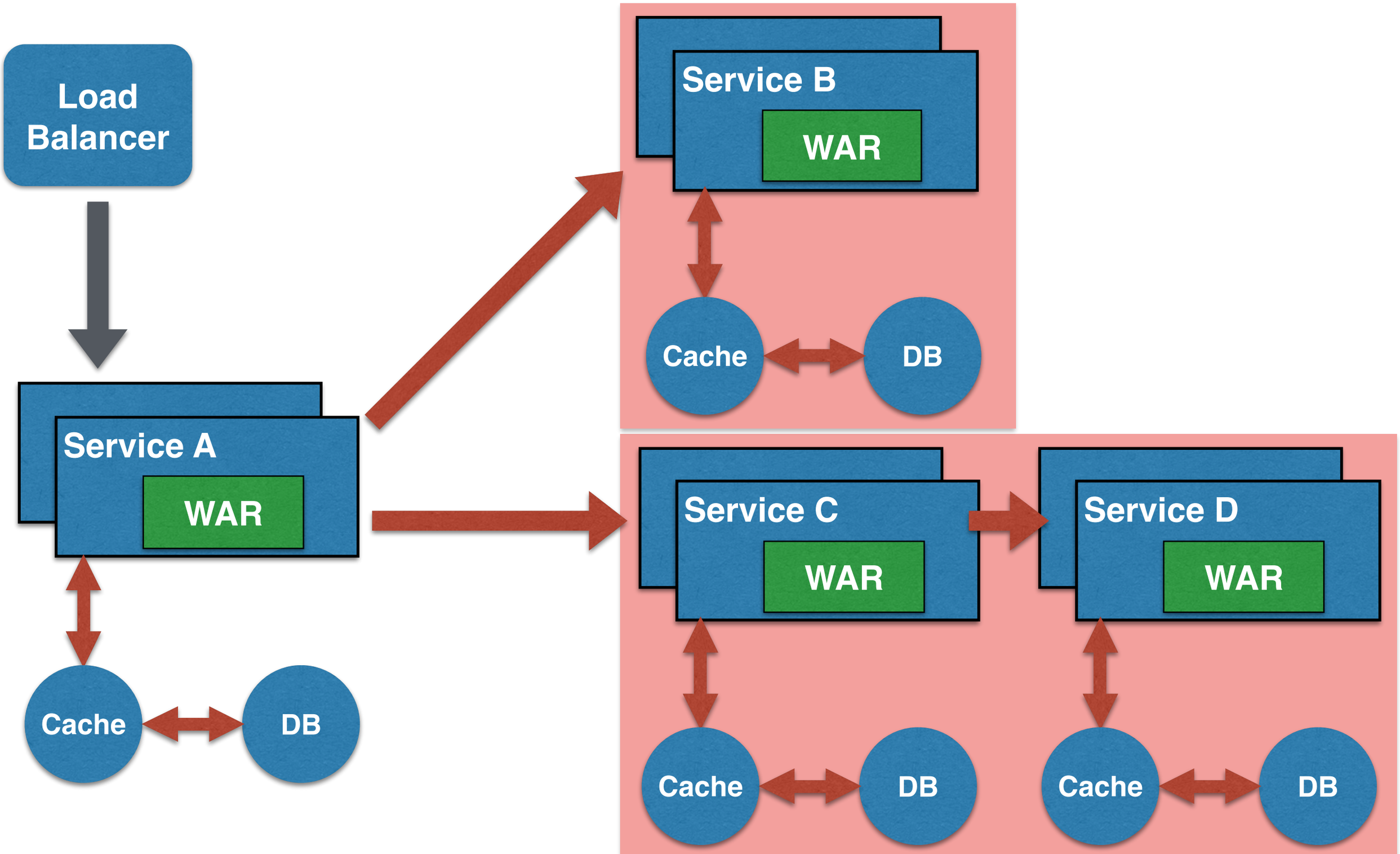
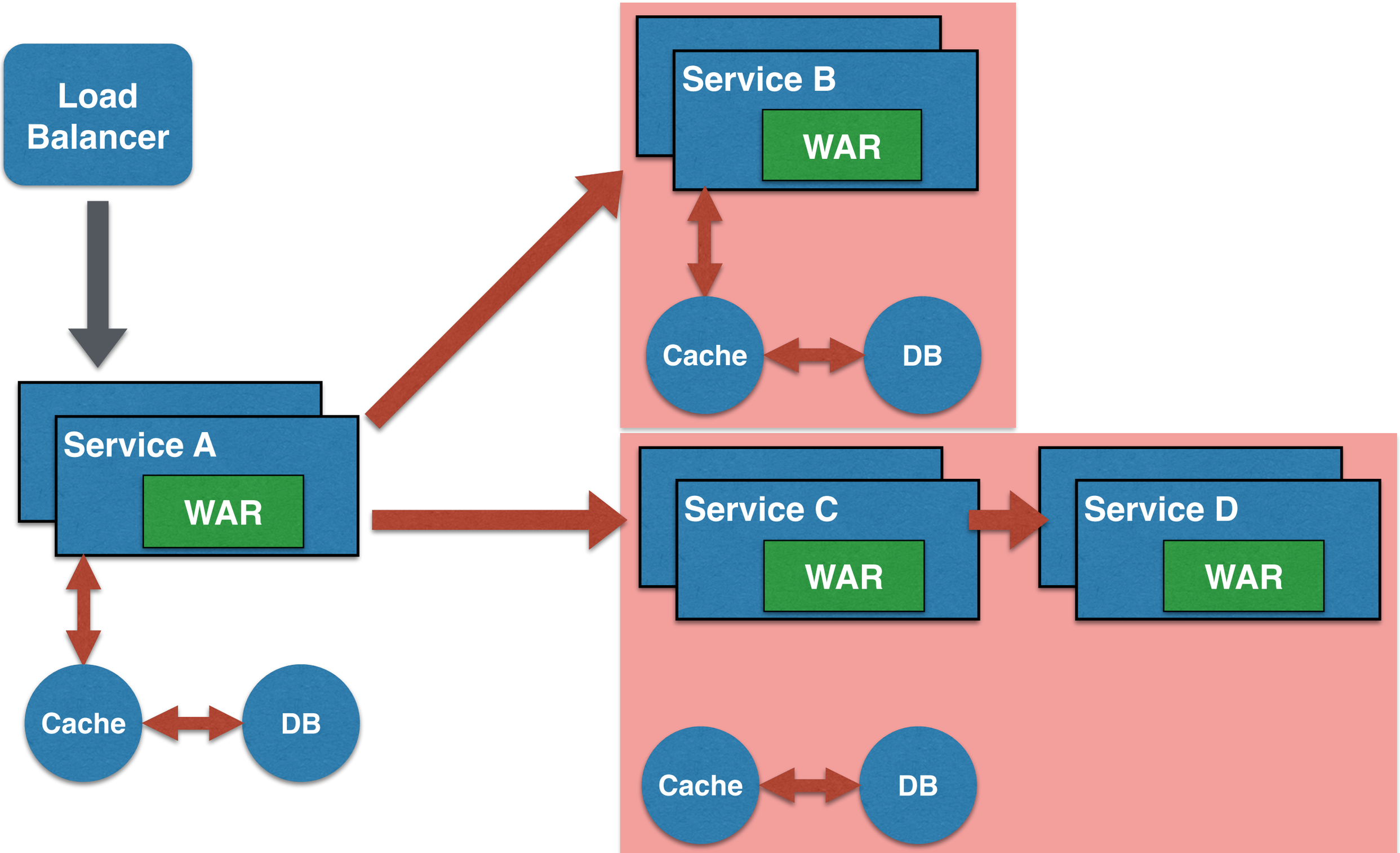


Shared Resources #4



Shared Resources #4



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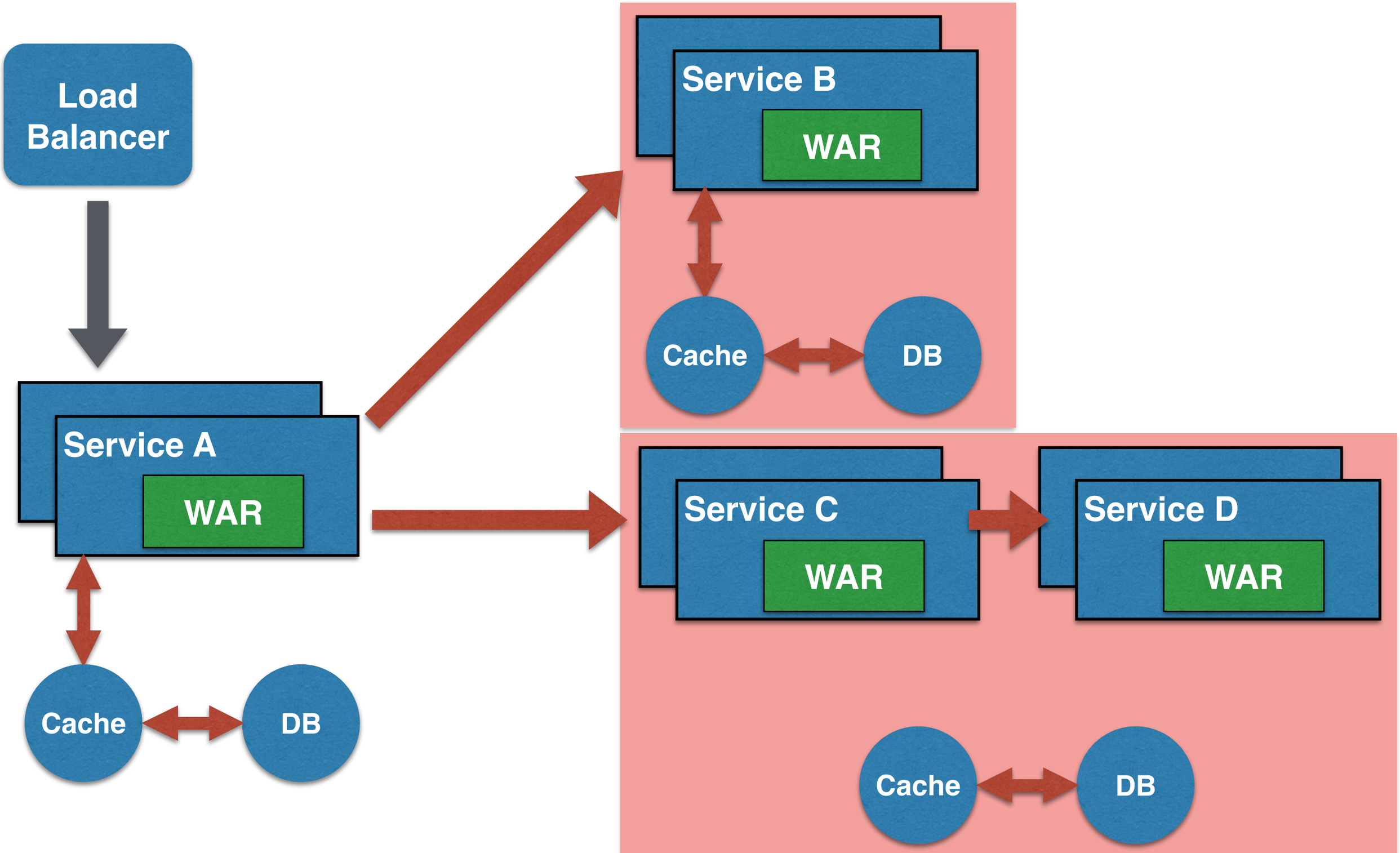

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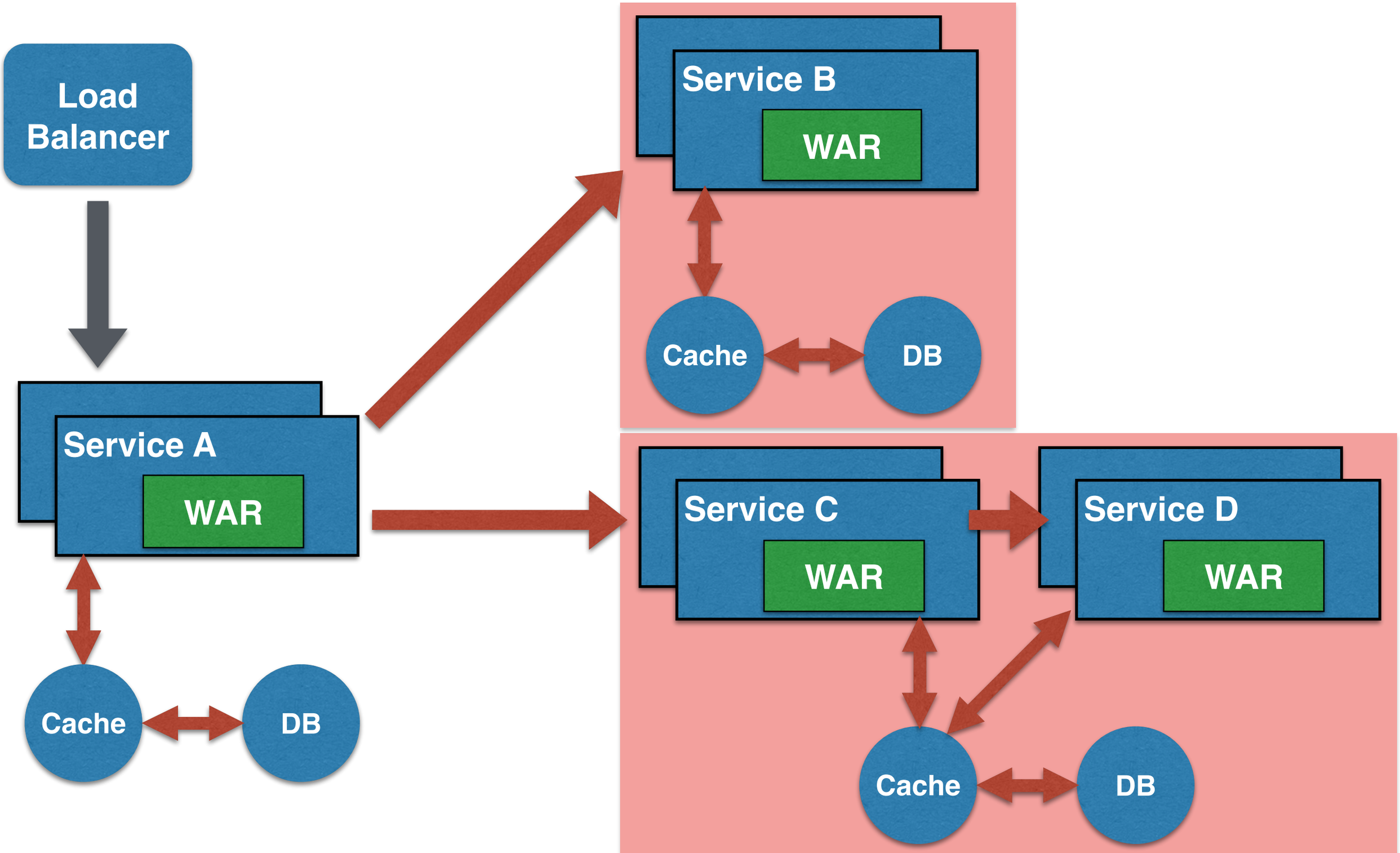

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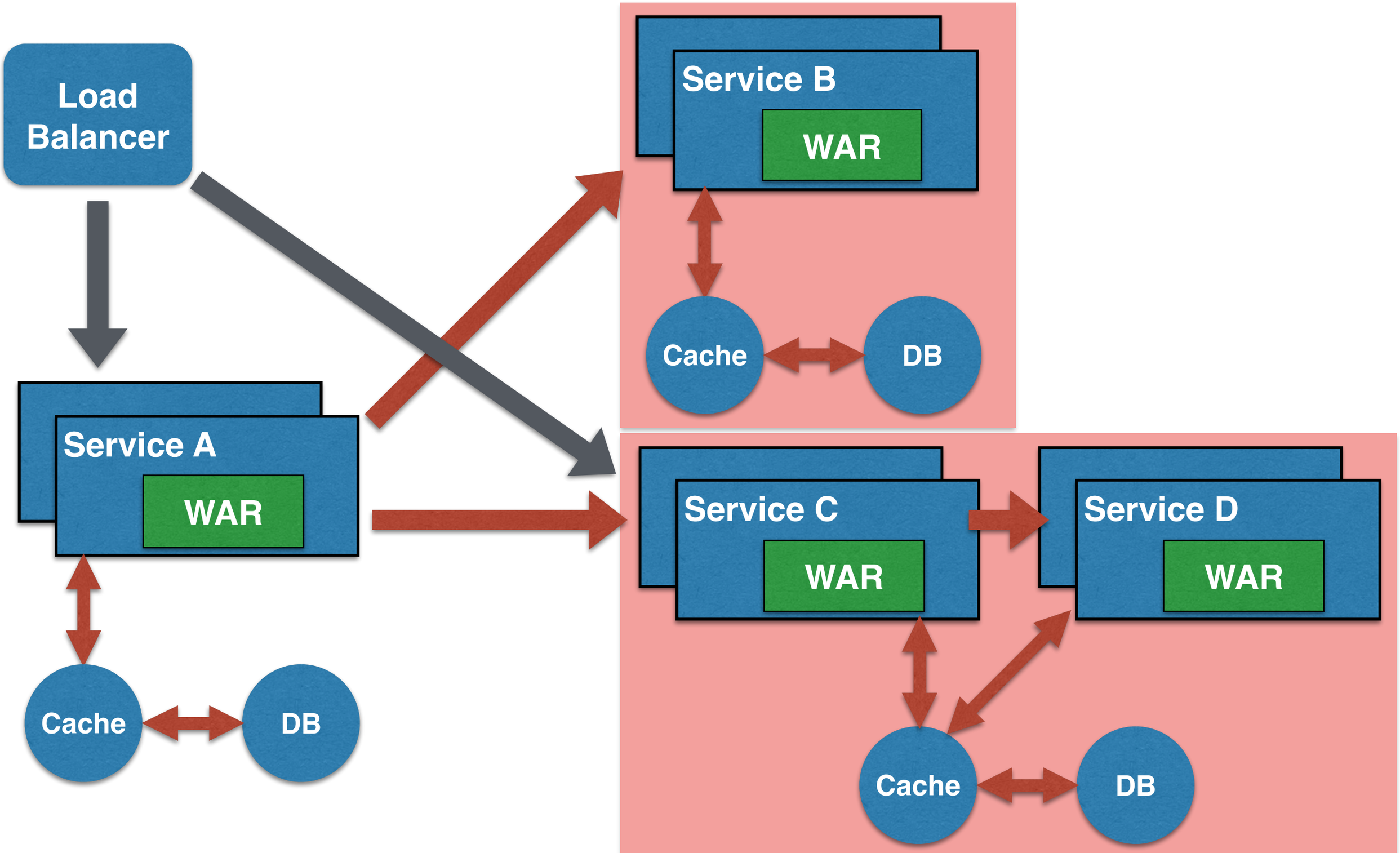
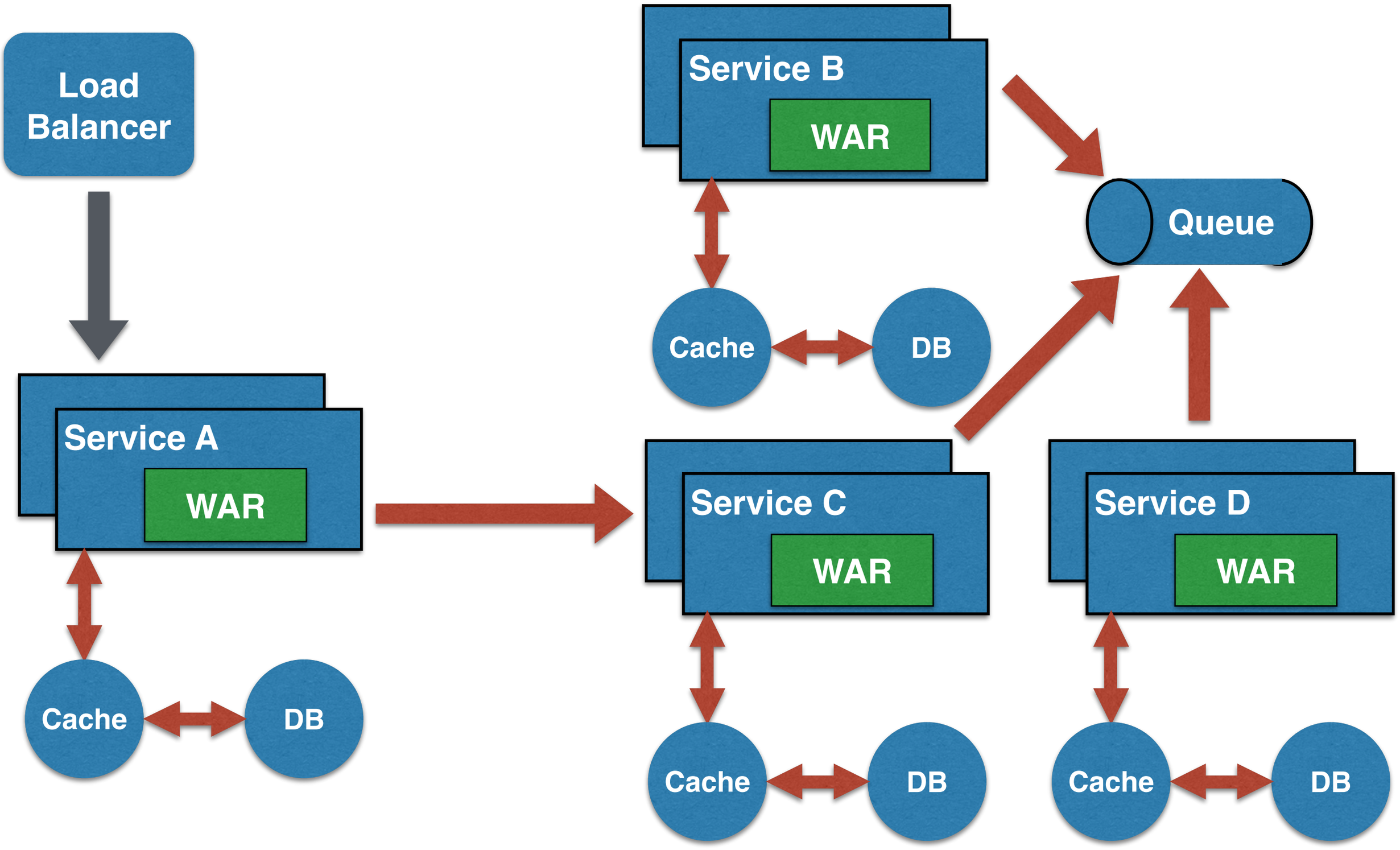


Async Messaging #5



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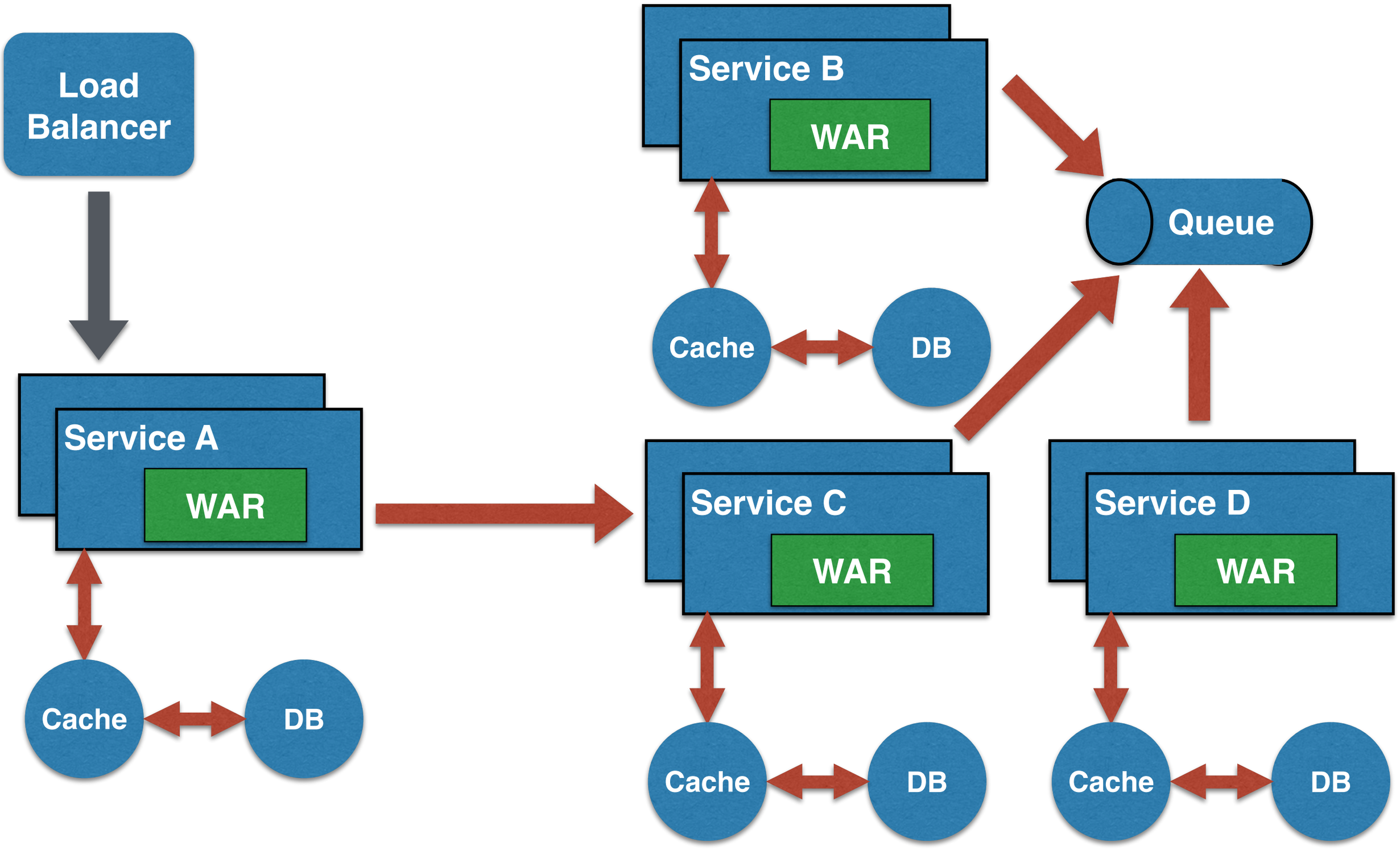

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  - Simplifies development
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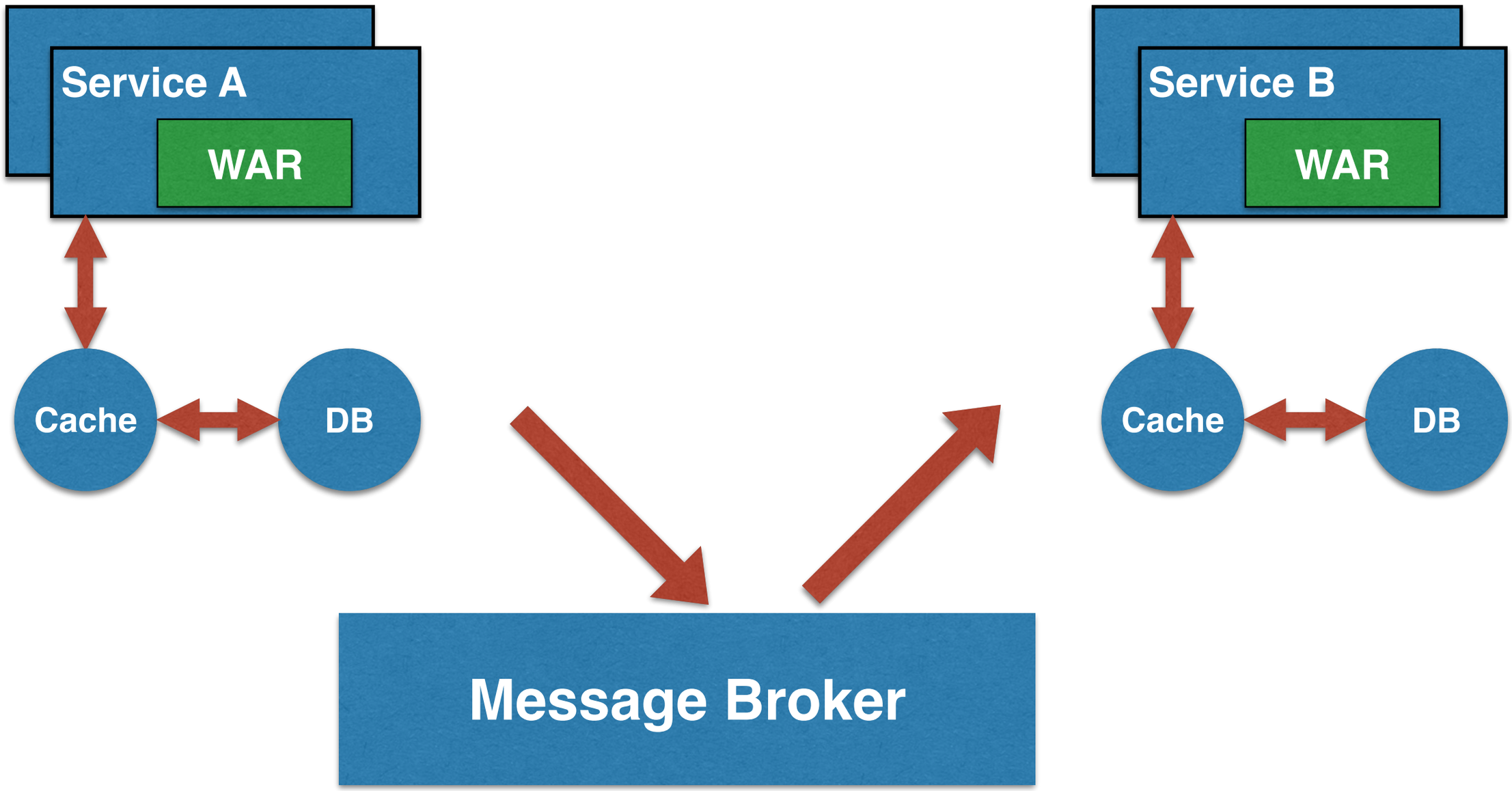
  - Implement compensating transactions

Event-driven async updates



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- Slower ROI, to begin with

Docker and Kubernetes are well suited to create a *μ*services-based application.

References

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- www.infoq.com/articles/microservices-intro

Refactor your applications using Container and Microservices

Arun Gupta, @arungupta
Red Hat