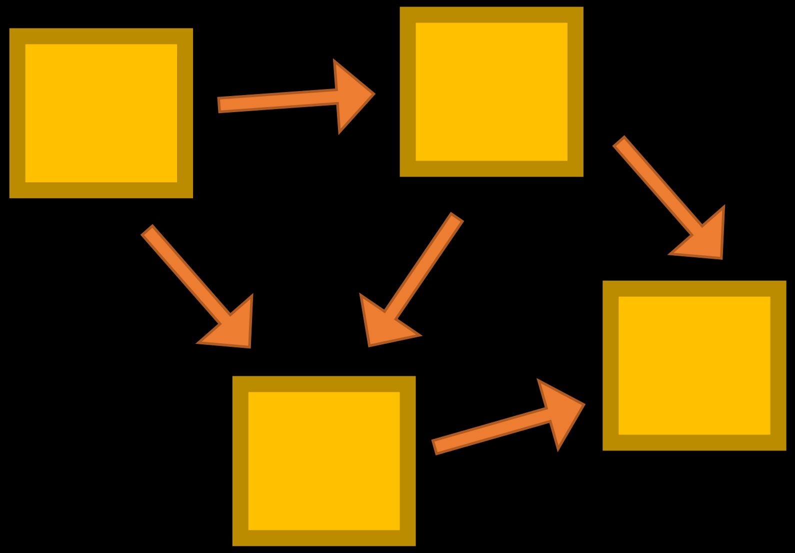
Logging in the age of



Microservices

and the

@axelfontaine

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POLL:
what type of infrastructure are you running on?

- On Premise
- Colocation
- Root Server
- Cloud

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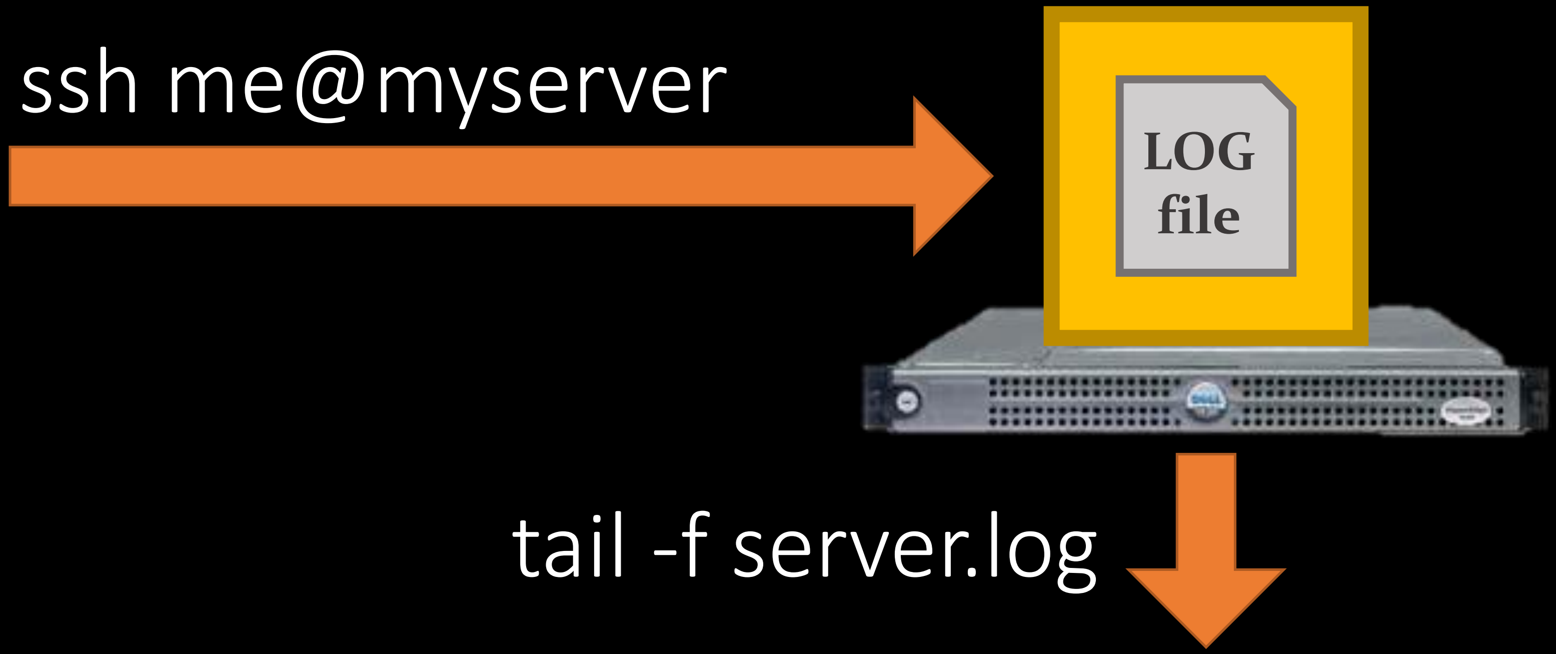
The (good) old days of logging …



```
ssh me@myserver
```

```
tail -f server.log
```

```
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```

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Looks great!

@axelfontaine

Thanks !

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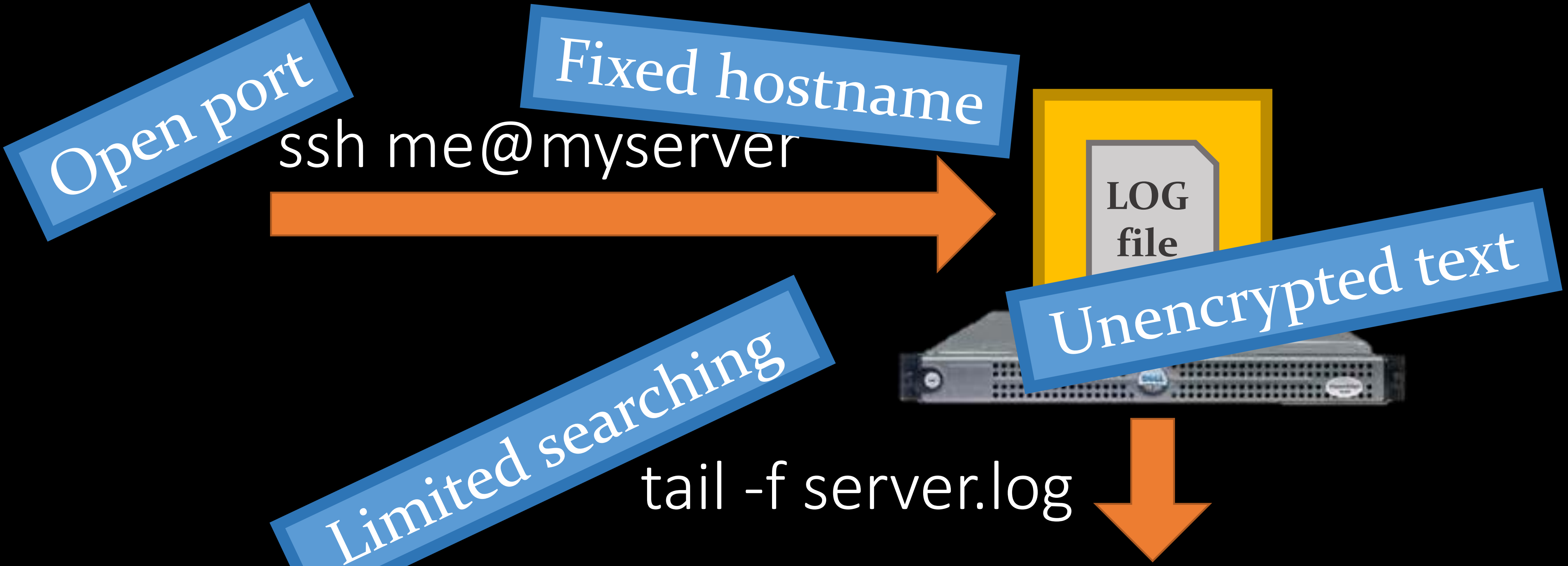
boxfuse.com



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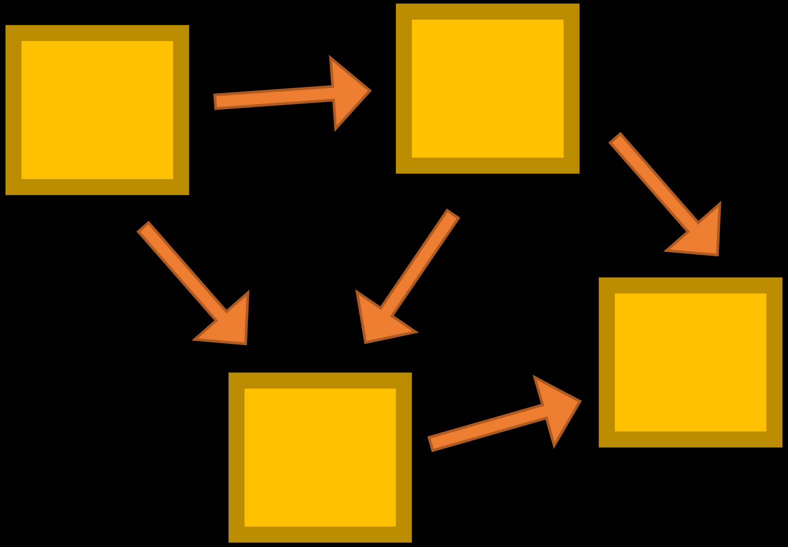
Times have changed …

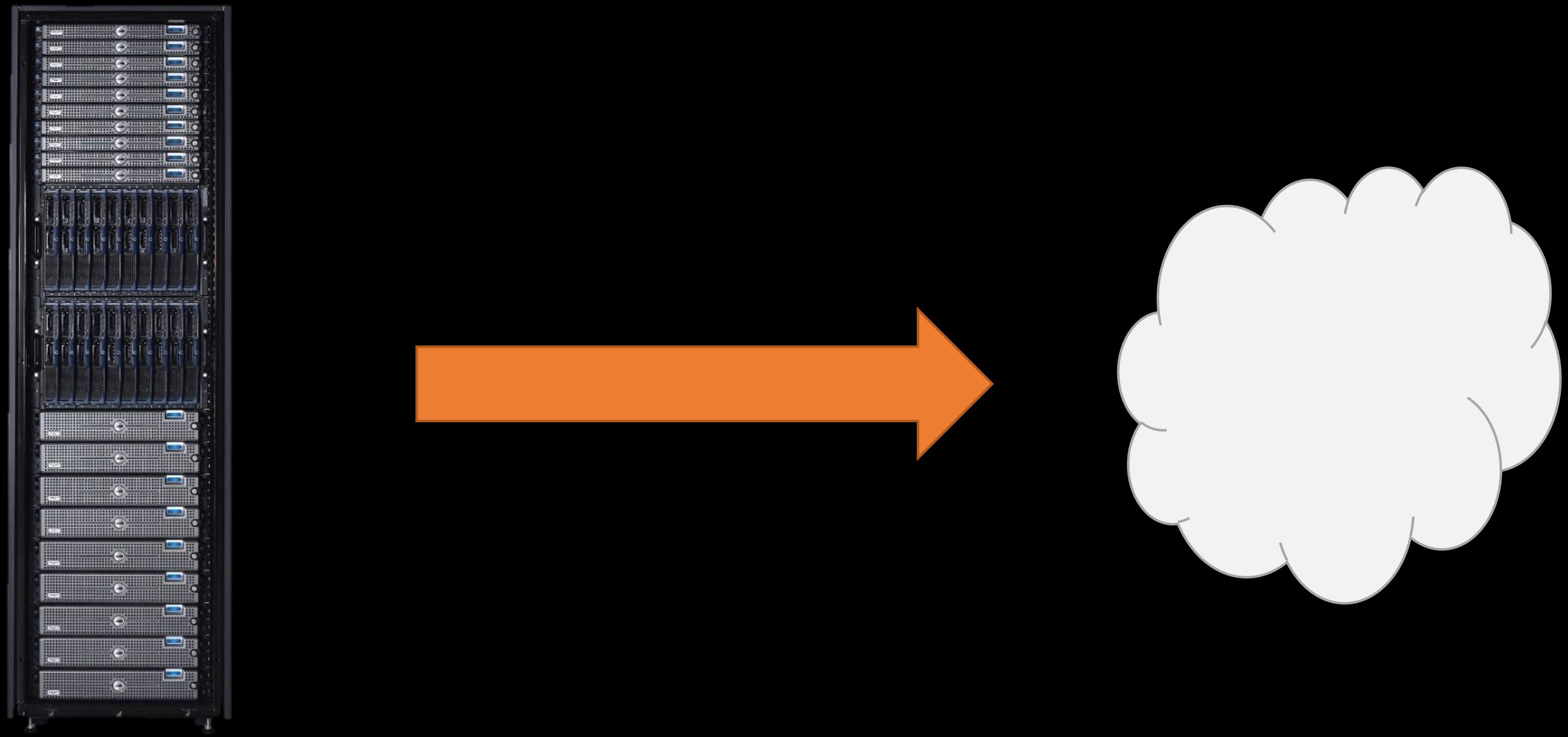
The new reality



Microservices

Cloud

moving to the cloud



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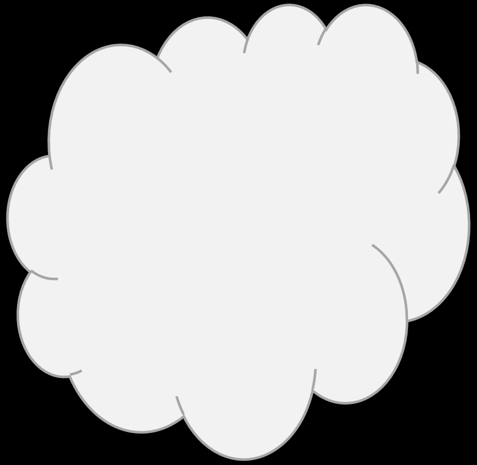
lift & shift

(= the naïve approach)



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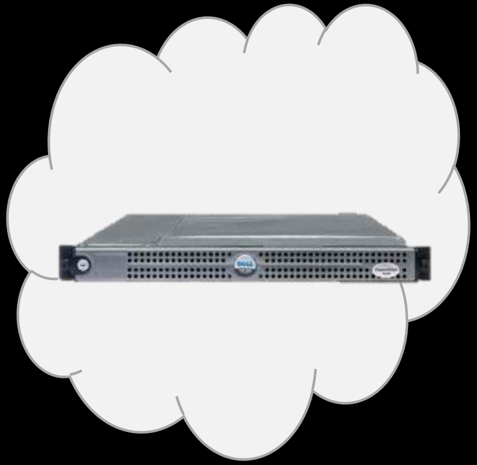
lift & shift
(= the naïve approach)

Congratulations! You now have:

- Lots of (too much?) trust in your cloud provider
  + legal trouble due to data privacy laws
- A more expense Hetzner/OVH
- Potential data loss when auto-scaling



Fundamental changes

1. Security
2. Cost-driven
3. Auto-scaling

1. Security

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understanding the cloud

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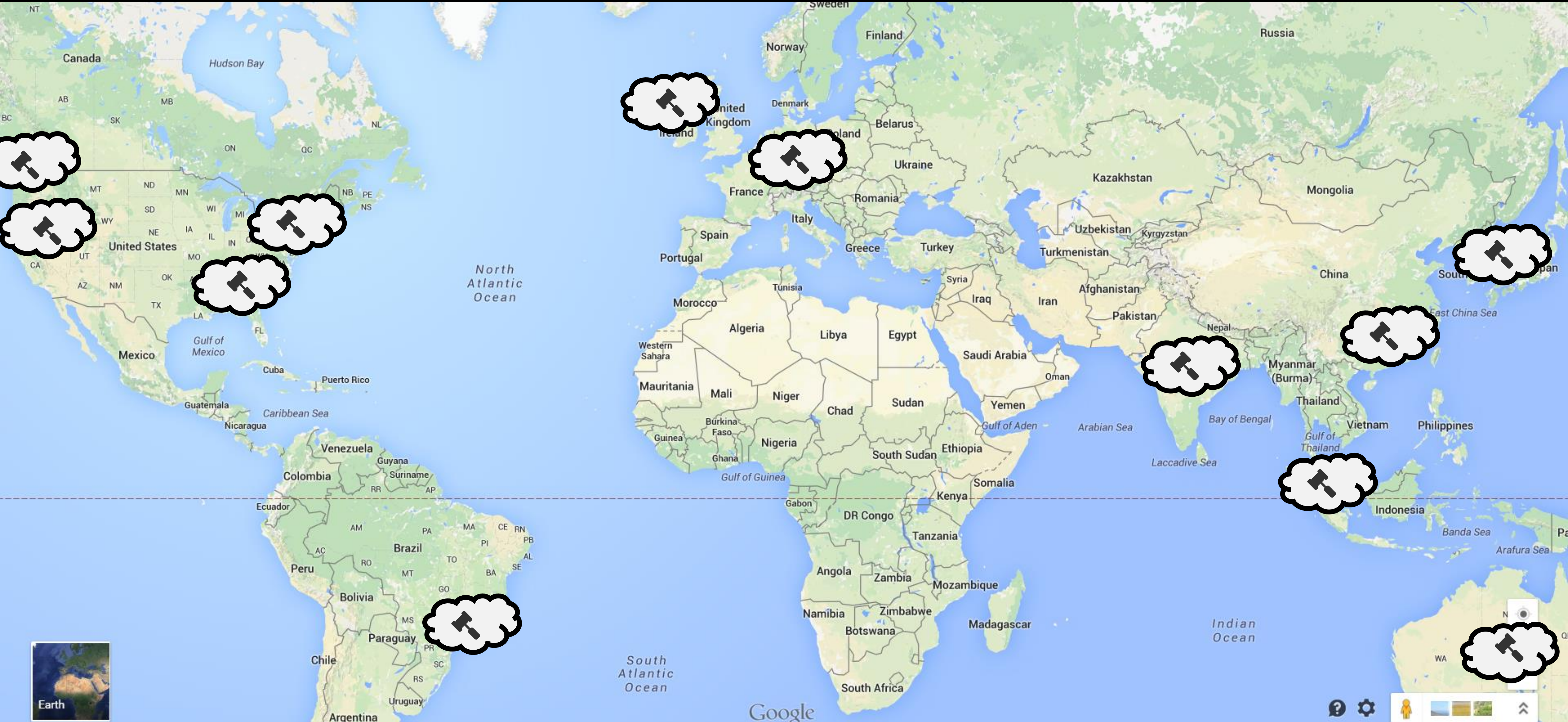
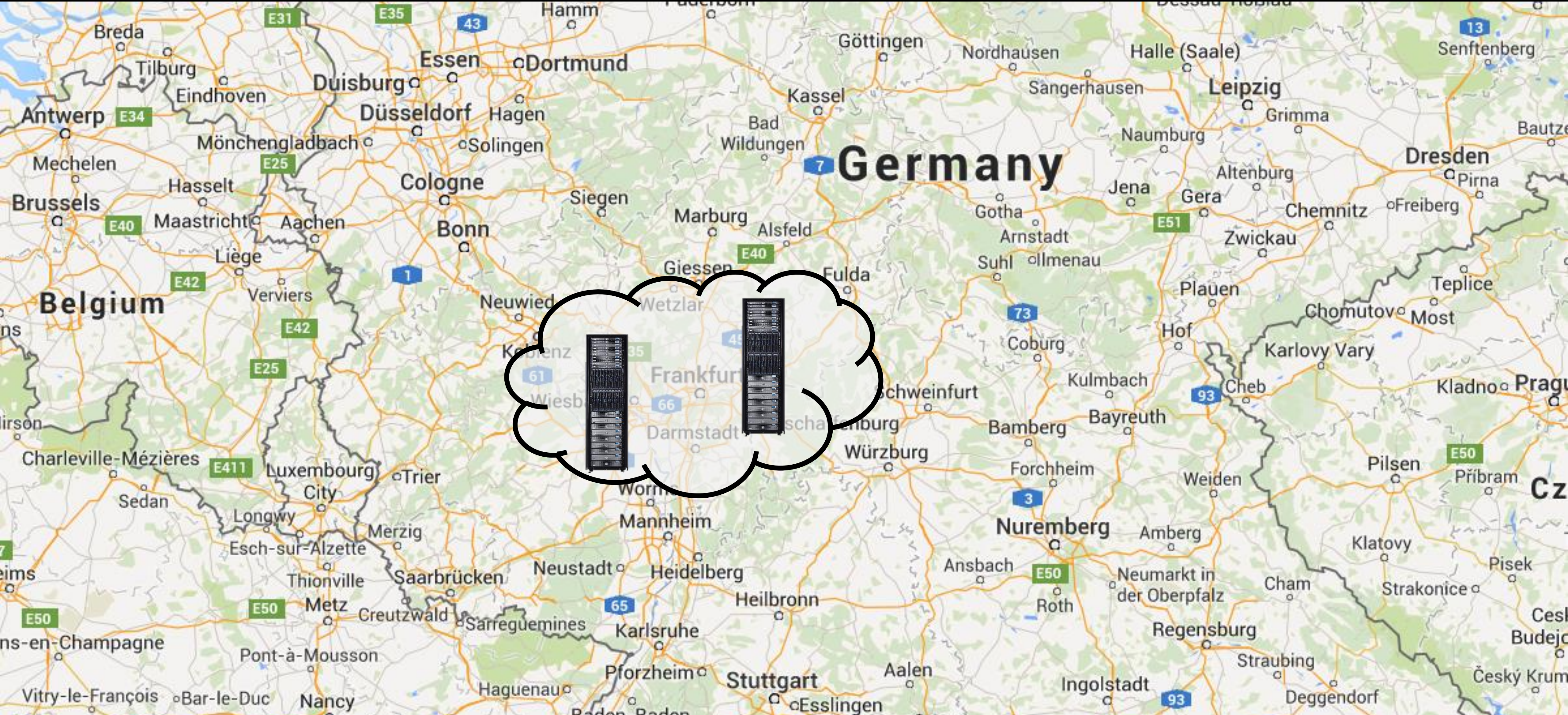
regions


Canada
Hudson Bay
United States
Mexico
Gulf of Mexico
Cuba
Puerto Rico
Caribbean Sea
Guatemala
Nicaragua
Venezuela
Guyana
Suriname
Colombia
Ecuador
Peru
Brazil
Bolivia
Paraguay
Chile
Uruguay
Argentina
North Atlantic Ocean
South Atlantic Ocean
Norway
Sweden
Finland
Denmark
United Kingdom
Ireland
Poland
Belarus
Ukraine
France
Spain
Portugal
Italy
Romania
Greece
Turkey
Morocco
Algeria
Tunisia
Libya
Egypt
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Burkina Faso
Guinea
Ghana
Nigeria
Gulf of Guinea
South Sudan
Ethiopia
Somalia
Kenya
Gabon
DR Congo
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
Madagascar
South Africa
Syria
Iraq
Iran
Saudi Arabia
Oman
Yemen
Gulf of Aden
Russia
Kazakhstan
Uzbekistan
Kyrgyzstan
Turkmenistan
Afghanistan
Pakistan
Mongolia
China
Nepal
Myanmar (Burma)
Thailand
Vietnam
Philippines
Indonesia
East China Sea
Arabian Sea
Bay of Bengal
Laccadive Sea
Gulf of Thailand
Banda Sea
Arafura Sea
Indian Ocean
Earth
Google

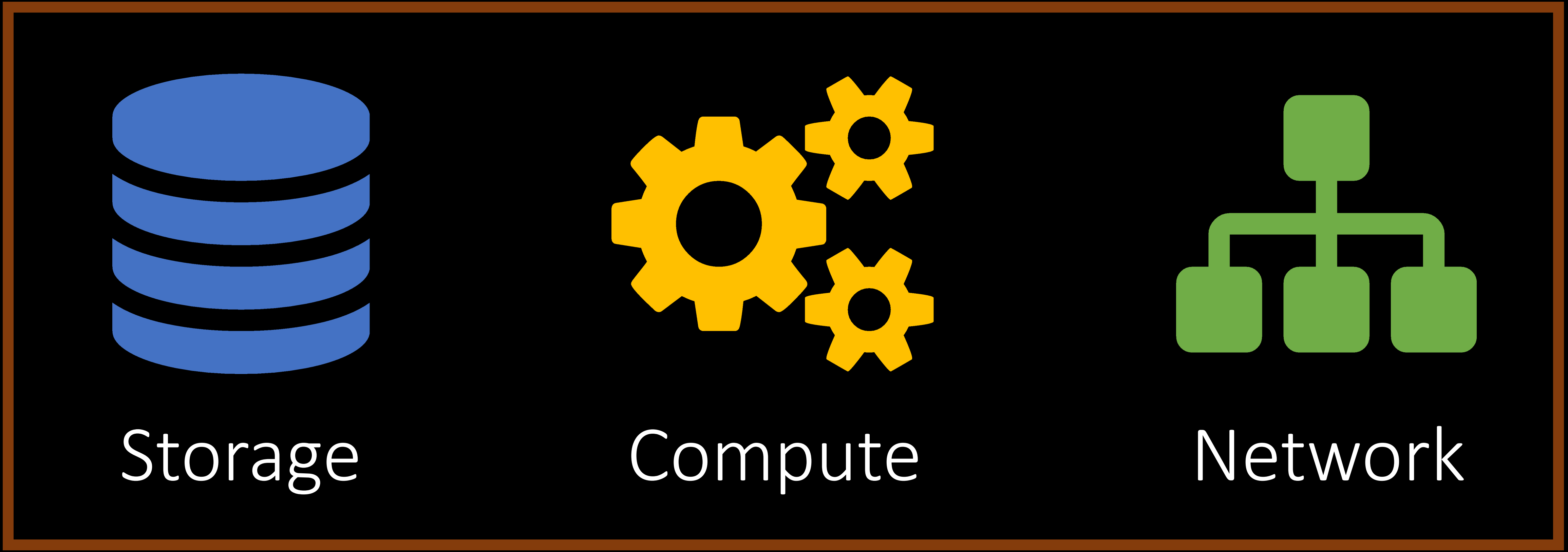
availability zones



building blocks

http://en.wikipedia.org/wiki/Lego#/media/File:Lego_Color_Bricks.jpg

building blocks



Security

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The hard Truth about Security

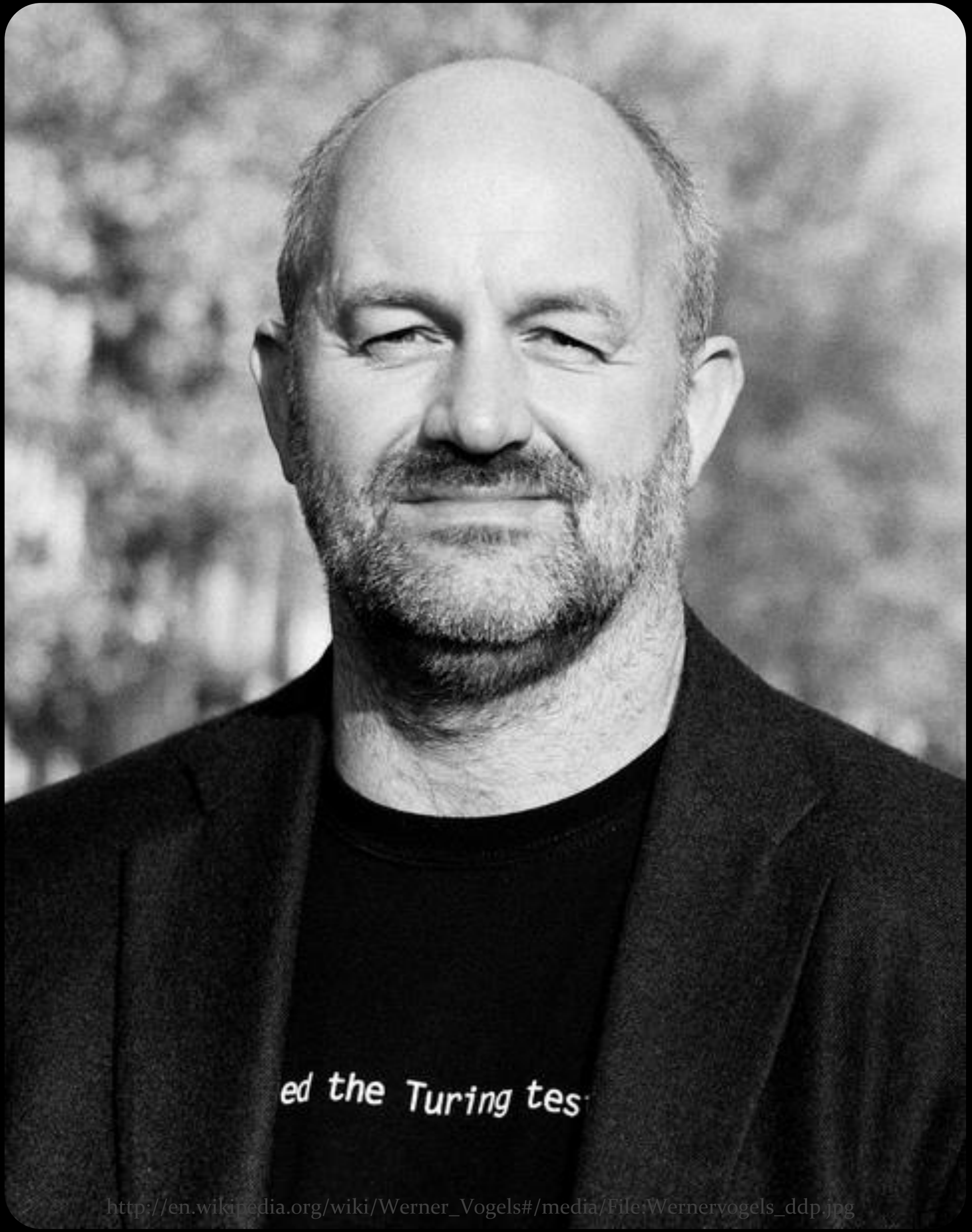
1. Always breakable with infinite time & resources
2. Must make it more complicated/expensive to break than it’s worth (use defense in depth!)
3. Has a usability cost
4. Almost always about the data

the 3 states of data

Data at Rest

Data in Use

Data in Motion



http://en.wikipedia.org/wiki/Werner_Vogels#/media/File:Wernervogels_ddp.jpg

Trusting your neighbors is good. But it's even better to put a good lock on the door.

Werner Vogels
CTO of a large online book shop

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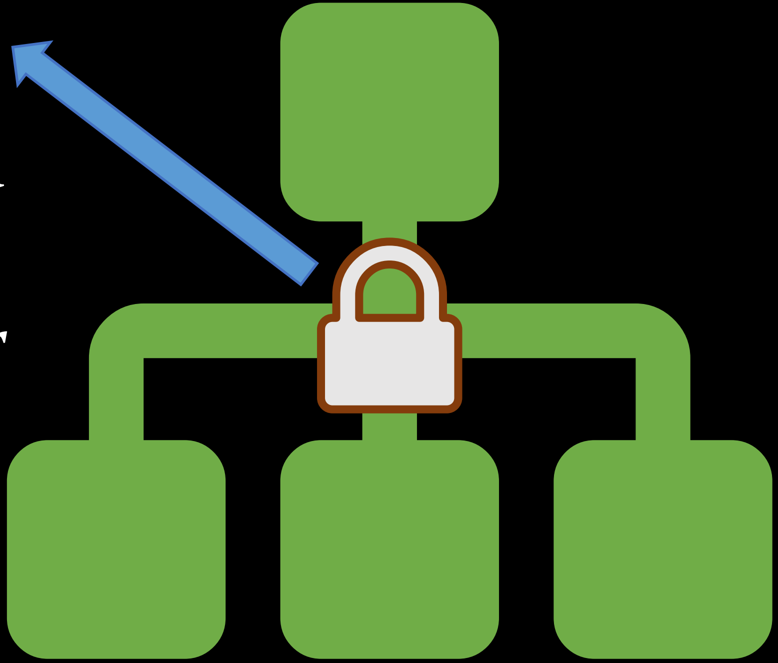
Data in Motion

No excuse in 2017!

100% free and automated
With **Let's Encrypt** and
AWS Certificate Manager

Let's Encrypt



TLS / SSL

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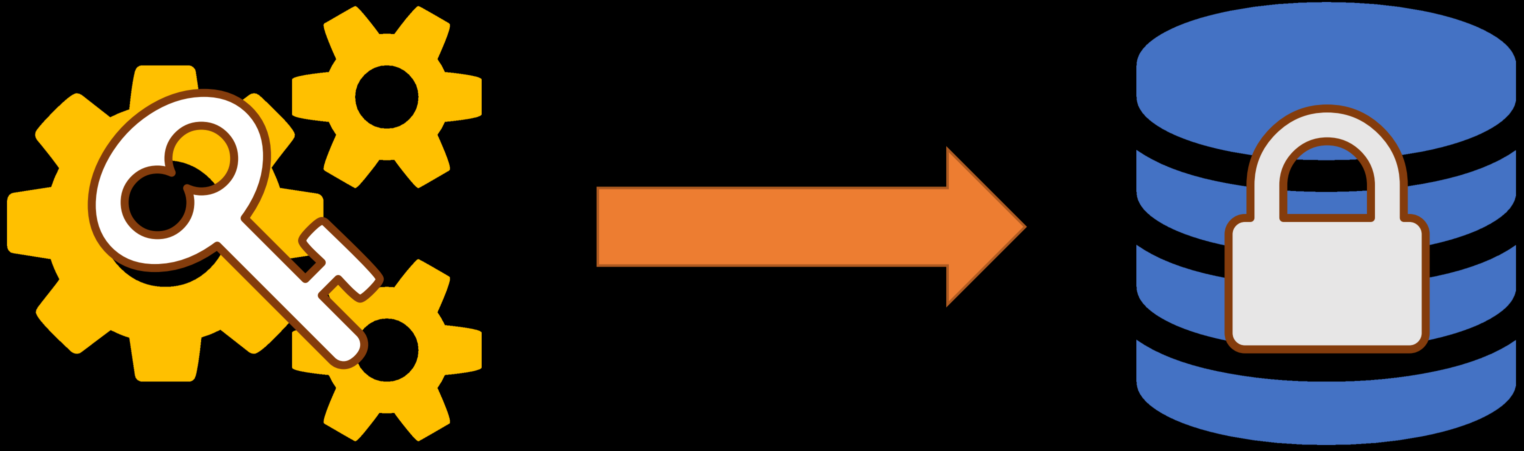
Data in Use & at Rest



Client-side encryption

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2. Cost-driven

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Compute

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Spare Capacity = Wasted Money

(paying for something you don’t use)

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Scaling

=

Adjusting capacity
in response to a metric
exceeding a threshold

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Scaling

=

Corrective action
in response to
an alarm

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scaling metrics for different types of services

sync
=> CPU load

async
=> queue depth

cron
=> time

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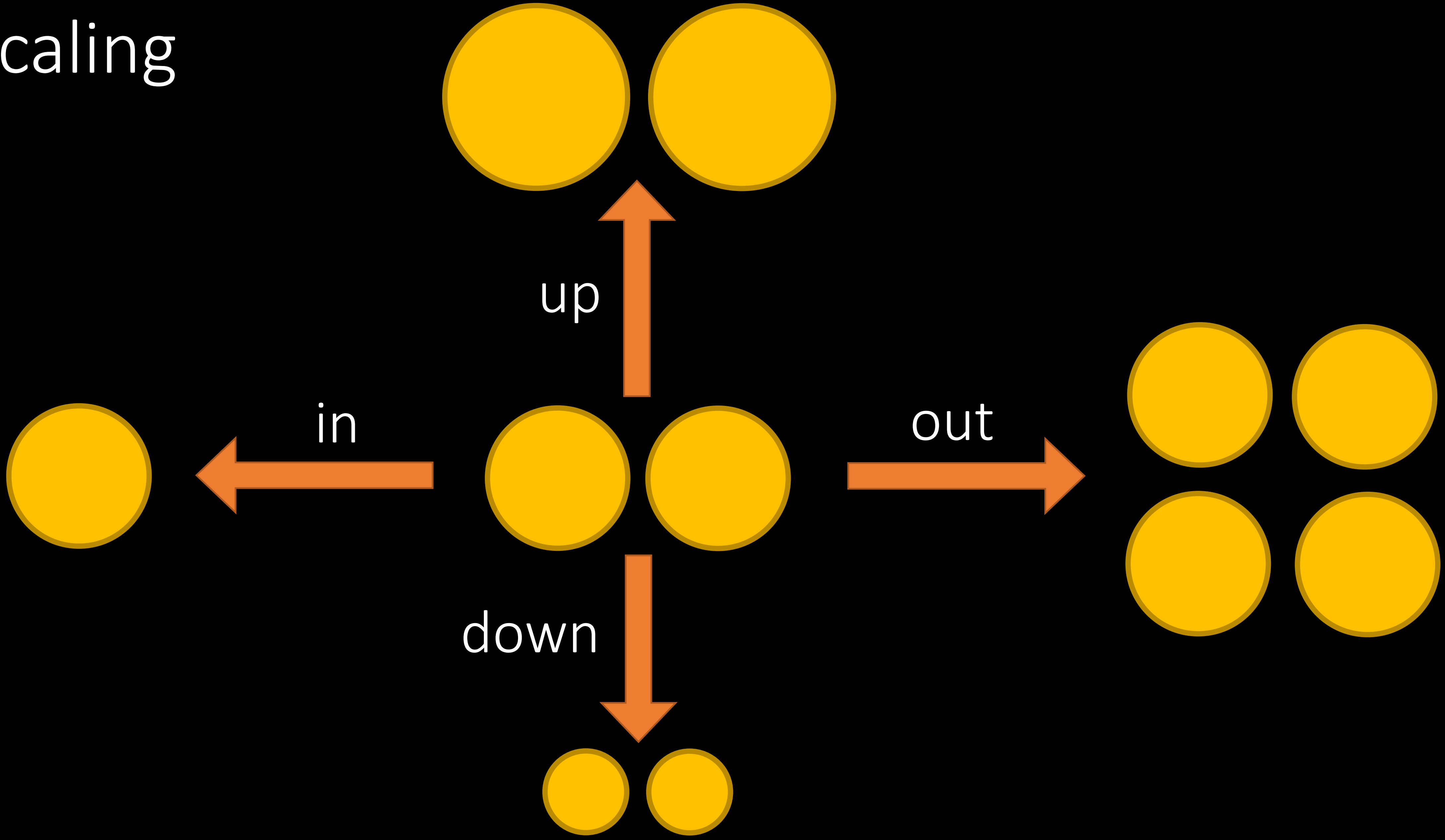
scaling



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3. Auto-scaling

Auto-Scaling

=

automated alarms

+ automated corrective actions

(scaling in or out)

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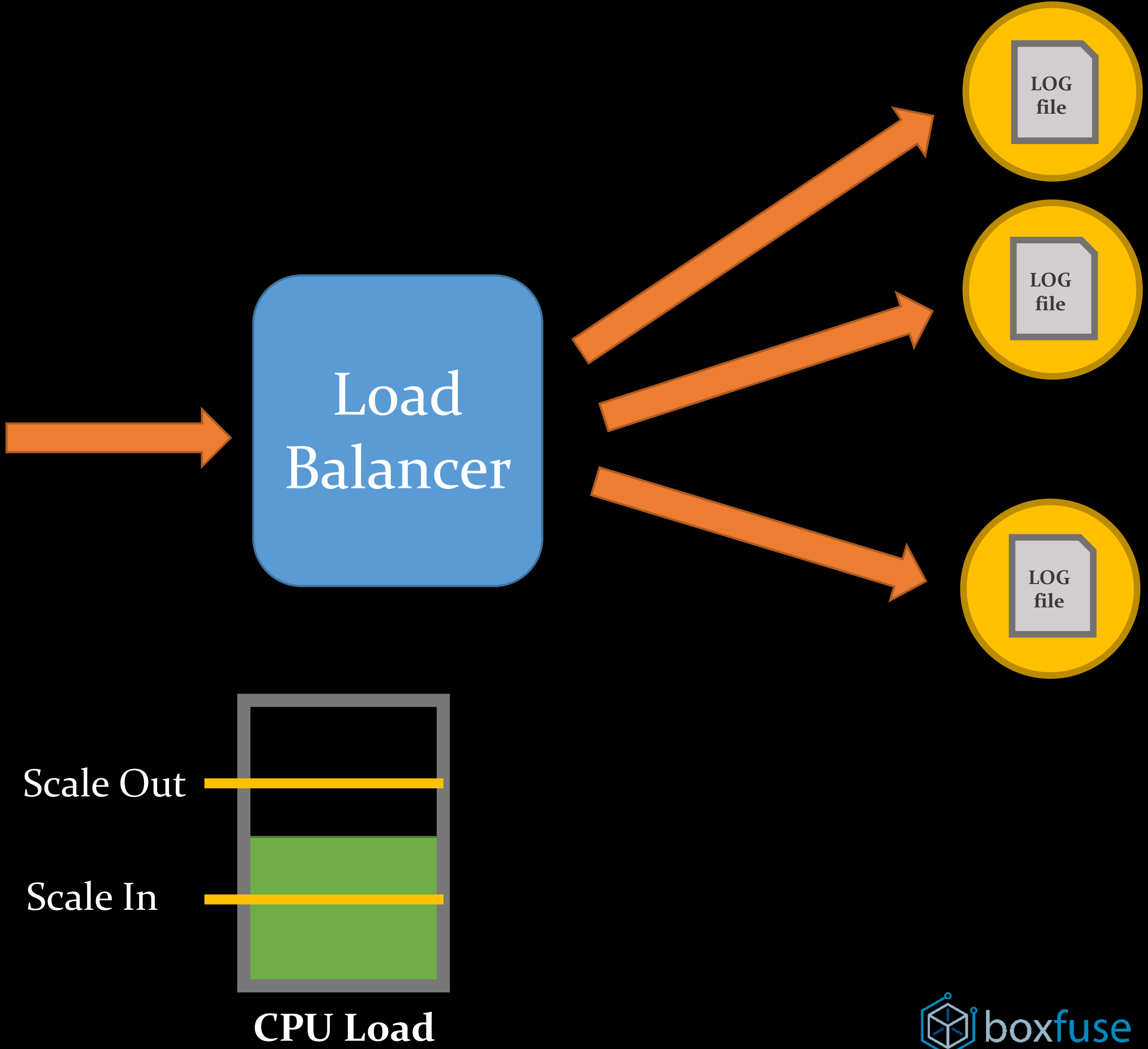

```
ssh me@myserver1
tail -f server.log
```

```
ssh me@myserver2
tail -f server.log
```

```
ssh me@myserver3
tail -f server.log
```

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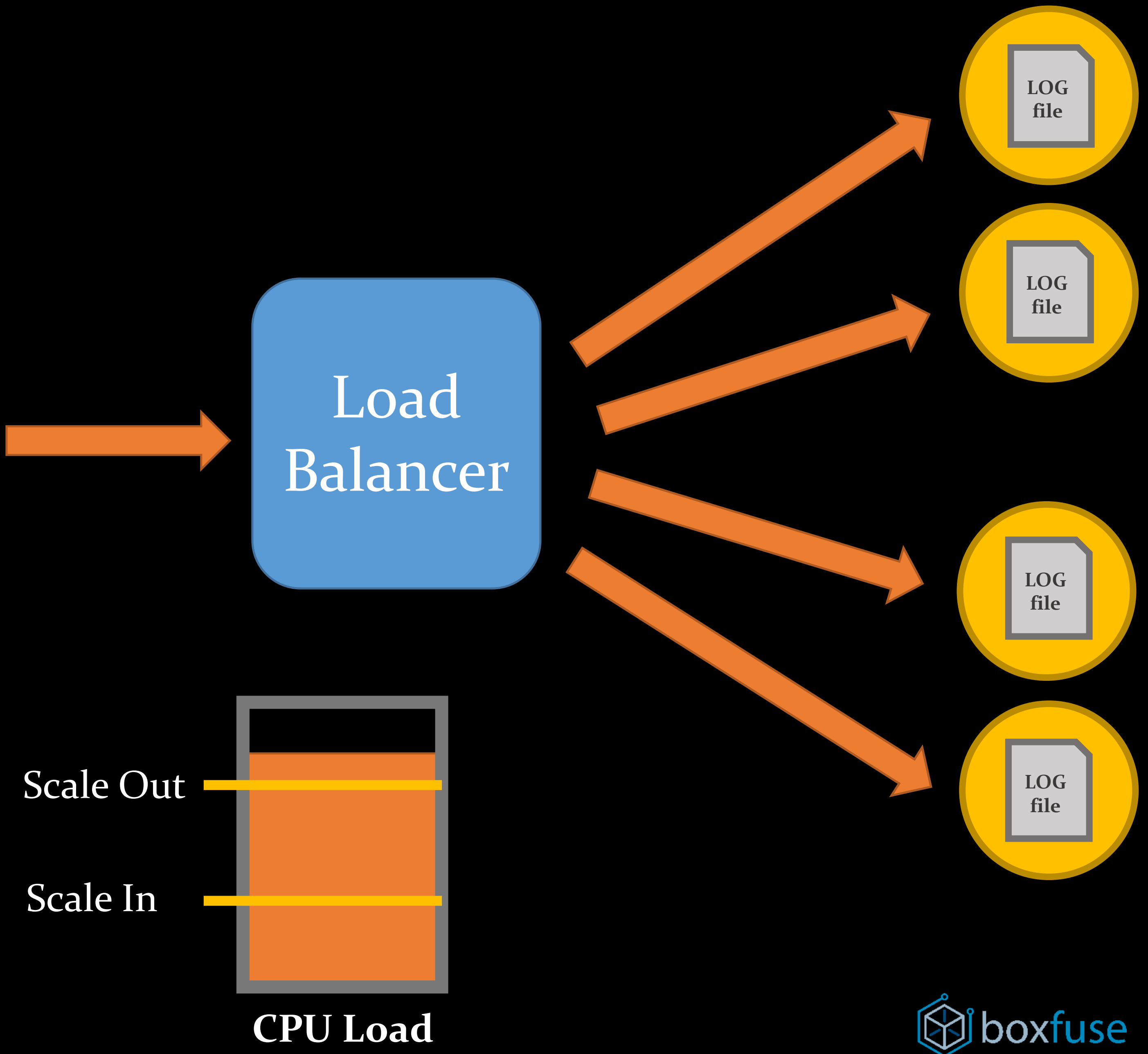


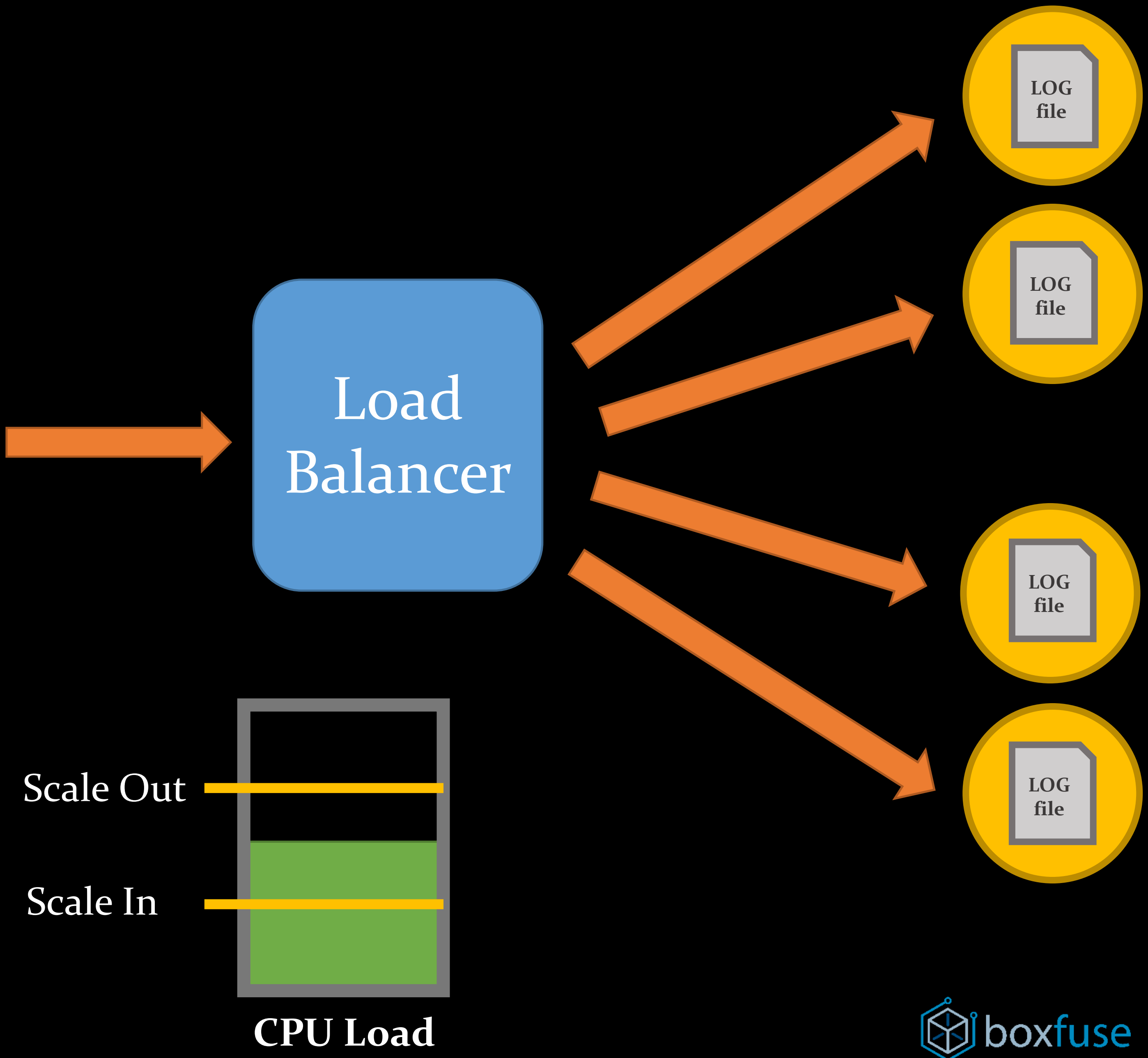
```
ssh me@myserver1
tail -f server.log

ssh me@myserver2
tail -f server.log

ssh me@myserver3
tail -f server.log

ssh me@myserver4
tail -f server.log
```

boxfuse



```
ssh me@myserver1
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```

```
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tail -f server.log
```
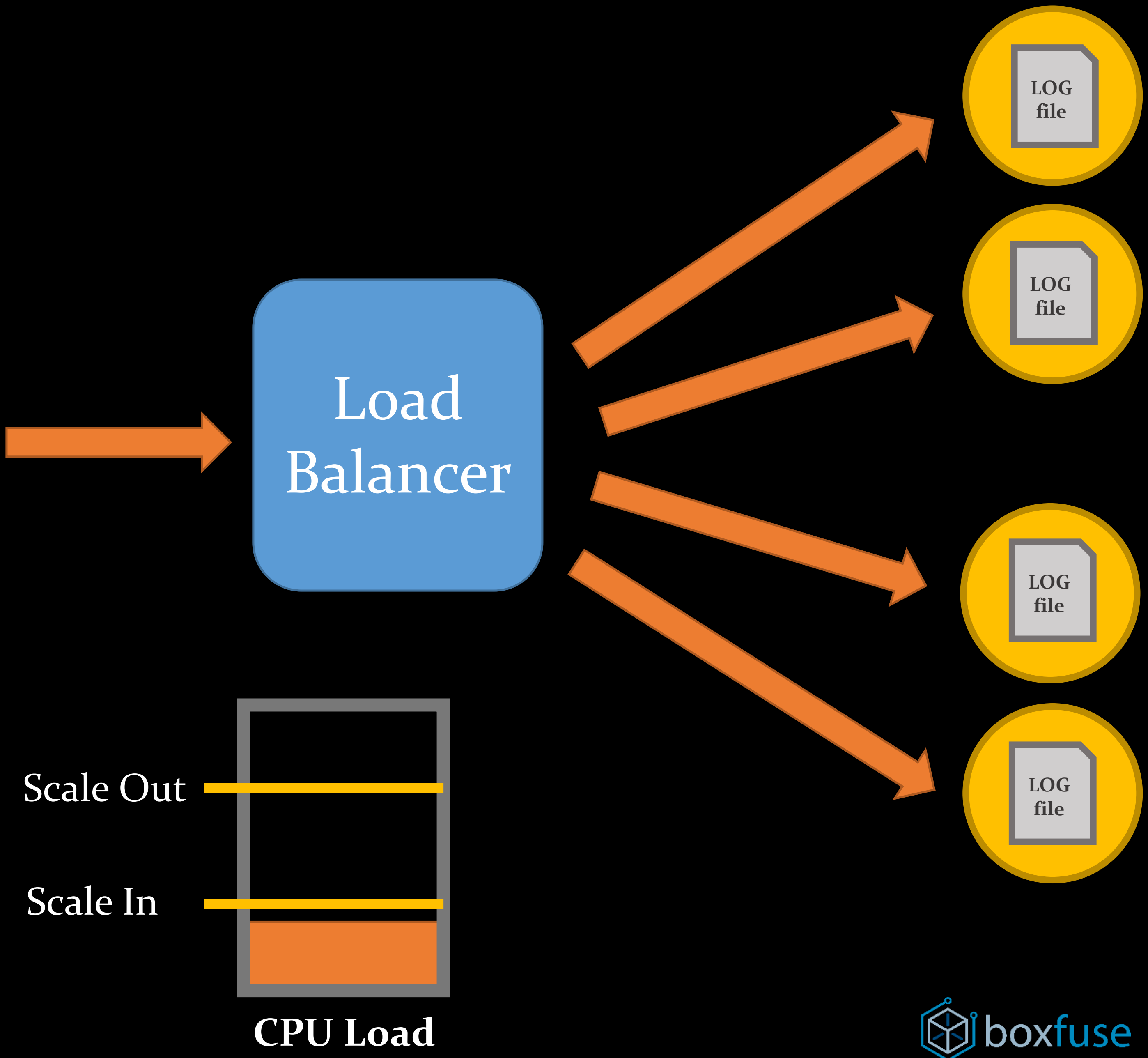

```
ssh me@myserver3
tail -f server.log
```

```
ssh me@myserver4
tail -f server.log
```



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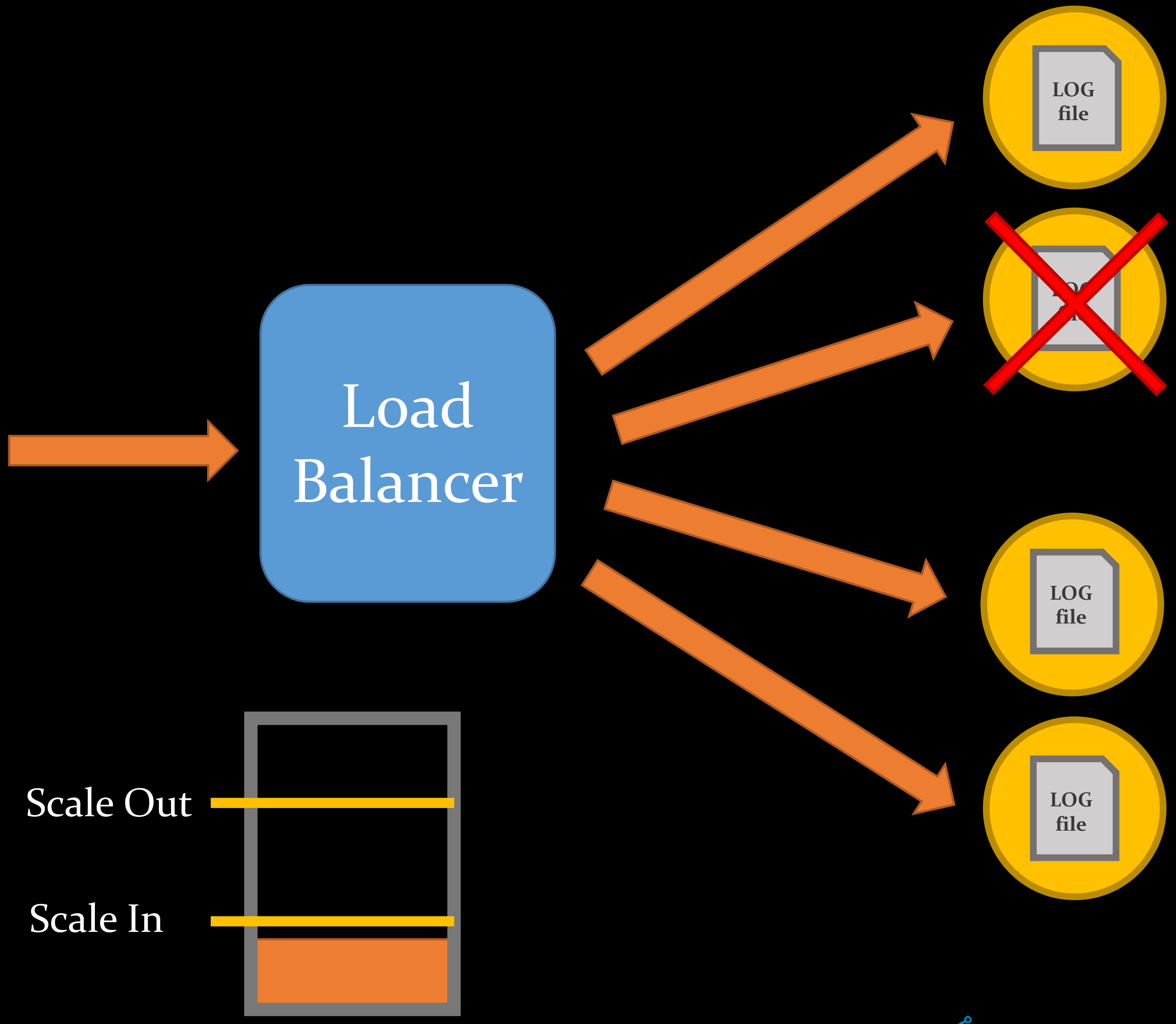


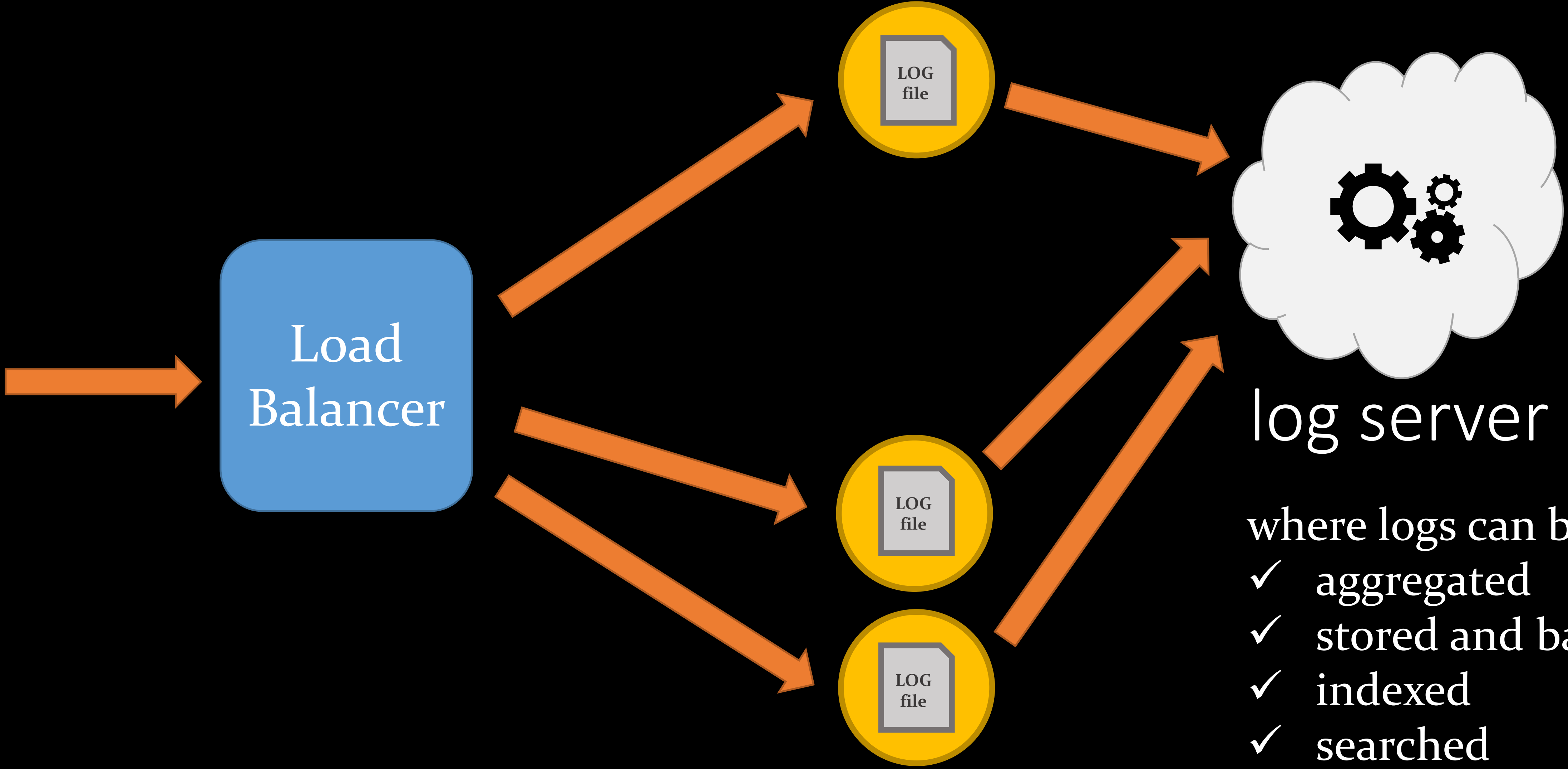
```
ssh me@myserver1
tail -f server.log
```

DATA LOSS

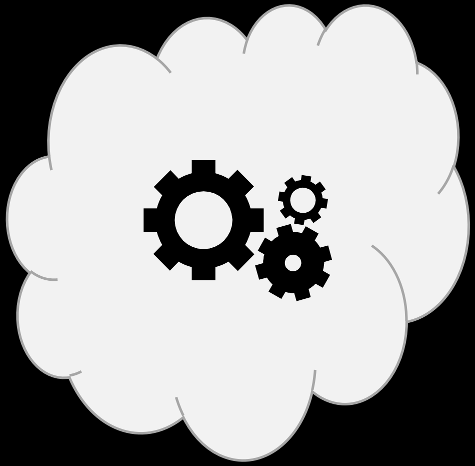
```
ssh me@myserver3
tail -f server.log
```

```
ssh me@myserver4
tail -f server.log
```

boxfuse



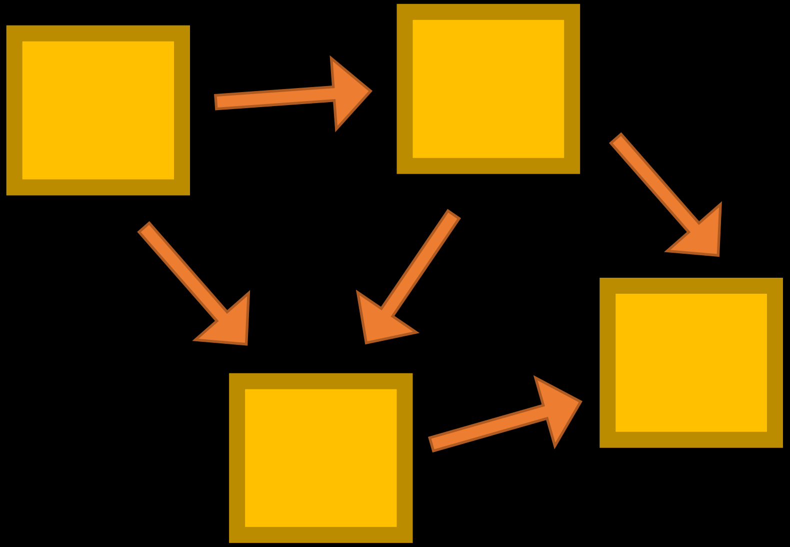
where logs can be
- ✓ aggregated
- ✓ stored and backuped
- ✓ indexed
- ✓ searched



log server

where logs can be
- ✓ aggregated
- ✓ stored and backuped
- ✓ indexed
- ✓ searched

Many options:
- Logstash (ELK)
- AWS CloudWatch Logs
- Loggly
- Papertrail
- …



Microservices

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POLL:
what type of architecture does your software have?

- Integrated (Monolith)
- Distributed (Microservices)

Why are we logging?

Postmortem analysis of
user activity and programming errors

Powerful debugging tool

Should contain answers to
important questions:
What? Who? Where? When?

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What?	
Who?	
Where?	
When?	

What?	Message, Code, Severity
Who?	
Where?	
When?	

What?	Message, Code, Severity
Who?	Account, User, Session, Request
Where?	
When?	

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What?	Message, Code, Severity
Who?	Account, User, Session, Request
Where?	App, Module, Class
When?	

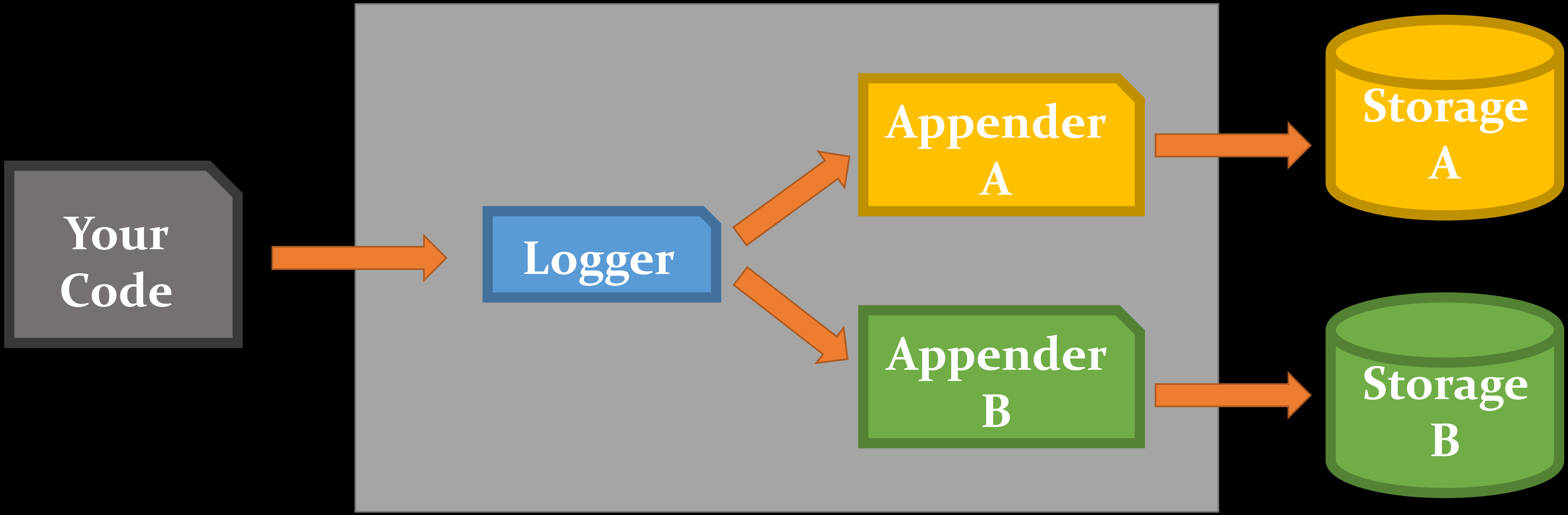
What?	Message, Code, Severity
Who?	Account, User, Session, Request
Where?	App, Module, Class
When?	Timestamp, Hostname, PID, Thread

How can all this information be captured?

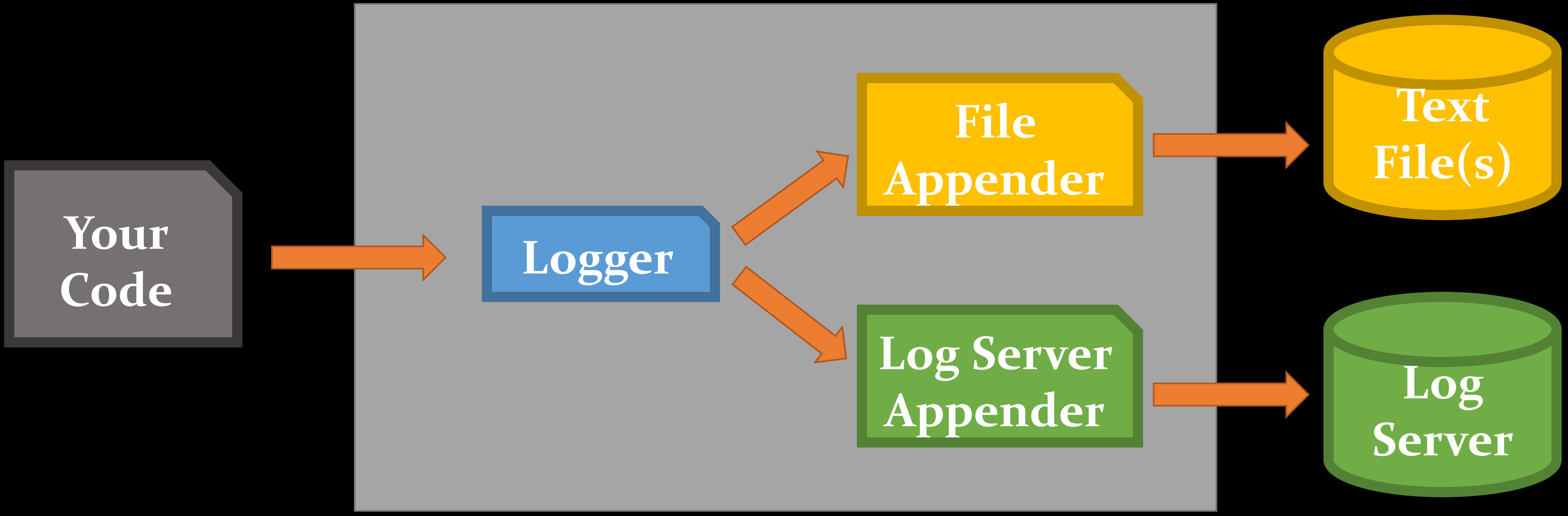
How can these questions be asked?

Capturing log info

Logging framework architecture



Logging framework architecture



logger.info(“my log message”);

What?	Message, Code, Severity
Who?	Account, User, Session, Request
Where?	App, Module, Class
When?	Timestamp, Hostname, PID, Thread

logger.info("my log message");

What?	Message, Code, Severity
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logger.info("my log message");

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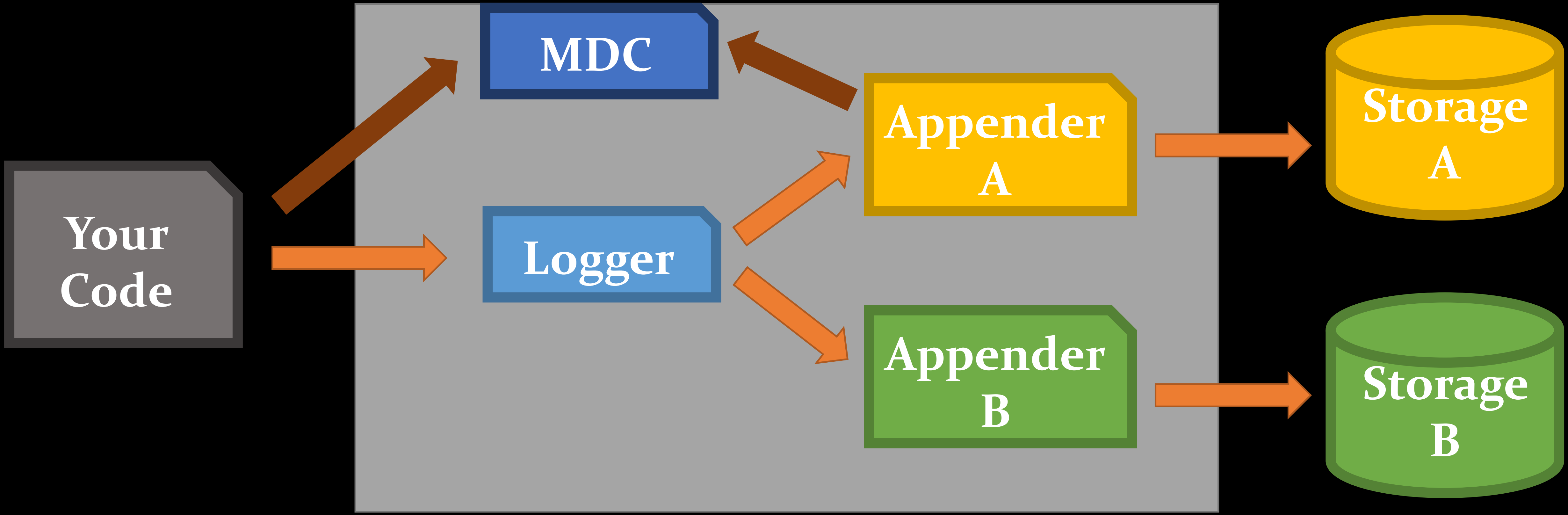
Mapped Diagnostic Context

(Thread-local temporary key-value store)



```
MDC.put("account", "company ABC");
MDC.put("user", "user123");
```

What?	Message, Code, Severity
Who?	Account, User, Session, Request
Where?	App, Module, Class
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MDC.put("account", "company ABC");
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What?	Message, Code, Severity
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Where?	App, Module, Class
When?	Timestamp, Hostname, PID, Thread

boxfuse

```
MDC.put("account", "company ABC");
MDC.put("user", "user123");
```

Populate when:

- ✓ a request enters the application
- ✓ a message is received from a queue
- ✓ an async or cron task starts

And don't forget the clear when done!
(Threadpools reuse threads!)

Querying the logs

```
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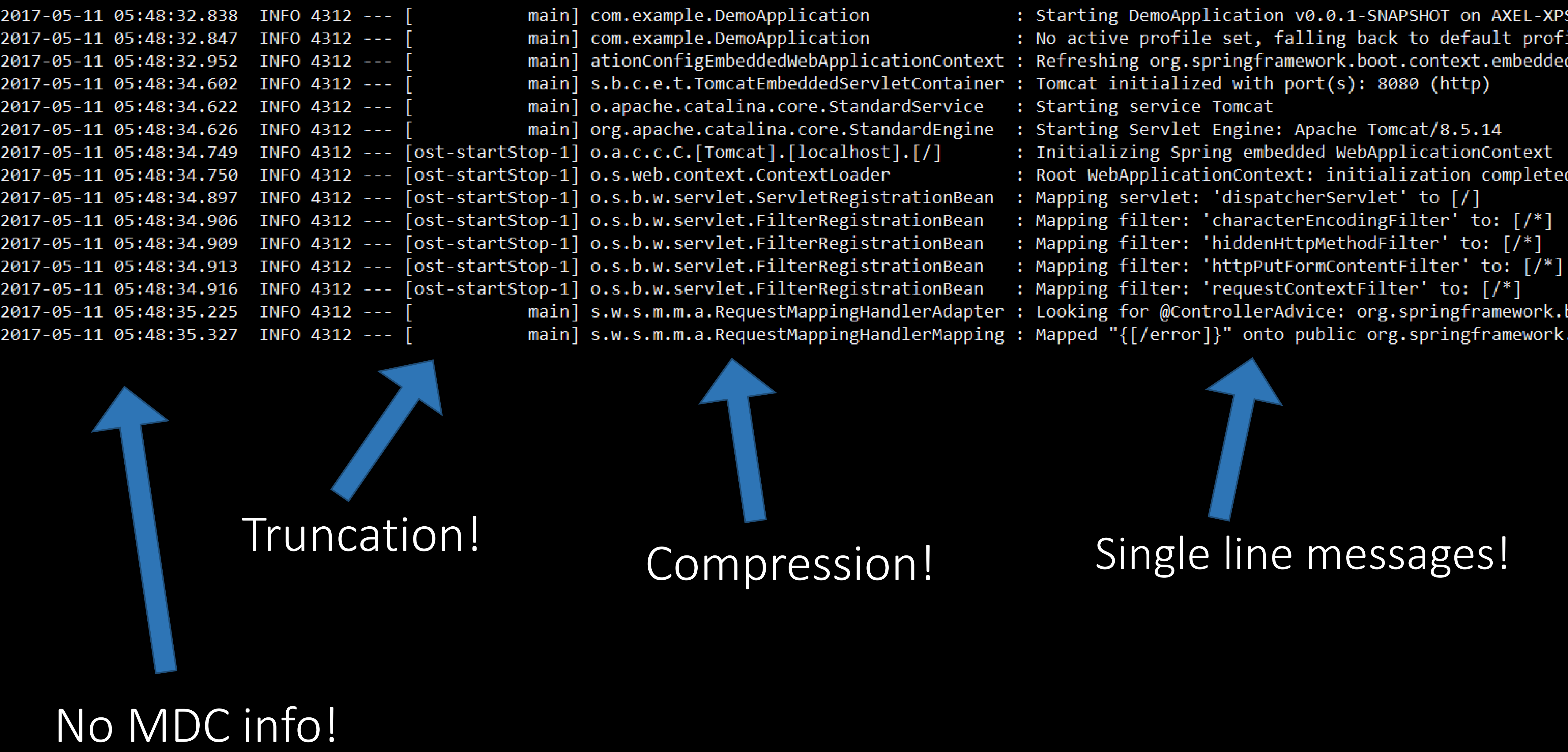
grep?



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2017-05-11 05:48:34.913  INFO 4312 --- [ost-startStop-1] o.s.b.w.servlet.FilterRegistrationBean   : Mapping filter: 'httpPutFormContentFilter' to: [/*]
2017-05-11 05:48:34.916  INFO 4312 --- [ost-startStop-1] o.s.b.w.servlet.FilterRegistrationBean   : Mapping filter: 'requestContextFilter' to: [/*]
2017-05-11 05:48:35.225  INFO 4312 --- [           main] s.w.s.m.m.a.RequestMappingHandlerAdapter : Looking for @ControllerAdvice: org.springframework.
2017-05-11 05:48:35.327  INFO 4312 --- [           main] s.w.s.m.m.a.RequestMappingHandlerMapping : Mapped "{[/error]}" onto public org.springframework
```
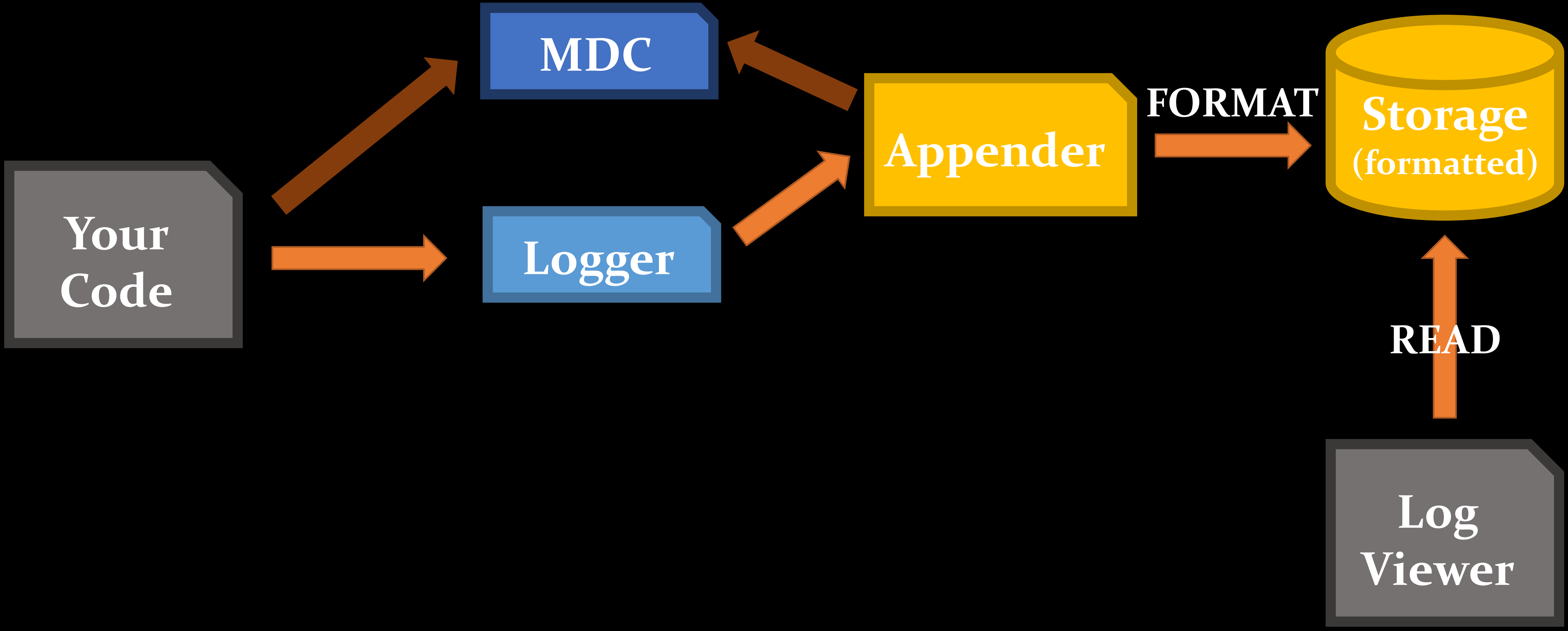
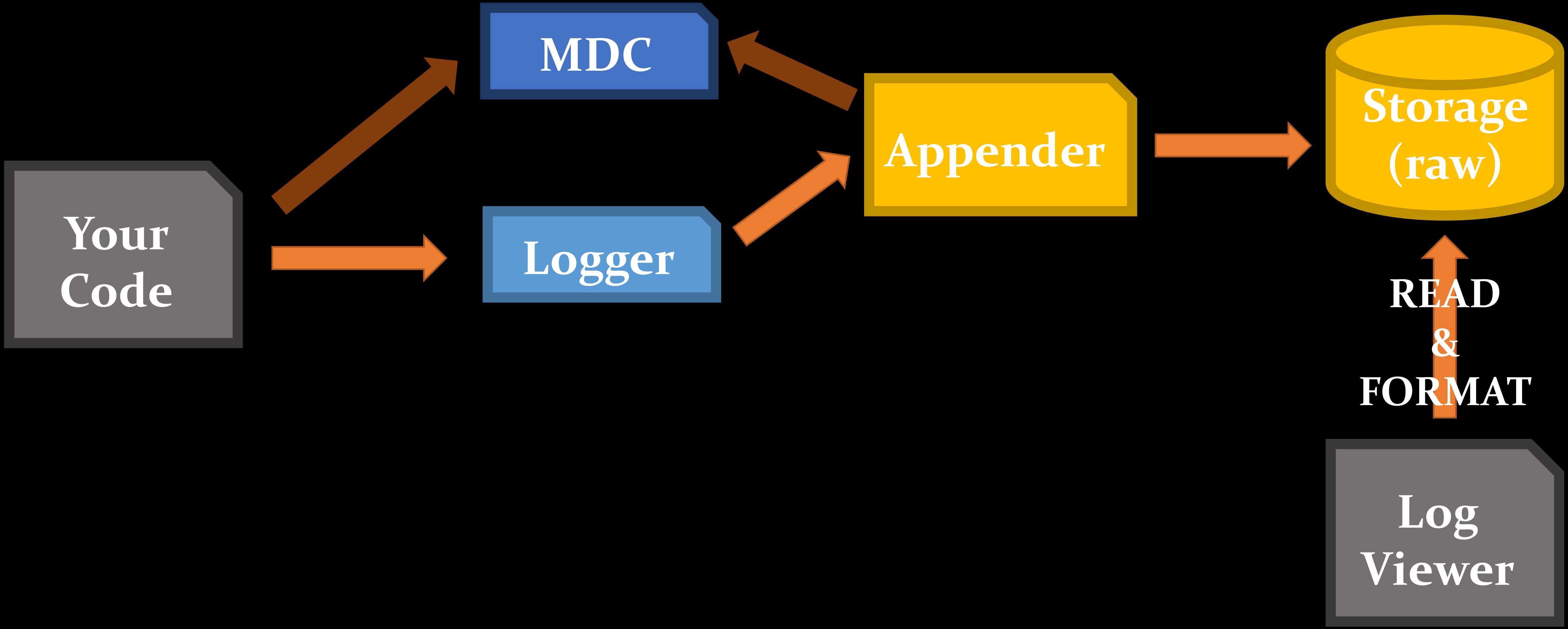

Decoupling log storage from log representation


MDC
Your Code
Logger
Appender
FORMAT
Storage (formatted)
READ
Log Viewer


MDC
Your Code
Logger
Appender
Storage (raw)
READ & FORMAT
Log Viewer

Structured logging

```
{
    "account": "axelfontaine",
    "image": "axelfontaine/xyz:543",
    "instance": "i-0d843d5af9b366a69",
    "level": "INFO",
    "logger": "com.myapp.task.TaskService",
    "message": "Successfully killed axelfontaine/demo in prod",
    "request": "crq-7R2CVPUMKREUFLMQUE3XB7JWCX",
    "session": "cli-CRFM2IPABRFUJD7KTDYVDVXABX",
    "thread": "Thread-18710",
    "timestamp": "2017-05-12T10:20:30.444"
}
```

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Machine-readable logs

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~~Machine-readable~~ logs

Machine-queryable logs

What?	Message, Code, Severity
Who?	Account, User, Session, Request
Where?	App, Module, Class
When?	Timestamp, Hostname, PID, Thread

AWS CloudWatch Logs

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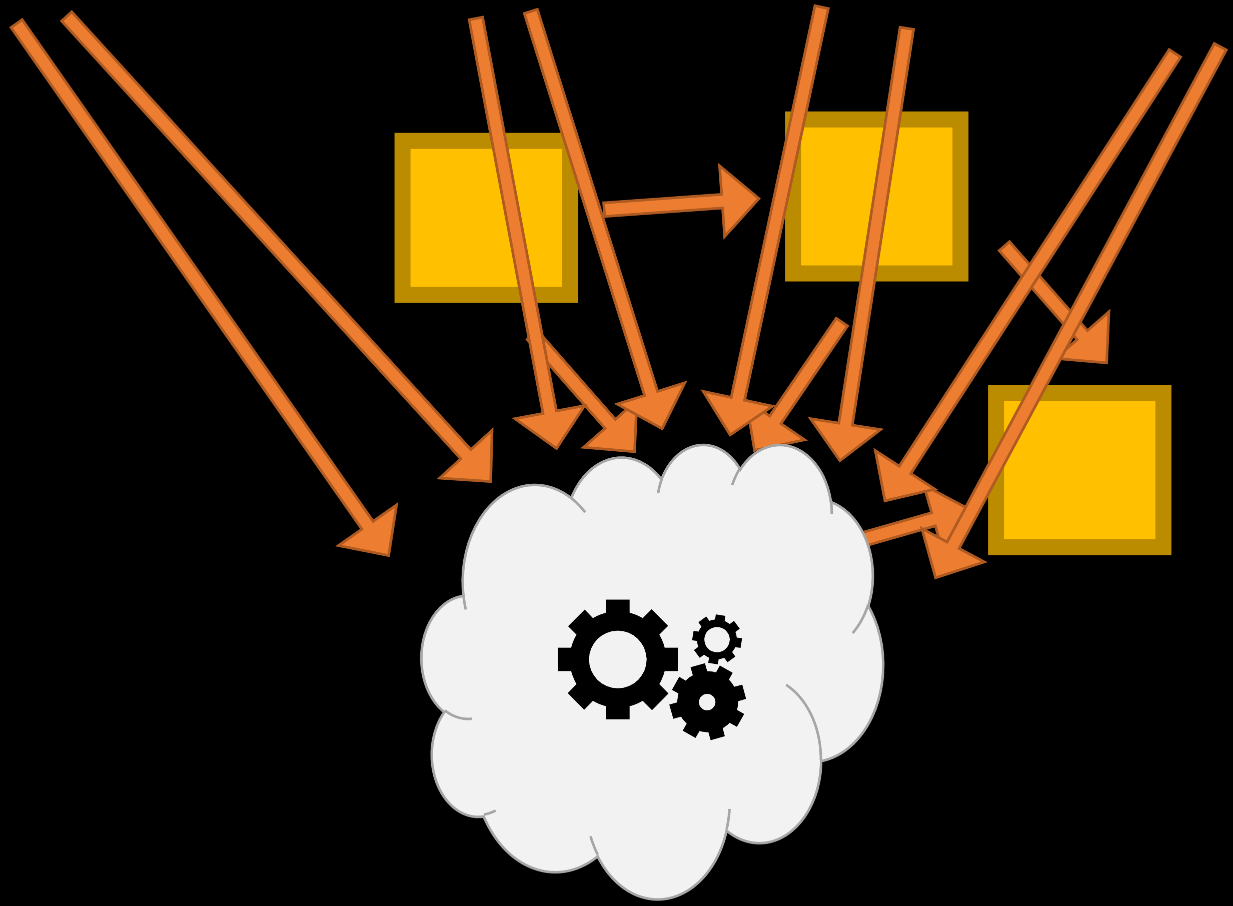
```
{ $.account = “axelfontaine“ && $.request = “crq-12345678” }
```


log server

Querying across systems

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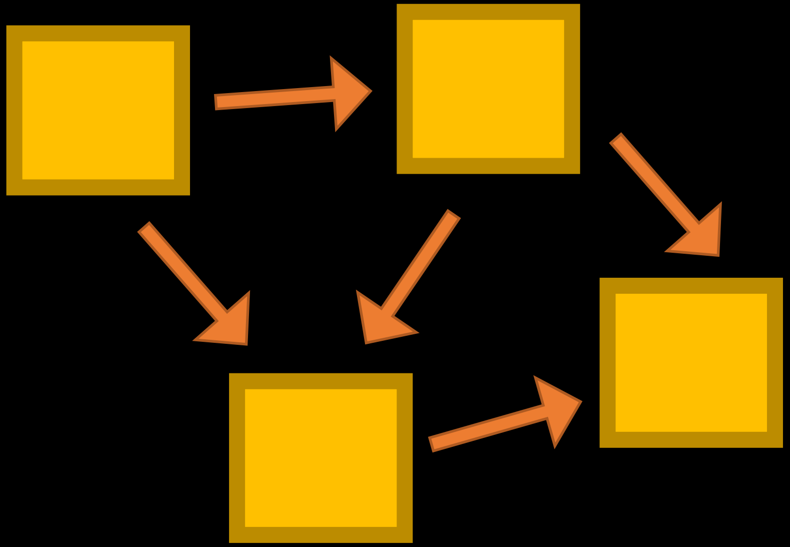

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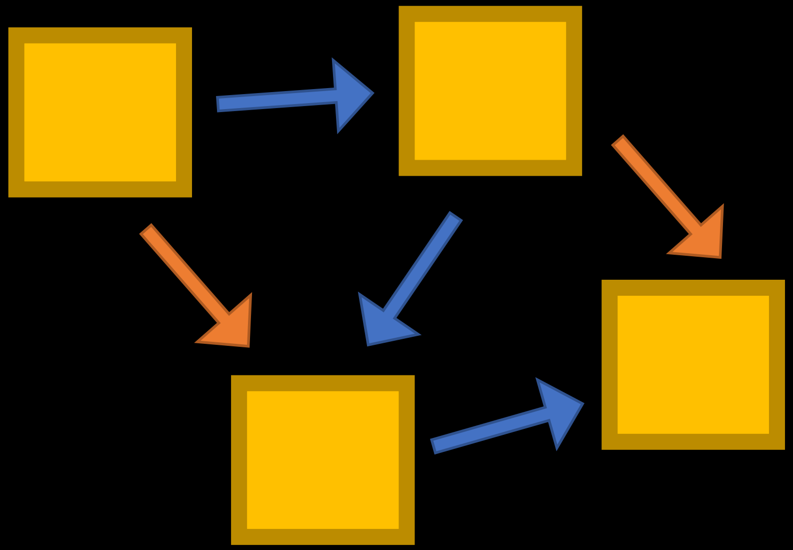

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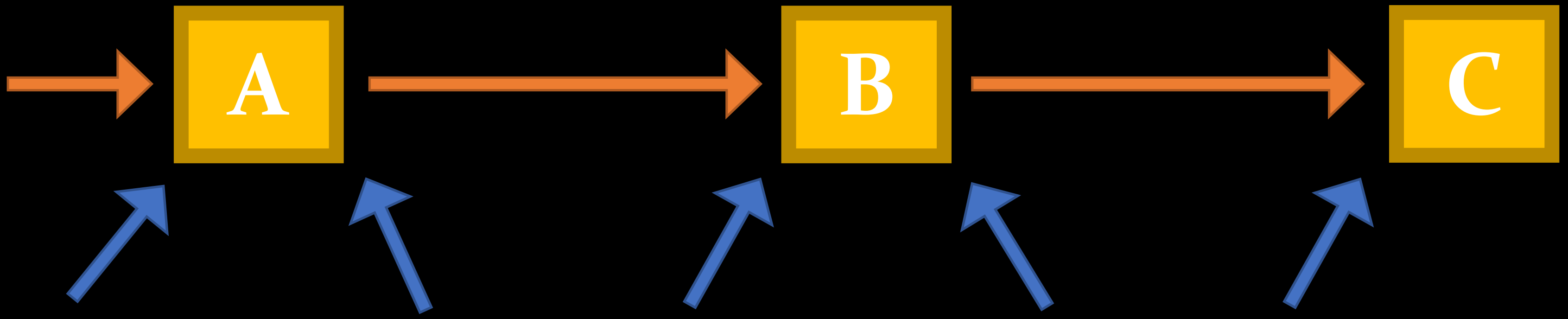
Propagating MDC



Create MDC (based on session) and assign unique request ID

Copy MDC to HTTP(S) headers

Read MDC HTTP(S) headers

Copy MDC to HTTP(S) headers

Read MDC HTTP(S) headers

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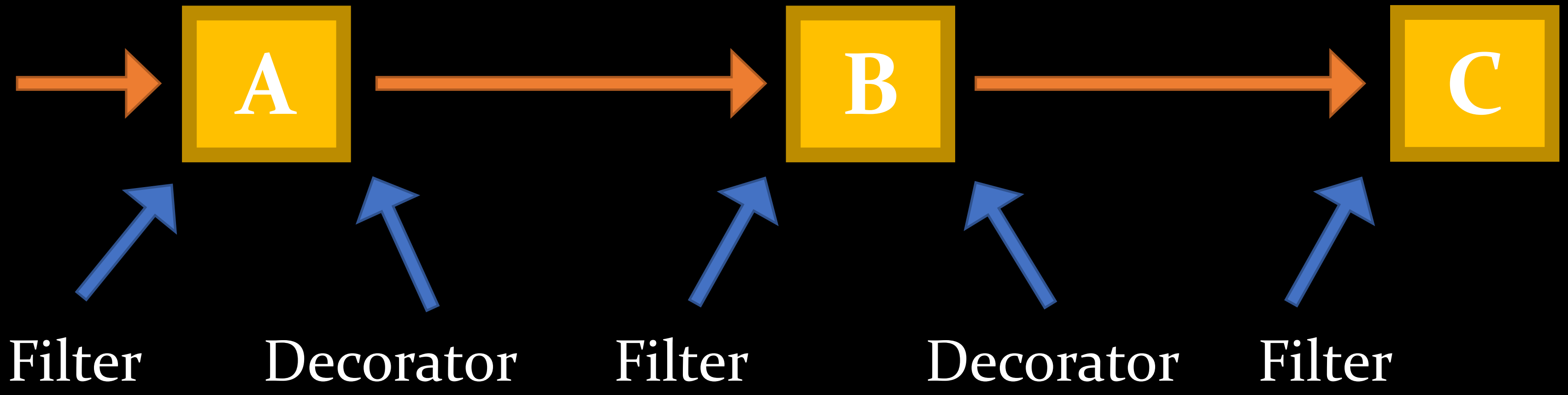
Propagating MDC



Standardized keys

```
{
    "account": "axelfontaine",
    "image": "axelfontaine/xyz:543",
    "instance": "i-0d843d5af9b366a69",
    "level": "INFO",
    "logger": "com.myapp.task.TaskService",
    "message": "Successfully killed axelfontaine/demo in prod",
    "request": "crq-7R2CVPUMKREUFLMQUE3XB7JWCX",
    "session": "cli-CRFM2IPABRFUJD7KTDYVDVXABX",
    "thread": "Thread-18710",
    "timestamp": "2017-05-12T10:20:30.444"
}
```

Standardized values

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```json
{
    "account": "axelfontaine",
    "image": "axelfontaine/xyz:543",
    "instance": "i-0d843d5af9b366a69",
    "level": "INFO",
    "logger": "com.myapp.task.TaskService",
    "message": "Successfully killed axelfontaine/demo in prod",
    "request": "crq-7R2CVPUMKREUFLMQUE3XB7JWCX",
    "session": "cli-CRFM2IPABRFUJD7KTDYVDVXABX",
    "thread": "Thread-18710",
    "timestamp": "2017-05-12T10:20:30.444"
}
```

Summary

- ✓ Send your logs to a centralized service
- ✓ Ensure your logs are structured
- ✓ Use and propagate MDC
- ✓ Standardize keys and values
- ✓ Query your logs to answer the what, who, where, when questions

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About Axel Fontaine

- Founder and CEO of Boxfuse
- Flyway creator
- Continuous Delivery & Immutable Infrastructure expert
- Java Champion, JavaOne RockStar

@axelfontaine

Flyway

flywaydb.org

- Evolve your relational database schema reliably across all your instances
- Supports all popular RDBMS
- Open-source
  (with commercial support available)
- Millions of users

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boxfuse.com

- Deploy JVM (Spring Boot, Dropwizard, Tomcat, TomEE, ...), Node.js and Go apps effortlessly to AWS
- Immutable infrastructure with minimal images just 1% of size of regular OS
(think Linux x64 kernel + your app)
- Zero downtime orchestration on AWS
(atomic blue/green deployments)
- First-class support for centralized, structure and standardized logging with AWS CloudWatch Logs

Thanks !

@axelfontaine

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Flyway

flywaydb.org