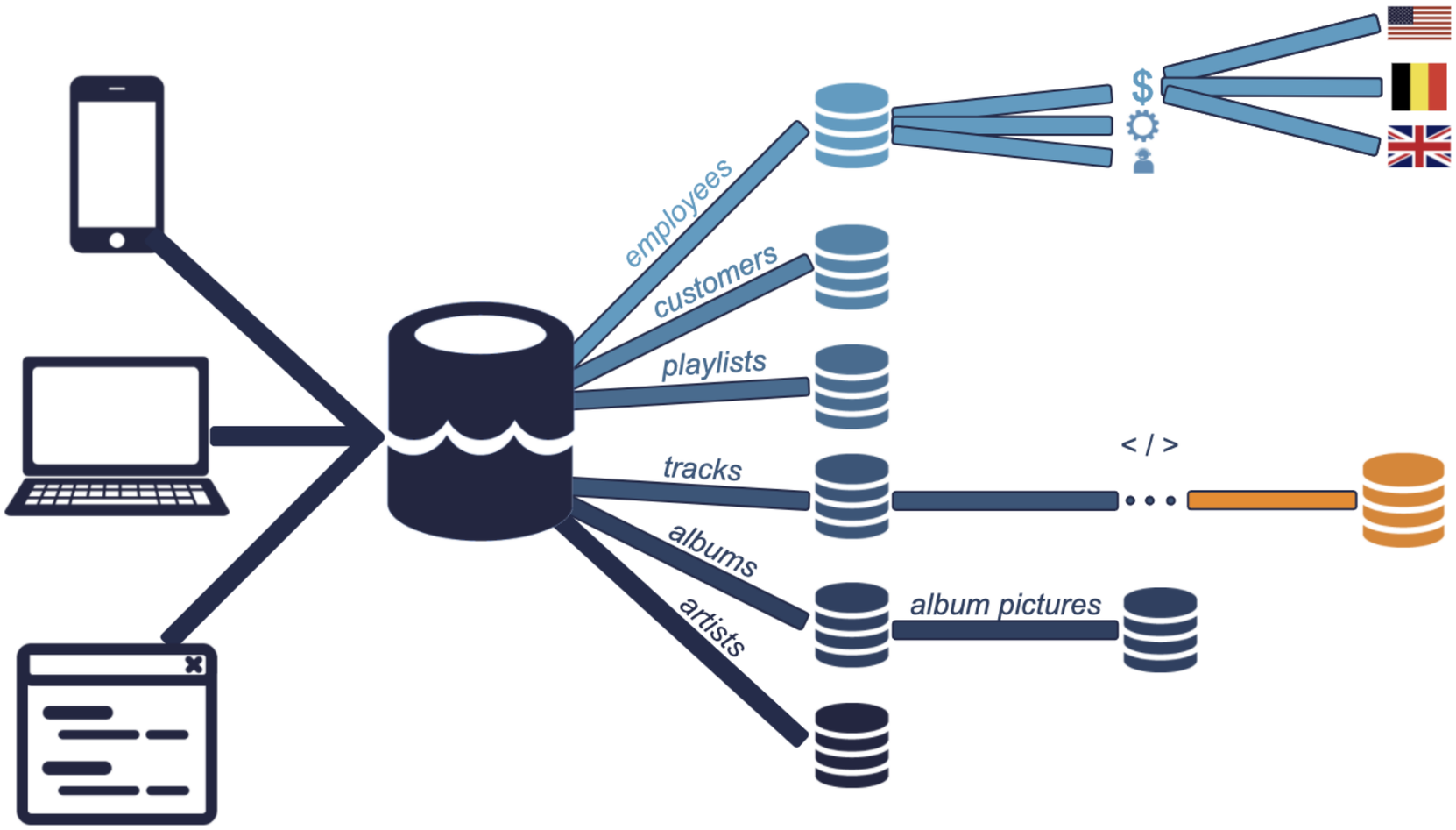
Processing data

UNDERSTANDING DATA ENGINEERING

Hadrien Lacroix
Content Developer at DataCamp

datacamp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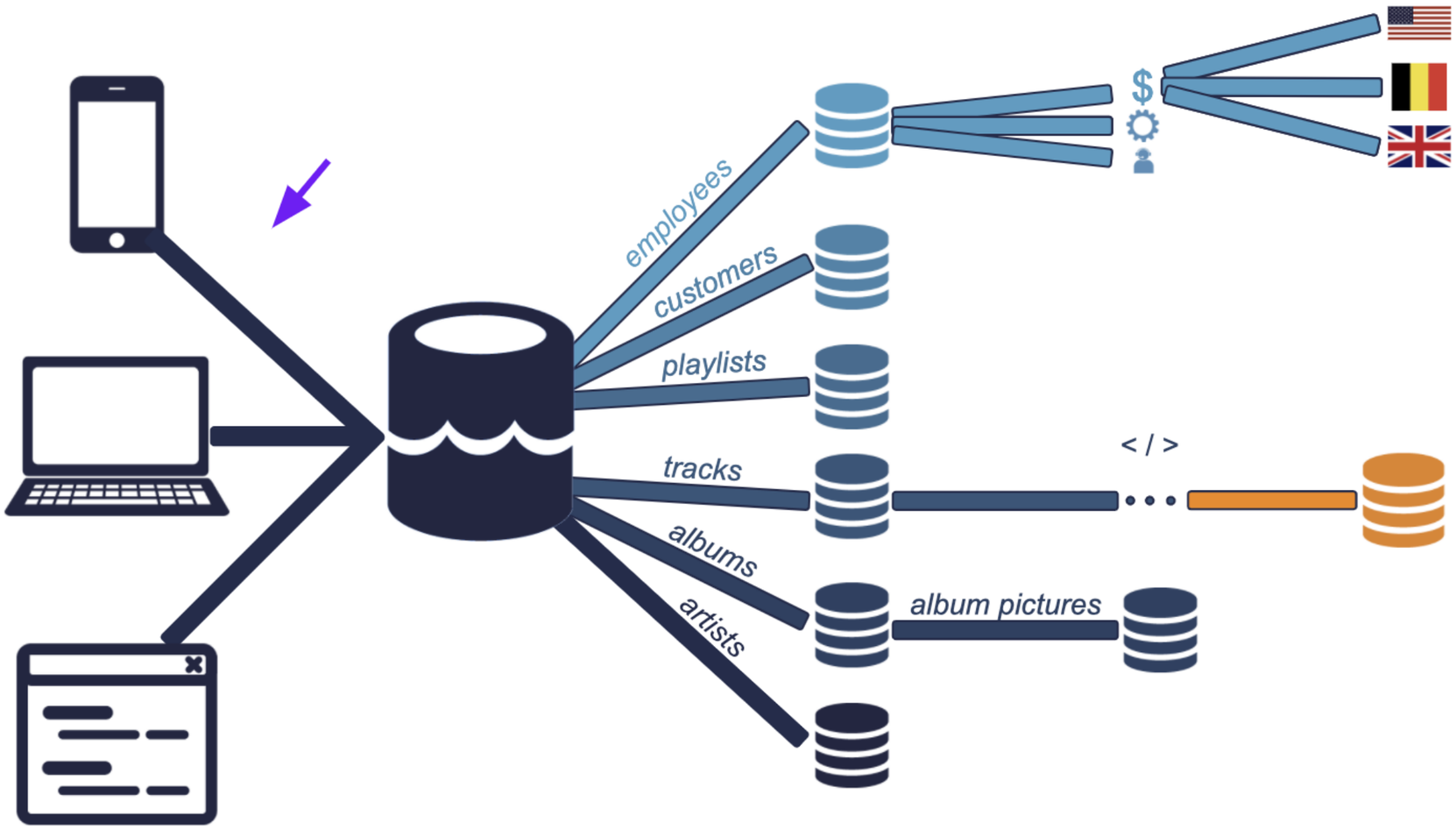
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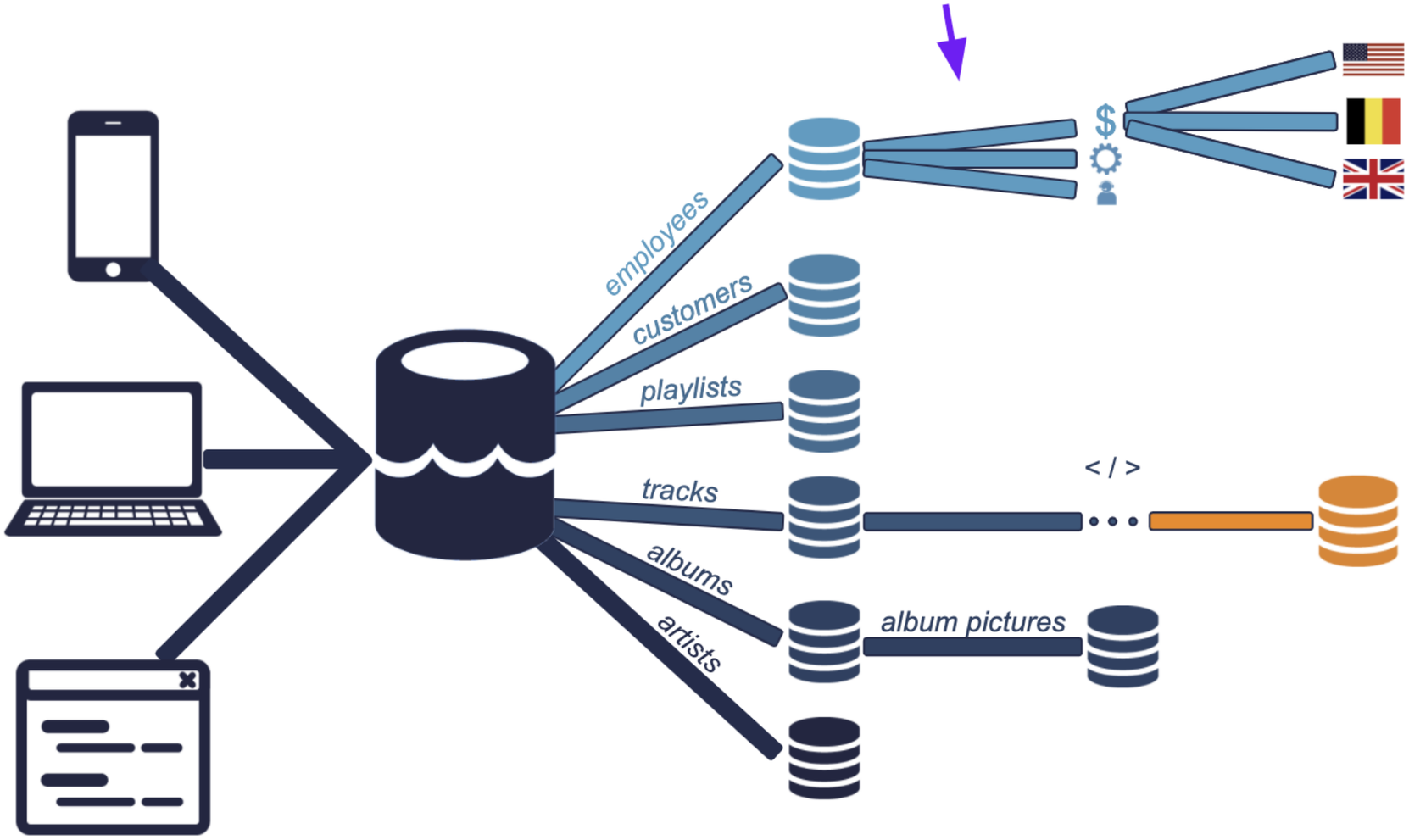
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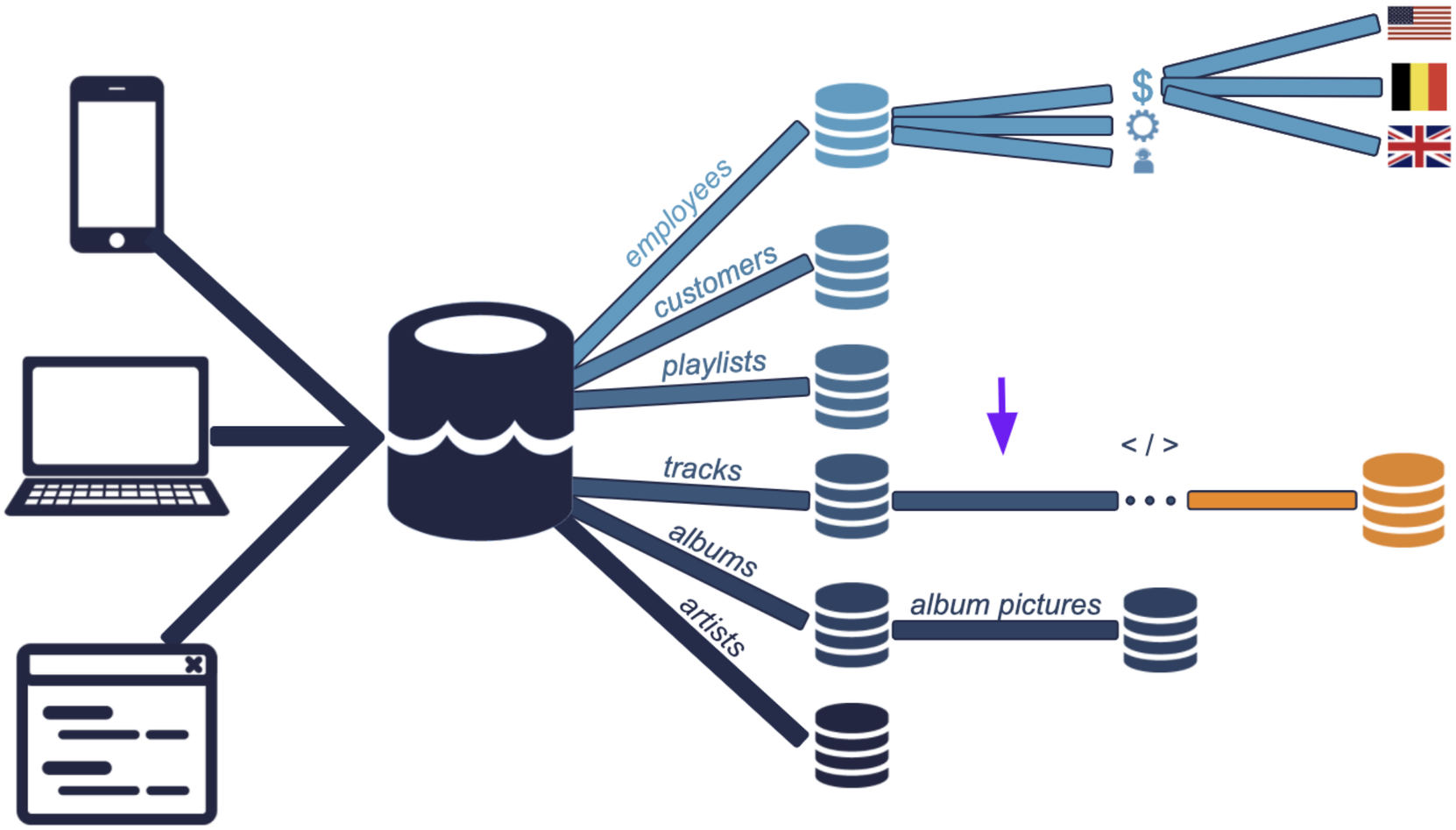
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A general definition

- Data processing: converting **raw** data into **meaningful** information

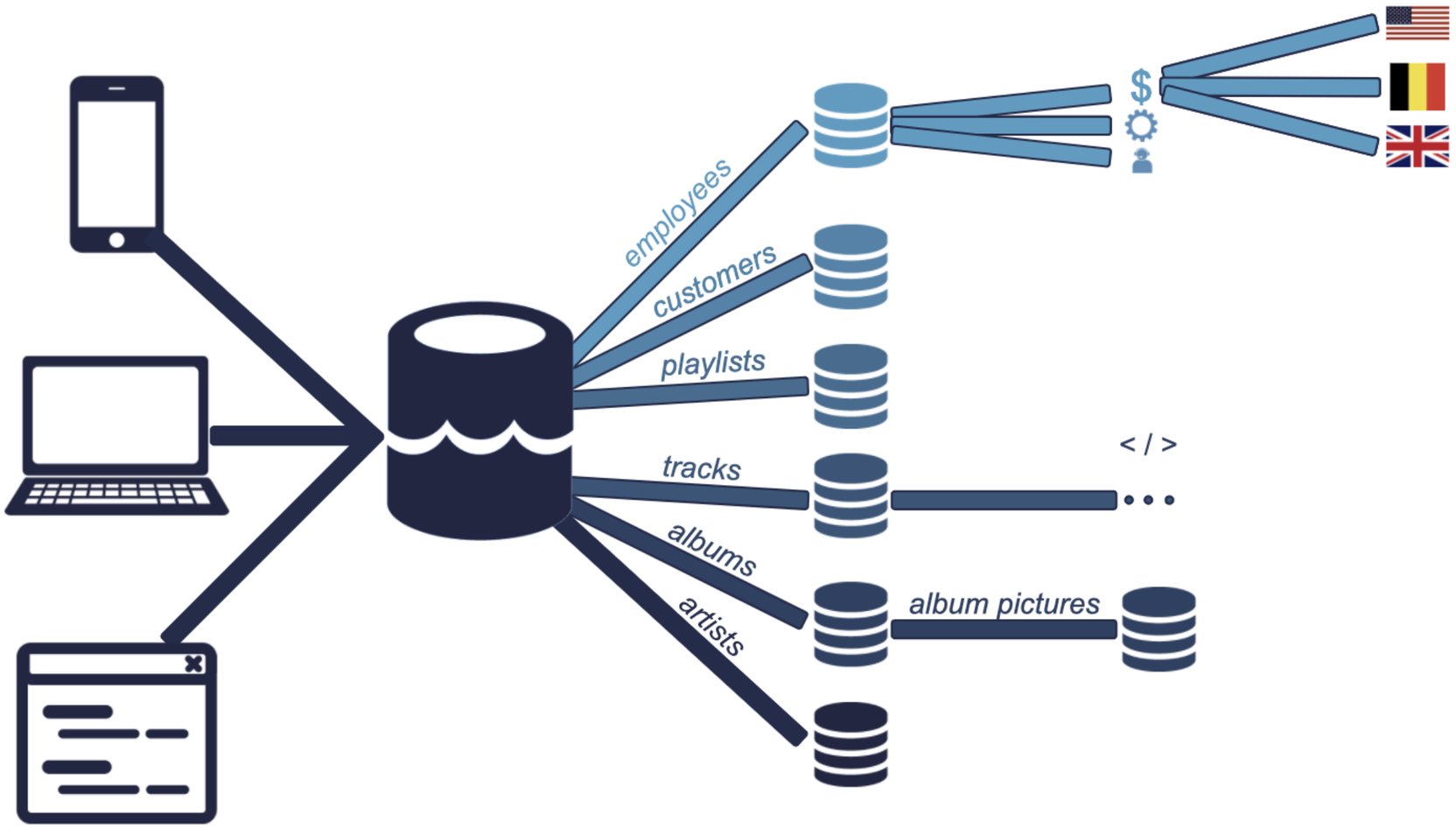
Data processing value

Conceptually

- Remove unwanted data
- Optimize memory, process and network costs
- Convert data from one type to another

At Spotflix

- No long term need for testing feature data
- Can't afford to store and stream files this big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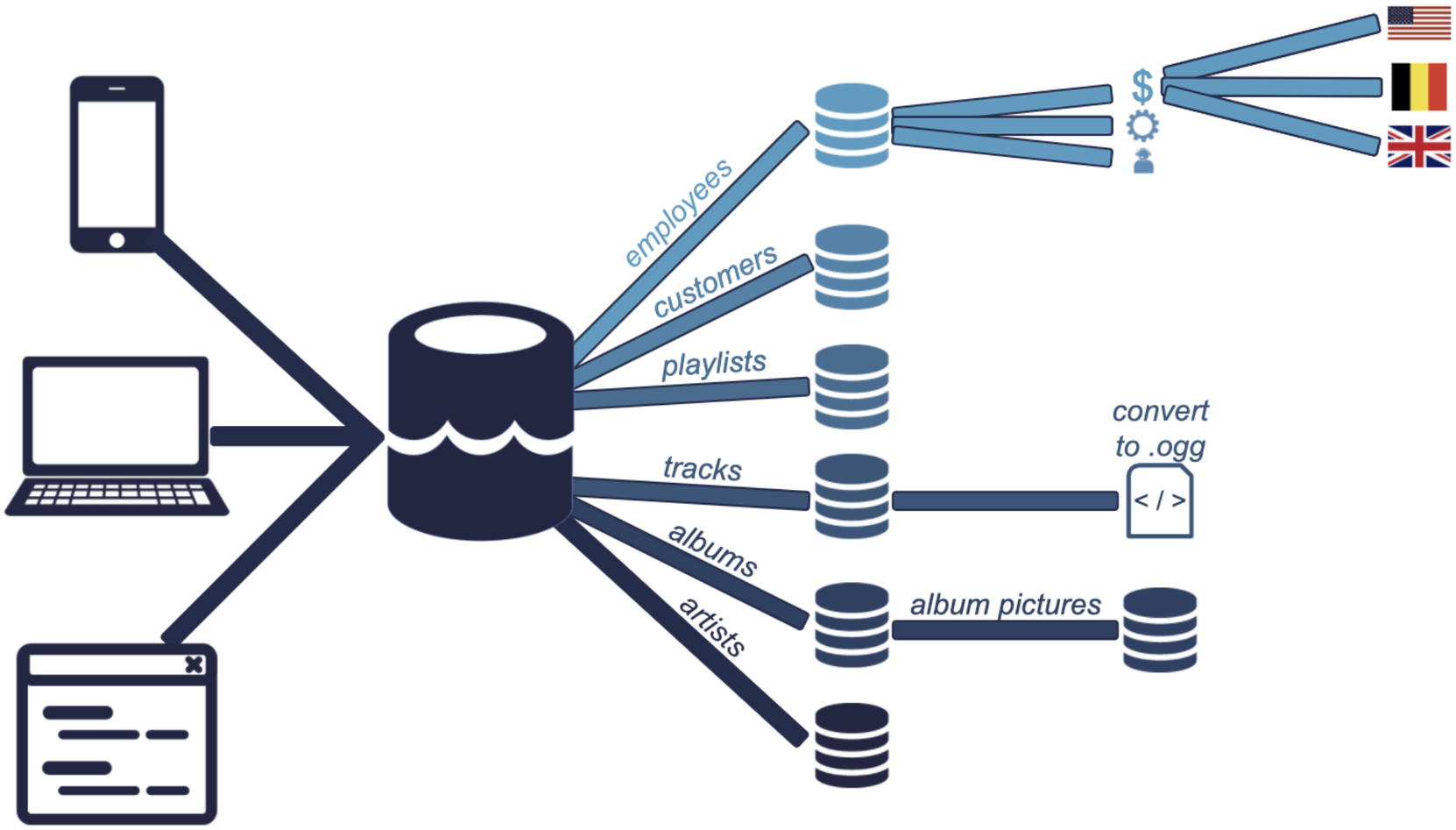
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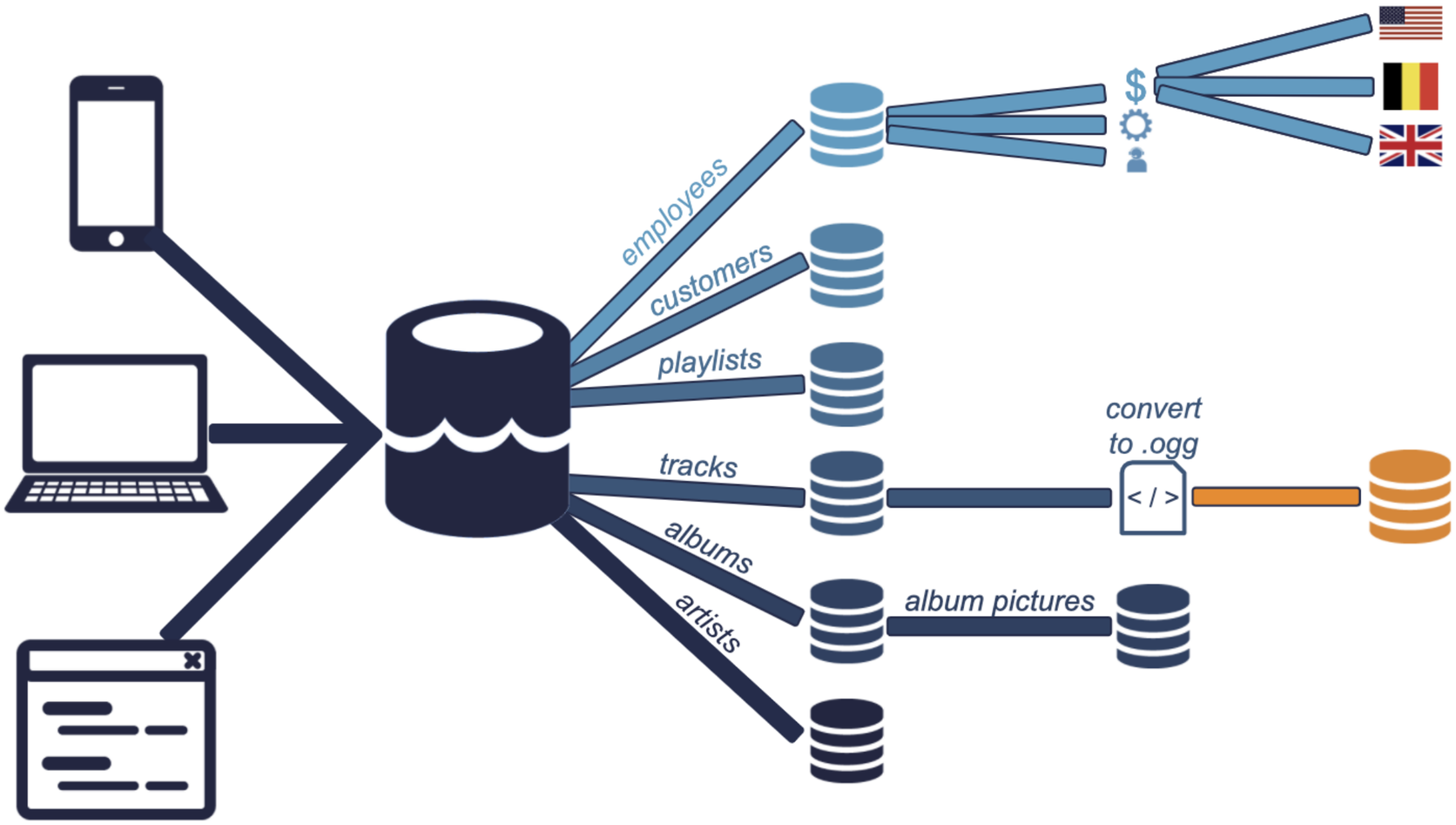
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Data processing value

Conceptually

- Remove unwanted data
- To save memory
- Convert data from one type to another
- Organize data
- To fit into a schema/structure
- Increase productivity

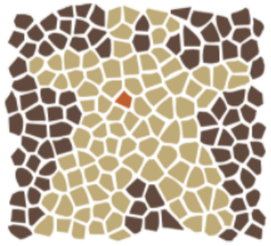
At Spotflix

- No need for lossless format
- Can't afford to store files this big
- Convert songs from `.flac` to `.ogg`
- Reorganize data from the data lake to data warehouses
- Employee table example
- Enable data scientists

How data engineers process data

- Data manipulation, cleaning, and tidying tasks
  - that can be automated
  - that will always need to be done
- Store data in a sanely structured database
- Create views on top of the database tables
- Optimizing the performance of the database
- Rejecting corrupt song files
- Deciding what happens with missing metadata
- Separate artists and albums tables...
- ...but provide view combining them
- Indexing

Batch processing



Stream processing

[1] The difference between batch and stream will be explained in the next lesson!


APACHE
Spark
TM

Summary

- What data processing is
- Why it's necessary
- What it consists in
- How we process data at Spotflix

Let's practice!

UNDERSTANDING DATA ENGINEERING

Scheduling data

UNDERSTANDING DATA ENGINEERING

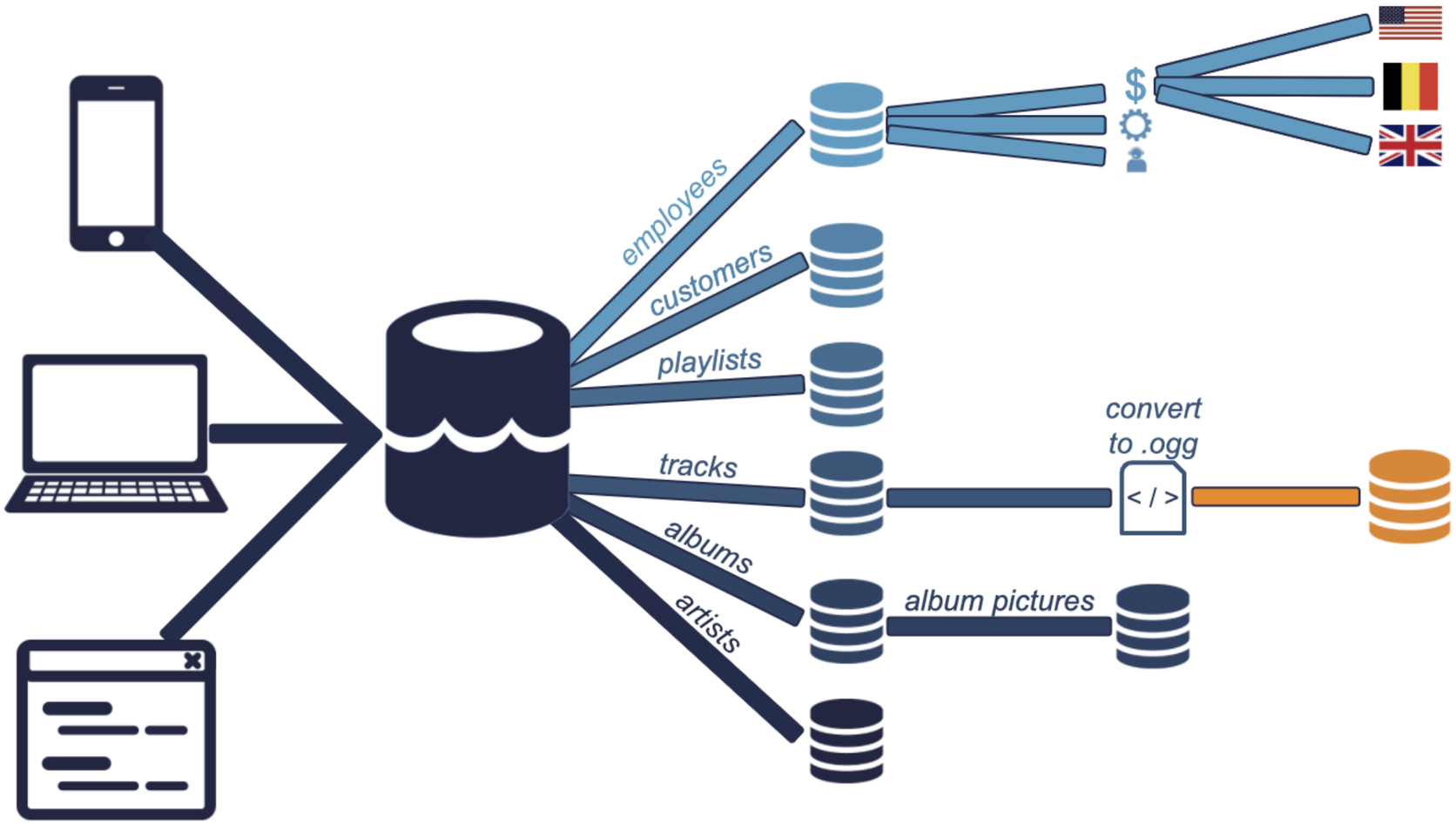
Hadrien Lacroix
Content Developer at DataCamp

Scheduling

- Can apply to any task listed in data processing
- Scheduling is the glue of your system
- Holds each piece and organize how they work together
- Runs tasks in a specific order and resolves all dependencies

Manual, time and sensor scheduling

- Manually
- Manually update the employee table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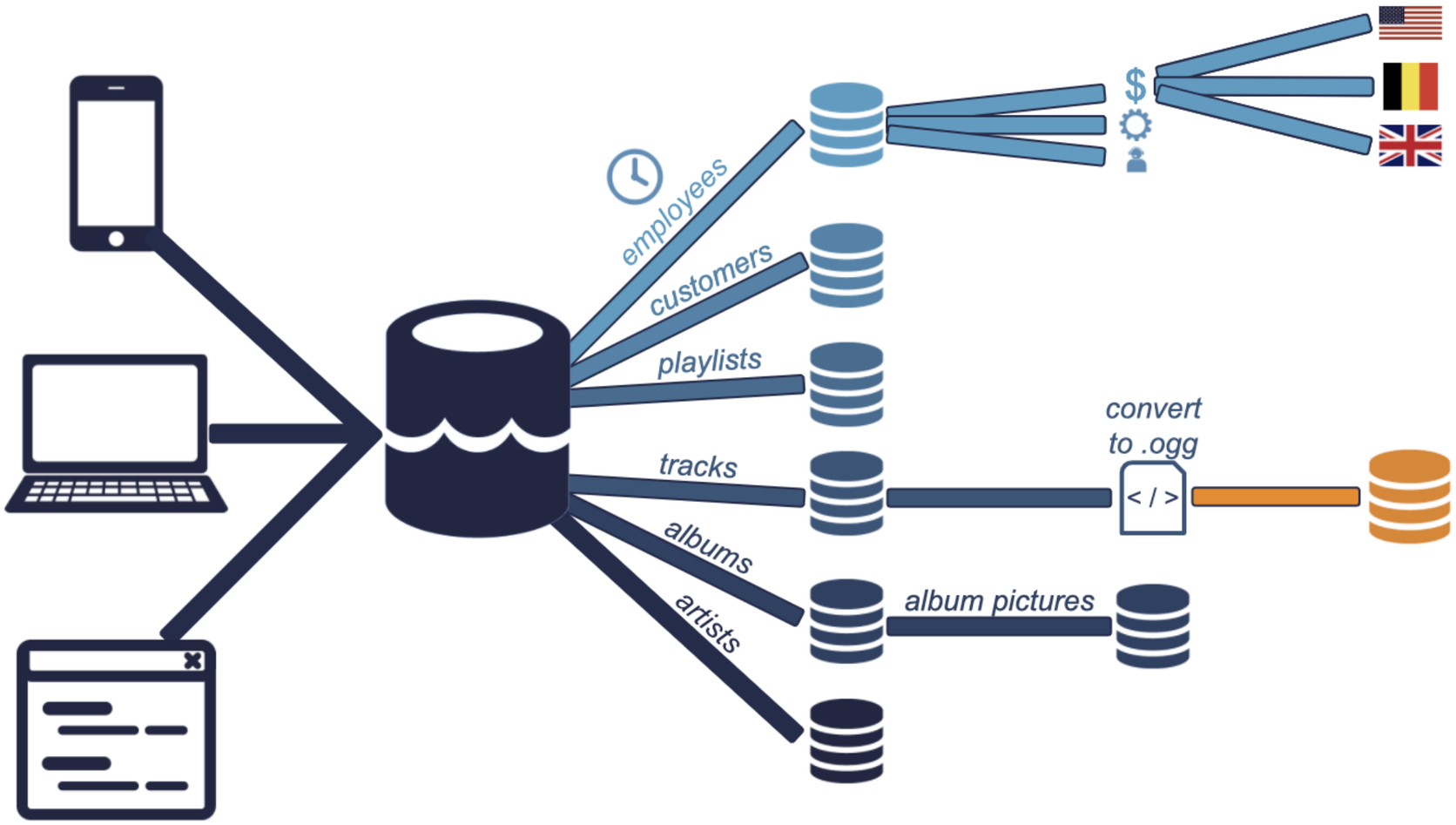
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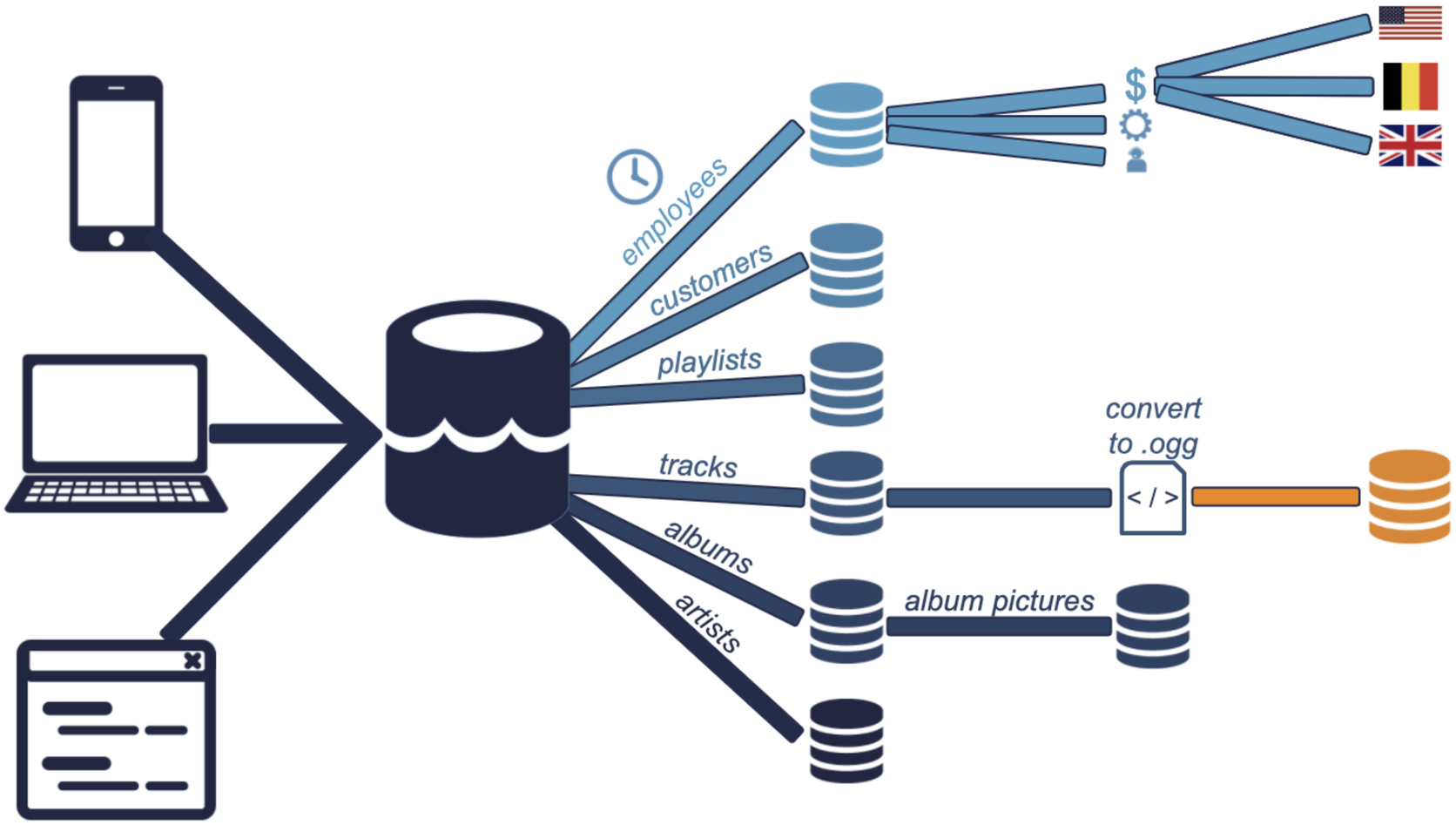
Manual, time and sensor scheduling

- Manually
- Automatically run at a specific time
- Automatically run if a specific condition is met
  - Sensor scheduling

- Manually update the employee table
- Update the employee table at 6 AM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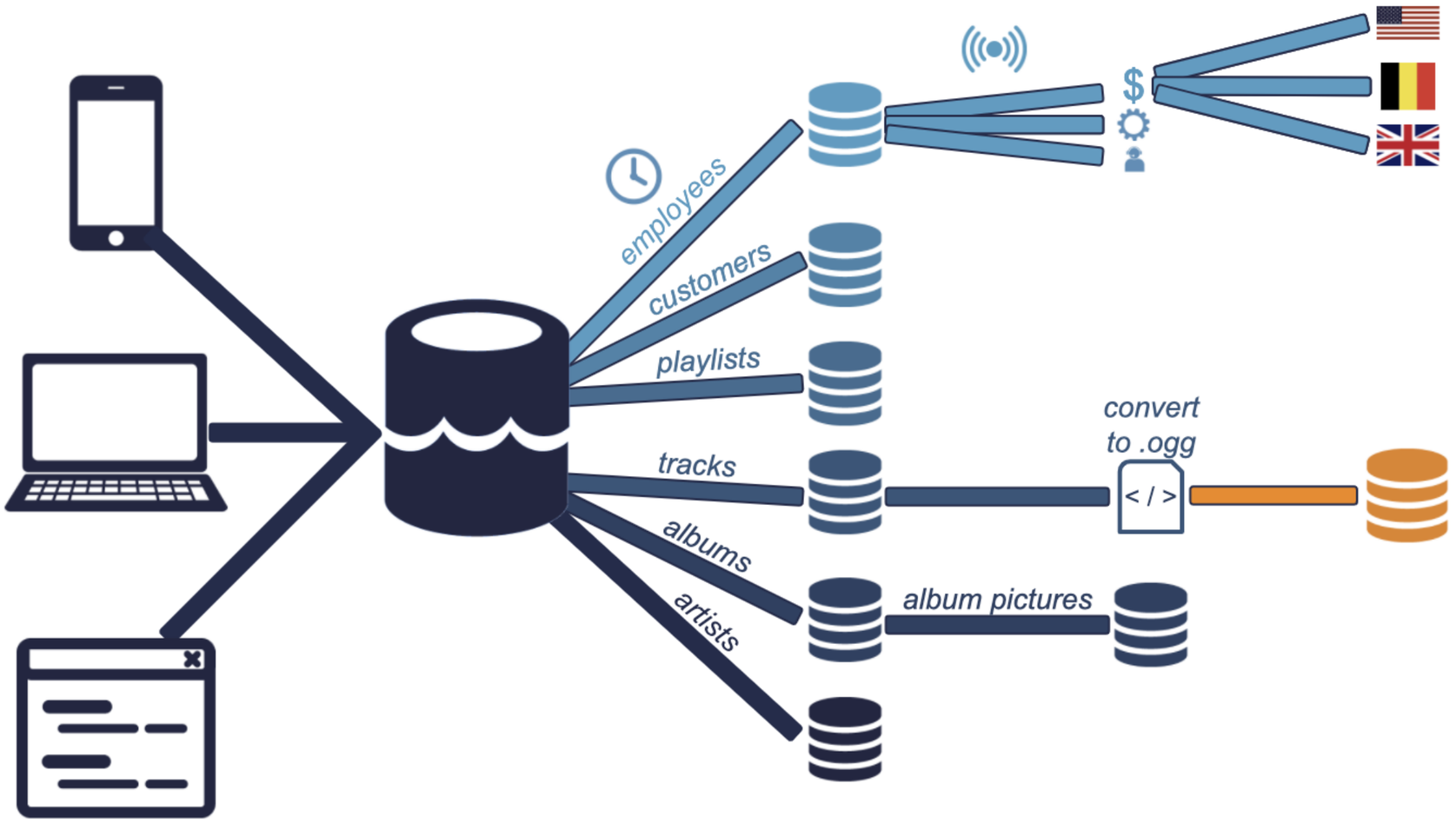
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Manual, time, and sensor scheduling

- Manually
- Automatically run at a specific time
- Automatically run if a specific condition is met
  - Sensor scheduling

- Manually update the employee table
- Update the employee table at 6 AM
- Update the department tables if a new employee was added

Batches and streams

- Batches
  - Group records at intervals
  - Often cheaper
- Streams
  - Send individual records right away

- Songs uploaded by artists
- Employee table
- Revenue table
- New users signing in
- Another example: online vs. offline listening

Scheduling tools

Apache Airflow

Summary

- What scheduling is
- Different ways to set it up
- Difference between batches and streams
- How scheduling is implemented at Spotflix
- Airflow, Luigi

Let's practice!

UNDERSTANDING DATA ENGINEERING

Parallel computing

UNDERSTANDING DATA ENGINEERING

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Content Developer at DataCamp

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Parallel computing

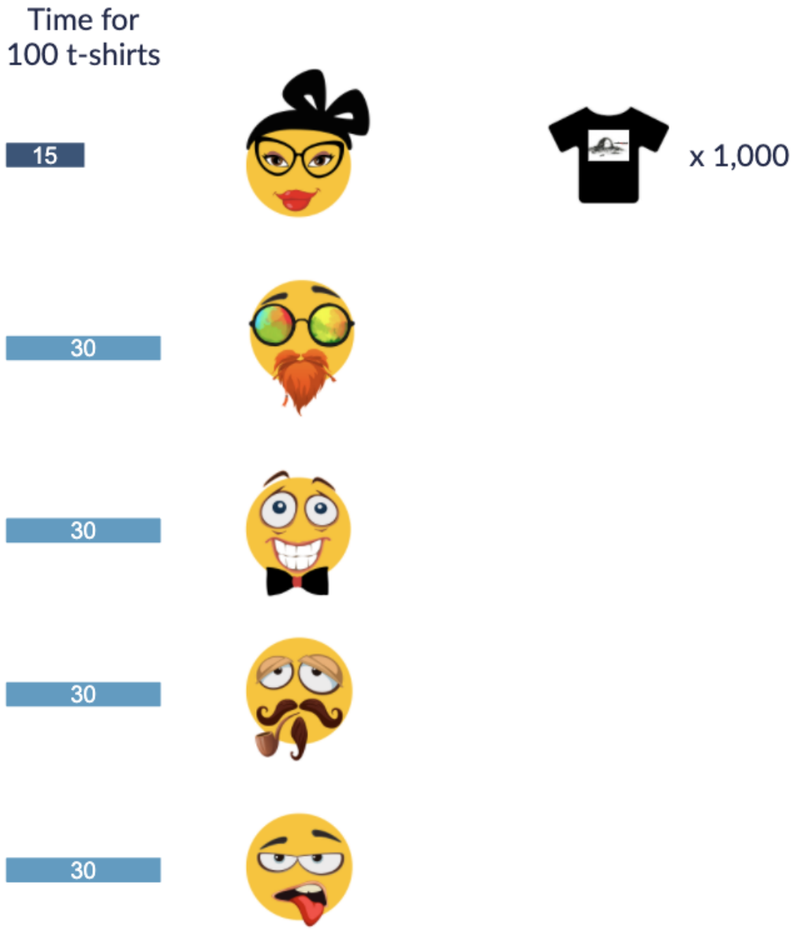
- Basis of modern data processing tools
- Necessary:
  - Mainly because of memory
  - Also for processing power
- How it works:
  - Split tasks up into several smaller subtasks
  - Distribute these subtasks over several computers

x 1,000

Time for
100 t-shirts

15

x 1,000



[1] Emojis by Mohamed Hassan

Time for
100 t-shirts

15

x 1,000

30

30

30

30

Time for
100 t-shirts

15

x 1,000

30

x 250

30

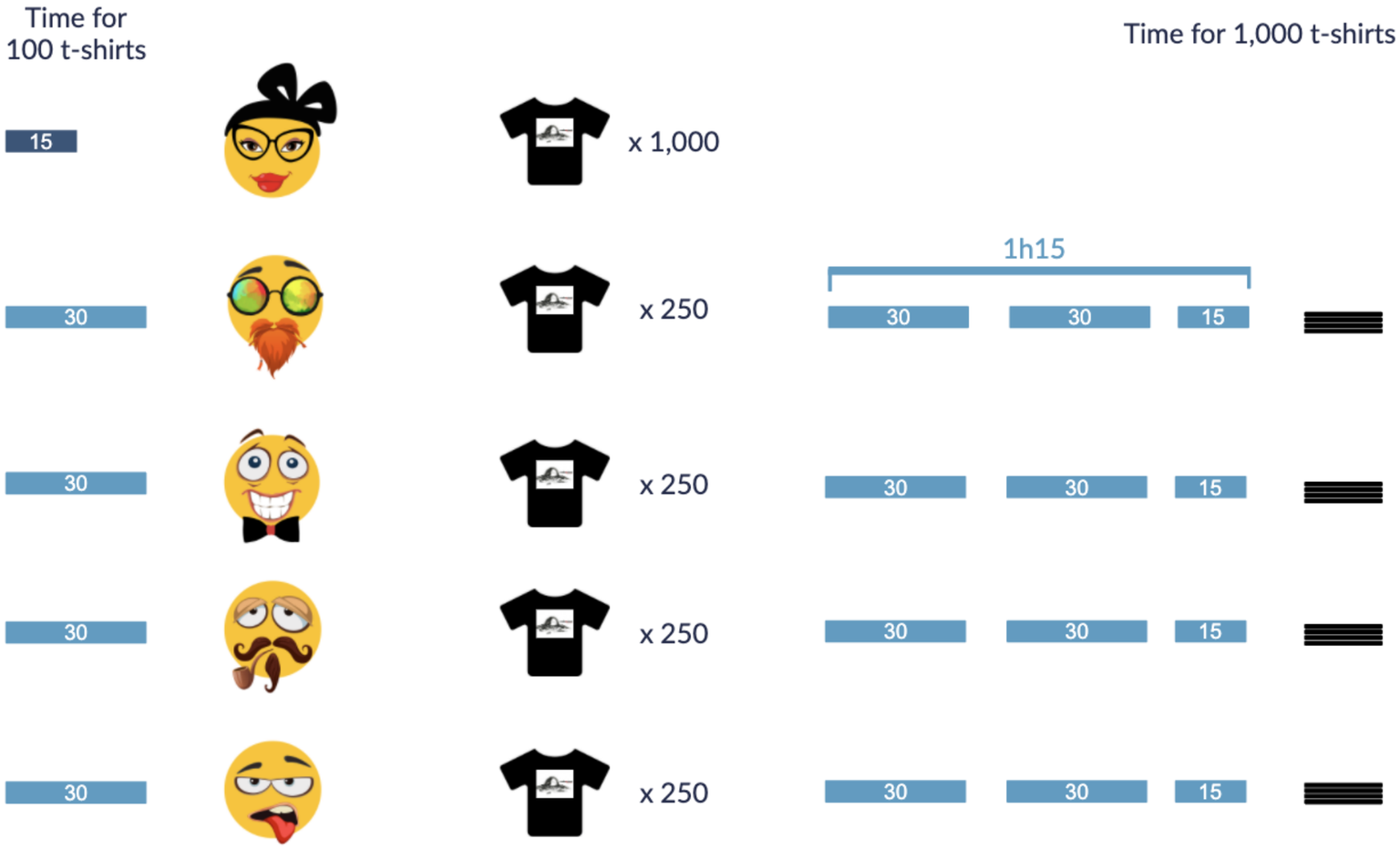
x 250

30

x 250

30

x 250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Time for
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Time for 1,000 t-shirts
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x 250
30 30 15
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x 250
30 30 15
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Benefits and risks of parallel computing

- Employees = processing units
- Advantages
  - Extra processing power
  - Reduced memory footprint
- Disadvantages
  - Moving data incurs a cost
  - Communication time


Time for
100 t-shirts
Time for 1,000 t-shirts
2h30
15
x 1,000
15 15 15 15 15 15 15 15 15 15
1h15
30
x 250
30 30 15
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x 250
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x 250
30 30 15
30
x 250
30 30 15


Time for
100 t-shirts
Time for 1,000 t-shirts
2h30
15
x 1,000
15 15 15 15 15 15 15 15 15 15
0h10
1h15
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x 250
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Time for
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x 1,000
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x 250
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Time for 1,000 t-shirts
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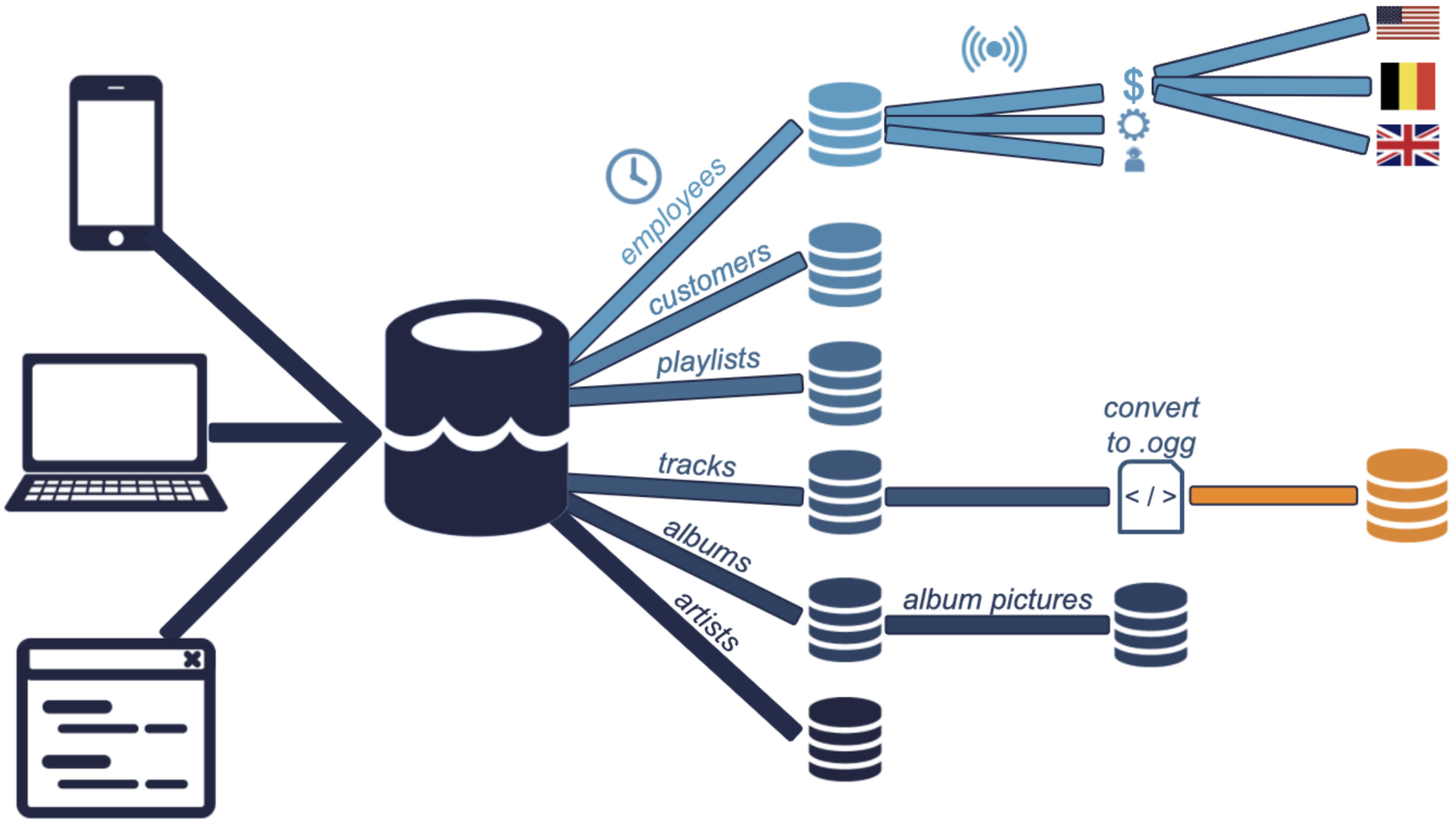
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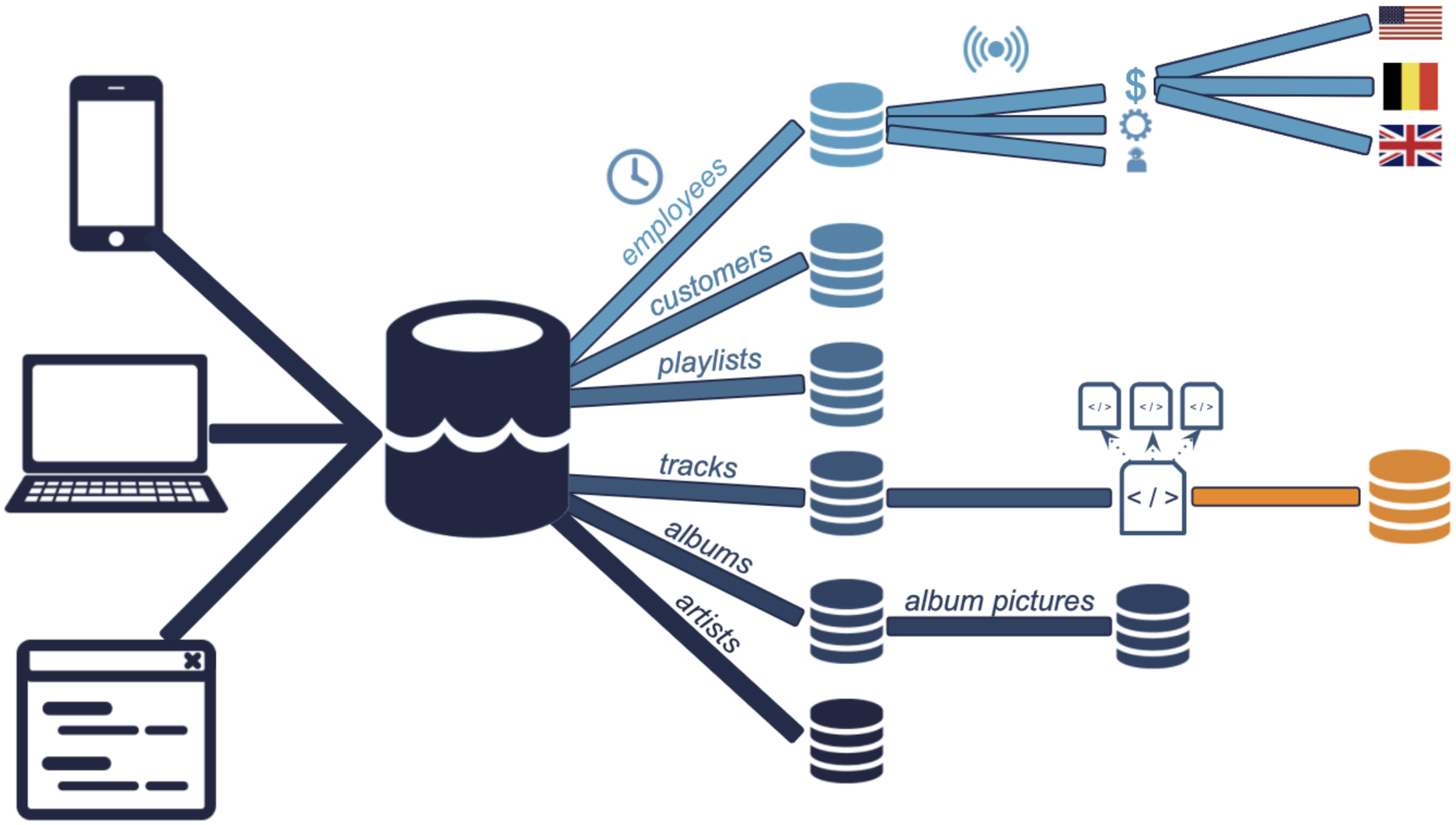
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Summary

- Benefits and risks
- How it's implemented at Spotflix

Let's practice!

UNDERSTANDING DATA ENGINEERING

Cloud computing

UNDERSTANDING DATA ENGINEERING

Hadrien Lacroix
Content Developer

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Cloud computing for data processing

Servers on premises

- Bought
- Need space
- Electrical and maintenance cost
- Enough power for peak moments
- Processing power unused at quieter times

Servers on the cloud

- Rented
- Don't need space
- Use just the resources we need
- When we need them
- The closer to the user the better

Cloud computing for data storage

- Database reliability: data replication
- Risk with sensitive data

32.4%

32.4%

17.6%

32.4%

17.6%

6%

File storage

File storage

AWS S3

File storage

AWS S3

Azure Blob Storage

File storage

AWS S3

Azure Blob Storage

Google Cloud Storage

	File storage	Computation
aws	*AWS S3* 	
Microsoft Azure	*Azure Blob Storage* 	
Google Cloud	*Google Cloud Storage* 	

	File storage	Computation
aws	*AWS S3* 	*AWS EC2* 
Microsoft Azure	*Azure Blob Storage* 	
Google Cloud	*Google Cloud Storage* 	

	File storage	Computation
aws	*AWS S3* 	*AWS EC2* 
Microsoft Azure	*Azure Blob Storage* 	*Azure Virtual Machines* 
Google Cloud	*Google Cloud Storage* 	

	File storage	Computation
aws	*AWS S3* 	*AWS EC2* 
Microsoft Azure	*Azure Blob Storage* 	*Azure Virtual Machines* 
Google Cloud	*Google Cloud Storage* 	*Google Compute Engine* 

	File storage	Computation	Databases
aws	*AWS S3* 	*AWS EC2* 	
Microsoft Azure	*Azure Blob Storage* 	*Azure Virtual Machines* 	
Google Cloud	*Google Cloud Storage* 	*Google Compute Engine* 	

	File storage	Computation	Databases
aws	*AWS S3* 	*AWS EC2* 	*AWS RDS* 
Microsoft Azure	*Azure Blob Storage* 	*Azure Virtual Machines* 	
Google Cloud	*Google Cloud Storage* 	*Google Compute Engine* 	

	File storage	Computation	Databases
aws	*AWS S3* 	*AWS EC2* 	*AWS RDS* 
Microsoft Azure	*Azure Blob Storage* 	*Azure Virtual Machines* 	*Azure SQL Database* 
Google Cloud	*Google Cloud Storage* 	*Google Compute Engine* 	

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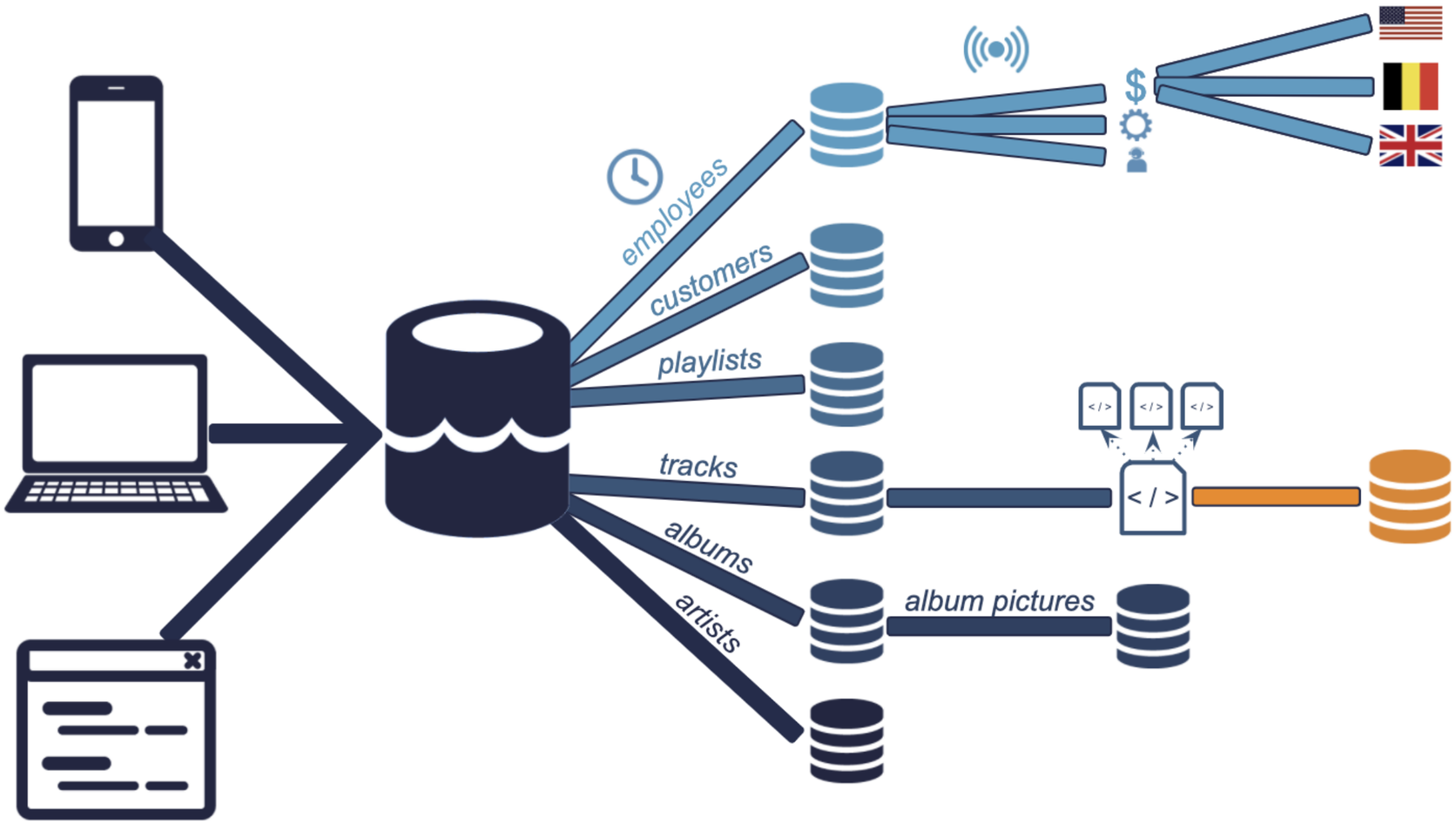
Google Cloud	*Google Cloud Storage* 	*Google Compute Engine* 	*Google Cloud SQL* 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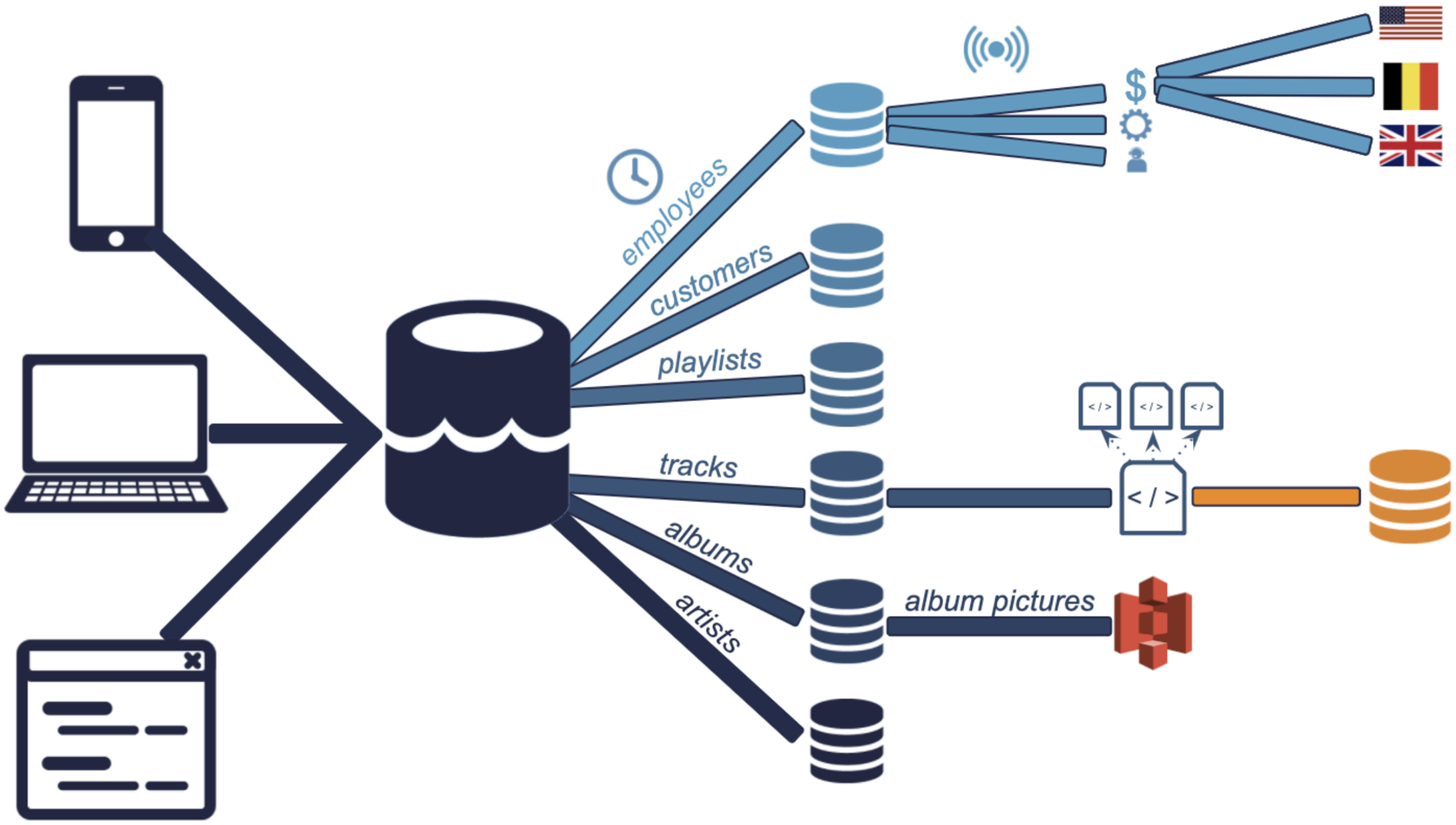
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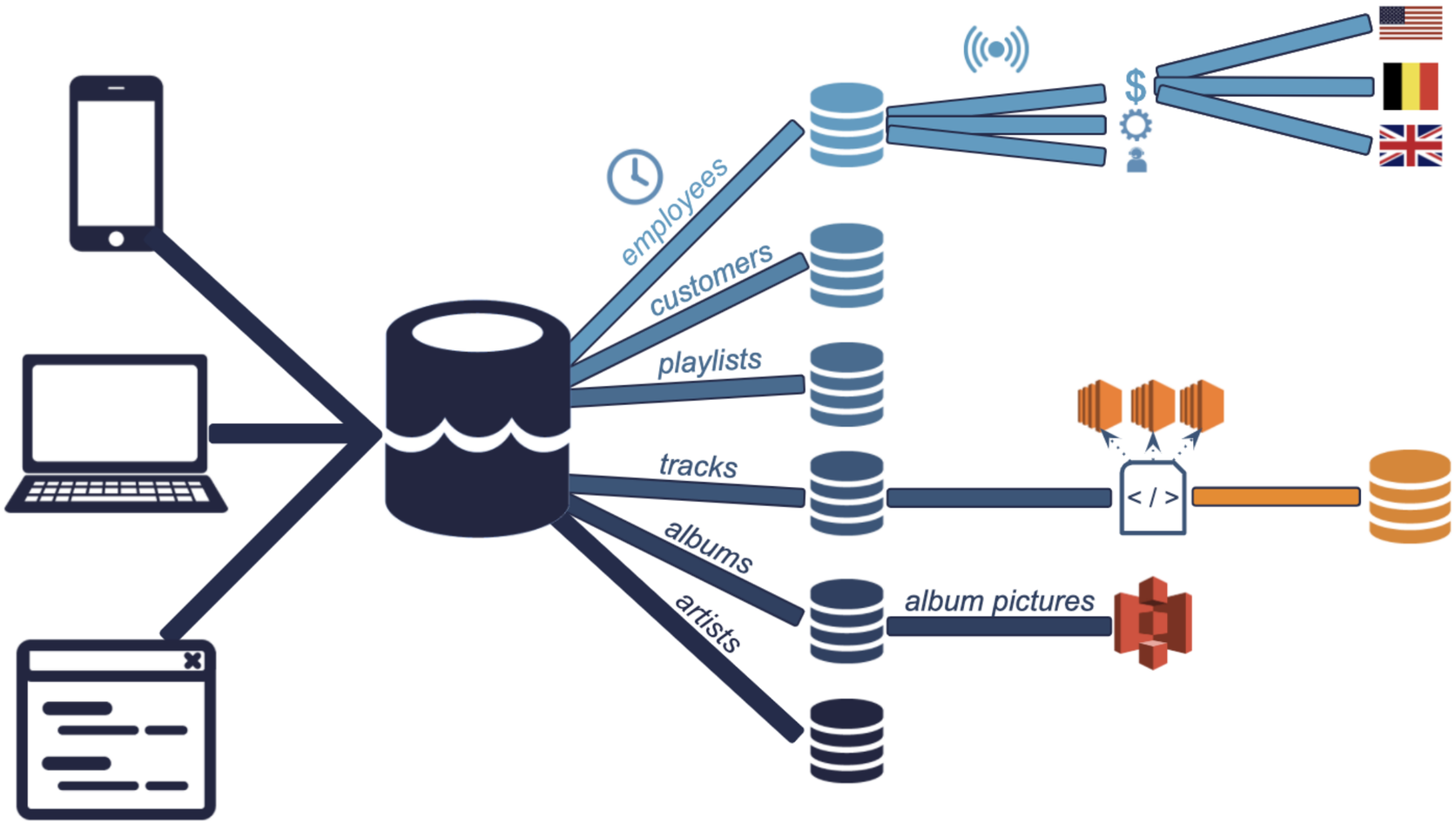
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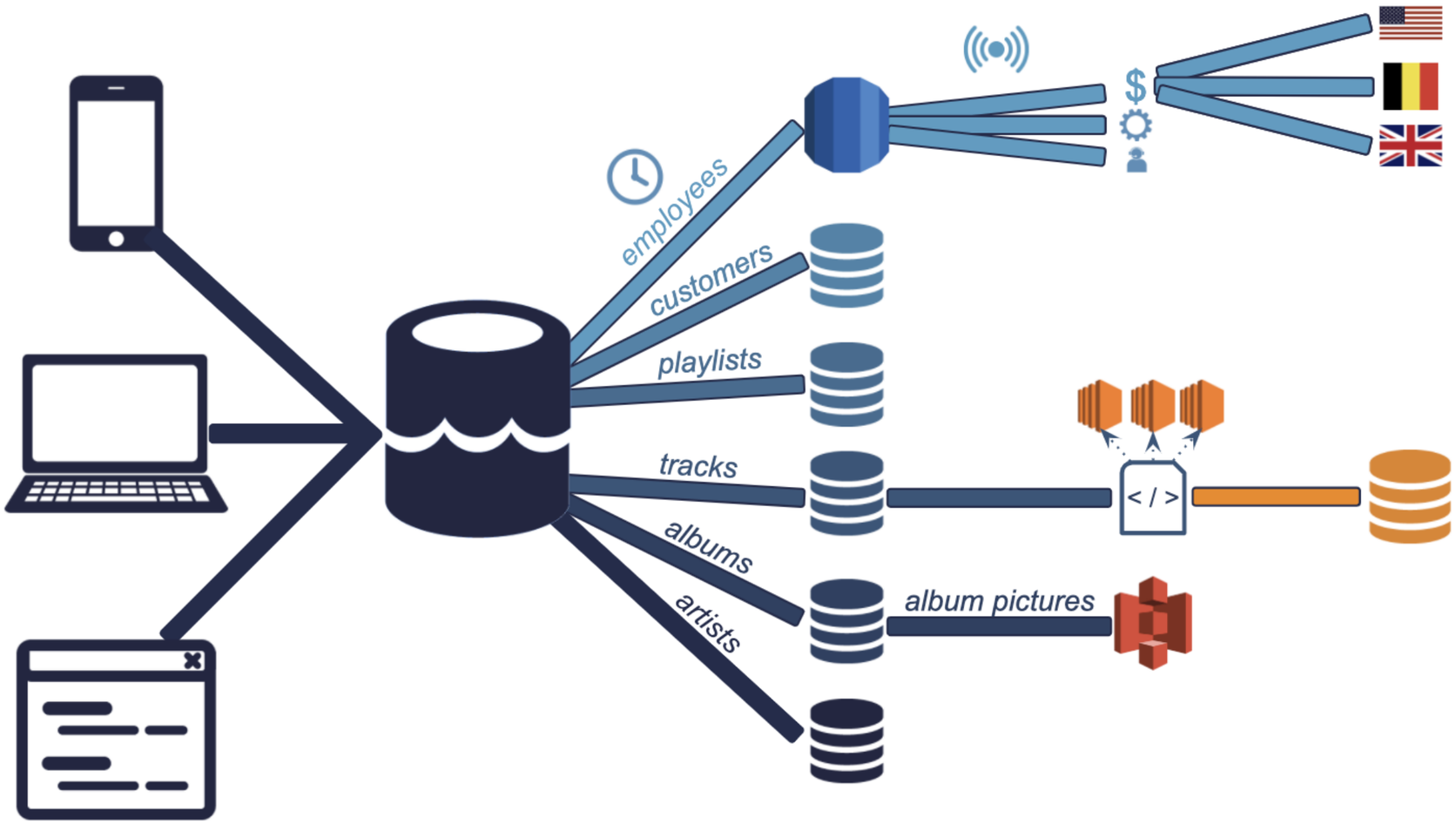
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Multicloud

Pros

- Reducing reliance on a single vendor
- Cost-efficiencies
- Local laws requiring certain data to be physically present within the country
- Mitigating against disasters

Cons

- Cloud providers try to lock in consumers
- Incompatibility
- Security and governance

Summary

- Benefits and risks of cloud computing
- How it is implemented at Spotflix
- Can cite the main cloud providers and their services

Let's practice!

UNDERSTANDING DATA ENGINEERING

We are the champions

UNDERSTANDING DATA ENGINEERING

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Actually, YOU are the champion!

What you learned - chapter 1

- What Data Engineering is
- How important it is
- How data engineers differ from data scientists
- What a data pipeline is and how it works

What you learned - chapter 2

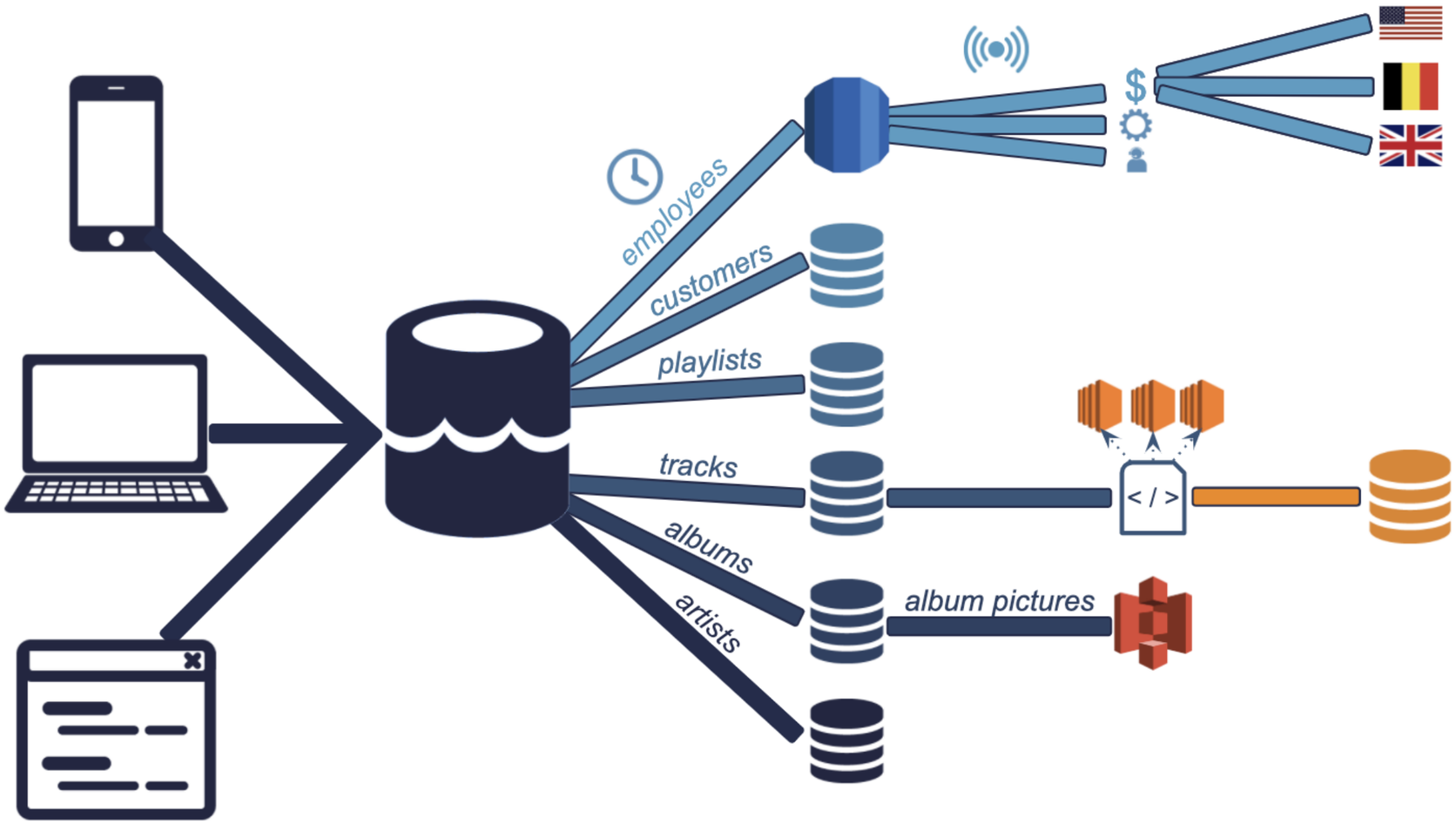
- The different structures data can take
- How fundamental SQL is
- The differences between data lakes, data warehouses and databases

What you learned - chapter 3

- How data is processed
- How scheduling holds it all together
- Parallel computing
- Cloud computing

And some more

- What SQL code actually looks like
- Main tools and technologies used in data engineering
- And some more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Lexicon

Data Engineering for Everyone - Lexicon

Data Engineering for Everyone - Lexicon

- **Airflow**: an open-source workflow management platform used to schedule data engineering tasks. Started at Airbnb, now maintained by the Apache foundation.
- **AWS**: Amazon Web Services. Amazon's cloud computing services.
- **Azure**: Microsoft's cloud services.
- **Big data**: the systematic storage, management and analysis of datasets that are too large or complex to be dealt with by traditional data-processing application software. Big Data revolves around 4 Vs: volume, variety, velocity, and veracity.
- **Cloud computing**: the use of a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.

A promise is a promise, DataChamps!

- All the exercises are song titles
- Search for "DataChamps" on Spotify

Congratulations!

UNDERSTANDING DATA ENGINEERING