Please ask questions via the mobile app!

📢

Engage

Microservices @ Spotify

Kevin Goldsmith
VP Engineering

@kevingoldsmith

Let’s say I wanted to build a large application

Some requirements

Some requirements

- Must scale to millions of users

Some requirements

- Must scale to millions of users
- Support multiple platforms

Some requirements

- Must scale to millions of users
- Support multiple platforms
- Handle complex business rules

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- Competitive in a fast moving market

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  - React Quickly

Some requirements

- Must scale to millions of users
- Support multiple platforms
- Handle complex business rules
- Competitive in a fast moving market
  - React Quickly
  - Out-innovate

A product like this

Search
Sara Chin
MAIN
Browse
Discover
Radio
Follow
Top Lists
Messages
Play Queue
Devices
App Finder
YOUR MUSIC
Songs
Albums
Artists
Local Files
Browse
OVERVIEW
TOP LISTS
GENRES & MOODS
NEW RELEASES
NEWS
Good Morning, Monday!
Morning Commute
Your Favorite Coffee
Ready for the Day
Feelin Good
Spotify
SPOTLIGHT
Foster The People
PLAY
FOLLOWING
OVERVIEW
RELATED ARTISTS
BIOGRAPHY
LATEST RELEASE
Supermodel
2014
POPULAR
1 Pumped up Kicks 67,340,836
2 Helena Beat 25,493,471
3 Houdini 21,605,943
4 Don't Stop (Color on the Walls) 17,815,011
5 Call It What You Want 17,759,776
SHOW 5 MORE
ALBUMS
RELATED ARTISTS
The Black Keys
Neon Trees
Of Monsters And ...
Gotye
Florence + The M...
The Strokes
Arctic Monkeys
Best Friend
Foster The People
RELATED MUSIC
Making Mirrors
Gotye
The Source
Sleepyhead
Passion Pit
Colours
People
AWOLNATION
Daylight
Matt and Kim
Such Great Heights
The Postal Service
Waste
Foster The People
Jump Into The Fog
The Wombats
Search
Browse
Discover
Radio
Your Music
Follow
Sara
Carrier
6:21 PM
Foster The People
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908,149 FOLLOWERS
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11 tracks • 2014
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Spotify®

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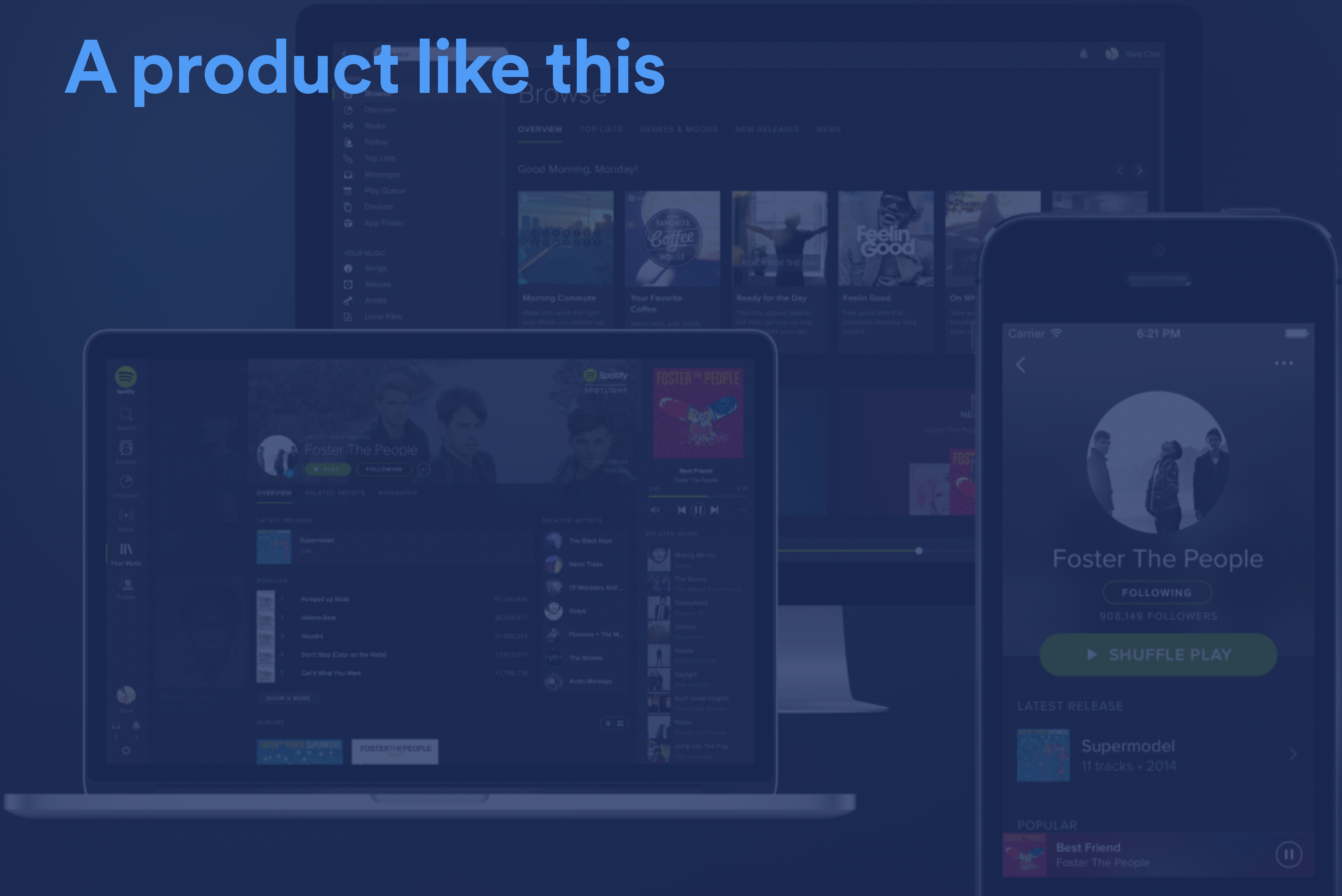
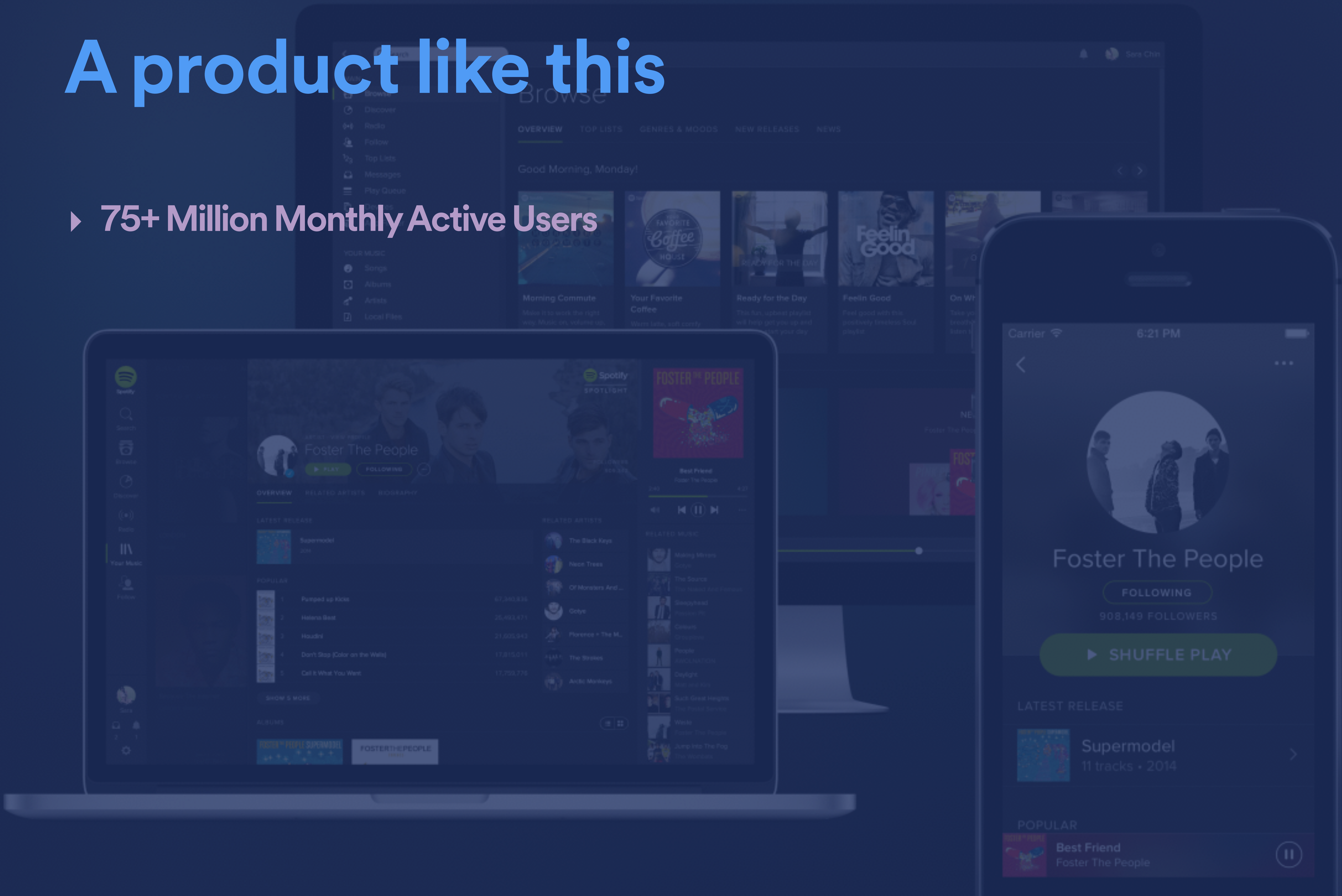
A product like this



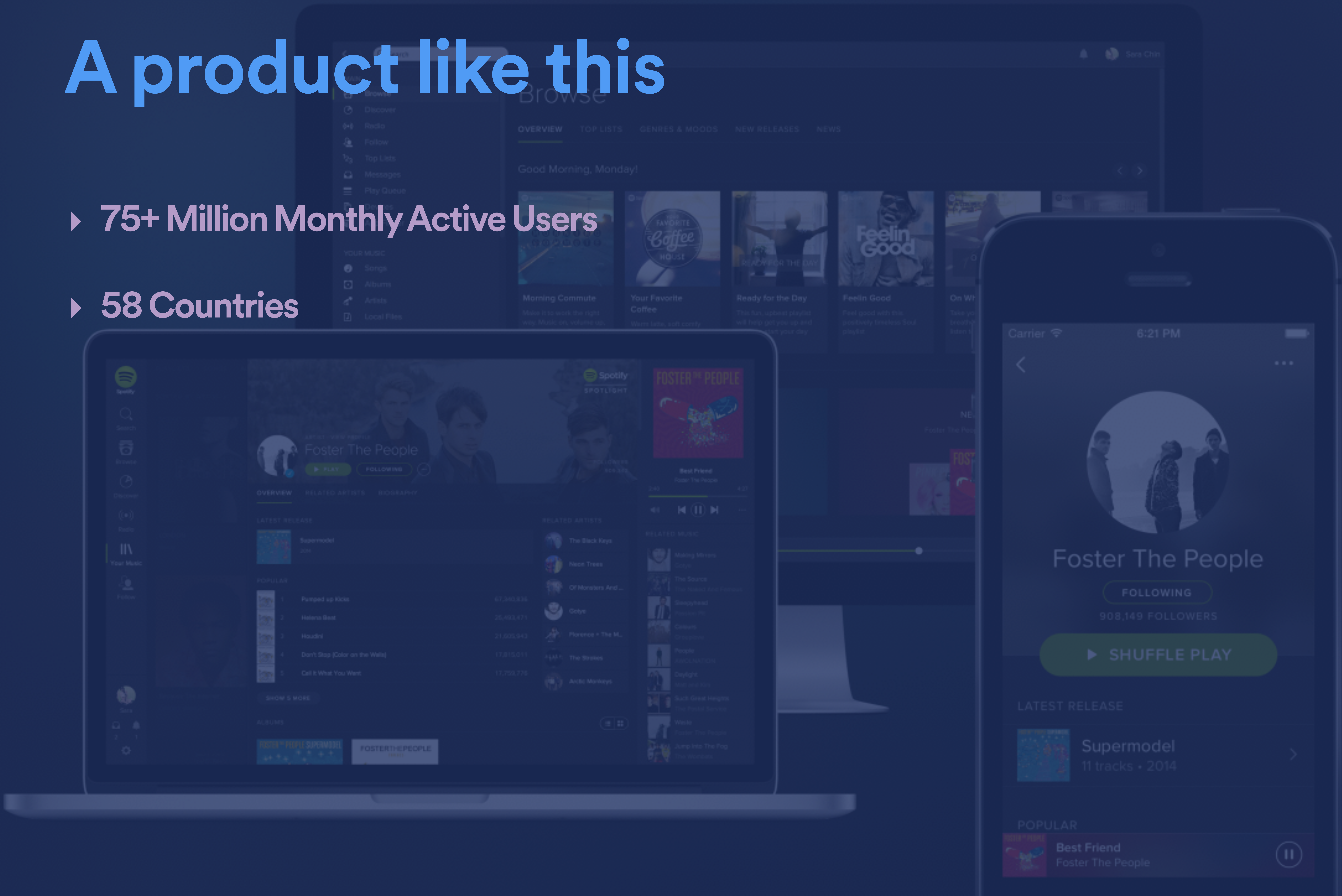
A product like this

- 75+ Million Monthly Active Users



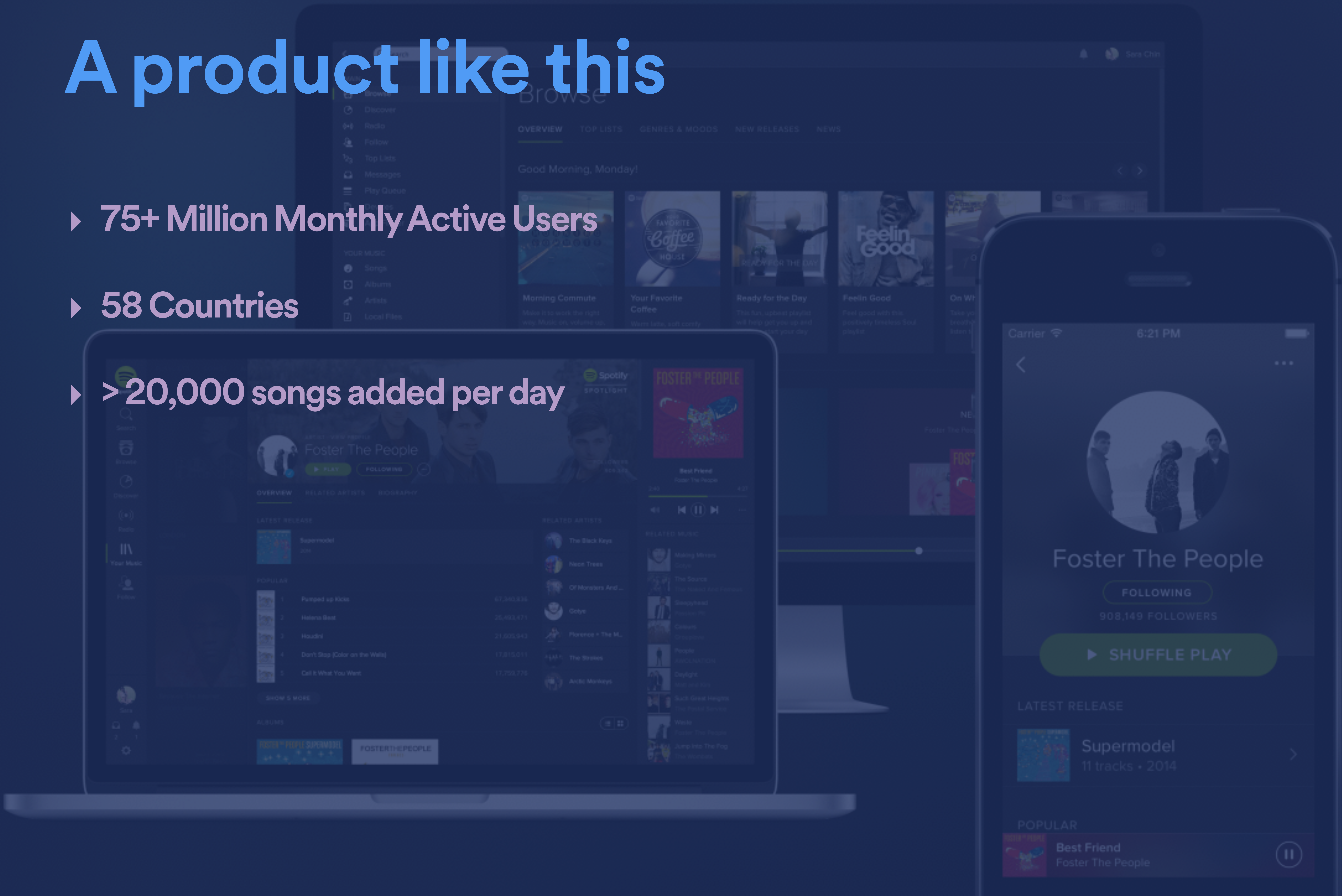
A product like this

- 75+ Million Monthly Active Users
- 58 Countries



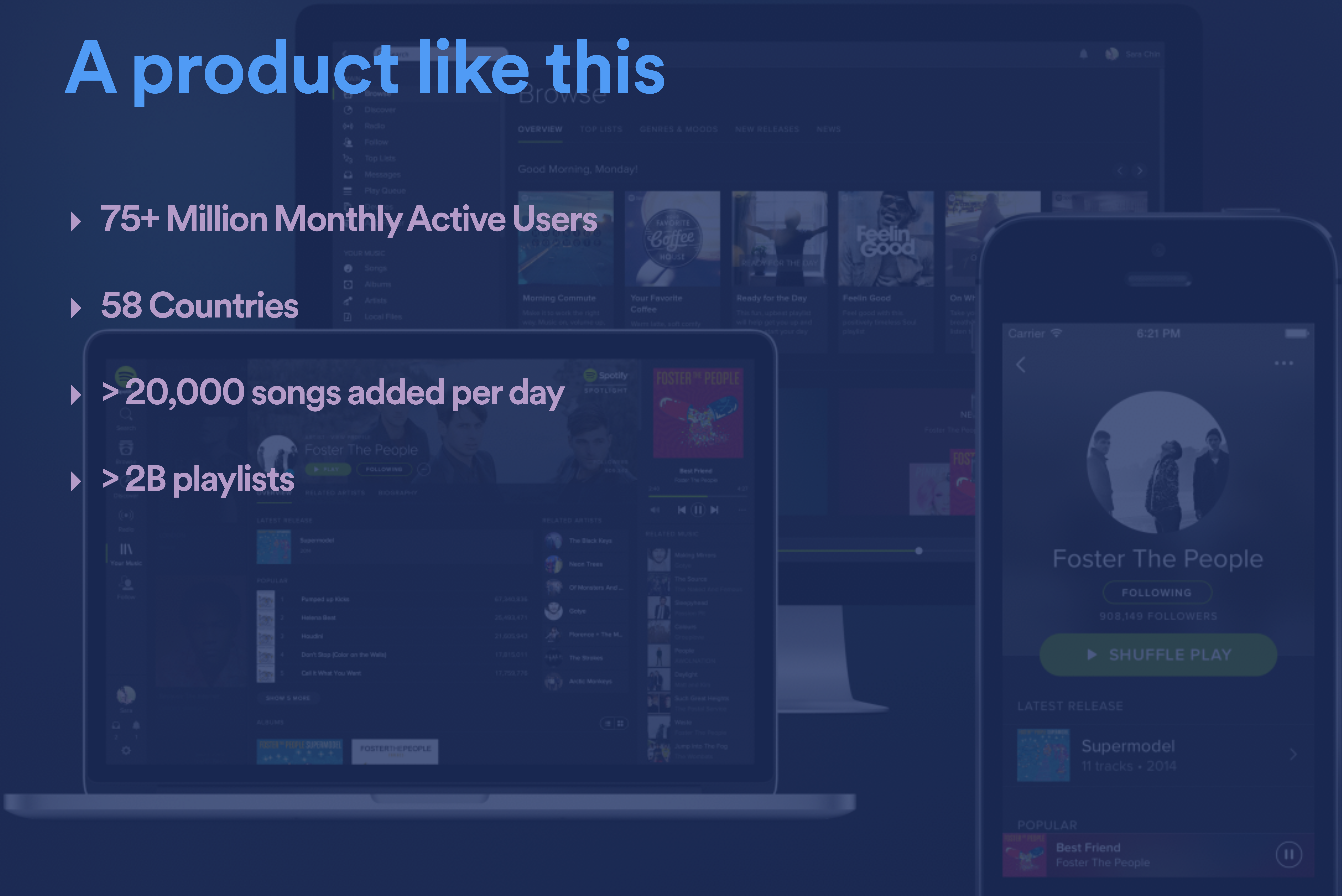
A product like this

- 75+ Million Monthly Active Users
- 58 Countries
- >20,000 songs added per day



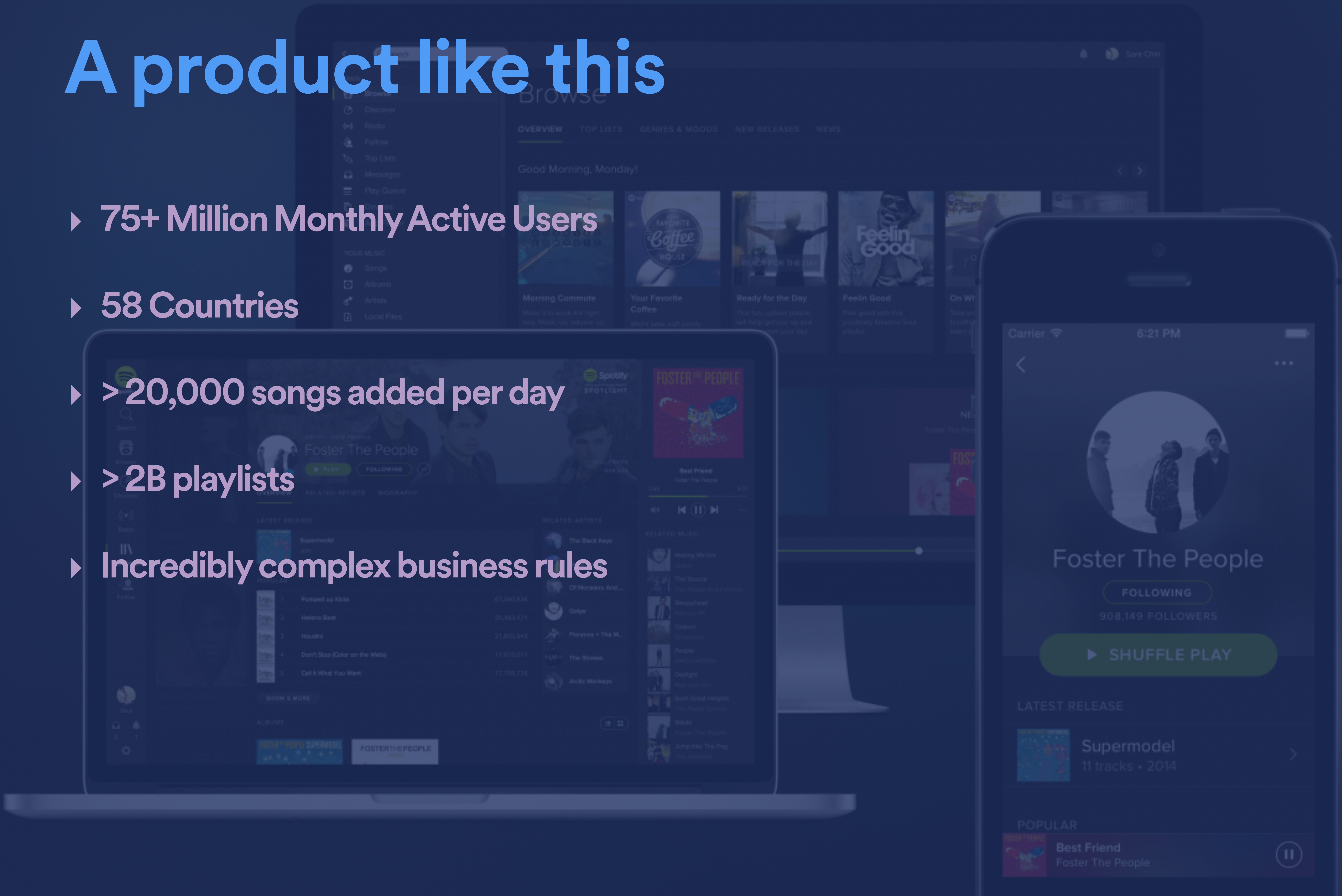
A product like this

- 75+ Million Monthly Active Users
- 58 Countries
- > 20,000 songs added per day
- > 2B playlists



A product like this

- 75+ Million Monthly Active Users
- 58 Countries
- > 20,000 songs added per day
- > 2B playlists
- Incredibly complex business rules



A product like this

- 75+ Million Monthly Active Users
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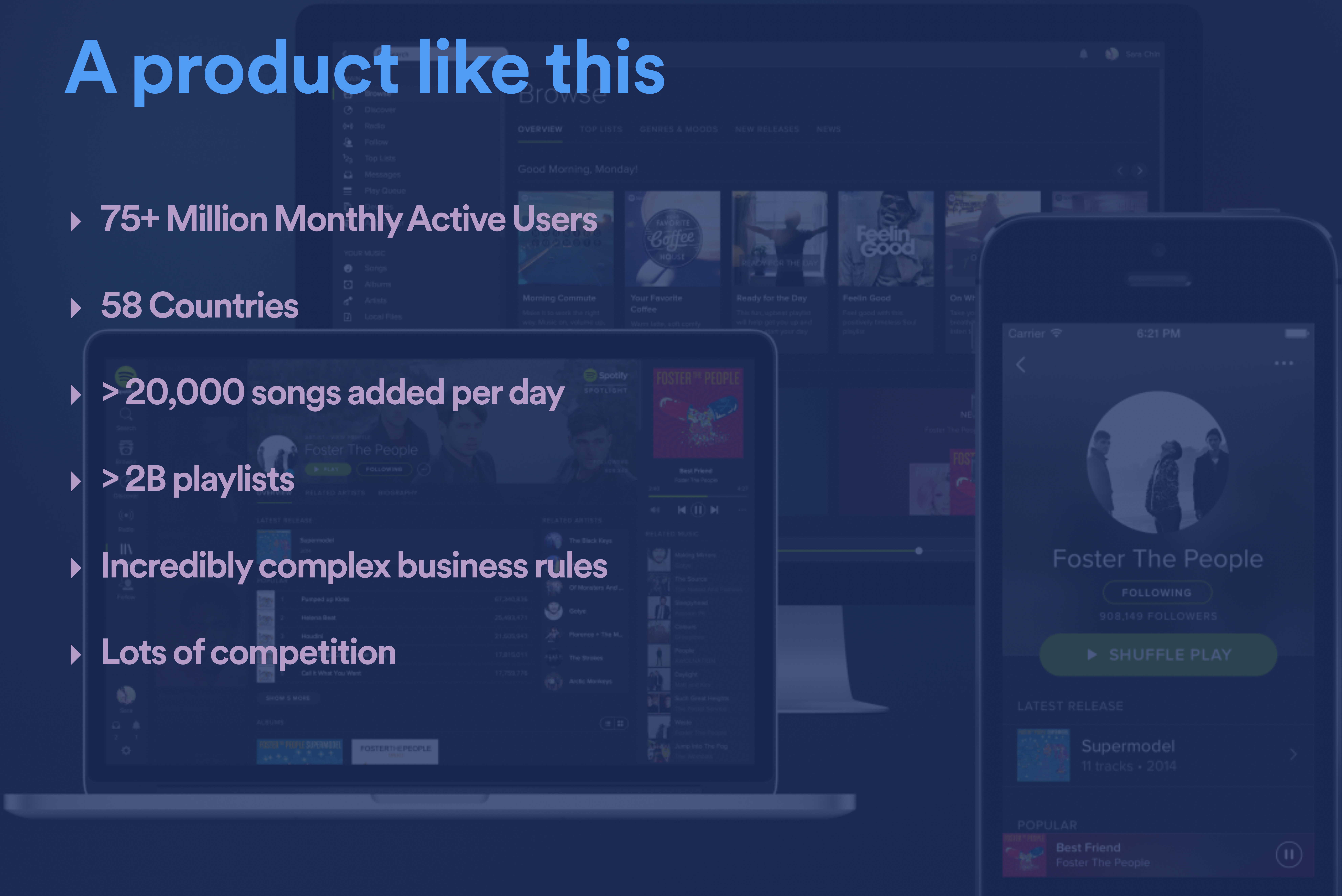
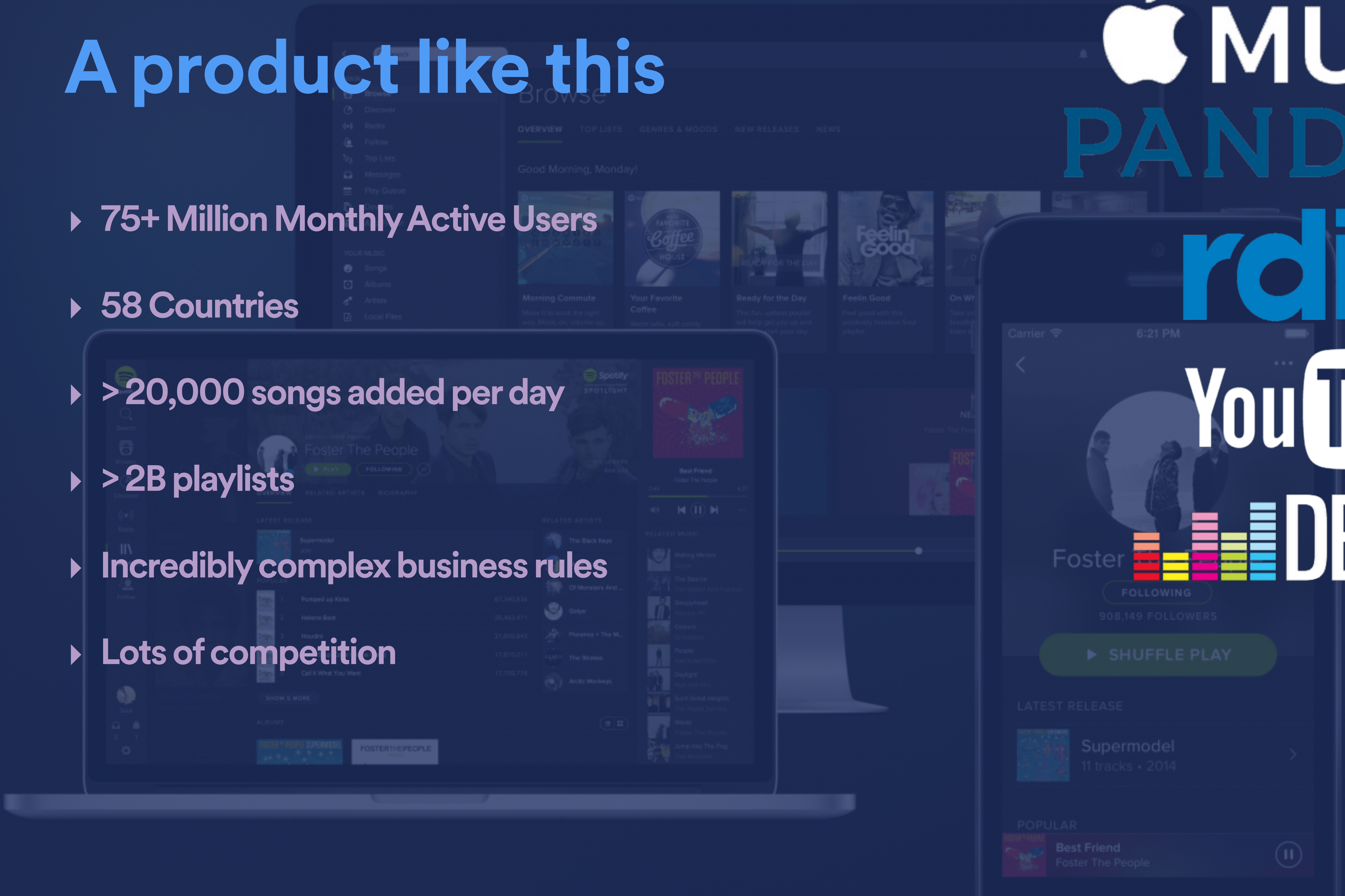
- > 20,000 songs added per day
- > 2B playlists
- Incredibly complex business rules
- Lots of competition



A product like this



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MUSIC

PANDORA®

rdio™

YouTube

DEEZER

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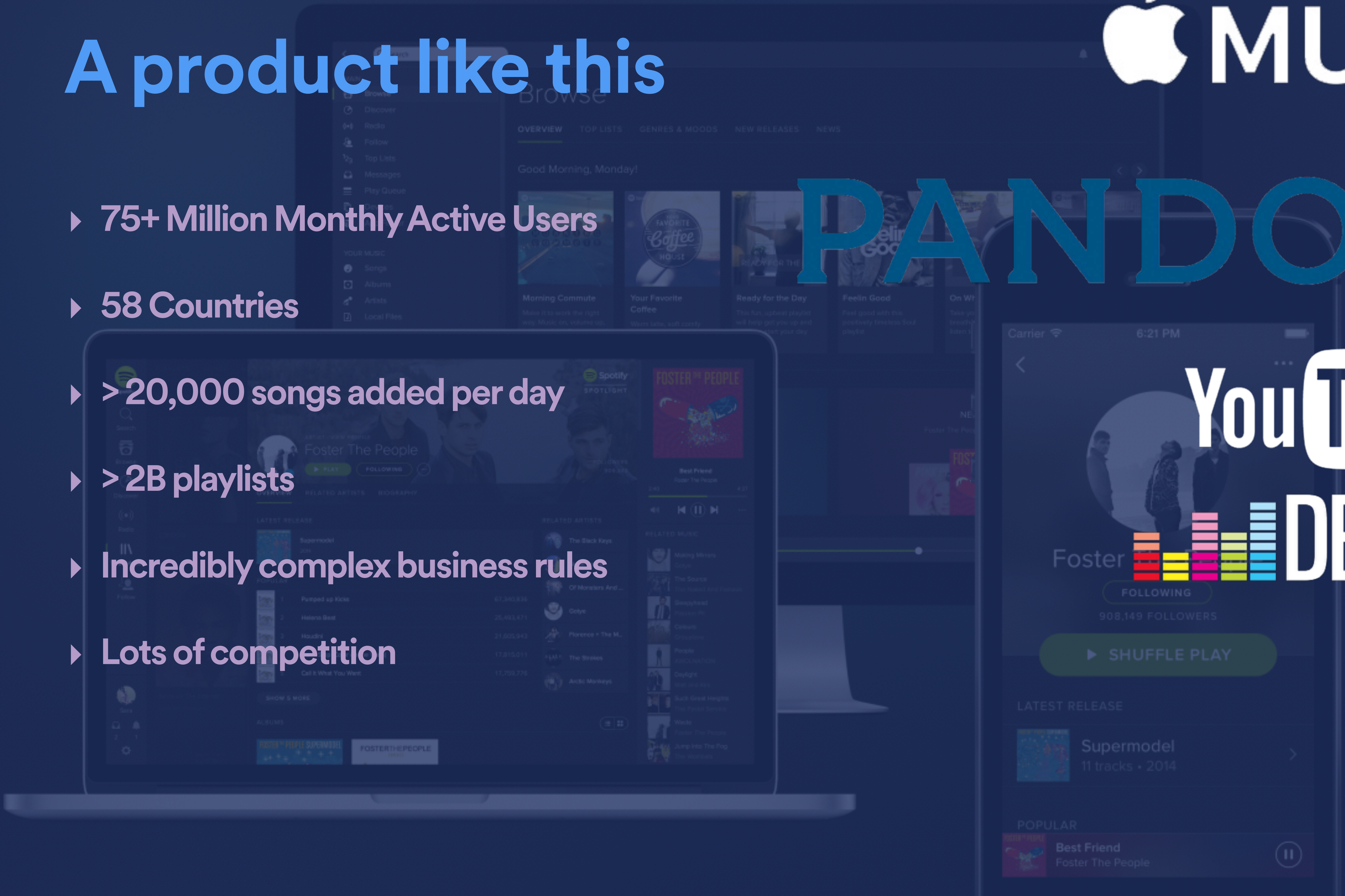

MUSIC

PANDORA®

YouTube

DEEZER

How do you support these requirements while moving fast and innovating?

Spotify®

Solution

Autonomous full-stack teams

Autonomous

adjective
au·ton·o·mous - \ȯ-ˈtä-nə-məs\

(of a country or region) having the freedom to govern itself or control its own affairs.
"the federation included sixteen autonomous republics"
having the freedom to act independently.
"school governors are legally autonomous"
synonyms: *self-governing, independent, sovereign, free, self-ruling, self-determining, autarchic; self-sufficient*
"an autonomous republic"

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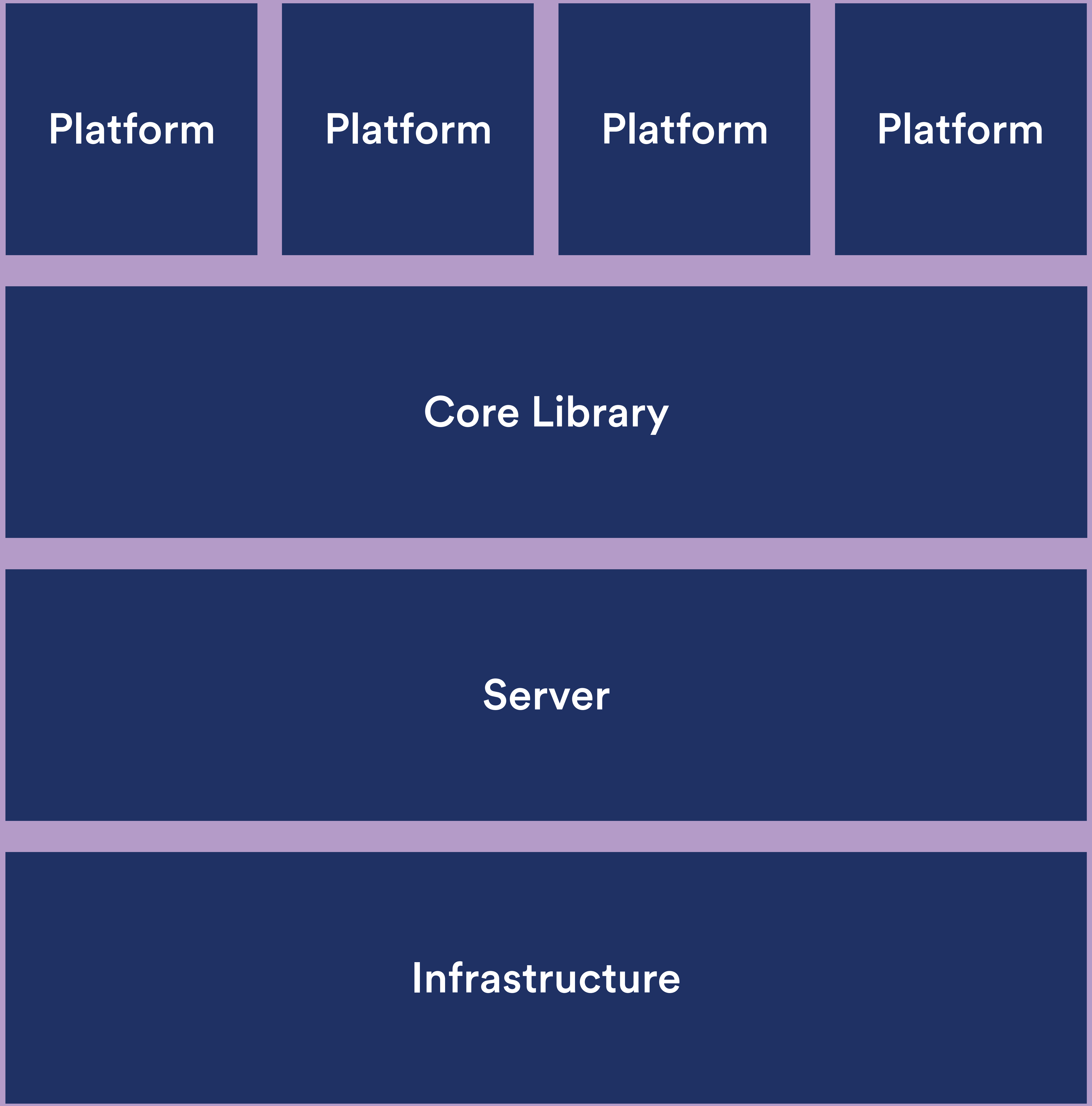

Platform

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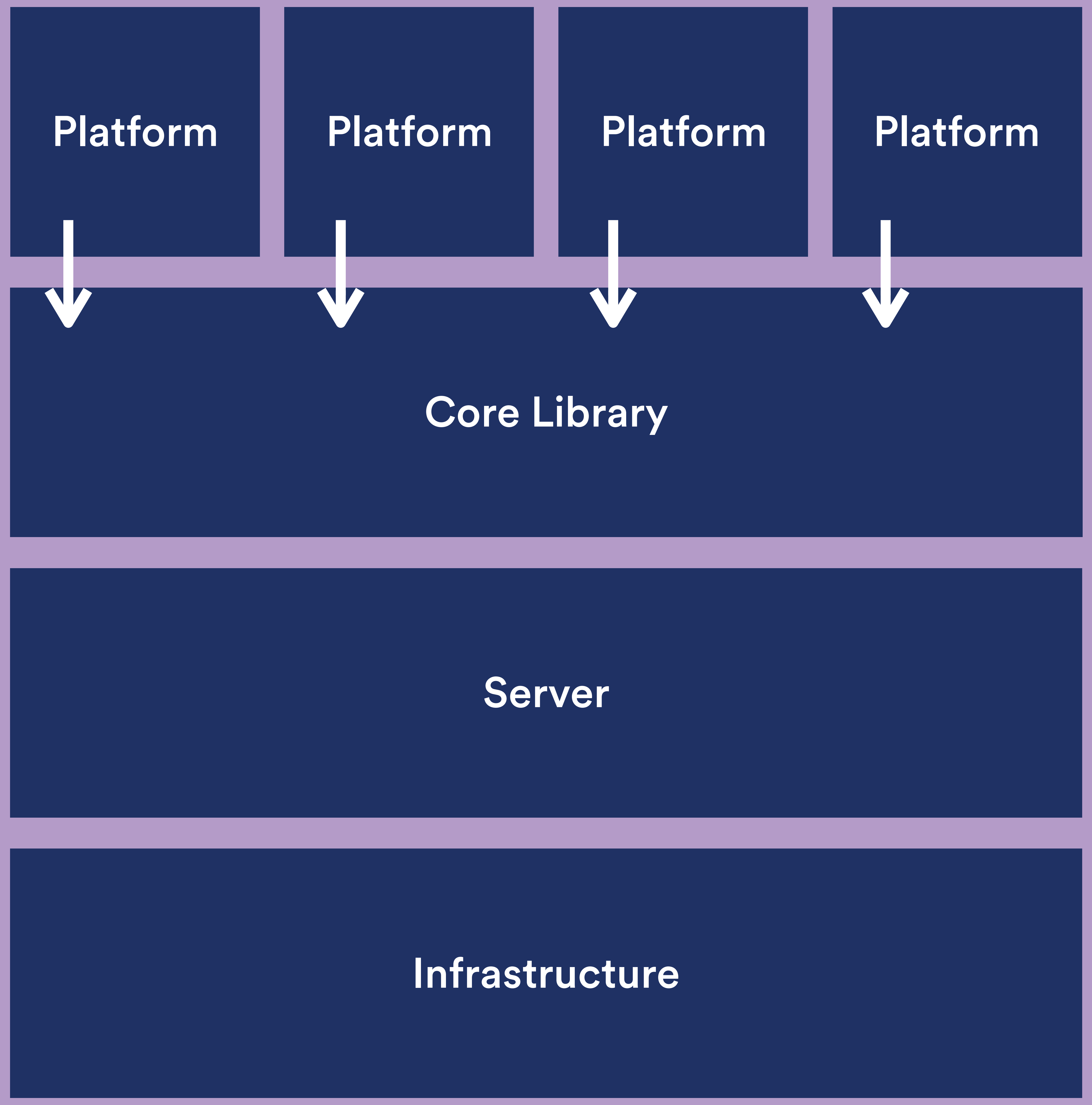
Platform

Platform

Core Library

Server

Infrastructure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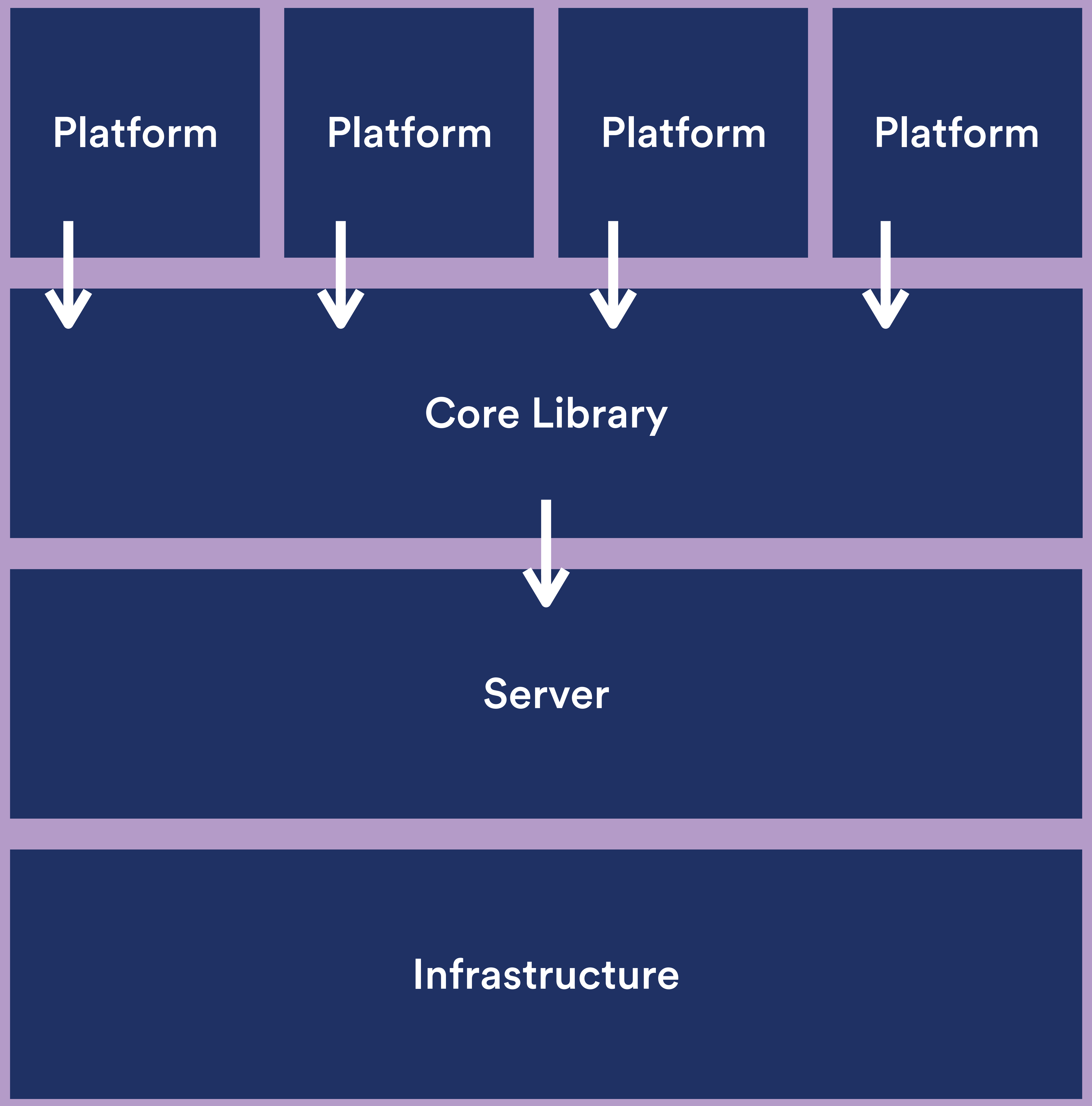

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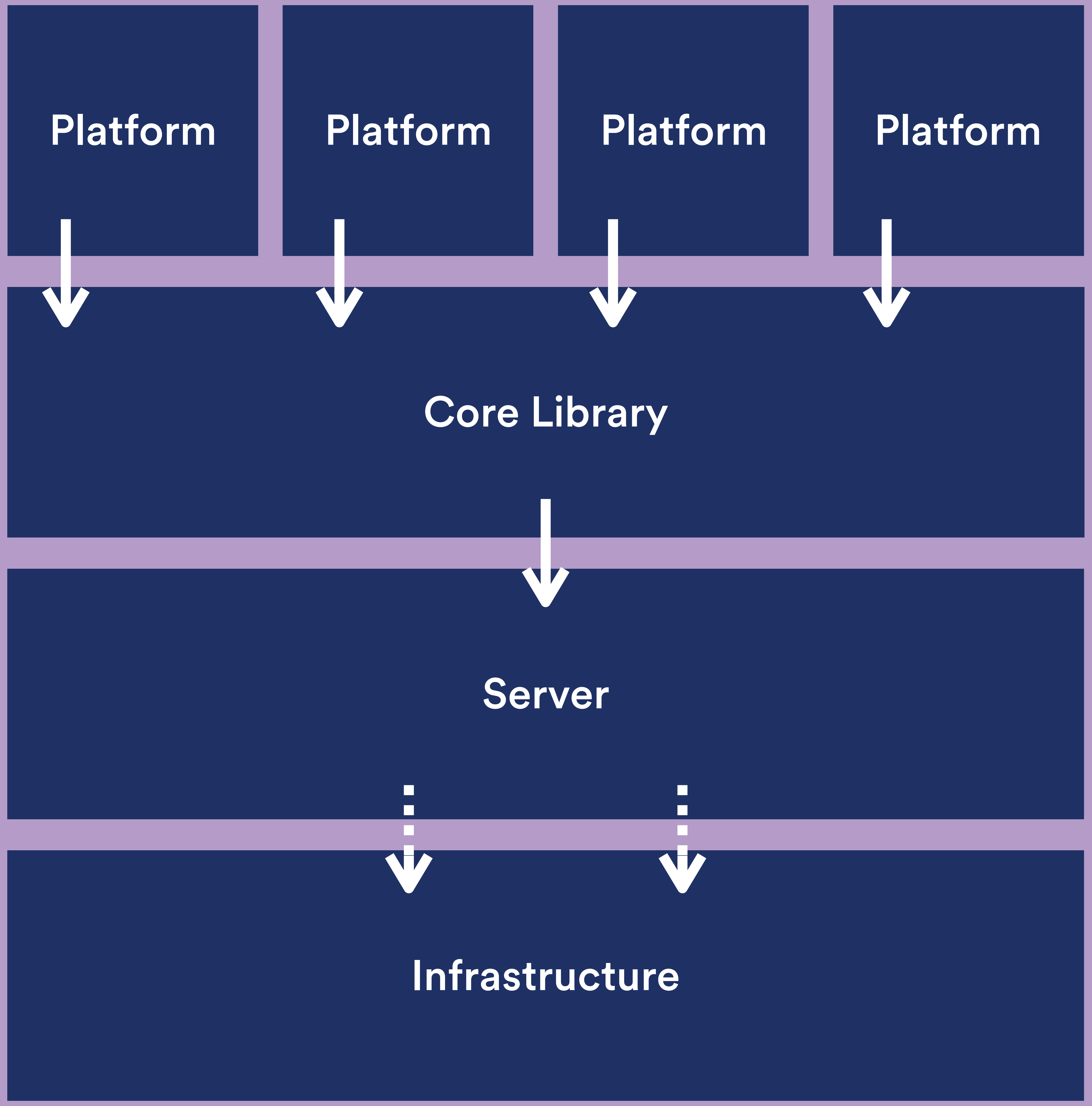
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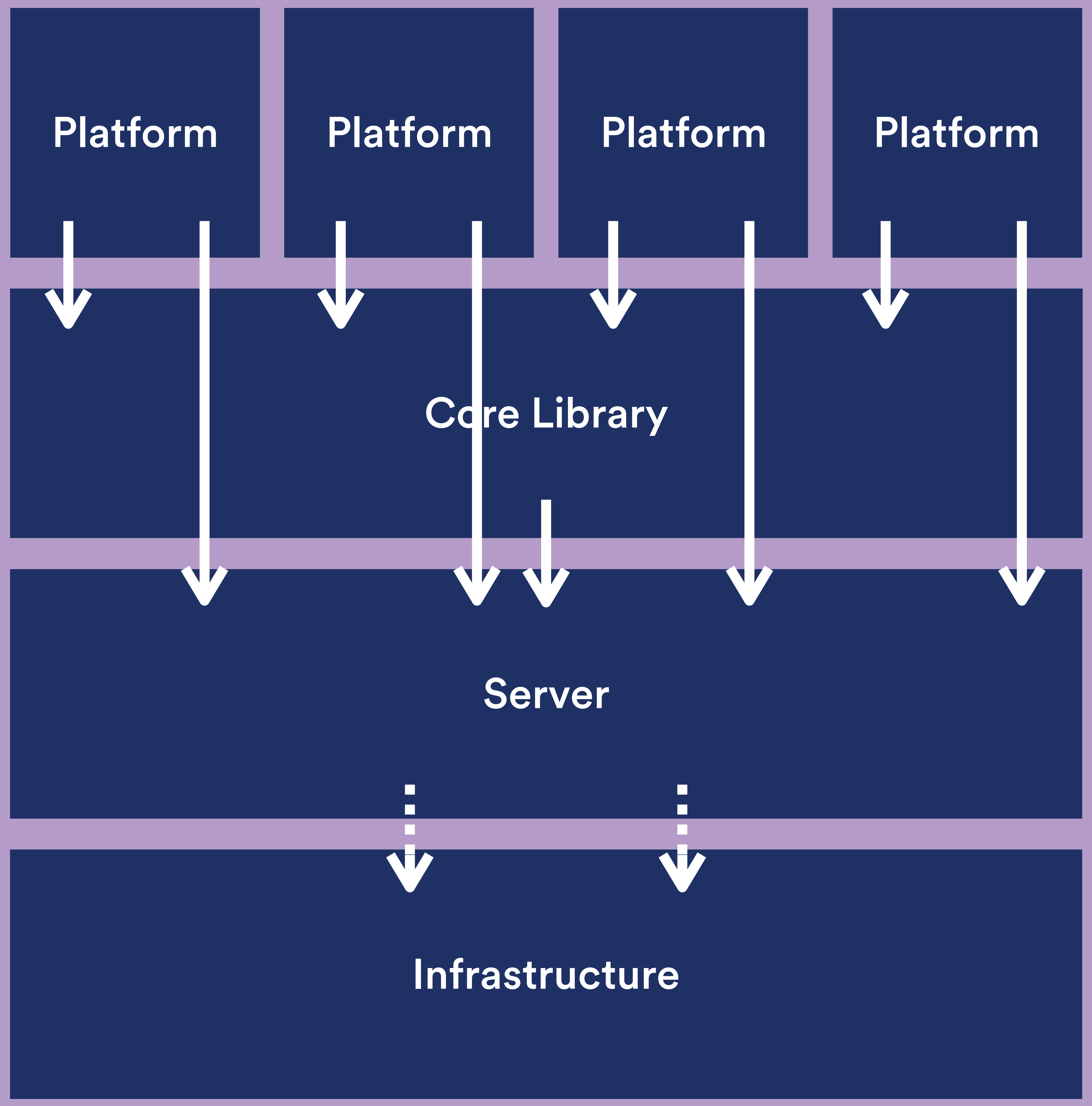
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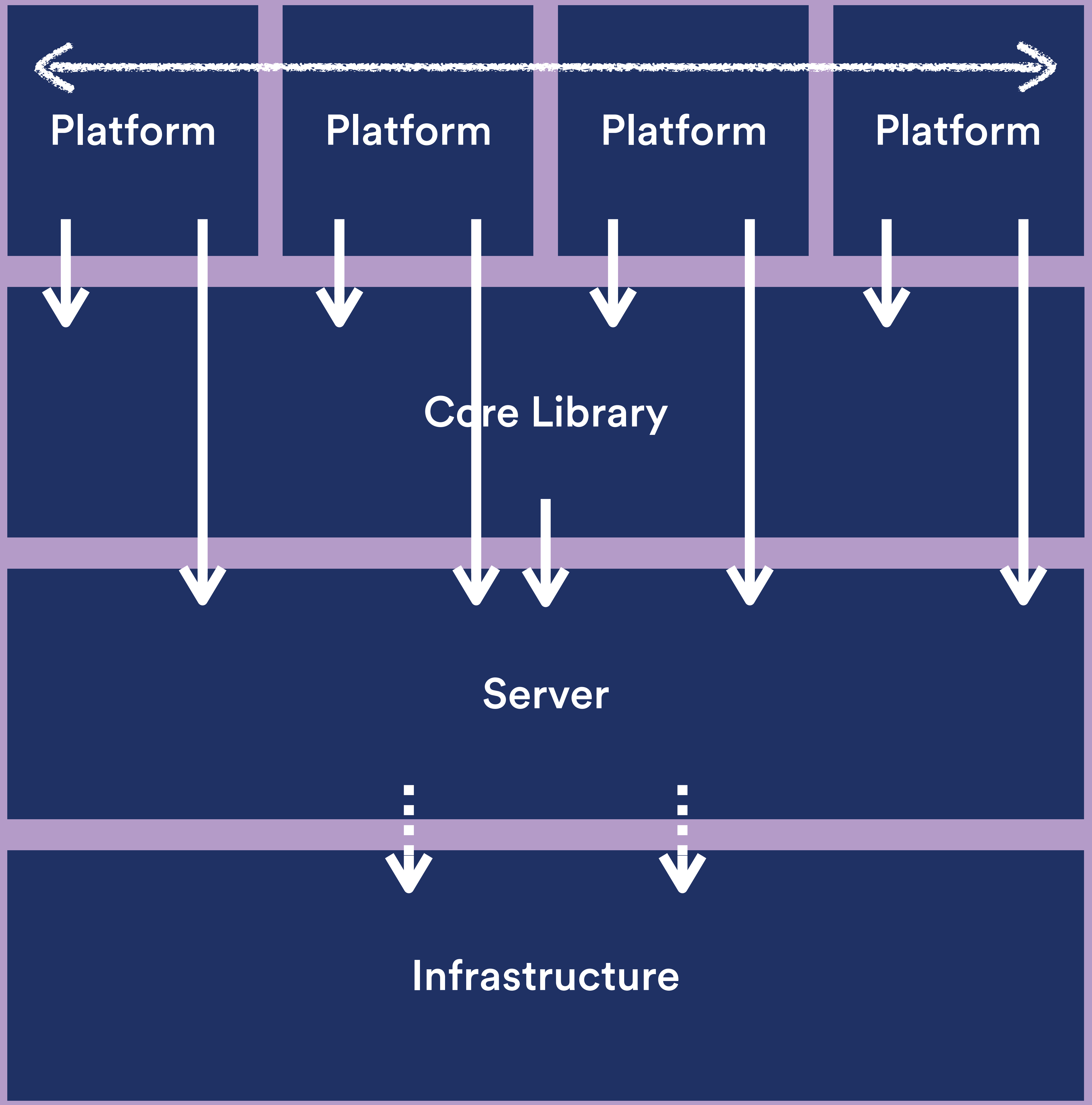
Platform
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Challenges

Challenges

Synchronization

Challenges

Client UX implementation

Synchronization

Challenges

Client UX implementation depends on

Synchronization

Challenges

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Client UX implementation depends on

Core Library Implementation

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Challenges

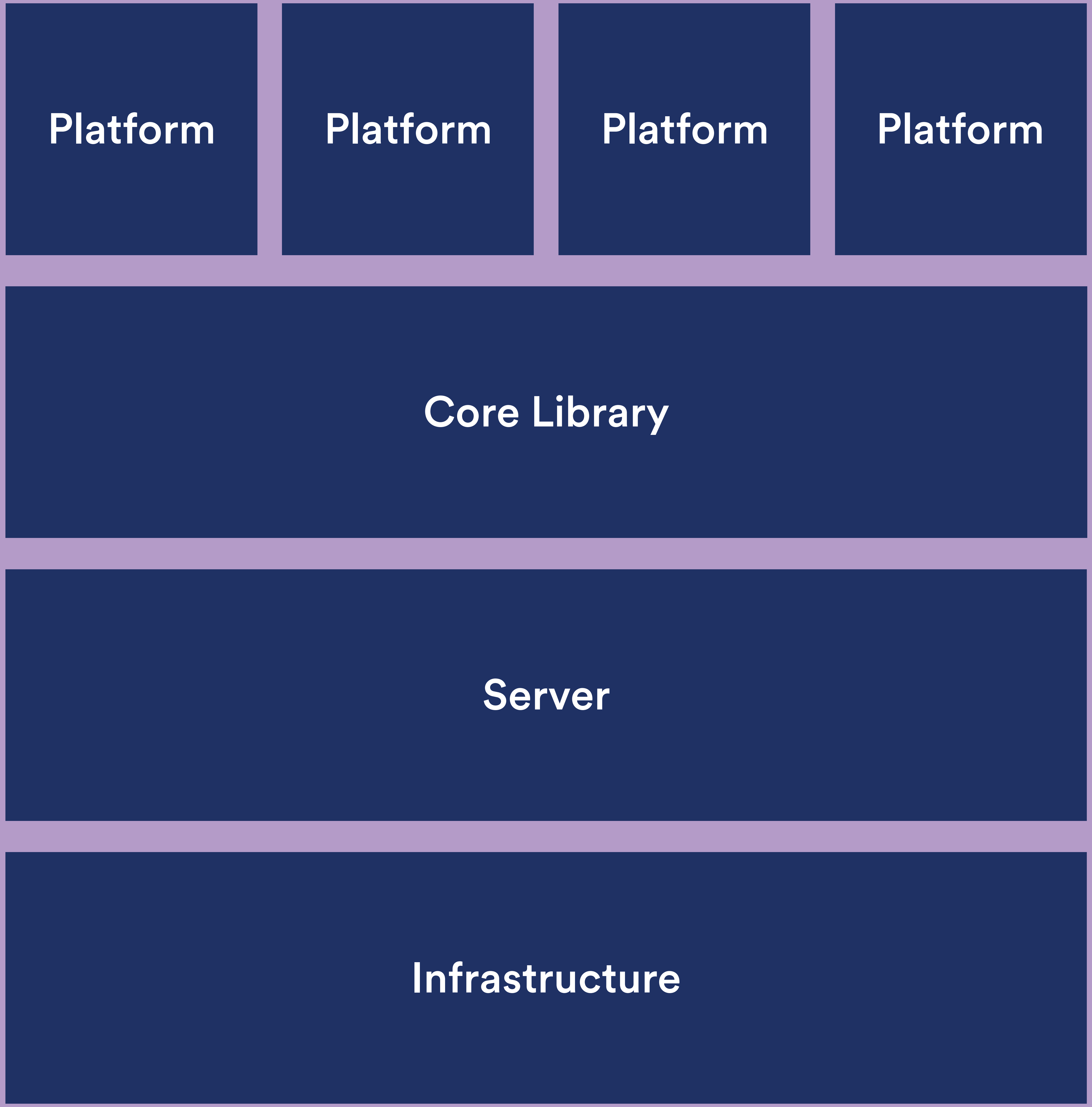
Synchronization

Client UX implementation depends on

Core Library Implementation depends on

Server Implementation depends on

Infrastructure Implementation



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Core Library

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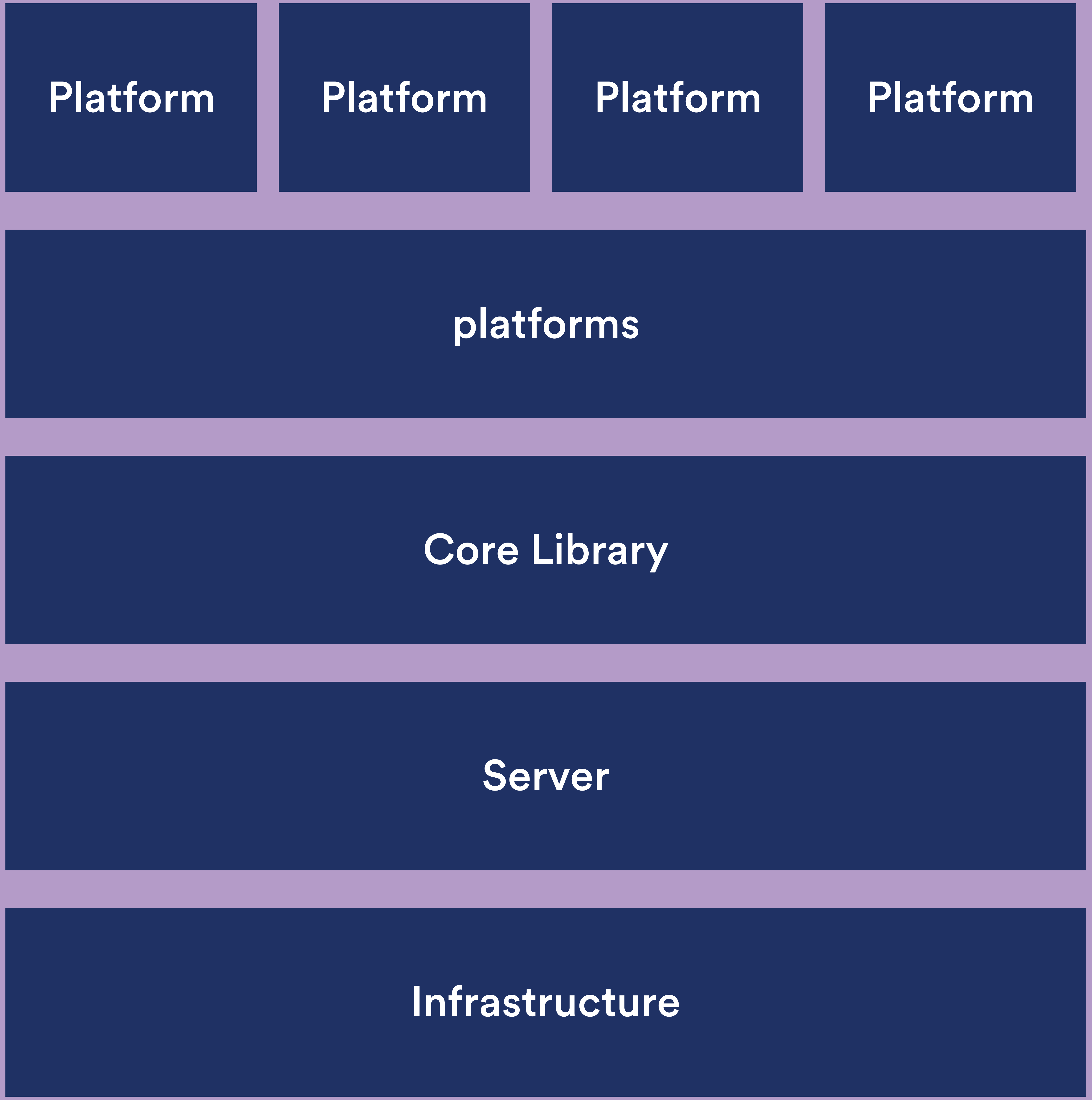

Platform

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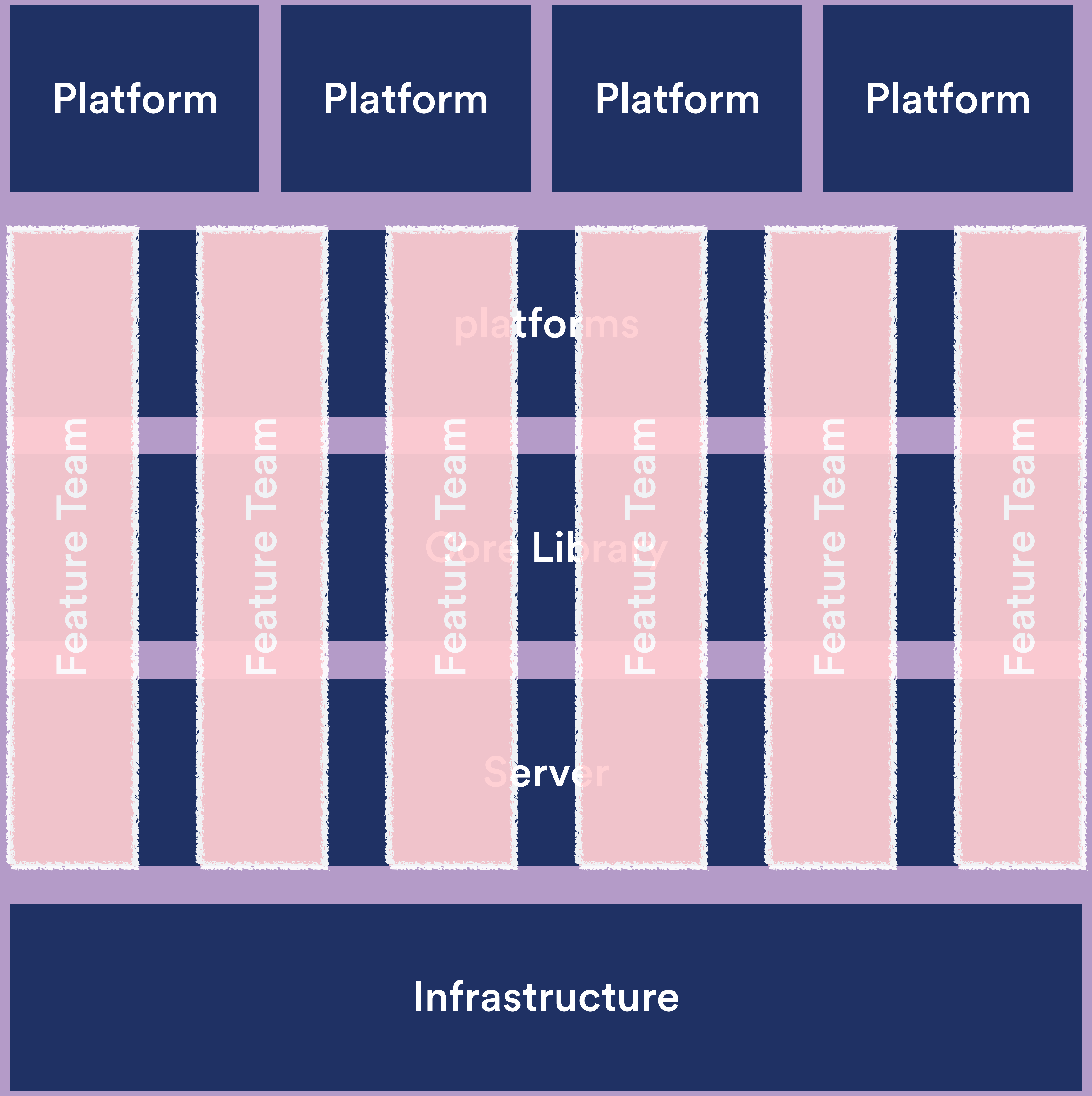
Platform

platforms

Core Library

Server

Infrastructure



Platform

Platform

Platform

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platforms

Core Library

Server

Feature Team

Feature Team

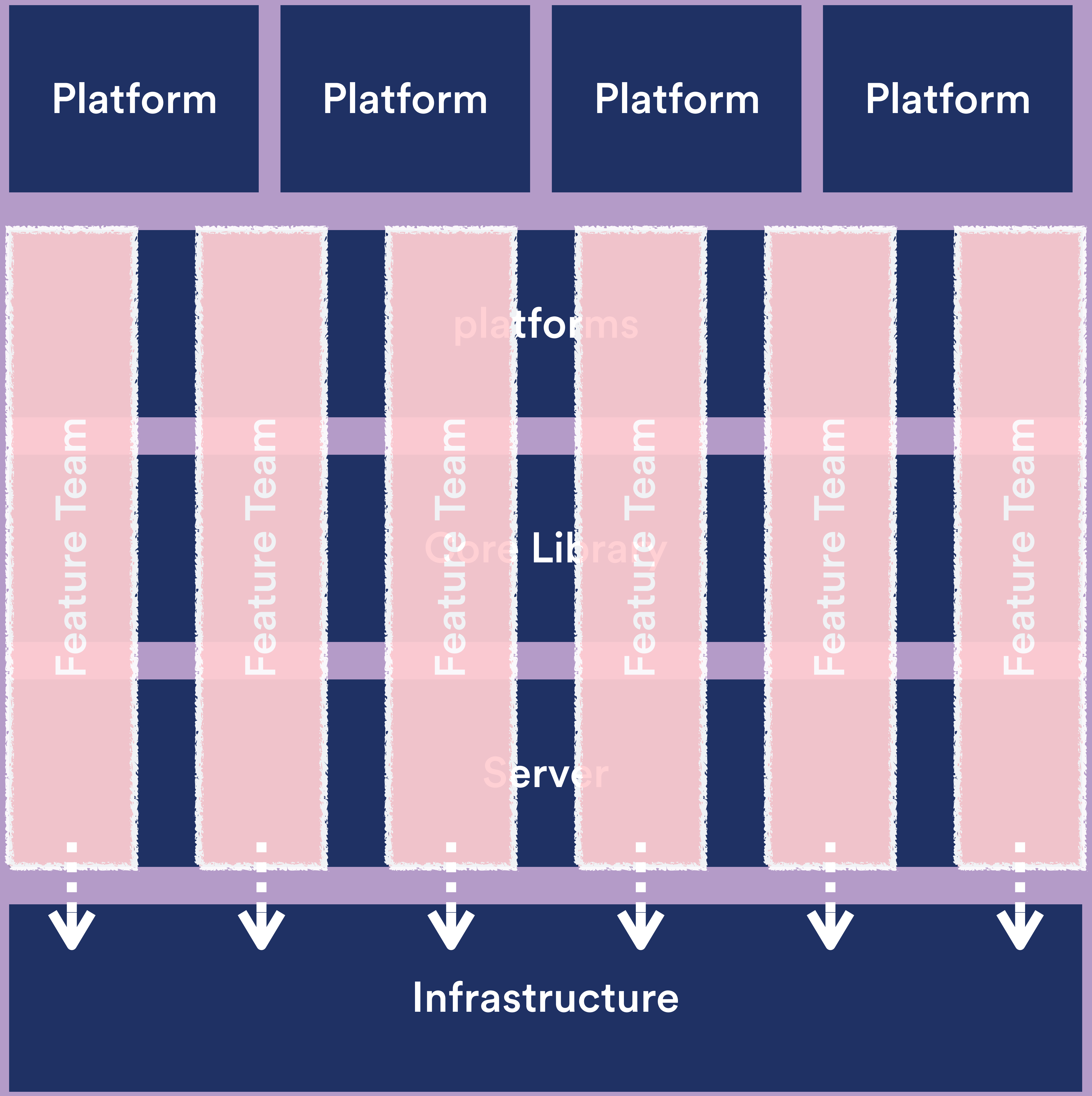
Feature Team

Feature Team

Feature Team

Feature Team

Infrastructure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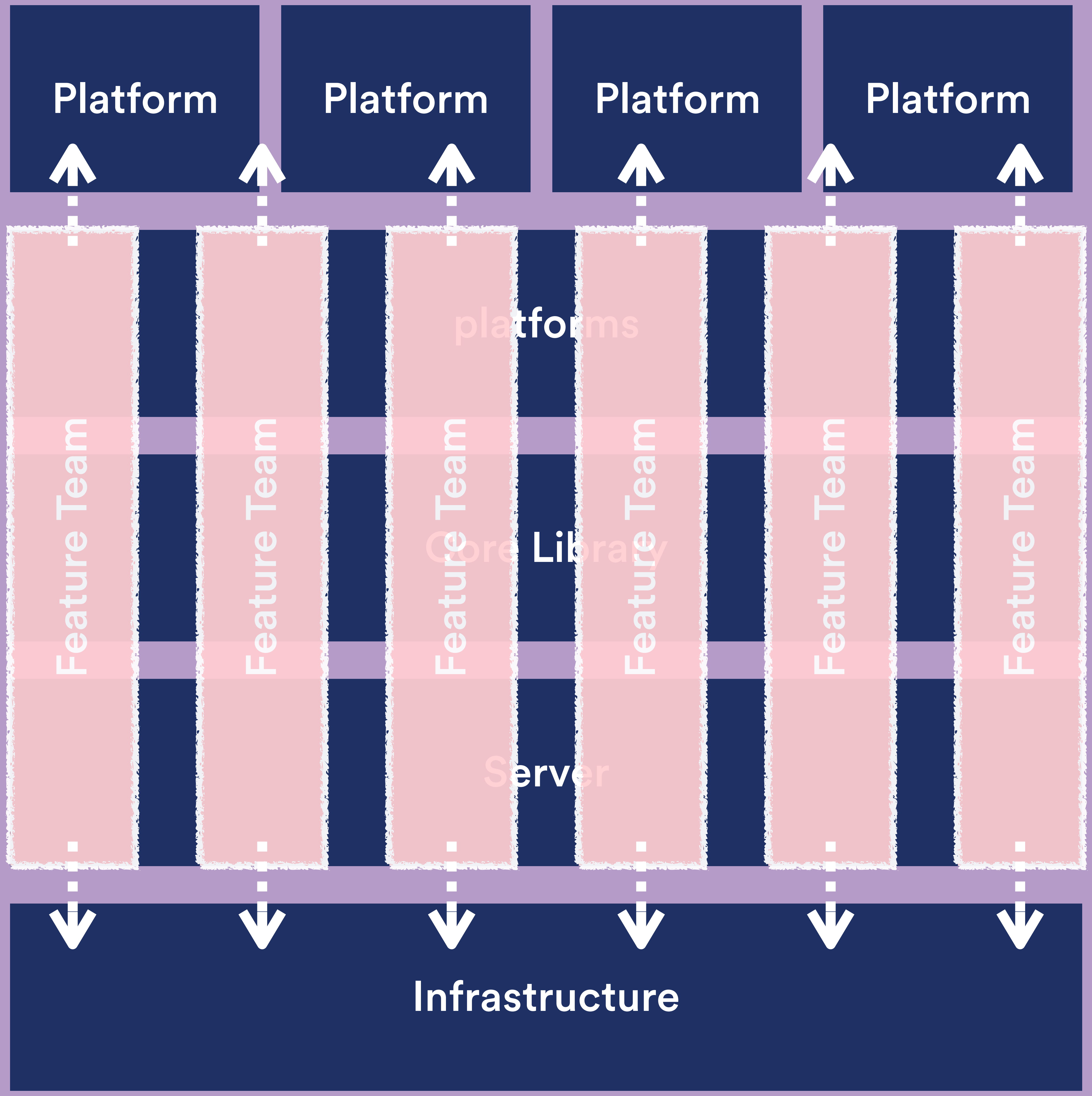
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Spotify®

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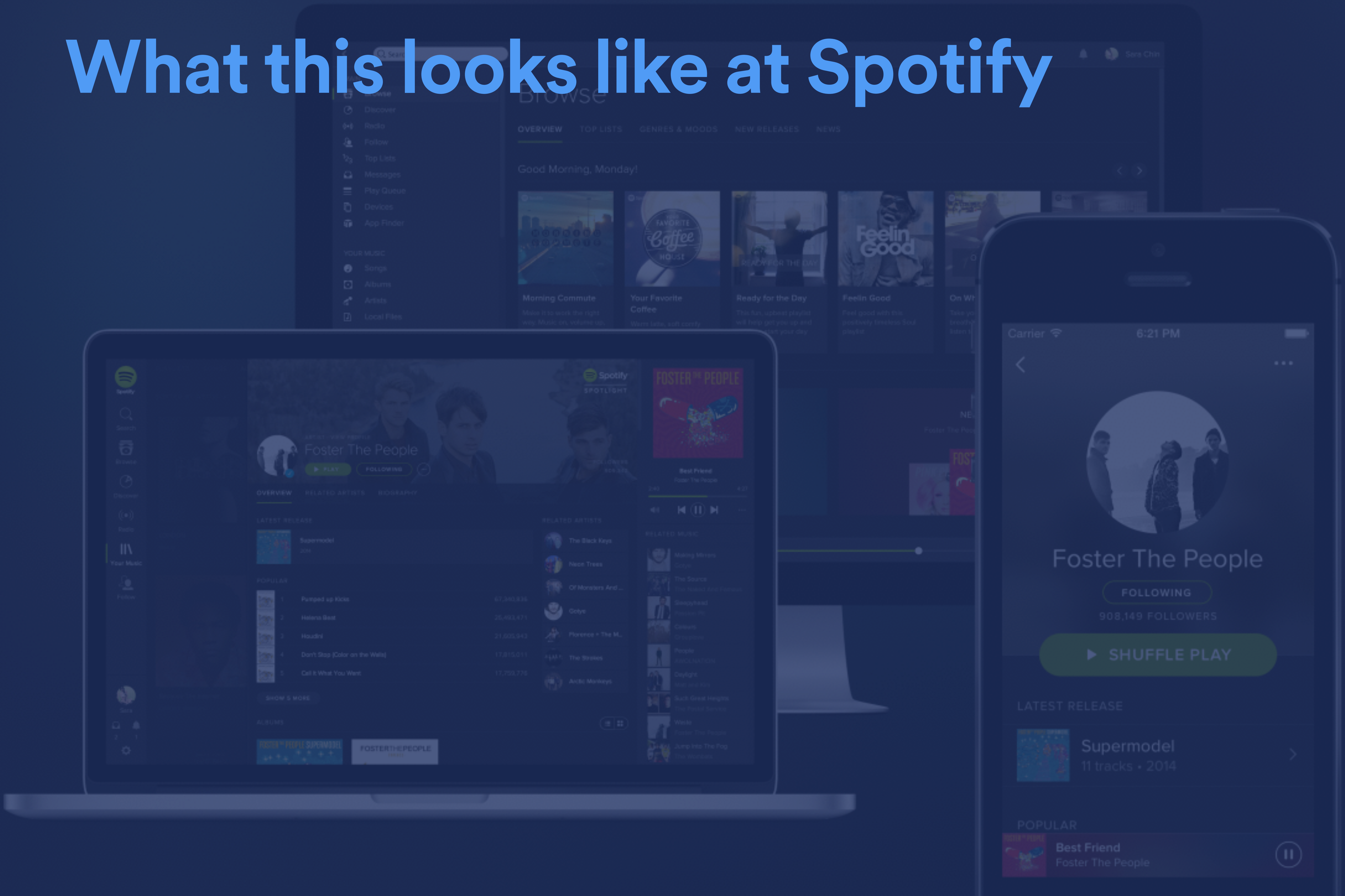
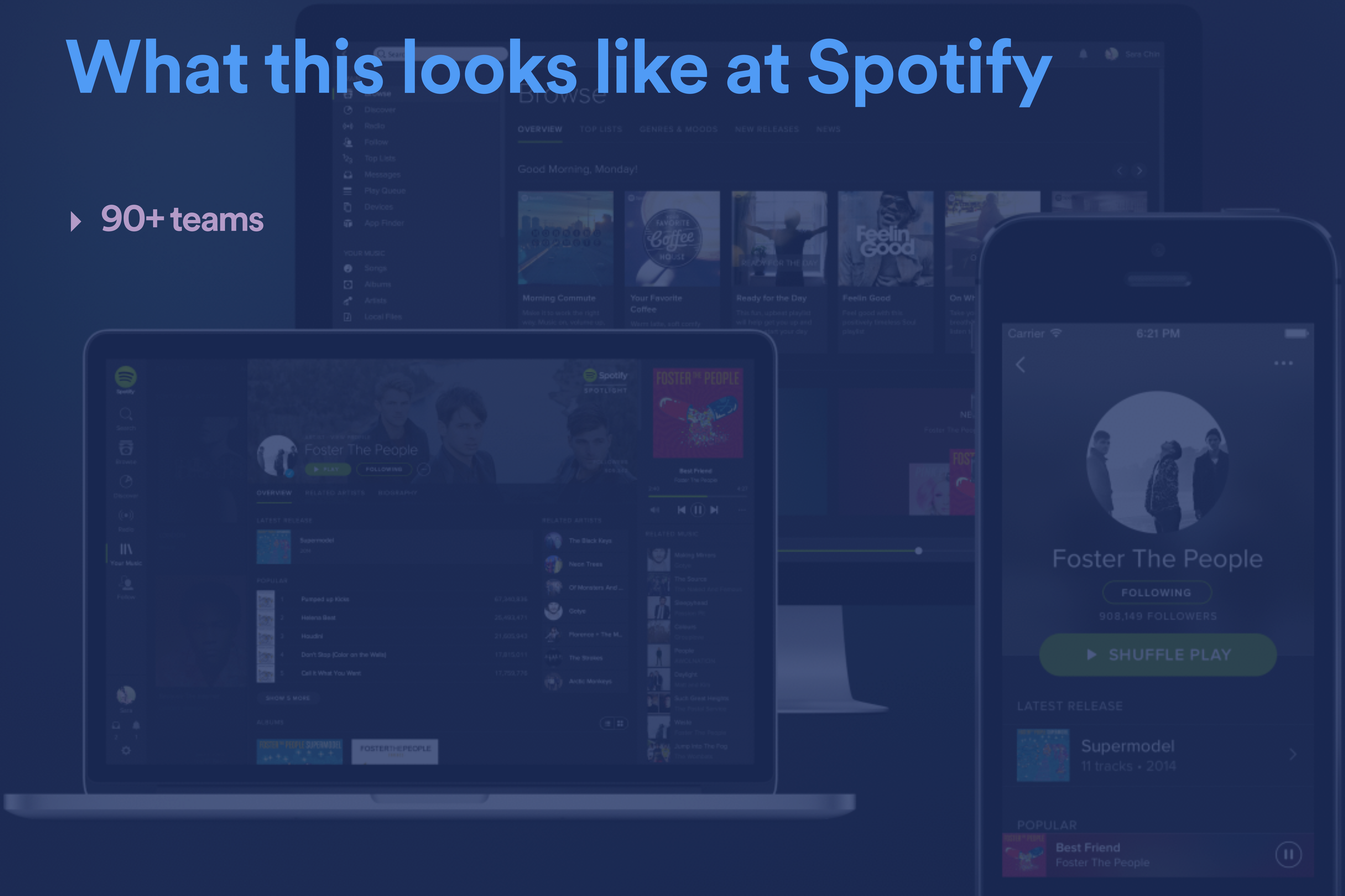
What this looks like at Spotify



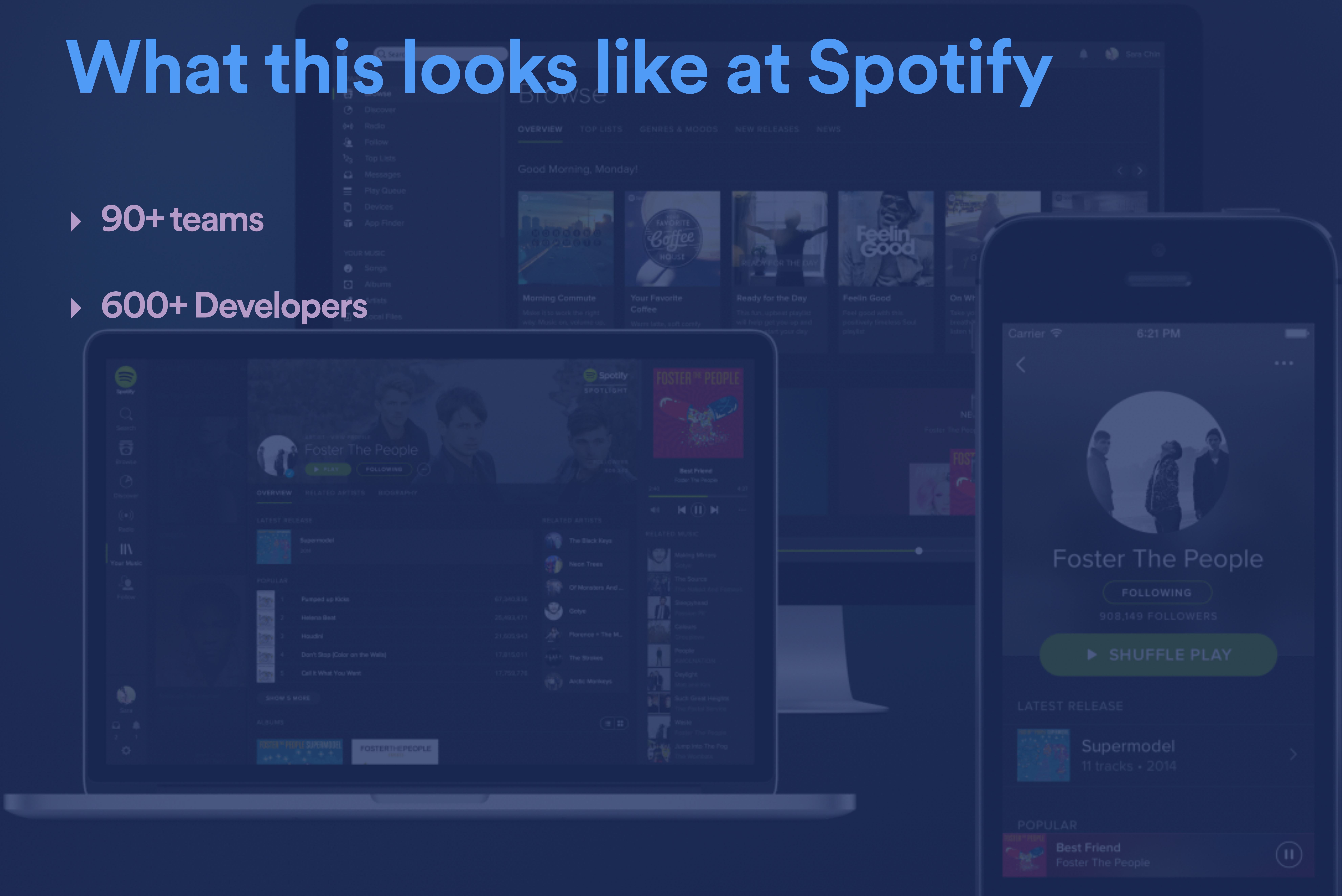
What this looks like at Spotify

- 90+ teams



What this looks like at Spotify

- 90+ teams
- 600+ Developers



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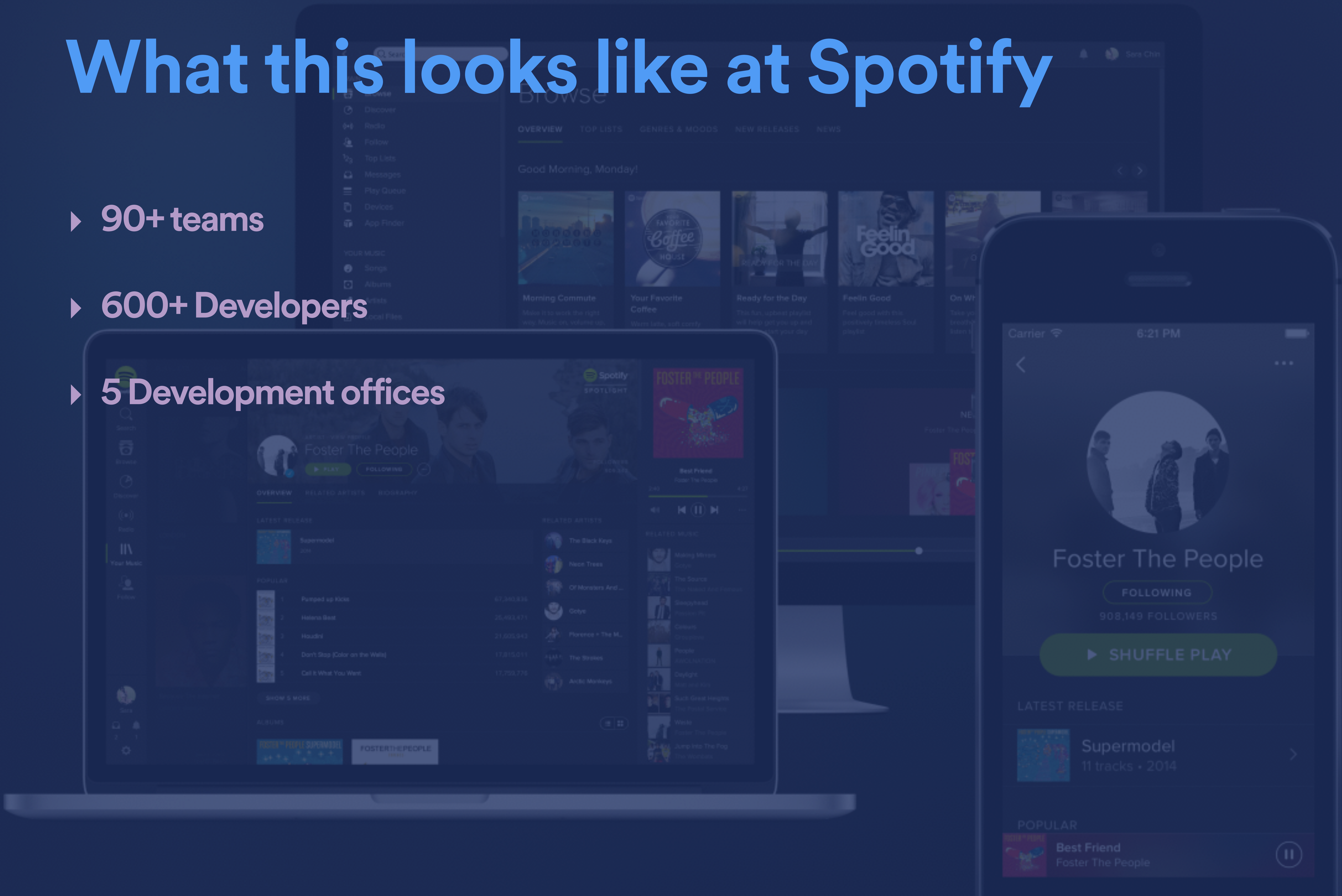

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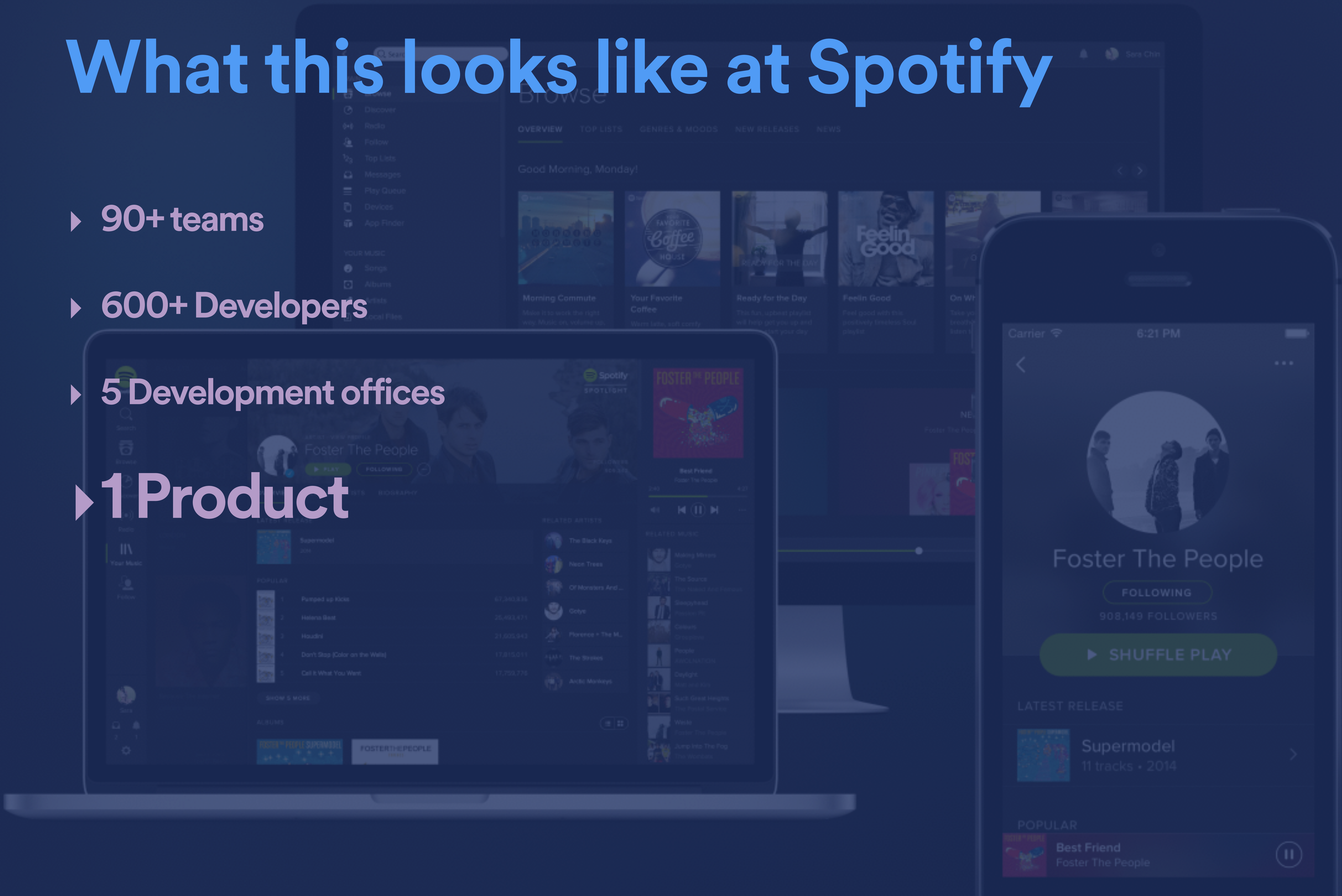


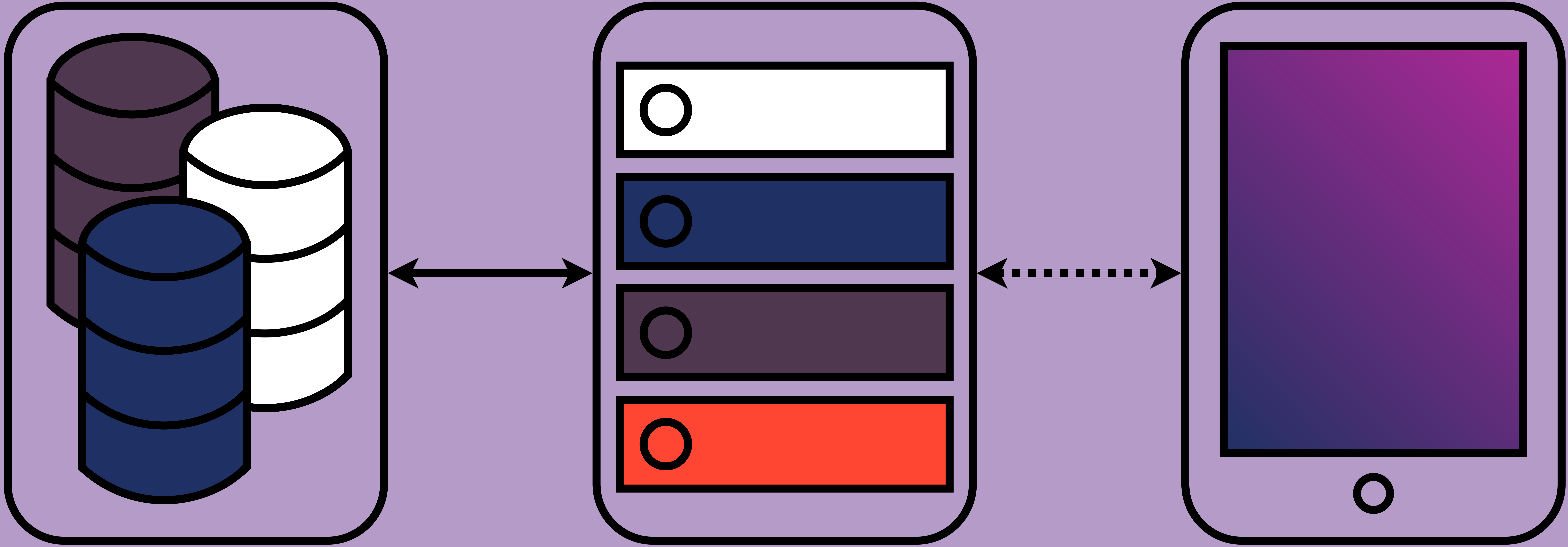
- 90+ teams
- 600+ Developers
- 5 Development offices
- **1 Product**

Full-stack autonomous teams

Requires you to structure your application in loosely coupled parts

Services

Spotify®



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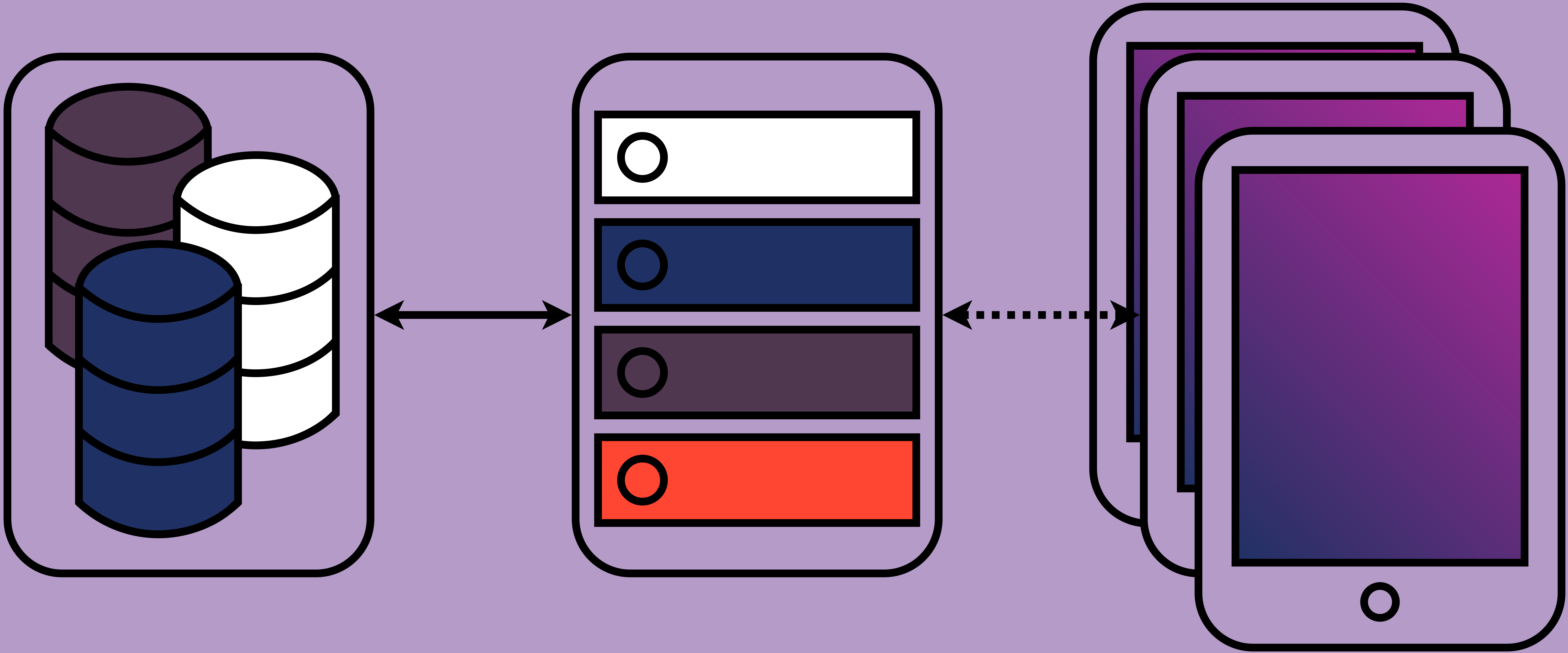

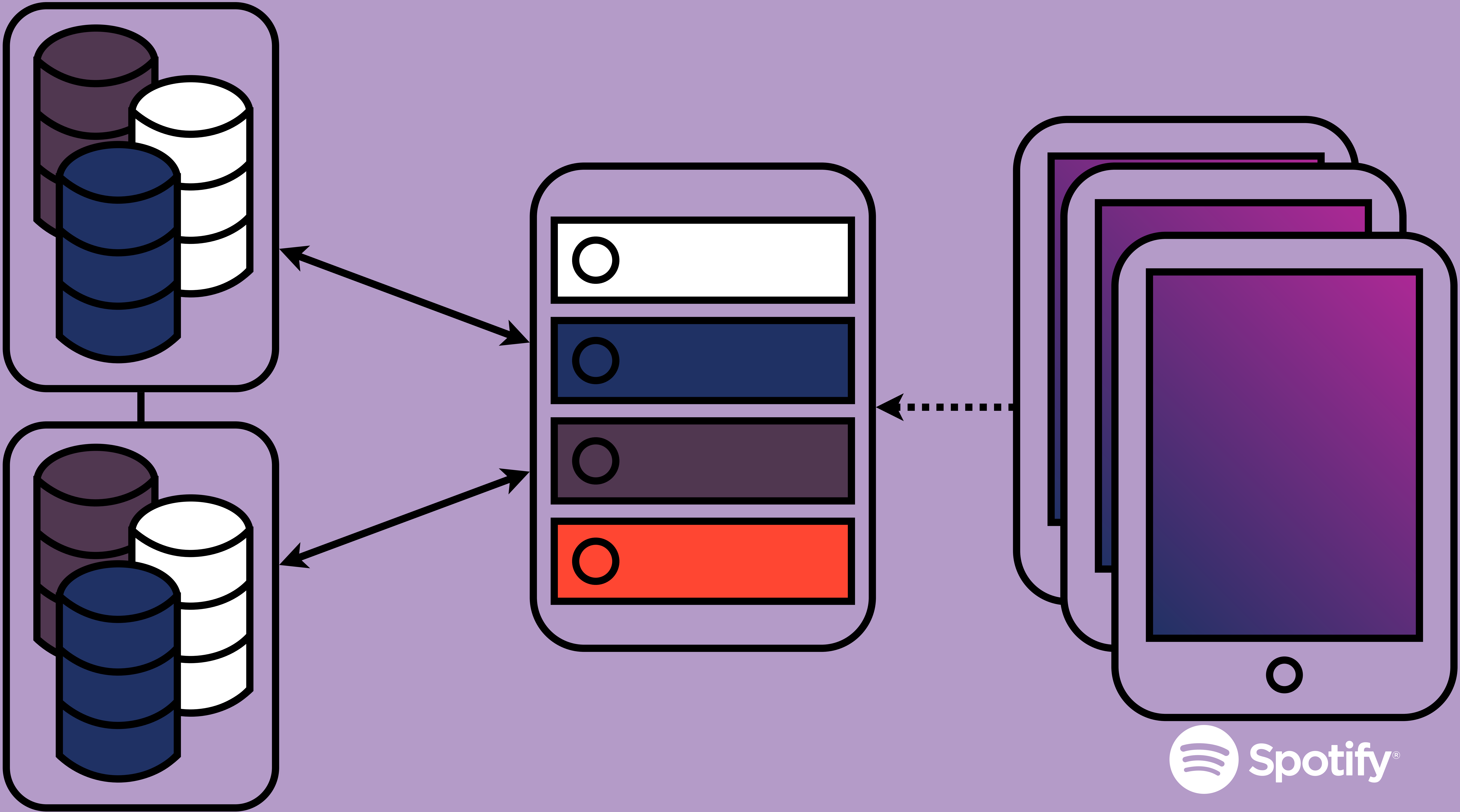

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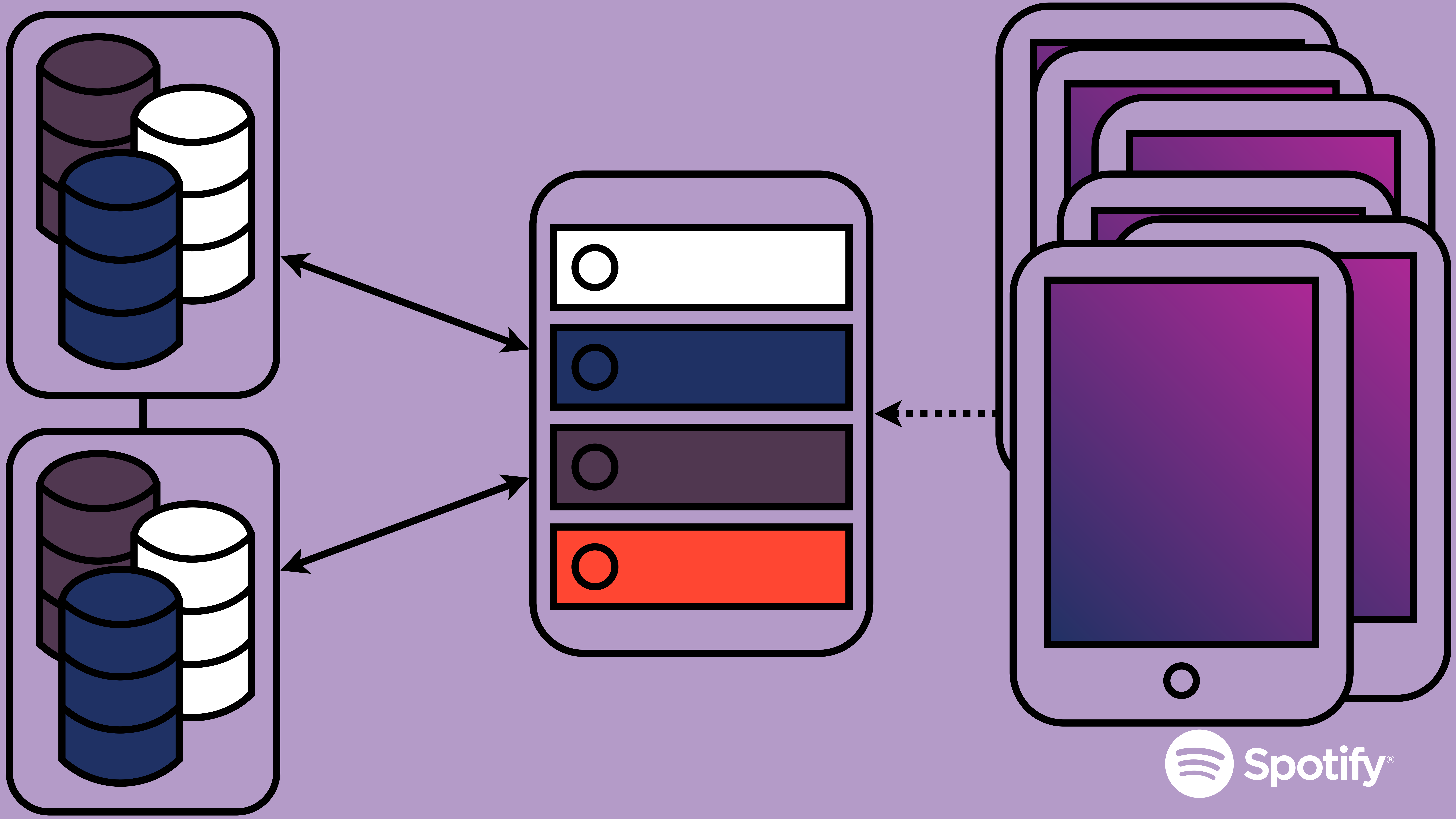
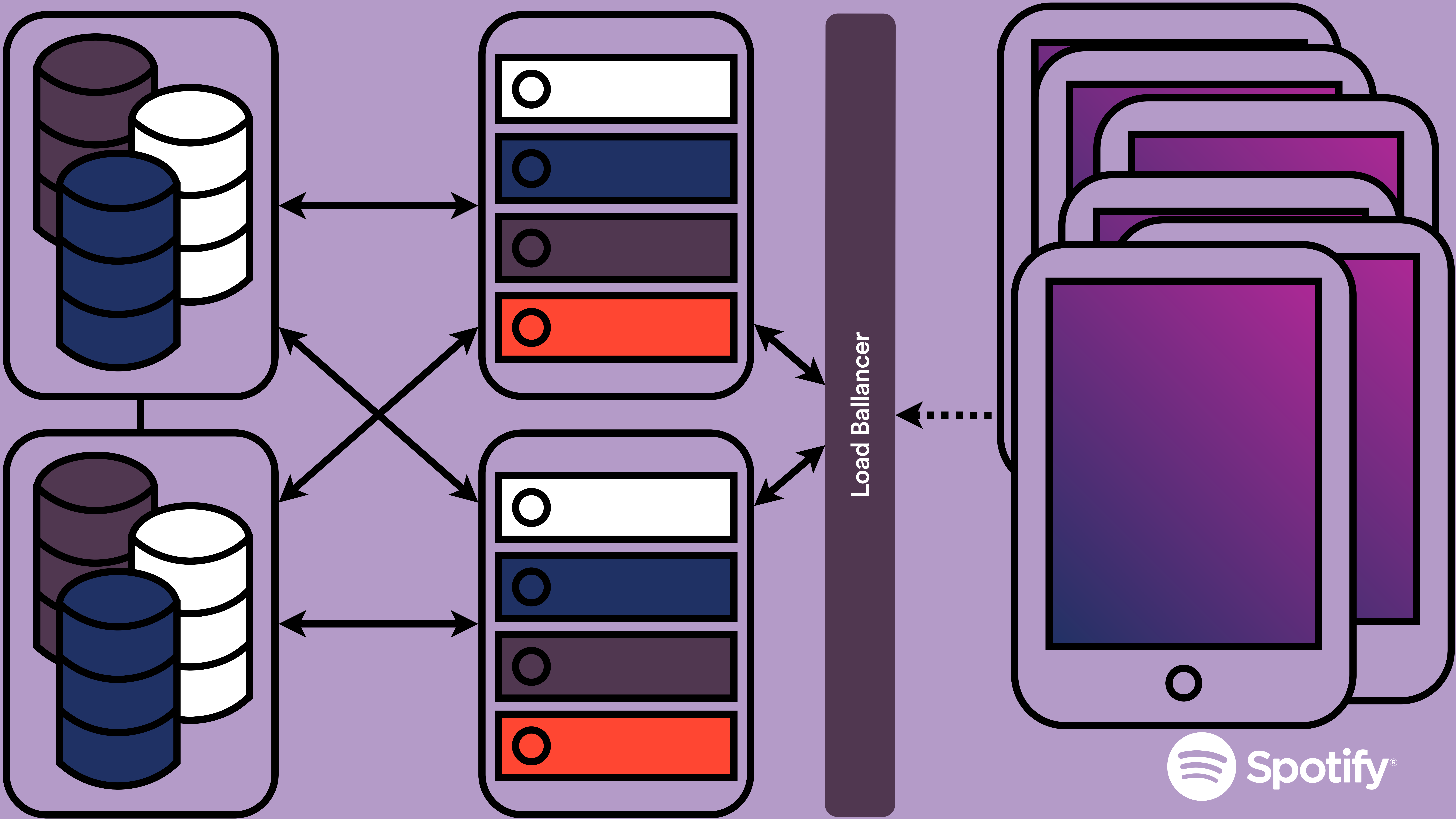


Spotify®



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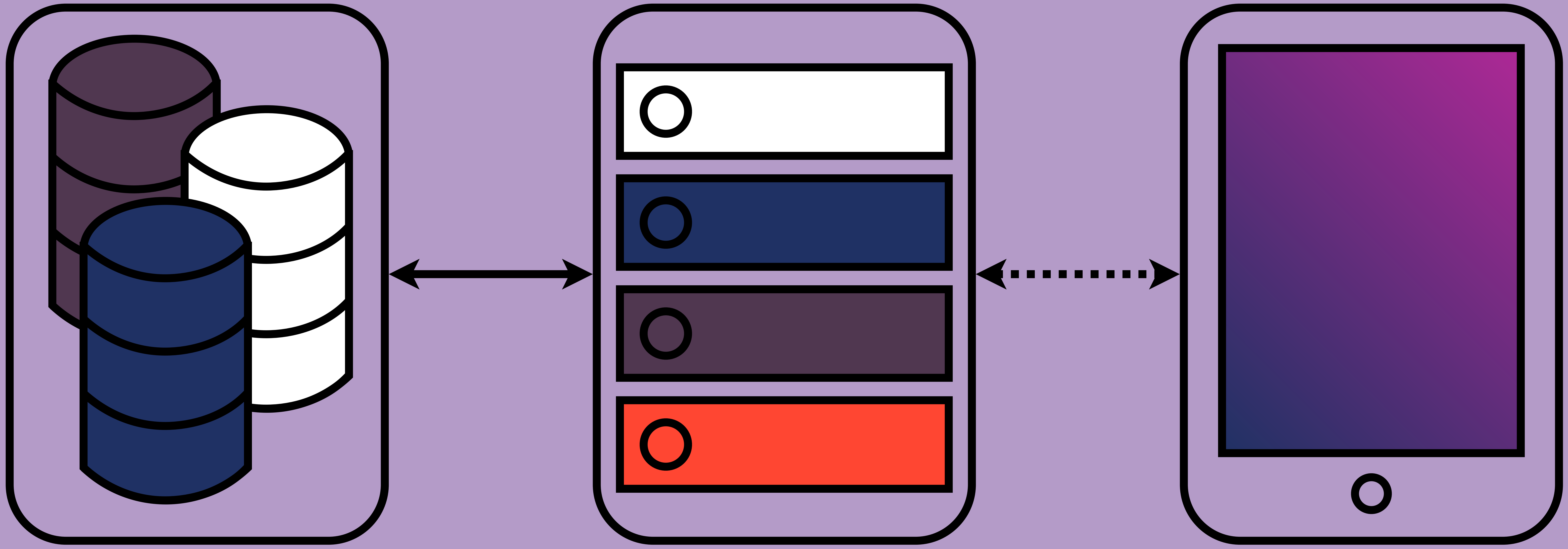

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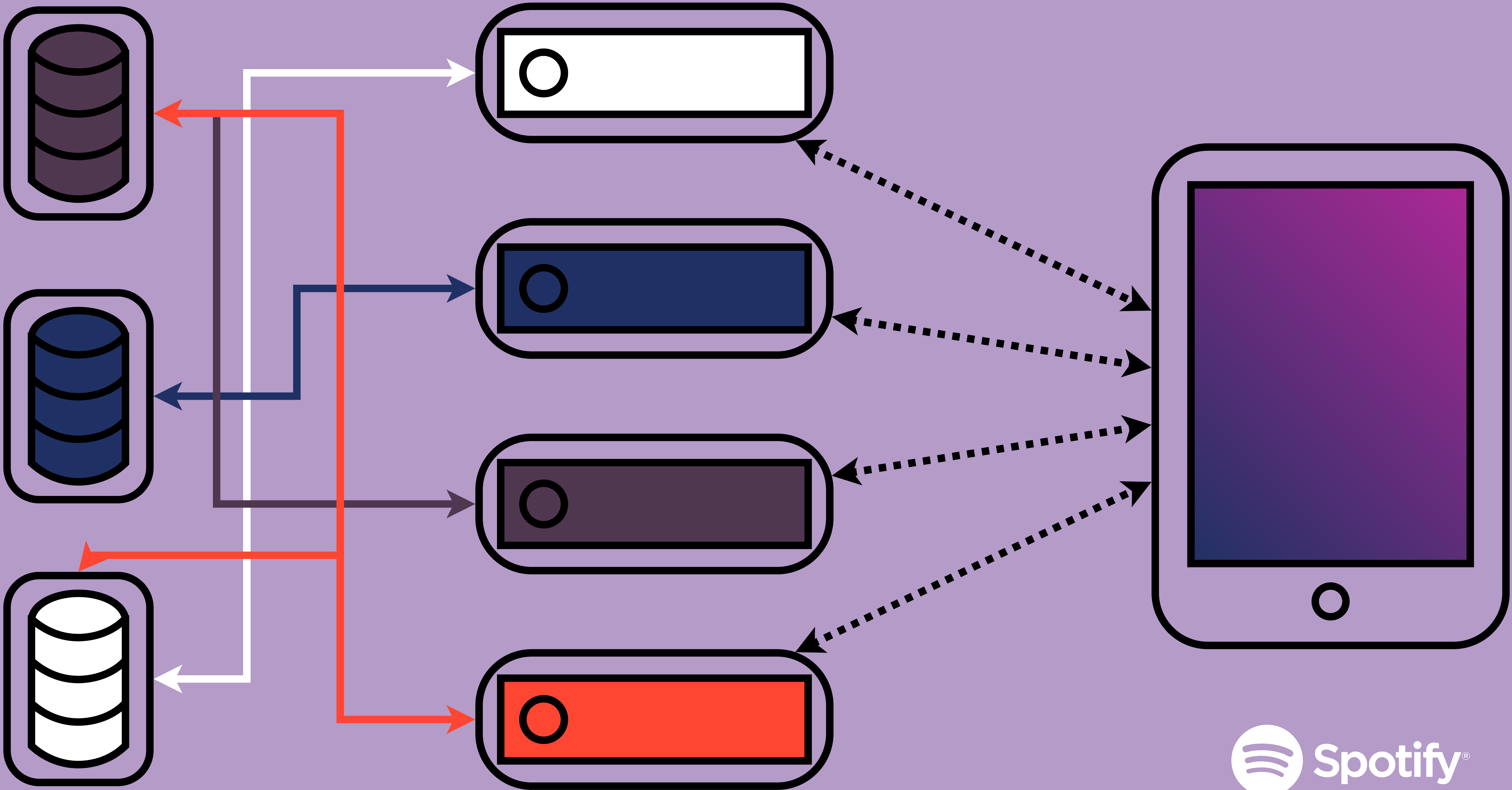

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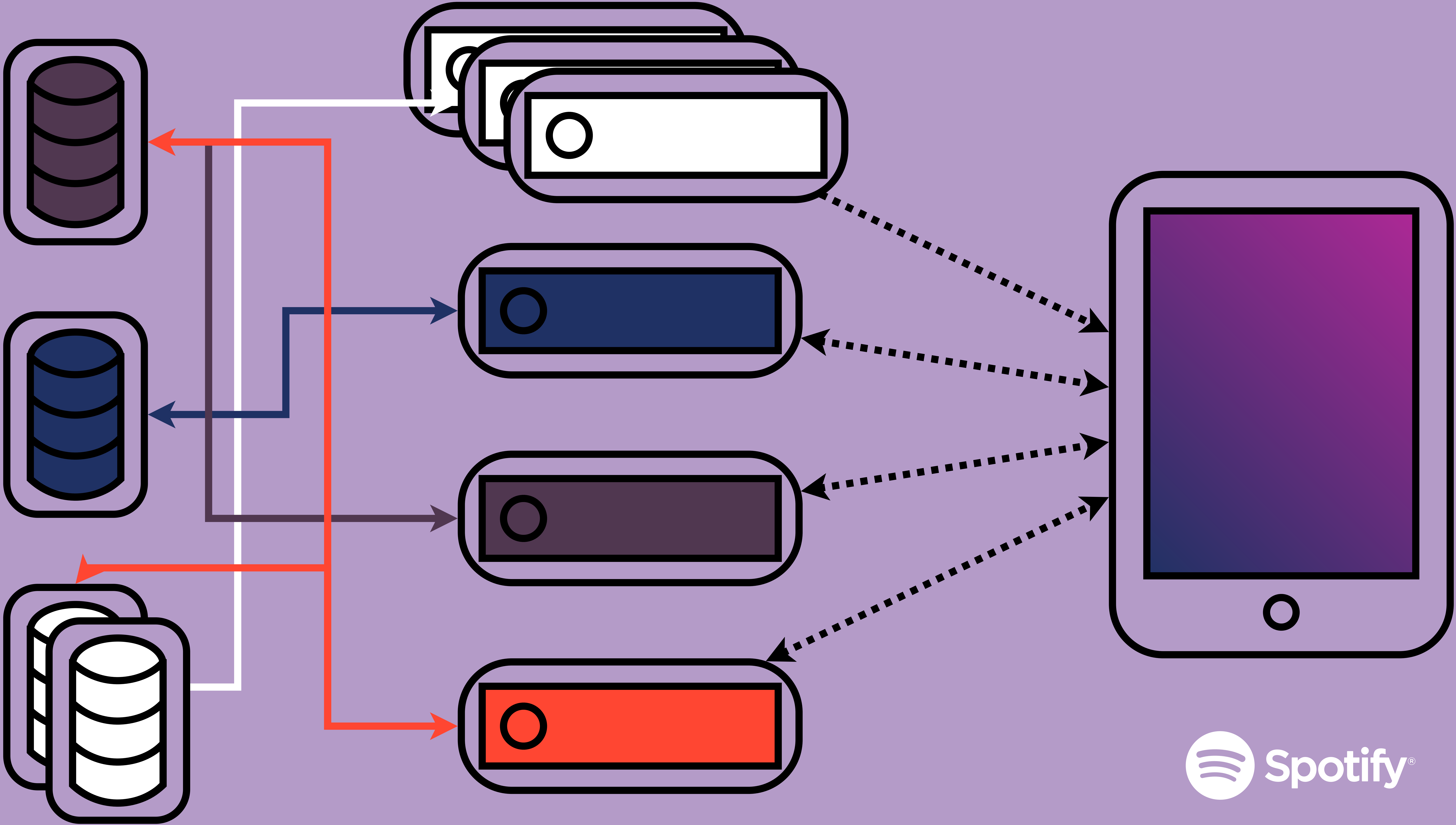


Microservices yay!

Easier to scale based on real-world bottlenecks

Microservices yay!

Easier to test

Microservices yay!

Easier to deploy

Microservices yay!

Easier to monitor

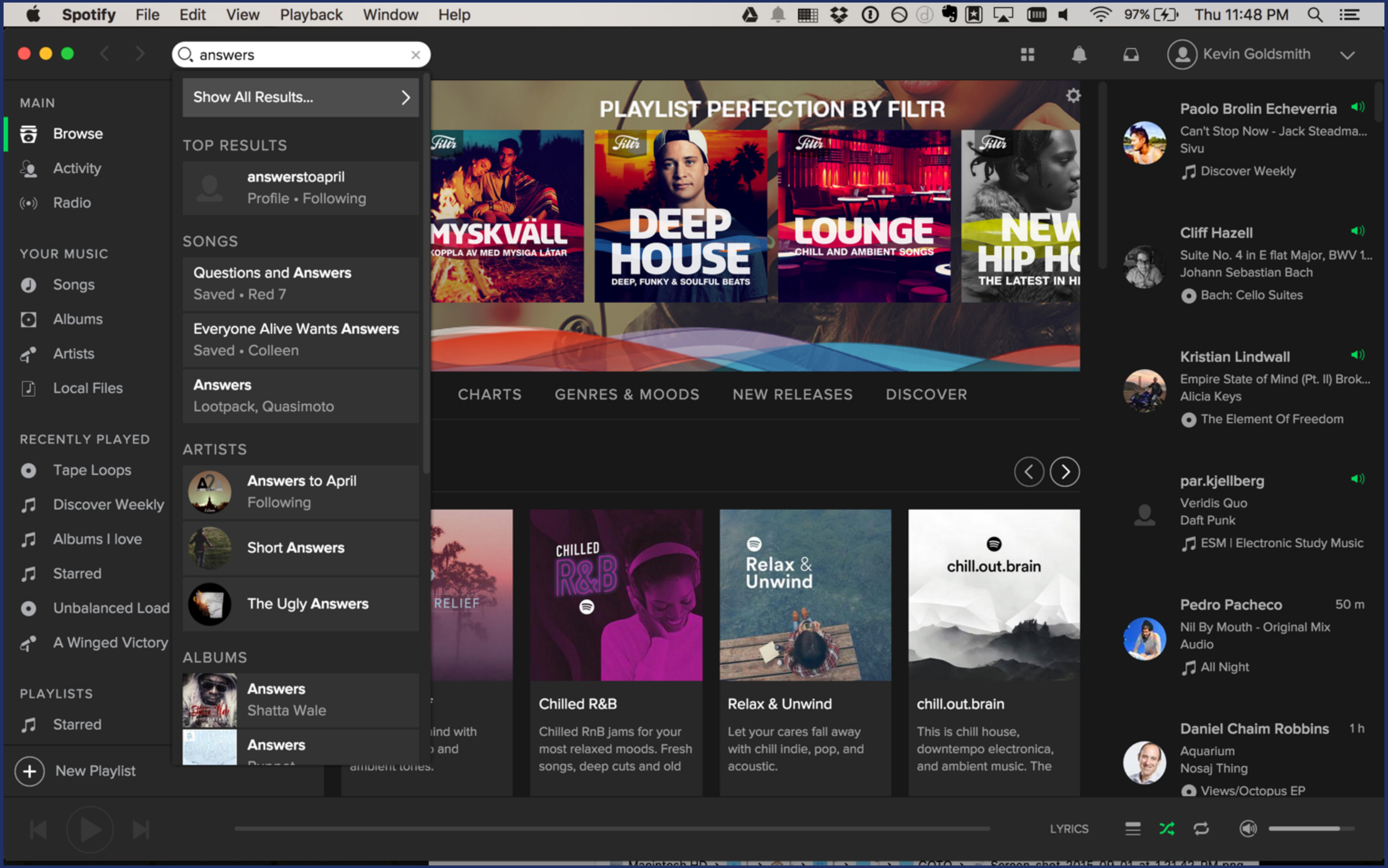
Microservices yay!

Can be versioned independently

Spotify
Withings
07:30 AM
Wake up
7:30 AM
WAKE UP
HAPPY

Microservices yay!

Are less susceptible to large failures



Spotify File Edit View Playback Window Help
97%
Thu 11:48 PM
answers
Kevin Goldsmith
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New Playlist
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Profile • Following
SONGS
Questions and Answers
Saved • Red 7
Everyone Alive Wants Answers
Saved • Colleen
Answers
Lootpack, Quasimoto
ARTISTS
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Following
Short Answers
The Ugly Answers
ALBUMS
Answers
Shatta Wale
Answers
PLAYLIST PERFECTION BY FILTR
MYSKVÄLL
KOPPLA AV MED MYSIGA LÅTAR
DEEP HOUSE
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CHILL AND AMBIENT SONGS
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THE LATEST IN HI
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DISCOVER
RELIEF
CHILLED R&B
Relax & Unwind
chill.out.brain
Chilled R&B
Chilled RnB jams for your most relaxed moods. Fresh songs, deep cuts and old
Relax & Unwind
Let your cares fall away with chill indie, pop, and acoustic.
chill.out.brain
This is chill house, downtempo electronica, and ambient music. The
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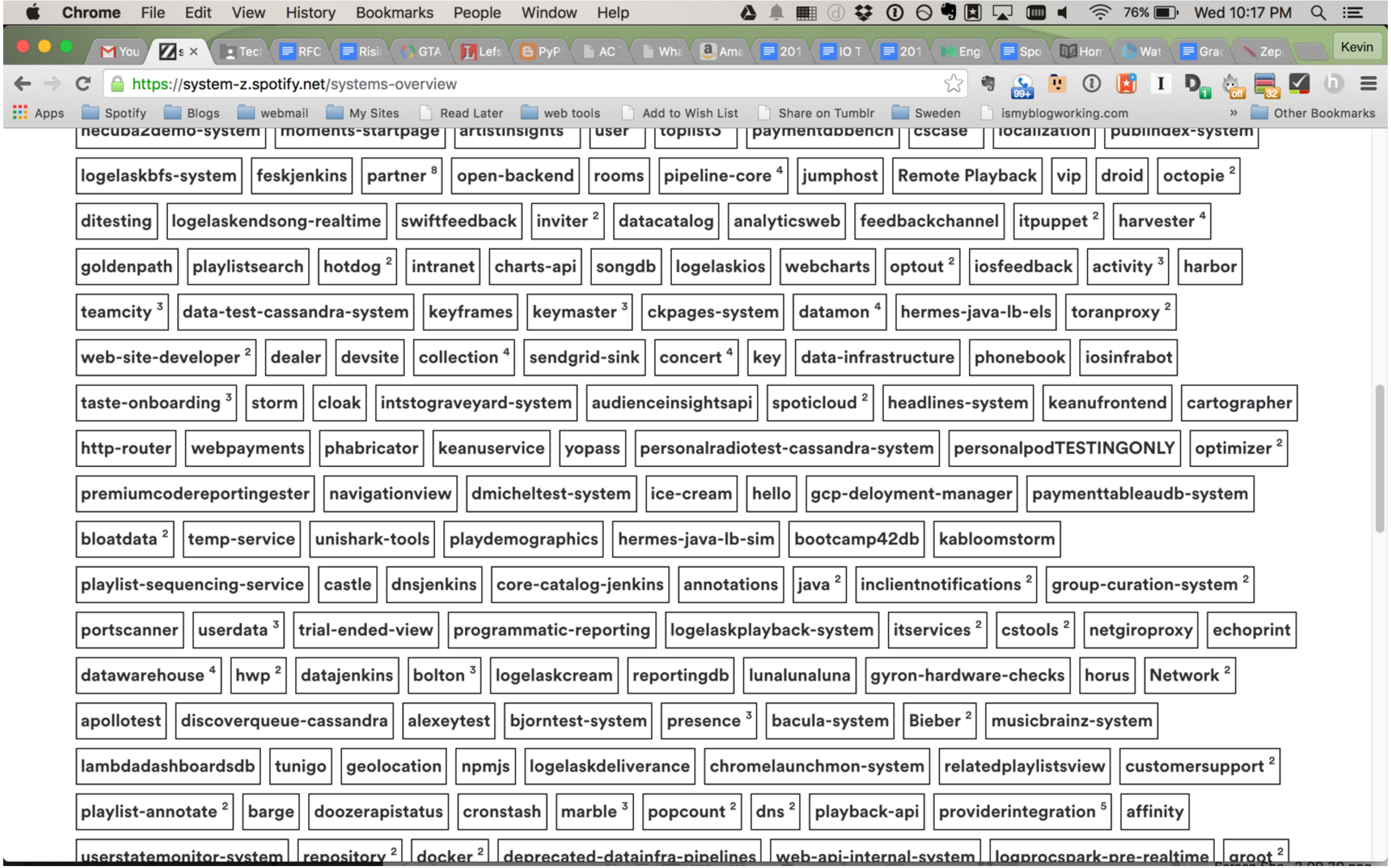
ambient tones.
Paolo Brolin Echeverria
Can't Stop Now - Jack Steadma...
Sivu
Discover Weekly
Cliff Hazell
Suite No. 4 in E flat Major, BWV 1...
Johann Sebastian Bach
Bach: Cello Suites
Kristian Lindwall
Empire State of Mind (Pt. II) Brok...
Alicia Keys
The Element Of Freedom
par.kjellberg
Veridis Quo
Daft Punk
ESM | Electronic Study Music
Pedro Pacheco
50 m
Nil By Mouth - Original Mix
Audio
All Night
Daniel Chaim Robbins
1 h
Aquarium
Nosaj Thing
Views/Octopus EP
LYRICS

Microservices boo!

are harder to monitor

Microservices boo!

need good documentation / discovery tools



necuba2demo-system moments-startpage artistinsights user toplist3 paymentabbench cscase localization publindex-system

logelaskbfs-system feskjenkins partner ^{8} open-backend rooms pipeline-core ^{4} jumphost Remote Playback vip droid octopie ^{2}

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goldenpath playlistsearch hotdog ^{2} intranet charts-api songdb logelaskios webcharts optout ^{2} iosfeedback activity ^{3} harbor

teamcity ^{3} data-test-cassandra-system keyframes keymaster ^{3} ckpages-system datamon ^{4} hermes-java-lb-els toranproxy ^{2}

web-site-developer ^{2} dealer devsite collection ^{4} sendgrid-sink concert ^{4} key data-infrastructure phonebook iosinfrabot

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http-router webpayments phabricator keanuservice yopass personalradiotest-cassandra-system personalpodTESTINGONLY optimizer ^{2}

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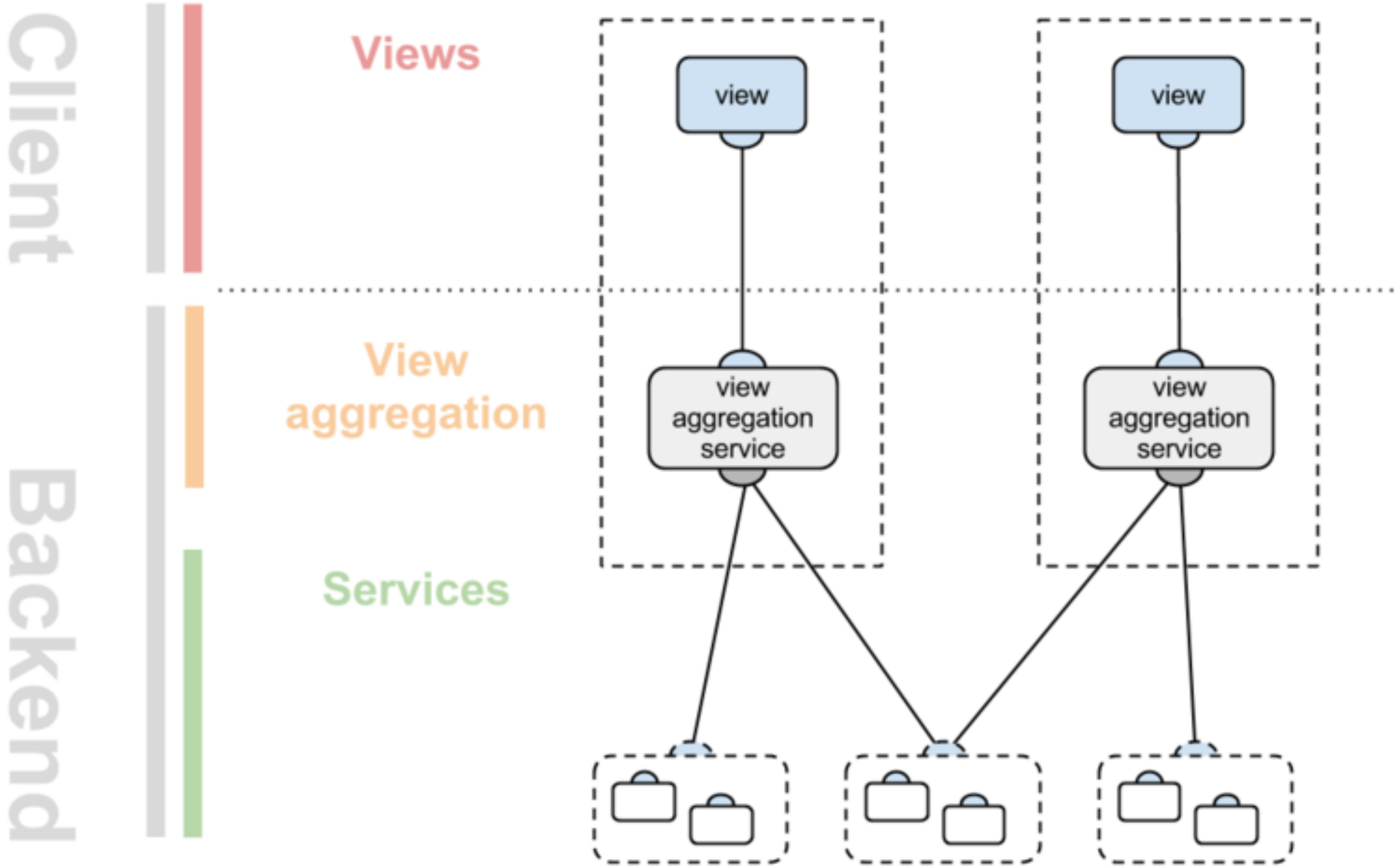
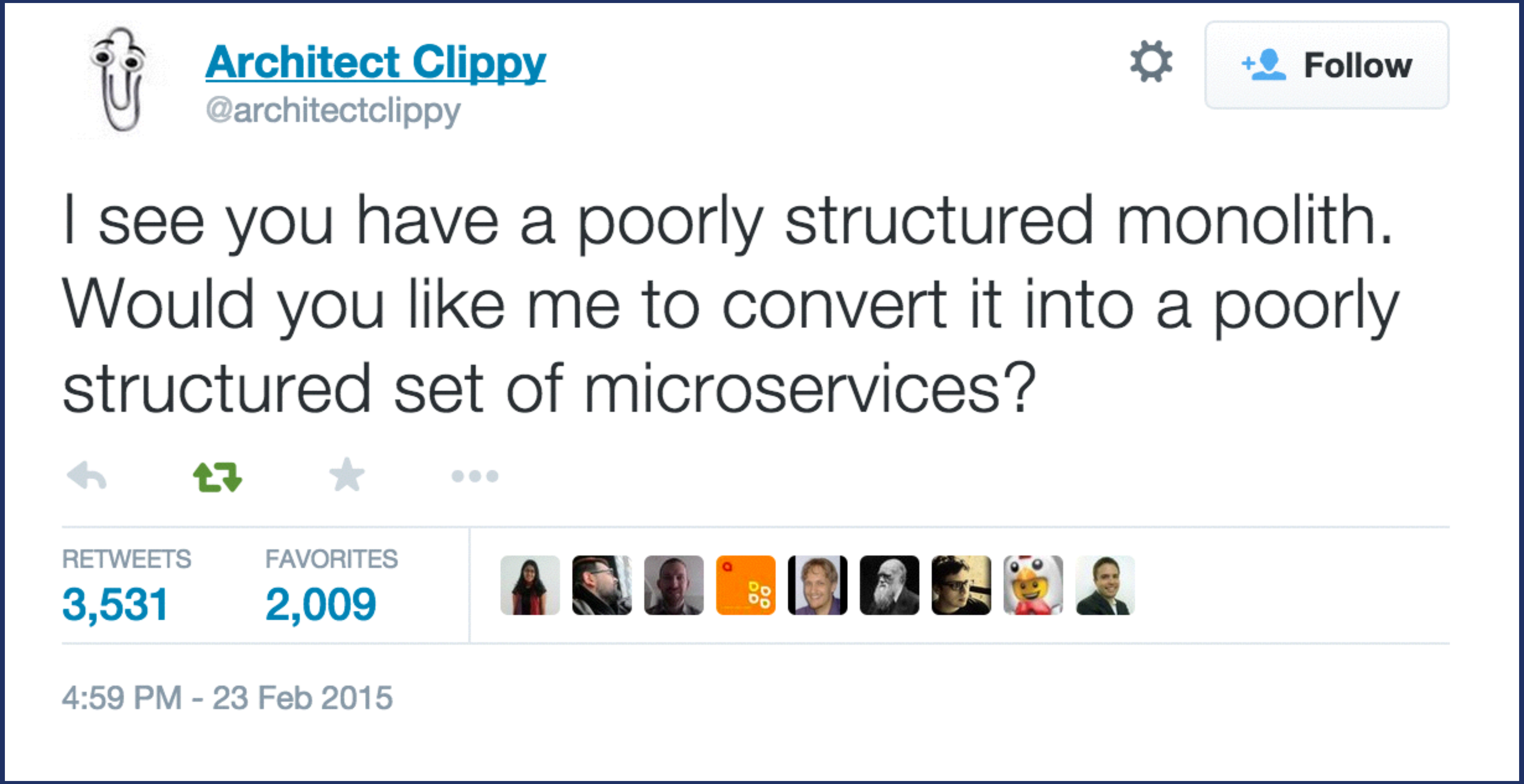
Microservices boo!

create increased latency


Client
Backend
Views
View aggregation
Services
view
view
view aggregation service
view aggregation service



Architect Clippy
@architectclippy

I see you have a poorly structured monolith. Would you like me to convert it into a poorly structured set of microservices?

RETWEETS 3,531

FAVORITES 2,009

4:59 PM - 23 Feb 2015

What does this look like at Spotify?

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- 810 active services

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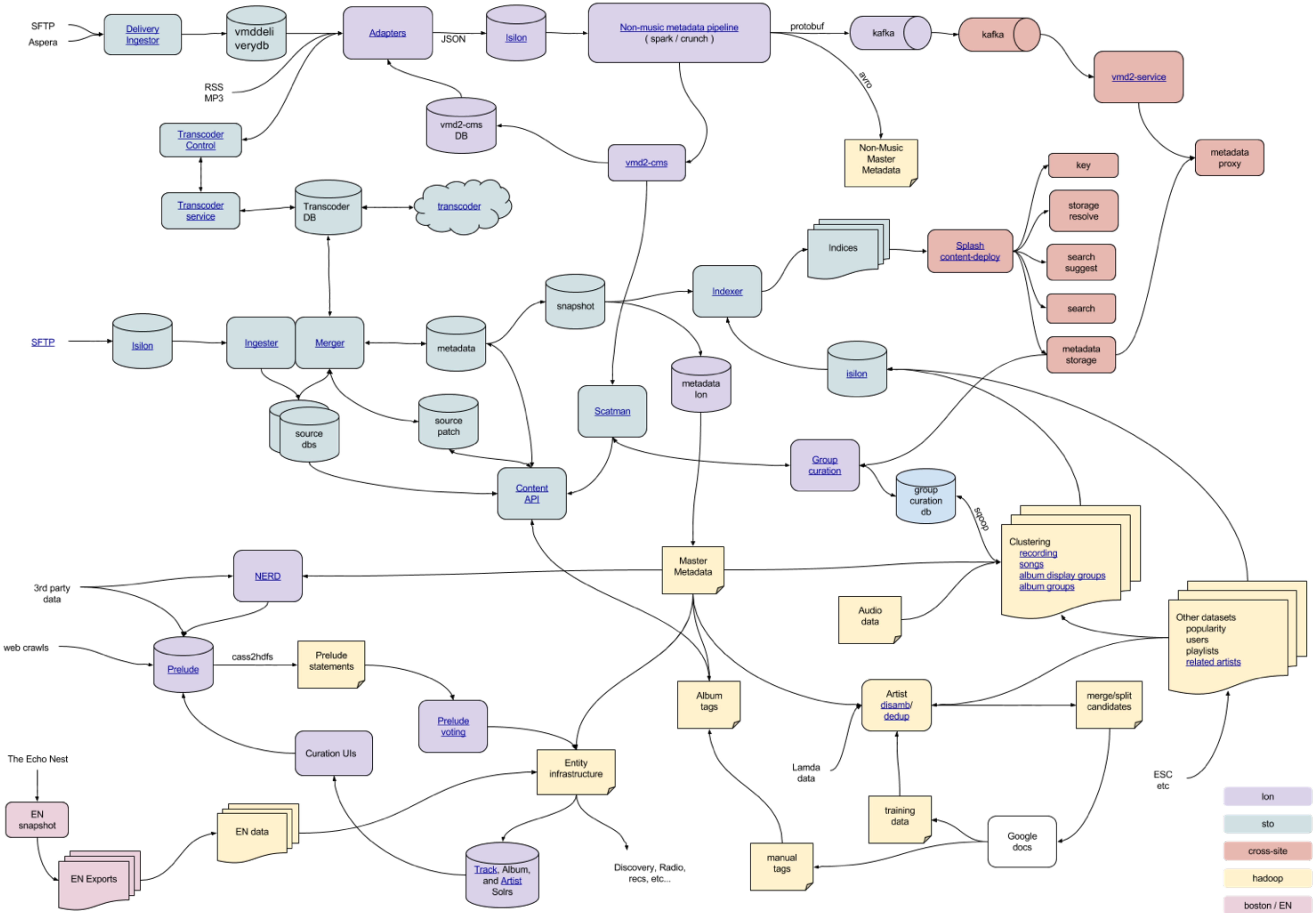
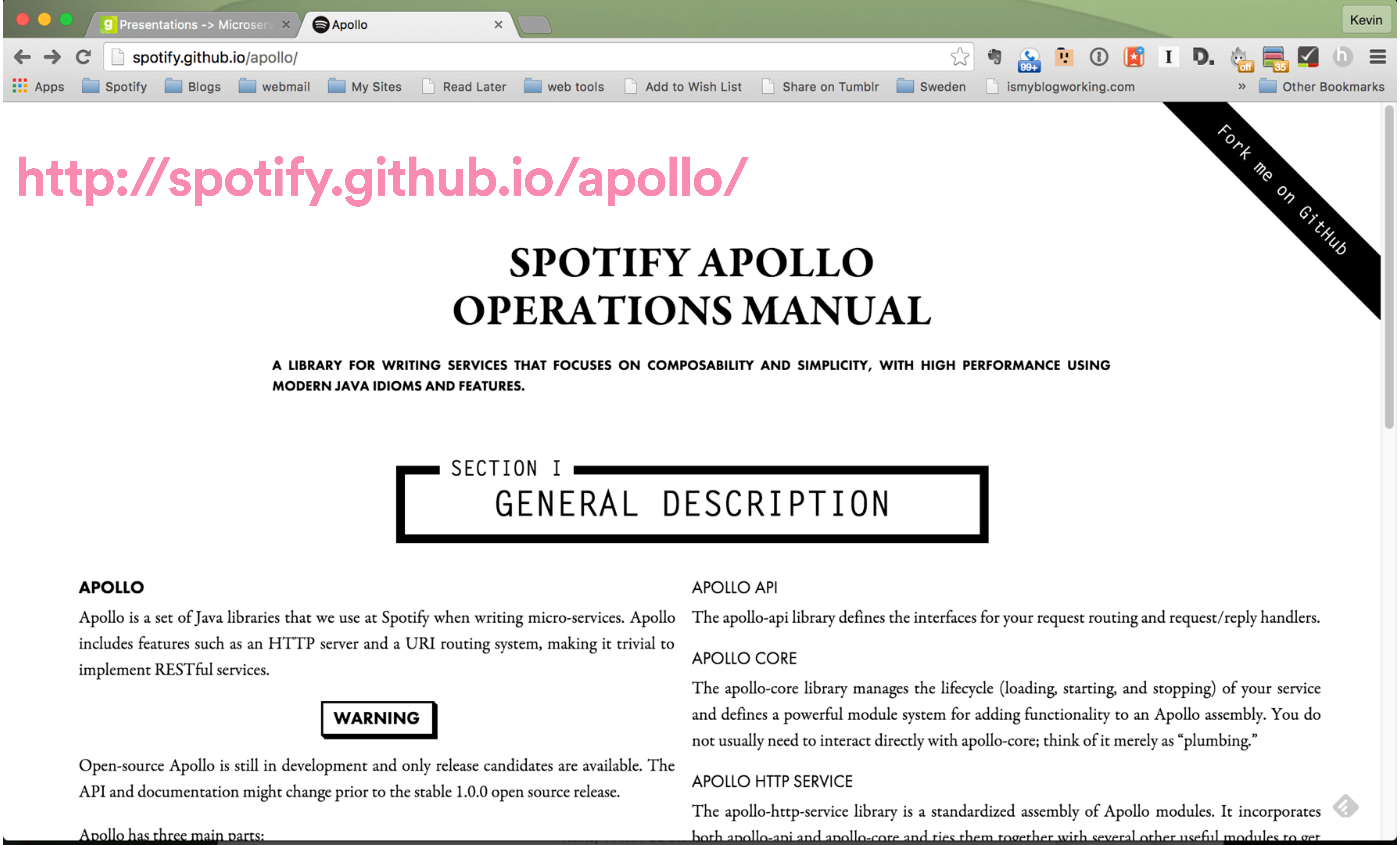
- ~1.7 Systems per person with access to production servers

What does this look like at Spotify?

- 810 active services
- ~10 Systems per squad
- ~1.7 Systems per person with access to production servers
- ~1.15 Systems per member of Technology


SFTP
Aspera
Delivery Ingestor
vmddeli verydb
Adapters
JSON
Isilon
Non-music metadata pipeline (spark / crunch)
protobuf
kafka
kafka
vmd2-service
avro
Non-Music Master Metadata
RSS MP3
vmd2-cms DB
vmd2-cms
Transcoder Control
Transcoder service
Transcoder DB
transcoder
metadata proxy
key
storage resolve
search suggest
search
metadata storage
Indices
Splash content-deploy
Indexer
snapshot
SFTP
Isilon
Ingester
Merger
metadata
metadata lon
isilon
Scatman
source dbs
source patch
Content API
Group curation
group curation db
sqoop
Clustering
recording
songs
album display groups
album groups
NERD
Master Metadata
3rd party data
web crawls
Prelude
cass2hdfs
Prelude statements
Prelude voting
Audio data
Other datasets
popularity
users
playlists
related artists
Album tags
Artist disamb/ dedup
merge/split candidates
Curation UIs
Entity infrastructure
The Echo Nest
EN snapshot
EN Exports
EN data
Track, Album, and Artist Solrs
Discovery, Radio, recs, etc...
Lamda data
training data
manual tags
Google docs
ESC etc
lon
sto
cross-site
hadoop
boston / EN



http://spotify.github.io/apollo/

SPOTIFY APOLLO OPERATIONS MANUAL

A LIBRARY FOR WRITING SERVICES THAT FOCUSES ON COMPOSABILITY AND SIMPLICITY, WITH HIGH PERFORMANCE USING MODERN JAVA IDIOMS AND FEATURES.

SECTION I GENERAL DESCRIPTION

APOLLO

Apollo is a set of Java libraries that we use at Spotify when writing micro-services. Apollo includes features such as an HTTP server and a URI routing system, making it trivial to implement RESTful services.

WARNING

Open-source Apollo is still in development and only release candidates are available. The API and documentation might change prior to the stable 1.0.0 open source release.

Apollo has three main parts:

APOLLO API

The apollo-api library defines the interfaces for your request routing and request/reply handlers.

APOLLO CORE

The apollo-core library manages the lifecycle (loading, starting, and stopping) of your service and defines a powerful module system for adding functionality to an Apollo assembly. You do not usually need to interact directly with apollo-core; think of it merely as "plumbing."

APOLLO HTTP SERVICE

The apollo-http-service library is a standardized assembly of Apollo modules. It incorporates both apollo-api and apollo-core and ties them together with several other useful modules to get

Spotify®

Questions

twitter: @kevingoldsmith

(yes, we're hiring)

Spotify

Please evaluate this talk via the mobile app!

📣

Engage