SCIENCE

&

MUSIC

-

October 2017 - Ecole Centrale de Nantes

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PLANNING

- Session 1
  - Talk & QA: *Music & Web - Architecture & Technology Overview*
  - Lab 1: Working with APIs

- Session 2
  - Talk & QA: *Music & Big Data - Overview of challenges & technologies*
  - Lab 2: Introduction to Data Processing - Python/Pandas

MUSIC & WEB

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ARCHITECTURE & TECHNOLOGY OVERVIEW

MUSIC TRANSFORMATION

TECHNICAL & DIGITAL TRANSFORMATION

Vinyl > Cassette > CDs > MP3 > Streaming

CONSUMPTION MODELS

- Access
  - Concert / Public Events
  - Record Shop
  - Subscription
  - Pay As You Go

- Ownership
  - Physical libraries
  - Digital libraries (local/remote)

INTERNET

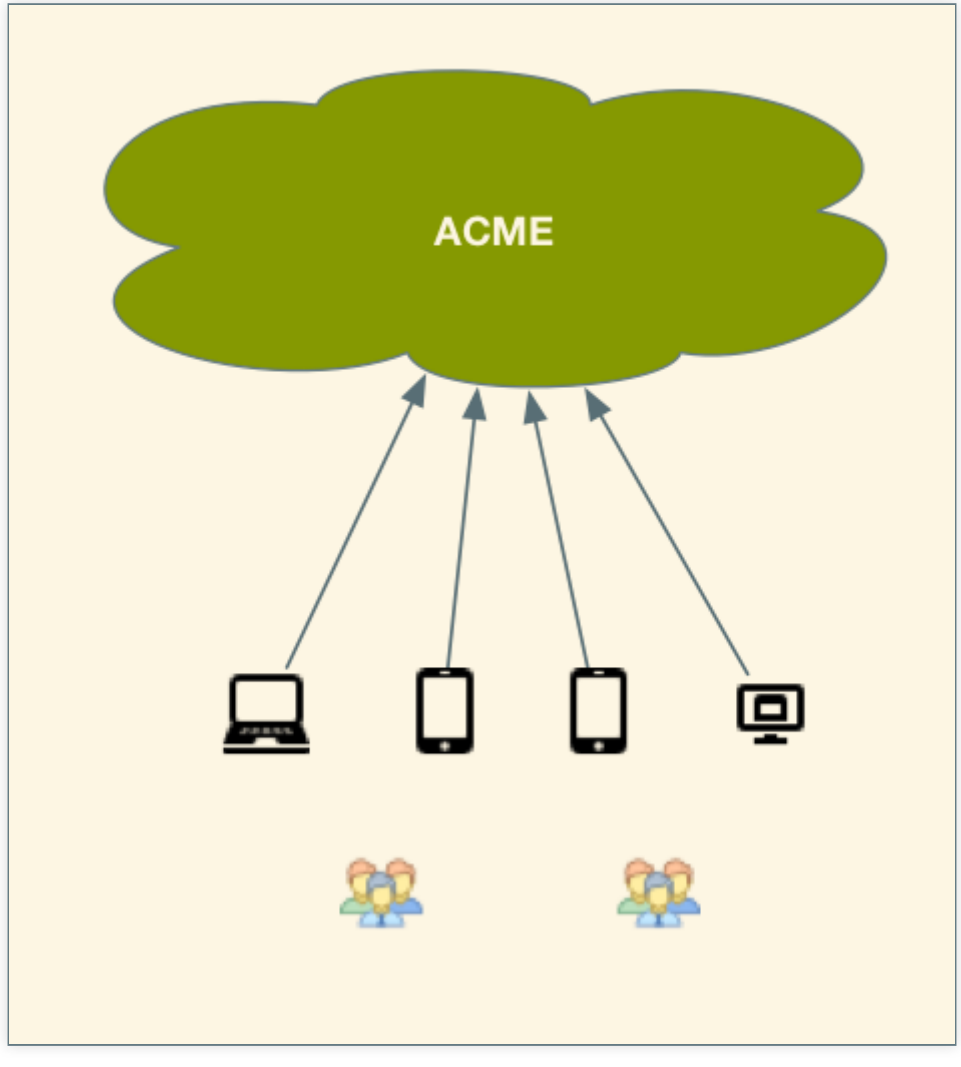
- Online stores
- Cloud libraries
- New services
  - Recommendation
  - Discovery

- Music is social

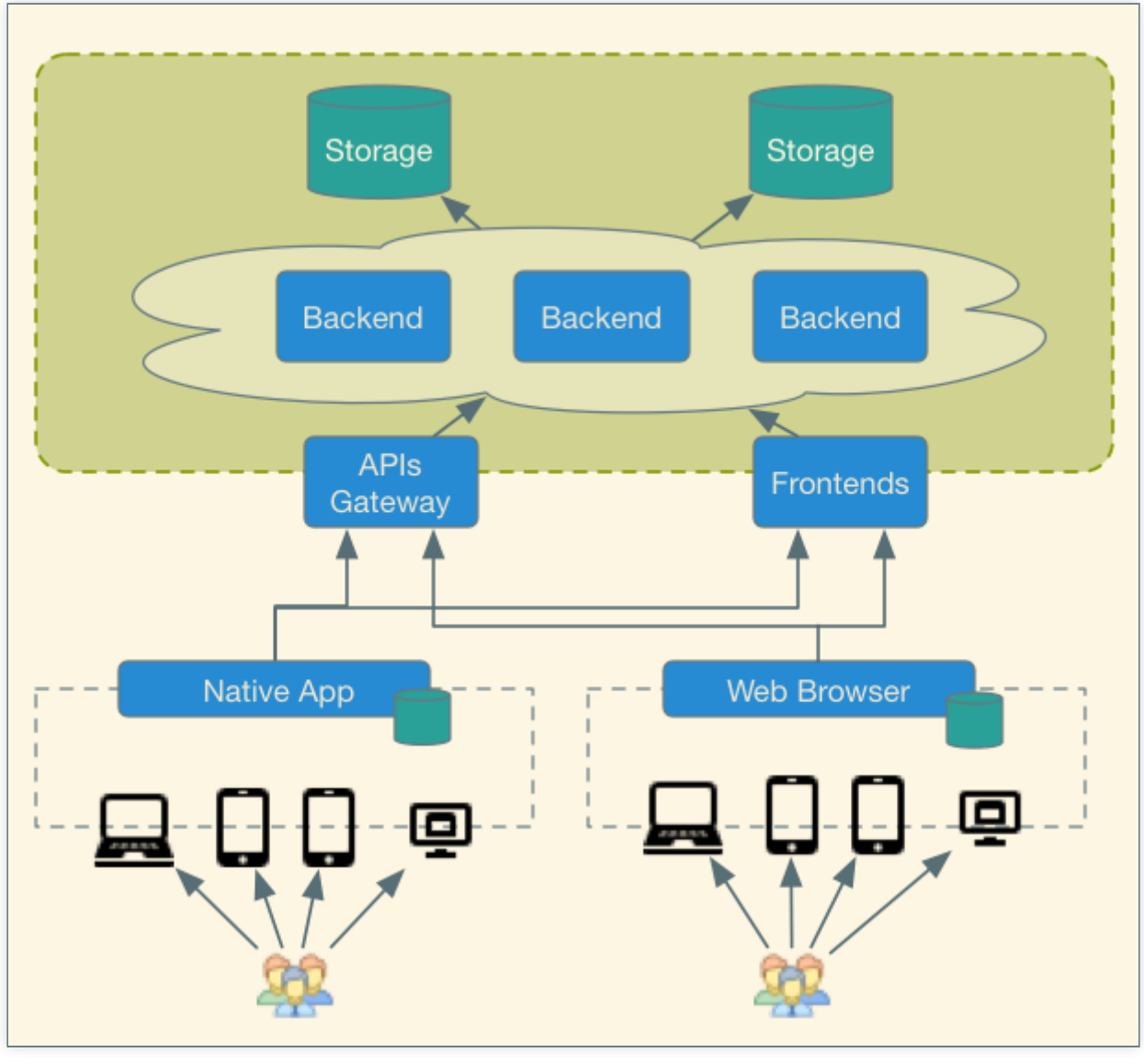
COMPONENTS OF A MUSIC SERVICE

Thinking of building a Music service?

10,000 FEET VIEW



DIVE 1 - GENERIC ARCHITECTURE



API

Application Programming Interface

A set of subroutine definitions, protocols, and tools for building software and applications

API

They are *everywhere*!

- OS (POSIX, Windows API, iOS, Android, ...)
- Software libraries (C++, Scala, Java, Python, Javascript, ...)
- Protocols, Remote APIs (HTTP, JDBC, ...)
- Web API (SOAP, REST, ...)

API

API is not an implementation, only defines the *interface*

```
// Compare strings - C
int strcmp(const char *s1, const char *s2);

// The strcmp() and strncmp() functions return an integer greater than, equal to,
// or less than 0, according as the string s1 is greater than, equal to, or less
// than the string s2.
```

- Functions, Methods, Input/Output parameters, Return types
- Protocols
- Data models of Input/Output objects

API & WEB

- Web Services
- REST

WEB SERVICE

- SOAP (Simple Object Access Protocol)
- XML (eXtended Markup Language)

```
POST /InStock HTTP/1.1
Host: www.example.org
Content-Type: application/soap+xml; charset=utf-8
Content-Length: 299
SOAPAction: "http://www.w3.org/2003/05/soap-envelope"

<soap:Envelope
    xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
    xmlns:m="http://www.example.org/stock/Manikandan">
    <soap:Header>
    </soap:Header>
    <soap:Body>
        <m:GetStockPrice>
           <m:StockName>GOOGLE</m:StockName>
        </m:GetStockPrice>
    </soap:Body>
</soap:Envelope>
```

WEB APIS

- REST/RESTful (Representational State Transfer)
- JSON (JavaScript Object Notation)

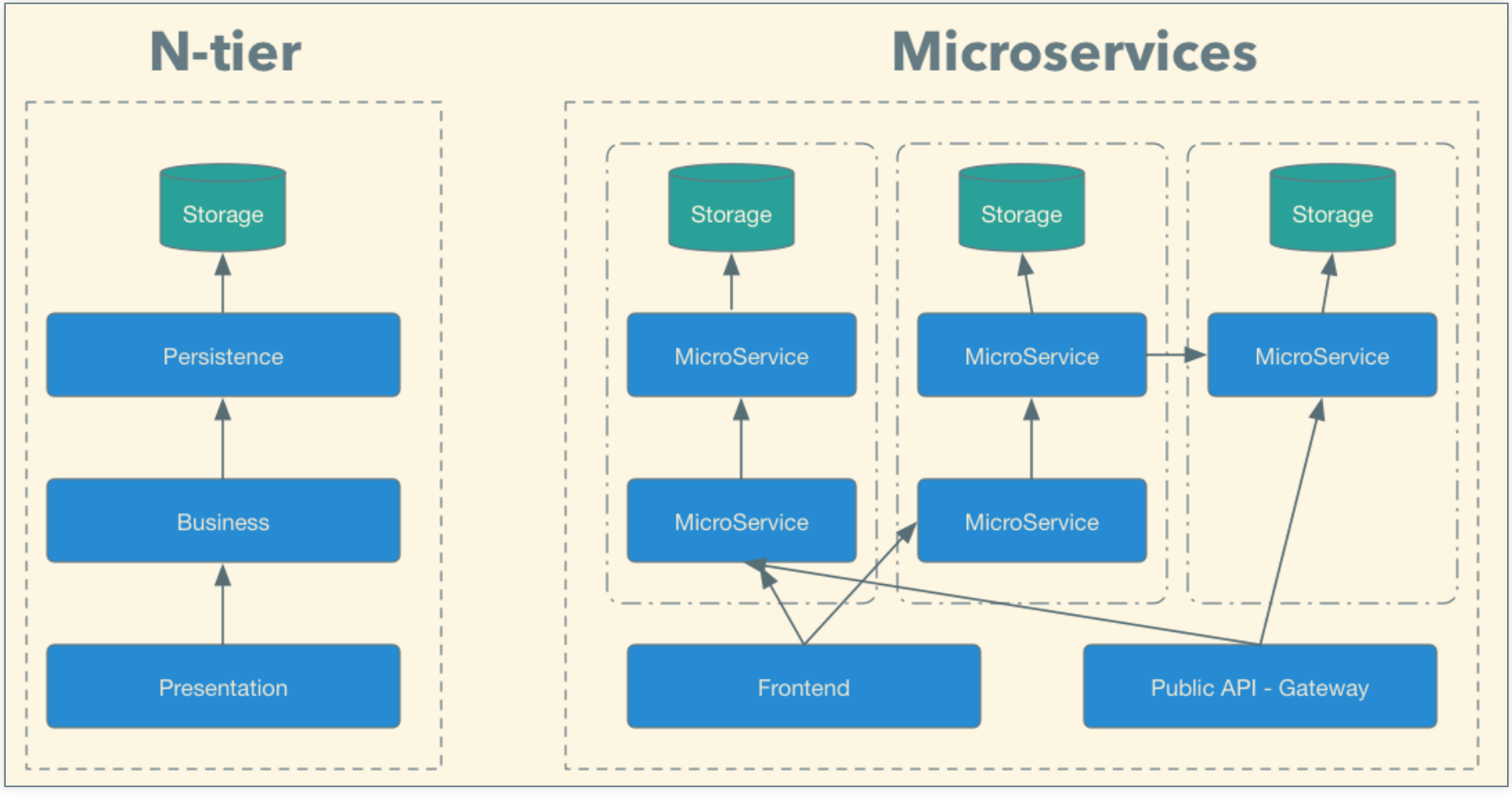
```
GET /products/1
Host: https://api.example.com
Accept: application/json

{
  "id": 1,
  "name": "Foo",
  "price": 123,
  "stock": {
    "warehouse": 300,
    "retail": 20
  }
}
```

WHY WEB SERVICES/API?

- Composition
- Re-usability
- Testing
- Prototyping

Sofware Development!

ARCHITECTURE OVERVIEW



FRONTEND / BACKEND

FRONTEND

Presentation layer, software closest to the end users

- Visualization
- Client application
- User interface and interaction (UI/UX)
- Lightweight

BACKEND

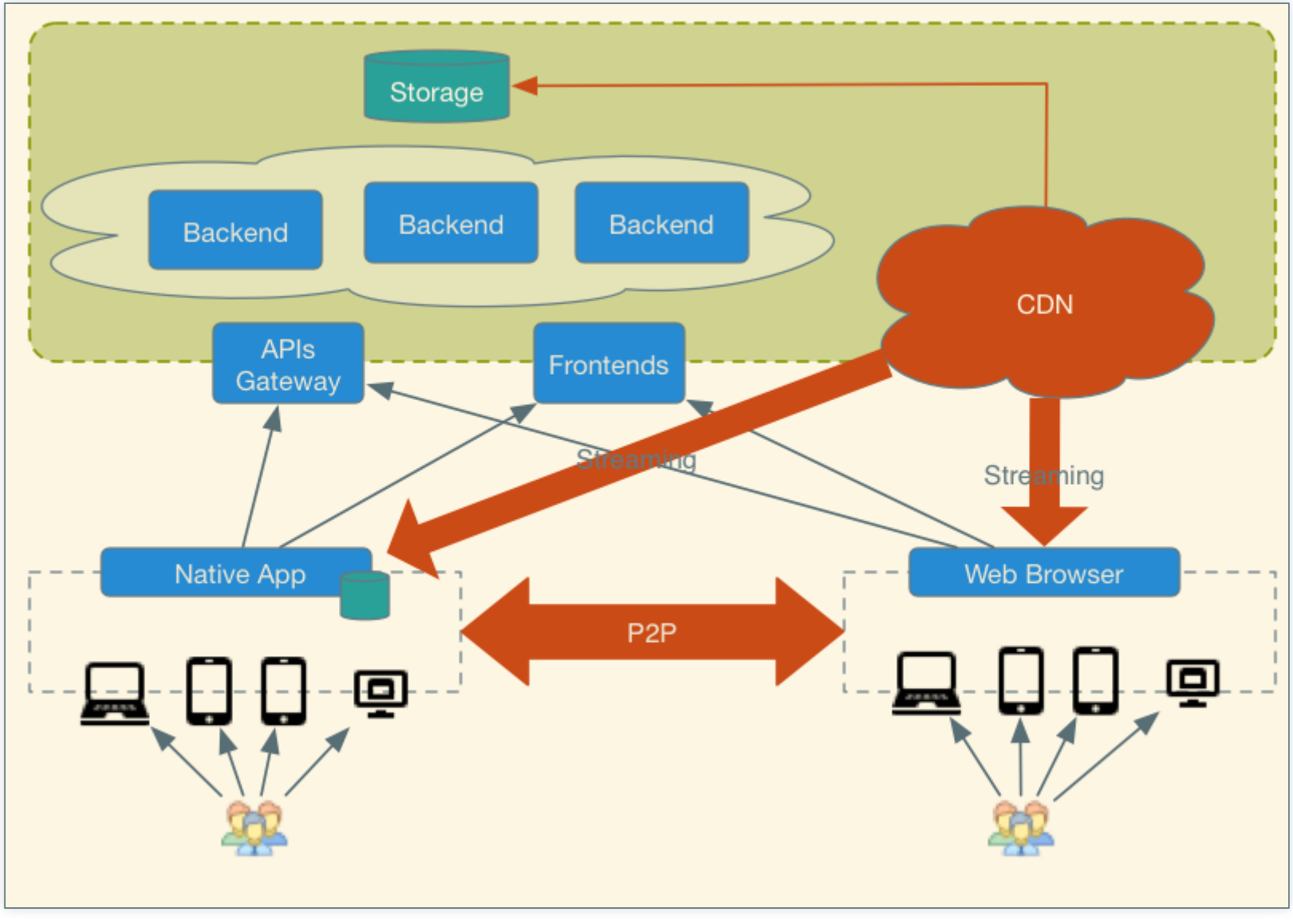
Business, Data access & Data storage layer
Not accessed directly by end users

- Business logic
- Data access
- API

DESIGN PRINCIPLES

- **Monolithic Applications**
  - Self-contained
  - Independence
- **Modular Applications**
  - client/server, n-tiered, microservices
  - loose coupling
  - modularity
  - reuse

DIVE 2 - CONTENT DELIVERY

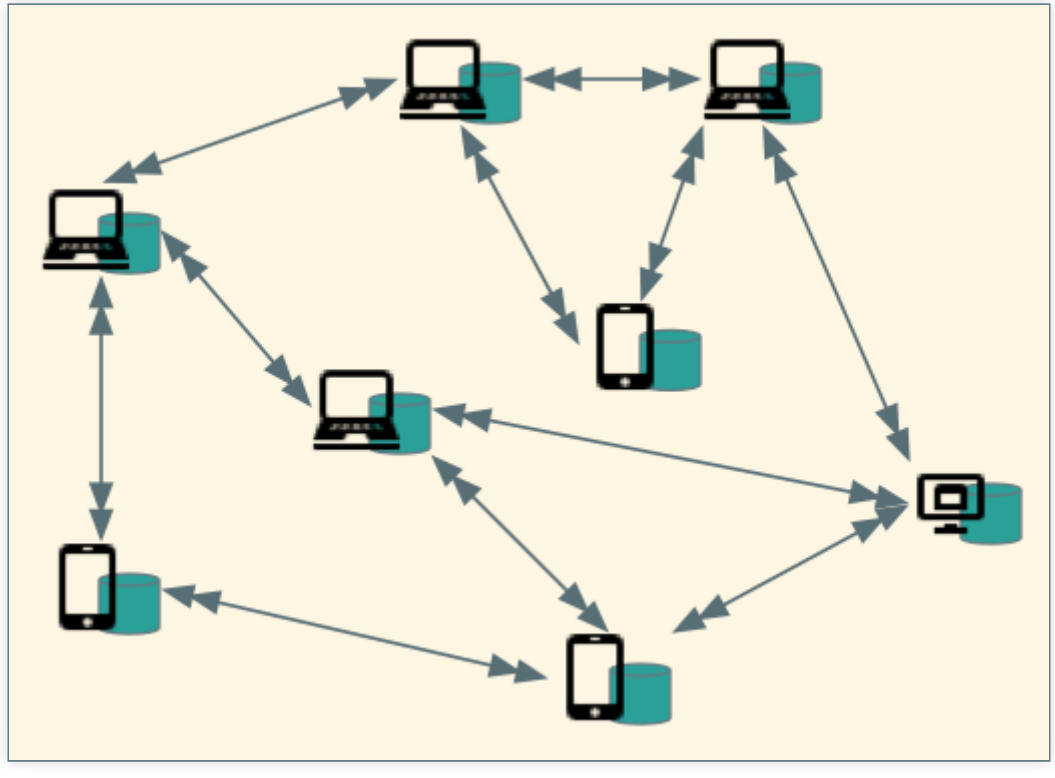


CDN

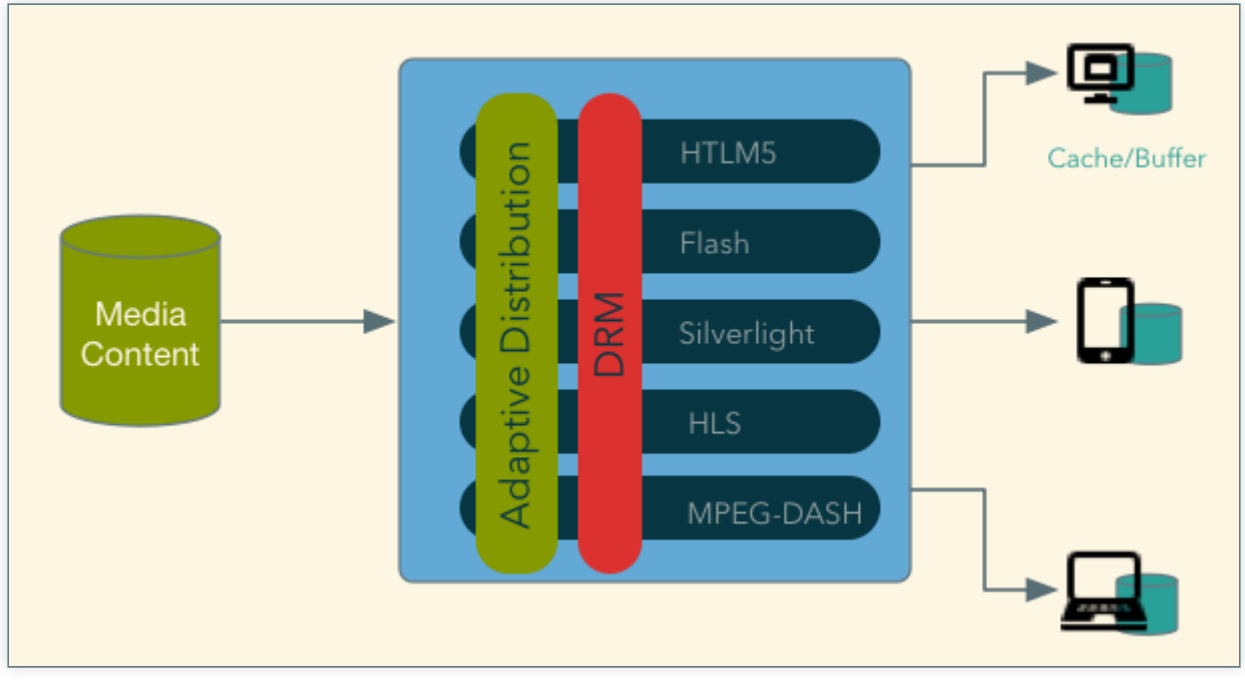
Content Distribution Network

PEER 2 PEER

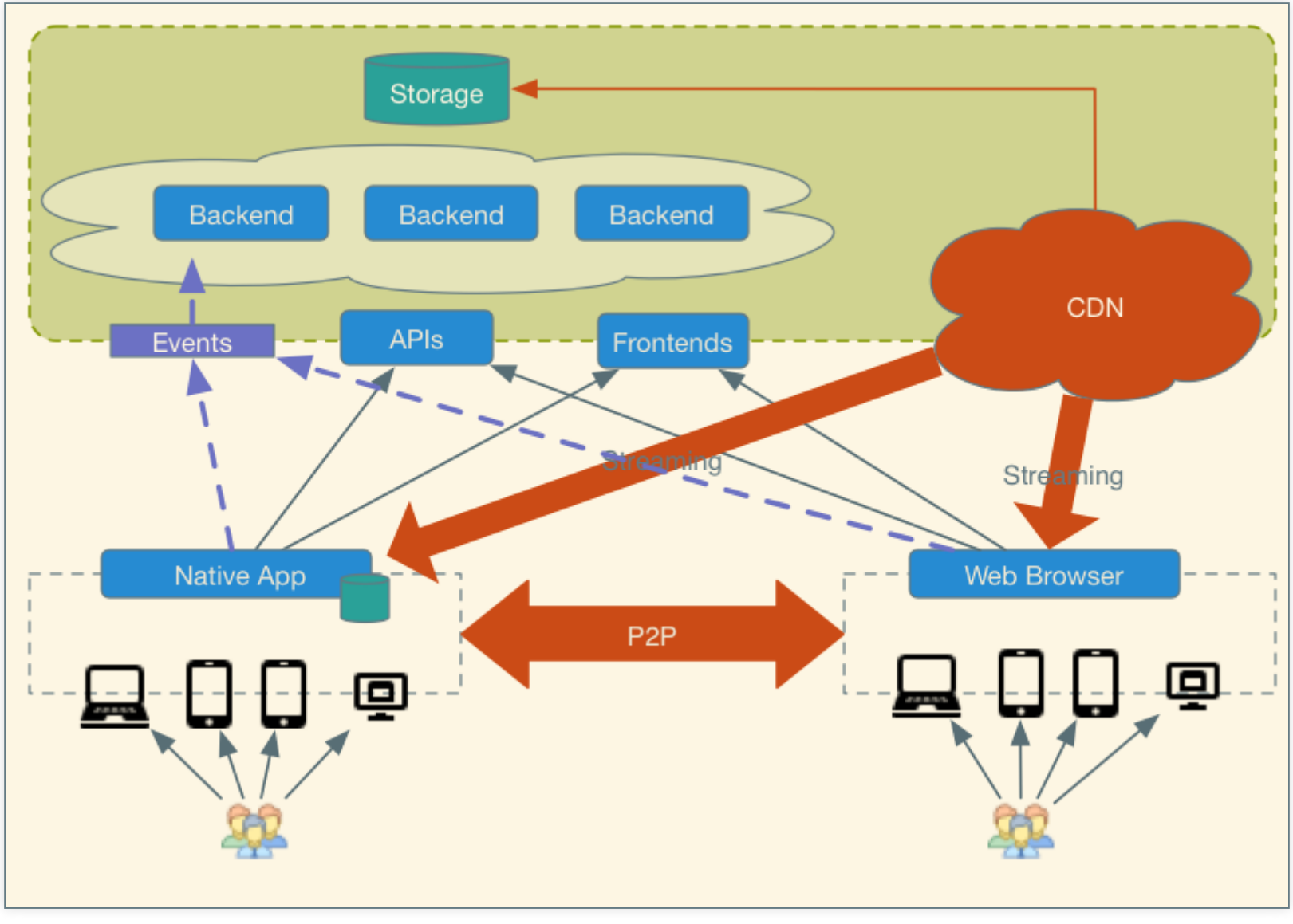
Decentralized network



STREAMING


Media Content
Adaptive Distribution
DRM
HTLM5
Flash
Silverlight
HLS
MPEG-DASH
Cache/Buffer

DIVE 3 - DATA & EVENTS COLLECTION



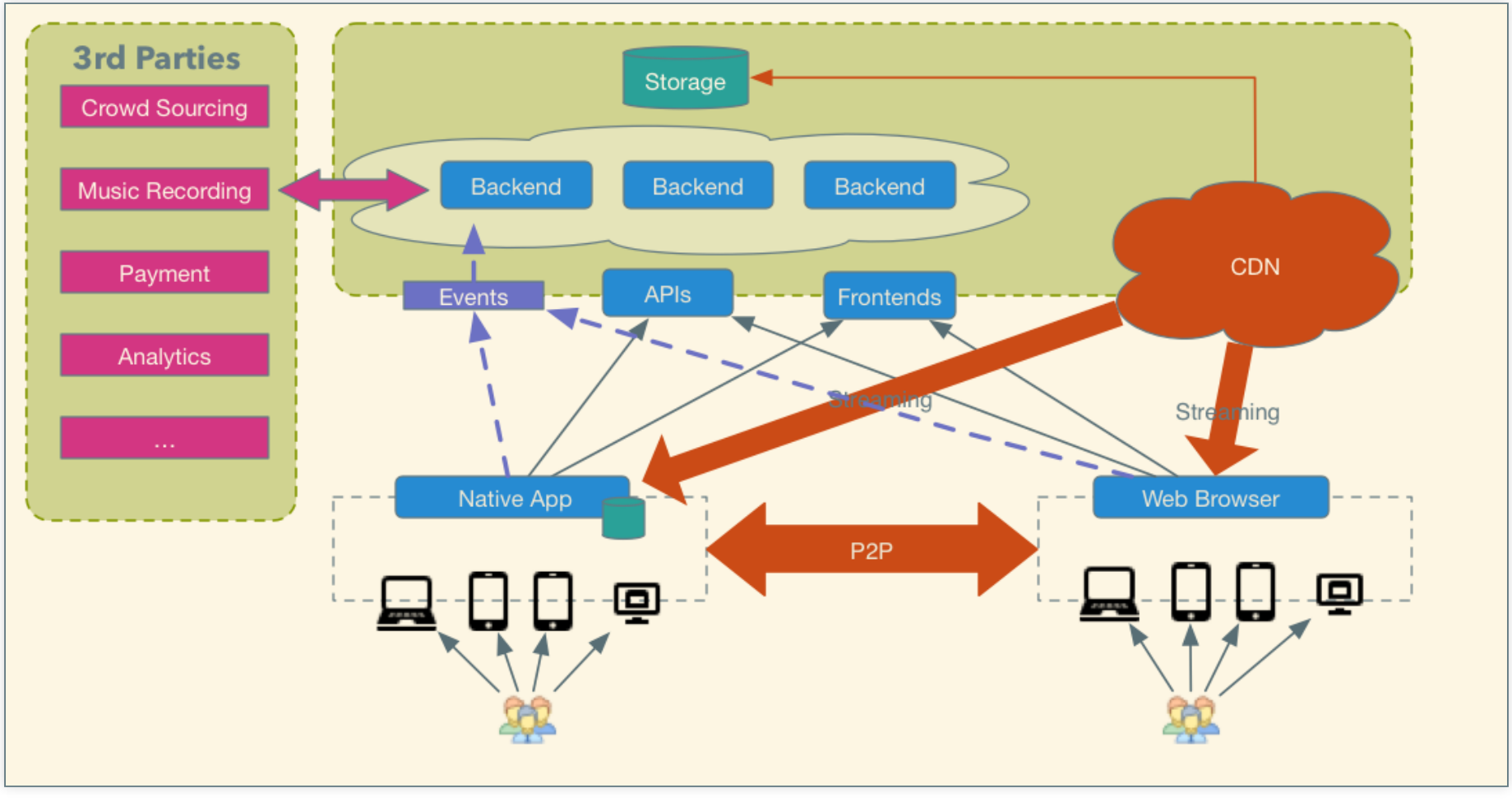
WHAT IS BEING COLLECTED ?

- **User Activity**
  - Clicks
  - Application activity
  - Listening activity
- **Monitoring**
  - Logs
  - Application performance
- **Related servicess**
  - Analytics, User engagement, tracking, ...
  - Social website monitoring (Facebook/Twitter feeds, ...)

WHY ?

- Sales increase: Marketing / Targeting
- Product improvements
- Prioritization on features
- Performance analysis / reliability
- Recommendation
- ...

DIVE 4 - 3RD PARTIES



CONTENT ANALYSIS & ENRICHMENT

- Metadata & content analysis
- Crowd sourcing
- Clustering & classification
- Fingerprinting
- Added content
- ...

OUTSOURCING & EXTERNAL SERVICES

- Payments
- Analytics
- CDN
- Streaming
- ...

DIVE 5 - INFRASTRUCTURE

Where & How do we run all of this?

WHERE?

- Physical Data Centers
  - On-premise
  - DC (owned or colocation)
- Cloud Infrastructure

DIFFERENT TYPES OF APPROACH TO INFRASTRUCTURE

PHYSICAL

- Management of servers, network, cabling ...
- Human actions
- No automation

IAAS

IaaS - Infrastructure As A Service

- Servers
- Storage
- Network
- Operating System
- ...

Amazon EC2 / S3, Windows Azure, Google Compute Engine, VmWare, OpenStack, ...

PAAS

PaaS - Platform As A Service

- Managed databases
- Web servers
- Content Delivery
- Container solutions

AWS Elastic Beanstalk, AWS RDS, Heroku, Google App Engine, Cloud Foundry, ...

SAAS

SaaS - Software As A Service

- Managed Softwares

Google Apps, Office 365, Gmail, Dropbox, SalesForce, ...

MUSIC SERVICES (NOT EXHAUSTIVE!)

QUESTIONS?