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What is Spotify's architecture?

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6 Answers



Niklas Gustavsson, Spotify backend developer

Updated Dec 2, 2012 · Upvoted by Daniel Ek, Founder & CEO of Spotify and Mattias Petter Johansson, former Software Engineer at Spotify (2012-2017)

The Spotify backend architecture is heavily service oriented. The backend is composed of about a hundred services, most of them fairly small and simple. Services are written in Python or Java with a few exceptions. Services communicate primarily using our own protocol called Hermes, which is a message based and built on ZeroMQ and Protobuf. Older services still use HTTP and XML/JSON payloads. Storage is primarily PostgreSQL, Cassandra or various static indexes. The latter primarily being used by the various content services, e.g. for search or metadata. Audio files are stored in Amazon S3 and cached in our backend or using CDNs for low latency.

The various clients keeps a persistent connection to a backend service called "accesspoint". It basically works as a messages router on steroids, handling communication with the needed services. The protocol between clients and the accesspoint is proprietary.

Clients for desktop, mobiles and our embeddable library, libspotify, all share a common code base. Each client then builds on this core to provide user interfaces and other platform specific adoptions. The shared code base is written in C++ and the platform adoptions in the platform native languages, e.g. ObjC on iOS. Also, many views and apps in the desktop client are now implemented as web apps, using an embedded instance of Chromium.

Audio is retrieved from local cache, peer-to-peer or from our storage. Our P2P solution has been described in detail in various papers by Gunnar Kreitz ([papers](#)).

Infrastructure is heavily based on Debian and open source software in general.

118.6k views · View 679 Upvoters · Answer requested by Mattias Petter Johansson and Shankar Cabus

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Gerry Giacomani Colyer, Technology and business professional in San Francisco.
Yale, Stanford MBA

Updated Apr 4, 2017 · Author has **295** answers and **785.9k** answer views

[Niklas Gustavsson](#) already gave an excellent answer so I will do my best to add to it.

Products that make up **Spotify's** tech stack include:

Amazon (CloudSearch, CloudFront, S3) Android Wear SDK, Apache (Cassandra, Kafka, CloudStack, Web Server), Babel, Bootstrap, DbVisualizer, Fabric, Genymotion, Java, jQuery, Mashape, Modernizr, Objective-C, PostgreSQL, PyCharm, Python, Raml, Reveal, SQLite, Testflight, Underscore.js, UpSource, Bynder, Carpathia by QTS, Crashlytics, Datadog, DigiCert, Disqus, Docker, Domaininfo Domain Registration, eNom Hosting, Fastly, GoDaddy SSL, Kount, New Relic, nginx, Pingdom, PractiTest, TeamCity, Tumblr, and WordPress.

Additionally, here's a list of other software products that Spotify is using internally:

- **Marketing:** 4C Insights, AdRoll, Ambassador, Chute
- **Sales and Support:** ROKT, Salesforce Sales Cloud, Lithium, Qualaroo
- **Product and Design:** ActiveInbox, Blossom, LeanKit, Splash
- **Analytics:** adjust, Apache Ambari, Google Analytics, Hortonworks
- **HR:** Beamery, Jobvite, Piazza
- **Finance and Accounting:** Digital River, PayNearMe
- **Productivity:** Slack, Dropmark, Sift, Knotable

For a complete list of software used by Spotify, check out: [Spotify's Stack | Sift](#)

(Disclaimer: The above data was pulled from Sift and has been verified by individuals working at Spotify)

9.2k views · View 63 Upvoters



Jim Humelsine, Software Developer (1985-present)

Answered Nov 13, 2017

Spotify has two relatively short videos about their engineering culture, which gets into their architecture a bit:

- [Spotify engineering culture \(part 1\)](#)
- [Spotify engineering culture \(part 2\)](#)

Their architecture is based upon microservices. Google for "microservices" and you'll find a ton of content about this architecture philosophy in general.

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Mattias Petter Johansson, former Software Engineer at Spotify (2012-2017)

Answered Nov 28, 2012 · Author has **1.1k** answers and **14.6m** answer views

@jooon on Twitter also talks publically on this matter from time to time, but his slides are slightly more surreal: <http://www.slideshare.net/jooon>

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Samaira Akhter, studied Software Engineering at University of California, Berkeley
Answered Oct 24, 2017

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1.1k views



Robert Straus, The perfect mix of sales, marketing and digital.
Answered Apr 13, 2018 · Author has 531 answers and 552.5k answer views

Here's all of the services used for Spotify.com:

Google Conversion Tracking

This free tool in AdWords can show you what happens after customers click your ad (for example, whether they purchased your product, called from a mobile phone or downloaded your app).

New Relic is a dashboard used to keep an eye on application health and availability while monitoring real user experience.

Optimizely Logo Optimizely

Optimizely empowers companies to deliver more relevant and effective digital experiences on websites and mobile through A/B testing and personalization.

DoubleClick Floodlight Logo DoubleClick Floodlight

Floodlight is feature of DoubleClick ads that allows advertisers to capture and report on the actions of users who visit their website after viewing or clicking on one of the advertiser's ads.

Pingdom RUM Logo Pingdom RUM

Real User Monitoring gives insight into performance for actual users visiting the website.

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Insights out of Facebook to this domain.

Google Analytics Logo Google Analytics

Google Analytics offers a host of compelling features and benefits for everyone from senior executives and advertising and marketing professionals to site owners and content developers.

Google Universal Analytics Logo Google Universal Analytics

Google Analytics Enhanced Link Attribution Logo Google Analytics Enhanced Link Attribution

Google Analytics 360 Suite Logo Google Analytics 360 Suite

SessionCam Logo SessionCam

Session Replay, Website Heatmaps and Web Analytics.

Rapleaf Logo Rapleaf

Marketing automation tools with the necessary data to help brands keep their customers engaged.

comScore Logo comScore

Market research company that studies internet trends and behavior.

Yahoo Web Analytics Logo Yahoo Web Analytics

Yahoo! Web Analytics is an enterprise site analytics tool that provides real-time insight into visitor behavior on your website.

Yahoo Dot Logo Yahoo Dot

Fives advertisers a simple way to measure and improve customer engagement across campaigns.

Twitter Conversion Tracking Logo Twitter Conversion Tracking

Twitter ads conversion tracking code.

Twitter Website Universal Tag Logo Twitter Website Universal Tag

A tool from Twitter that makes it possible for advertisers to track website conversions and manage tailored audience campaigns.

Bing Universal Event Tracking Logo Bing Universal Event Tracking

Universal Event Tracking (UET) is a simple and powerful campaign measurement solution that allows you to track key conversion goals important to your business.

Google Optimize 360 Logo Google Optimize 360

Test different variations of a website and then tailor it to deliver a personalized experience that works best for each customer and for your business.

Hotjar Logo Hotjar

A heatmap, survey, feedback and funnel application.

Facebook Signal Logo Facebook Signal

Journalists use Signal to surface relevant trends, photos, videos and posts from Facebook and Instagram for use in their storytelling and reporting.

Search for questions, people, and topics

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Facebook helps website owners understand how much traffic they receive from Twitter and the effectiveness of Twitter integrations on their sites. Includes Twitter Conversion Tracking.

Widgets

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Google Tag Manager Logo Google Tag Manager

Tag management that lets you add and update website tags without changes to underlying website code.

Smart App Banner Logo Smart App Banner

Displays a banner that provides a direct link to an Apple Store app, or opens the app if the user already has it installed.

Wordpress Plugins Logo Wordpress Plugins

Plugins are tools to extend the functionality of WordPress. The website uses various plugins from WordPress to provide additional functionality. Some of them may be listed here.

Qualaroo Logo Qualaroo

Behavior insight surveys for improved A/B testing. Formally KissInsights.

FastClick Logo FastClick

Polyfill to remove click delays on browsers with touch UIs.

WebEx Panel Logo WebEx Panel

WebEx system.

Workplace by Facebook Logo Workplace by Facebook

Group discussion, a personalised News Feed, and voice and video calling from Facebook.

Language

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German Logo German

Website content is written in German.

Frameworks

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PHP Logo PHP

PHP is a widely-used general-purpose scripting language that is especially suited for Web development and can be embedded into HTML.

Mobile

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Apple Mobile Web Clips Icon Logo Apple Mobile Web Clips Icon

This page contains an icon for iPhone, iPad and iTouch devices.

Viewport Meta Logo Viewport Meta

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Content Delivery Network

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AJAX Libraries API Logo AJAX Libraries API

The AJAX Libraries API is a content distribution network and loading architecture for the most popular, open source JavaScript libraries.

CloudFront Logo CloudFront

Amazon CloudFront is a web service for content delivery. It integrates with other Amazon Web Services to give developers and businesses an easy way to distribute content to end users with low latency, high data transfer speeds, and no commitments.

Fastly CDN Logo Fastly CDN

[Links to fastly CDN based content.](#)

Payment Providers

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Euro Logo Euro

The website uses the € symbol on its website - meaning it may accept payment in Euros.

Content Management Systems

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WordPress Logo WordPress

WordPress is a state-of-the-art semantic personal publishing platform with a focus on aesthetics, web standards, and usability.

JavaScript Libraries

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Facebook for Websites Logo Facebook for Websites

Allows a user to make a website more sociable and connected with integrations from the hugely popular Facebook website.

Facebook SDK Logo Facebook SDK

JavaScript SDK enables you to access all of the features of the Graph API via JavaScript, and it provides a rich set of client-side functionality for authentication and sharing. It differs from Facebook Connect.

jQuery Logo jQuery

jQuery is a fast, concise, JavaScript Library that simplifies how you traverse HTML documents, handle events, perform animations, and add Ajax interactions to your web pages. jQuery is designed to change the way that you write JavaScript.

SWFObject Logo SWFObject

SWFObject is a small Javascript file used for embedding Adobe Flash content. The script can detect the Flash plug-in in all major web browsers (on Mac and PC) and is designed to make embedding Flash movies as easy as possible.

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html5shiv Logo html5shiv

HTML5 IE enabling script shim.

Twitter Platform Logo Twitter Platform

The page embeds the Twitter platform in one method or another.

core-js Logo core-js

Modular standard library for JavaScript.

Advertising

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[One by AOL](#) Logo [One by AOL](#)

[One by AOL](#) network reaches nearly 85% of all Internet users in the U.S., making us the biggest ad network in town.

[DoubleClick - Digital Advertising Solutions](#) Logo [DoubleClick - Digital Advertising Solutions](#)

DoubleClick enables agencies, marketers and publishers to work together successfully and profit from their digital marketing investments.

Evidon Logo Evidon

Evidon gives businesses an easy, standard way of providing evidence of compliance with industry guidelines, and consumers more transparency into and control over how their information is used online

Twitter Ads Logo Twitter Ads

Twitter advertising includes conversion tracking and re-marketing tools.

Yahoo Small Business Logo Yahoo Small Business

Yahoo advertising network and search engine marketing solutions.

Google Remarketing Logo Google Remarketing

Google code specifically for remarketing/retargeting based advertising.

Facebook Custom Audiences Logo Facebook Custom Audiences

Custom Audiences from your website makes it possible to reach people who visit your website and deliver the right message to them on Facebook.

Drawbridge Logo Drawbridge

Precision audience targeting technology.

Pubmatic Logo Pubmatic

PubMatic Enables Ad Optimization Across Every Ad Network

Rubicon Project Logo Rubicon Project

Advertising optimization service.

IponWeb BidSwitch Logo IponWeb BidSwitch

BidSwitch facilitates both Supply and Demand technology partners to efficiently and transparently connect, trade and manage multiple RTB partners.

AppNexus Logo AppNexus

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decisioning on top.

IndexExchange Direct Logo IndexExchange Direct

Website is a direct publisher for IndexExchange ad content.

Shipping Providers

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UPS Logo UPS

US based package delivery company.

Email Services

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Google Apps for Business Logo Google Apps for Business

Web-based email, calendar, and documents for teams. Renamed to Google Apps for Work, but now known as G Suite From Google Cloud.

SPF Logo SPF

The Sender Policy Framework is an open standard specifying a technical method to prevent sender address forgery.

DMARC Logo DMARC

A technical specification created by a group of organizations that want to help reduce the potential for email-based abuse

MailChimp SPF Logo MailChimp SPF

This site has an SPF record for MailChimp managed email sending.

SSL Certificate

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SSL by Default Logo SSL by Default

The website redirects traffic to an HTTPS/SSL version by default.

DigiCert SSL Logo DigiCert SSL

Certificate provided by DigiCert.

Hosting Providers

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Google Logo Google

Site hosted on Google infrastructure.

Google Cloud Logo Google Cloud

Website hosted on Google Cloud Platform.

Nameserver Providers

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Dyn DNS Logo Dyn DNS

DNS services provided by Dyn.

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Netflix delivers data-driven DVD and Blu-ray with enterprise-level support and transparent pricing.

Web Server

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nginx Logo nginx

nginx [engine x] is a HTTP server and mail proxy server written by Igor Sysoev.

Apache Logo Apache

Apache has been the most popular web server on the Internet since April 1996.

Aggregation Functionality

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Really Simple Discovery Logo Really Simple Discovery

Really Simple Discovery is a way to help client software find the services needed to read, edit, or "work with" weblogging software.

Live Writer Support Logo Live Writer Support

Windows Live Writer Tagging Support Schema

Encoding

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UTF-8 Logo UTF-8

UTF-8 (8-bit UCS/Unicode Transformation Format) is a variable-length character encoding for Unicode. It is the preferred encoding for web pages.

CSS Media Queries

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Device Width Logo Device Width

Describes the width of the output device (meaning the entire screen or page, rather than just the rendering area, such as the document window).

Orientation Logo Orientation

CSS Orientation Media Query

Device Pixel Ratio Logo Device Pixel Ratio

A media query to display different CSS based on the device pixel ratio. Standard screens have a pixel ratio of 1, retina devices have a pixel ratio greater than 1.

Min Width Logo Min Width

A CSS media query to display specific CSS if a device greater than the minimum width specified.

Max Width Logo Max Width

Media query to limit CSS to display for devices with a maximum width defined.

Resolution Logo Resolution

Indicates the resolution (pixel density) of the output device. The resolution may be specified in either dots per inch (dpi) or dots per centimeter (dpcm). Used to change

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[HTML5 DocType Logo HTML5 DocType](#)

The DOCTYPE is a required preamble for HTML5 websites.

[Open Graph Protocol Logo Open Graph Protocol](#)

The Open Graph protocol enables any web page to become a rich object in a social graph, a open protocol supported by Facebook

[Conditional Comments Logo Conditional Comments](#)

The website uses conditional comments that are supported by Microsoft Internet Explorer. They allow web developers to show or hide HTML code based on the version of the viewer's browser.

[Javascript Logo Javascript](#)

JavaScript is a scripting language most often used for client-side web development. Its proper name is ECMAScript, though "JavaScript" is much more commonly used. The website uses JavaScript.

[Meta Description Logo Meta Description](#)

The description attribute provides a concise explanation of the page content.

[Meta Keywords Logo Meta Keywords](#)

Meta tag containing keywords related to the page.

[Twitter Cards Logo Twitter Cards](#)

Twitter cards make it possible for you to attach media experiences to Tweets that link to your content.

[Canonical Content Tag Logo Canonical Content Tag](#)

Public specification of a preferred URL for a page allows search engines to understand the original location for content.

[Cascading Style Sheets Logo Cascading Style Sheets](#)

Cascading Style Sheets (CSS) is a stylesheet language used to describe the presentation of a document written in a markup language. Its most common application is to style web pages written in HTML

[IFrame Logo IFrame](#)

The page shows content with an iframe; an embedded frame that loads another webpage.

[HTML 5 Specific Tags Logo HTML 5 Specific Tags](#)

This page contains tags that are specific to an HTML 5 implementation.

[Content Security Policy Logo Content Security Policy](#)

Content Security Policy is a computer security concept, to prevent cross-site scripting XSS attacks.

[Content Type Options Logo Content Type Options](#)

Used to disable MIME-sniffing for a particular HTTP response.

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The [HTTP Strict Transport Security \(HSTS\)](#) header instructs the browser to only use https.

HSTS Logo HSTS

Forces browsers to only communicate with the site using HTTPS.

CDN Providers

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Amazon S3 CDN Logo Amazon S3 CDN

Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers.

1.3k views

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