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2021: Whitepaper

Headless - Ecommerce

Adopting DXP Ecommerce Solutions:

Headless CMS Frameworks & GraphQL API Services

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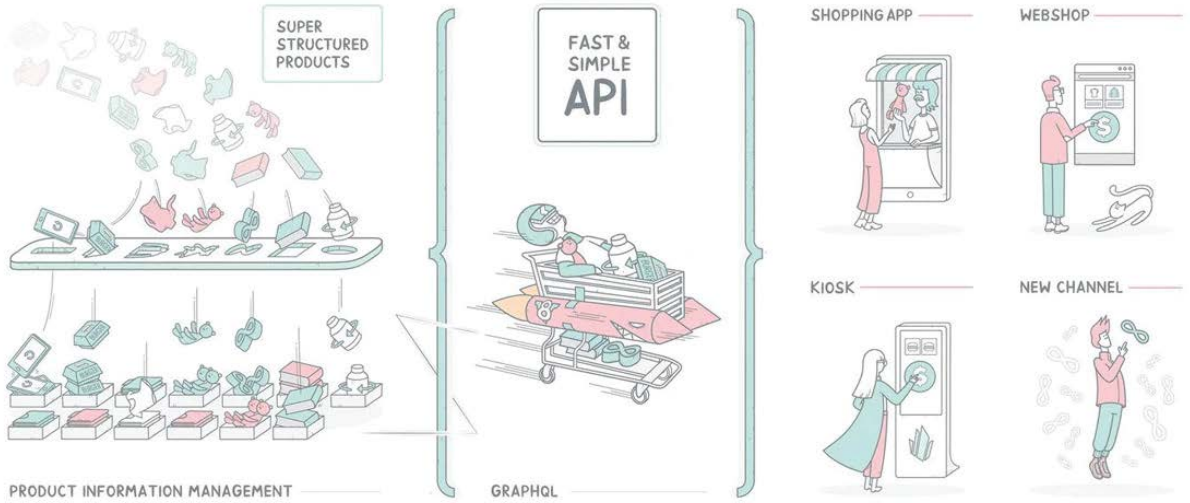
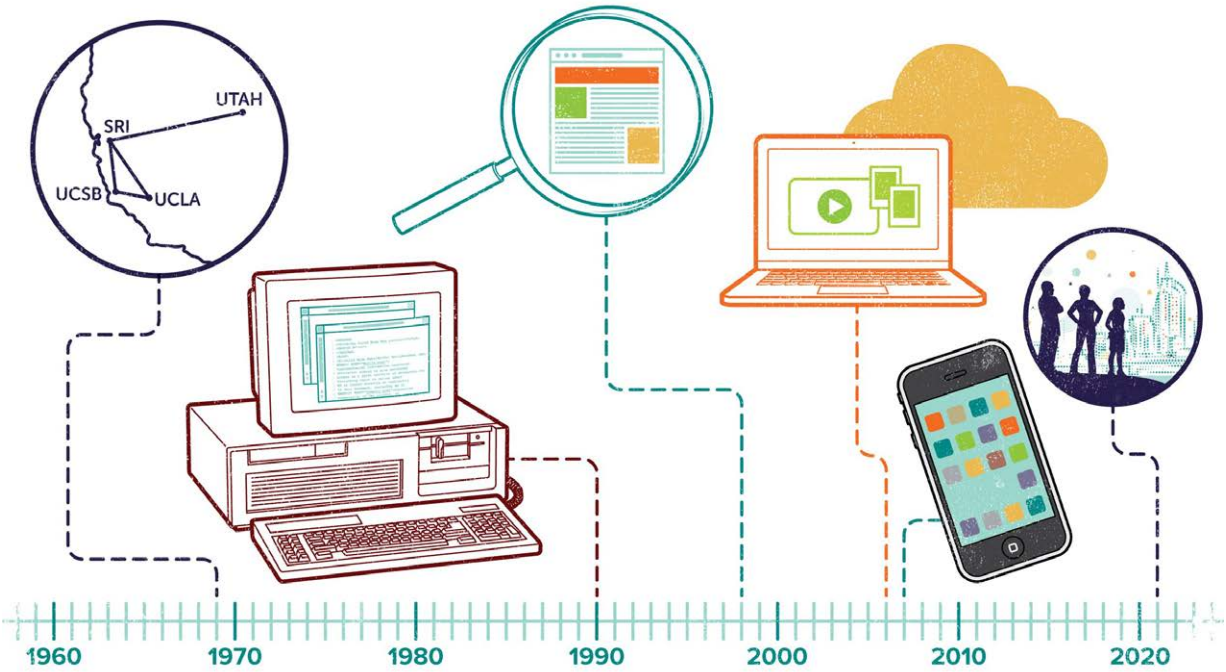
Introduction



Mobile ecommerce has surged from Q1 of 2016[1] onwards, with over 72% of American adults now using smartphones[2] daily. Online retailers have been forced to start focusing more heavily on custom software development and cloud solutions for mobile apps. The advent of JavaScript frameworks like React, NativeScript, and VueJS running on Node.js servers enabled a new type of client-rich applications with the ability to launch chat and other customized services for dynamic content in real-time. This quickly led to a new normal for ecommerce users, advancing the development of Digital Experience Platforms (DXPs) with personalized journeys for customers.

[1] https://www.clickz.com/the-age-of-m-commerce-why-consumers-love-using-mobile-as-a-shopping-tool/112518/
[2] https://www.pewresearch.org/internet/fact-sheet/mobile/

With increasing bandwidth availability through WiFi-hotspots and mobile device proliferation through tablets, retailers have adopted "mobile-first" strategies in the delivery of client-rich experiences. With DXPs, machine learning and event-driven architecture can now be used to customize user journeys based on data analytics and advertisement tracking for better sales & marketing campaigns.



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Client-Rich Experiences:
Decoupled Backend Architecture

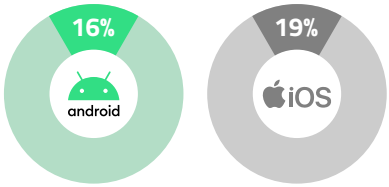
The current trend is for the simultaneous development of custom software applications for the iOS and Android platforms integrally, using the same code base. In 2021, all mobile ecommerce solutions can be categorized by their approach to solving the problem of app development for these two platforms. One popular method is to use each feature release to trigger two, new separate releases for iOS and Android, distributed to users through updates in the App Stores. Alternatively, Native development can be adopted, where JavaScript-based website applications auto-fork into two mobile apps that will

run natively on each platform, including a custom desktop release for Windows, Mac, and Linux that is also developed from the same code-base. This includes custom app distribution through website downloads as well as update distribution through Google and iOS App Stores. With so many challenges to software development teams across Native iOS, Android, Adaptive Mobile, and Desktop applications, ecommerce COTS (Component Off the Shelf) platforms are increasingly being adopted to maintain the dynamic content for each of these display modes in the cloud. Agile programming teams also need to implement CI/CD solutions for managing security and feature upgrades across the software development pipeline for their apps on the iOS, Android, and desktop platforms with version control.

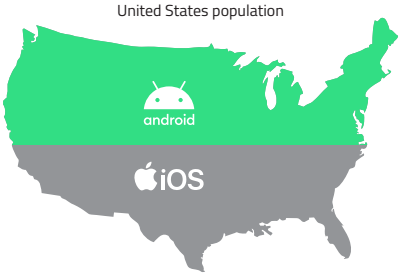
Official Number of Apps

700,000 775,000

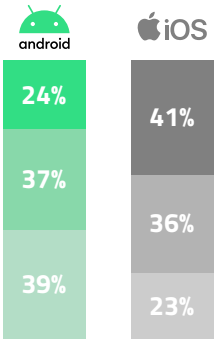
Share of Platform Users (Age 18-24)



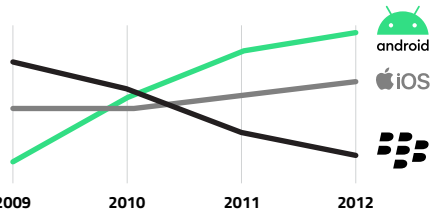
Android smartphones and iPhones are owned by more than a third of the entire United States population



Annual Household Income Share by Platform

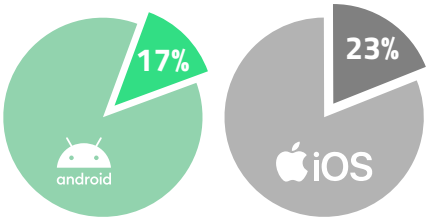


Smartphone Market Share by Mobile Operating System

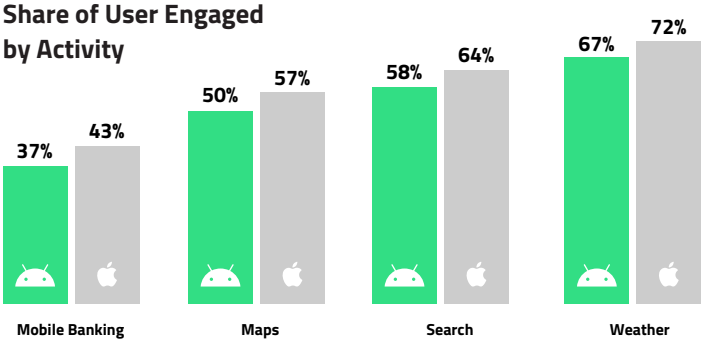


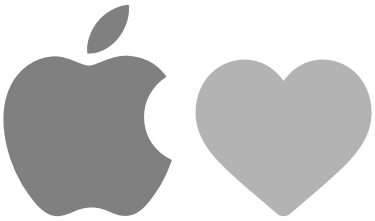
In 2009, the BlackBerry operating system controlled half of the U.S. smartphine market. Now it's found on less than 10% of these devices. Android and iOS currently control the vast majority of U.S. smartphone

Share of User Purchasing Goods or Services via Smartphone



Share of User Engaged by Activity





80% of current iPhone owners owned a previous iPhone

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The Age of Responsive Mobile Web Applications ("Mobile-First")

The need for a fluid layout design to deliver client-rich experiences in a device-agnostic way started in 2010, gained traction into early 2014, and became an influence for new standards in mobile development. The use of RWD (Responsive Web Design) with a "mobile-first" approach became mainstream with the widespread international growth in smartphone adoption. With RWD, businesses of any size can develop a unified content strategy for deploying content to mobile and desktop applications across devices with pixel-perfect layout control. The practice of using a monolithic web application like a CMS to generate displays for mobile apps has led to a wide number of competing headless and decoupled CMS solutions entering the marketplace. The use of RWD can facilitate the creation of a custom display for every device screen size automatically. Professional software development teams are choosing API solutions to modernize monolithic applications and databases with microservices for elastic cloud runtime support that includes Native mobile app support.

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Microservices: Breaking Up the Monolithic Web Ecommerce Application

Traditional ecommerce web application frameworks distribute decisions like code functions across experience layers that compose the front end and business layers that form the backend. This approach can often result in lengthy release cycles, higher defect leakage, and huge technical debts. To overcome these challenges, the use of headless architecture with decoupled monolithic CMS applications was pioneered by JavaScript developers, primarily using React, an open-source framework for Native app development released by Facebook. To integrate with React or other JavaScript-based solutions for Native mobile and desktop app development, traditional ecommerce frameworks began exposing business interfaces using REST API endpoints. Frontend layers were made responsible only for delivering client experiences with Node.js to improve page load speeds with React and other JavaScript app development frameworks like VueJS, Gatsby, Next, Ionic, etc. When custom APIs are synchronized with the monolithic CMS application database, a mobile app can make multiple round-trip calls to the business layers of the server for user data and programmed actions, realizing the headless approach in production.

Microservices allow for monolithic software applications and databases to be modernized with APIs for cloud runtimes. Headless solutions bridge the resources of monolithic applications like CMS or DAM platforms with Native mobile device displays that are coded specifically for iOS and Android using JavaScript with PHP, ASP.NET, Objective C, C#, Dart, Go, & Python code according to the requirements of the software development team.

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Challenges with Monolithic Apps & Headless CMS Architecture

The headless web layer still maintains a dependency on the backend in monolithic CMS or CRM applications with decoupled and headless architecture. This can cause further complexities that warrant longer test and release cycles. Although the experience layer moves faster in custom app development for mobile, this approach often has too many limitations for programming teams, which restrict the ability to introduce new features in an Agile fashion.

Customizing monolithic CMS & CRM applications for mobile is technically difficult, requiring complex integrations with React or other JavaScript app-building frameworks, as well as increased testing of code in the CI/CD pipeline with version control. Ongoing business activities built around marketing and merchandising efforts can also stifle release cycles. To overcome these limitations with headless or decoupled CMS frameworks, development teams increasingly rely on GraphQL as an API solution that integrates well with Node.js & React for performance.

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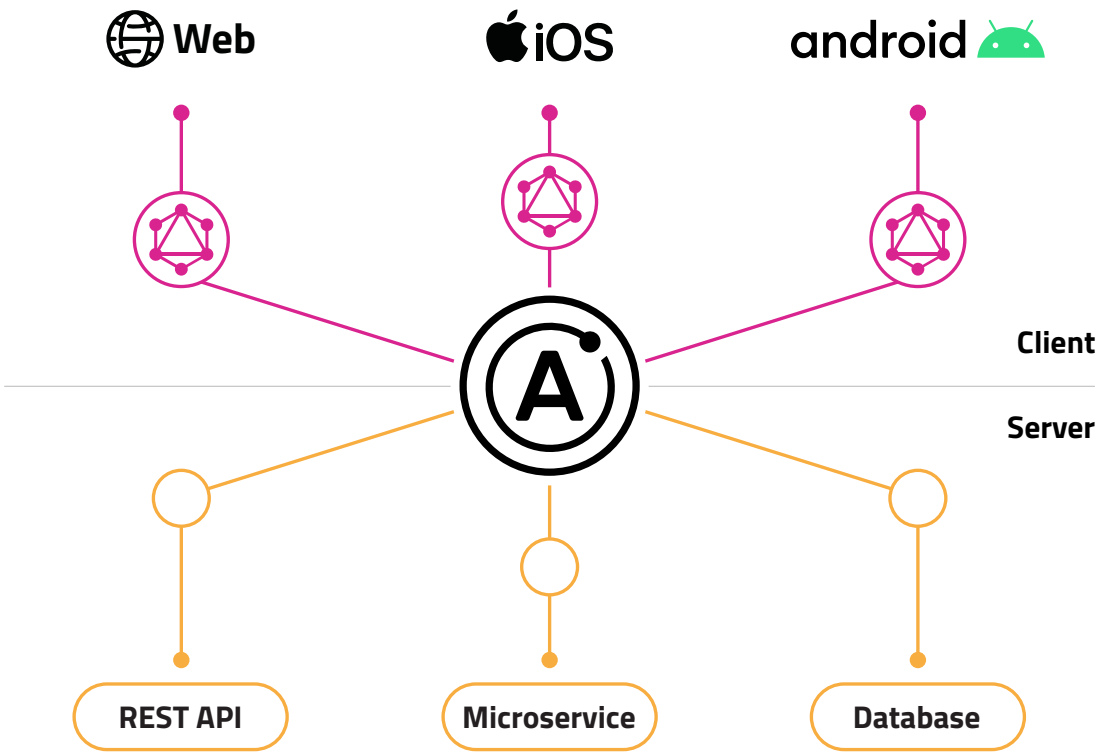
GraphQL:
The Solution for Converting Monolithic Apps to Headless CMS



GraphQL was introduced by Facebook in 2012 and made public in 2015 as a query language for APIs. GraphQL is a runtime for fulfilling database queries with a decoupled CMS or CRM. GraphQL can work with an existing database or data warehousing resources. GraphQL provides a complete and understandable description of the data in your API, gives clients the power to ask for exactly what they need and nothing more, makes it easier to evolve

APIs over time, as well as enabling powerful, new developer tools. With its REST API options, GraphQL shines by exposing schema and structure to the client-side, giving applications the ability to evolve independently over server changes. GraphQL works with Apollo Server, Node.js, React, and other next-gen JavaScript app-building frameworks.

The table below shows the feature comparison of GraphQL vs. other REST APIs[3]:

	GraphQL	REST
Architecture	client-driven	server-driven
Organized in terms of	schema & type system	endpoints
Operations	Query Mutation Subscription	Create, Read, Update, Delete
Data fetching	specific data with a single API call	fixed data with multiple API calls
Community	growing	large
Performance	fast	multiple network calls take more time
Development speed	rapid	slower
Learning curve	difficult	moderate
Self-documenting	✓	—
File uploading	—	✓
Web caching	(via libraries built on top)	✓
Stability	less error prone, automatic validation and type checking	better choice for complex queries
Use cases	multiple microservices, mobile apps	simple apps, resource-driven apps

[3] https://graphql.org/

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CMS/CRM-based Headless Ecommerce Applications

Any ecommerce application is made of three primary components:

Admin Control Tools

A web application that includes CMS/CRM capability to manage customers, catalog, merchandising, inventory, orders, shipping, & logistics.

Ecommerce Backend

The backend business layer of web server code that provides user authentication, catalog, pricing, promotions, purchase process support, shopping cart, checkout, and other platform capabilities.

Ecommerce Storefront

The experience layer delivers the display for ecommerce functionality through services connecting to the backend for display on devices.

Traditional CMS/CRM platforms can be converted to run with Node.js, React, and other JavaScript app-building frameworks using REST APIs, SQL, or web programming languages. Decoupled or headless solutions build on the existing user data in the CMS or CRM, which can also be filtered by third-party data analytics services to create custom displays.

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GraphQL-based Ecommerce Applications

With GraphQL-based solutions, the three primary components of ecommerce apps are:

Admin Control Tools

A JavaScript-based "mobile-first" application powered by a GraphQL interface. The GraphQL Schema and types provide management tools for catalogs, product inventories, taxonomy categories, customer orders, and content.

Ecommerce Backend

A GraphQL-interfaced backend layer completely decoupled from the frontend. The backend functionality can also integrate with third-party API services for search, tax, shipping, data analytics, and fulfillment.

Ecommerce Storefront

A JavaScript-based, "mobile-first" progressive web application (PWA) that uses a GraphQL interface to power digital experiences.

Digital Experience Platforms (DXPs) are the next-generation of ecommerce, using machine learning and data analytics to build custom user journeys that include automated display generation for any desktop, mobile, or tablet device. Businesses with legacy CMS/CRM applications operating in ecommerce can grow with their resources by implementing data analytics with machine learning for DXP usage. Large-scale companies benefit by introducing event-driven architecture in the data center for real-time platform analytics.

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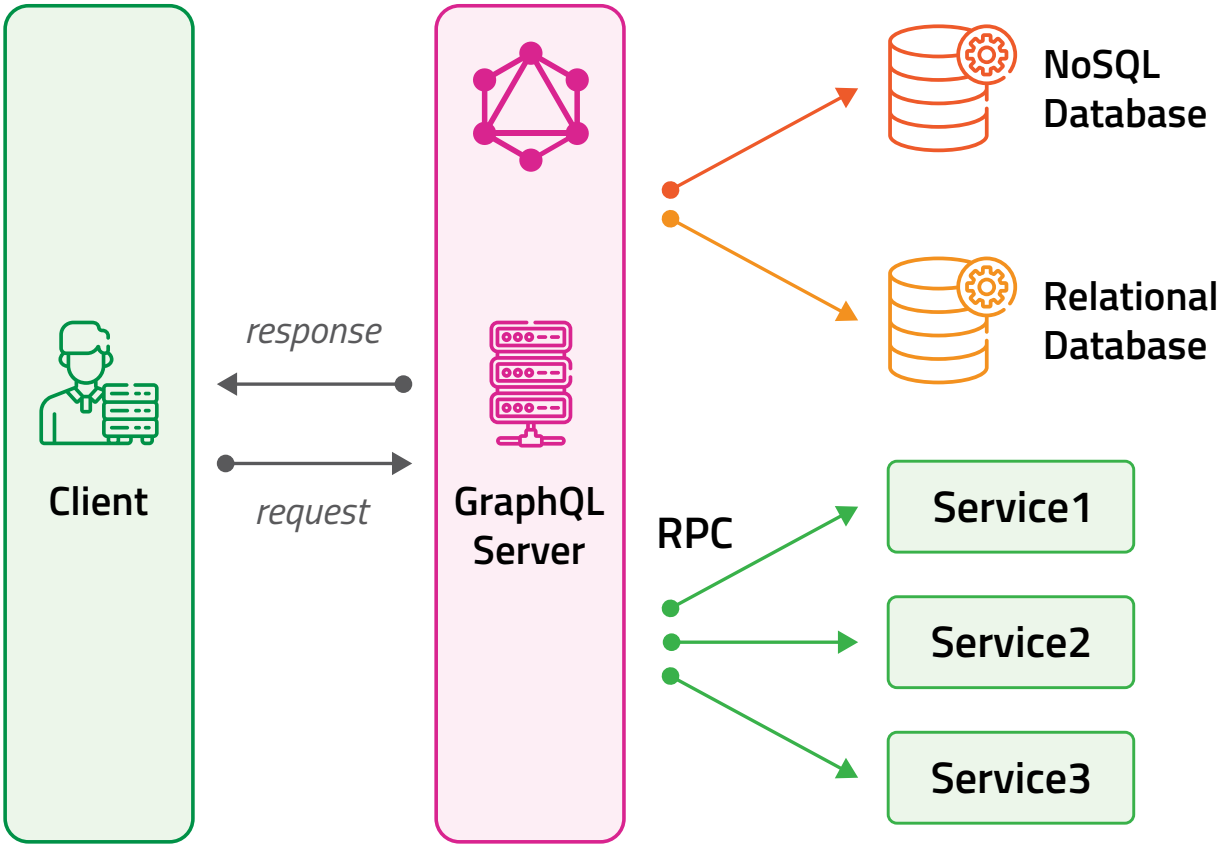
Conceptual View of Ecommerce Applications Powered by GraphQL



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Main Players in Headless GraphQL - based Ecommerce Platforms

commercetools
Next generation commerce

https://commercetools.com/headless-commerce

With a wide range of integrations and enterprise clients, commercetools is one of the leaders in the space of headless ecommerce platforms recognized by IDC. The commercetools framework supports websites, mobile, IoT, wearables, cars, voice, CRMs, etc.

APOLLO

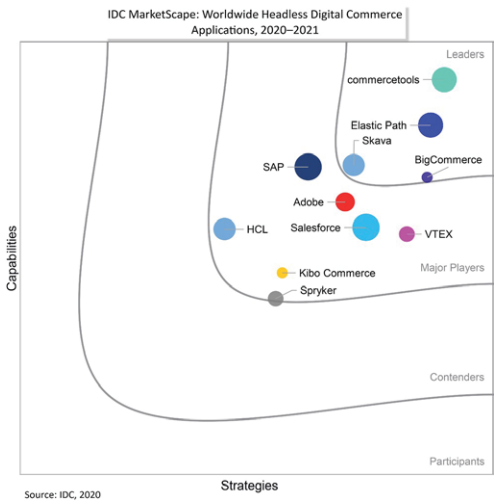
apollographql.com

Apollo Server combines the use of GraphQL with Node.js as a web server stack runtime environment that can be deployed in support of custom-coded websites and mobile applications in the cloud. Apollo Server also generates data analytics.

HASURA

hasura.io

Hasura allows developers to build and host a GraphQL API with backend support for Microsoft SQL, PostgreSQL, Google BigQuery, Timescale, and other databases.



IDC: Worldwide Headless Digital Commerce Applications (2020-21).[4]

[4] https://www.idc.com/getdoc.jsp?containerId=US45741620

Adobe

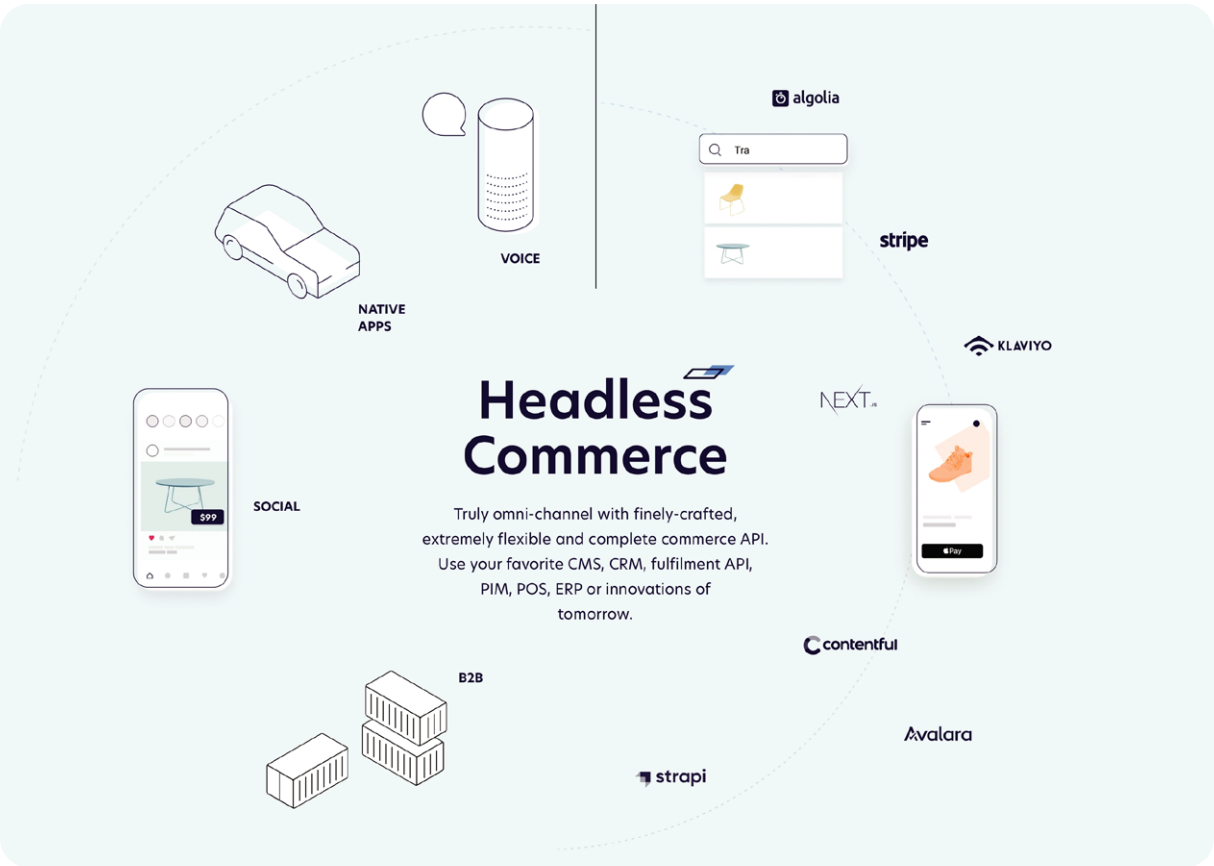
www.adobe.com/marketing/experience-manager.html

AEM allows for the use of GraphQL for content fragments. Query Experience Manager builds displays for websites & mobile apps with React, Angular, etc.

aws AppSync

https://aws.amazon.com/appsync/

AWS AppSynch allows developers to build and manage a GraphQL API in the cloud with pre-built connectors for DynamoDB, Aurora, Elasticsearch, and Lambda. AWS AppSynch includes auto-scaling on the API service to meet the requirements of any level of request traffic.



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New Entrants in Headless Ecommerce Platform Powered by GraphQL

saleor.io

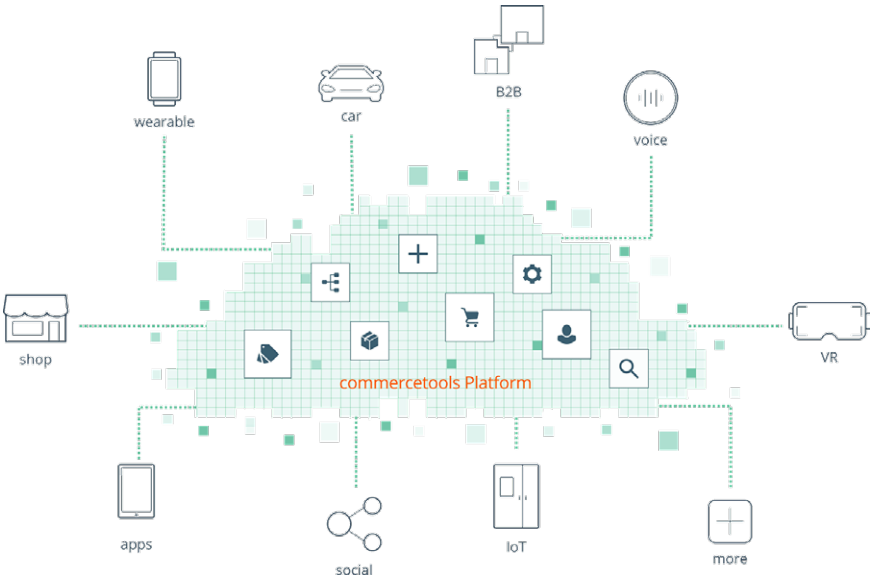
Saleor.io is an open-source headless ecommerce platform with GraphQL interfaces for a PWA-powered Storefront and admin tool. With out-of-the-box integrations for tax, shipping, & payment processing, Saleor is aggressively growing in the SMB space of retail ecommerce.

graphcms.com

GraphCMS is a SaaS product that allows developers to build apps using GraphQL in a cloud environment under a subscription plan. GraphCMS supports React, Gatsby, Next.js, & Vue.

contentful.com

The Contentful CMS is a headless or decoupled solution that can be used to host a GraphQL server with PostgreSQL. Developers can build JavaScript apps for iOS & Android.



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Technology Stack for Headless eCommerce

STACK	APPLICATIONS	PROVIDER	DETAILS
commercetools Next generation commerce CommerceTools (Powered by Apollo GraphQL) Proprietary DB Vue Storefront Frontend (Any frontend, Officially Vue (VueStorefront.io)	End to end eCommerce headless framework powered by GraphQL on SAAS Have connectors for various enterprise CMS (Adobe) and marketing suites	https://commercetools.com/	SAAS platform with a license model that supports enterprises implement headless eCommerce framework with choice of frontends using VueStorefront
shopify developers Shopify API (Powered by Apollo GraphQL) Proprietary DB Vue Storefront Any Frontend (VueStorefront.io has an official plugin)	An end to end API framework that helps Shopify clients implement a different head for their shop	https://shopify.dev/tutorials/build-a-shopify-app-with-node-and-react	SAAS based API platform with billing that supports eCommerce retailers scale their head (Front end) using Shopify API

STACK	APPLICATIONS	PROVIDER	DETAILS
saleor Saleor (Powered by Apollo GraphQL) PostGres DB (Available on Cloud) Search: Native and ElasticSearch Frontend: React	Open source end to end eCommerce framework that exposes storefront and merchandising capabilities using GraphQL APIs	https://saleor.io/	Open Source Platform deployable using Docker on any cloud. Also provides a consulting service for hosting ecommerce on the cloud (SaleorCloud)
graphcms GraphCMS: GraphQL native Headless CMS to deliver omnichannel content in an API first manner.	A headless CMS is a backend-only content management system, making content accessible via an API for display on any device, without a built-in front-end or presentation layer.	https://graphcms.com/	GraphQL Headless CMS for true Content Federation The leading GraphQL Headless Content Management System (CMS) to programmatically create, manage, and deliver content, API-first. (39 kB) https://media.graphcms.com/qd8DY4QRRbXGajEQ7aew
contentful An enterprise class API driven (and user managed) Content management system for Headless eCommerce platforms	Compose + Launch give content teams powerful tools to work faster and collaborate more effectively to deliver projects in Contentful	https://www.contentful.com/	API-first content platform to build digital experiences More than a headless CMS, Contentful is the API-first content management platform to create, manage and publish content on any digital channel.

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Conclusion

With the evolution of headless ecommerce frameworks and GraphQL-based interfaces, rich assortments of rapidly deployable, open-source ecommerce applications are increasingly becoming available to developers. With huge open-source support backed by a strong technology team, there are considerable advantages to adopting GraphQL solutions in conjunction with existing CMS applications and third-party API integrations for custom displays. The use of open-source resources in custom software development for websites and mobile applications can help to offset licensing costs, the share of revenue requirements, and elevate brands to go fully SAAS-based to provide rich digital experiences to customers.

Companies running legacy CMS and CRM products need to consider the upgrade path to DXP technology for the new decade. Headless and decoupled solutions preserve existing data in ecommerce platforms, using it with APIs to build mobile applications with JavaScript. This hybrid approach integrates websites, mobile apps, and desktop distributions as the main requirements for programming team support. The use of GraphQL with JavaScript platforms running on Node.js like React, Vue, Gatsby, Next.js, Ionic, etc. represents one of the most effective means of managing a web/mobile app combination. Resources like Apollo Server provide backend support for Node.js & GraphQL. Managed cloud services like Hasura, AEM, GraphCMS, and Contentful can speed up and optimize programming teams with SDKs, CI/CD, and DevOps tools.

For the gradual adoption of DXP solutions, choose a headless or decoupled CMS approach that preserves existing web properties while adding new React Native apps for iOS, Android, and desktop use. GraphQL APIs are designed to provide the fastest page load speeds and mobile device displays through JavaScript technology like React. For legacy software application and database modernization, Fortune 500 companies are increasingly choosing GraphQL as a microservice component for mobile development, as well as applying the technology to voice UI support, IoT devices, wearable computers, and the software that runs in vehicles worldwide. If your business is searching for an integration company to manage custom mobile application development for iOS and Android with React and GraphQL, please contact ChangeCX for a consultation and free estimate.

References

CX

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SUPPORTED SOFTWARE SOLUTIONS:

APOLLO
Adobe
commercetools Next generation commerce
aws AppSync
HASURA
saleor
graphcms
contentful
Vue Storefront
shopify developers