

THE STATE OF  
**API INTEGRATION**  
REPORT | 2020

Cloud Elements

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# A WORD FROM THE EDITOR

## Welcome to the State of API Integration 2020 report!

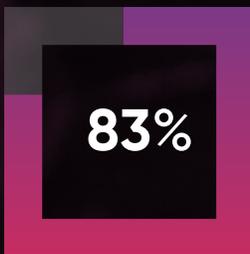
It's a new decade and a new set of expectations. A balancing act between driving innovation and "playing nice" with a growing ecosystem of overlapping applications outside our control. The challenge itself is not new – APIs have been connecting applications for years – but the problem space facing integration professionals and application developers has gotten bigger.

Between more cloud apps in the marketplace, legacy systems, and the digital products our own companies release and expand, it's increasingly difficult to "build a platform", as many of this year's survey respondents are aiming to do.

Call it 'stickiness,' 'loyalty,' or 'customer success,' respondents building digital products are looking for ways to build an experience that keeps customers using their products and services. It sounds simple, but given current application marketplaces, today's customers expect to work seamlessly with all the products and services they use to run their business. An application can be best in class, but if it's not well-integrated, its value goes down significantly.

For those inside the enterprise and at the “sharp end” of digital transformation, the road to cost savings and rapid innovation for the business runs through fit-for-purpose APIs. The inherent tension between the teams building APIs and those consuming them only grows as you integrate more core business processes.

From either perspective, APIs have moved from a one-off development challenge to a competitive business advantage. The speed of change, driven by the proliferation of applications, is taking us from connecting one-off applications to thinking at platform scale.



**On average, 83% of respondents consider API integration a critical part of their business strategy**



In this year's report, we explore how API integration is key to creating 'connected experiences.' According to respondents, connected experiences drive sales and revenue, attract and retain top talent, and unlock new data-driven insights. The ecosystem that matters most is the one that turns your product or service into a platform and creates a seamless experience for your business users, customers, and partners.

## Connected Customer Experience:

Linking the interactions of customers, partners, and employees with your products and services and how the data and experience logically link together to drive ease-of-use and value.

API integration has come a long way. There are tremendous benefits to be gained by having a solid strategy. Yet there are new challenges on the horizon. API providers, practitioners, architects, and consumers are wrestling with new strategies to unlock the potential of event-based integration and testing the merits of GraphQL.

Along with the above topics, this year's report also looks at the state of the business of APIs. But above all, we hope this report provides useful insights that help you advocate for, design, and build strong API integration solutions that lead to genuine change, improve your platform strategy, and ultimately deliver the user experience you and your customers want.



## Happy Integrating!

Ross Garrett  
Chief Product Officer, Cloud Elements  
[@gssor](#)



# MEET OUR CONTRIBUTORS

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## Ross Garrett

Chief Product Officer, Cloud Elements

[@gssor](#)

Ross Garrett is the Chief Product Officer at Cloud Elements - responsible for market strategy, product management, positioning, and evangelism. He is a well-known speaker at developer events and other industry conferences.



## Mark Geene

CEO and Co-Founder, Cloud Elements

[@mgeene](#)

Mark Geene is the co-founder and CEO of API integration pioneer Cloud Elements. Since his days in the computer engineering program at WPI (Worcester Polytechnic Institute), Mark has made a career of solving business problems with a strong technology foundation. In fact, the founding of the industry's first API Integration platform in 2015 is just one example of Mark helping customers connect complex systems in as simple a way as possible. In his previous role as CEO of Channelinsight, a Channel Data Management SaaS company, Mark kept running into challenges trying to find APIs that could connect the hundreds of apps and systems "proliferating like wildfire" that his customers and partners were using. Cloud Elements was born of that need.



## Brian Busch

Director of Product Marketing, Cloud Elements

[@brbusch](#)

Brian Busch leads Product and Alliances Marketing for Cloud Elements. He has been involved in launching and scaling new products and services throughout his career, most recently with Kapost (now Upland Kapost) and before that at Captricity (now Vidado.ai) where he helped bring a revolutionary new handwriting recognition technology to market. He holds degrees from Boston College and an MBA from UC Berkeley-Haas.



## Matthew O'Riordan

CEO, Aply Realtime

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Matthew O'Riordan is the technical co-founder of Aply, a protocol-agnostic global cloud messaging service that provides APIs used by thousands of developers and businesses. He has been a programmer for over 20 years. As a developer himself, his focus is not just on the best technical solution, but more often on the experience developers have with their APIs. Developer relations for Aply is necessarily at the heart of everything they do, given their customers are all developers.



## Richard Pulliam

Principal at 2Disrupt, LLC

[@2disrupt](#)

Richard Pulliam is a senior business executive with more than 20 years of experience in general management, business and product strategy, business development, and international expansion. He specializes in entering untapped growth markets and helping companies transform at the front of digital waves. He also advises several startups, served as Chief Commercial Officer of wearableOS platform Muzik, and previously led Layer 7's transition from SOA gateways to API management and continued to lead the business unit after acquisition by CA.



## Luke Vance

Product Manager, Cloud Elements

[@lukealav](#)

Luke Vance is a Product Manager at Cloud Elements and a hobbyist developer. Recently his after-hours hack sessions have been spent on conversation graphs and chatbots. He has been building software applications ever since a failed solar energy venture during which he learned first-hand the importance of product management. Luke was an accomplished track and field athlete at Wheaton College where he studied Physics.

01

# INTRODUCTION

A silhouette of a person wearing a cap and a jacket, standing on a rooftop or balcony. The background is a sunset or sunrise sky with a gradient from dark blue at the top to orange and red at the bottom. The person is looking towards the right side of the frame.

## ABOUT THIS REPORT

For the fourth edition of the State of API Integration report, we surveyed over **380 API experts from 44 countries across the globe.**

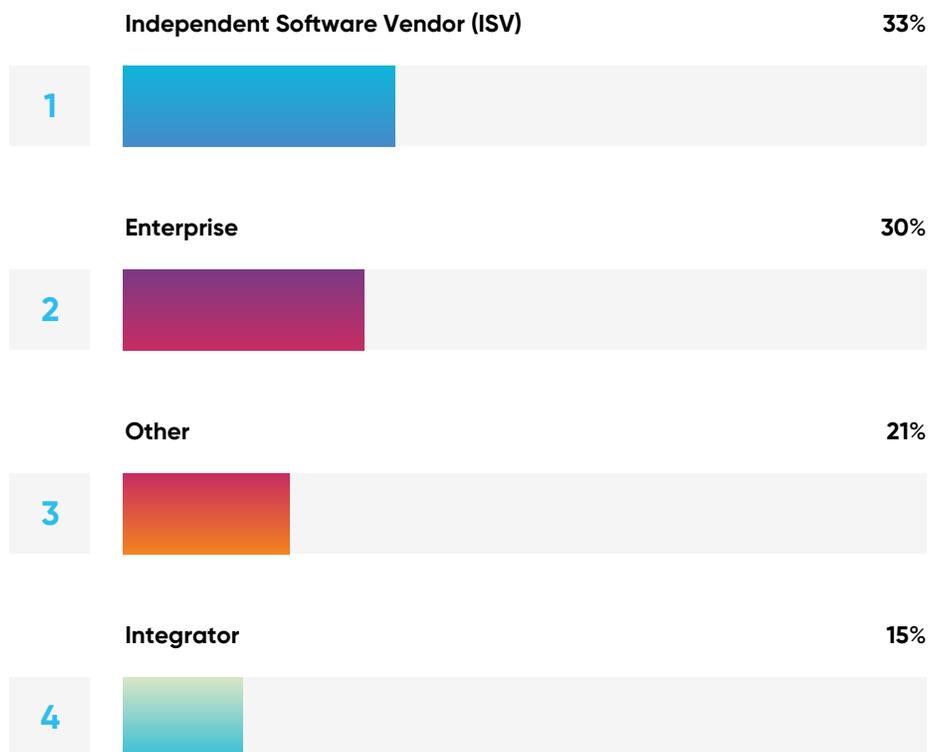


The survey was open from November 2019 to January 2020. The titles of the respondents included technical/engineering, product leaders, and c-suite. The goal of this year's report was to discover:

- ✓ How, or if, API integration strategies are shifting
- ✓ Which emerging technologies are transforming integration standards
- ✓ The role of APIs in product strategies and development
- ✓ Which key decisions drive the development process
- ✓ How to support the decision process for implementing API integrations

## Meet Our Respondents

### What type of company is \_\_\_\_\_ ?





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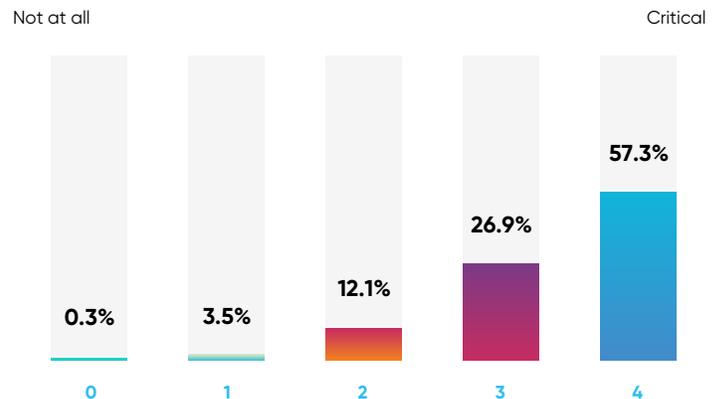
# API INTEGRATION - KEY INSIGHTS AND TRENDS

## API INTEGRATION - KEY INSIGHTS AND TRENDS

1. API integration continues to be critical to business strategy with 84% of respondents reporting that it's critical or very critical.

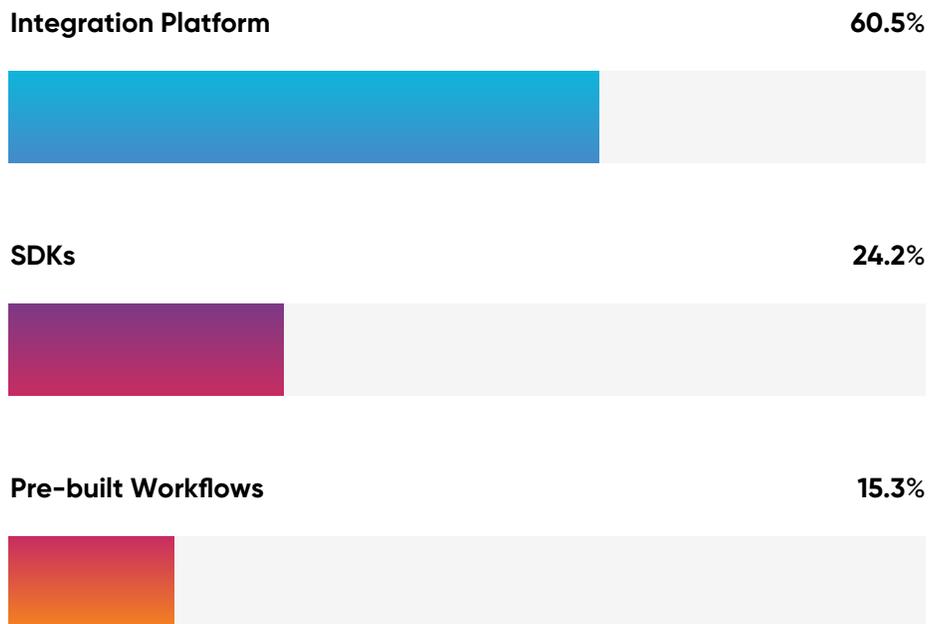
How critical is API integration  
to your business strategy?

Avg. 3.4



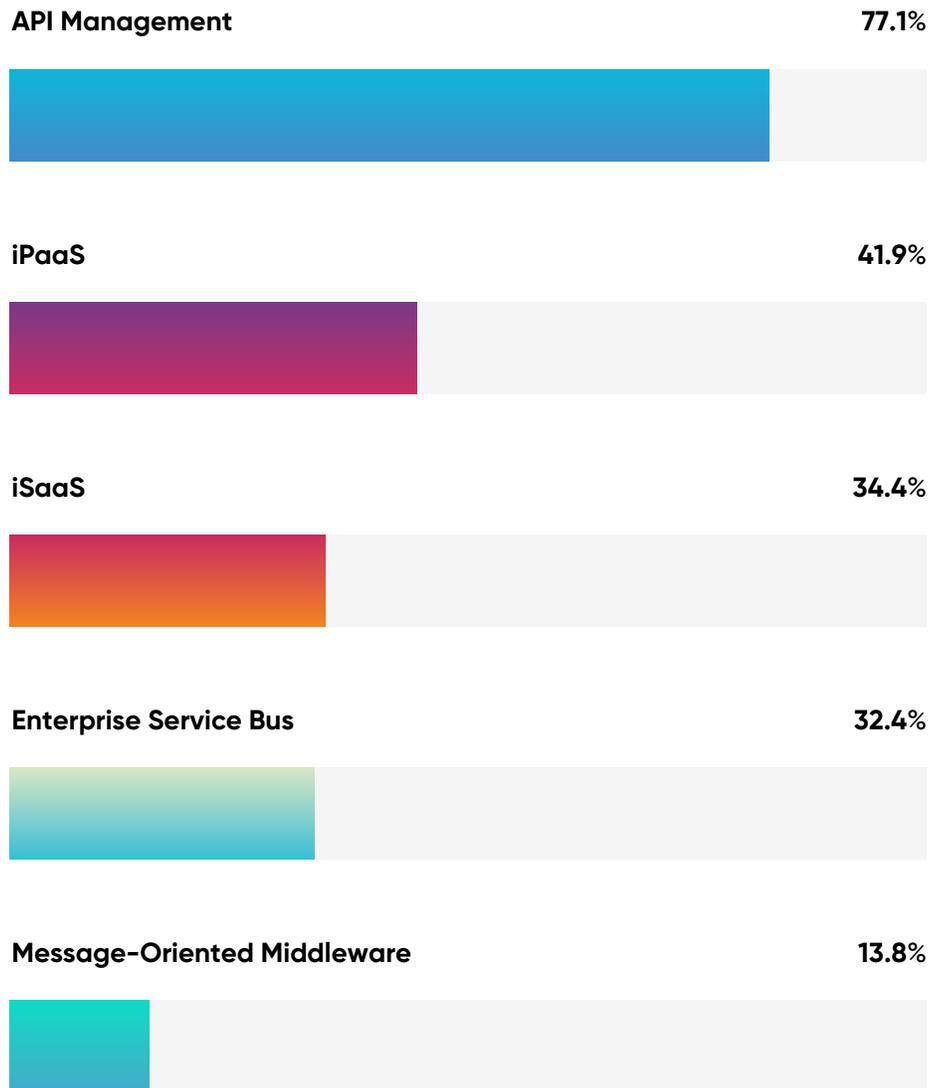
2. This year's respondents are focused on integrations to enable the building of digital platforms.

## Which of the following integrations do you offer as part of your product?



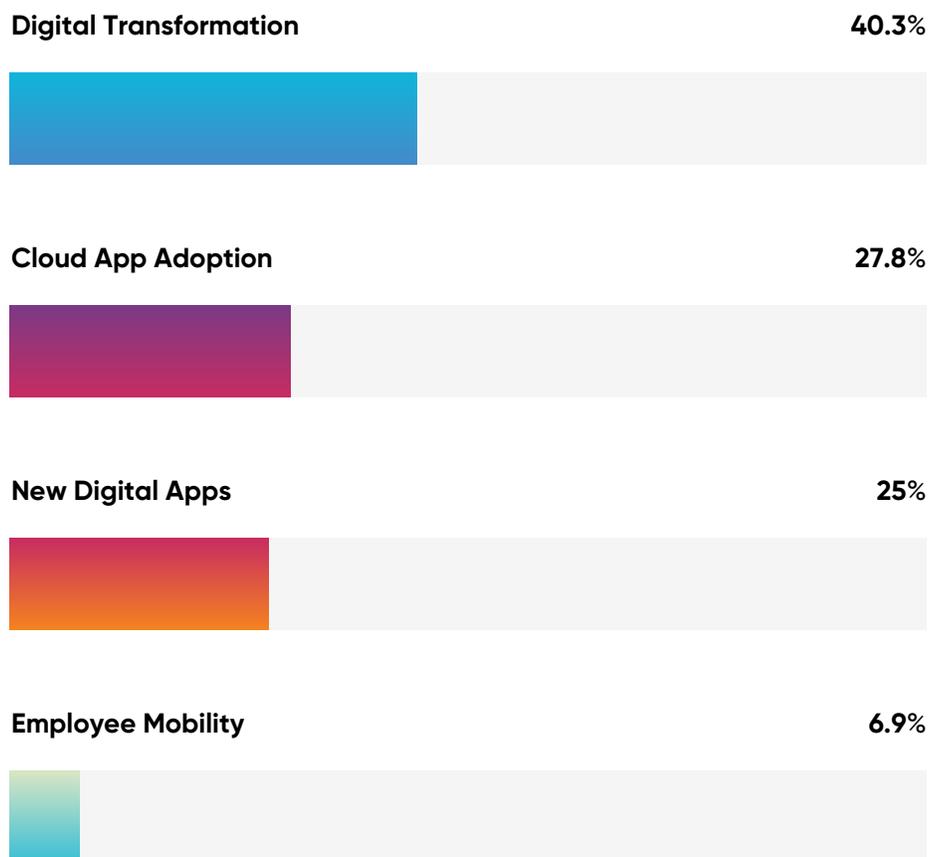
### 3. Investing in integration infrastructure for API Management leads the way.

## What integration infrastructure have you invested in to date?



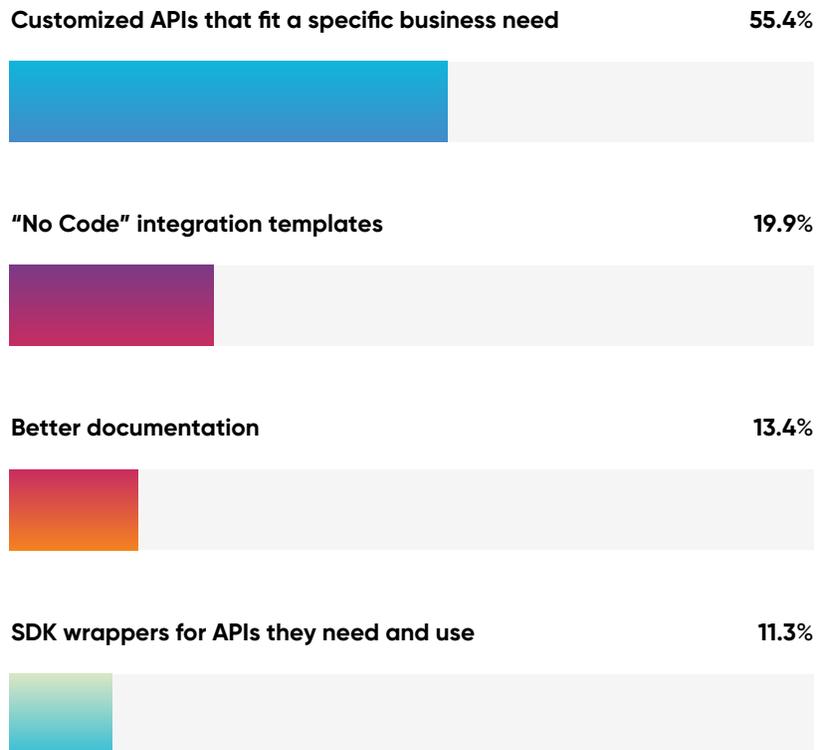
4. The need for app integration is largely driven by Digital Transformation, which was cited as the leading use case.

## Which of the following use cases are driving your need for app integration?



## 5. Customers and partners need APIs for specific business processes.

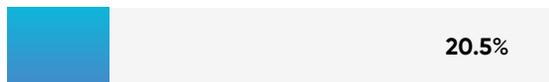
### What is the highest demand from your customers and partners for API integration?



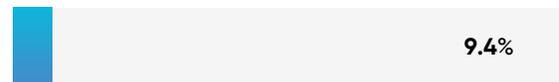
## 6. Cloud-based integration requirements dominate that of on-prem.

### Describe the split of on-prem vs cloud-based integration requirements.

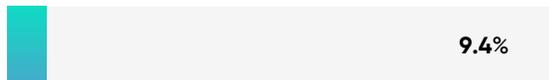
90-100% Cloud Based, 0-10% On-Prem



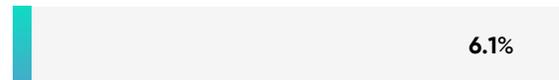
0-10% Cloud Based, 90-100% On-Prem



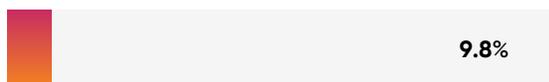
80-90% Cloud Based, 10-20% On-Prem



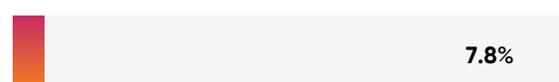
10-20% Cloud Based, 80-90% On-Prem



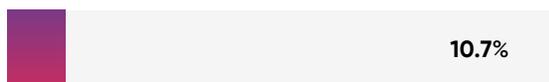
70-80% Cloud Based, 20-30% On-Prem



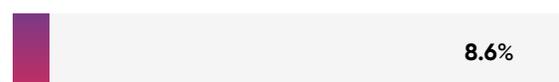
20-30% Cloud Based, 70-80% On-Prem



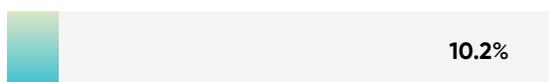
60-70% Cloud Based, 30-40% On-Prem



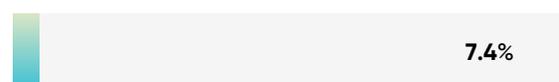
30-40% Cloud Based, 60-70% On-Prem



50-60% Cloud Based, 40-50% On-Prem



40-50% Cloud Based, 50-60% On-Prem



A person wearing large headphones is seen from behind, sitting at a desk and working on a laptop. The scene is dimly lit with a purple and blue color cast. In the background, another person is visible, also working at a desk. A decorative vertical bar on the left side of the image transitions from red at the top to orange at the bottom.

03

# THE BUSINESS OF APIs

# THE BUSINESS OF APIs

From launching a public API to redesigning and retiring existing APIs, the phrase ‘What’s the business case?’ will come up around all API initiatives. Fifty-seven percent of respondents rated API integration as ‘critical’ to their strategy, and an additional 26% rated it ‘very important.’ Based on the data, two key drivers emerge: customer experience and analytics.

## Whether customer experience or employee experience, always a *connected experience*

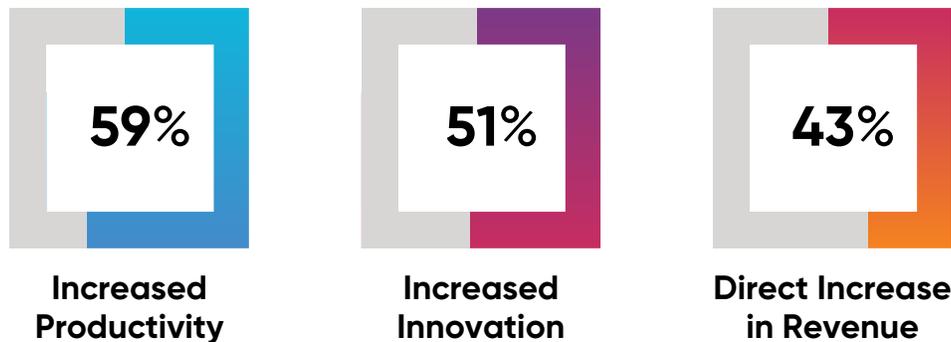
We won’t rehash all the technology trends – Mary Meeker has already [taken care of that](#) and you know them well: services are now digital products, move to cloud, shift to mobile, software to X-as-a-Service, Slack melting everyone’s brain. These trends together have given customers more power. Whether it’s our internal business users or external paying customers, they all know that applications can and should work together.

‘Connected experiences’ are seen in the 68% of respondents who self-identify as ‘platform providers’ (up from 56% in 2019). That’s admittedly a [broad term](#), but the least common denominator is a ‘framework others build on.’ The implied benefit to the *user who pays for the platform* is that different applications built on the same platform *will work together*. The average number of applications that enterprises identified as running is reported [to have passed 1,500+](#). Either those applications work together in a connected experience that makes employees and users more effective, or they silo data and work, making employees and users less productive.

Nearly half of respondents said that the majority of their customer base would renew or upgrade if they offered the integrations customers need. The inverse is that a majority of customers will cancel and switch to a competitor if the vendor **does not** offer the required integrations. To quantify for that often-mentioned business case, take total revenue and divide it in half as a starting point.

## Analytics: If Everybody Is a Software Company, Is Everybody a Data Play?

Respondents also listed key business results they have realized from leveraging APIs. At the top of the list are:



Looking through the qualitative responses on executive priorities related to APIs and integration, many related to 'real-time data analytics' (while we didn't code all of the responses, 'analytics' seems to be right behind responses that were simply "\$").

Even though connected experiences hinge on the ability of systems to sync and share data, these responses clearly relate to automating processes that aggregate, augment, and synthesize data to **deliver insight not easily seen or surfaced by the user**. Respondents mentioned offering more 'data-driven insight' to customers as a competitive differentiator. However, respondents also recognized that every software product or platform generates proprietary data. As the Facebooks of the world have taught everyone, proprietary data is not only a new potential revenue opportunity, but also a frontier that needs to be managed very closely to protect privacy.

Data aggregation and the application of machine learning to produce new insight appears to drive both the 'increased productivity' and 'increased innovation' responses. As an example, Harrods, the iconic London department store and third-most visited tourist destination in the city, shared at the 2019 SAP TechEd conference that a key driver for its IT modernization (moving from legacy data integration to 'cloud-first' API integration) was to access analytics services from IBM Watson and Microsoft Azure.

## Business Models For APIs

While there are multiple ways to justify APIs, API integration, and the creation of self-serve integration experiences for users within digital products, it's worth noting that 45% of respondents said they charge for their APIs. This is trending down from 56% who charged for their APIs in 2019 and 43% in 2018.

This contrasts with the typical ways product and engineering teams justify API and integration investments – two of three directly generate revenue:



### Profit generation

APIs and/or integration experience generate both top-line revenue and bottom-line net profit.



### Break-even

APIs and/or integration experiences generate top-line revenue, but just enough to justify the investment.



### Indirect revenue

Costs for APIs and/or integration experience are justified by increased competitive wins, new sales, and reduced churn.

## Beyond Revenue Strategy For Key APIs, We Have Various Tactics to Achieve Those Goals:



### Usage metering:

#### Dun & Bradstreet

a global data provider for Finances, Sales & Marketing, and Government needs - exposes data as a service via API. In this case, customers are willing to pay for programmatic access to D&B's services to enable new business processes and products.



### Premium option:

#### Concur

an enterprise procurement and expense platform owned by SAP - provides pre-built integration options with their product so that subscribers of the service can easily synchronize expense management data with the ecosystem of apps used in their back-office processes.



## Embedded software products: [PaySimple](#)

a payment gateway provider, offers API access to their payment services. Customers of this service will then be charged a percentage of the payment amount for each API transaction.



## Indirect monetization and partners: [Sage](#)

a comprehensive finance and accounting suite for small and medium businesses globally - works with various ISVs to distribute their products and services as part of a broader offering. This network effect has enabled them to achieve the scale and growth that would be difficult in a direct sales model.

The MicroStrategy logo is displayed in a white rectangular box. It features the word "MicroStrategy" in a bold, red, sans-serif font. A small red asterisk is positioned above the letter "i" in "Strategy".

## Operational efficiency: Microstrategy

an enterprise business intelligence platform  
- provides pre-built integration to leading enterprise SaaS applications, so their customers can quickly access and integrate the data they care about without needing to build anything from scratch.

04

# ENTERPRISE VS. ISV



## ENTERPRISE VS. ISV

Stepping back to put this year's responses in perspective, two key shifts have happened within the past decade:

1. In spite of the explosion of applications, each successful application vendor's offering has moved steadily in the direction of expanding the scope of the solution for the customer.



For example, Salesforce's early "No Software" motto effectively said to customers 'Don't buy software and then also buy and manage the hardware to run it on. Buy our software and we'll manage the hardware so you don't have to.' As Salesforce grew, many competitors shifted to software-as-a-service models as well, and the basis of competition, i.e. what customers select for when choosing between vendors, evolved.

In terms of integration, software vendors, driven by competitive markets, have steadily taken on more of the integration burden previously borne by their customers in an effort to win market share. For the buyer, this makes sense - you get more for your money by avoiding development costs required to write to an API.

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2. The priorities for the enterprise have grown beyond cost savings and productivity gains to include data-driven insight and rapid innovation. These new goals depend on breaking down data silos and governing massive amounts of data.

## Example:

As the chief architect of a large European compressor and pressurized tank manufacturer shared, "I have six hundred applications running my business that all need to talk to at least some others in the stack."

Interestingly, there's a third trend: enterprises launching digital products and platforms that put them in direct competition with disruptive ISVs. Some of the most iconic enterprises have always been software companies (SAP, Microsoft, etc.) but many are now services companies that look like software companies. Banks and financial services companies that previously provided account and trading services now offer digital payments platforms - take American Express as an example. Pharmaceutical companies that traditionally produce medications now engage patients holistically via software partnerships, like [Sanofi's partnership with Happify](#), and look to analyze "digital biomarkers" that wearable devices produce to personalize care ([Roche](#)). Insurers have launched apps to target younger audiences with different perceptions of their services and, like MetLife's "digital time capsule" [Infinity](#), create a "digital legacy" to match the financial legacy their life insurance product ensures.

We see this in the results: a surprising number of 'Enterprise' respondents spoke of integration priorities like 'streamlining integration with third parties' and 'helping bring new products to market' and 'integrating with all the CRMs'.

## Enterprise

respondents listed top priorities including:

- ✓ digital transformation to drive innovation
- ✓ reduced costs and/or increased productivity
- ✓ integration benefits ('driving API adoption' and justifying past investments, 'platformification,' and 'integrating partners through various platforms')

## Integrator

respondents shared similar concerns, but:

- ✓ echoed many of their enterprise clients' drivers ('cloud containers, security, and facilitating API aggregation for our customers, and 'digital transformation and modernization' and 'enable innovation and ensure robust and solid operation')
- ✓ reflected the revenue pressures and other dynamics affecting their businesses ('sales activity reporting in CRM and visible to leadership' and 'transform our investments into a marketable product' and 'create replicable integrations').

However, all **121 ISV** respondents declined to answer the question about their top priorities.

Which means they either couldn't be bothered to answer or more likely (at least in our opinion) the answer is self-obvious and didn't merit time to repeat: customers demand integration, it's necessary to compete for their business, thus ISVs treat it like any other 'core' feature.

## Digital Transformation: Something Important, and Something Different, to Everyone.

While there were relatively few 'Enterprise' respondents who also shared what integration options they offer, 80% said they offered SDKs and about 20% stated they offer a platform or iPaaS.

Enterprises had a more even distribution of responses when asked if customers would renew or upgrade with the addition of integration options they requested, whereas all respondents clearly skewed to indicate that a majority of customers would renew or upsell. We credit this to the fact that large enterprises usually have large installed bases and longer tenured customers. This fact seems to insulate them more from competitive concerns related to integrations. It could also mean that enterprise respondents offer services that are early in the maturity curve for digital products and integrations matter less in customer choice.

When it comes to systems modernization and digital transformation, these themes and the related cost savings were at the top of the CIO priorities for respondents. More granularly, 'Enterprise' respondents who described the integration experience they want to build spoke to making integration less beholden to core applications. Specifically, respondents mentioned 'adding RESTful endpoints to core systems of record (CRM, ERP, PIM, etc.)' and '[making] enterprise systems easy to connect with one another.'

Seventy-seven percent of respondents have already invested in API Management to publish private and/or public APIs, and respondents also said that the highest demand is for 'customized APIs that fit a specific business need.' These data points indicate that architects see a path to designing and implementing a flexible integration strategy that facilitates change and agility and delivers ever-changing best-of-breed applications to business users.

In addition, about 40% of 'Enterprise' respondents said their integration needs are still primarily (>50%) on-premise. This seems to be the reason that analysts like Gartner and several of the larger integration platform vendors have shifted their promotions to focus on the idea of a 'hybrid integration platform' (HIP). It's also clear that the costs of maintaining legacy, on-prem systems,

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especially for ERP and custom-developed applications, outweigh the risks of wholesale upgrades for key decision makers.

The burden of that legacy infrastructure is clear, however. Twenty-four percent of 'Enterprise' respondents said it takes 90 days or more to release a new API with advanced features compared to 14% of 'ISV' respondents. This matters because on average, 'ISV' and 'Enterprise' respondents selling digital platforms want to add dozens of new integrations in 2020 - 34 on average. Most 'Enterprise' respondents listed 'Authentication,' 'Custom Objects,' and 'Workflows' as the most challenging aspects of API integration.

'Enterprise' respondents also nearly unanimously said the industry should invest in and adopt additional data standards.

# What does embedded mean to different business types?

We can sum up the integration experience respondents want to deliver in four words from an ISV respondent in the legal tech space:

**"Seamless. Effortless. Highly Performant."**

As mentioned, Enterprise respondents mostly spoke of API infrastructure improvements, like "Adding RESTful APIs to key systems like CRM, ERP, etc." Integrators echoed many ISVs with comments like "clear and naturally intuitive." Many respondents also mentioned "no-code integration flows," presumably for ad hoc integrators with some experience or non-technical users. However, this aspiration glosses over the complexity of delivering this integration experience. No-code integration tooling can enable a wider range of users to solve their own integration problems, but looking through the survey respondents we see a difference between offering *no-code integration tooling and pre-built or productized integrations that users configure.*

Offering tooling empowers users but still puts much of the burden on them. Productized integrations leave room for no-code configuration but look and feel like a part of the core product UI. These integrations feel like a thoughtful, effortless user experience, and perform as any other product feature.

Perspective remains important here. Enterprises serving employees and partners may want to opt for tooling whereas digital products tend to think of integrations as a part of the core value proposition or user experience. They prefer to embed integration platforms the way a developer might embed Twilio for telephony or Stripe for payments using an API in their own UI.



## API EVOLUTION IN ACTION: A CASE STUDY IN FINANCIAL SERVICES

By Richard Pulliam, Principal at 2Disrupt, LLC

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The B2B banking segment, while slower than B2C in terms of the innovation ramp up, has begun to see a significant uptick in focus recently.

The tools available to businesses to digitally transform their financial processes have exploded within the fintech arena thanks to APIs. However, the transformation requires at minimum a three-pronged integration approach to work: fintechs, banks, and business process applications.

When you ask corporate bankers about their customers' key business process applications, they'll mention the likes of Enterprise Resource Planning (ERPs) and Treasury Management Systems (TMS). That's usually because they'd like to take back some of the payments revenue fintechs like TransferWise or Currency Cloud have won. But when you ask about helping clients optimize and automate the full Order-to-Cash or Procure-to-Pay process, they're often less sure about all the

key applications. That's because truly optimizing billing and collections means integrating with the CRM, document management applications, and perhaps even marketing automation, social, and help desk tools. Giving CFOs real spend control, not just smoother payments, means integrating with supply chain management, field service automation, and many other technologies used throughout the business.

While an integration between one banking API for digital payments and a single ERP is a step forward, it's not sufficient to create problem-solving momentum. Delivering analytics insights or automating Order-to-Cash or Procure-to-Pay requires a platform integration approach across multiple systems and integration/data workflows that are agnostic of endpoints and single applications – rather built around entire business processes.

Corporate banks have begun to innovate in these processes for their corporate clients, following fintechs like Tungsten Networks and Divvy, as well as interesting new platforms from other FinServ players like American Express. As an example, JP Morgan Chase does excellent work in its API strategy, and with its Treasury Ignition solution it shows a clear focus on resolving B2B banking processes for corporate clients. Treasury Ignition offers an initial pre-built integration with NetSuite to process payments directly from the ERP. This is an admirable strategy, and for those corporate clients on NetSuite, this solution should be a big step up.

However, what's lacking in this story is a truly resilient platform architecture – an ability to scale that workflow across multiple ERPs through a reusable set of API calls and data abstractions. Also missing is an ability to tie in additional business processes and applications to that flow. The ERP used to be the mission-critical system taking data from all points of the business to help it run more efficiently. This is why ERPs are more often than not inclusive of larger suites of software like CRM, marketing automation, customer support, and more. But as the volume of data grows and customers desire to use best-of-breed cloud applications to solve specific functions, the ERP no longer holds all the mission-critical data. That creates a need for more and more robust API integrations with more applications across the business process workflow.

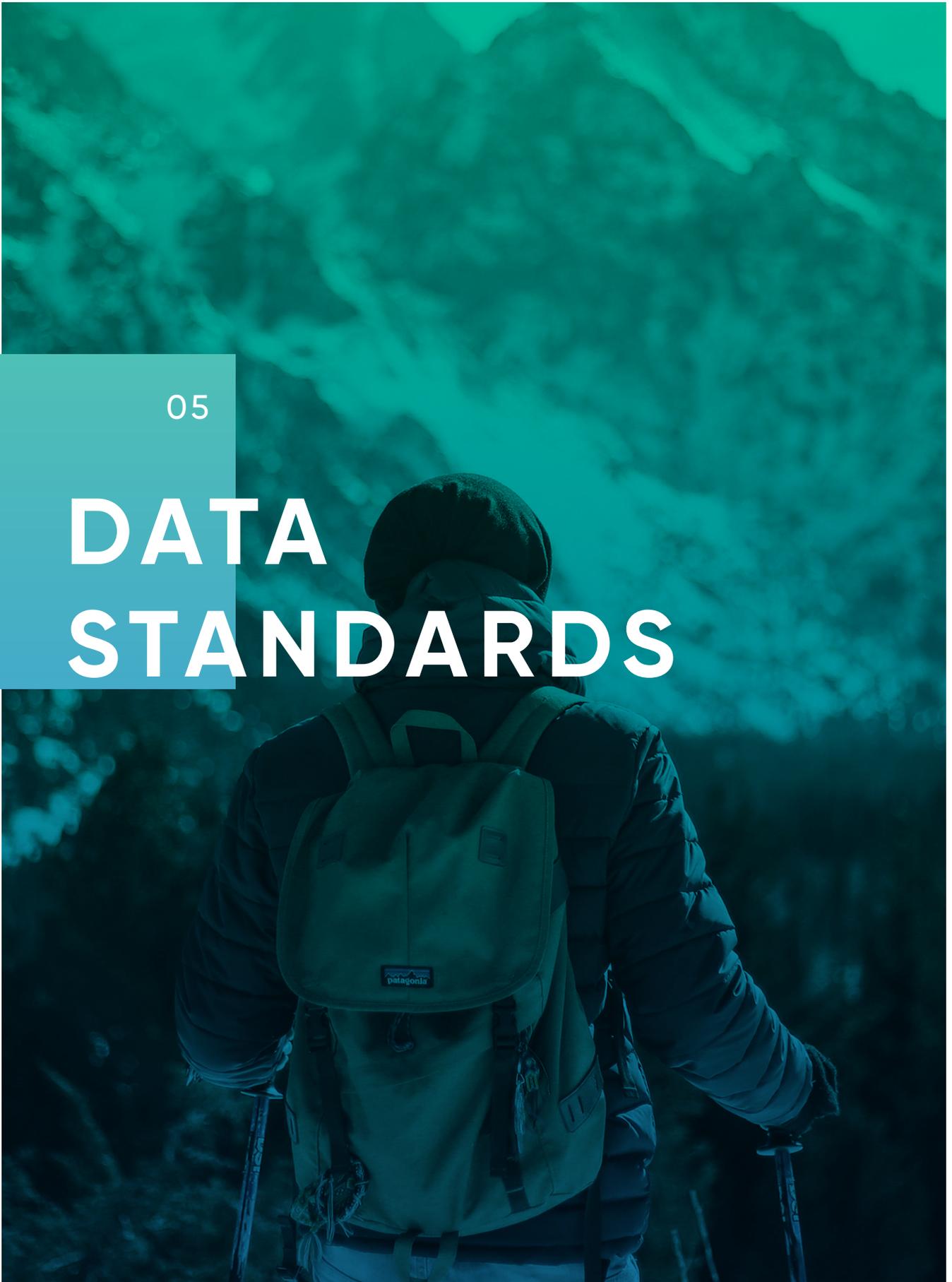
Treasury Ignition says other ERP integrations are coming, but corporate clients may reasonably ask, “When? And when will the platform cover Cloud Storage, Conferencing, CRM, Databases, Ecommerce, ERP, Field Service, Finance, Help Desk, Human Capital, Marketing, Messaging, Payments, Productivity, Social, etc.?” The list goes on. In the commercial banking world, each of these categories is critical in their importance, and just as important from a scale perspective is not to offer just one in a given category. In the ERP domain, for example, a solution must address the plurality of ERP solutions and related applications.

Serving corporate clients today means integrating with their unique application ecosystems. In a world of enterprise technology that provides the backbone of each business process, to do each integration one at a time is an exercise in futility. Each one will be brittle, purpose-built, and not able to easily or efficiently scale to meet additional systems with different APIs and workflows in the same function. What is needed is a platform that provides resilient API integrations to multiple APIs within any particular function. Further, banks need to provide a data abstraction – what one might call a canonical model for each business process – that would allow someone like JP Morgan Chase to accelerate its Treasury Ignition relevance exponentially.

Again, JPMC deserves credit as a leader taking new risks to better serve B2B clients. And a one-off financial service integration is better than none. But the corporate world is so much bigger than a single ERP. To truly optimize and digitally transform any business, the more digital services you can tie together, the more valuable the asset.

05

# DATA STANDARDS





# DATA STANDARDS

By: Ross Garrett, CPO, Cloud Elements

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## A WEB OF DATA

For decades, the application and data integration industry has provided tooling, patterns, and best practices to improve the interoperability of systems.

More explicitly, solutions to move, manage, and use the data we care about that is contained within these systems. But what if we had a more intuitive way to ease this integration problem?

In 2001, Sir Tim Berners-Lee first described the concept of a new Semantic Web where the semantic understanding of data is layered on top of the current web architecture. He defines this concept as "a web of data that can be processed directly and indirectly by machines" - the main value of this being a standardized way of expressing the meaning and structure of any given data and the relationship that may exist among resources.

Despite the long passage of time and the proliferation of data exchange and integration via the web, adoption of data standards has been mostly limited to very specialized use cases (e.g. HL7 in healthcare or SWIFT in banking), and the concept of the "Semantic Web" has been largely ignored.

Based on research collected for this report and data points from other industries, the tide is starting to turn toward data standards. Perhaps the most obvious example of this shift is the growing adoption of and results delivered through [Schema.org](https://schema.org). We can see implementations of this in things like search and email every day, and it's driving new user experiences in many ways.

**Schema.org is a data standardization and metadata implementation that has been growing steadily since its inception in 2011. Schema.org is a collaborative community activity with a mission to "create, maintain, and promote schemas for structured data on the Internet, on web pages, in email messages, and beyond."**

**You can see the benefits of this in your email inbox. For example, when you receive an email confirmation of a flight reservation or a package delivery, your email client often highlights these messages as special emails, files them automatically, and perhaps even creates reminders for you. This is not magically provided by Google or Microsoft, but rather simply the email client leveraging the schema.org markup to make your life easier.**

Data standardization also happens through the opportunity of scale that some players bring to the table. For example, during the development and evolution of Google Maps, it was recognized that showing public transit information could be hugely beneficial to users. Conceptually, this is simple—get data from public transport providers—but on a technical level, this represented an impossible problem of scale considering the number of regional transit authorities and zero standardization for the consumption or exchange of data. Google ended up defining a de facto standard, which all regional providers quickly rushed to adopt, called the Google Transit Feed Specification (GTFS).

**What became GTFS started as a side project of Google employee Chris Harrelson in 2005, who was trying to incorporate transit data into Google Maps when he heard from IT managers at TriMet, the transit agency for Portland, Oregon, and eventually provided Google with CSV exports of TriMet's schedule data.**

**In December 2005, Portland became the first city to be featured in the first version of Google's "Transit Trip Planner." In September 2006, five more U.S. cities were added and the data format was released as the Google Transit Feed Specification.**

**This resulted in hundreds of useful transit applications, as well as catalogs listing available GTFS feeds. Due to the common data format those applications adhere to, solutions can easily be extended to any region where a GTFS feed is available.**

**In 2009, to reflect the broad adoption and wide use of the format, the "Google" part of the name was dropped, becoming the General Transit Feed Specification.**

## YOUR DATA IN CONTEXT

### Data governance is the watchword amongst CIOs and IT leadership.

For product leaders, interoperability and self-service data integration are top of mind. But what do these things mean? And what steps should you take?

If businesses want the right kind of data to underpin advanced business processes or to create multi-dimensional views of data objects, data-centric integration must be pursued as a strategic function that aligns with business objectives.

Unfortunately, many enterprises today have become bogged down with legacy integration platforms while also overwhelmed with a growing number of applications. Data-centric integration turns the focus of application integration toward the data upon which organizations rely, rather than “point-to-point” application integration patterns that dominate the integration landscape today. With 1,500+ cloud services in use by the average enterprise today, legacy integration patterns simply can’t scale.

As application ecosystems become increasingly complex, companies need a solution that simplifies their business and the data they care about while also ensuring the highest levels of security and governance. Modern businesses must select a data and application integration strategy that empowers them to unify all of their company’s data assets and analyze them in context to get the full picture of the business. Only when real-time situational awareness is achieved can stakeholders truly act in the moment, predict future business outcomes with confidence, and devise new business models that can propel the company forward.

For example, a bank can leverage internal data, such as the number of SMB loans sold over a period, and third-party data, such as interest rates, and customer data such as accounts or accounts payable/receivable, and bring it all together to drive new business at the right moment and within acceptable levels of risk. While this is a simple example, there can be enormous complexity when understanding, managing, and ultimately transforming data to make decisions or automate business processes.

Data is strategic, both data that you own and data that you don't. The ability to bring the right data together at the right time leads to a business that can make decisions around almost perfect data. To that end, a thoughtful integration strategy will continue to be a key piece of the puzzle; data standards play a similarly important role.

## THE EMERGENCE OF STANDARDS

**In September 2018, Enterprise software giants SAP, Adobe, and Microsoft jointly announced an "Open Data Initiative."**

The trilateral coalition of influential enterprise software companies tackles one of the key challenges all enterprises face: siloed data. The initiative aims to enable standardized data exchange and interoperability among different platforms via a common data model.

## A new class of insight and action

### Unify your business data

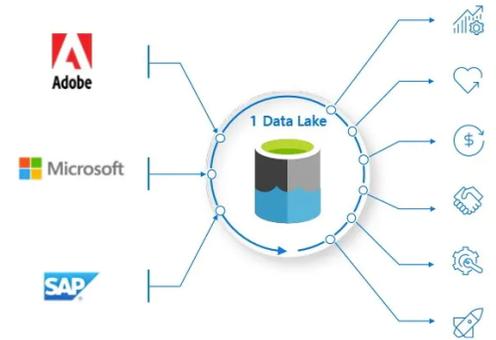
A common data model, and a common data lake help you say goodbye to costly, complex disconnected data silos—and realize your data's full potential.

### Enable AI-driven insight

Use AI to gain a deeper understanding of your business. Drive real-time insights and actions at scale—your data becomes a renewable resource that is continuously enriched.

### Enhance your applications and services

Take advantage of a new class of services that consume enriched data to deliver real-time personalized experiences to your customers.



Source: <https://www.microsoft.com/en-us/open-data-initiative>

The key problems the Open Data Initiative aims to solve are i) interoperability of data and ii) providing a unified repository for customers to take ownership of their data. Further, this collection of software companies represents several important data management use cases. For example, if you are a retailer, you likely have customers who buy both from your website and brick-and-mortar stores. They then go to social media to review your products, say good and bad things about it, and perhaps even raise complaints with your call center. Today, all these different systems—your point of sale (POS) software, website e-commerce, CRM, social media channels, etc.—build customer profiles and transaction data using their own format and structure. They have different repositories and different architectures, and linking them across channels and systems isn't a trivial exercise.

The Open Data Initiative seeks to address this issue by providing a common data model among some key vendors (along with a common language and set of APIs) and a data lake to store information that can then be used by other applications to run analytics, campaigns, or other data-heavy applications.

## DATA OWNERSHIP & CUSTOMER TRUST

**As businesses evolve to make data-driven decisions in real time, they are increasingly responsible for the protection of sensitive customer data.**

With the movement of legacy systems to new cloud-based apps, there are huge challenges to managing customer data with care and diligence, just as they would any other key asset. Data demonstrates its value when it gets used, when it moves from A to B, or as it propagates through a business process like Order-to-Cash.

These challenges reflect fair demands for data security and privacy. For example, you need to safeguard access to data, concealing people's identities as necessary and avoiding unlawful identification. Trusted data should be accessed only by people and processes with the correct credentials to respect the privacy expectations and policy rules defined by the owner.

In enterprise terms, this rapidly moves into a discussion around data governance.

- ✓ Data protection and consent for its use, demanded by users and enforced by regulations such as GDPR or CCPA, are new considerations impacting the value and quality of data.
- ✓ Business is highly flexible, with new data sources and an ever-increasing number of consumers inside and outside the organization. The days of a static application landscape with defined data flows between established processes inside the corporate firewall are long gone.
- ✓ Trust also means establishing controls at data endpoints and increased visibility across systems and boundaries. There is a huge increase both in the supply and the demand for data.

To achieve trust with data, you need a holistic, flexible, and open platform that works in real time. The following steps enable you to meet your expanding data management requirements:

- 1 Establishing a trusted data-governance foundation:** Define and document data and security policies, business rules, master data definitions, business terminology standards, and enterprise architecture models. Discover and document where data and content resides. Identify and document what data and content are subject to which internal policies and external regulatory requirements.
- 2 Driving business trust with always accurate data:** Cleanse, match, consolidate, and enrich data to comply with corporate standards. Continually monitor and measure data quality against validation rules, display metrics scorecards, and quantify the financial impact of poor quality. Manage and synchronize master data across applications.
- 3 Setting "trust" as a priority across the whole data lifecycle:** Maintain the system by managing the content lifecycle and its association with data, processes, and applications. Implement access controls, data anonymization, and encryption. Establish and communicate with data owners and stewards. Embed validation checks into business processes and data-entry workflows. Implement archiving, retention, and deletion policies and rules.
- 4 Centralizing landscape orchestration and governance, metadata management, and lifecycle management:** Prepare data as it is being ingested, govern data across all data stores (whether on-prem, private cloud or third-party cloud applications), and actively review controls and policies regularly (including compliance with data destruction policies).

Whether we arrive at Sir Berners-Lee's vision for the Semantic Web or not, the concepts he articulated are valid and important for all of us trying to better manage and use the data we care about. Standards require consensus, a messy and sometimes agonizingly slow process at the scale of modern technology ecosystems. But the move towards standards continues in various sectors; we all should continually take note.



06

# DEVELOPER TRENDS & API DESIGN



# DEVELOPER TRENDS & API DESIGN

## GRAPHQL: TAKING INTEGRATION IN A NEW DIRECTION

By Luke Vance, Product Manager, Cloud Elements

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GraphQL has already seen rapid adoption since its public release in 2015.

Production use cases from enterprises, governments, and startups are already in place, and new tooling continues to evolve and diversify. As an API technology, GraphQL is finding its place in the broader API market landscape and has the potential to strengthen adoption by leveraging two other API sectors: Serverless and the Internet of Things.

While sectors like e-commerce and publishing are already seeing significant value from moving to a GraphQL API architecture, this year other industries are beginning to take notice, particularly online video services. Key early user segments in marketing technology, software development tooling, and digital consultancies will help spread adoption to other industries.

One of the key benefits of GraphQL – the ability to create a data abstraction layer that can combine multiple sources through a single gateway and endpoint – will

garner growing interest from industry sectors that have complex data supply chains. Data science, healthcare, and city services will be drawn to GraphQL in 2020 in the same way that publishing, social media, and e-commerce have been to date.

GraphQL has quickly established itself as a valid option for businesses and developers making choices around how to create and manage their API strategy. Across the sector, the biggest gap is a matrix decision tool that allows API creators to assess each type of API architecture option and weigh the best cases each is suited to implementing. Without this clarity, each individual business must do its own research from REST, Hypermedia and HATEOAS, SOAP, and GraphQL options.

For many use cases, GraphQL has the potential of leapfrogging the growing interest in hypermedia APIs. In hypermedia APIs, responses describe what data and links are available so that as queries are made, an application can discover what other data and capabilities are available that are relevant to the application's need. In Hypermedia, this requires good metadata and well-structured endpoint linking, but can return bloated responses that slow down an application's performance. In GraphQL, the schema itself describes the full data model. The introspection quality means that inside any GraphQL API is the ability to query its own data model to better understand what data is available. The reliance on types and fields rather than endpoints or resources provides a preferable developer experience for building clients. And GraphQL's advantage of allowing clients to specify what data is returned avoids Hypermedia's bloat problem.

As an abstraction layer that can draw in multiple data sources and make them available or referenced within a single schema/data model, GraphQL has huge potential for use in sectors where data comes from disparate and disconnected sources. GraphQL removes data access barriers and makes all data – regardless of the original owner or place of publication – available through a single schema where relevant, related data can be queried at one time. This suggests that the fields of data science, healthcare, city services and other sectors that manage complex relational data models may see an advantage in adopting GraphQL.

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There is no doubt there are still some challenges GraphQL must solve. Significant progress has been made in the area of writing data in bulk by the likes of Hasura. Managing real-time data querying via subscriptions was added to the popular Apollo libraries. But these advanced operations and others, including managing caching and pagination, require more testing against production use case needs.

Ultimately, in 2020 GraphQL's evolution is still in its infancy, but with the rapid interest from developers and the quick iteration and availability of tooling, there are strong signs that GraphQL is becoming a legitimate option for how APIs are created and managed, offering significant performance and developer experience benefits.



# EVENT-DRIVEN INTEGRATION: ASYNC APIS AND EXPONENTIAL DATA GROWTH

Guest Contributor: Matthew O'Riordan, CEO, Ably Realtime

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Event-driven integrations are top of mind for businesses and developers alike.

This isn't surprising given that the volume and criticality of event-driven data produced and consumed in real-time are growing exponentially. [IDC predicts](#) that by 2025, 1/3 of all data produced globally will be real-time, with data classified as critical being in the highest demand.

At Ably, a cloud real-time messaging provider, we deal exclusively in event-driven integrations for some of the largest organizations in the world. We're starting to see patterns in how engineers are tackling event-driven integrations.

One of the more high-profile developments in the event-driven ecosystem is the AsyncAPI Initiative, working to define an industry standard for event-driven (or asynchronous) API specifications, readable by both humans and machines. This is an essential piece of the puzzle to solve, but only one part of a rather complex puzzle.

We also see fragmentation in a number of areas. Two of these, I believe, are mostly responsible for event-driven API integrations being unnecessarily difficult today:

- ✓ Protocol fragmentation
- ✓ Engineering fragmentation

## Protocol Fragmentation

“Traditional” REST-based APIs have been hugely successful over the last two decades, primarily for command and query operations. Today’s API ubiquity can be largely attributed to the unofficial industry choice to use common web protocols, thus adopting HTTP as the transport and protocol layer, and REST for its lightweight and simple architectural pattern.

Yet we now need to go beyond simple command and query operations for event-driven data. However, we’re seeing huge fragmentation among protocols and patterns to solve subscription-oriented operations, with no clear winner or standard. Options include simple webhooks; the newer WebSub; and Kafka, AMQP, and MQTT. Or, often just custom proprietary protocols built on top of HTTP streaming or Websockets. Unlike REST, which was primarily competing against SOAP at the time, today we’re seeing in excess of 10 popular protocols being used.

Additionally, event-driven API integrations can be push- or pull-based, which makes them even more complicated:

- ✓ **Push-based (or server-initiated) protocols** put the onus on a data producer to push data to endpoints or third-party integrations. The most obvious example is a webhook, where as an event is emitted, it is the producer’s responsibility to reach out to the consumer’s endpoint and publish the event. This can apply to other protocols too of course, like MQTT or Kafka, where the producer streams and publishes data to a third-party streaming or pub/sub-platform. This push-based model is often preferable for the subscriber, especially when the volumes increase, as they are no longer responsible for maintaining any state, relying on the producer to handle this complexity for them.

- ✓ **Pull-based (or client-initiated) protocols** put the onus on a data consumer to connect and subscribe to event-driven data on demand. A common protocol such as MQTT is often used by lower energy IoT devices, which can connect and subscribe to updates when connected. This is simpler for producers because, if the device is not connected, the producer has no work to do and relies on the client to decide when to reconnect and handle complexities around state.

The level of protocol fragmentation makes widespread adoption of event-driven APIs difficult. Yet we must recognize that, at times, choosing the right protocol for your needs as a data producer may mean a subpar protocol for your consumers, often because of differing downstream needs. Already we're seeing engineering teams thinking about how they will now support WebSub even though they already support Webhooks. The reality is that some protocols are simply better for one purpose than another. This adds an additional layer of complexity to event-driven protocols.

## The AsyncAPI Initiative

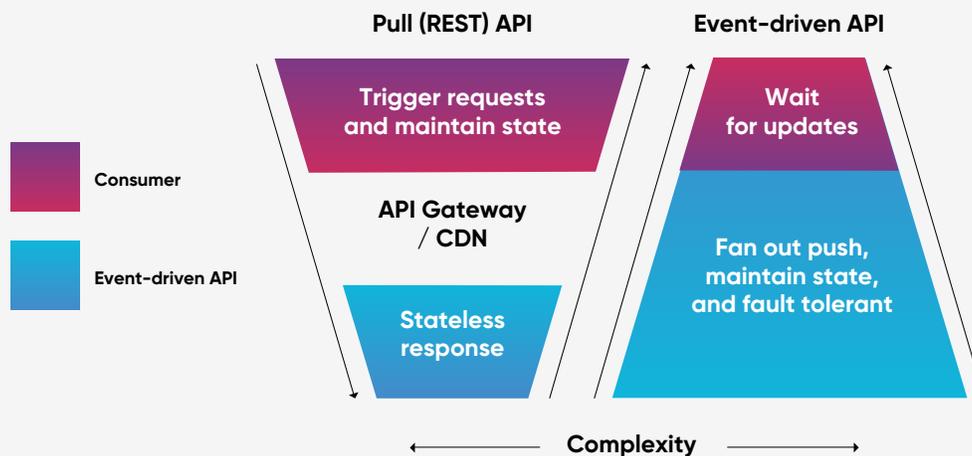
AsyncAPI is making good progress on making it easier to programmatically consume data streams as we can with REST APIs today. But the spec only details pull-based protocols (defined in this article) like MQTT. What it doesn't address is push-based (server-initiated) protocols like Webhooks or how interoperability between protocols could work.

## Engineering Fragmentation

Unlike more established paradigms, there's no clear service (on-prem, cloud, serverless, or other) that solves event-driven integration engineering problems. Across the board, we're seeing engineering teams creating their own solutions for event-driven integrations, generally based on an underlying event-driven software primitive such as Kafka.

This not only adds to existing fragmentation but makes it cost-prohibitive for everyone to participate in event-driven API integrations. To remove that barrier to entry, the following need to be addressed:

- ✓ Event-driven integrations, even those that leverage custom solutions, are expensive. Without standards to drive lower costs, event-driven integrations will lose to other engineering priorities, stifling event-driven adoption.
- ✓ Consumers need to understand producers' engineering decisions and trade-offs so they can effectively integrate with an API. This requires richer documentation than REST APIs.
- ✓ Engineering teams need to deal with many more stateful problems than with REST. This is just one reason that complexity is inverted when compared to REST APIs.



Regardless of whether you build or buy a solution, you'll still need to overcome complex engineering challenges that include:

- ✓ **Integrity vs. Latency.** This is a straight-up trade-off between data integrity (i.e. guaranteed message ordering and delivery) and speed.
- ✓ **Throughput.** With exponential increases in real-time data, scale isn't an engineering challenge API publishers can ignore. It's likely you'll need to consider supporting push-based (server-initiated) protocols.
- ✓ **Continuity of Streams.** Given event-driven API integrations typically operate over unreliable networks (aka the internet), when using a pull-based protocol consumers need to handle disconnects and resume from where they left off. Push-based protocols need to deal with unreliable endpoints and implement back-off strategies, for example. To achieve continuity, you will likely need a persistence layer that keeps track of what data each consumer has received, which is no easy feat.

## Final Thoughts

Specifications like AsyncAPI show what event-driven APIs should look like and how they should be consumed. Tools like Kafka are almost ubiquitous, showing just how important event-driven APIs are becoming. But Kafka and other streaming platforms only address a small part of the problem, and AsyncAPI doesn't yet address some important properties such as quality of service, interoperability, or push-based protocols.

Our belief at Ably is that event-driven data will balloon as soon as the infrastructure is in place for people to interact with each other in a decoupled and protocol-agnostic way. In an ideal world, the industry as a collective should decide on what's best. But this will take time. I believe there are two things we can focus on as an industry to get us there faster:

- ✓ Shift the event-driven design focus to consumers, with the aim of allowing them to choose what they want from an integration by providing an appropriate range of protocols.
- ✓ Work to decouple producers from event-driven engineering considerations with the event-driven equivalents of API Management platforms for REST APIs or CDNs for media delivery. Even stepping-stone methods/solutions that are used widely will be better than the current level of custom solutions causing fragmentation.

**Once this happens, we believe the next generation of real-time services will emerge.**

A night sky photograph featuring the Milky Way galaxy, a blue rectangular overlay on the left, and a silhouette of a forest at the bottom.

**CLOSING**

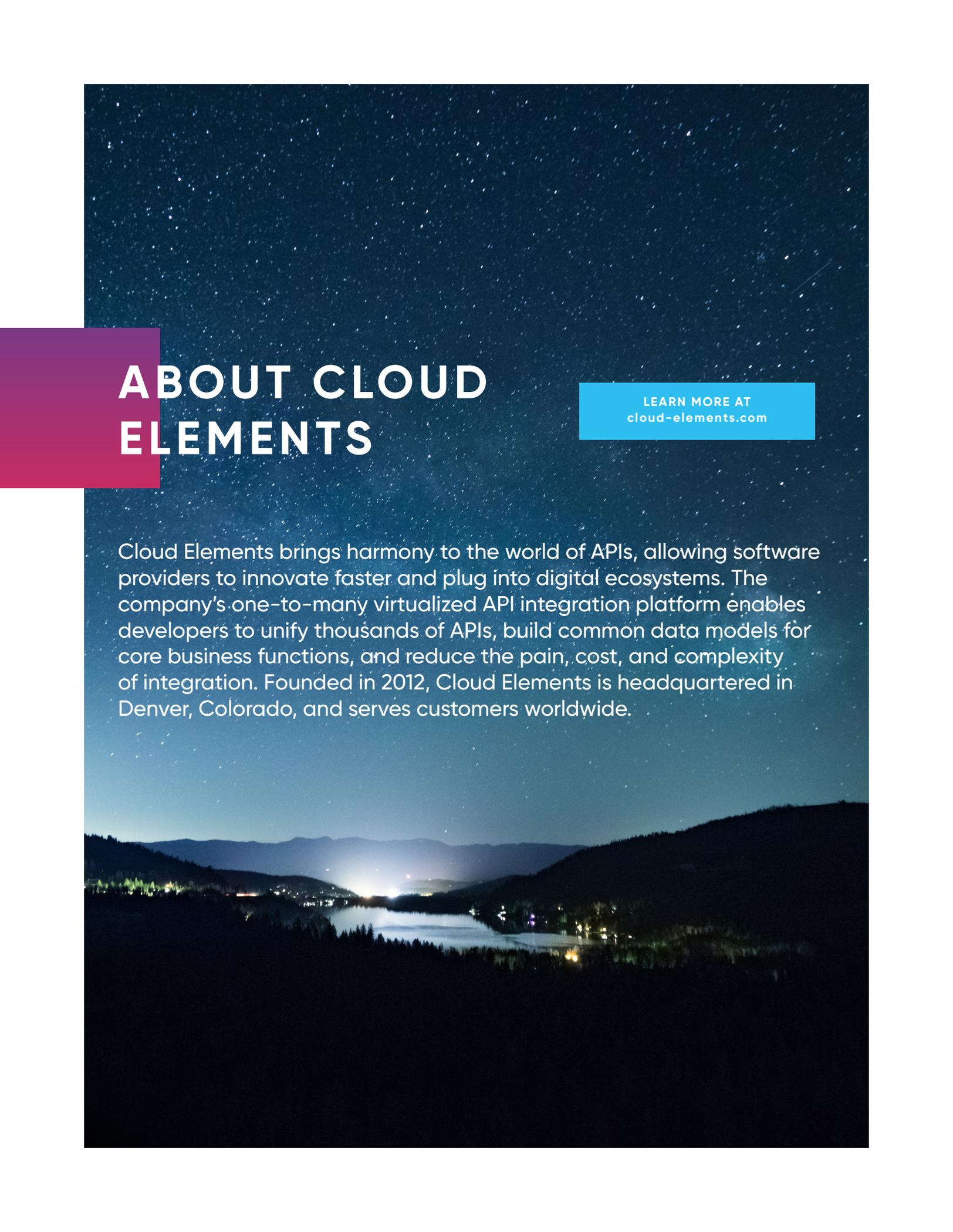
# CLOSING

As anyone can see, a lot is happening in the world of API integration. Join the ongoing conversation by using the hashtag [#StateofAPIIntegration](#) or following us on Twitter at [@CloudElements](#).

We hope you enjoyed seeing the trends and hearing from our contributors on the changes affecting API design, application and data integration, and the specific contexts in a few different industries. To recap a few of the highlights of the report:

- ✓ We see integration professionals and app developers continuing to struggle with balancing innovation and “playing nice” with an ecosystem outside their control.
- ✓ Nearly all respondents (83%) say API integration is a critical part of their business strategy. But the challenges highlighted also make clear that turning business strategy into successful, profitable platforms is no small feat.
- ✓ Whether we’re focused on the external ‘customer experience’ or the internal ‘employee experience,’ only connected data, applications, and processes can create that desired experience.
- ✓ While respondents clearly articulated their vision for their ideal integration architecture (“Seamless. Effortless. Highly Performant.”), there’s also a clear need for data standards to deliver on transformational priorities.
- ✓ As the scale of data and opportunities to use that data grow, trends like GraphQL and event-based integrations continue to gather steam, though both face real challenges to adoption as well as the inherent protocol tension between API producers and consumers for event-based data streams.

Cloud Elements produces the State of API Integration report annually to give practitioners research-backed information with which to make better decisions. We’d like to sincerely thank all those who shared and responded to this survey or contributed to creating this report. For additional API integration resources, check out our [resource center](#). If you have questions, or would like to learn more about Cloud Elements, visit our [website](#) or [contact us](#).



# ABOUT CLOUD ELEMENTS

LEARN MORE AT  
[cloud-elements.com](https://cloud-elements.com)

Cloud Elements brings harmony to the world of APIs, allowing software providers to innovate faster and plug into digital ecosystems. The company's one-to-many virtualized API integration platform enables developers to unify thousands of APIs, build common data models for core business functions, and reduce the pain, cost, and complexity of integration. Founded in 2012, Cloud Elements is headquartered in Denver, Colorado, and serves customers worldwide.

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