Capgemini

Unlocking the hybrid integration dividend

How to transform your business with hybrid integration and APIs

Contents

About the research

The analysis in this report is based on an online survey of 818 IT executives conducted between March and May 2018. Two-thirds of the respondents (66%) are IT directors and one-fifth (20%) are senior IT architects. C-level technology executives (including CIOs and CTOs) constitute the remainder. They work in one of ten sectors, with the majority (63%) distributed roughly evenly between banking, consumer products and retail, manufacturing, utilities, high-tech, and telco and communications.

The survey respondents are based in 16 countries in Europe (40% of the sample), North America (40%), and Asia-Pacific (20%). All the companies represented have turnover exceeding €500m, with 80% having turnover of €2bn or more.

To complement the survey, in-depth interviews were conducted with the following executives (listed alphabetically by first name):

- Charlie Li, Head of Cloud Services, North America, Capgemini
- Chris Timmerman, Chief Technologist, Dell Boomi
- Chuck Knostman, Vice President, Strategy and Technology, T-Mobile
- David Chao, Head of Product Marketing, MuleSoft
- Ed Anuff, Head of Product Strategy and Product Management, Apigee
- Imran Haider, Head of Product, Open API Channel, Wells Fargo

What is hybrid integration?

Hybrid integration is an approach used to connect applications and data that exist in disparate parts of an organization's IT environment. Integration tools can provide secure and reliable connections, for example, between on-premises applications and those run in the public cloud, or between applications in a private and public cloud, or multiple public clouds. They help IT teams to manage integration smoothly in an increasingly complex IT environment.

Modern integration tools are cloud-based but can also coexist with older, legacy tools that operate on premises. Because they are cloud-based, hybrid tools work hand-in-hand with web-based APIs, which facilitate integration by unlocking data within applications. The latter is made possible when organizations use a microservices architecture (based on the use of loosely coupled services) to build their applications.

Integration and APIs have a symbiotic relationship. The latter facilitate integration, while integration facilitates and accelerates the development of APIs.

Achieve a step change in speed, agility, and innovation

Businesses are pursuing digital transformation to achieve a step change in their speed, agility, and ability to innovate. Realizing this rests in large part on the organization's ability to access data at great speed and in great breadth. Modernized hybrid integration and microservices-based APIs (application programming interfaces) are the means to making that happen.

When mobile operators bundle video services from third parties together with their core voice and data offerings, or when auto producers enable customers to personalize features of the cars they are ordering, dozens or more applications are connecting behind the scenes, sharing data, and creating a seamless experience.

This is hybrid integration at work. APIs unlock the data and unique functionalities of applications residing in disparate systems inside and outside the enterprise, often in multiple clouds as well as legacy on-premises environments. Modern integration tools connect all these applications and their functionalities.

A hybrid integration approach is called for because legacy integration tools, such as the ESB (enterprise service bus), are not up to the task of integrating at such scale and across multiple environments. Organizations may be creating a growing share of their applications in a cloud-native approach,[1] a trend identified in the first report in our cloud trilogy, *Cloud native comes of age*[2].

Other organizations are also migrating more of their legacy applications to a cloud environment. But it is clear that firms will be managing hybrid, multi-cloud, and on-premises environments for a long time to come. Their challenge is to transform the way they integrate applications and data across these systems by breaking down monolithic integration flows into microservices.[3] This is essential in achieving the speed, agility, and innovation that supports their growth ambitions.

To learn how businesses are addressing their integration challenges, we conducted a global survey of 818 senior IT executives working in large organizations in 10 separate industries. Our research finds that a select group of companies have progressed further than others in modernizing their approach to integration. Labeled "Integrators," this group displays greater confidence in their integration and API capabilities than their peers. They also appear to outperform the rest of the survey sample in key business metrics, including revenue growth, innovation, and speed to market. The disparities are particularly marked between Integrators and respondent organizations that have done the least to modernize integration – the "Deliberators".

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1 In this approach, applications are built entirely in the cloud using a modular, microservices architecture, in order to perform optimally in it.
2 https://www.capgemini.com/service/cloud-native/
3 Monolithic denotes a software engineering architecture, used on premises, in which an application is a single entity, with all constituent parts interwoven. It contrasts with a microservices architecture, used in the cloud, in which applications consist of small, loosely coupled services that may easily be deployed elsewhere.

Integrators and Deliberators

"Integrators", the most advanced group in the survey in terms of integration modernization, account for 15% of the respondent firms. They meet two criteria:

- Their executives "strongly agree" that their organizations have developed a hybrid integration strategy;
- Cloud-based integration and/or microservices are "very prominent" in their integration approach.

"Deliberators" are respondent firms that meet none of these criteria. They account for 16% of the overall survey sample.

The main advantages and attributes that Integrators enjoy:

Better business performance.
The research suggests that a mature hybrid integration strategy is a contributing factor to business growth. Nearly half (49%) of Integrators report revenue growth of 5% or more over the past three years, compared with just 23% of Deliberators.

Better innovation.
Integrators are also far more bullish about their ability to innovate, the majority (68% vs. 25% of Deliberators) saying they are able to develop new products rapidly and bring them to market quickly.

Better ability to support IoT (internet of things) and other technology use cases.
Eight in 10 Integrators (81%) say that they are in a strong position to support IoT use cases. Over half (52%) say the same about machine learning use cases. Their capabilities are also far stronger than the rest of the surveyed firms when it comes to developing new services from composite applications.

Greater scalability, reliability, and customization.
Nearly eight in 10 Integrators (78%) strongly affirm that their existing integrations are highly scalable. Around two-thirds of them (64%) say their integrations are also highly reliable and can be easily customized.

Greater engagement in the API economy.
Nearly half of the Integrator group (46%, much higher than the survey average) aim to use APIs to create new revenue streams. They are also more likely to have derived benefits from API use already, such as in new product development and reducing time to market.

More concerted outreach to CFOs.
Integrators work harder than the rest to secure CFO support for integration projects. Their greater focus on building revenue-enhancing capabilities (including with APIs) likely strengthens the business cases they present.

Few reservations about asking for help.
Nearly half (48%) of Integrators look to external vendors to help them identify the integration platforms and tools to support their business requirements; just 35% of Deliberators do the same

Bolder ambitions.
Hybrid integration strategies should envision the day when their applications and integrations are completely cloud native. A large share (42%) of Integrators do this, planning eventually to replace all existing integration tools with cloud-based tools.

Enable digital transformation to proceed at pace

Charlie Li

Head of Cloud Services, North America, Capgemini

Spare a thought for the CIO of a large restaurant chain. The firm has been a leader in its market segment for many years. Its business model, however, once lauded as innovative, is now under pressure on many fronts. Global growth is straining its supply chain, while customers demand much greater variety and more customized options. Above all, customers expect greater convenience and faster service. Because, unlike in the past, nimble new competitors are able to leverage digital technology to deliver these on consumers' terms.

The CIO's boss is unhappy because, despite a business-wide digital transformation effort, its technology infrastructure has been unable to deliver on key objectives. These include:

- The growth of consumer mobile apps
- The introduction of new order-taking and payment systems
- The smoother integration of partner offers with its own
- The development of a better supplier rating model.

The reason is that the company has failed to break the hold of its legacy IT infrastructure. The IT team has shifted many of its applications to the public cloud, where it uses several different vendors, and is in the process of retiring its own data centers. What's holding it back is the failure to modernize application integration.

Put simply, the applications residing in the company's various clouds are unable to connect in a reliable and scalable manner with those remaining in its monolithic on-premises estate. Until they can, the objectives of greater speed, agility, collaboration, and innovation will remain elusive.

For organizations such as these, the embrace of APIs and hybrid integration are a means to break the hold of the monolith and allow digital transformation to proceed apace.

In two other reports that Capgemini has published recently, *Cloud native comes of age* and *The automation advantage*[4], we highlighted the advantages that select groups of companies are accumulating – firstly, from developing more of their applications entirely in the cloud; and secondly, from automating their infrastructure provisioning and key application processes such as configuration and release management.

This third report in our cloud trilogy similarly finds that an elite group of organizations – we call them "Integrators" – is also gaining distinct benefits in business and technology performance, in this case from more concerted and ambitious efforts to modernize integration. The sections that follow explore their endeavors, and the benefits they are realizing, in more detail. The starting point is an examination of how they use APIs – the agents of modernized integration.

4 https://www.capgemini.com/service/cloud-native/
   https://www.capgemini.com/service/cloud-services/the-automation-advantage/

Discover the API advantage

APIs have become indispensable to companies. They are the instruments developers and IT teams use to unlock data, thereby facilitating the integration of applications across any number of systems within and outside the organization.

APIs do more than that, however, with the reciprocal help of cloud-based integration tools. They generate business value in their own right, giving substance to the term "API economy." Besides connecting data, applications, systems, and algorithms, they enable the creation of new products and services, and sometimes new business models.

Applications built with the help of APIs can be simple yet powerful, because they "rest on the shoulders of giants": developers build composite applications from data surfaced from multiple other applications via APIs, the result often being new services. Well-known examples are the mobile applications populating Apple, Android, and other app stores, created by developers using APIs to access publicly available weather, transport, entertainment, or other data.

APIs serve a similar purpose within enterprises, as in the example of a recruitment app that draws data from several different internal and external sources (social media, for example) to rate the attractiveness of potential hires. When combined with predictive analytics, machine learning, or other advanced techniques and technologies, composite applications can be highly innovative.

Using APIs to open up new channels and routes to market

Cliff Evans

Vice President Digital Banking, Capgemini

Companies born in the cloud are leveraging emerging technologies, such as artificial intelligence (AI) and machine learning (ML), to create new models for customer experience, allowing consumers to engage with ecosystems of services in different ways. This is creating immense pressure on traditional enterprises to find new ways to either compete or collaborate with these digital disruptors.

Build ecosystems around customer journeys

We have seen this across sectors, with the media industry leading the way, followed by retail, telco, and now banking. There is now a convergence of these ecosystems around different customer journeys, combining multiple sectors. As an example, buying a house brings together real estate, retail, logistics, legal, banking, and insurance.

This creates the opportunity to either become the aggregator of the new customer experience, or to present services to such an aggregator. Either way, APIs are the key for enabling these ecosystems to be assembled and to evolve in response to customer demand and feedback.

View your APIs as products

How do you engage with these ecosystems and create new routes to market? The simple answer is to present your services as APIs, and the key to success is to treat these APIs not as technical solutions, but as products in their own right. They can then be easily used by developer communities, supported by appropriate monitoring and charging structures. The developer portal then becomes a key marketing aid.

Collaborate effectively to get your business operating model right

These APIs need to evolve in response to market opportunities and competitive pressures, as with any other product or service. Thus, if the use of APIs is to be successful in opening up new routes to market, the business operating model for the APIs is as important as the technical operating model. For this, the product manager needs to understand the proposition in the market the API is addressing; and be able to assess its competitive position and monitor its sales and service performance. The technical solution must therefore ensure the appropriate monitoring has been built in. Success will ultimately flow from effective collaboration between the business and technology teams.

APIs unlock innovation and new revenue streams

Large organizations today typically run dozens of APIs. The average number of internal APIs[5] run by the companies in our survey is 107, and that of external APIs is 116. Some companies may have several hundred APIs in their arsenal. T-Mobile in the US runs over 300, according to Chuck Knostman, Vice President, Strategy and Technology, although he stresses that a more important metric to him is their consumption by developers.

The survey respondents cite two motivations above others for using APIs, whether created by themselves or externally. One is to enable more productive collaboration with partners and communities – open-source developer forums, for instance – in the service of innovation. Another is to improve customer experience; an example is a Wells Fargo API that its wholesale banking customers can use to accelerate payments made to their own customers. (See Page 16 "Wells Fargo's API channel extends its distribution network.")

"APIs are controlled, they're standardized and they're secure. This allows companies to collaborate in a much bigger way than they have before."

Charlie Li
Head of Cloud Services,
North America, Capgemini

5 We define internal APIs as those surfacing data from different systems within an organization and used by internal developers. External APIs mainly, or in addition, surface data from sources outside the organization, or alternatively make internal data accessible to developers from third parties or communities.

The most advanced group of survey respondents, the Integrators,[6] think even more ambitiously. Nearly half of this group say that a primary motivation for using APIs is to create new revenue streams for the business. These could be direct fees earned from the surfacing of data; but more often they are likely to be fee-earning services that APIs have been instrumental in creating.

"The most immediate return on investment from APIs is, for most companies, internal productivity gains. Once organizations mature their understanding of APIs and embrace a design-first approach, architecting them as actual products, APIs can also become an important engine for new revenue streams"

David Chao
Head of Product Marketing, MuleSoft

6 See Executive summary for a description of Integrators and Deliberators.

46%

of Integrators
aim to use APIs to create new revenue streams

"C-level executives ask us all the time: "Do we have APIs for this?" When that conversation is happening at that level, it's a true sign of transformation to me."

Chuck Knostman
Vice President, Strategy and Technology, T-Mobile

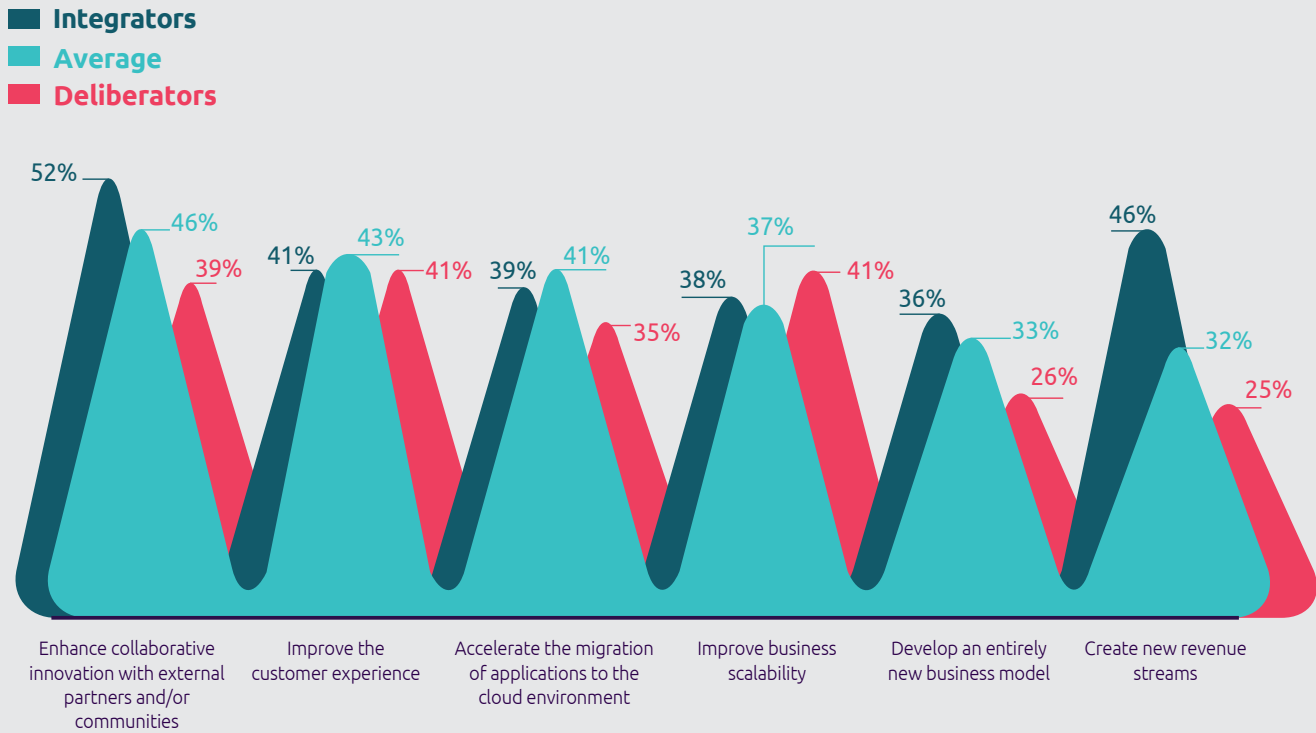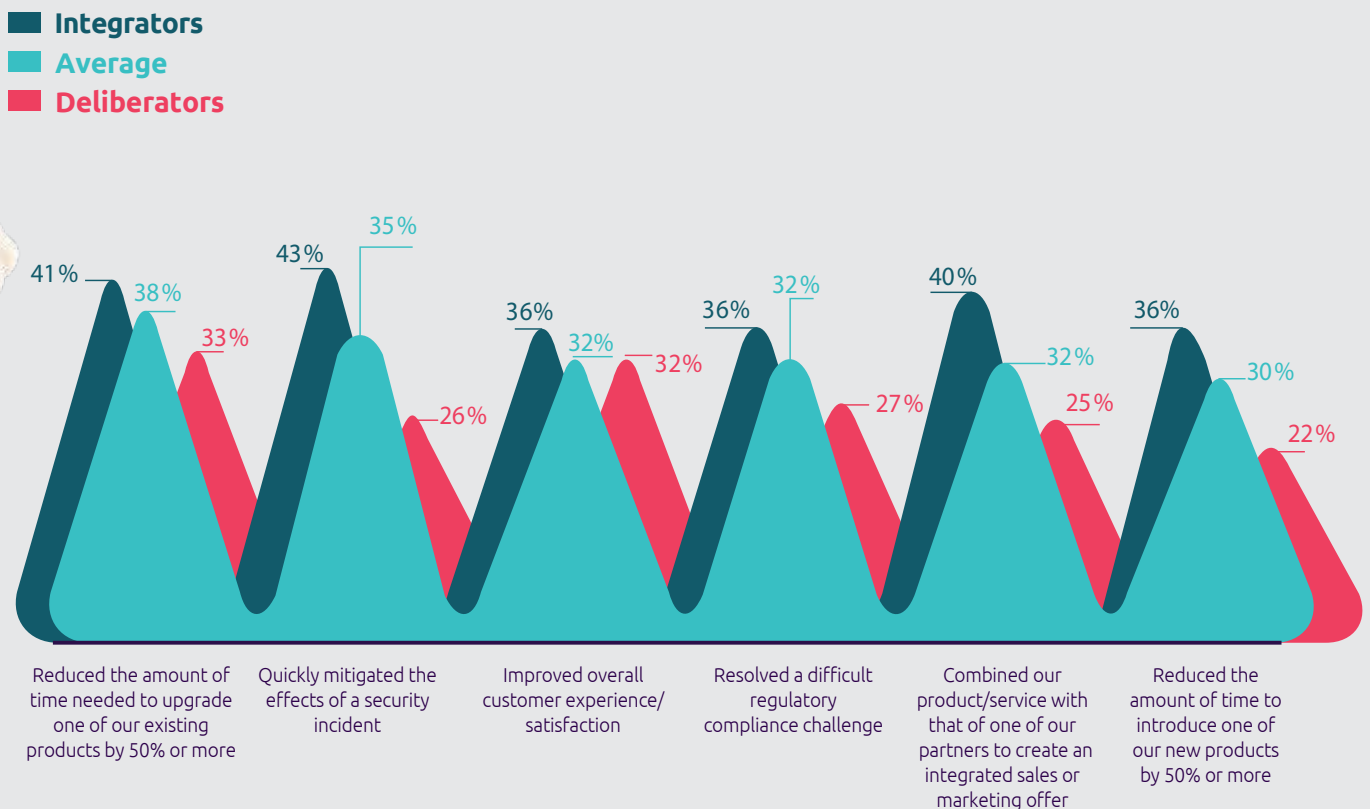## Figure 1. What are your organization's primary motivations for developing and/or using APIs? (Top responses)

Integrators
Average
Deliberators

	Integrators	Average	Deliberators
Enhance collaborative innovation with external partners and/or communities	52%	46%	39%
Improve the customer experience	41%	43%	41%
Accelerate the migration of applications to the cloud environment	39%	41%	35%
Improve business scalability	38%	37%	41%
Develop an entirely new business model	36%	33%	26%
Create new revenue streams	46%	32%	25%

Figure 2. Which of the following has your organization achieved in the past year mainly thanks to its use of APIs? (Top responses)

Integrators
Average
Deliberators

	Integrators	Average	Deliberators
Reduced the amount of time needed to upgrade one of our existing products by 50% or more	41%	38%	33%
Quickly mitigated the effects of a security incident	43%	35%	26%
Improved overall customer experience/ satisfaction	36%	32%	32%
Resolved a difficult regulatory compliance challenge	36%	32%	27%
Combined our product/service with that of one of our partners to create an integrated sales or marketing offer	40%	32%	25%
Reduced the amount of time to introduce one of our new products by 50% or more	36%	30%	22%

Wells Fargo's API channel extends its distribution network

In the banking industry, APIs are quickly becoming a competitive necessity rather than a differentiator, according to Imran Haider, who is head of product, Open API Channel, at Wells Fargo.

The American bank has been at the forefront of industry efforts to use APIs not just as an internal tool of integration but as an external channel to customers as well. In Wells Fargo's case, they underpin many of the digital services provided to its wholesale customers. "API use cases are obvious in wholesale banking," says Haider. "Companies want to connect to their bank, run their payments, and get data for their own accounts using APIs. If you're in the wholesale market, having APIs is an absolute necessity. However, on the retail banking front, the market is just emerging. There are many exciting potential use cases to embed banking into a customer's digital experience of choice."

The bank currently makes over 20 APIs available to customers through its developer gateway. The data services they cover range from the checking of account balances and statements, to wire payments and foreign exchange transactions. One of its newer products is the "Push to Card" API, which allows companies to make payments to their customers (as in the example of insurance claims) in near real-time directly to their debit cards, rather than through lengthier clearing-house transactions.

Customers run a variety of application architectures, not all of them cloud-based, says Haider, so Wells Fargo's APIs need to be designed to be able to integrate effectively with those different architectures. At the center of its API design standards is what Haider terms "developer experience." "This is really important," he says. "We want anyone who comes to our developer portal to be able to quickly find the product they're looking for. The right API design should enable developers to quickly get what the API does and how it works. They don't have to sit down and read pages and pages of documentation. If the API design is simple and really intuitive, it's very easy to connect to Wells Fargo and use our APIs."

Connecting applications across disparate environments with APIs

The third-ranked of respondents' motivations for using APIs is to accelerate the migration of their applications to the cloud environment. This highlights the less publicized but instrumental role that APIs play in modernizing organizations' IT infrastructure. CIOs' and CTOs' sights may be set on a cloud-native future,[7] but most face the reality of having to maintain some legacy applications in their on-premises estates for several years to come. Failure to ensure the smooth integration of applications and data across the different environments (which may also include multiple clouds) during this transition negates the advantages of greater velocity and agility that cloud should confer.

This is where APIs come in. If integration is about enabling access to data across hundreds or thousands of enterprise systems in different environments, APIs are often the tools used by companies to unlock that data and thereby enable many more integrations than had previously been possible. They are a core component of what has come to be known as the hybrid approach to integration. It is now time to explore what hybrid integration looks like in practice.

"In a connective architecture, APIs are quite literally what connect the applications and systems that are spread across the multiple clouds used by companies, and sometimes across their on-premises estates and data centers. How to establish, manage, secure, and monitor those connections is a key element of a company's API strategy."

Ed Anuff
Head of Product Strategy and
Product Management, Apigee

60%
of surveyed firms
use an API-based integration approach today

76%
expect to be
using it in three years

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7 See our report, Cloud native comes of age:
   What businesses need to know.

The composite application advantage

Akshay Kumar

Principal – GTM Solutions & Customer Success, North America, Capgemini

Organizations today face stiff challenges to grow their businesses and increase revenue while balancing the costs of an ever-increasing need to modernize the company's information technology infrastructure to keep pace with these ambitions.

Software design flexibility is critical for business agility and for offering new business and customer services in response to competitive pressures. On top of these daunting challenges is an increasing focus on employee productivity and IT operational efficiency.

Tackling the challenges with microservices

So, how does an organization confront the rather tedious technology activities involved in the design, integration, or development of new applications, markets, business services while still maintaining current services and leveraging existing technology resources?

A microservices-driven design, coupled with an API-first strategy, provides a methodical approach to addressing these challenges. Microservices help encapsulate a "repeatable business task," such as checking customer credit, pulling down new work orders, etc., that can easily be componentized, automated, and assembled to create composite applications.

Achieving scale and savings

Composite applications are groups of business-oriented microservices that are programmatically linked together to deliver a comprehensive business solution. They can be deployed and scaled as per unique business requirements. APIs can then be leveraged to expose both the microservices and the composite apps to the outside world or to consumers – using appropriate security, SLAs, throttling rules, and constraints.

Savings are realized with well-thought-out and well-architected composite apps because the applications are created just once and reused across multiple lines of business (LoBs). For example, an account creation service may be the same across multiple business units and thus such APIs and microservices (or assets) could be used in each LoB application.

Defining an API-first strategy

A consistent API-first and microservices-led architectural strategy for the entire enterprise – from the client to the back-end – can deliver an end-to-end business solution. It is thus an objective that modern-day IT teams should pursue.

Hybrid integration at work

A hybrid integration approach involves the use of modern, cloud-based integration tools in combination with on-premises ones, such as the enterprise service bus (ESB), to connect applications in different environments.

It does not necessarily dispense with the ESB, which many organizations cannot afford to phase out yet for different reasons. (See page 37 "Beware the piecemeal approach to integration.") Rather, cloud-based tools, along with microservices and APIs, help manage integrations within the cloud and across the different environments, while the ESB retains a role in managing legacy integrations. In this context, hybrid integration is a means to gradually break the remaining hold of legacy, monolithic architecture.
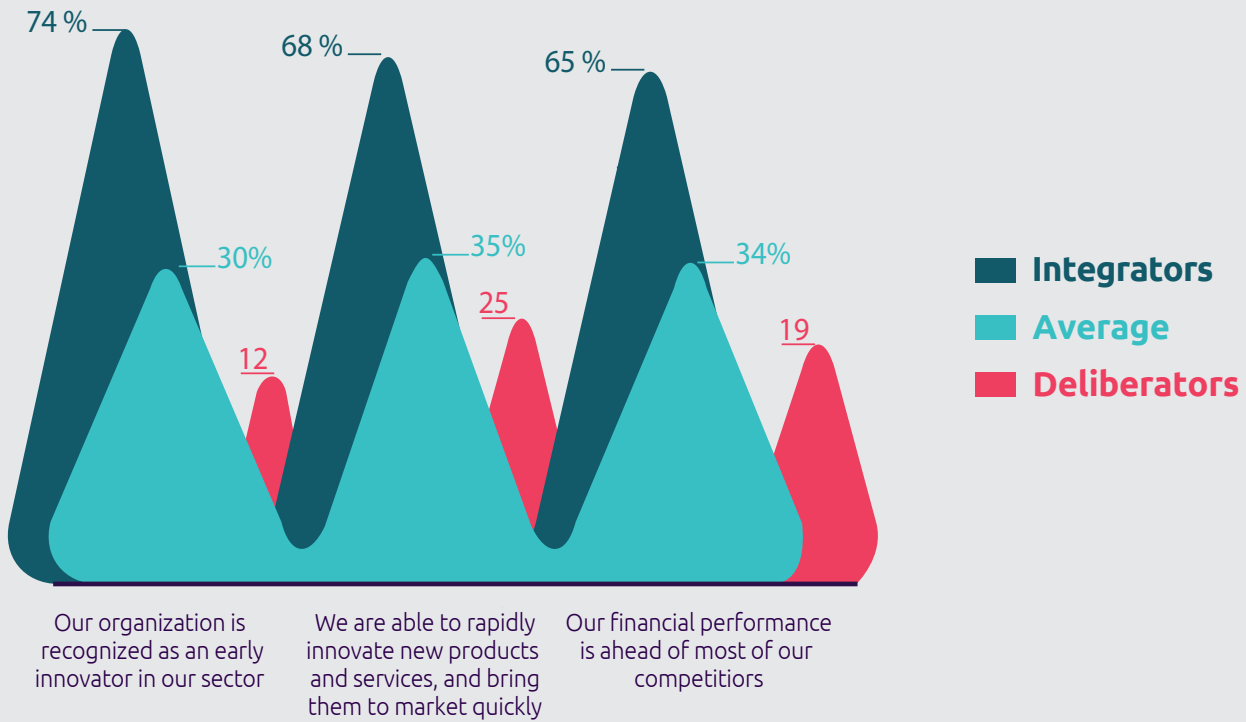
Just over one-quarter of surveyed organizations have taken this path, as evidenced by respondents' strong affirmation that they've developed a hybrid integration strategy. Most, although not all of them, are in the process of implementing that strategy by making cloud-based integration and/or microservices "very prominent" in their integration approach. These are the Integrators. At the other end of the spectrum are respondent firms that meet none of these criteria – the Deliberators. (See the executive summary for a fuller definition of these groups.)

Significant gaps in performance and approach separate both groups, but most striking of all are the gaps in business performance between them. Just under half (49%) of Integrators, for example, report revenue growth of 5% or more over the past three years, compared with just 23% of Deliberators. Not only are Integrators far more likely to say that their financial performance is ahead of their rivals, they are also far more bullish about their ability to innovate. It is probably no accident that Integrators' strategic priorities gravitate around business growth (improving customer experience and scalability), while the other group's top priority is reducing costs.

49%

of Integrators report revenue growth of 5% or more over the past three years

Figure 3. Share of respondent firms who "strongly agree" with statements about innovation and financial performance

74 % — 68 % — 65 % —

30% 35% 34%

12 25 19

Integrators
Average
Deliberators

Our organization is recognized as an early innovator in our sector

We are able to rapidly innovate new products and services, and bring them to market quickly

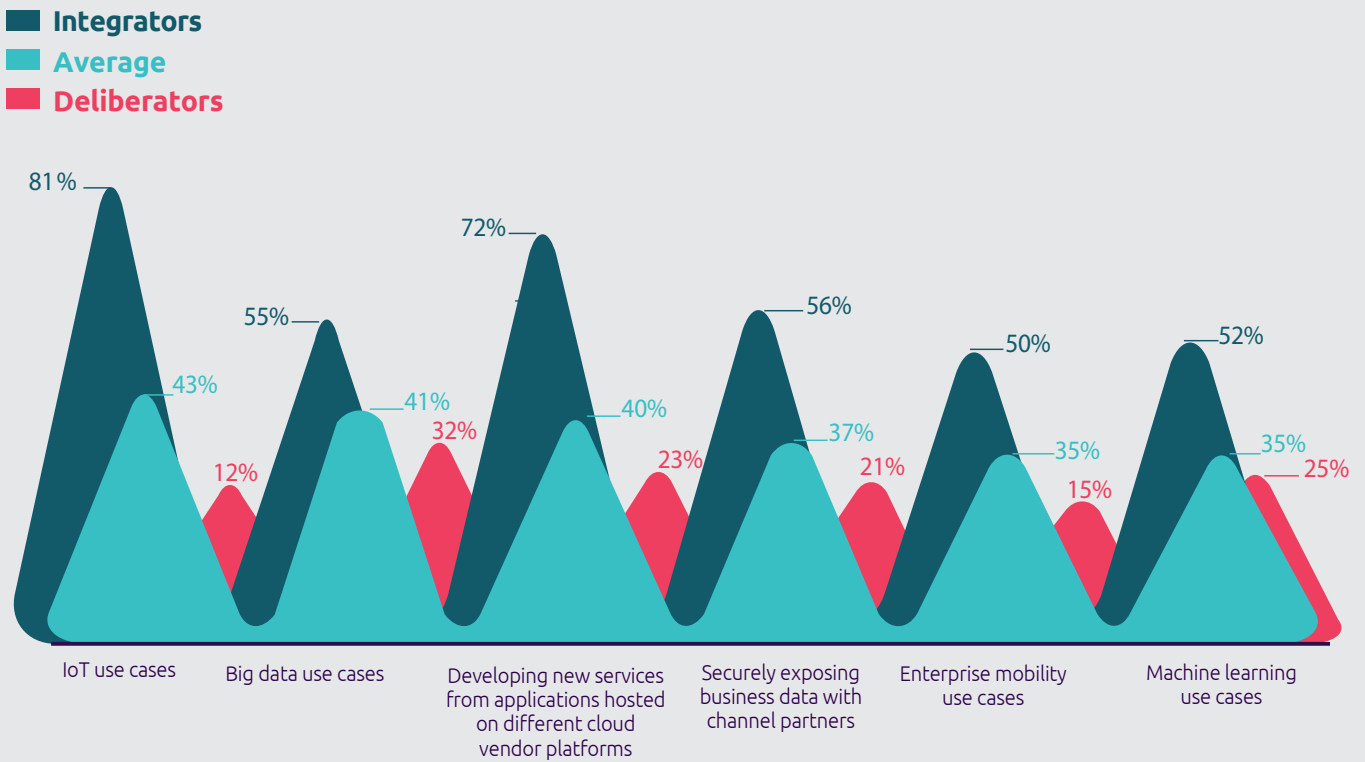Our financial performance is ahead of most of our competitiors

"With our T-Mobile One product, customers with family plans get Netflix on us. The Netflix integration with the APIs took us two weeks to get up and firing. Completing this type of integration in the past would have taken anywhere from six to nine months."

Chuck Knostman
Vice President, Strategy and Technology, T-Mobile

Figure 4. Share of respondents who are "very satisfied" with their organization's ability to support integration requirements

Integrators
Average
Deliberators

	IoT use cases	Big data use cases	Developing new services from applications hosted on different cloud vendor platforms	Securely exposing business data with channel partners	Enterprise mobility use cases	Machine learning use cases
Integrators	81%	55%	72%	56%	50%	52%
Average	43%	41%	40%	37%	35%	35%
Deliberators	12%	32%	23%	21%	15%	25%

Integrators are clearly in a much stronger position to deliver the business benefits of newer technologies and capabilities. This applies to internet of things (IoT), big data, machine learning, and enterprise mobility use cases. The Integrators also appear supremely confident of being able to deliver new business services based on composite applications, and to securely expose business data with external partners – a non-negotiable criterion for collaborative innovation.

T-Mobile's journey from monolith to microservices

T-Mobile in the US is not an old business; its antecedent having been founded in 1999 before being acquired by Germany's Deutsche Telekom in 2001.

Until a few years ago, the US operator's technology architecture was nonetheless "heavily monolith," in the words of Chuck Knostman, its Vice President for Strategy and Technology. "It was full of stovepipe billing, financial, and other systems with a middleware layer gluing them together. It was very hard to scale and very hard to deliver with any kind of velocity. With the help of APIs, microservices, and more modern architectures, we were able to pull it apart."

Some of the middleware is still there, says Knostman, but his team have put APIs atop the pieces it is trying to pull out, in a type of "strangler pattern" (a term used to describe the process of migrating a legacy system by gradually replacing pieces of functionality with new applications and services). "This has bought us time to split apart that monolith while shielding developers from all the changes being made behind the scenes," says Knostman. He expects that, within the next few months, most or all of T-Mobile's transactions that its middleware had been handling will be going through a modern microservices architecture.

With over 300 APIs run internally, good API management is naturally an important part of the picture. One manifestation of its importance arose, says Knostman, when an internal team ("Team A") planned to use an API created by another ("Team B") without communicating with each other. When the latter's API experienced an unusually high call volume that the other team did not anticipate, a policy written into the API management layer throttled it, avoiding a damaging failure. This was a moment when it became clear, says Knostman, "that this stuff really does work."

How secure hybrid integration and APIs enable improved digital interaction with customers

Pankaj Sehgal,

Cloud Native Leader,
North America
Capgemini

Organizations can change the playbook with the ability to quickly release new products or services and provide seamless digital interaction at every touchpoint between their brand and their customers. As evidenced by our research, a mature hybrid integration strategy provides the speed and flexibility that organizations need to achieve this in today's hyperconnected world.

A phased approach to transformation

Most traditional organizations approach their digital transformation journey in a phased manner. This means that existing on-premises ESBs and public cloud-enabled APIs and microservices will need to coexist as part of an organization's hybrid integration approach. Hence, IT leaders need to modernize their existing ESBs to operate alongside new cloud-based tools and define governance around the creation, management, and consumption of APIs.

For example, as the number of APIs and integrations multiply, minor defects can be difficult to isolate and may result in catastrophic system failures. To prepare for this, they need to adopt a circuit breaker approach that quickly identifies and proactively isolates any defect while the rest of the system falls back to a predefined state. This ensures your APIs and integrations can provide reliable omnichannel interactions, including modern rich UI, voice recognition, mobile interactions, and offline data synchronization.

A mature hybrid integration strategy also helps organizations to drive real-time data accuracy in interactions between back-end systems of record and front-end systems of customer engagement. This is essential for offering a unified customer experience across channels and touchpoints.

Securing your environment

Security is a key consideration in all of this. Securing your hybrid integration and APIs is as critical as the ability to offer them quickly to customers. After all, one small breach of digital customer data could lead to irreparable damage to trust and reputation. Thus, it is essential to standardize and adhere to fundamental security concepts like encrypting personal information (PII) and/or sensitive data, setting up secure user groups, VPN gateways, etc. In addition, IT leaders should think about creating standard blueprints that ensure "security by design" and automate their security processes using security-as-a-code (SaaC) to ensure robustness in their approach to security.

Achieve scalability, flexibility and empowerment

The reasons for Integrators' confidence are also clear. According to their executives, the integrations this group is putting in place are highly scalable. Their networks, for example, can handle sudden and significant increases in the number of service requests. Almost two-thirds of Integrators also say their integrations can easily be customized for the needs of individual regions or units, the addition of new channels, or the use of open APIs.

This advanced group is also doing much to democratize integration. Compared with Deliberators, far more of them have empowered specialists within the lines of business to integrate applications with the tools on hand. Over 40% have even enabled business end users to do the same.

"With an iPaaS (Integration Platform as a Service) platform you can leverage a low code/ no code environment. You can create an integration process that knows how to string multiple complex data sources together. Then expose an API for the development team that gives them one web service to interact with, which provides a layer of abstraction to the data sources, connectivity, security and complexity of the individual endpoints. The API, from the developers' perspective, doesn't change when the process or data sources change. So the developers can focus more holistically on their core competency, which is building the coolest new whiz bang thing for the business."
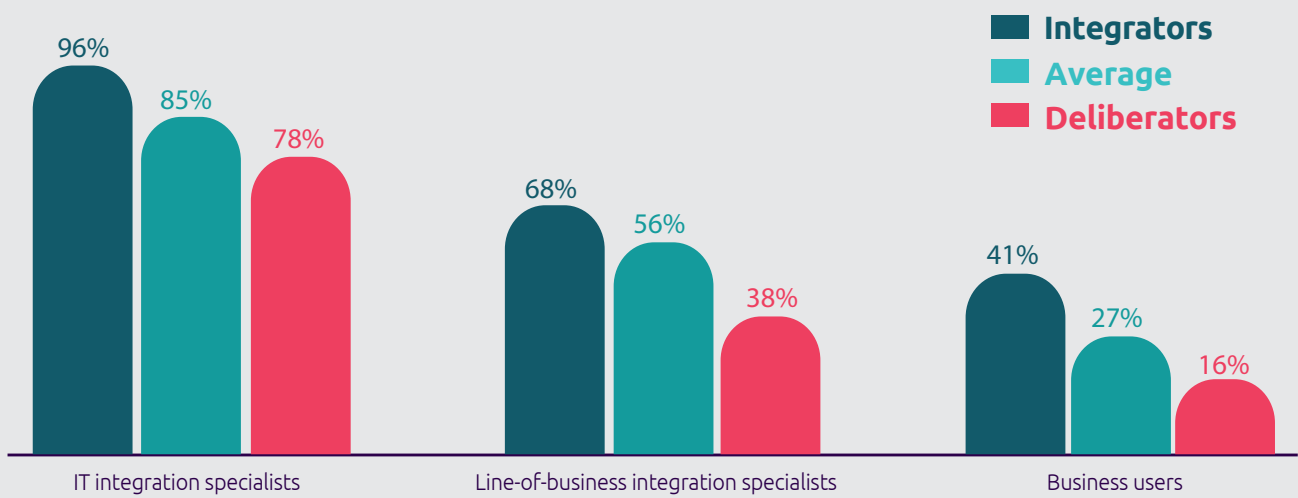
Chris Timmerman
Chief Technologist, Dell Boomi

78%
of Integrators say their integrations are highly scalable; only 8% of Deliberators say the same

Figure 5. Which of the following are empowered to integrate applications using your existing integration tools?

Legend:
- **Integrators** (dark teal)
- **Average** (teal)
- **Deliberators** (pink/red)

IT integration specialists
- 96%
- 85%
- 78%

Line-of-business integration specialists
- 68%
- 56%
- 38%

Business users
- 41%
- 27%
- 16%

Manage complexity with modernized hybrid integration

Organizations taking part in the "great migration" of enterprise applications to the cloud – as all in our survey are – face a considerable degree of added IT complexity as a result. For large businesses especially, with a sizeable share of their applications and systems still running on premises, the migration is likely to take several years to complete. This creates a multi-layered integration challenge. For example, companies' on-premises infrastructure may include a private cloud and a data center, and they are likely to use multiple public cloud providers, as almost all our surveyed firms do.

66%
of survey respondents' firms use three or more cloud providers

Add the fact that over three-quarters of their applications are currently run in a private cloud or on premises (or both), and the level of integration complexity becomes clear. The traditional point-to-point integration approach used within monolithic systems will not be able to cope for long when hundreds or thousands of a company's applications reside in several different environments. For many years, the ESB has provided an antidote to point-to-point by enabling integration between multiple enterprise systems. Its worth, however, is limited to the on-premises environment – by itself, the ESB cannot manage the complex integration flows of a hybrid (multi-cloud and on-premises) environment.
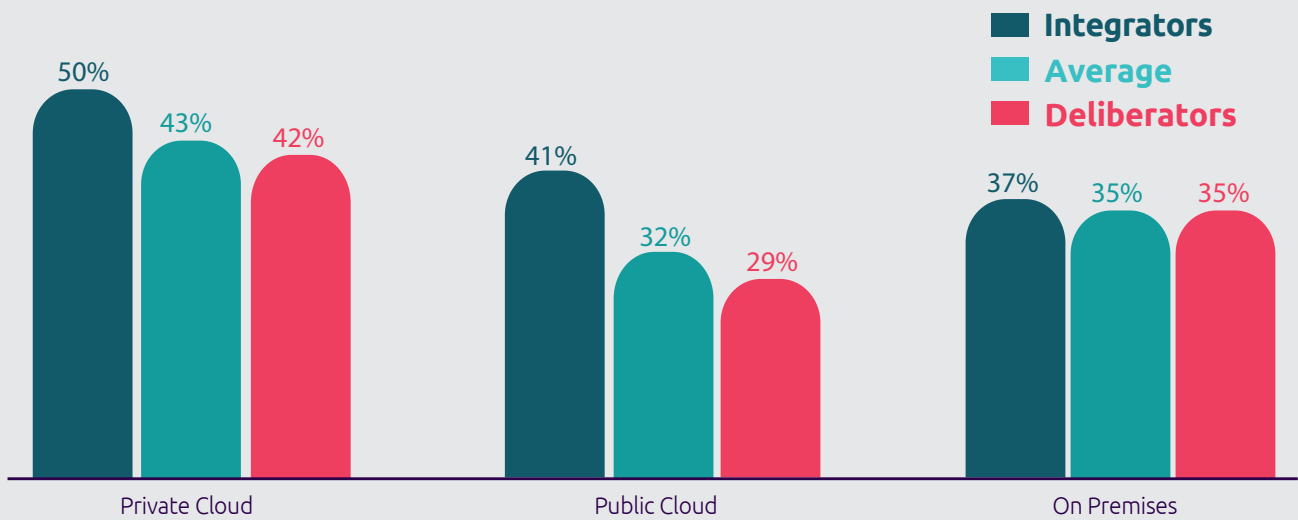
"The most successful API strategies are the ones that also factor in integration. APIs are great to expose functionality and data from individual systems through a predictable contract. You then need a flexible integration layer that can work across clouds to compose APIs and business logic into reusable services that automate end-to-end business processes."

David Chao
Head of Product Marketing, MuleSoft

Figure 6. Share of respondent firms' applications running in different IT environments

Legend:
- Integrators
- Average
- Deliberators

Private Cloud: 50%, 43%, 42%
Public Cloud: 41%, 32%, 29%
On Premises: 37%, 35%, 35%

Failure to cope with this complexity will do more than compromise the IT environment. It will seriously threaten achievement of the organization's main strategic objectives, the foremost of which, according to survey respondents, is improving customer experience. Also at risk will be other key goals, such as increasing scalability, reducing costs, developing more new products, and accelerating time to market.

Hybrid integration, as we have explained, is a means of managing this complexity and ensuring that the firm's technology infrastructure can deliver on these business objectives. As with any technology project, developing and implementing an effective strategy entails method and attention to a variety of factors, of which technical details are just one part.

"Monolithic, on-premises-based solutions are not built in a way to allow for the business to be agile, so it takes an army to make a change. That's what this whole shift to hybrid integration is about - agility."

Chris Timmerman
Chief Technologist, Dell Boomi
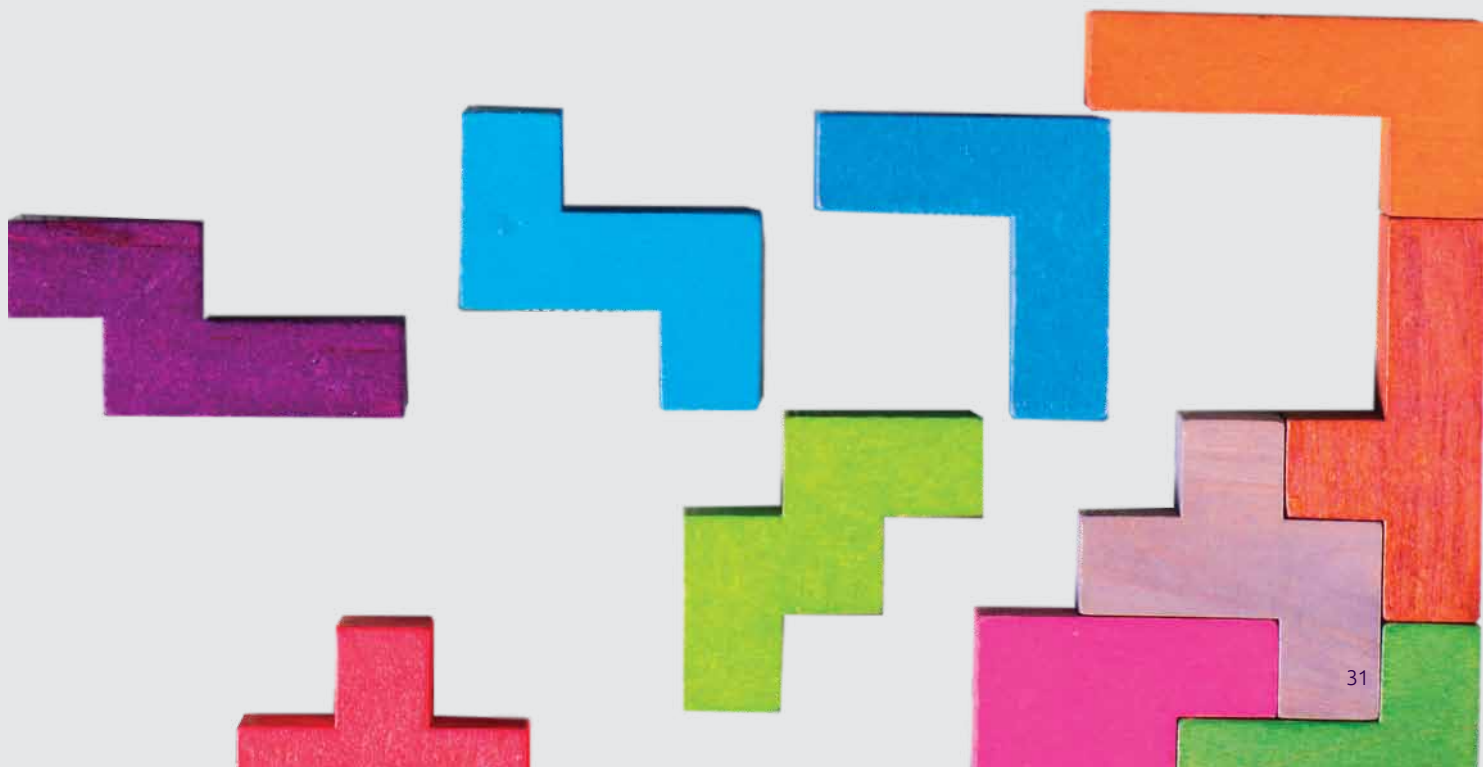
Hybrid integration as a staging post en route to cloud native

Until just a few years ago, robust but complex legacy enterprise service buses (ESBs) connected to business applications like CRM, ERP, and HCM were the technology of choice. Then along came cloud and the need for integrations to be more agile and flexible.

Al Liubinskas

Cloud Integration Leader, North America, Capgemini

Achieve scalability, adaptability, and flexibility

In today's era of rapid cloud adoption, the prevalence of mobile apps, the explosion of big data, and the growing adoption of IoT, a legacy ESB-type of platform is no longer sufficient. A digital business requires scalability, adaptability and, importantly, flexibility, leading to a hybrid integration platform as the new staging post.

In contrast to the monolithic ESBs, modern-day, hybrid-integration approaches provide lightweight, pattern-based, scalable platforms that support microservices architectures and API management while offering application deployment models, such as containers.

Supporting the shift to microservices, APIs and DevOps

Other features that we typically see include a zero- (or low-) coding development environment, as well as connectivity to disparate technologies and a variety of SaaS applications. We might also expect a high-performance messaging infrastructure with high availability and scalability.

The ability to create and orchestrate functional microservices without getting into code complexities, to build consumable APIs from enterprise applications, and to visually choreograph these APIs leveraging integration tooling, enables organizations to rapidly develop and deploy cloud-native services at web scale. We thus typically see out-of-the box support for DevOps automation, enabling continuous integration and continuous delivery.

Make a gradual shift to cloud

With a well-thought-out hybrid integration platform and architecture, it becomes possible to react quickly to new requirements. It allows the bimodal IT organization to continue its focus on the mission-critical core services that change infrequently while enabling the lines of business to quickly try out new business services and roll them out in an agile way.

Such a hybrid integration platform and architecture approach will see progressive organizations gradually shifting from a purely "on-premises" to a "cloud-ready," and eventually to a fully "cloud-native" deployment model.

Industry perspectives on APIs

Organizations from different sectors share very similar business objectives: ensuring faster speed to market with new products or services; providing a better customer experience and engagement; exploring newer business models and market opportunities leading to revenue growth; and strengthening their ability to support regulatory and security compliance.

It may be a consumer products company trying to provide an integrated customer experience in the form of a loyalty program or omnichannel initiatives, or it could be a telecoms operator undertaking a legacy modernization program to support a newer revenue model and increase its ability to roll out services faster to its customers. Our research shows that companies such as these are using APIs to meet their business objectives.

In the survey we identified API usage trends in various verticals and observed the following:

Banking

Better customer engagement, faster time to launch new services and products to customers, a consistent single view of customer data, and strong security and compliance are key to organizations in this sector. The use of APIs has helped the banks represented in the survey to improve the scalability and reliability of their back-end systems, allowing them to meet these objectives, with reduced time to market and improved customer experience cited most frequently.

Consumer Products and Retail (CPR)

Being a customer-centric industry, retail companies rely on the availability and accuracy of data to serve their customers and improve their overall experience and engagement. The survey suggests that CPR companies have realized clear benefits from API use in the forms of reliability, scalability, and security of their systems, leading to a better customer experience.

High-tech

Speed to launch a new product is of utmost importance for high-tech companies. Two-fifths of these firms in the survey have leveraged their APIs to slash the time needed to bring a new product to market, as well as to upgrade an existing one. Better scalability of their systems to support growth is another benefit cited by high-tech respondents.

Manufacturing, Telecom and Communications

Reducing time to market is also a top priority for manufacturers and telecoms companies. Close to 40% of respondents in both sectors have put APIs to work to meet this objective, substantially cutting the time they need to introduce a new product. APIs have also helped many to improve their compliance capabilities.

Figure 7. Which of the following has your organization achieved in the past year mainly thanks to its use of APIs? (Top responses, by sector)
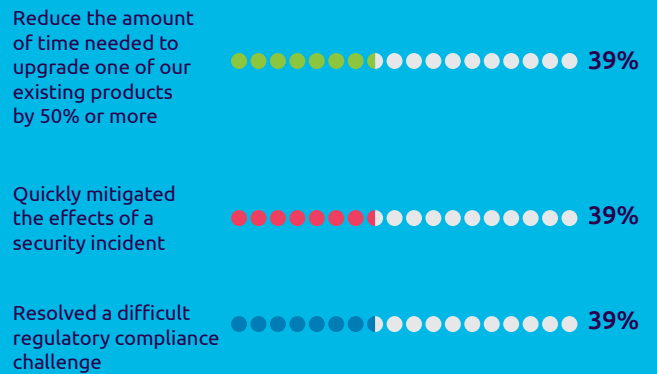
Banking

Reduce the amount of time needed to upgrade one of our existing products by 50% or more — **44%**

Improved overall customer experience/ satisfaction — **35%**

Improved scalability of systems — **34%**

Consumer Products and Retail

Improved overall customer experience/ satisfaction — **36%**

Quickly mitigated the effects of a security incident — **34%**

Improved reliability of systems — **32%**

High Tech

Reduce the amount of time to introduce one of our new products by 50% or more — **40%**

Reduce the amount of time needed to upgrade one of our existing products by 50% or more — **39%**

Improved scalability of systems — **38%**

Manufacturing

Reduce the amount of time needed to upgrade one of our existing products by 50% or more — **39%**

Quickly mitigated the effects of a security incident — **39%**

Resolved a difficult regulatory compliance challenge — **39%**

Telecom and Communications

Reduce the amount of time needed to upgrade one of our existing products by 50% or more — **37%**

Resolved a difficult regulatory compliance challenge — **37%**

Reduce the amount of time to introduce one of our new products by 50% or more — **35%**

Making hybrid integration a reality

The first step to modernizing an organization's integration capabilities is to identify the requirements based on their business goals and technology roadmap. Which systems really need to talk with each other?

Which applications are we aiming to shift to the public cloud and when? How will the pursuit of our key business objectives over the next few years change integration requirements? Six in ten survey respondents — and 77% of Integrators — say their organization has identified the existing and future integration requirements to support their business ambitions. No more than 41% of Deliberators can say the same.

Next comes the development of strategy. How wide should its scope be? According to Charlie Li, it is critical that integration strategy takes in the entire enterprise. He explains:

"In companies with multiple units and sites that have done things in different ways using different technologies, standardizing the integrations across the organization is imperative, but it requires a big planning effort even before you start making any changes."

The strategy should also be ambitious, with the organization's sights ultimately set on phasing out older integration tools and replacing them with cloud-based tools. Over 40% of Integrators plan to meet this objective.

42%

of Integrators plan

to replace all their existing integration tools with cloud-based tools

Beware the piecemeal approach to integration

There is a consensus among the experts interviewed for this study that companies should not attempt to rip up and replace their legacy integration architecture in one fell swoop, even though they may be lumbered by it.

Chris Timmerman, for one, who is chief technologist at Dell Boomi, believes that ripping out an ESB in one go is not advisable. "It's not realistic to think a new vendor can come in and replace the mission-critical processes that have been running on a legacy ESB for years in a single project," he says. "For example, if you're shuttling order data across your ESB and the organization is relying heavily on those mission-critical transactions, it becomes a very bad thing if that ESB goes down and the orders don't come in. Having a new vendor attempt to assume that risk in early phases of an ESB replacement is not advisable." Chris Timmerman believes that a temporary period of "coexistence" with modern integration tools while phasing out the ESB, makes more sense.

Ed Anuff of Apigee agrees, but maintains that architecture modernization at whatever pace must be guided by an overall strategic blueprint. In its absence, gradual steps may amount to no more than a piecemeal approach. Simply bolting new integration tools onto old ones in ad-hoc decisions is an example. "That is, at best, a coping strategy," he says. "It may make sense, but it's definitely not going to take a company where it ultimately wants to go."
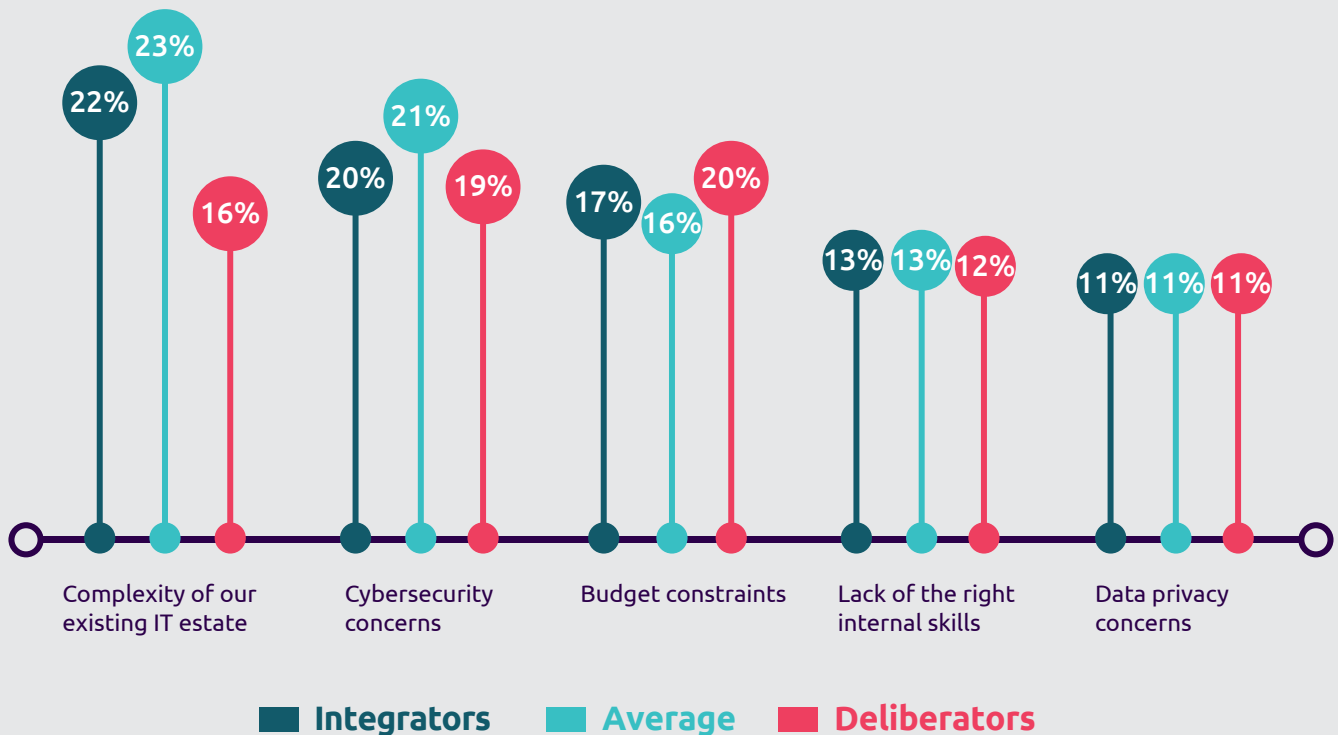
At the same time, it's important to get started. Companies can sometimes become paralyzed from a strategy perspective, says Ed Anuff. He believes cherry-picking a few actionable projects that will serve as lamp posts for the broader effort is a good way to go, saying, "If you try to do too much too soon, and your business isn't ready for it, the whole thing will grind to a halt. Biting off small pieces in the form of individual projects will allow you to get started on modernizing your integration, but doing so with the larger strategy in mind, not viewing it as pure incrementalism. That's taking a holistic view, but starting small."

Combating inertia to seize the hybrid integration opportunity

When it comes to technology change, implementing strategy is almost always a far tougher challenge than developing it. This is certainly true of hybrid integration. Asked to name the largest barrier to improving their organizations' integration capability, the complexity of their existing IT estate is the most common response, both of Integrators and that of the overall sample. (For Deliberators, budget constraints are viewed as the chief obstacle.) Not surprisingly, cybersecurity concerns are also a common refrain, as they are today in almost any technology initiative.
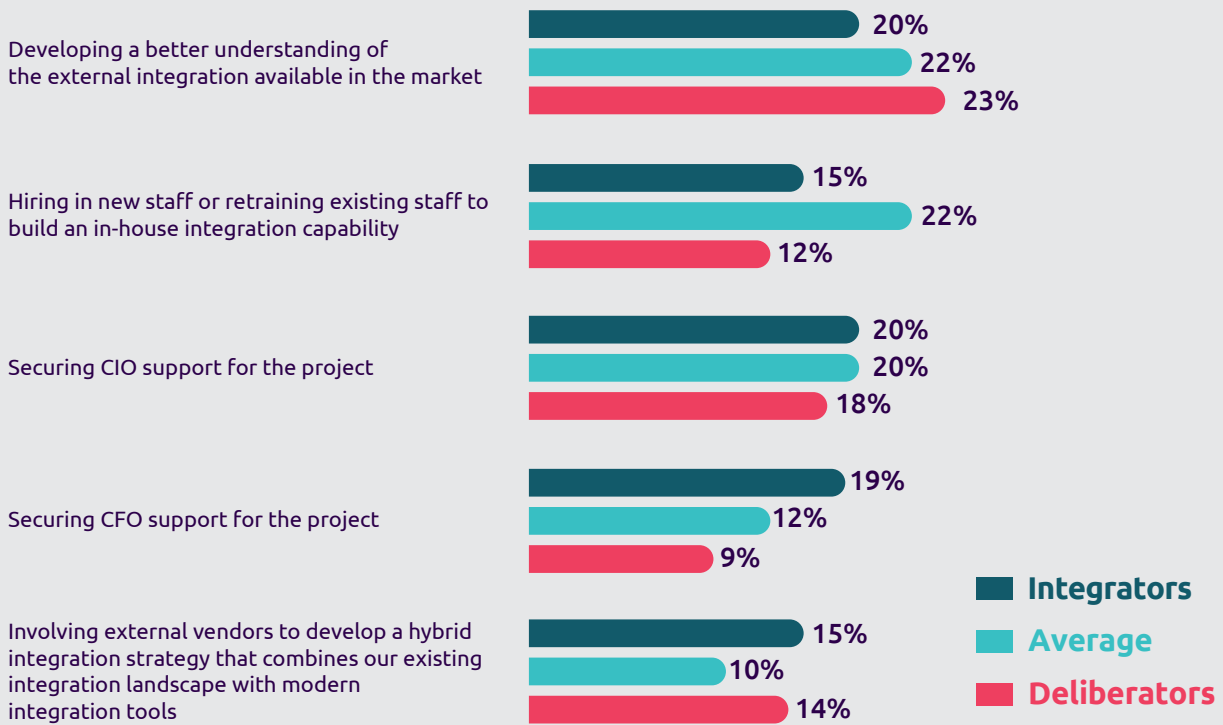
Figure 8. What are the principal barriers to improving your organization's hybrid integration capability? (Rank 1, top responses)

	Complexity of our existing IT estate	Cybersecurity concerns	Budget constraints	Lack of the right internal skills	Data privacy concerns
Integrators	22%	20%	17%	13%	11%
Average	23%	21%	16%	13%	11%
Deliberators	16%	19%	20%	12%	11%

Complexity need not paralyze IT leaders, however, as there is an array of integration tools and platforms available in the market to help organizations implement a hybrid approach. This is acknowledged by the survey respondents, who cite the need to develop a better understanding of such solutions.

48%
of Integrators work with external vendors
to identify the best integration platforms and tools to support their business requirements; just 35% of Deliberators do the same

Figure 9. Which of the following factors do you believe will be most important in overcoming the cited barriers? (Rank 1, top responses)

Factor	Integrators	Average	Deliberators
Developing a better understanding of the external integration available in the market	20%	22%	23%
Hiring in new staff or retraining existing staff to build an in-house integration capability	15%	22%	12%
Securing CIO support for the project	20%	20%	18%
Securing CFO support for the project	19%	12%	9%
Involving external vendors to develop a hybrid integration strategy that combines our existing integration landscape with modern integration tools	15%	10%	14%

A conspicuous gap between Integrators and Deliberators exists when it comes to the value of securing CFO support for integration. This figures prominently among the former group's top-ranked measures to remove impediments, but much less so among Deliberators. This may be one of the reasons why budget constraints are a bigger obstacle to improved integration for this group than for the others. Integrators clearly work harder to garner the support of this critical member of the senior management team.

C-level leadership is also likely to be needed to overcome two other common pitfalls: inertia and legacy thinking. When the ESB first made its appearance, it removed many of the integration constraints that enterprises were facing. Further, it fit neatly with the service-oriented architecture (SOA) approach that many IT teams were enthusiastically implementing at the time. Both the ESB and SOA approach achieved their mandate in a predominantly on-premises world and still provide benefits to some organizations. Falling back on some of the legacy integration practices associated with them is thus easy when pressure is on to grow the number of integrations quickly. But they are severely constrained in their ability to manage a complex hybrid IT estate.

"The most common pitfall is thinking that technology alone is enough. To succeed in the API economy, you also need a change of mindset: adopting a new IT operational model that is optimized for consumption, reusability, and self-service. This is not achieved overnight and requires practice. Organizations that surrender to the urgency of the now and continue with the legacy approach inevitably build insurmountable technical debt that blocks innovation and agility."

David Chao
Head of Product Marketing, MuleSoft

The capabilities needed for hybrid integration

Ben Scowen

xPaaS Business Lead, Capgemini Cloud Platform, Capgemini

Amanda Clay

xPaaS Product Marketing Lead, Capgemini Cloud Platform, Capgemini

For companies looking to adopt a comprehensive hybrid integration approach, it is evident that they will need to build new capabilities to support this transition. While this will certainly require new tools, it doesn't imply that everything they are currently using needs to be discarded. Making the right choices based on selection criteria that support their business objectives can ensure optimized TCO and greater ROI for their investments.

Re-using existing capabilities

If hybrid integration is part of your digital transformation strategy, it is unrealistic to think that all mission-critical processes running on an ESB can simply be replaced with modern integration tools without causing serious disruption to business.

A transitionary period of "coexistence" between the new and the old is an opportunity to gradually move your center of gravity from on premises to the cloud. Abstracting certain on-premises capabilities or functionalities and unlocking them with an API on the front end is a good starting point.

New capabilities

An effective API management capability is essential to enable you to exploit your processes and data with the added benefit of strong security and governance. Then there's an integration Platform-as-a-Service (iPaaS), which can be procured out-of-the-box from software vendors, or choose a more cost-effective solution based on containerization and open-source frameworks.

All new capabilities should predominantly be cloud-based and must always include security and DevOps components. Insist on a standardized set of pre-packaged capabilities that you buy, rather than build. This will prevent the introduction of ad-hoc technology that may be incompatible with a modernized integration approach.

Selection criteria

We recommend working with external partners who have a strong track record in hybrid integration. They will help to identify the right tools and capabilities, and will be experienced in managing the cultural change required around the adoption of DevOps and Agile.

It is important to avoid lock-in to a single cloud services vendor or systems integrator. Cybersecurity is a key selection criterion, so understand what is built in to the products and identify the gaps to be bridged. Finally, think about the future. Ensure scalability by avoiding point-to-point, custom code building, and only select something that will easily integrate with your evolving technology capabilities, such as internet of things, machine learning, etc.

Become an Integrator, and join the API economy

There are different approaches to hybrid integration, as this report illustrates. Each organization will have specific circumstances that guide the individual approach they take. These might include the extent and makeup of the organization's remaining legacy applications; the desired pace and timeframe of their migration to the cloud; the organization's portfolio of APIs, and its proficiency in creating and using them; the age of, and sunk investment in, the ESB; and the number and identity of their external cloud providers. These are just a few of the criteria and priorities affecting the choice of transformation roadmap – there are many others.

The roadmap you take will reflect your current priorities. In this section, we have identified a number of common scenarios, for which we have recommended transformation roadmaps. The first three reflect the state of play in terms of cloud and API maturity and existing legacy estates, while the fourth scenario focuses on the modernization of legacy ESB.

Scenario 1: Cloud-first strategy adoption
The journey to the cloud is underway for many organizations, whether it be rehosting legacy applications, or refactoring and rewriting applications for the new cloud environment. Some organizations are also replacing existing core legacy applications with SaaS applications, such as Salesforce, NetSuite, ServiceNow, and Workday, etc.

Transformation action plan:
1. Define an optimal cloud-first implementation strategy:
   – Evaluate the center of gravity for your enterprise applications by assessing how many applications are on premises, in a private cloud, and in a public cloud.
   – Understand how applications are accessed and from where; their process criticality to the business; data sensitivity and data security requirements; and level of customization required.
   – Identify which on-premises applications will be moved to a public or private cloud, which will be recreated with a cloud-native approach, and finally, which can be replaced with SaaS.

2. Evaluate data security and regulatory/compliance requirements:
   – Build clarity around how full benefits of the cloud (such as resource sharing and elasticity) can be harnessed without compromising on security.
   – Establish how an enterprise-class integration platform supporting an API-led integration approach can help IT teams retain control over data security, compliance, and total cost of ownership.

3. Model the integration features needed to support your short-, medium- and, if possible, long-term business and technology needs:
   – Identify any gaps in your current integration infrastructure.
   – Use a robust capability assessment framework, such as Capgemini's "Hybrid Cloud Integration Platform Capability Framework," to identify which functionalities need to be retained.
   – Identify and define the application integration strategy to integrate this mix of on-premises, private, public cloud, and SaaS applications during the transition phase, as well as in its end state.

4. Based on the above criteria, select an enterprise-class hybrid integration platform (HIP) that can support your transition to a cloud-based applications architecture.

Scenario 2: API-first strategy
The survey on which this report is based revealed several different reasons for (and approaches to) adopting an API-first strategy. Some organizations are creating a portfolio of APIs from a consumption standpoint, such as for mobile apps and self-service portals. Others are integrating cloud-based and cloud-native apps, along with existing legacy enterprise apps for seamless connectivity between back-end and front-end systems. A strategic intent to expand the business ecosystem and/or create new business opportunities and channels to reach new markets is seeing other organizations looking to discover, create, and deploy APIs.

Transformation action plan:

1. Identify and define your organization's goals, for example, incremental revenue streams, opening new business channels, and improving customer or employee experience and satisfaction levels:
   – Evaluate the need for, and organizational readiness to, future-proof your business (through reusable APIs), so that no matter which channel your customers, employees, and partners use across the business, it can be accommodated quickly and easily.
   – Ask why you need, and if you're ready to provide, a single, unified view of the customer with an aggregated representation of their personal data and behavior.
   – Assess the business's need as well as its readiness to support the roll-out of new products, provide personalized engagements, and improve existing experiences with applications spread across on-premises, public, and private cloud environments.

2. Leverage a comprehensive API assessment and adoption framework, such as Capgemini's "API-fication Framework " to assess how an API-led integration approach can address:
   – The integration flows (process, application, data) required to satisfy the business use case.
   – Unlocking of siloed data and services, and opening them for broader consumption by your internal and external customer(s).
   – Reusability, security, and governance requirements; creating re-usable services, connected with purpose-built APIs, as a foundation for an agile, flexible technology infrastructure.

Scenario 3: Legacy modernization

To modernize legacy IT estates, many organizations are refactoring their legacy monolithic applications using a microservices and API-based architecture. Others are adapting their legacy systems to support modern business and technology needs by implementing an integration layer with services and APIs to intermediate their legacy systems and various consumption channels. This allows legacy systems and applications to coexist with modern technologies, such as cloud-native apps, SaaS, IoT, and mobile.

Transformation action plan:

1. Identify the monolithic legacy systems that form the backbone of your organization – applications that are technologically incompatible with newer ones (for example, no open APIs, antiquated data standards, green-screen applications).

2. Create a business case for modernizing your legacy IT estate:
   – Identify your core customer and product data residing in aging legacy systems and its impact on agility and operational costs:
     • Understand what data you need to obtain about your customers, products, orders, invoices, inventory, and other items from these legacy systems, then record the number of requests for data feeds from them to fulfill such requests.
     • Calculate the effort and time required to extract data from your legacy systems to interface with other modern, digital channels, such as mobile apps and cloud apps.
   – Identify the number of point-to-point integrations that exist in your IT landscape to connect core legacy systems with systems of engagement:
     • Assess the impact of these point-to-point integrations on systems and data integrity.
     • Determine the time and budget spent on maintaining these connections and identify the skill gaps that may magnify such a problem.

3. Leverage available capabilities to move your legacy transformation forward at pace, including:
   – A mature and extensive modernization framework, such as Capgemini's "Application Modernization Framework," to identify the most appropriate legacy modernization strategy for your requirements: service modernization, application refactoring, application re-architecture
   – A "core integration framework" and API-led integration approach to "wrap" legacy systems and abstract core data and services from underlying system complexity, maintain full system integrity, create a foundation for asset re-use, and eliminate issues around skills gaps
   – A robust architectural approach, such as Capgemini's unique "4 Layered API Architecture," to create a set of reusable APIs that enable cost-effective modernization of legacy applications. The approach should allow for the coexistence of legacy as well as new SaaS and other cloud-based applications while also increasing the speed and ease with which legacy systems can be connected to modern applications.

Scenario 4: Legacy middleware/ ESB modernization

Whatever your business and technology priority, it is evident from our research that a mature hybrid integration strategy is essential to achieve sustainable business growth. Organizations are looking at born-in-the-cloud iPaaS or hybrid integration platforms to support their digital transformation initiatives and to cut the high operational costs associated with legacy middleware platforms.

Transformation action plan:

1. Make a sound business case for modernizing your integration platform:
   – Assess and evaluate the business need for your organization to quickly and easily provide access to information to its employees, partners and customers – whenever, wherever, and in any format they desire.
   – Consider the need and readiness of your organization to connect cloud-based SaaS applications with core on-premises ERP and financial applications, and/or to address a wide range of integration scenarios resulting from merger and acquisitions (M&A).
   – Calculate the time, resources, and budget required to maintain your legacy ESBs. This should include installation, configuration, and administration of multiple scenarios resulting from M&A activities, spread across multiple geographies for redundancy and failover, as well as server, storage, and networking costs.

   – Identify and record needs for (and organizational readiness to support) integration use cases using new technologies such as cloud, mobile, social media, big data, and IoT.
   – Count the cost of the growth in shadow IT within your organization as business leaders find ways to quickly meet their integration needs.

2. Use a comprehensive "cloud integration assessment" framework to clarify the advantages of adopting a modern, iPaaS-based integration platform that:
   – Supports multiple deployment models (on premises, cloud, and hybrid).
   – Provides a browser-based development. environment, reducing the time and skills required to connect applications.
   – Supports application-to-application, business-to-business, process, and data- integration use cases
   – Frees IT teams from the time and complexities associated with legacy middleware.