



WHITEPAPER

API-led connectivity

The next step in the evolution of SOA

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Executive summary

Key challenges

Companies must embrace [digital transformation](#) in order to stay relevant to their customers, or else risk ceding market share to competitors who are able to adapt more quickly.

At its core, digital transformation is driving companies to reframe their relationships with their customers, suppliers, and employees through leveraging new technologies to engage in ways that were not possible before.

These new technologies — SaaS, mobile, and the Internet of Things (IoT) — demand a new level of connectivity that cannot be achieved with yesterday's integration approaches.

Recommendations

- Build an application network by adopting an API-led connectivity approach that packages underlying connectivity and orchestration services as easily-discoverable and reusable API building blocks.
- Structure these building blocks across distinct systems, process, and experience layers to achieve both greater organizational agility and control.
- Drive technology change holistically across people, processes, and systems.

The digital transformation imperative

We are in the midst of an unprecedented phase of digital transformation. Hospitals are extending care beyond the hospital ward; non-bank players are driving innovation in the payments space; media distribution companies are moving into media production.

These changes are irreversibly reshaping industry boundaries and business models and rapidly changing competitive industry dynamics.

Technology is the critical enabler of this digital transformation. Mobile and cloud are now proven drivers of IT-enabled business disruption, both inside and outside the enterprise. APIs, once seen as tools for programmers, are now business strategies providing new routes to market for a new portfolio of digital products and services. Business and IT leaders must act now to ensure their businesses stay relevant and competitive. Customers have the means to quickly identify and switch to companies that can better meet their needs. Businesses who do not act now will be left behind.

However, digital transformation is not easily achieved. It is not the result of implementing a single application or a single technology. Rather, digital transformation can only be achieved when organizations are able to bring multiple technologies together to create truly distinctive and differentiated offerings. In order to do so, they must bring data from disparate sources to multiple audiences, such as customers, suppliers, and employees, securely, and at scale. It is in this context that connectivity must be viewed as an executive concern and why CIOs are now being described as the “Chief Integration Officers” with digital transformation their top priority. Ultimately, connectivity is not only a critical enabler of digital transformation, it is arguably the biggest differentiator of success.

Despite its importance, far too many organizations are not approaching connectivity with this strategic mindset. Either it's not a consideration at all — think lines of business heads driving credit card purchases of SaaS applications without reflecting on how they will connect those applications to underlying [ERP systems](#) — or it is only considered with a short-term approach, which values the success of an individual project to the detriment of the enterprise as a whole.

Traditional methods for integration applications do not work for digital transformation. These approaches, designed at a time with fewer endpoints and slower delivery expectations, often cannot move at the pace of today's business requirements. Point-to-point application integration can be brittle and expensive to maintain. [Service-oriented architecture \(SOA\)](#) approaches provide some instruction in theory, but have been poorly implemented in practice. The principles of SOA are sound: well-defined services that are easily discoverable and easily reusable. In practice, however, these goals were rarely achieved. The desire for well-defined interfaces resulted in top-down, big bang initiatives that were mired in process. Too little thought, if any, was given to discovery and consumption of services. And using SOAP-based web services technology to implement SOA proved to be a heavyweight approach that was ill-suited then and even more ill-suited now for today's mobile use cases.

IT leaders then must meet two seemingly contradictory goals: they must ensure stability and control over core systems of record, while enabling innovation and rapid iteration of the applications that access those systems of record. This is the challenge now variously referred to as bi-modal or two-speed IT. Existing connectivity approaches are not fit for these new challenges.

Just as digital transformation requires companies to embrace a new set of technologies, so too must they embrace a new level of connectivity. A new approach is required, one that leverages

existing investments, and enables IT to seize the moment to drive transformational change; one that enables agility, yet also allows IT to maintain visibility and control. This change is a journey that requires shifting IT's mindset away from project delivery to delivering assets as services and enabling line of business and IT to self-serve and build their own connections, processes, and applications, while central IT governs access, SLAs, and data quality. In short, IT has to become an enabler for the business.

This whitepaper proposes a new approach to integration — API-led connectivity — that extends traditional service-oriented approaches to reflect today's connectivity needs. We'll outline the core of this approach, implementation challenges, and discuss how IT leaders can realize this vision in their own organizations.

Microservices

[Microservices](#) continues to be hot topic amongst enterprise architecture leaders. In our view, we believe that microservices not only validate a service-oriented approach but are in fact one interpretation of how that approach should be implemented, by taking the need for well-defined services and reusability to an extreme. In doing so, it highlights the need for governance, and that successful implementation must also consider non-technology factors such as development processes and methodologies. In this way, the principles and approach behind API-led connectivity are entirely consistent with a microservices approach and vice versa.

API-led connectivity: The evolution of SOA

While connectivity demands have changed, the central tenets of SOA have not, that is, the distillation of software into services that are well-defined, reusable, and discoverable.

This vision is perhaps even more important given the proliferation of endpoints. The complexity of providing multiple stakeholders customized views of the same underlying data source, whether it be a core banking system or an ERP system, increases exponentially with the number of channels through which that data must be provided. It also reinforces the need for data at the point of consumption to be decoupled and independent from the system of record.

This problem lends itself to a service-oriented approach in which application logic is broken down into individual services and then reused across multiple channels. Yet, the heavyweight, top-down implementation approaches previously noted are not a fit for the agility that today's digital transformation initiatives demand.

API-led connectivity builds on the central tenets of SOA, yet re-imagines its implementation for today's unique challenges. API-led connectivity is an approach that defines methods for connecting and exposing your assets. The approach shifts the way IT operates and promotes decentralized access to data and capabilities, while not compromising governance. And the outcome of API-led connectivity is an [application network](#): a network of applications, data, and devices that are 'pluggable', providing the agility that the speed of today's digital transformation demands.

API-led connectivity calls for a distinct connectivity building block that encapsulates three components:

- **Interface:** Presentation of data in a governed and secured form.
- **Orchestration:** Application of logic to that data, such as transformation and enrichment.
- **Connectivity:** Access to source data, whether from physical systems or from external services.

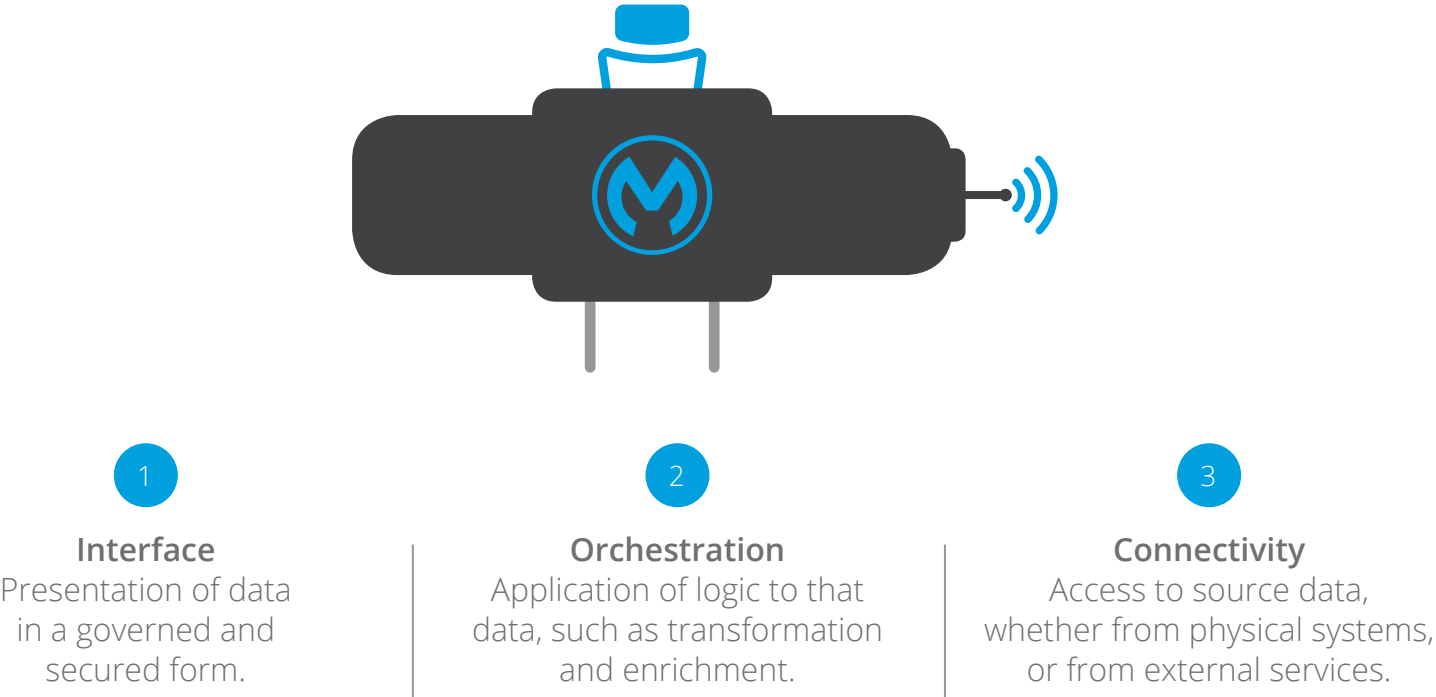


Figure 1: Anatomy of API-led connectivity

Designed with the consumption of data top of mind, APIs are the instruments that provide both a consumable and controlled means of accessing connectivity. They serve as a contract between the consumer of data and the provider of that data that acts as both a point of demarcation and a point of abstraction, decoupling the two parties and allowing both to work independently of one another (as long as they continue to be bound by the API contract). Finally, APIs also play an important governance role in securing and managing access to that connectivity.

However, the integration application must be more than just an API; the API can only serve as a presentation layer if it sits over a set of orchestration and connectivity flows. This orchestration and connectivity is critical: without it, API-to-API connectivity is simply another means of building out point-to-point integration. These APIs perform specific functions and provide access to non-central data and may be built by either central IT or line of business IT.

APIs vs. API-led connectivity

[Stripe](#), an “API as a company” disintermediating the payments space, is an archetype of the API economy. At MuleSoft’s CONNECT conference, Stripe’s CEO John Collison was quoted saying, “you don’t slather an API on a product like butter on toast.” Thought of in isolation, the API is only a shim that hides complexities of back-end orchestration and connectivity yet does nothing to address those issues.

Connectivity is a multi-faceted problem across data access, orchestration, and presentation, and the right solution must consider this problem holistically rather than in a piecemeal fashion. To only consider APIs is to only solve only one part of the connectivity challenge.

“Three-layered” API-led connectivity architecture

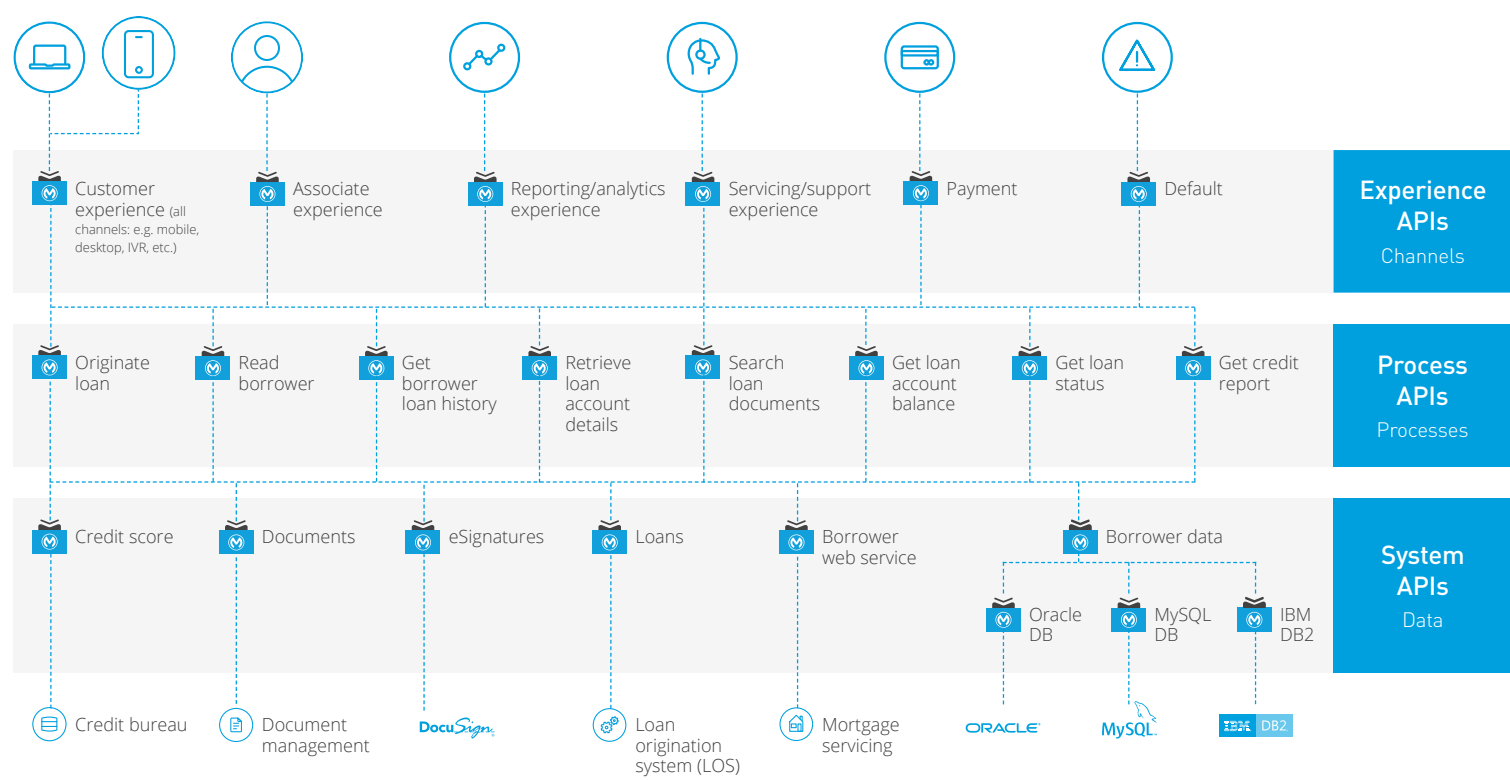
Large enterprises have complex, interwoven connectivity needs that require multiple API-led connectivity building blocks. In this context, putting in a framework for ordering and structuring these building blocks is crucial. Agility and flexibility can only come from a multi-tier architecture containing three distinct layers:

- **System layer:** Underlying all IT architectures are core systems of record (e.g. ERP, key customer and billing systems, proprietary databases, etc). Often these systems are not easily accessible due to connectivity concerns. APIs provide a means of hiding that complexity from the user. System APIs provide a means of accessing underlying systems of record and exposing that data, often in a canonical format, while providing downstream insulation from any interface changes or rationalization of those systems. These APIs will also change more infrequently and will be governed by central IT given the importance of the underlying systems.
- **Process layer:** The underlying business processes that interact and shape data should be strictly encapsulated independently of the source systems from which the data originates, as well as the target channels through which that data is to be delivered. For example, in a purchase order process, there is some logic that is common across products, geographies, and retail channels that can and should be distilled into a single service.
- **Experience layer:** Data is now consumed across a broad set of channels, each of which want access to the same data but in a variety of different forms. For example, a retail branch POS system, e-commerce site, and mobile shopping

application may all want to access the same customer information fields, but each will require that information in very different formats. Experience APIs are the means by which data can be reconfigured so that it is most easily consumed by its intended audience, all from a common data source, rather than setting up separate point-to-point integrations for each channel.

Layer	Ownership	Frequency of changes
System layer	Central IT	6-12 months
Process layer	Central IT and line of business IT	3-6 months
Experience layer	Line of business IT and application developers	4-8 weeks; more frequently for more mature companies

Table 1: Each API-led connectivity layer provides context regarding function and ownership



*Customer-facing channels are consolidated into a single customer experience API in this figure for simplicity.

Figure 2: Illustrative architecture: Mortgage lending transformation — the emergence of an application network and a foundation for reuse.

Benefits of API-led connectivity

The benefits of thinking about connectivity in this way include:

Business

- **IT as an enabler for the business:** By exposing data assets as services to a broader audience, IT can start to become an enabler that allows lines of business to self-serve.
- **Increase developer productivity through reuse:** API-led connectivity is consistent with a service-oriented approach whereby logic is distilled to its constituent parts and reused across different applications. This prevents duplication of effort and allows developers to build on each other's efforts.
- **More predictable change:** By modularizing integration logic and ensuring a logical separation between modules, IT leaders are able to better estimate and ensure delivery against changes to code. This architecture negates the nightmare scenario of a small database field change having a significant downstream impact and avoids extensive regression testing.

Technical

- **Distributed and tailored approach:** An API-led connectivity approach recognizes that there is not a one-size-fits-all architecture. This allows connectivity to be addressed in small pieces and for that capability to be exposed through the API or microservices.
- **Greater agility through loose coupling of systems:** Within an organization's IT architecture, there are different levels of governance that are appropriate. The so-called

bi-modal integration or two-speed IT approach makes this dichotomy explicit: the need to carefully manage and gate changes to core systems of record (e.g. annual schema changes to core ERP systems) whilst retaining the flexibility to iterate quickly for user-facing edge systems such as web and mobile applications where continuous innovation and rapid time to market are critical. Separate API tiers allow a different level of governance and control to exist at each layer, making possible simultaneous loose-tight coupling.

- **Deeper operational visibility:** Approaching connectivity holistically in this way allows greater operational insight that goes beyond whether an API or a particular interface is working or not, but provides end-to-end insight from receipt of the initial API request call to the fulfilment of that request based on an underlying database query. At each step, fine-grained analysis is possible, which can not be easily realized when considering connectivity in a piecemeal fashion.

Customer journeys to API-led connectivity

Realizing an API-led connectivity vision must be much more than a technology decision. It requires a gradual but fundamental shift in IT organizations' architectural vision, development approach and the way developers approach their roles. The challenge is one as much about process change as it is about technology implementation.

However, realizing the API-led connectivity vision is not a discrete goal, but rather a continuous journey. Moreover, it is a goal that can only be achieved in incremental steps. Through partnering with dozens of Fortune 500 companies on their API-led connectivity digital transformation journeys, we have distilled best practices into the following steps:

- **Start-up mode:** For the API-led connectivity vision to be successful it must be realized across an organization. However, in large enterprises it is simply not possible to wipe the slate clean and start from scratch. Consequently, the API-led connectivity customer journey must start with a vertical slice of the business, for a specific use case or for a specific line of business. By bounding the problem, the scope of change is reduced and the probability of success increased. Training and coaching to drive role modeling of new behaviors is critical at this stage.
- **Scale the platform:** Once initial proof points have been established, these use cases will naturally become lightning rods within the organization that will build mindshare and become a platform to leverage greater adoption. In addition, the service-oriented approach results in the natural creation of reusable assets which exponentially increases the value of the framework as the number of assets increases.
- **Build a Center for Enablement (C4E):** Once scale has been

established, it's critical to quickly codify best practices and provide a platform for discovery and dissemination through the organization. The result of such a process is mass adoption across the enterprise. The core of this [C4E](#) may also be built during the start-up mode and scaled as required.

Case study: PetSmart

PetSmart is on a mission to build a stronger relationship with their customers by offering an [omnichannel experience](#). They feel like the way to win is to offer a complete suite of not only retail products but comprehensive pet services as well.

The retailer wanted to become a trusted partner at every moment of pet parents' lives by providing a seamless experience at each customer interaction. Since PetSmart has over 1,500 stores and numerous pet websites, services, and applications, this meant tying together their vast portfolio of products and services.

By partnering with MuleSoft, PetSmart is building reusable APIs, such as a Customer Profile API, that can be leveraged across all customer touchpoints. The Customer Profile API is used in multiple platforms such as their mobile app, grooming services, and their pet hotel. This API allows PetSmart to have a valuable view of each customer across channels. And better yet, it ensures a seamless experience for their customers.

As PetSmart continues to build on their API-led approach, they have accelerated their go-to-market strategy, launching initiatives 2x faster than before. And by reusing assets in the network, they are able to build APIs that can be leveraged across multiple channels. This allows PetSmart to deliver a consistent experience to their customers.

"Now, the experience for the customer is the same. If they go to PetSmart's salon for grooming, if they go to PetHotel, if they

go to the store. We know who our customers are and who their pets are,” said PetSmart.

Case study: Wells Fargo

[Wells Fargo](#), one of the largest banks in the world, employs roughly 273,000 team members and serves over 70 million customers across 8,500 locations and 13,000 ATMs. The bank is driving a digital transformation journey to deliver a unified customer experience.

As part of this journey they built Wells Fargo Gateway, a Banking-as-a-Service (BaaS) platform that provides key services such as account servicing, payments, and foreign exchange through exposing APIs to Wells Fargo’s partners and developers.

As the foundation for this digital platform, their API-led connectivity approach is enabling reuse of the same APIs across multiple channels. This reuse allows more rapid project delivery — increasing the speed of IT project delivery from months to just weeks. “The FX API, which we are offering to our partners, has been a gamechanger,” says Sid Vyas, CTO in Capital Markets and Investment Banking Technology, “they [partners] can seamlessly integrate their applications or their systems with our platform.”

MuleSoft: The API-led connectivity platform

MuleSoft's Anypoint Platform™ is a single, unified platform that allows organizations to easily build and rapidly scale application networks. Anypoint Platform is the world's leading integration solution and is trusted by more than 1,600 enterprise customers across every major industry. Anypoint Platform enables end-to-end connectivity across APIs, service orchestration, and application integration. This allows developers to rapidly connect, orchestrate, and enable any internal or external endpoint. The result is a 2x to 5x faster time to launch new initiatives, connect systems, and unlock data across the enterprise and a 30% reduction in integration costs.

Furthermore, unlike alternatives, MuleSoft's Anypoint Platform can be rapidly deployed on-premises, or accessed as a cloud solution. Since MuleSoft's solutions are easy-to-use and understand, any developer can quickly become productive without lengthy training in vendor-specific technology, resulting in 10% higher employee productivity and 70% higher productivity for app development teams.

Finally, MuleSoft's experience in partnering with our customers to drive digital transformation initiatives allows our customer success teams to bring expertise in change management, organizational design, and IT development [best practices](#) to complement our technology offerings and truly partner to drive success. MuleSoft has developed [Catalyst™](#) to enable customers' journey to API-led connectivity by providing best practices, online tutorials, templates, and resources for customers and partners at all levels of experience. Whether it be for a single project or a broader digital transformation initiative, Anypoint Platform's ease of use combined with MuleSoft Catalyst enables organizations to achieve business outcomes faster.

About MuleSoft

MuleSoft, a Salesforce company

MuleSoft's mission is to help organizations change and innovate faster by making it easy to connect the world's applications, [data](#), and [devices](#). With its API-led approach to connectivity, MuleSoft's market-leading Anypoint Platform™ empowers over 1,600 organizations in approximately 60 countries to build application networks. By unlocking data across the enterprise with application networks, organizations can easily deliver new revenue channels, increase operational efficiency, and create differentiated customer experiences.

For more information, visit [**mulesoft.com**](https://mulesoft.com)

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