MuleSoft

WHITEPAPER

# From projects to platform:

## How Pfizer built an application network to accelerate innovation

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# Disclaimer

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# Contents

# Executive summary

The emergence of the API economy threatens to disrupt incumbent companies across all verticals, from banking, to retail, to healthcare and life sciences.

Pfizer, one of the world's three largest pharmaceutical firms, provides a striking example of how large, complex enterprises can build application networks to harness the power of the API economy.

Through API-led connectivity, Pfizer has enabled secure access to data and services from core systems and enabled them to be composed into a distinct set of business capabilities, which can then be re-used across the value chain to meet disparate business needs. Management of product inquiries from clinicians and patients, for example, has been redesigned into a platform capability that can support omnichannel engagement from distinct clinician engagement platforms across geographies without requiring point-to-point interfaces for each channel.

Product development, too, has been transformed, with APIs enabling secure data sharing of clinical trials data with investigators and the applications they use. This, in turn, has enabled the development of composite capabilities like the Global Clinical Supply API, which has been used to proactively provide alerts about temperature controlled drug shipments to reduce drug spoilage during clinical trials execution.

The application network serves as the organizing construct through which these capabilities are developed, consumed, extended, managed, and governed throughout the enterprise. As such, it serves as a foundational component for Pfizer's digital platform.

In addition, by establishing a Center for Enablement (C4E), Pfizer has been able to realize the organizational change required to drive the production and consumption of these application network capabilities across the entire enterprise, not just central IT. In doing so, they have driven business innovation across all parts of the value chain, from the production of new drugs, to the process of bringing these drugs to market.

MuleSoft's Anypoint Platform and outcome-based delivery model have served as the core enabler for this technological and organizational transformation. As a result of this transformation, MuleSoft's value assessment model projects that Pfizer will drive a projected 69.40% decrease in project delivery and maintenance costs for new applications consuming from the application network, which will allow them to reinvest in accelerated innovation.

| | After building an application network with MuleSoft |
|---|---|
| Projected application development and maintenance costs (next 3 years) | 69.40% decrease in project delivery costs |
| API development speed | 20% faster |
| Integration/API uptime | From 95% to 99.99% |
| Developer on-ramp speed | 40% faster |

**Table 1:** Value Pfizer drove building an application network with MuleSoft

# The need for an application network at Pfizer

As the world's third largest manufacturer and distributor of pharmaceuticals, Pfizer, and its IT team, operate at a massive scale. The company drives over $50B in revenue across over 600 different product lines, and sells products in approximately 175 markets with over 60 manufacturing plants and countless R&D partner institutions. Today, IT plays an increasingly vital role in helping the business to manage the massive size and complexity of its business operations.

Pfizer (and indeed all pharmaceutical companies), is not unlike manufacturing or consumer goods companies. They face increasing pressure to digitize processes supporting product development, and to expand the use of digital channels to support how they bring these products to market. They must then bring these products to market across a variety of geographies and through a number of distribution channels. And in doing so, they must streamline internal operations in a way that combats downward price pressures. The unique product, go-to-market, and regulatory complexities that come part and parcel with the pharmaceutical industry compound these business requirements.

This complexity at the business process level has created a corresponding complexity for IT. As a result of these initiatives, Pfizer's IT team had faced an explosion of IT initiatives — whether it be from a growing number of stakeholders and partners supporting a business process, or a growing number of applications, data, and devices which must be connected. As we will demonstrate below, integration emerged as a focus area that Pfizer depended on to bring new products to market faster and to meet evolving customer needs.

Previously, the manner in which Pfizer developed applications in support of these initiatives was decentralized, with distinct "business technology" (BT) units supporting different parts of the value chain, including:

- **Global product development:** Responsible for supporting new product development
- **Medicinal sciences:** Responsible for supporting the distribution and tracking of clinical supplies
- **Medical:** Responsible for ensuring the safe and effective use of Pfizer's medications
- **Commercial:** Responsible for supporting sales and marketing focused IT
- **ERP:** Responsible for supporting back office ERP systems anchoring core business processes
- **Enterprise:** Responsible for developing enabling capabilities supporting the other business technology groups

Within the enterprise team resided Pfizer's Enterprise Application Service Integration team (EASi), responsible for enabling the rapid and secure sharing of data between business systems across the enterprise.

The EASi team realized that across different business technology units, common capabilities were being redeveloped over and over again in support of similar, yet distinct business initiatives. Projects across these teams shared many of the same requirements, such as extracting data from the same core legacy systems, or surfacing data to a shared set of new cloud endpoints.

"Previously, integrations were largely application specific," said Jeff LoVetere, Director of the EASi team, "and as a result, we were unable to go as fast as we wanted to meet emerging business needs."

For example, the management of medical inquiries — scientific questions asked of Pfizer from healthcare professionals and consumers — previously required hardcoding between PRIMA, Pfizer's internal medical inquiry management system, and the digital platform that healthcare professionals used to submit the inquiry.

Under their old operating model, each platform that was onboarded required additional hardcoding to PRIMA. This rework represented wasted effort that had the potential to be channeled into a variety of net-new projects. If various business technology units were able to tap into a platform of shared IT enterprise resources, instead of simply rebuilding what they needed from scratch for each incremental project, Pfizer would be able to supercharge the speed and minimize the cost at which they could deliver innovation.

To address this challenge, LoVetere and the EASi team identified the need to pivot from a project-based approach, where they or other teams would address business integration needs on a one-off basis, to a platform-based one, where they would surface and orchestrate capabilities that could be accessed by different business units and their respective line-of-business IT teams. APIs would serve as the primary means through which the capabilities could be securely shared with line of business teams, who would in turn be able to extend core capabilities surfaced by the platform in a way that met their needs. Over time, exposing sets of common business capabilities through APIs would lead to the emergence of an application network, which would provide a framework for asset reuse that would allow them to meet the increasing demands imposed upon them by the business.

## The application network imperative in the life sciences industry


Companies in the life sciences space, from pharmaceutical firms like Pfizer, to medical device manufacturers, to diagnostic laboratories, face particularly acute pressure to increase the clock speed at which IT can operate. As core business processes grow more complex, competitive pressures increase, and downward price pressures place renewed focus on operational efficiency, IT has been asked to do "more with less," which in turn demands a new operating model.

Product development, and IT's role in supporting it, has grown increasingly sophisticated. For a pharmaceutical company, bringing a single drug to market is an enormous undertaking, requiring an average of 12 years from discovery in the lab to approval, at an average cost of over $2B USD. To support scale, life sciences companies have increased their reliance on external parties like contract research organizations, which in turn has put an increased need for IT to support the ability for internal product stakeholders to interface with external partners.

The act of bringing products to market has similarly grown in complexity. The traditional medical sales go-to-market motion has been disrupted by mobile apps, physician portals, and other digital technologies that have augmented (or even replaced) sales reps. The proliferation of an increasingly specialized set of sales and marketing technologies — from pharma-focused CRMs like Veeva to industry-agnostic marketing platforms like Marketo — have created an "arms race" between these companies as they fight to maintain clinician mindshare.

Last but not least, life sciences companies face growing pressure to increase internal operational efficiency as a means of reducing costs. While the adoption of modern back-office cloud applications and the modernization of legacy on-premise ones provides an opportunity to drive cost reduction across the business, doing so while "keeping the lights on" provides an enormous burden for IT teams that are already overstretched by the more immediate needs of the business.

These pressures, amongst others, have created a particularly marked increase in the demands placed on IT to deliver projects in life sciences. For this reason, many companies in the pharmaceutical and medical device space have adopted the application network as a framework for meeting this increased demand.

## How application networks drive speed and agility

Application networks are the technical foundation on which enterprises like Pfizer have unleashed the power of the API economy to increase the speed at which they can deliver projects for the business. They connect applications, data, and devices through APIs in order to securely share their assets to internal and external consumers, and emerge organically as successive endpoints within the enterprise are added to the network.

As depicted in the Figure 1, an application network consists of business applications whose capabilities need to be combined to implement business processes. Composite services connect to these applications, and either surface some of their capabilities directly as APIs, or combine them with other applications to surface enriched APIs. Those composite services, in turn, are treated as applications by other composite services that implement other business processes.

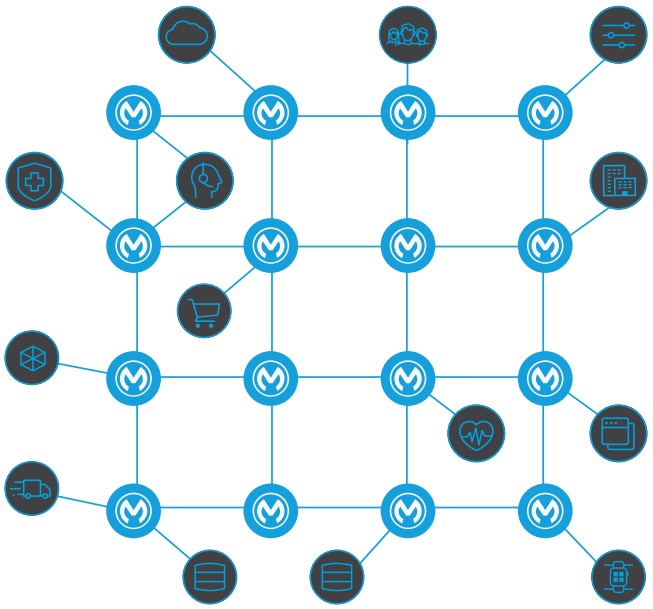


**Figure 1:** The application network

The defining aspect of the application network is reuse—capabilities in an application or composite service can be leveraged by other applications and services, creating an efficient marketplace of business capabilities to fuel rapid, agile, distributed, and scalable creation of business value.

Application networks are endpoint agnostic — any application can be plugged into the network to enrich its own value, as well as to contribute to the creation of composite business capabilities. These endpoints can reside within the enterprise, or outside of it. For example, systems from business partners (e.g. manufacturer and distributor ERP systems) as well as end customers (e.g. hospital EHRs) can (and indeed, should) be plugged into the network.

Note that, as in other networks, not all information in the network is necessarily surfaced to others in the network. The same APIs which provide the ability for an application to be plugged into the network allow for the teams who own access to the application or data source to govern who can access it, and under what conditions. Indeed, this model of federated access was one of the primary reasons why the EASi team decided to construct an application network.

While the benefits of application networks extend across companies of all sizes, they are especially relevant to large multinational firms like Pfizer. Consider: like other networks, such as social or telecommunication networks, the application network adheres to Metcalf's law — namely — that the value of the network grows in proportion to the number of connected endpoints. Because of this, it can be inferred that the greater the number of endpoints that can be connected to an application network, the more powerful that application network can become, and the greater of a competitive advantage it can confer.

At Pfizer, these endpoints are not in short supply. Product development demands coordination between internal product teams, external contract research organizations, and the clinical sites where trials are administered. Effective distribution requires seamless interoperability between the life sciences company's

internal operations team, external manufacturers and distributors, and pharmacies. And Pfizer's global go-to-market strategy requires coordinated collaboration between internal sales, digital marketing, and external distributors. Each stakeholder across each part of the Pfizer value chain maintains their own ecosystem of applications, data, and devices which they depend on to support their respective business processes.

Due to the myriad of systems residing across different business functions within and outside the organization, the application network afforded unique potential for Pfizer to transform their business. By surfacing, composing, and securely sharing capabilities across these different functions to both internal and external stakeholders, Pfizer's EASi team aimed to turn the proliferation of endpoints from a technical challenge into a competitive advantage.

To do so, they leveraged the application network to support the development of a platform of capabilities extending across Pfizer's value chain, from the development of new drugs, through manufacturing and distribution, all the way to sales and marketing, enabling a vibrant internal and external platform ecosystem at each step along the way.

## Pfizer's journey to an application network

The application network is not something that organizations must build in its entirety order to realize value. It emerges over time, with each successive project adding value to the broader network by promoting reuse and eliminating rework. Below, we will speak to Pfizer's journey to an application network, highlighting three initiatives along the way that illustrate how an application network has emerged, the value that Pfizer has realized, and the lessons they have learned.

## The increasing value of IT across the life sciences value chain

In the life sciences industry, IT has evolved from a project delivery function into a key strategic overlay that can drive efficiency, speed, and cost reduction across virtually all parts of the business.

Pfizer's IT team plays a vital role in enabling each distinct component of the life science value chain, from R&D, to manufacturing and distribution, to sales and marketing, to regulatory compliance. Their application network has emerged as a key enabler toward helping them develop reusable business capabilities that span across different parts of the value chain, enabling them to drive disproportionate impact for the business.

| | Product R&D | Manufacturing and Distribution | Sales and Marketing | Regulatory Compliance |
|---|---|---|---|---|
| **Business Objective** | Research and develop new drugs, and validate the efficacy of these new drugs through clinical trials. | Ensure availability of products across clinical trial sites and pharmacies. | Provide education to clinicians on the benefits of the company's products and how they can be used to help patients. | Maintain compliance with local regulations by reporting necessary product and safety information as required by law. |
| **How Pfizer IT Supports** | Optimize coordination of efforts between internal Pfizer researchers and R&D trial administrators. | Enable seamless communication between warehouses, and pharmacies to optimize inventory management. | Support the incorporation and development of technologies designed to engage clinicians and improve customer service. | Streamline reporting of key data from internal and systems to external regulatory authorities. |

# From projects to platform: Medical inquiries

One of the earlier projects supported by the EASi team, medical inquiry submission and management, represents an initial pivot from a project-based delivery approach, to a platform-based one.

The need for medical inquiries to be extended to a platform capability was acutely felt by the business. Digital engagement technologies have fundamentally disrupted the pharmaceutical go-to-market motion by transforming healthcare professional (HCP) expectations around how they engage with the companies they conduct business with. As a result, more HCPs are opting to digitally engage with drug and device providers instead of through traditional face-to-face channels; in fact, according to a report by IQVIA, over 36% of healthcare providers no longer accept visits from medical industry sales reps — a 55% increase over the past five years.[1]

"We're facing growing demands to expand the number of channels that can process medical inquiries," explained Ron Segal, Sr. Director of Medical Business Technology at Pfizer. "Technology is changing, and the way we deal with customers is changing," added Cory Arthus, Technical Project Manager with the Medical Business Technology team. "There is a lot more of a digital presence in our industry, and there are new ways that customers are seeking to interact with companies."

Medical inquiries are a common way for HCPs to engage with the company. Pfizer receives over 500,000 of these inquiries per year, and responding to each promptly is critical toward maintaining HCP loyalty.

Yet, while PRIMA was well suited to capturing, routing, and managing medical inquiries once they were submitted, external systems were required for the medical inquiries to be submitted. And as PRIMA was rolled out globally, the IT team ran into difficulties scaling the platform in a way that supported all of the different medical inquiry submission channels that different markets (and their respective clinicians) were accustomed to using. Some markets preferred leveraging physician portals; others desired to have their sales reps and medical science liaisons input medical inquiries on physicians' behalf through their CRM.

"As we continued rolling out PRIMA and made it a global platform, there were different needs and channels based on different geographies, with region interacting with customers in different ways," said Arthus. "Each time a new solution came onboard, we had to write custom integration code. Because of this, we were not in a position to scale the solution."

Treated as a mere system or endpoint, the internal BT teams like EASi responsible for supporting access to PRIMA would be unable to meet the growing demand placed on the system by the business without a corresponding increase in resource. Prior to adopting Anypoint Platform, developing new APIs or integrations at Pfizer took an average of 10 weeks. Because of this, onboarding the growing number of channels requested by the business with point-to-point code was unsustainable. Even if the team had the bandwidth to redevelop similar interfaces across each incremental channel, doing so would cripple agility in the long run, by requiring the entire set of interfaces to be rebuilt if they ever decided to replace PRIMA.

1. 2017 Access to Physicians Market Insights Report.

The solution was for EASi to transition medical inquiries from an application-centric capability that needed to be accessed through point-to-point interfaces by end-consuming applications, to a platform capability that could be easily consumed and extended by any channel that needed to submit inquiries or receive data from the platform. By leveraging APIs to surface "medical inquiries" as a platform capability, each end-consuming line-of-business IT team, from regional sales teams looking to support request submission through localized physician portals, to drug safety teams seeking to automate regulatory reporting, would be able to extend this capability to suit their own needs. This, in turn, would support Pfizer's omnichannel engagement initiatives, drive operational efficiencies in the drug safety unit, and allow any future project across any business technology unit that requires this capability to access it with no rework required by the EASi team.

## Transforming medical inquiries into a platform capability with API-led connectivity

"When we transitioned to MuleSoft, we worked with the EASi team to define standard APIs for receiving medical inquiries, and structuring them for import into PRIMA," explained Arthus. "From there, we share the APIs with the regional line-of-business IT teams who support the end-consuming software used in their markets, so they can more easily support medical inquiry submission."

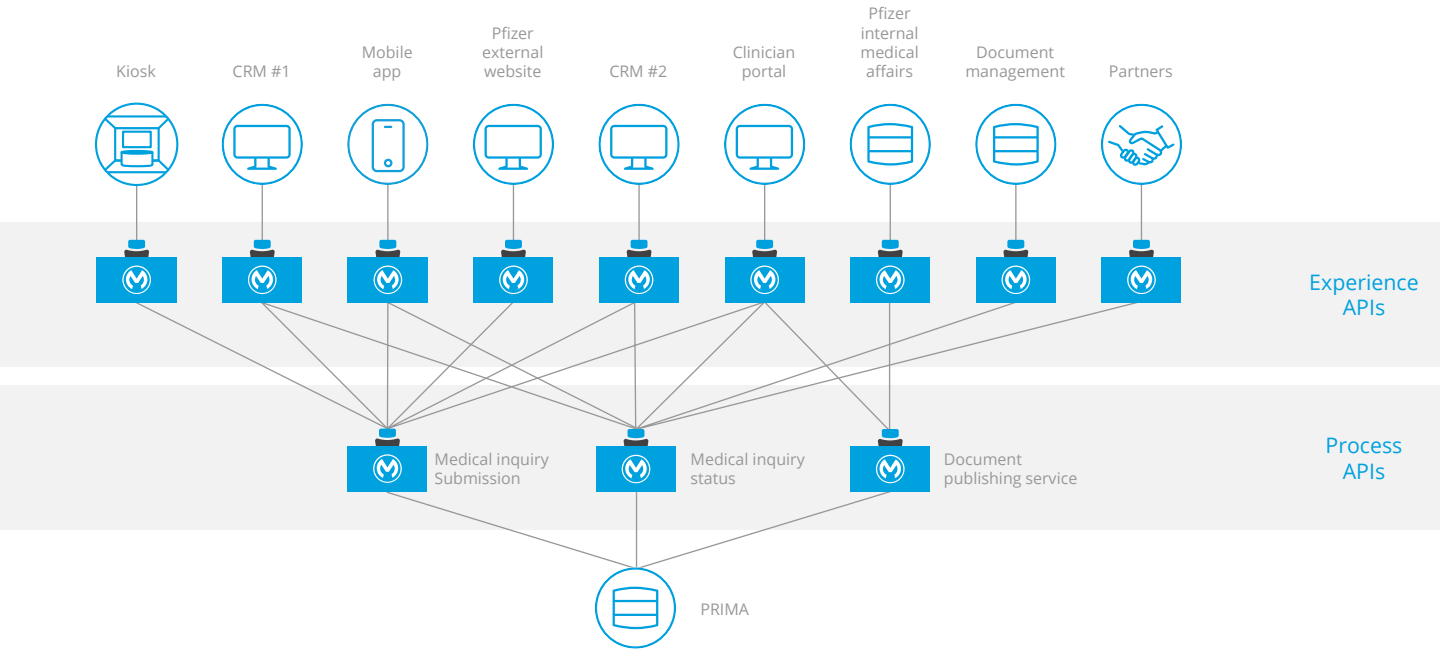



**Figure 2(a):** Medical inquiries reference architecture.

The architecture shown in Figure 2 demonstrates how core capabilities have been surfaced from PRIMA through API-led connectivity to support a scalable solution for supporting the growing number of digital channels that clinicians across Pfizer's various markets leverage.

By leveraging API reuse, the solution elegantly transforms key medical inquiries business processes into platform capabilities that are available for broader consumption. Such capabilities include:

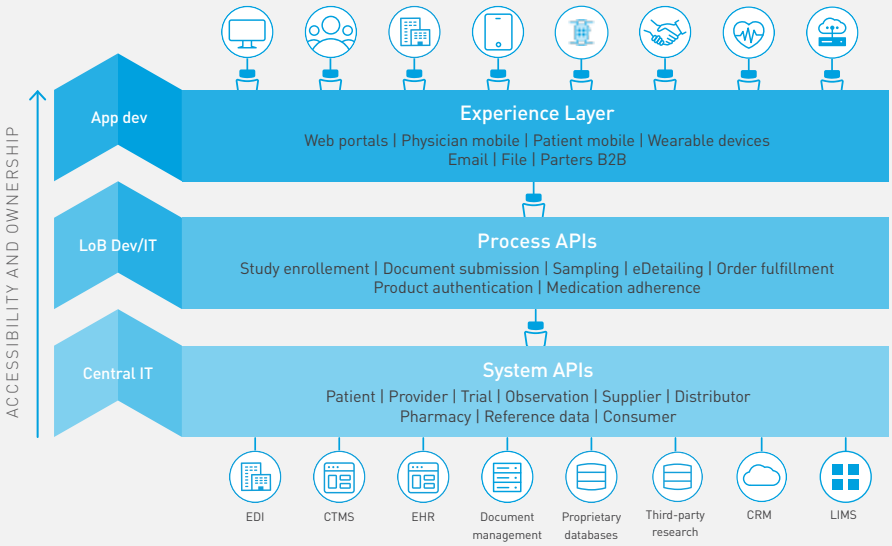
- **Inquiry submission:** PRIMA surfaces a shared set of APIs allowing for the submission of medical inquiries across distinct channels by clinicians and the sales reps that serve them, as well as by partners co-promoting Pfizer medications. By providing clinicians with the flexibility to digitally submit inquiries through their preferred channels, Pfizer is able to provide a better digital clinician experience. Furthermore, by enabling field reps to provide improved service and manage medical inquiry submission on behalf of clinicians, Pfizer enables superior "on-the-ground" service, increasing brand loyalty to their products.
- **Receiving status updates:** In addition to allowing for the submission of medical inquiries, PRIMA surfaces APIs with the ability to provide inquiry status updates to both the healthcare professionals (through external portals) and through the sales teams' CRM instances. Because the API decouples the business logic for providing status updates from the complexity of the underlying PRIMA platform, any CRM adopted by the regional line-of-business IT team can leverage this service.

## API-led connectivity

API-led connectivity is the means through which organizations like Pfizer can enable secure access to data and services in a way that allows them to be surfaced onto a platform for broader consumption by the business. It calls for the decoupling of underlying system data and services from the business capabilities that leverage them, as well the experiences through which these business capabilities are delivered.

System APIs enable secure data sharing across core systems of record, such as CTMS, ERP, CRM, or proprietary databases. APIs enable shared consumption of this data throughout the enterprise, enabling geographically dispersed project teams to access the same resources without having to write duplicate code. In an API-led architecture, system APIs provide governed access to their respective downstream systems, and serve as a wrapper that insulate these systems from upstream changes to applications that consume their data. These APIs are typically built and managed by the central IT function.

Process APIs consume and orchestrate data that are surfaced by System APIs, and represent common business processes that interact with and shape data. They exist independently of the source systems from which that data originates as well as the target channels through which that data is delivered. These APIs are typically built and managed by line of business IT functions.




Experience APIs are the means by which data and services can be transformed so that it is most suitably consumed by its intended audience, all from a common data source. These APIs are designed with developers in mind, and abstract away the underlying data and services from the complexity of downstream systems.

API-led connectivity is the architectural cornerstone enabling the development of a platform of capabilities. By decoupling data from business logic from experience channel, API-led connectivity enables these capabilities to be adapted beyond the scope of the original project they were designed for, and applied to different business requirements as needed.

Implemented accordingly, API-led connectivity leads to the creation of modular building blocks representing distinct data elements and business processes, which in turn serve as the foundation of the application network.

- To learn more, please reference MuleSoft's whitepaper on API-led connectivity.

- **Secure content sharing:** For common medical inquiries, PRIMA includes a repository of pre-approved responses that internal support personnel leverage to more efficiently respond to clinician requests. In order to provide further scale to the business, the platform solution securely shares these internal medical responses externally to healthcare professional. This enables clinicians to self-serve, providing them with on-demand access to information that they would have otherwise had to wait for a response for. It also adds leverage to Pfizer's clinical support staff, who can spend more time creating content and handling unique medical inquiries, and less time responding to the same set of common inquiries.

In balancing the need to deliver the project on-time with the desire to follow API-led connectivity best practices, the team opted to skip the process of developing an underlying System API, and instead proceeded straight to exposing a set of common business processes from PRIMA. Given that the intended reuse inherent to the solution would occur at the process layer, the architecture implemented was able to meet business needs.

As a standalone project, the medical inquiries solution demonstrates the enormous value that a platform approach has conferred to Pfizer. Exposing a platform of reusable capabilities from PRIMA in partnership with the EASi team has enabled the inquiries team to scale core business processes across digital channels, across sales channels, and across geographies. With a platform in place, Segal, Arthus, and team seek to further expand into new and innovative channels, including social media, and chat bots. This will enable them to improve the clinician experience through the convenience and quality of service they provide.

## Extending PRIMA capabilities from omnichannel engagement to drug safety

Better yet, the benefits of this platform approach extend beyond the scope of the original medical inquiries project. With their application network, Pfizer has enabled secure access to these capabilities to other projects extending outside of the sales and marketing domain to the product domain, helping to streamline core processes related to patient safety.

Consider: of the over 500,000 medical inquiries per year that Pfizer receives, approximately 15% of them, are classified as potential adverse events.

Processing each of these potential adverse events created an enormous amount of work for the drug safety team. Each time a medical inquiry was classified as a potential adverse event in PRIMA, PRIMA generated an email with a case snapshot (in PDF format) that was sent to the drug safety unit from the medical inquiry's country of origin. The local drug safety unit would open the PDF, and manually copy and paste data from the medical inquiry into their drug safety platform. Once this was completed, they needed to enter the case number and the medical inquiry case number into a document that could be audited. In total, this process took approximately 20 minutes to execute.

Seeing an opportunity to reduce costs, the drug safety team partnered with the EASi team to automate this process. The EASi team, in turn, was able to extend the medical inquiries platform capability, leveraging established best practice from the previous project to build a new API, Export Medical Inquiry, that generates E2B XML files that are consumable by their pharmacovigilance application.

By leveraging the application network to automate adverse reporting automation, Pfizer has realized enormous business impact.

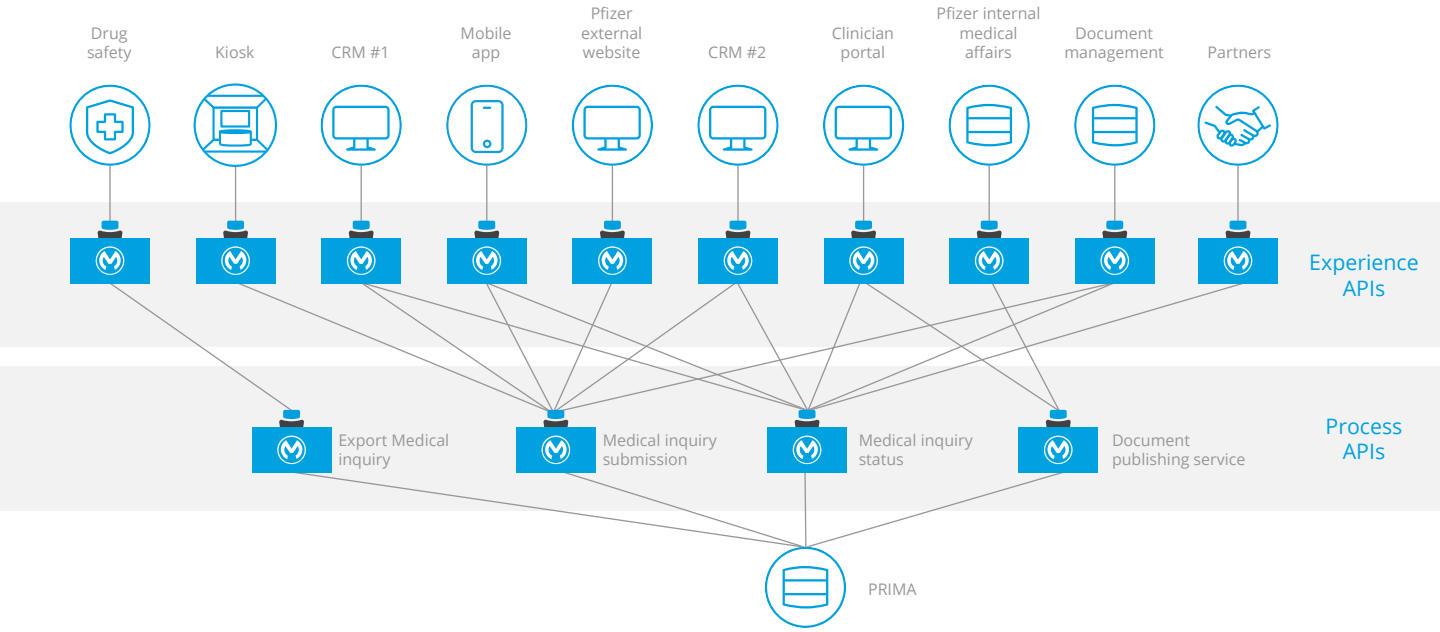



**Figure 2(b):** Extending medical inquiries architecture to support drug safety reporting.

The project yielded a significant reduction of manual effort, eliminating 1,100 emails per day. The integration automated the manual process for entering Medical Inquiry sourced cases, eliminating a non-value added step in the process and removing the potential for data entry errors. Furthermore, the team no longer has to worry about monitoring their emails for potential adverse events that need to be urgently reported, since transmission is done automatically. Last but not least, there is now improved traceability of cases from source to recipient, improving patient safety.

With these successive projects, the EASi team not only met business needs for "PRIMA as a service," but did so in a way such that the system's capabilities have been packaged for reuse throughout the organization. Any project that requires access to medical inquiries status or the system's medical documentation, independent of the business context or the end consuming applications, can reuse these capabilities.

## From projects to platform: Clinical trials

Powering the drug safety adverse event reporting automation project through assets that were already surfaced through the application network validates how it can be used to support a transition from a project-based to platform-based technology strategy. The benefits of this approach, however, extend far beyond Pfizer's external go-to-market motion. They are equally relevant to other parts of Pfizer's business operations, including the development of the products that they bring to market.

Pharmaceutical and medical device companies globally face rising costs in bringing new products to market. Research performed by the Tufts Center for the Study of Drug Development showed that, "over the past 10 years, per-drug R&D costs have increased at an average of 8.5% per year above inflation," and that "the estimated out-of-pocked R&D cost per approved new compound has increased to $2.87B."[2]

2. Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs.

These increasing costs are a reflection of the growing complexity of bringing new drugs to market, with a growing number of partners involved in the process of developing new products. For example, while pharmaceutical companies have turned to working with external stakeholders to add leverage to their research initiatives, many have found the complexity of partnering with these organizations to create unexpected cost. As this market is highly fragmented (with the top 10 CROs controlling less than 60% of the market), the costs of interfacing with this growing number of partners has in some cases outweighed the benefit of scale that they can afford.

The growing importance of patient engagement in the clinical trial process has also added a new layer of complexity to R&D. Recruiting patients for trials has become more challenging, as pharmaceutical companies look to treat increasingly rare diseases, or develop drugs that are uniquely targeted to specific genetic profiles. Because of this, pharmaceutical companies face increased pressure to enhance the development of digital technologies that support the recruitment (and retention) of patients for clinical trials.

Last but not least, the R&D space has seen a proliferation of increasingly specialized technologies for addressing self-contained aspects of the clinical trial process. Modern cloud technologies that manage clinical trial payments or enable patients to provide digital informed consent can improve the patient experience, reduce costs, and increase efficiency. To best realize these benefits, IT needed a way to configure these applications so that they could easily consume data from and securely surface data to legacy on-premise applications and data sources.

Pfizer was no stranger to this increasing R&D complexity. As a global pharmaceutical company, Pfizer operates hundreds of clinical trials at any given time, creating enormous pressure (and opportunity) to address this complexity in a way that produces high quality medicines faster, at a lower cost.

Previous attempts to add scale through CRO engagements created challenges for Pfizer's internal researchers, demanding a change in operating model. As Marty Marx, lead solution architect at Pfizer's Solution Delivery (SoDe) organization Business Technology unit, supporting Global Product Development (GPD) said, "We're facing a paradigm shift in how we do clinical studies."

To improve the quality of clinical data and clinical studies, Pfizer launched the Next Generation Clinical Trials (NGCT) program, designed to bring on external specialized SaaS offerings to better enable internal and external collaboration, as well as support the execution and optimization of the clinical trials process. New applications to be introduced as part of the NGCT program include:

- Investigator-facing applications like electronic data capture to streamline how studies were conducted at a clinical trial site.
- Patient-facing mobile applications designed to support patient recruitment, retention, and medication adherence
- Internal-facing applications, like new clinical trial management systems, to be used internally by study managers.

Each of the new end-consuming applications that were part of the NGCT initiative required access to the same data, but in slightly different ways. For example, operational study data, hosted in the Pfizer Operational Data Store (PODS), is needed by:

- Pfizer's Clinical Trial Management System (CTMS), which must be notified when new studies are approved and assigned to it

- The Shared Investigator Platform (SIP), an external portal used by clinical trials investigators, which consumes data with a proprietary API required that study data be sent to it with a different proprietary API
- The Investigator Payment Solution, an externally hosted application used for paying study investigators, required study data to decide if subject visits are eligible for payment
- Patient-facing mobile applications, which need a mechanism to retrieve operational study data on demand in real time

The NGCT initiative created a new set of challenges for the GPD business technology team, who needed a way to securely share internal data within on-premise systems to a plethora of new cloud technologies, as well as enable these cloud technologies to exchange data with each other. The prior model to integration, an application-specific approach using a variety of technologies and methodologies such as direct database integration to on-prem data stores, would not scale in a manner that would allow for the incorporation of all these new technologies and externally hosted solutions. Pfizer understood that, as important as it was to decide which technologies needed to be selected to improve clinical trial operations, none of this work would achieve the desired business outcome without improving how the technology was actually implemented.

Because of the opportunities for reuse afforded by the distinct applications described above, Marx and the EASi team used the opportunity to address this program solution's data requirements with a platform-based approach, where on-premise and cloud systems surface a reusable set of capabilities that can be consumed by any other internal or external system.

The platform, named CORDIS (Clinical Operational and Reference Data Integration Services), is designed to transform trials-facing IT from a distinct set of projects to "a service offering." To do so, CORDIS aims to provide a set of capabilities accessible by internal and external stakeholders in a manner that streamlines the integration of clinical trials solutions, enabling Pfizer to improve the speed and efficacy of their clinical trials while reducing costs. The vision is to establish a platform of capabilities that every internal and external stakeholder, from investigator, to researcher, to doctor, to patient, can tap into to accelerate the speed and improve the efficacy of the hundreds of clinical trials Pfizer runs across the globe.

"CORDIS provides an abstraction layer on top of our data allowing us to not only be more agile in how we run our projects, but also in how we manage our data sources [and] how we deliver that data," said Marx. "We're trying to build for not only the present, but for the future, building our platform in a way that decouples services and applications so we can easily add new systems and switch out old ones as needed."

In partnership with EASi, Marx and the GPD team adopted existing patterns for authentication, authorization, logging, messaging, and error handling that had been established by the EASi team, and worked together to ensure that APIs surfacing access to core GPD systems were built in such a way that they could support both existing business initiatives, such as NGCT, as well as whatever future business needs emerge over time.

## Enabling superior patient engagement with an application network

As part of the Next Generation Clinical Trials initiative, Pfizer aimed to develop and implement digital patient engagement capabilities, including improved recruitment, retention, and tracking. This vision, dubbed "mClinical", demanded a comprehensive mobile platform for clinical trial participants, providing an end-to-end set of experiences that could be configured to the needs of individual study teams, and ultimately study participants.

Like with many other solutions within their ecosystem, the supporting IT systems associated with this business need had grown increasingly complex. For example, one of the software vendors was selected

to support mobile engagement to power more effective recruitment and engagement, another platform managed the tracking of informed consent. Each of these systems required access to the same core systems to receive subject, study, and study site data hosted on on-premises.

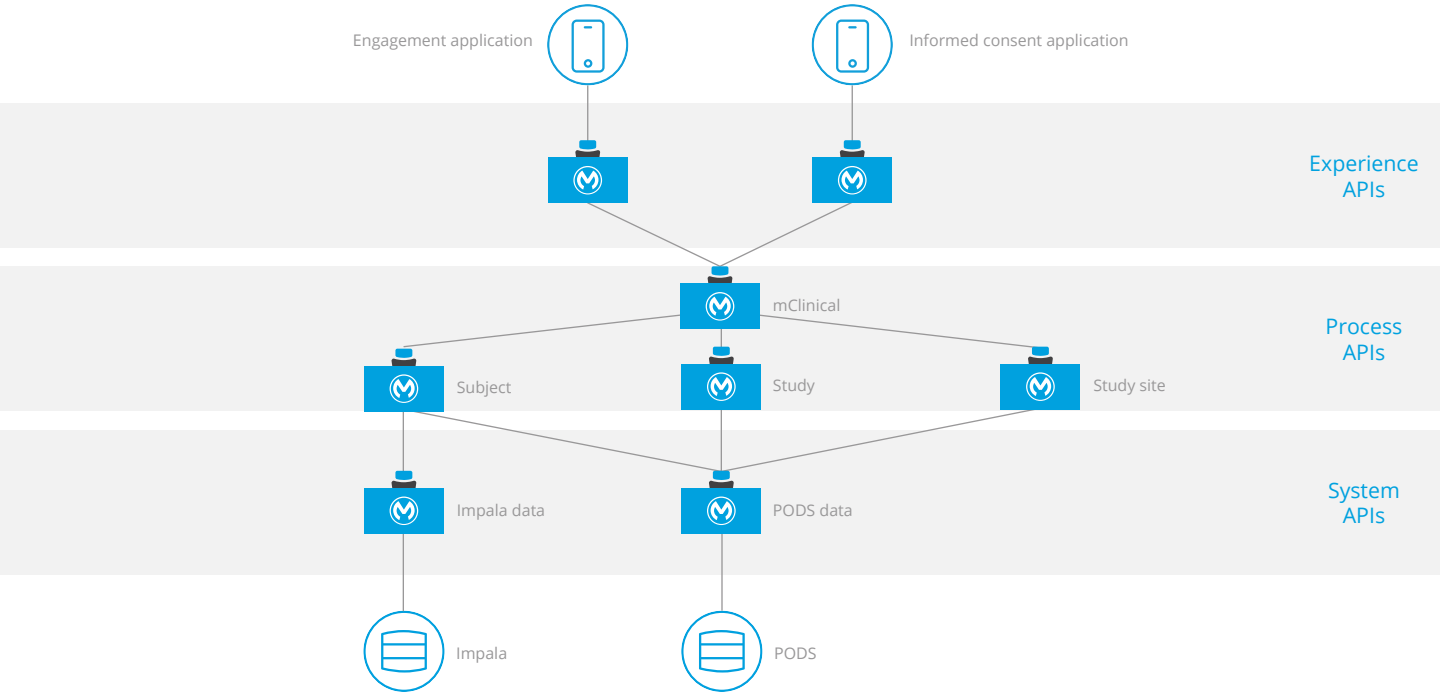



**Figure 3:** API-led connectivity reference architecture for surfacing study data to SaaS applications.

As a part of the CORDIS platform, the GPD and EASi team developed the mClinical API, which orchestrated distinct data elements from these on-premise systems in a way that enabled consumption by these two applications, and any other site-facing cloud applications.

The below reference architecture demonstrates how this solution was implemented.

Key systems include:

- **Impala:** Pfizer's IRT system, which clinical trials investigators use to enroll patients into a clinical trial
- **PODS:** Pfizer's Operational Data Store, which contains data on studies, and study sites
- **Engagement application:** A mobile health technology platform with solutions for clinical trial patient recruitment and engagement.
- **Informed consent application:** A mobile technology that provides patient education and electronic informed consent for clinical trials

CORDIS represents an evolution in thinking in how projects could be delivered at Pfizer. In addition to driving reuse at the business process level, like with the medical inquiries example, CORDIS also calls for the creation of system APIs, which decouple data and business logic from the underlying systems of record.

The mClinical initiative demonstrates how system APIs surface access to Impala and PODS for external consumption in a way that decouples the data and business logic from underlying systems of record.

Downstream process APIs extract the specific data elements relevant for patient-facing application consumption, and those APIs, in turn, feed into an aggregated "mClinical API," which can in turn be called by the engagement application, the consent application, and any other patient-facing application that Pfizer decides to incorporate as part of the broader mClinical initiative.

Prior to providing access from core systems like Impala to these external applications, clinical trials investigators had to manually enroll clinical trial patients into each of these systems, as well as into Impala. It also made it more difficult to add more patient-facing technologies to the clinical trials process without adding even more manual data entry work for trials investigators.

Now, by exposing data from core systems to the mClinical API, the GPD and EASi teams have created a foundation for scale, enabling any end-consuming application requiring subject or site data to be added to the stack, improving the patient experience without creating incremental work for investigators.

The business impact of the mClinical initiative was in fact called out in Pfizer's annual report as an example of Pfizer's digital innovation. The report called out that these capabilities "were utilized by 20 study teams in 2016 and some studies utilizing these tools experienced a reduction in protocol deviations, which can improve Pfizer's ability to capture high-quality clinical trial data."[3]

The program's success speaks to the value of the CORDIS platform initiative more broadly. "CORDIS avoids costly point-to-point solutions, allowing us to deliver integrations more quickly," said Marx. "The initiative is broad in scope, and aspires to establish a set of shared services for core systems outside of PODS and Impala, and securely share data to end consumers extending beyond patient engagement applications."

Furthermore, should Pfizer decide to replace or upgrade any of their core systems, such as their CTMS or EDC, an API-led connectivity approach will provide minimal disruption to the business processes that end-consuming applications depend upon, since the business logic has been decoupled from the source system.

As part of the CORDIS platform, Marx and his team also plan to build on the work that the EASi team drove with the drug safety unit through the PRIMA to pharmacovigilance platform interface. During clinical trials, investigators may use electronic data capture systems to the medical results of treatments; as a result, they are another common source for adverse events, described earlier. "We want to put an abstraction layer on top of all our different EDC systems, and automate the adverse event reporting process the same we did for PRIMA," said Marx.

Marx and team are well aware that as the needs of the business continue to evolve, so will the demands placed on CORDIS. For this reason the platform approach has become a key enabler for continued operational excellence in running clinical trials. "As the business changes and evolves over time, the abstraction layer becomes an increasingly valuable component of our architecture," said Marx.

## From projects to platform: Supplies shipments

With an application network, existing CORDIS components have created enormous value for the business, and future additions, such as the ability to automate additional adverse event reporting, promise to extend this value. Beyond CORDIS, the Pfizer team has been able to take a similar approach to optimizing other parts of the clinical trials value chain, including how they manage shipments and shipment notifications for drugs arriving at study sites.

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3. Pfizer 2016 Annual Review.

While in many industries, a feature as seemingly banal as shipment notifications may appear to be a relatively low priority, for pharmaceutical companies, providing real-time access to this information has grown increasingly important in maintaining relationships with clinical trials investigators and site staff to support efficient management of clinical trial supplies.

Consider: many of the drugs pharmaceutical companies run studies for are biologics, which require refrigeration in order to remain effective. Previously, trials investigators would not be proactively notified when shipments would arrive and plan for pick-up, and as a result biologics would sometimes spoil on the loading dock before the clinical trial site personnel had the chance to process and store them. This delayed the administration of trials, since the clinical trial sponsor must send a new shipment of drugs. It also provides a poor experience for the investigator and the patients enrolled in the trial, since when the drugs spoil, there may not be enough drugs for all the patients scheduled to be administered the investigational drug that day. "If the shipment goes bad, patients can't get receive the investigational drug when there's not enough on site. That can cause the inconvenience of making the patient come back another day, or worse, causing them to be removed from a trial," explained Carol Miello, Client Partner for the Global Clinical Supply Medicinal Sciences organization. In part due to challenges with shipping, biologic spoilage represented a substantial dollar cost for Pfizer to replenish the expired drugs.

Before providing the shipment status notification, investigators would not receive notice of the expected delivery date and time for a new drug shipment until the night before, requiring investigators to constantly check their inbox. "That just wasn't enough lead time," said Miello. "Because if you're an investigator, you're not in your email that often. Because of that, the investigators wanted something that would get pushed to them on their mobile devices." To address this challenge, Pfizer aimed to develop a solution for providing proactive, real-time notifications on drug shipment status to clinical trials investigators. The reference architecture illustrated in Figure 4 demonstrates how this solution was implemented.

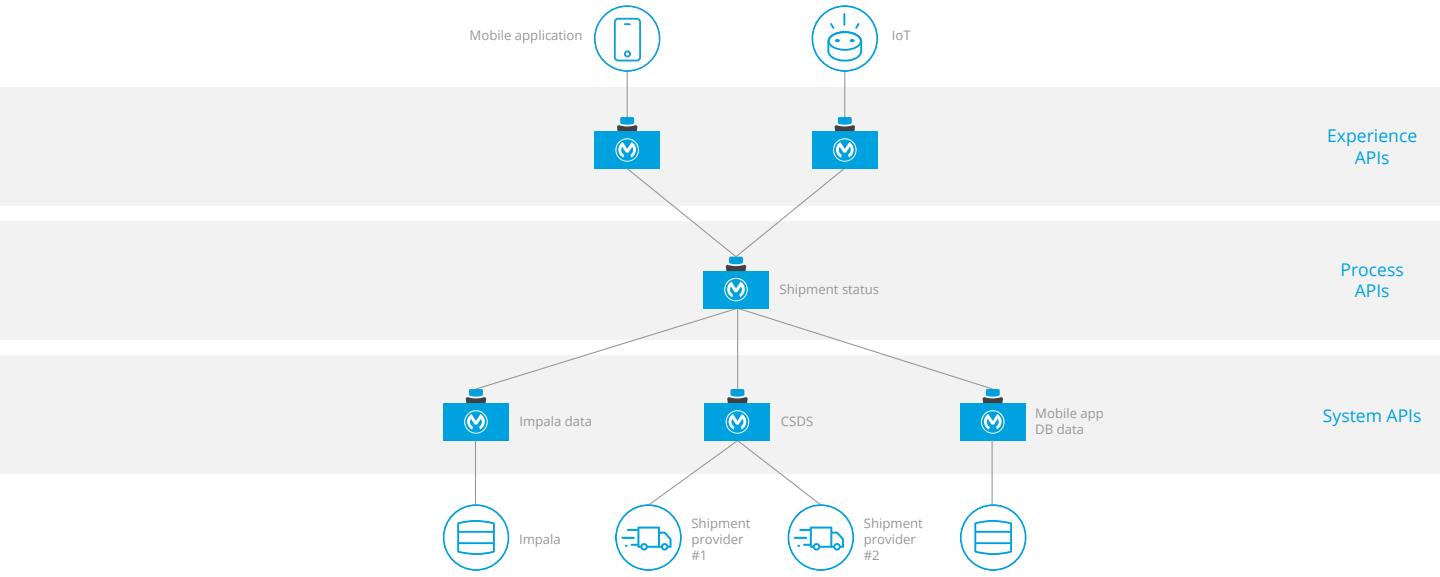


**Figure 4:** API-led connectivity architecture for Pfizer's shipment status solution.

Key systems include:

- **Impala:** Pfizer's IRT system, which investigators use to administer clinical trials
- **Clinical Supplies Distribution System (CSDS):** Pfizer's system for generating orders, as well as tracking inventory, location, and shipping status of the drugs used for clinical trials
- **Mobile application database:** A database storing the preferences of users of mobile application users

The system APIs surfacing access to the Impala system enables secure access to the list of orders that an investigator is allowed to access. Data from all of Pfizer's disparate shipment providers feed into CSDS, which surfaces real-time shipment status. The mobile application database system API surfaces which protocols and sites a user has access to.

Each of these capabilities are orchestrated into a "shipment status" process API, which provides the shipment status of all drugs that a given investigator is permissioned to access. This API is in turn consumed by a mobile application, and is configured to be reused across other channels designed to increase investigator convenience. For example, the team has already prototyped enabling IoT smart speakers to consume this API, enabling investigators to access shipment status with voice commands.

"By exposing shipping status as a reusable capability via an API, Pfizer can easily scale to support these experiences in a manner that allows consumption from different external stakeholders."

The end result: investigators can use a mobile application to proactively check on order status, and can set up push notifications to ensure that new drug shipments don't slip through the cracks. This reduces drug spoilage, which saves costs, and simplifies clinical trials administration for investigators. Most importantly, the solution improves the patient experience. When shipments were missed, patients might arrive at clinical trial sites, only to be turned away due to a lack of sufficient drug supply. Now, patients can more consistently receive investigational drugs per study protocol.

Consider the challenges that would have presented themselves were this solution developed through a point-to-point connectivity approach. With point-to-point code, each individual carrier Pfizer partners with globally would need to have data hard coded into the application. In addition to creating duplicate work at the system level, a point-to-point solution would also create duplicate custom code on the experience level. Each incremental channel that Pfizer decided to provide shipping data to in the future, whether it be Amazon's Alexa application, or a contract research organization's mobile application, or a desktop application, would require additional custom code. By exposing shipping status as a reusable capability via an API, Pfizer can easily scale to support these experiences in a manner that allows consumption from different external stakeholders.

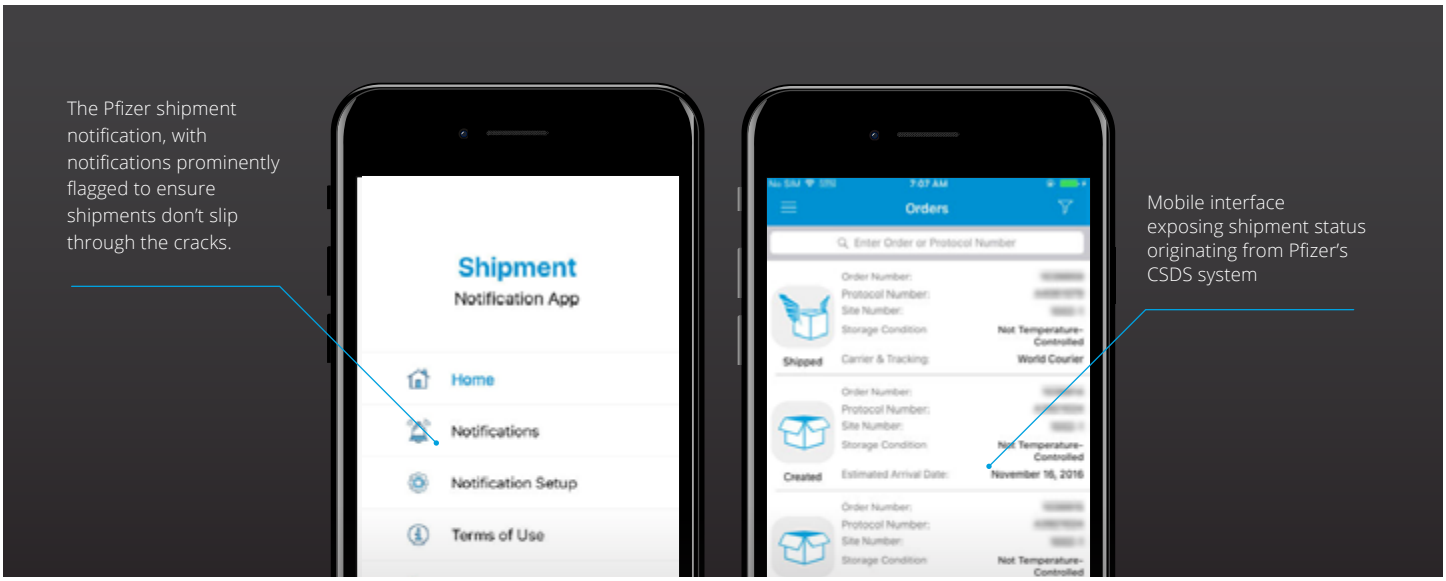


**Figure 5:** Pfizer's shipment notification application, which consumes the shipment status API to provide push notifications to investigators.

In this solution, API-led connectivity also enables loose coupling, which will eliminate downstream work as the team replaces their legacy IRT with a modern off-the-shelf offering. If the mobile application were connected to Impala with point-to-point code, significant rework would have been required to maintain the solution through the transition.

The shipment status demonstrates how the application network serves not only as a platform for exposing capabilities for broader use, but for enabling the composition of new capabilities from existing capabilities. As evidence, services securely shared by Impala as part of the CORDIS initiative are reused in the composition of a new service for shipping status.

Now that the shipping status capability has been plugged into the application network, one can imagine different business units reusing this composite capability for additional solutions. The sales and marketing line-of-business team, for example could reuse the underlying business logic of the API to provide doctors with shipment status updates for drug samples for in-market drugs. The API, or its constituent components, could also be provided to global distribution partners, who could use it to support track-and-trace or serialization initiatives.

> "With an application network, each of these capabilities that are plugged into the network have the potential to be extended across multiple lines of business, as well as across internal and external stakeholders."

With an application network, each of these capabilities that are plugged into the network have the potential to be extended across multiple lines of business, as well as across internal and external stakeholders. Shipment status is but one of many composite capabilities that Pfizer has developed that can have this outsized impact on the business over the coming years.

# Building an application network with MuleSoft

Technology projects are notorious for coming up short of business expectations — in MuleSoft's 2016 Connectivity Benchmark Report, only 18% of IT decision makers surveyed were confident they would be able to meet their digital transformation goals.

What explains this lack of confidence?

What many IT decision makers have discovered is that technology on its own is insufficient in effectively driving digital transformation — more is required. MuleSoft's experience reflects that meeting digital transformation goals requires successful execution across three distinct areas:

- **Business outcomes:** Anchoring technology initiatives against clear business goals and metrics, and ensuring a joint business and technology governance structure
- **Organization enablement:** Ensuring the organization is set up for success through developing and nurturing functions that are complementary to technology delivery, such as training and support
- **Technology delivery:** Building common development standards and approaches, and ensuring that these best practices are codified and readily accessible.

In the sections that follow, we discuss each in detail as they pertain to Pfizer.

## Building an application network: Business outcomes

IT's role in driving the success of business outcomes has never been greater. Yet, it is not sufficient for the business to simply throw projects "over the wall" to IT and expect them to be delivered in a manner that meets their needs. To meet business needs, business and IT leaders must partner together to align around a shared plan for success, monitor progress against this plan over time, and iterate on the plan as needed.

Pfizer's business technology organization has been structured in a manner that allows for continual feedback to be passed back and forth from business leads across various functions to the EASi team, ensuring that their application network is designed and expanded in a way that will best meet organizational needs. While previously, interlock existed between line architects, client partners, and business leads, and EASi for individual initiatives, the organizational initiatives piloted by the EASi team (detailed in subsequent sections) helped drive IT alignment across different business initiatives. Doing so allowed for the identification of common assets that could support multiple business initiatives.

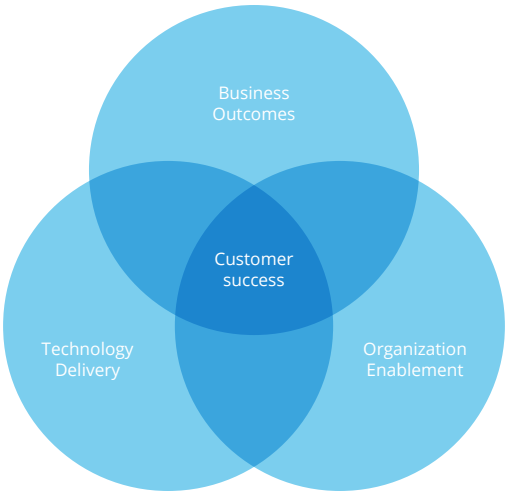


**Figure 6:** Customer success is centered around three core pillars

To illustrate, consider how these different stakeholders played a part in CORDIS, detailed in Figure 6.

Business leads define the desired business outcomes, and provide input on how technology can help realize these outcomes. For this project, a variety of different business leaders helped shape the Next Generation Clinical Trials (NGCT) business initiative and define how technology would support it. Client partners serve as the bridge between business leads and IT within their respective functions. With the CORDIS initiative, Chrissy Johnson, Senior Manager in Clinical Trials solutions, played this role, partnering with lead line architect Marty Marx to define a solution that would meet business needs.

"To redesign how we exchange data, I wanted to provide future flexibility, in the hopes that we don't have to redesign how we exchange data every single time we swap a system out," explained Johnson. "With our new NGCT initiative. I laid out a challenge to Marty to create an architecture that would be "plug and play."

Line architects take the technology needs shared by client partners, balance them against other priorities, and architect technology solutions to accommodate these needs. They do this in partnership with EASi, who provides enablement on how these solutions can be developed by consuming assets from the application network.

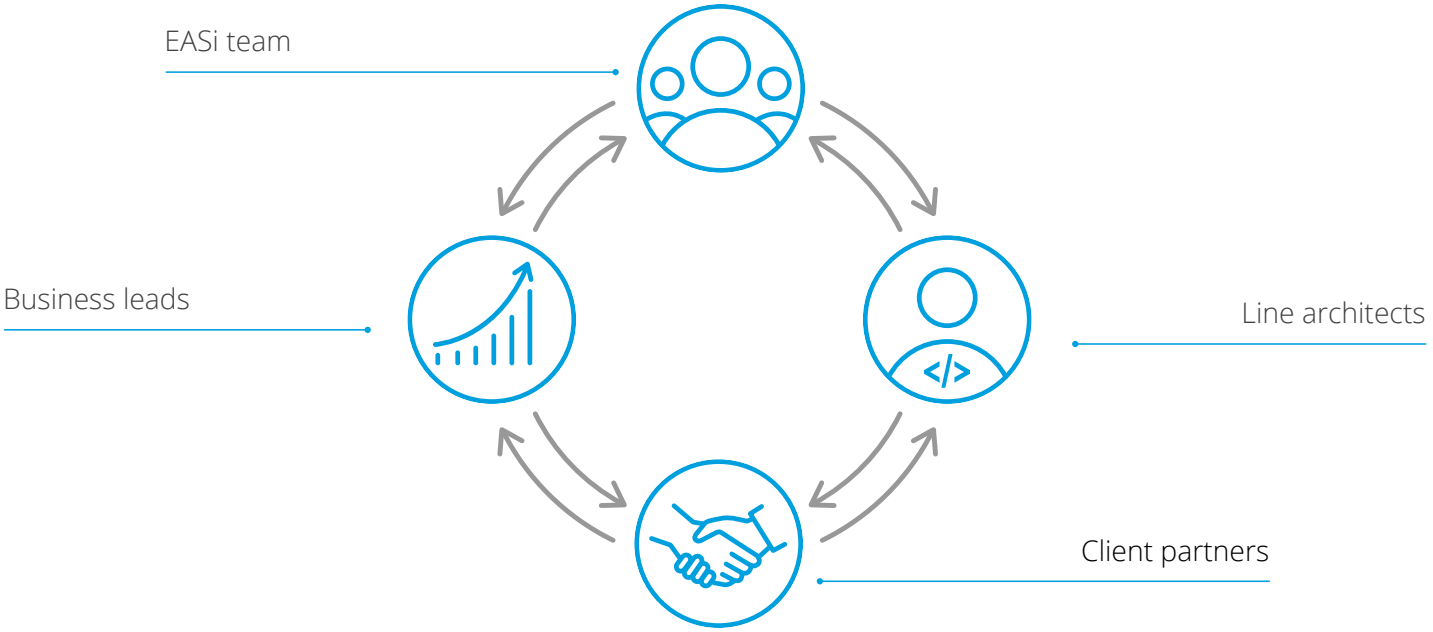


**Figure 7:** Cross-functional partnerships across different business and IT teams ensures alignment across projects.

Roles and responsibilities across this chain are delineated in a manner that allows each team to execute on its responsibilities in alignment with broader IT and business objectives. This ensures that IT and the business operate in lockstep, working together in achieving the same shared business outcomes.

## Building an application network: Technology delivery

The projects profiled earlier reflect how an application network can enable businesses like Pfizer to leverage the benefits of platforms, and the business value that can be created in doing so.

With an application network, Pfizer has enabled omnichannel clinician engagement by providing PRIMA access to preferred systems of engagement across different geographies. As a side benefit, this has enabled

them to automate over 5000 hours per year of adverse event submissions into their pharmacovigilance application, reducing costs while increasing patient safety. CORDIS securely surfaces its platform of product development related services to the application network, which not only drives product development efficiencies through internal reuse, but also provides the opportunity to further support drug safety by exposing data back into their pharmacovigilance application. WIth an application network approach, the delivery of the projects like the patient engagement mClinical initiative were accelerated by reusing integration artifacts that were developed as part of the shipment status API.

The capabilities that Pfizer has surfaced with their application network extend far beyond the ones profiled above. For example, in addition to building capabilities designed to support product development and go-to-market, Pfizer has developed internal capabilities that simplify and streamline the development and maintenance of business applications. For example, one API, createIncident, securely provides services from Pfizer's legacy ITSM system to over 30 internal applications, automating the process of submitting support tickets.

The application network has also emerged as a key enabler to Pfizer's sales and marketing strategy. With it, they have been able to securely share, orchestrate, and manage APIs from external SaaS vendors and on-premise technology vendors to create composite services that support the ability for clinicians to digitally order drug samples, making them more likely to become long-term prescribers. By promoting reuse throughout their ecosystem, they have been able to scale the experiences they have created across over 100 different markets.

Indeed, as constructed, Pfizer's application network supports excellence across each stage of the pharmaceutical value chain, from the development of new products, through manufacturing and distribution, all the way through to sales, marketing, and customer engagement.

All in all, the EASi team supports over 200 systems as part of its application network, with 200 million transactions flowing through the network per year via over 100 distinct APIs. MuleSoft's Anypoint Platform has been a key enabler in supporting the construction of this application network.

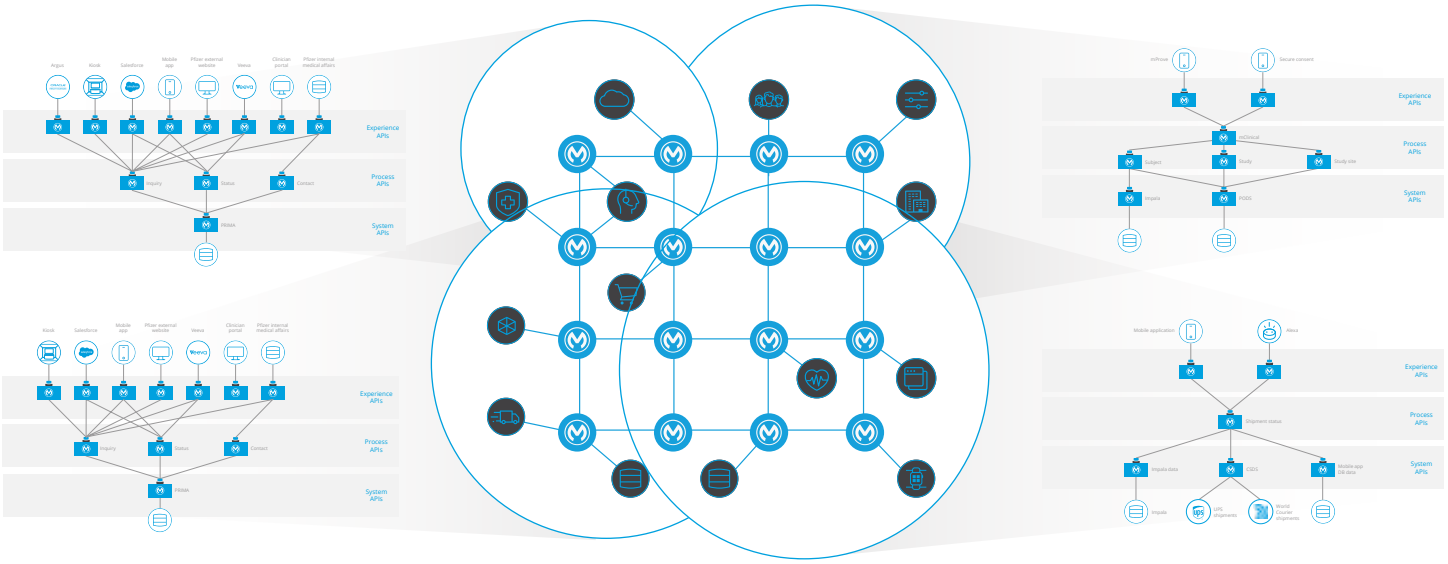

**Figure 8:** Pfizer's application network

By driving reuse on a project-by-project basis, they have established a platform of capabilities that are shared internally to drive line-of-business innovation, and externally to the network of investigators, contract research organizations, investigators, patients, and regulators that form core parts of Pfizer's platform ecosystem.

## Building an application network: Organization enablement

Technology strategy, on its own, is not enough for organizations to successfully drive a platform vision. After all, even the most robust of platforms are only useful to the extent that consumers can access the platform's capabilities. And if consumers are unaware that these capabilities exist, or do not know how to access them, organizations are little better off than if they had not even bothered to surface access to these capabilities in the first place. It is for this reason that enterprises looking to transition from a project-based strategy to platform-centric one must create organizational frameworks that promote the production and consumption of reusable platform capabilities.

Early in its journey toward this platform strategy, Pfizer identified key organizational challenges that would hinder the development and adoption of a shared set of capabilities. Previously, they had five different organizations developing and supporting integrations. With little communication across these different organizations, integrations were largely application-specific, and not suitable for consumption by other applications or external stakeholders. In response, Pfizer IT leadership established a cross-functional governance model designed to encourage the creation of shared technology and services across distinct business technology units, and to provide enablement around the consumption of these services.

The EASi team is one of the core components of this governance model. Their mandate includes four core strategic objectives:

- Supporting the application network infrastructure in a manner that enables secure, governed consumption of capabilities that have been surfaced through API-led connectivity
- Delivering solutions across Pfizer in a way that expands the application network and grows Pfizer's internal API economy
- Driving integration strategy, roadmap and governance through alignment with business technology line-of-business leadership
- Supporting internal IT excellence through promoting DevOps and automation across the SDLC

EASi team leaders include Jeff LoVetere, who heads the team, Bill Nerbonne, a technical architect and delivery manager, Nico Loriente, who leads the development of APIs that provide capabilities to the application network, and Kalyan Kanumuru, who provides operational support for the application network.

The team includes a bench of developers who partner with line-of-business IT teams to develop capabilities served on the application network, as well as a team of application and platform engineers to support the application network infrastructure. EASi also partners with a strategic integrator to provide support and testing services for the application network.

As they embarked upon their mission of enabling the organization around the platform approach, the EASi team identified the Center for Enablement, or C4E, as a vital organizational construct that they needed to adopt in order to be successful. "MuleSoft has been really effective at helping us transition from a COE,

where everybody depends on us to deliver projects, to a C4E, where we're enabling other solution teams to also deliver their integration projects with the platform and existing services we've built," said LoVetere.

As a C4E, the EASi team identified the need to create a plan for platform success, and establish a foundation for driving that success across the enterprise. To do so, they performed a thorough baseline of the full range of capabilities and integration use cases that supported the business, so that they could identify common capabilities that could be reused across different business units and begin a pivot from a project-based model to a platform-based one.

"EASi's initiatives ensure that the application network evolves in a way that best suits business needs, and simplifies the process of consuming capabilities from the application network."

To align the disparate business technology units around a plan for developing common platform capabilities with their application network, LoVetere formed the Application Integration Technical Architecture Committee (AI-TAC). The committee has representation from a diverse set of stakeholders — including line architects, integration service owners, delivery leads, as well as security and compliance teams — to ensure that services are built in a manner that not only serves immediate project needs, but are fit for reusable consumption across the enterprise. This team works collectively to define the roadmap, service management, and architecture support, which facilitates a smooth partnership between the EASi team and line-of-business teams in the production of platform capabilities.

After defining and driving alignment around a shared plan for success, the EASi team has developed programs designed to scale the execution of this plan. For example, as new capabilities and APIs are plugged into the application network, the EASi team has established a formalized process for documenting APIs so that they can be easily reused by internal and external consumers.

Each API user guide contains a description of the API, business benefits and supporting use cases, as well as environment resources for different deployment environments, and documentation for how to consume the API.

To further drive awareness of the application network with the broader Pfizer IT community, the EASi team hosts a variety of developer forums and town halls designed to promote best practice for consuming from the platform they've built.

In total, EASi's initiatives ensure that the application network evolves in a way that best suits business needs, and simplifies the process of consuming capabilities from the application network. They provide the organizational compliment to the application network technology strategy, which ensures not only the production of platform capabilities, but the widespread consumption of these capabilities across the business.

## Application network business impact

By measuring the extent of API reuse Pfizer drives through their application network, as well as the increased speed at which APIs can be built and maintained as part of the network, it's possible to quantify the value the application network has created. According to MuleSoft's value assessment model, Pfizer's application network, built on Anypoint Platform, will drive a 69.40% reduction in people/project costs over the next three years. This figure represents the delta between projected people and project expenses to deliver an equivalent amount of work in the future by consuming assets from the application network, compared to projected costs incurred to deliver the same business projects with legacy integration solutions and methodologies.

### Application network value drivers

The bulk of Pfizer's value realized from the application network stems from reuse. To date, Pfizer's EASi team has built 100+ in-production APIs across all of the projects they have delivered, including but not limited to what has been featured in this whitepaper. 59% of these APIs are reused across multiple projects, providing a framework for new applications to be seamlessly "plugged in" to the network without developers needing to write additional code.

Driving this high rate of reuse contributes to approximately 80% of the value Pfizer is projected to capture over the next three years. In addition to driving value through API reuse, Pfizer has leveraged MuleSoft's Anypoint Platform to increase the speed at which they can develop new APIs when needed. Before MuleSoft, Pfizer took an average of 10 weeks to produce a new API; now, it takes only 8 weeks, contributing to further project development savings over the next three years.

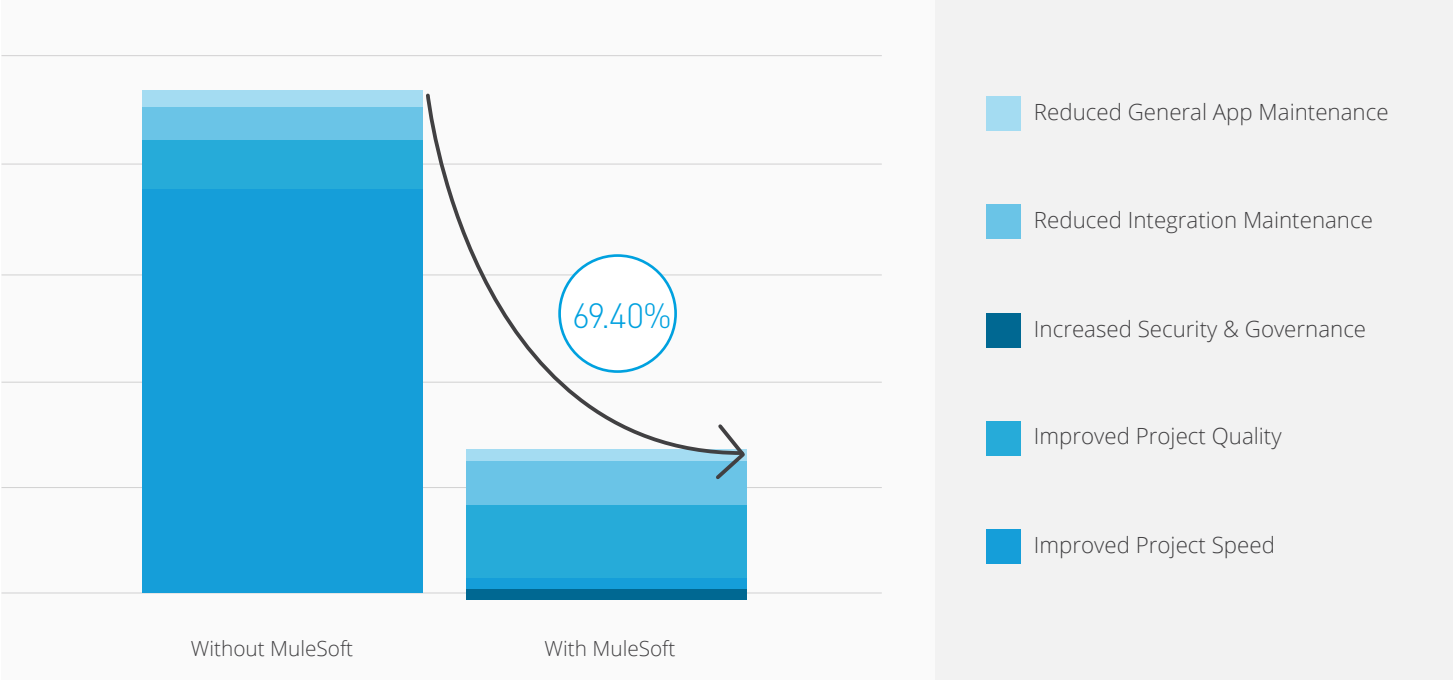


**Figure 9:** Three year people/project expenses comparison. MuleSoft's value assessment model projects a 69.40% reduction in people/project costs, driven largely by API reuse.

CUSTOMER STORY

## How Pfizer uses Anypoint Platform to build APIs

Pfizer begins API development by drafting what they call a "middleware design specification." Each middleware design specification identifies the context of the API: the message queues, databases, web services, SaaS applications and other APIs that produce and consume messages, as well as the transactions, queries, payloads and resources with the API being designed. Any relevant schemas or data models are included in the specification.

Based on the context of the API, Pfizer completes their "outside in" API design process to create a RAML definition of the API. They use API Designer, including the Mocking Service and the API Console, to design and unit test API definitions written in RAML. API implementations are developed with Anypoint Studio. APIkit is used to automatically generate a pattern-based set of microservice "seeds" for each REST service defined in the API. Pfizer "grows" each seed into a complete flow by iterating through a four step process:

1. Establish message routing logic to connect the service flow to all relevant endpoints and transports based on the middleware design specification.

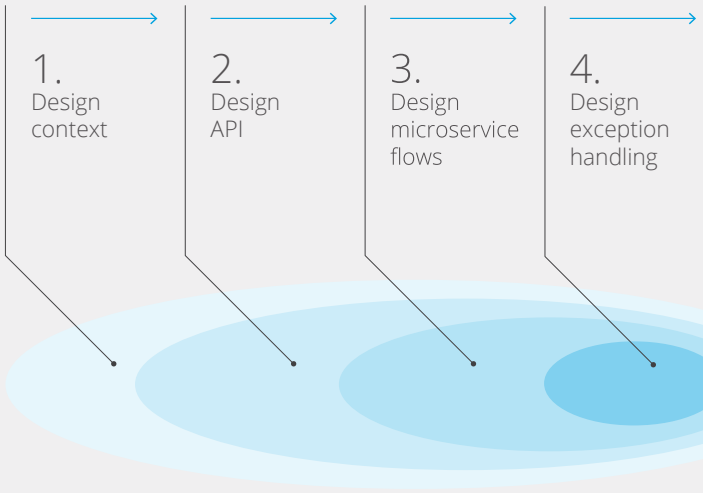


**Figure 10:** Pfizer's "outside In" design approach

2. Add message transforms using DataWeave at all points in the service flow where data format and/or semantic mapping are needed.
3. Identify common flows/sub flows that can be used to make complex service flows easier to maintain and support flow reuse.
4. Create relevant exception handling for each service flow.

The completed Anypoint service flows are pasted into the middleware design specification to provide documentation for the ongoing support of the API.

Both Anypoint API Manager and Anypoint Studio are used to deploy the API and associated microservices based on requirements specified in the middleware design specification.

In addition to increasing the speed at which APIs can be built, Anypoint Platform has driven additional cost savings by reducing maintenance expenses. As a result of Pfizer's "Outside In," RAML-enabled design approach, they have been able to enable earlier input from API end consumers. This, in combination with standardized documentation that the EASi team has developed, reduced the number of project errors by 30%.

Furthermore, by building their application network with MuleSoft, which provides a single runtime for API lifecycle management and application integration, they've been able to cut time spent on application maintenance by 66%, and time spent making changes to applications in production by 50%. Uptime, too, has improved, from 95% to 99.99%. And when integration errors do occur, with Anypoint Platform, they can be fixed in half the time.

Last but not least, Pfizer continues to drive value via accelerated developer onramp. With their legacy integration platform, developer on-ramp took 4-5 weeks; now, it takes 2-3 weeks, representing substantial cost savings per developer.

The forward-looking value that Pfizer will realize will only continue to grow as more APIs are built and more applications are plugged into the application network. This value capture allows for reinvestment into business technology innovation, creating a flywheel effect: value captured from the application network can be re-invested into expanding the application network through the development of additional APIs, which in turn increases the value the application network produces. Such a strategy enables Pfizer to bolster its innovation edge, driving superior digital engagement with clinicians, and improving the speed at which new drugs can be brought to market — all while reducing costs.

"By building their application network with MuleSoft, which provides a single runtime for API lifecycle management and application integration, (Pfizer) cut time spent on application maintenance by 66%, and time spent making changes to applications in production by 50%. Uptime, too, has improved, from 95% to 99.99%."

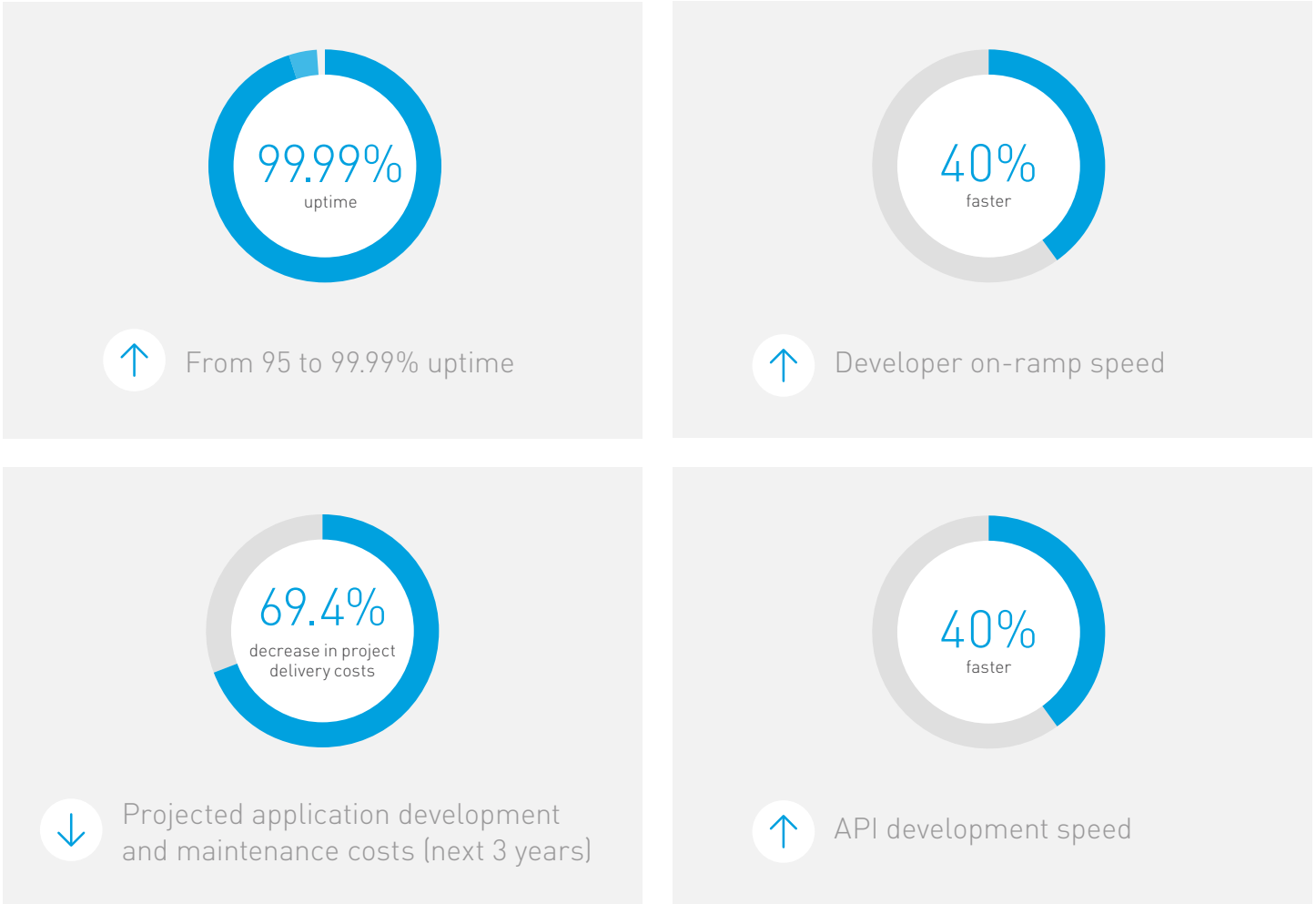


**Figure 11:** Value Pfizer drove building an application network with MuleSoft

# Conclusion

Pfizer's success in building and driving value from an application network resulted from a combination of factors. By employing a technology strategy centered around API-led connectivity, where access to core systems and composite business processes are surfaced to internal and external stakeholders, they've created a platform of services that drive efficiency for those who consume from it. By establishing a C4E and proactively driving consumption from the network, the EASi team has helped maximize the value that can be realized from their platform of reusable services. And by partnering with MuleSoft, Pfizer has been able to effectively implement the technology and organizational changes needed to transition from a project-based strategy to a platform-based one.

> "Based on a thorough understanding of business use cases related to system connectivity, our integration strategy is centered around the application network and the API economy ... we see it as a cornerstone of our digital transformation strategy."
>
> Jeff LoVetere

MuleSoft's Anypoint Platform was purpose-built to enable the development of an application network through API-led connectivity, and is the leading platform for doing so. It delivers an unmatched combination of capabilities that allow organizations to realize this vision, including:

- **Support for the full API lifecycle:** While many solutions in the market focus exclusively on API management, Anypoint Platform supports the full API lifecycle, enabling APIs to be treated like products. Anypoint Platform supports the entire software development life cycle (SDLC)—from designing, collaborating, building, and testing to deploying, publishing, versioning, and retiring APIs. This capability has enabled Pfizer to realize their vision of creating an internal "API economy" to support business needs.
- **Security by design:** API-led connectivity embraces the importance of securing and governing APIs. With Anypoint Platform, every connectivity asset can be governed using policies. In addition, every node, connection, and API is automatically registered within Anypoint Platform. This enables organizations like Pfizer to create application networks that are inherently secured. Anypoint Platform also provides unparalleled visibility into what applications access which systems within the application network.
- **Ubiquitous connectivity:** Anypoint Platform can connect to any source of data, on-premises, or in the cloud, enabling rapid implementation of APIs. With a library of over 140+ out-of-the-box protocol, transport and database, and application connectors, users can quickly plug new applications into the application network for broader consumption by the enterprise.

- **A unified platform:** Anypoint Platform provides enterprise grade connectivity and support for the full API lifecycle on a single platform, eliminating the need to manage multiple products, vendor relationships, and skillsets. Unifying the functionality required to build an application network streamlines development and simplifies application maintenance. According to Pfizer, doing so allowed a 4:1 reduction in their integration technology spend through reduced support, licensing, and staff costs.
- **Flexible deployment: On-premise, or in the cloud:** Deployment environments are evolving with the emergence of public and private clouds. Anypoint Platform enables organizations to write once and deploy anywhere—whether it be in the cloud, on-premise, or within a hybrid environment. This enables organizations like Pfizer to manage their application network as a single fabric extending across on-premises and cloud systems, regardless of where the API nodes are deployed.

With these capabilities, and through their partnership with MuleSoft, the EASi team feels well equipped to continue driving consumption of assets from the application network, and to partner with business technology teams to expand the network for even broader internal and external consumption.

"Based on a thorough understanding of business use cases related to system connectivity, our integration strategy is centered around the application network and the API economy," said LoVetere. "We see it as a cornerstone of our digital transformation strategy."

# 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 1,400 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**

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