Transforming Business with Microservice Architecture

A Scalable Digital White Paper

SCALABLE
DIGITAL

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EXECUTIVE SUMMARY

Over the last half-century, it is hard to argue that there has been any other entity of our society that has been more influential than the development of computing technology. From simple binary computing systems to countless lines of computer code that make the world an easier place to live, the amount of growth that software computing systems have undergone is astounding. The amount of time it takes to deploy a simple application in a few minutes today would have taken thousands of hours to accomplish a few decades ago.

But in many cases, as something rapidly grows such as an industry like software development, there lies an inherent challenge for human beings to keep up and manage that growth. From an organizational perspective, creating a deployment strategy for new computer systems is one of the largest problems large enterprises face. Fortune 500 companies that have been around since the 20th century have been trying to catch up to the innovation that technology giants like Amazon, Facebook, or Google have brought about. They face some of the largest business challenges when learning to adopt new ways of incorporating technology to positively affect operations.

Thus, organizations need technology leaders with brilliant minds for business, in order to scale and remain flexible. Automation is creating more efficient business processes, and if you are a business leader today you have to consider implementing effective systems to stay competitive.

So the question is, how can we choose a technology deployment strategy that will allow for businesses to remain flexible and scale? The answer lies in the emergence of Microservice based software architecture, a systems engineering and software development philosophy that has made building, testing, deploying and scaling new applications a more manageable and successful process. Technology leaders like Amazon, Netflix, Paypal, and Uber have all adopted this philosophy. And technology-driven organizations that are looking to stay competitive for the long term and scale effectively businesses are following suit. In a recent survey, 67 percent of companies that have adopted microservice based architecture saw benefits to the adaptation within 12 months of switching over.

But there has also been another revolutionary change in the cloud computing space that adds another caveat to the complexity that enterprises will have to deal with moving forward. In the last decade or so, the commoditization of data storage has led to the ability to build and deploy effective algorithms for making sense of massive datasets. This has led enterprises to lead digitization initiatives and strive to become data-driven organizations. This means that companies see the value in all of this data they are accumulating, and are planning to rely on automated data models to make better decisions through the deployment of analytics applications. A great example of this can be found at one of the United States most successful and long-standing companies in its history, General Electric. For the longest time, GE was solely a manufacturer of machines. Now they are marketing themselves as a data-driven technology organization, who has a business division called GE Digital which is currently scooping up some of the top data science talent and most experienced technologists in Silicon Valley to build their digital platform that allows for machines to talk to one another.

Major shifts like these disrupt the way industries think. In order for technologists to be as productive as possible in this new age of technology, we need a software development philosophy such as Microservices Architecture that will wrangle all of these new developments in the cloud computing space. With the adoption of this philosophy, we can create applications that brilliantly work in tandem as we enter an age of endless innovation.

MICROSERVICE BUSINESS DRIVERS

Time to Market

- Enables short development cycles for greater agility
- Enabler for continuous delivery
- Reduced size and risk of changes enables faster time to market
- Reduced code complexity enhances developer productivity enables quick turnaround

Technology Stack Independence

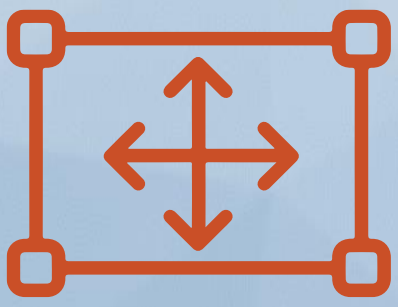
- Technology best suited for a business need
- Deployed onto supported software and hardware configurations
- Quick adaption to Technology changes

Digital Transformation

- Connected devices
- API based service invocation
- Cloud based deployments

Governance Decentralization

- Governance decentralized to specific Business Units
- Quick Decisions



WHERE DID MICROSERVICES COME FROM?

Microservice Architecture is quickly becoming the foundational philosophy for how technology organizations are creating scalable cloud-based applications. However, it is important to understand why exactly it is being so heavily adopted within the industry.

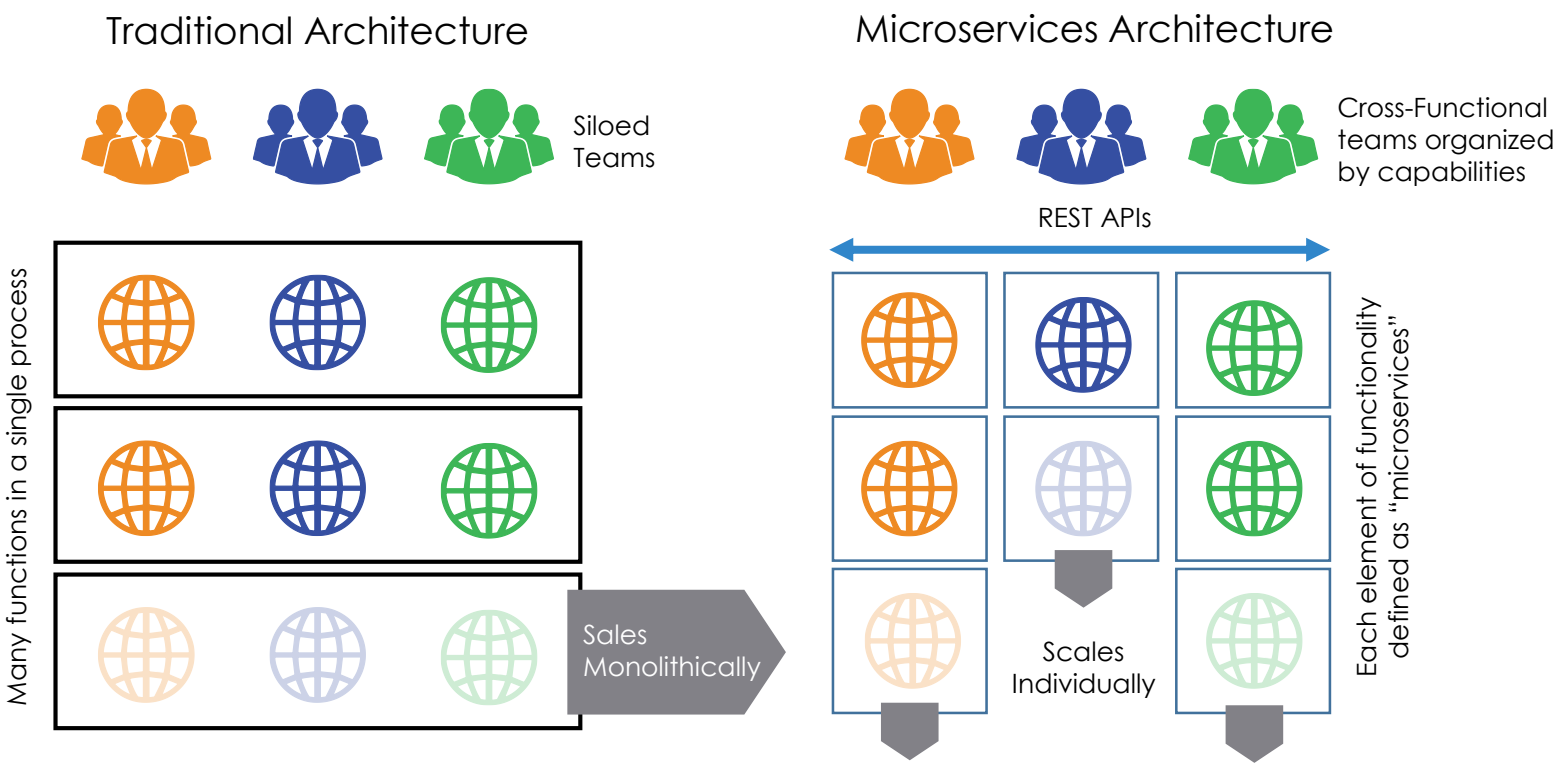
First, let's start with a little bit of history. For the longest time, web applications were built essentially using three components; a database, which was mostly a relational database, a server-side application, as well as the client side application which would consist of the HTML, Javascript, and CSS markup. As the server side components started becoming more complex, the number of dependencies that existed for each service within the application remained in one code base. This made it incredibly difficult to troubleshoot when bugs arose within the application. Thus, engineering teams could not be segmented into separate sprint teams in order to optimize the functionality of each service. This is how applications which were built as a monolith functioned.

But nowadays monolithic is a swear word when it comes to architecting a new platform for many software engineers. As platforms started to offer more and more services within their whole of product offerings, the monolithic approach started becoming outdated, and a detriment to the future of some of these technology giants. Just imagine if Google's full suite of office solutions was held within one code base, with each service dependent on one another. It made no sense for any ambitious organization that wanted to scale. The monolithic approach was archaic.

Then a few years after the turn of the millennium, technology organizations began to champion change in standard systems architecture strategies. Studies held at Hewlett Packard Labs along with paradigm shifts in strategic thinking for companies like Microsoft and Netflix began to signal the first changes in the industry. Leaders in the fields of computer science and software development saw the benefits of having independently deployable web-based services that were focused around more specific, isolated purposes that contributed to applications as a whole. Platforms started to be developed that featured the creation of independent services such as accessing specific databases, making recommendations, and even completing operational tasks such as billing.

As organizations saw the flexibility of this type of software development philosophy, large technology organizations started to catch on. More importantly, fail fast and fail forward type companies saw the way this type of microservice architecture allowed for faster speed to market for innovators across all different types of industries.

And it caught on at the most opportune time for entrepreneurs with a data-centric mind. The meteoric rise of Big Data in the late part of the 2000's contributed alongside the adaptation of microservice architecture and gave rise to some of the most successful technology companies today. Tech giants like Uber, Twitter, and Groupon burst onto the scene as companies that use Big Data and Analytics as a core business strategy, all the while championing microservices. Amazon, a company that had been established since before the turn of the millennium, has grown by an order of magnitude since both Big Data and Microservice architecture has caught on. Through these shifts in thought, we are now seeing a continuation of the growth of Analytics based platforms, with even more growth to come.



HOW MICROSERVICE ARCHITECTURE BENEFITS BIG DATA ANALYTICS

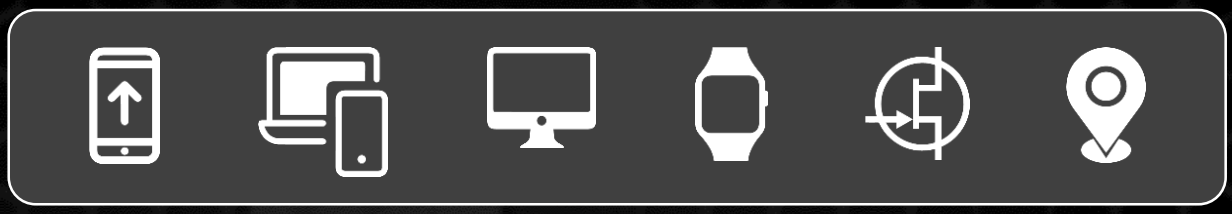
With a new philosophy taking over the software development world, one can see the potential benefits presented to technology-driven organizations in the long run. It is especially important for technology-driven organizations that are also data analytics-driven as well. Companies across industries are deploying applications in order to make use of massive amounts of data, and the two in tandem can be incredibly powerful for large enterprises.

Paving the Way for Analytics

As technology spreads and becomes more accessible, our lives grow easier every year. This is especially the case in the business world, where processes that once took either hour of human effort, or vast computer resources, are being replaced by advanced autonomy and artificial intelligence.

A large push in the recent advancement of cloud computing has come about due to Big Data. Big Data is a common buzzword throw around these days, but the term is used to describe the ability to store massive datasets and analyze them to determine trends, patterns, and insights that are valuable for businesses and consumers alike. Technologies such as Hadoop and MapReduce are at the forefront of this phenomenon and have streamlined access to this data.

MICROSERVICES REFERENCE ARCHITECTURE



Outer Architecture

API Gateway

Analytics

Security Access Mgt.

Service Router

API/Service Registry

Inner Architecture

Microservices Cluster

Microservices Cluster

Microservices Cluster

Data

Messaging Channel

DevOps Tools

Continuous

Dev Tools

Exciting Services

Big Data in itself has been a revolution of sorts. It has opened the door for all different kinds of innovation. Technologists who now have ideas of how to make sense of all of this data now have the opportunity to build applications that create value from the massive amounts of available data rather quickly. Systems can now be created to track the activity of users on web applications in the form of clicks and web search forms. As more and more people are spending time online, this gives analytics businesses a great opportunity to understand their customers in the form of insights from this data.

But with any new innovation comes even more layers of complexity. How can software engineers develop systems that wrangle all of these new data sources, and make sense of all of them? Microservice architecture comes into to play, creating a model where which new services that make use of a Data Lake can be spun up independently in order to test and deploy new ideas. Now instead of having to layer on different dependencies within the same application to serve those functions, computer scientists had the option of spinning up new applications independent of each other to make use of the data as many ways as possible.

This is becoming a perfect storm for data scientists and technology entrepreneurs alike. With data storage becoming a commodity, and entrepreneurial minds can use the technology available to test different ideas (web-based services) without much risk to the core application as a whole. It is due to this phenomenon that technology organizations became even larger breeding grounds for independent and creative thought. This has given rise to the new creative and exciting career of the data scientist, and the amount of people that are starting careers in data analytics is truly a testament to the way microservice architecture is helping Big Data-driven applications scale. According to IBM, the demand for data professionals will increase jump from just over 2,300,000 in the year 2017 to 2,726,000 in in 2018.

The growing demand for data analytics professionals is a telltale sign that technology companies will have a need for computer scientists and data scientists alike, who know how to build and deploy analytics-based services quickly using a new philosophy of microservice architecture. The fail fast and fail forward nature of the technology industry can't allow for outdated strategies like monolithic architectures. Thus, adopting a philosophy like microservice architecture that allows these companies to stay competitive in this new and exciting industry is paramount.

Cross Functional Scalability

The sheer amount of code being written today can be intimidating to think about. But before even writing a new line of code, engineers have to think long and hard about what they are building, and how it will interact with the application as a whole as time moves forward. Project management and product development philosophies like Agile do a great job of constantly asking the correct questions, but there is an architectural philosophy that is needed here, especially for data-driven technology applications.

Now with the advent of new analytics services, these data-driven applications are going to be interacting with different databases and applications. Let's take Spotify's recommendation service for example.

Millions of users depend on Spotify to receive recommendations for new music based on their listening history, as well as the listening history of others like them. This service has been wildly successful for Spotify, as well as other Music streaming services like it. However as the online experience expands, and Spotify enters new platforms on mobile interfaces, as well as wearables, that recommendation service will have to interact new layers of the technology stack. If that engine is tied too tightly to a platform that fails, it risks the profitability of the company. And then millions of users miss out on their a new favorite artist recommended by Spotify. Managing the complex nature of all of these interactions as a whole can only be accomplished if you have a philosophy that decouples that recommendations engine from any other piece of the puzzle.

This is just a simple case. Now let's take an insurance company that has hundreds of different products and thousands of customers with different types of life situations. This means you have all types of data you need to store in of databases. Companies need to access this data and figure out new and inventive ways to make value out of the data with analytics. If you don't have processes in place to build and deploy new services year in and year out, then your engineering organization will be caught up in fighting fires from past failures, and before you know it you will become a dinosaur within your industry as opposed to a thought leader and an innovator.

Adaptability to Legacy Systems

Since the mid 20th century, database technology has gone through many changes. One major component of the change is the way we are storing unstructured data in the form of video, photo, or complex data models. Thus, different new and innovative database technologies have emerged. One major shift has been Hadoop technology and MapReduce, a programming methodology that allows for massive scalability across different databases, and allowing to access that data easily. But even though new ways of storing data are emerging each decade, legacy systems still have value. Technologists are still finding a use for relational database technology that has been around for decades. Databases like MySQL and PostgreSQL are still widely used since their inception in the 1990's.

These older database technologies won't go away. So the question remains, with the ushering of new ways to store data and the remnants of database technologies of the past, how will we make sure that there is a methodology that can retrieve data from all of these different sources without being too loosely tied to the applications?

The answer is with RESTful microservices, or what many call RESTful API's. REST , short for Representational State Transfer, is a standardized technique that allows developers to set up interfaces to access data allowing third parties, whether it be within or from outside your organization, to make valuable use of data within a database. The REST interface is then able to be made useful across a number of different microservices. A great example of a publicly available REST services is what Twitter has managed to develop. Twitter has one of the most well-used REST API's, allowing developers to access data from user tweets in order use of them within their own applications. For data scientists, this can be in the form of creating Natural Language Processing models that evaluate what public feedback is based on identifying trends from thousands of tweets.

This is just a simple example, but developing microservices in the form of RESTful APIs within a large organization can be useful as well. Giving your developers and data scientists access to data and allowing them to experiment in thoughtful value-adding ways can be a great way to foster creativity and innovation, something that technology companies like Google have stood by for years.

The REST model is just another great way that microservices have given the tech world a great way to make value out of the systems already intact. They are a great way to make sure legacy systems aren't rendered obsolete, while still making the most use of your modern and up to date database systems.

HOW DO MICROSERVICES ENABLE DIGITAL TRANSFORMATIONS?

As more business make digital transformation an imperative, many have found microservices to be an integral part of meeting that goal. Here are six ways a microservices architecture enables digital transformation.

BETTER APPLICATION MANAGEMENT

A microservices architecture allows you to start and stop one part of an application without affecting the rest of the application.

EFFICIENT SCALABILITY

Scaling a monolithic application up as your needs change can be challenging because you have to increase the capacity of the entire application, even if only one part of it needs to be scaled.

IMPROVED SECURITY

In a well-designed microservices architecture, an attacker who is able to gain control of one microservice will not automatically be able to compromise the rest of the application.

APPLICATION MODERNIZATION

Modernizing monolithic legacy applications requires rewriting the entire application, which is often not feasible to do in a single go. You can rewrite each microservice, making it possible to modernize your applications at a gradual pace.

CODING FLEXIBILITY

Microservices also make it possible to write part of your application in one language and other parts in a different language.

INCREASED SERVICE AVAILABILITY

With a microservices architecture, a failure in one microservice doesn't necessarily mean your entire application stops working.

THE BUSINESS CASE FOR MICROSERVICES

From a technical standpoint, microservices architecture makes a ton of sense. It creates a software development ecosystem that sets up engineering organizations to succeed in the long run, and grow in innovative ways.

But we have only skimmed the surface on the overall benefits of the software development philosophy. The advent of a software development paradigm that allows for quick deployment of value-added services means big things for businesses. With microservice architecture is benefiting the bottom line of businesses everywhere, technology organizations are adopting this methodology increasingly across industries, and the change is being ushered in by business leadership.

Increasing Productivity

Microservices architecture allows for a much more scalable development model when it comes to scaling across different enterprises. With a monolithic approach to software development, software engineers worked in very large groups, as there were many dependencies between services when developing an application under this model. From an operational perspective, this meant organizations needed to have buy-in from multiple stakeholders to change certain features a product. If we know anything about large companies, this can create blockades to getting things done, and in a time where developers are pushing out code and software updates constantly, innovative organizations can't afford these hold-ups.

In monolithic applications, when a bug was found in one function of the application, other features were affected. This meant engineers who had different focuses were sucked of their time and creativity just from a simple bug from a dependency on a certain part of the application that didn't have much to do with the part of the app that they were building. Engineering talent and human resources were wasted on these types of problems that could have been spent either strategically thinking of new services that would add value or of could have been spent actually building software.

With the advent of microservice architecture in tandem with Agile project management philosophies sweeping Silicon Valley, engineering organizations could assign small groups of 4-6 engineers on a particular microservice. Since these microservices were mostly independent of other services, sprint teams were left to stay out of each other's way, and do what skilled software engineers do best - build. A tech organization like Spotify is a great example of this team structure, where they call their small, self-organized teams "squads" where each squad focuses on a different component of the platform to add value. These are the type of team structures enterprises need to adopt in order to stay competitive in the 21st century.

Decreasing Risk

Big Data analytics and the meteoric rise of the technology industry has given birth to a generation of some of the most creative entrepreneurs the world has ever seen. From phone applications that make life easier to new and innovative ways to communicate with family, friends, and colleagues, these new and exciting applications are being developed every day utilizing Analytics and Big Data. This has largely come at the vast decrease in overhead that it takes to store data. In 1967, it roughly cost a whopping $1,000,000,000 to store one megabyte of data on a hard drive. Today, it costs an incredible 2 cents to store the same amount.

As the capital cost necessary to store data continues to decrease, and platforms like Google, Apple and Amazon Web Services make it easier for startups to test and deploy applications on the fly, it will only pave the way to more opportunities to innovate.

But small businesses aren't the only ones that are taking advantage of this risk-free nature of software development and analytics these days. Large companies that have been around for ages are also structuring their technology organizations to become innovators. FIAT Chrysler is an example of one of many manufacturers that are using customer data to advance their business using a software application called EcoDrive. As a company not originally branded as a technology company, it is of the utmost importance that a system such as microservice architecture is implemented. Chrysler surely isn't a grizzled veteran when it comes to developing user interactive software, so microservices architecture is a key in allowing their organization to grow as a technology company. The digitization of large companies like General Electric and Chrysler is one of the main business trends that is occurring right now.

The importance in all of this is that microservices give risk-averse companies a framework to build out a digital component to their enterprise. Leaders of Fortune 500 companies are seeing the value in the ability for self-organized sprint teams executing new ideas that could save time and energy across every level of Fortune 500 company. But their hesitation always comes in evaluating the risk-reward component of any new initiative.

Microservices Architecture gives these leaders a framework to minimize that risk. Sprint teams can be assigned to the development of a microservice, and if that service becomes discontinued, it won't affect the overall platform. This is exactly the type of team structure that big companies need to introduce less risk and more flexibility as they figure out how to digitize their current operations.

No matter what the size of the company, this gives big data organizations and data scientists more room to innovate and create data science models that have a large upside, and less of a downside if any given project is a failure.

MICROSERVICES CHALLENGES

Although Microservices can be quite powerful if implemented correctly, with any massive shift in strategy in software development, nothing is that simple. There comes a number of challenges that we need to face when shifting to the implementation of microservices. Designing a microservice architecture that can effectively scale is difficult. It takes a considerable amount of thinking and foresight as to how the system as a whole will deal with future problems that haven't arisen yet.

Finding the right type of Leadership

The type of thinking that building a microservices framework that allows for scalability and flexibility takes a level of software architecture talent that is hard to come by. With the increased demand for technology professionals, the demand for these types of leaders is only going to increase with time. In addition to this, a recent study found the 40% of job postings for tech talent on Indeed were posted by firms who wouldn't consider themselves technology organizations. This means more and more non-tech firms are shifting their focus to becoming more digital and tech-minded. As this trend continues, it will be harder and harder to find the right type of leaders that can design microservices platforms to allow for scalability.

Also, as any system scales, it creates more of a challenge to manage the growth of different components. The integration of separate functions within a platform creates a high demand for developers who are skilled in all phases of software development and data analytics. As you could imagine, we arrive again at the challenge of finding individuals or teams of individuals who have the skill and experience to make sure that these components run smoothly in tandem. As any technology company will tell you, one of the biggest challenges these companies have is recruiting and keeping this type of talent within their organization, and as you scale a microservice based platform, these challenges will arise.

Monitoring

One of the major benefits of Microservices Architecture can be the opportunity to truly scale your platform in ways that you would have never imagined. However, as your application grows and adds more and more microservices, this becomes challenging for DevOps to consistently monitor all of these different services and understand the root cause of a bug in each service. Although one of the main reasons any organization switches over to this type of architecture is because it allows for more productive debugging, we are still talking about software here and we have to be prepared for troubleshooting in any scenario. The debugging of different microservices has to start with a robust monitoring process so that deficiencies in across different services don't go unnoticed.

This can be tackled using advanced automated monitoring services that alert DevOps engineers when certain microservices are not performing as expected. This gives your team at least somewhat of a peace of mind and allows it to prioritize troubleshooting across different layers of a platform.

CONCLUSION

There is no question that cloud computing is growing more complex. The internet is still changing our lives, and there are bound to be other technologies that are introduced to the cloud computing world which we will have to manage somehow. Additionally, more data than ever is being stored today and it is a telltale sign that we have to keep preparing to deal with the complexities of this Big Data revolution.

There are many new fronts that technology will bring that accessing data will have a large impact on. Technologies like Artificial Intelligence and Augmented Reality will introduce new ways of interacting with computers, and in turn, new platforms to deploy software will emerge. The amount of new and complex data that is stored will exponentially grow, and we will need systems architecture that will handle this growth. This will be the key to success for any leading technology organization.

About Scalable Digital

Scalable Digital is a Data, Analytics & Digital Transformation Company focused on vertical specific innovative solutions. By providing next generation technology solutions and services, we help organizations to identify risks & opportunities, achieve operational excellence and to gain an innovative edge.
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