

Microservices Architecture for Healthcare

Anand Laxman Mhatre*

Anand Laxman Mhatre, Senior Program Manager/Technical Architect, Architecture/Health Care, Accenture, USA

Citation: Mhatre AL. Microservices Architecture for Healthcare. *J Artif Intell Mach Learn & Data Sci* 2023, 1(4), 1590-1592.
DOI: doi.org/10.51219/JAIMLD/anand-laxman-mhatre/356

Received: 03 December, 2023; **Accepted:** 28 December, 2023; **Published:** 30 December, 2023

***Corresponding author:** Anand Laxman Mhatre, Senior Program Manager/Technical Architect, Architecture/Health Care, Accenture, USA, E-mail: anand.mhatre@gmail.com

Copyright: © 2023 Mhatre AL., Postman for API Testing: A Comprehensive Guide for QA Testers., This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

ABSTRACT

Although monolithic applications have served the healthcare industry for long, their efficacy to continue supporting operations in the modern dynamic healthcare industry is dwindling. The modern healthcare industry is quickly evolving and there is a need for applications that not only evolve with the industry but also empower the evolution. Microservices architecture is emerging as an ideal model for developing agile and scalable applications. This writing discusses why monolithic applications are unsuitable for healthcare facilities and how microservices applications are perfect for healthcare providers.

Keywords: microservices architecture, monolithic applications, healthcare, technology, scalability.

1. Introduction

Like other businesses, healthcare providers depend on software applications to streamline their operations, enhance productivity and boost the quality of their service delivery. The efficacy of applications to deliver these functions depends on their flexibility, scalability and maintainability. Applications with these attributes can evolve with changing user needs and can be easily configured to align with businesses' immediate needs. An application's ability to be scalable and agile depends on the development approach used. This writing discusses traditional software development approaches and why microservices architecture is ideal for healthcare applications.

2. Traditional software development

Traditional software development methods, commonly called monolithic architecture, are development approaches where applications are developed as a unified unit that is self-contained and independent from other applications. IBM defines the architecture as one where a single codebase executes multiple business functions¹. In monolithic architecture, each component and related modules must be present and functional for the entire

code to be compiled and for the application to run. This implies a slight error in one application component renders the whole application dysfunctional.

Although monolithic architecture is a straightforward application development approach, it is synonymous with various weaknesses that make it unsuitable for application development. These issues include;

- **Slow time to market:** A monolithic application must be developed to completion before being released to the market. Besides, since it's a large application, it can be too complex to create. Complexity coupled with the need to develop an entire application can prevent an organization from quickly launching its applications.
- **Reduced scalability:** Monolithic architectures are extremely poor at handling scalability. A minor change to a single function will require disintegrating and rebuilding the entire application. This is not only laborious but also time-consuming.
- **Poor reliability:** A minor error in one module can bring down the entire application.

- **The barrier to new technology:** Integrating new technologies into monolithic applications can be expensive and time-consuming. The process requires retooling an entire application.
- **Limited flexibility:** It is inflexible due to the time and resources required to make changes to an application.
- **Deployment hurdles:** Any minor change to a monolithic application requires redeployment of the entire application.

3. Limitations of monolithic applications in healthcare

The healthcare sector is amongst the rapidly evolving industries. To remain at par with changing patient expectations, healthcare providers are assimilating technologies that support personalized care and advanced diagnosis and treatments. Such technologies include telemedicine, artificial intelligence and modern EHR systems. The core features of these technologies that render monolithic architecture unsuitable are;

Scalable and flexible: Scalability and flexibility are key attributes of healthcare applications. To meet the ever-growing demand for health care, healthcare applications must scale up flexibly. As aforementioned, monolithic architecture does not support expedient software scalability and flexibility².

Interoperable: Healthcare applications operate in a dynamic environment where data is sourced and shared with other systems. Monolithic applications do not allow easy connection of applications to other systems, limiting interoperability of applications.

High data safety: Healthcare applications hold patients' sensitive information. It is essential that this data is kept from being accessed by unauthorized persons. Besides, they must comply with HIPAA and other data privacy regulations. Monolithic applications are poor at safely transmitting patient data, making them unsuitable for health applications.

Traditional software development architectures are not well suited for healthcare applications. Monolithic applications are unscalable, inflexible and less interoperable with scrawny data security mechanisms. Microservices is an emerging architecture that bridges the weaknesses of monolithic architecture. The model guarantees the production of agile, scalable, secure and reliable applications, making it ideal for healthcare applications.

4. Microservices architecture

Microservices architecture is a cloud-native model where applications are composed of multiple loosely coupled smaller components or services. Although the services are interconnected to accomplish a specific feature, each service is self-reliant and can be deployed independently³. Major development processes occur at the service level - updating, testing, deployment and scaling occur at the service level. Some of the key benefits of the model include;

Flexible Scaling: To add a new capability or function to an application, all that is needed is connecting a new service to existing services. Alternatively, modifications can be implemented in relevant modules to scale functions. The ability to alter specific parts of an application without affecting the entire application reduces scaling complexity and resources.

Continuous deployment: No need to develop a complete

application before launching it. Basic applications with core features can be deployed in the working environment as fast as possible and the remaining features implemented incrementally.

Highly maintainable: Teams can experiment with new features and roll back quickly if they do not work as expected. Besides, it is easy to isolate system errors and debug them.

Technology flexibility: Teams can conveniently get rid of old technology and replace it with modern technology.

Highly reliable: Failure in one module does not affect the rest of the application. Users can continue using an application even when other services are down.

Comparison between monolithic architecture and microservices architecture

Monolithic Architecture	Microservices architecture
Limited scalability	Highly scalable
Limited flexibility	Very flexible
Not open to new technologies	Very accommodative of new technologies
Maintenance hurdles	Very maintainable
Poor fault tolerance	Very reliable
Slow to market	Fast to market
Poor interoperability	Supports interoperability

5. Why microservices for healthcare

Microservices architecture is well suited to the needs of healthcare applications in various ways. The model is tailored to handle the dynamic nature of the healthcare sector - it can support rapid evolution of healthcare applications. The model is also accustomed to support development of complex healthcare applications. Here are some of the reasons microservices architecture is ideal for development of healthcare applications.

Highly scalable: Demand for health care services is constantly shifting. Besides, healthcare applications continually need upgrades to support new features and capabilities. Microservices architecture supports the development of highly scalable applications. New features can be incorporated easily and capabilities such as larger storage space or bandwidth can be attained by simply allocating more resources to the application. Vishal Ghariwala, senior director and CTO for the Asia Pacific region at SUSE, asserts that "Unlike traditional monolithic systems, microservices allow organizations to introduce new features or modify existing capabilities without disrupting the entire application"⁴.

Interoperable: Applications developed via microservices architecture can be quickly connected to other healthcare systems for data sharing. IT teams can conveniently create or remove data transfer connections between applications as needed.

Technology flexibility: Technologies such as telehealth, telemedicine and AI are still evolving. Healthcare applications developed via microservices architecture can be easily reconfigured to accommodate new versions of these technologies.

Agile development: Microservices architecture provides an ideal environment for developers to conveniently modify applications according to changing requirements and technologies. The architecture allows modification to particular functions without affecting the entire application. This adaptability is vital for responding to changing dynamics in the healthcare sector.

Fast development: Some healthcare applications or functions should be implemented quickly and deployed to benefit patients. Microservices architecture permits incremental development of applications - most basic functions can be developed and deployed and other features implemented later.

Reliable applications: Healthcare applications should always be up. Downtimes can have severe consequences on patient outcomes. Applications built via microservices architecture are fault tolerant. Failure in some components does not affect operations in other modules.

Data safety: Microservices architecture guarantees the development of secure applications compliant with data privacy regulations.

6. Issues To Consider When Using Microservices Applications

Although microservices architecture is ideal for developing healthcare applications, the model is not a silver bullet. Its downsides must be considered and addressed to attain the maximum benefits of the model. These issues are;

Deployment complexity: Although the model breaks down applications into simple services that can be easily implemented, it introduces management complexity. Each service requires independent monitoring, fault handling and version control. This can be challenging for healthcare facilities with limited IT infrastructure. Healthcare organizations should train or hire skilled IT staff before deploying sophisticated microservices applications.

Data inconsistency: Ensuring data consistency across microservices can be challenging. This is particularly true for applications that handle real-time data. For applications where accurate data exchange is critical, microservices should be designed to update and draw data from a shared repository.

7. Conclusion

Monolithic applications are poor at keeping up with the dynamic nature of the healthcare sector. These applications are not scalable, lack flexibility and are difficult to maintain. Microservices architecture addresses these weaknesses. The architecture permits the construction of highly scalable, easily maintainable, reliable and flexible applications. These features make microservices applications ideal for the ever-evolving healthcare landscape. However, as healthcare organizations assimilate microservices architecture, they must invest in necessary IT infrastructure to support the applications and use system designs that facilitate consistent data flow in microservices.

8. References

1. Zaki J, Islam SR, Alghamdi NS, Abdullah-Al-Wadud M, Kwak KS. Introducing cloud-assisted micro-service-based software development framework for healthcare systems. IEEE Access 2022;10:33332-33348.
2. Zaki J, Islam SR, Alghamdi NS, Abdullah-Al-Wadud M, Kwak KS. Introducing cloud-assisted micro-service-based software development framework for healthcare systems. IEEE Access 2022;10:33332-33348.
3. <https://medium.com/@Larisa10/introduction-to-healthcare-microservices-architecture-d81badc0949f>