



IT Architecture in eCommerce

A Recipe for Success: How Design
Patterns Can Take You to the Next Level



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TL;DR

As eCommerce businesses grow and evolve, so do their IT systems. But without the right strategy, this evolution can result in a tangled web of technology that is ill-equipped to

handle the demands of modern commerce. To stay ahead of the pack, you need a strategically designed IT architecture that can support your business in reaching its goals.

- ✓ IT business alignment is your key to success.
- ✓ Every IT architecture is unique and beautiful, as long as it serves your business.
- ✓ Headless eCommerce software is a great foundation for a reliable, flexible IT architecture.
- ✓ Focusing on a composable, API-led approach provides you with ultimate scalability.
- ✓ Utilize architecture design to tackle common problems.

In this whitepaper, we'll take a closer look at why choosing the right architecture design patterns can help you solve some of the most pressing challenges eCommerce businesses face today.

Introduction

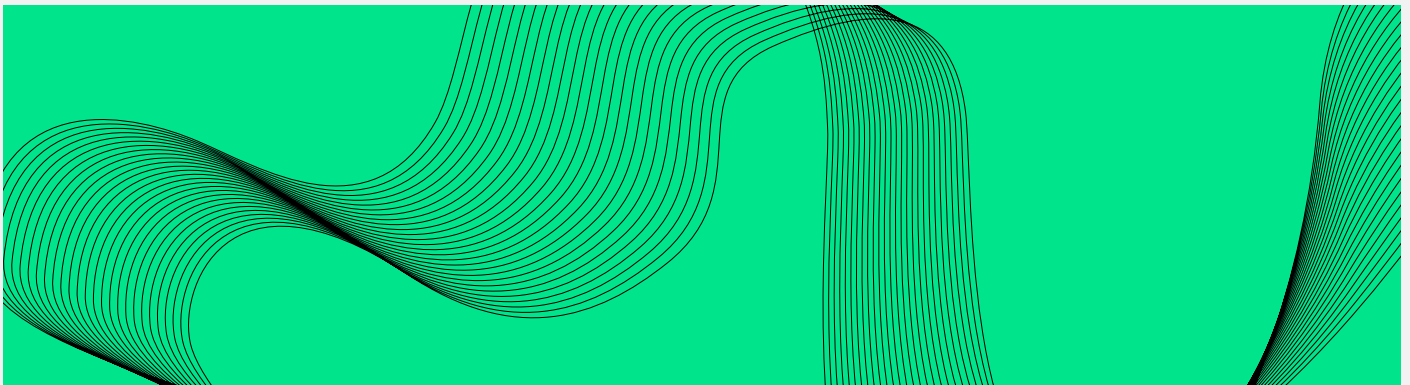
eCommerce is growing at an incredible pace worldwide. According to Statista, "**revenue is expected to show an annual growth rate (CAGR 2023-2027) of 11.51%**". This growth is a major opportunity for businesses to increase their online presence and reach more customers. But we also need to bear in mind that customer expectations have changed dramatically and grown far more complex in the last few years. To stay ahead of the pack, businesses need to offer an exceptional customer experience and seamless customer journey. For that to be possible, they need the right IT architecture.

For many eCommerce businesses, their IT architecture has grown up along with their business, increasing in complexity each step

of the way. As new applications and systems become necessary, they are integrated into the existing architecture – often on top of the existing systems. The result is a tangle of IT dependencies that make the entire system inefficient, slow, and error-prone.

The premise behind a system's architecture is quite simple. An IT system needs to function as a unified whole, with fully integrated components that work together seamlessly. Turning this theory into reality, however, requires thoughtfully designed IT architecture and carefully chosen architecture patterns.

In this white paper, we'll introduce IT architecture and design patterns that enable eCommerce growth.



➔ The Basics: What is IT Architecture?

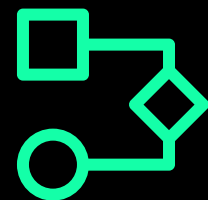
Every one of your customers' actions generates data. For your business to successfully reach its goals, this data needs to be efficiently processed, analyzed, exchanged, synchronized, and used in a variety of ways. For that to be possible, the various IT systems in your business need to work in harmony with one another. That's where IT Architecture comes into play.

IT architecture refers to the plan that outlines the logical and physical connections between the various components of a computing system. It defines hardware, software, access methods, and protocols utilized by it. The IT architecture also serves as a blueprint that sets the standards for constructing new systems and defines the mechanisms through which individual components collaborate.

A. The Importance of the Right Fit

The design of the IT architecture, and which structures it actually contains, can vary wildly from business to business. The term "IT

architecture" encompasses many different elements, and each individual architecture is based on the expertise and knowledge of the enterprise architects. There is really no "right" or "wrong" IT architecture. However, there are indeed suitable and unsuitable architectures for different business objectives. The goal is to find the most suitable structure that will achieve the best return on investment and be able to grow sustainably to meet future challenges.



Dennis Poteski, Senior Solution Architect at SCAYLE, explains:

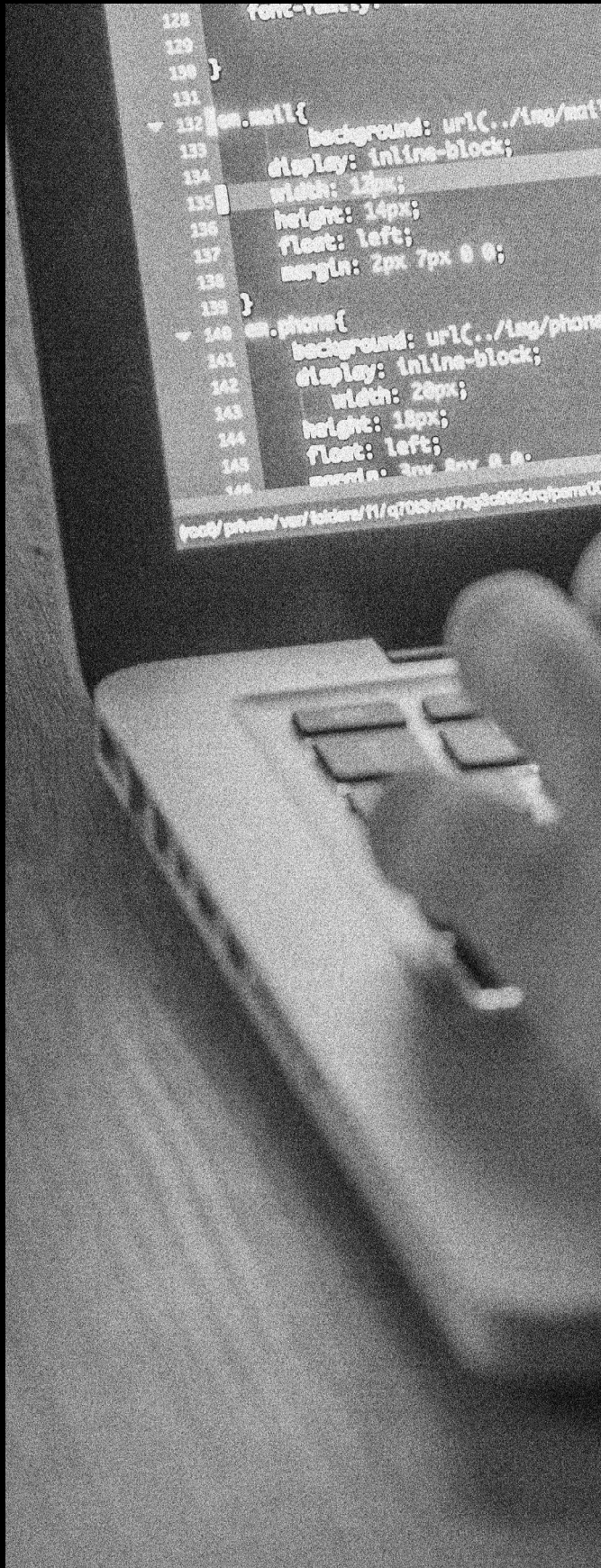


“The most important thing is for a company to have an architecture that is actually planned out. It is essential that the components work together rather than getting in each other’s way – all the elements of the system should complement each other and be able to grow along with the needs of the company and its customers. New functions – and the components required to implement them – must fit into the existing architecture seamlessly, improve the company’s business processes and drive them forward.”

Dennis Poteski
Senior Solution Architect
SCAYLE



The IT architecture takes the individual components that exist alongside each other and unites them, creating a cohesive whole that is larger than the sum of its parts.



B. IT Business Alignment Is Crucial

In this context, you can see why aligning IT with the business is a crucial process. The business's IT systems are not ends in themselves – they must serve as a foundation that allows your business to reach its objectives, such as improved financial performance, expanded market share, or other KPIs.

For a business to succeed, it is essential that IT systems are seamlessly integrated into business processes. Careful alignment of business and IT strategy allows your business to use technology more effectively and, ultimately, increases value creation. Suitable IT architecture ensures that the different systems within your business work together effectively.



IT Architecture in eCommerce: Staying Ahead of the Curve

In the world of eCommerce, there is no touchpoint or process that doesn't leave a digital trail. It starts with importing product data, continues on to managing the webshop data and customer orders, and moves on to re-ordering new products. And it doesn't end there.

A. Meeting Customers' Demands in a Fast-Paced World

In the fast-paced world of modern eCommerce, customers expect a fully optimized, efficient online shopping

experience. Omnichannel is king, and business-as-usual is no longer enough. Retailers and brands not only need to be present on multiple channels, but the channels need to be fully integrated. The goal is to create a seamless customer journey, so you can reach your customers wherever they happen to be.

The shifting landscape of eCommerce means that new, modern applications must often be integrated into legacy IT infrastructures and connected to older applications. With an unsuitable IT architecture, these "generation gaps" often result in unstable connections, suboptimal interfaces (APIs), and systems that are out of sync. This can cause a lot of problems for your business, such as slow

website loading times, problems during the ordering process, and information loss due to data silos.

If your business is limping along with outdated software, you could be losing out on revenue, and, ultimately, it can mean that you won't be able to keep pace with your competitors.

The right IT architecture for your eCommerce business isn't just "nice to have". It's a "must-have".

B. Headless Commerce: Modern Architecture for Modern eCommerce Businesses

eCommerce can quickly push traditional IT systems and their architectures to their limits. These systems are often too monolithic and inflexible to cope with the demands of eCommerce. Scaling them can be expensive, time-consuming, and complex. For this reason,

more and more eCommerce businesses are switching to a headless architecture. Headless systems are designed to provide you with the ultimate flexibility and scalability. Back end and front end are decoupled, which allows businesses to adapt and expand their functionality more easily.

Modern systems like SCAYLE's that combine their headless architecture with a composable approach take this one step further by modularizing the codebase into small, reusable components. This makes it easier to develop complex websites quickly and efficiently.

Using a variety of different technologies and components for processes such as product management, searches, or checkout, allows you to plan and build an architecture tailored to your needs. Moreover, these individual components can be scaled much more efficiently and easily than in a tightly-knit monolithic software architecture. Having powerful APIs in place is especially important, as they ensure efficient, stable data transfer between the different components in your IT system.

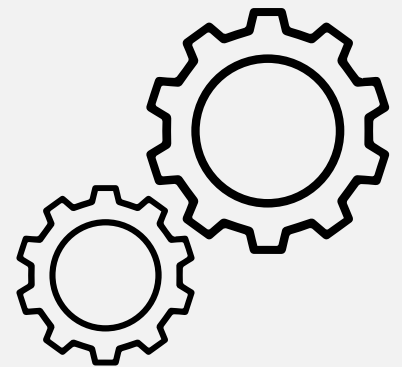
Paul Brejla, Senior IT Solution Architect at SCAYLE, points out some of the benefits for eCommerce businesses:

“A headless architecture makes it possible to implement beneficial new systems, touchpoints, and features quickly. The well-structured APIs allow new applications to be connected easily with the existing components so that they all work together perfectly. This allows businesses to expand rapidly to international markets, manage logistics effectively even with global deliveries, and offer localized customer experiences and customer service. Businesses like Marc O’Polo, FC Bayern, Fielmann, Deichmann, and DEPOT, as well as hundreds of other online shops, are already benefiting from this approach.”



Paul Brejla

Senior IT Solution Architect
SCAYLE



➔ Architecture Patterns in eCommerce: Using Blueprints

As mentioned, there isn't one perfect architecture suitable for every business. Instead, IT architecture comes in many different forms known as architecture patterns. An architecture pattern is a general, reusable solution to a common software problem. Patterns differ from one another in terms of their functions and attributes, making each suitable for unique use cases.

There are countless types of architecture patterns, but they all share a common goal: to provide a blueprint for designing and building software applications. Each pattern comes with its own advantages and disadvantages, strengths and weaknesses. By skillfully combining different architectural patterns, your company can leverage the strengths and benefits of certain patterns while minimizing or nearly eliminating the disadvantages.

In this section, we give two examples of how typical problems in eCommerce could be solved thanks to the use of exemplary architecture patterns.

Example #1: Slow Back End Performance

Our expert Dennis describes an issue that SCAYLE often sees: "At SCAYLE, we frequently get inquiries from businesses that need help because their back end is no longer able to process data quickly enough. This happens most commonly when businesses grow quickly and their IT systems can't keep pace. Especially when the product range has expanded rapidly, the result is that product imports take far too long or even begin to crash. The system is overloaded and can't display the products on the front end quickly enough." There can be many reasons for this lack of performance.

SCAYLE's headless Commerce Engine uses a variety of architecture patterns to counteract the performance problems that many rapidly growing eCommerce retailers face. One possible solution is **command**

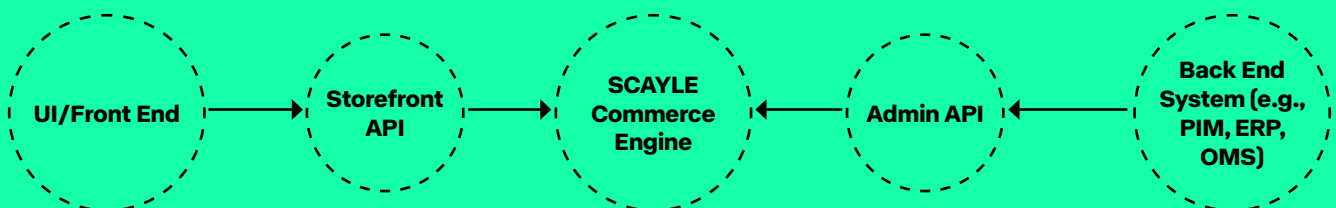
query responsibility segregation (CQRS). This pattern segregates operations that read data from those that write data.

There are many benefits to using the CQRS pattern in eCommerce applications. It can improve performance and scalability by allowing data operations to be processed independently. It can also simplify development and testing by decoupling the back end domain model from the shop front end. As a result, CQRS can increase system flexibility, allowing businesses to adapt to changing requirements. It also helps to avoid the issue of update commands causing domain level merge conflicts.



Command Query Responsibility Segregation (CQRS)

Possible Setup



As Dennis explains: “SCAYLE, for example, is designed so that the Storefront API is optimized to perform mostly read operation, while the Admin API is optimized for mostly write operations. This type of CQRS pattern is frequently seen in composable systems architectures, as different containers can

be used to better segregate the functions.” However, CQRS does make it more difficult to run queries that use data from multiple services. This model is capable of handling complex validation and business logic on the write-side, but this might also lead to the model becoming extremely complex.

A. Pros and Cons of the CQRS Pattern



- + CQRS makes it possible to scale the read and write workloads independently which results in much higher performance.
- + A schema that is optimized for queries can be used for the read-side, while a schema that is optimized for updates is used for the write-side.
- + CQRS can make it easier to ensure that only the appropriate domain entities update the data.
- + Having the read-side and write-side separated provides more flexibility, is easier to maintain, and can reduce merge conflicts.
- + Saving a materialized view in the read database can prevent complex joins when querying.



- In principle, CQRS is quite simple, but it can ultimately result in a complex application design.
- Messaging is not actually required for CQRS, but it is typically used to process commands and publish updates. When it is used, the application will need to cope with messaging errors or duplicated messages.
- If the read-database and write-databases are segregated from one another, there is a risk that the data accessed by a query could be outdated. The read-database must be updated regularly to reflect changes made to the write-database.
- It may be difficult to tell if a user has made a request based on outdated read data.

As you can see, CQRS – like most architecture patterns – comes with a lot of advantages but is not without its disadvantages. The CQRS pattern is one of many possible solutions for slow back-end performance.

Example #2: Scalability Problems in Databases

If an eCommerce business grows rapidly, the databases will, of course, grow along with it. The problem is that many database engines don't scale well and, at a certain point, are unable to provide sufficient performance.

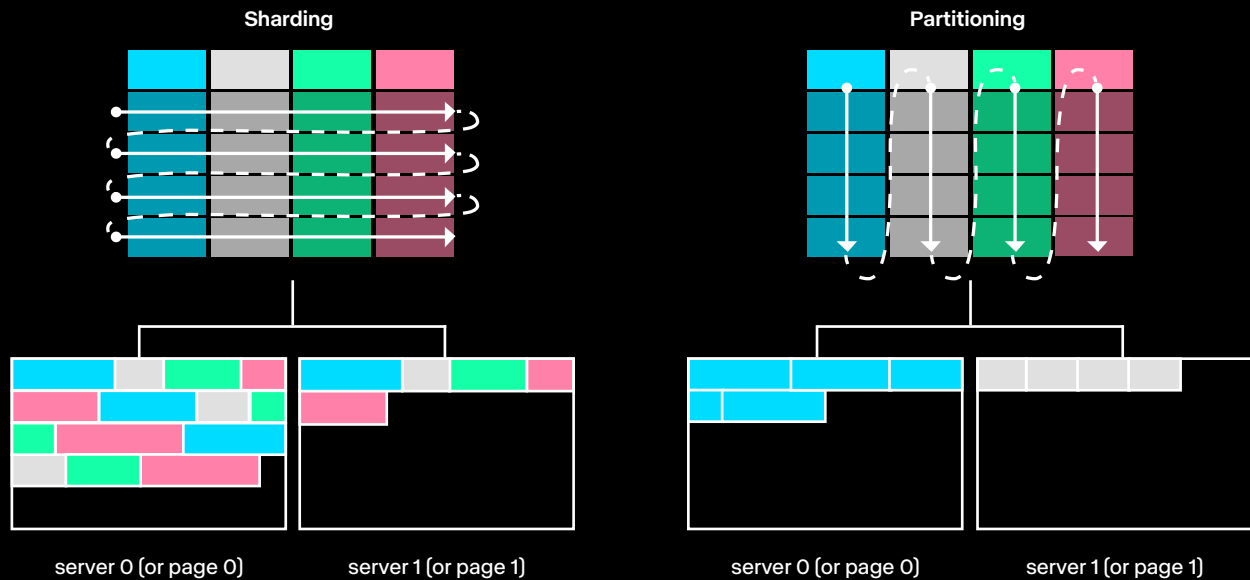
In particular, relational databases such as MySQL quickly reach their limits. As soon as a database grows beyond a certain size, its performance declines rapidly. Conflicts can occur between the different write operations and, in some cases, the database could even crash. On top of that, backups grow ever-larger and take more and more time to complete. The result is that it becomes totally impractical to maintain the fall-back strategy. So what now?

If you've done research on "scalable database architecture", you've probably come across

the terms **sharding** and **partitioning**. These two patterns describe different methods of breaking large data sets down into smaller subsets. Sharding is typically used for horizontal scaling (adding additional capacity), while partitioning is used for vertical scaling (adding more power to existing nodes). Partitions can be used within a single database instance, while shards are divided across multiple database instances. Both methods can be used to improve performance, but sharding is generally considered to be more effective. Partitioning is often used when there is a limited amount of space available, while sharding is more commonly used when there is an unlimited amount of space available.



Sharding vs. Partitioning





A. Pros and Cons of Sharding

- + Sharding is ideal for large enterprise applications that are distributed across multiple databases.
- + Commands and queries can be carried out quickly.
- + Sharding can be used for controlled scaling of existing infrastructure.

- Sharding requires administrators to have a certain level of expertise in order to manage the sharding segmentation correctly.
- If data is stored in a large number of physical locations, sharding will result in increased data traffic between the locations.
- Not all database technology is well-suited to the use of sharding.
- Additional hardware requires greater investments in IT infrastructure.

B. Pros and Cons of Partitioning

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- + Splitting data across multiple servers can reduce the risks caused by having a single point of failure.
 - + There are different partitioning strategies that allow flexible partitioning for different use cases: horizontal, vertical, or functional partitioning.
 - + Data partitioning can be a good choice for both large and small data stores, particularly when they need to be accessed by a large number of clients.
 - + Partitioning data can help reduce conflicts as well as improve performance.
 - + Data partitioning is a common strategy that uses multiple databases to store large data sets. It can also be used with data sets that need to be accessed with more frequency than a single database can manage.

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- As the system continues to grow and develop, it may be necessary to refine the partitioning strategy, which can be a complex task.
 - Partitioning increases an application's complexity.
 - The partitions need to be designed so that the data is distributed correctly to prevent an unbalanced workload.

Both sharding and partitioning have their pros and cons. Which one is better? The answer is completely dependent on your unique business processes and goals. The important part is knowing these patterns and understanding their pros and cons to make an informed decision for your organization.



In a Nutshell: Solutions Architecture in eCommerce

A common problem in eCommerce businesses is that the IT structures grow organically over time, becoming more and more complex as the business changes. Implementing an optimized and thoughtfully designed IT architecture can help to alleviate many of the problems that eCommerce businesses commonly experience.

A huge variety of different architecture patterns are available to help your businesses make their IT systems more stable and powerful. These systems need to be as scalable and flexible as possible in order to keep up with growth and new demands.

Headless systems that are built with a composable, API-first approach make it possible to scale the system's individual components and offer a greater level of flexibility when integrating new services and applications. This approach lets companies save resources while simultaneously increasing efficiency.

To make this a reality, it is essential that your business's overall goals are fully aligned with its IT investments. This ensures that all parties and departments are working towards the same goals and that resources can be used efficiently. Prioritizing IT-business alignment will set you up for success.

Are you ready to take your business to the next level with a modern IT architecture?

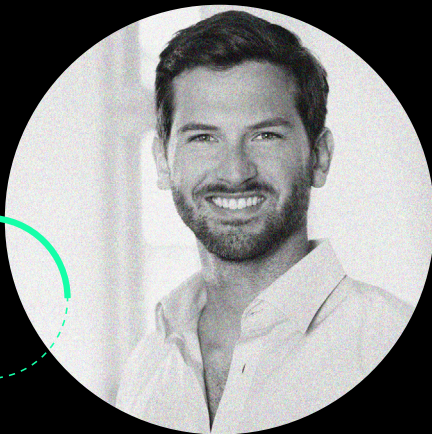
Our team of experts is ready to help you develop and implement the right solution for your business. We'll work with you closely to understand your challenges and goals, and create a plan that will meet your specific needs. SCAYLE your business with us – let's talk.



Contact

SCAYLE is a flexible B2C SaaS enterprise shop system built on a headless and API-first architecture. An extensive feature set, including PIM, Shop Management, Checkout, and OMS, is combined with an intuitive UI. Brands and retailers use SCAYLE to stay on track with fast-changing market developments and to drive differentiation in commerce.

SCAYLE GmbH is a member of the ABOUT YOU Group and unites modern technology with a unique retail DNA. Leading brands like Deichmann, s.Oliver, Fielmann, FC Bayern, Marc O'Polo, and DEPOT choose SCAYLE's Commerce Engine. Managing directors are Christopher Metz, René Dalock, Sergio Sola, and Tobias Ring.



Rico Adler

Head of Solution Consulting
SCAYLE - Commerce Engine



Tobias Ring

Managing Director Commercials
SCAYLE - Commerce Engine