Online Pharmacies

The Pandemic Response for Web Performance

Baqend

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> Loading times are as stressful as watching a **horror movie**!

Ericsson ConsumerLab

Neurons Inc., 2015

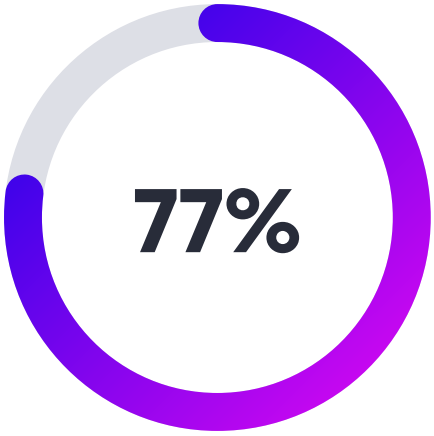
01 Web performance is becoming a priority

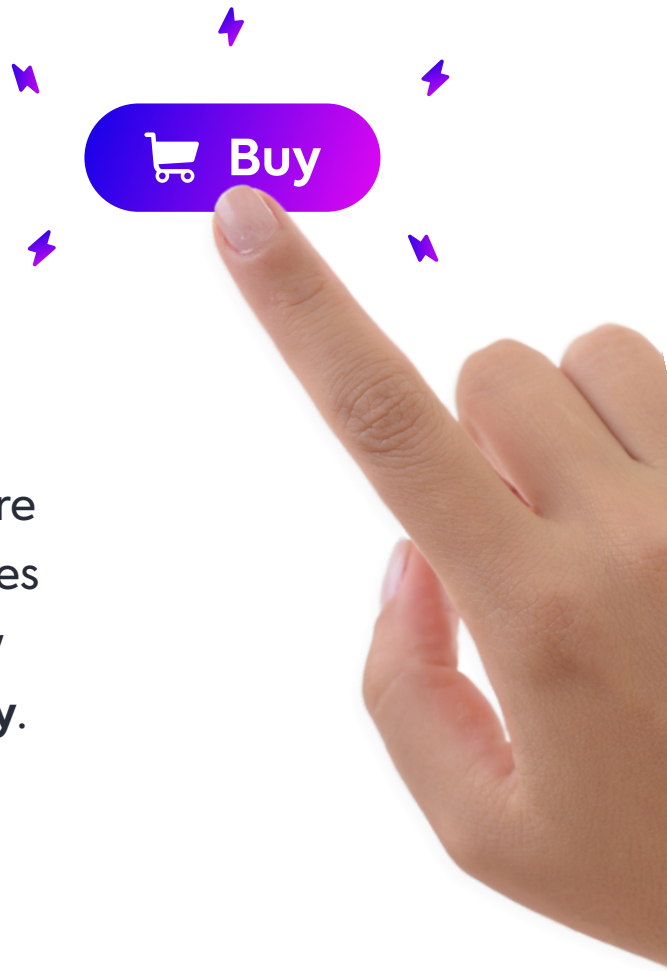
Fast page load times are critical for user satisfaction and therefore business success. This undisputed fact has not only driven technical innovation over the last decade, but has also steadily increased user expectations in terms of speed and pleasantness. The development is particularly eminent in e-commerce where page load times well below one second are the norm rather than the exception. But the same trend is visible in other verticals such as fashion and consumers electronics: The higher the online maturity of an industry, the better the loading time performance of online stores.

> Amazon.com outpaces the online pharmacy competition with a **2-3x faster** experience.

Since the pharmacy business has been dominated by physical transactions, though, web performance has not been a priority so far: The average online pharmacy shop loads 2 to 3 times slower than e-commerce leader Amazon. But the online share of German pharmacy business has increased steadily and the recent pandemic even accelerated this trend. As illustrated by Amazon PillPack in the US, big players of the e-commerce industry may eventually enter the pharmacy market and thereby raise the bar for site speed and user experience (UX).

To stay competitive with this new kind of ultra-fast marketplace, traditional online pharmacies need to catch up to the e-commerce leaders in terms of UX and site speed.





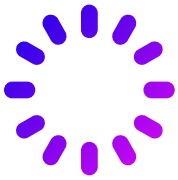
of smartphone shoppers are more likely to purchase from companies whose mobile sites or apps allow them to **make purchases quickly**.

Think with Google
Playbook Omnibus 2019

> Perceived loading times depend massively on the **user** and his or her **situation**.

Young users under 24 and **iOS-users** react more sensitive to slow websites.

Think Fast, The 2019 Page Speed Report, 2019



Users can hardly distinguish **slow** websites from **broken** websites.

Performance Matters, Akamai, 2014

44% of users perceive loading times as slower **when under stress**.

Speed Matters, Google, 2017

Page load delays of over 1 second trigger a **mental context switch**.

Jakob Nielsen, Usability Engineering, 1994

In this white paper, we examine the status quo of the online pharmacy market with respect to technology and business models and identify web performance as one of the major challenges for the German e-pharmacy market: In a technical analysis of the German online pharmacy market, we find that none of the German online pharmacies can compete with the speed of e-commerce leaders like Amazon today. To address this issue, we present a comprehensive checklist of action points to make legacy tech stacks future-proof.

02 Market overview & growth drivers

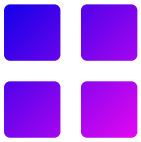
In Germany, pharmacies have the legal mandate to ensure the supply of medicines to the population. This concerns each individual pharmacy, but also the nationwide overall distribution of pharmacies throughout Germany. In addition to the supply of ready-to-use drugs and medicines, pharmacies also fulfill duties in the public interest, such as night and emergency services or the preparation of prescriptions.

The German online pharmacy market is strictly regulated by the government, so that only local pharmacies with an official mail-order license and high quality assurance standards are allowed to ship drugs to consumers. Prescription drugs may further only be shipped to Germany from either the Netherlands, Great Britain, Sweden or Iceland, because only these countries have been certified as having comparable safety standards. Because of this tight regulation, less than 3,000 of the almost 20,000 local pharmacies in Germany have a mail-order license, and only 150 operate websites with an online dispatch service which can be found by search engines.

> The business model is **under structural pressure**.

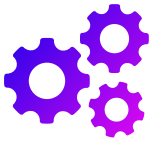
The range of products offered by online pharmacies can be described as objectively homogeneous. All providers offer largely similar, if not the same assortments, brands, products and functional offers. They are faced with the major task of setting themselves apart from the competition and stand out to customers within the regulatory framework outlined above.

Pivotal success factors of online pharmacies are the range of products, availability, price, convenience, service, and user experience. For this reason, the leading online pharmacies consider different means for developing their own business models such as expanding their product ranges to include additional categories (food, personal care, toys, hobbies & DIY, etc.), the introduction of private labels, the transformation into a marketplace (for manufacturers and retailers), an extended offering of additional services (such as medical consultation), and the optimization of their internal business processes (especially logistic) as well as customer experience.



Additional **customer services**

Marketplace **transformation**



Optimization of **internal processes**

Better **customer experience**

Website performance plays a critical role in customer experience and therefore online purchasing behavior: On the one hand, customers seem to care about fast page loads as they actively invest in good performance through modern smartphones and high-bandwidth internet connections. On the other hand, customers have also gotten used to the very high standards of performance and UX set by e-commerce leaders and therefore typically flock to the fastest providers when shopping online.

The market share of online pharmacies in the overall prescription drugs business is approximately 2%, with a share in OTC and non-prescription drugs of approximately 17%. The main business of online

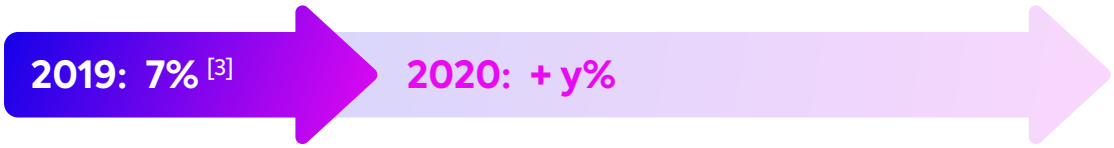
pharmacies thus revolves around over-the-counter (OTC) and non-medical products, while on-site pharmacy sales focus on prescription drugs. Due to the prevalence and high level of transparency of OTC products, the price is one of the critical criteria when buying in an online pharmacy.

The Corona Pandemic has led to a significant increase in demand from online pharmacies since March 2020. Some providers even had to temporarily stop accepting further orders, as their processes were no longer able to cope with the onslaught of customers or order volumes. The surge in demand temporarily led to far-reaching reductions in discounts and even to price increases for standard products. In view of the latent dangers posed by the advancing pandemic, experts predict that the market shares of OTC and non-pharmaceutical products could even shift up to 30% in favor of online providers by the end of 2020 [1].

> Overnight, the COVID-19 pandemic has accelerated the channel shift in the online pharmacy market by a **factor of 10x**. In 2020, the online pharmacy market will exceed the growth rates of the total e-commerce for the first time.
>
> *Fabian Moritz, Managing Director WEFRA LIFE CORPORATE GmbH*

Total e-commerce growth:

Online pharmacies growth:



[1] https://www.apotheke-adhoc.de/nachrichten/detail/coronavirus/versandapotheken-ueberforderte-gewinner-corona-effekt-im-apothekenmarkt/

[2] Verbraucherbefragung "Interaktiver Handel in Deutschland" 2019, bevh

[3] DIE APOTHEKE – ZAHLEN, DATEN, FAKTEN 2020, ABDA

Technologies of online pharmacies

With onsite user experience being one of the key factors to differentiate in an increasingly competitive market, the underlying technology stack becomes a primary factor for differentiation as well. There are 3 clearly distinguishable architectural patterns in German online pharmacies today: First, there are generic e-commerce shop systems that have been modified to fit the online pharmacy use case. Second, there are shop systems that have been built specifically for the online pharmacy business. And third, there are fully customized deployments that have been created from scratch.

Generic shop system

A number of vendors have developed very mature and highly scalable e-commerce products which are being used by thousands of different companies in their online shops. The range of offerings spans from rather inexpensive and generic solutions to full-scale enterprise implementations which are being used by some of the largest e-commerce sites in the world. While not specialized in pharmacies, e-commerce shop system vendors have a lot of expertise in scalability, ERP integrations, personalization, and other needs related to managing an online shop. But while the e-commerce platforms can be optimized on various levels depending on the strategy and budget of the business owner, every additional customization in the backend also increases the need for additional platform specific technical expertise. Front-end performance optimization is further often subject to certain limitations, depending on the concrete shop system.

Specialized e-pharmacy shop system

In part due to the above-mentioned market regulations, customizing e-commerce systems according to the requirements of an online pharmacy business can be challenging. A number of companies therefore offer specialized systems that closely reflect the specific enterprise resource planning (ERP), ordering, and delivery processes established in German e-pharmacies. Their expertise allows them to streamline the actual implementation phase, fulfill all the individual needs, and thus enable a very quick go-to-market. The advantage of such a managed and industry-tailored solution thus obviously lies with an ease of operation. Similar to managed e-commerce systems, managed e-pharmacy systems only provide limited options for front-end optimizations and typically limited scalability in the backend.

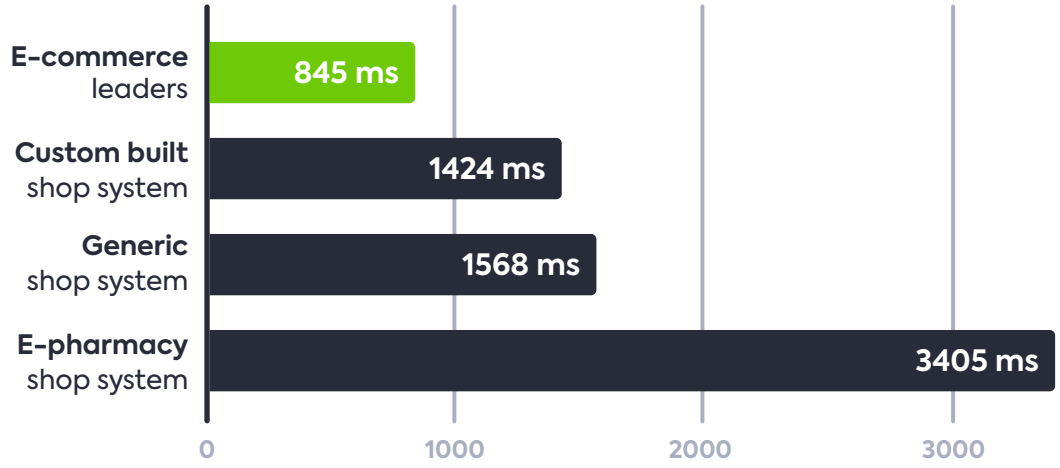
Custom built shop system

Technically, the most challenging approach with the slowest go-to-market is developing and operating a customized solution. Most industry leaders have taken that route and have thus made a cutting-edge IT infrastructure one of their core competencies. While systems in this category offer the highest flexibility, they are also associated with the highest total cost of ownership (TCO) compared with the other categories. There are no limits to backend scalability and front-end optimizations, but mileage varies dramatically depending on the concrete architecture and the amount of technical debt.

	Custom built shop system	**Generic** shop system	**E-pharmacy** shop system
Flexibility and customization	⊕⊕⊕	⊕	⊖
Total cost of ownership	⊖⊖⊖	⊕	⊕⊕
Implementation complexity	⊖⊖⊖	⊖	⊕⊕⊕
Scalability and performance	⊕ / ⊖	⊕	⊖⊖⊖

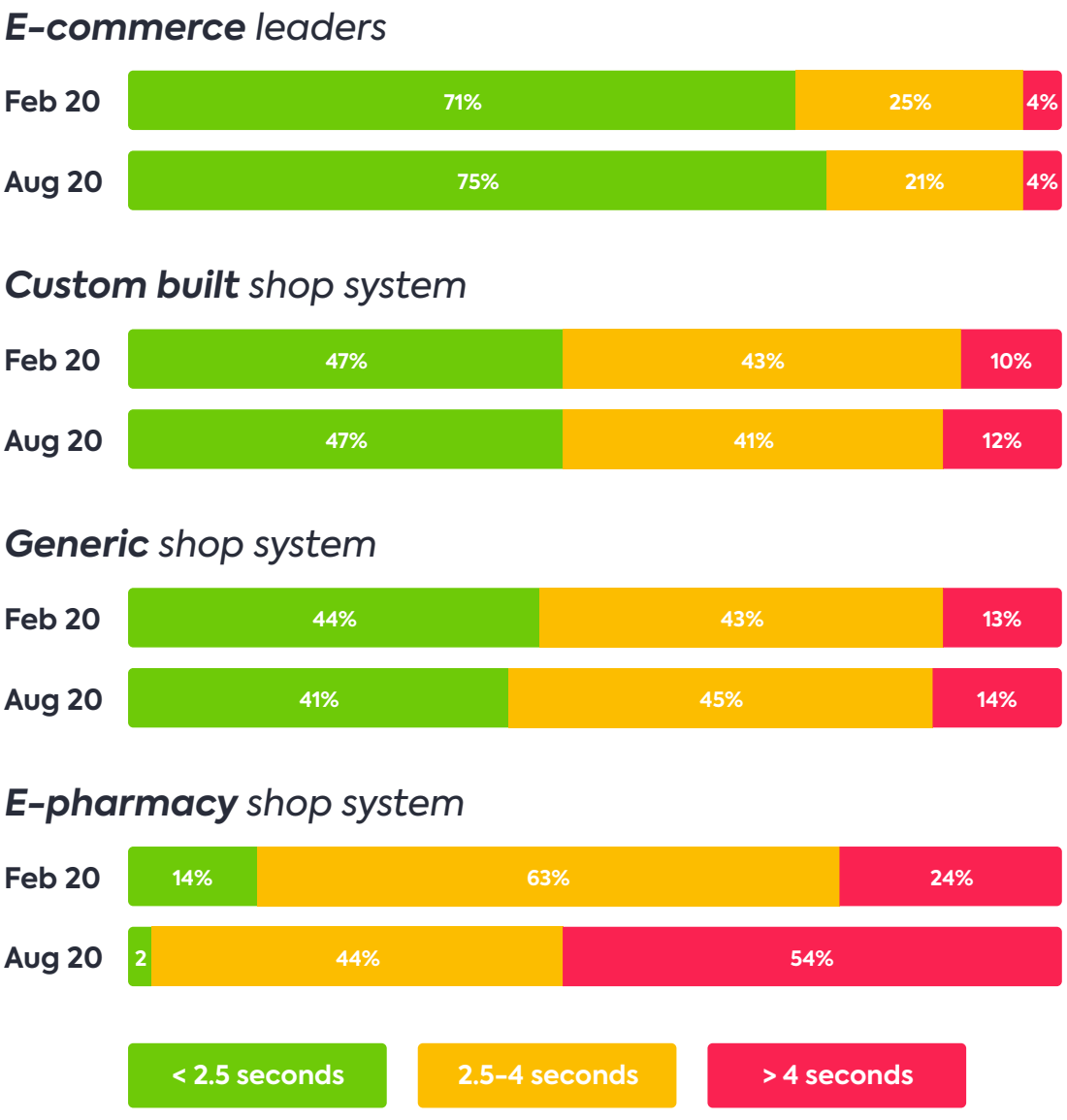
❞ Customers expect equally fast loading times like e-commerce leaders **Amazon, OTTO and Zalando**.

***First Contentful Paint** (ms) in August 2020:*



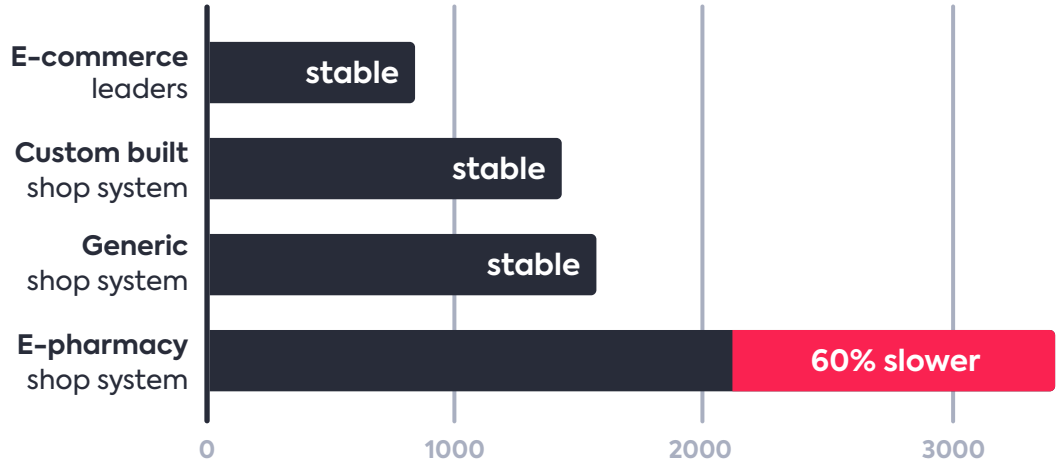
Loading times have a significant impact on user experience and therefore on the success of any online business model. To help service providers understand the impact of site speed, Google defined the core Web Vitals as a benchmark that combines multiple performance indicators. **Dominik Woeber, Head of Web & App Solutions at Google Germany**, says: „The recently launched 'Core Web Vitals' initiative provides foundational, user-centric metrics for better website performance. Measuring and optimizing Core Web Vitals help to (1) close website performance gaps, (2) better position themselves among leading e-commerce players, and (3) grow conversion rates and drive business growth." In fact, Google has announced that slower websites will be ranked down in Google search compared to faster websites. This means that a slow website is penalized twice, since fewer users find their way through Google onto the website and users are more likely to abandon the site due to bad user experience. Google publishes data on real-user performance metrics in the Chrome User Experience Report (CrUX) to capture how actual users perceive page load times and UX in the web. As such, the CrUX report is a valuable resource for business owners in itself. Since it is used as an influencing factor in the SEO ranking by Google, website performance according to CrUX data is even objectively marketing-relevant.

CrUX performance is often summarized in bar charts that distinguish between great, tolerable, and bad user experience (respectively green, orange, and red). Using this style of presentation is a good way to illustrate how many website users are satisfied with the online experience (green) and how many of them are likely to leave in frustration (orange and red): The CrUX data clearly shows that the top-50 traffic-heaviest online pharmacies in Germany do not satisfy the high expectations set by the current e-commerce leaders (amazon.de, ebay.de, otto.de). While custom-built e-pharmacy systems perform slightly better than the rest, all of today's online pharmacy systems are way behind in terms of web performance when held against the industry leaders.



> Online pharmacies with e-pharmacy shop systems are **significantly slower since COVID-19**.

***First Contentful Paint** (ms) since January 2020:*

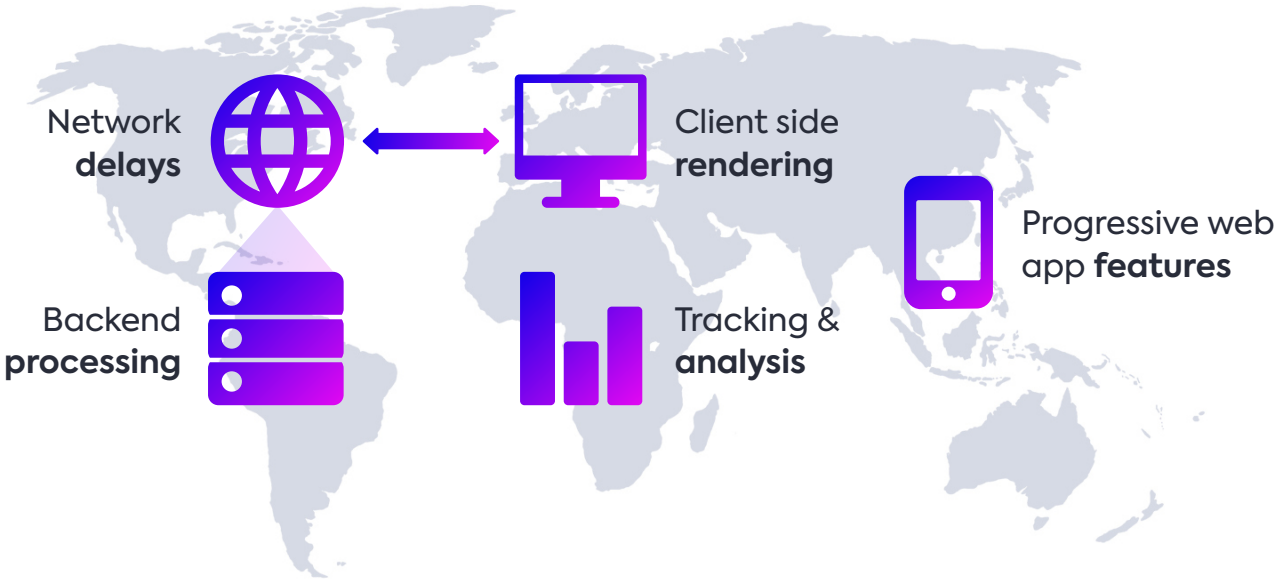


The situation is particularly dire for the online pharmacies using specialized e-pharmacy systems. Page load times have been getting slower consistently from January (pre-COVID) until August 2020: Especially sites using specialized e-pharmacy solutions have decelerated by more than 1.2s or 60%, while all the other categories have displayed relatively stable performance. The relevant set of online pharmacies in the German market shows a broad range of website loading speeds. Interestingly, even large players of the market like DocMorris are struggling with page load speeds. Since Google takes the website performance into account regarding the search rankings, though, this might very well significantly diminish the overall SEO achievements resulting in much lower efficiency of SEA spendings.

Even the fastest German online pharmacies are lagging behind the fast loading speeds that consumers have become used to. The entire online pharmacy industry is in a race to catch up with the high quality of user experience that e-commerce giants like Amazon have made the de facto standard.

03 Challenges of web performance

In theory, loading a website may seem like a simple task: In a nutshell, the customer's browser sends a data request to the web server and the web server assembles the requested data and then sends it back. In practice, however, loading a website is actually a very complex task – and loading a website fast even more so. There are 5 specific challenges you need to tackle in order to provide a smooth experience for your customers.



For starters, **1) backend processing** is very expensive for modern websites, because content is often personalized and therefore custom-made for every individual user. Users are further geographically distributed from the Web server or on a weak mobile connection, so that **2) network delays** become a bottleneck of their own. But delivering data fast is only half the rent as **3) client side rendering** within the browser is required to create visuals from the

received data packets. Progressive Web Apps (PWAs) are particularly appealing to the ever-growing mobile audience, but **4) PWA features** are simply not available for the majority of shop systems in use today. A final and often overlooked aspect of fast page loads is **5) tracking & analysis** of Web performance which is simply required to monitor customer experience. To make sure that your website loads fast for every customer, you need to tackle all of the above challenges simultaneously.

1) Scalable backend processing

The server response time or Time To First Byte (TTFB) is the pivotal metric for **server stack efficiency** as it represents a lower bound for (and usually corresponds with) page load time: The smaller, the better. On the server side, a minimal TTFB can be facilitated through efficient code and processing requests in parallel instead of sequentially. In a distributed backend, it is further recommended to optimize database calls for low latency and minimize shared state to avoid coordination where possible. The storage system further needs to be designed in such a way that sustainable load grows with the number of machines in the cluster. In practice, **horizontal scalability** is often achieved by combining a sharded database with (mostly) stateless application servers. In order to make sure that client requests are actually spread evenly across all machines, effective load balancing has to be implemented. To further achieve **high availability** in the presence of machine outages or network partitions, data is often replicated to several places by the backend itself or via a content delivery network (CDN).

2) Full-stack network optimization

With about 100 requests for an average website, efficient networking is critical for achieving fast page load times. To reduce networking overhead, it is not only necessary to accelerate every individual access operation, but also to **optimize the entire protocol stack**.

While the HTTP, TLS, and TCP layers abstract from the complexities of the respective layers below, understanding how each of them works and how they depend on one another is critical to avoid bottlenecks. For example, TLS packet size needs to be aligned with the TCP congestion window to avoid latency hiccups for encrypted HTTP traffic. As another example, persistent TCP connections should be used wherever possible to max out bandwidth despite TCP slow-start. **CDN caching** is a means to bring data closer to the accessing clients and thus minimize request latency for static assets: While caching the HTML file has the biggest impact on performance, it is also the most difficult as it is personalized to the individual users. Another leverage to increase networking performance is choosing the latest version of HTTP: Compared with its predecessor, **HTTP/2** provides several optimizations out-of-the-box, e.g. multiplexing for increased concurrency or header compression to get the most out of the available bandwidth. Advanced features like server push or stream prioritization, however, require some effort on the client or server side. Some HTTP/1.1 best practices are HTTP/2 anti-patterns (video) and should therefore be avoided: Domain sharding, for instance, was an effective way to overcome the limited concurrency of HTTP/1.1 by loading resources over different connections in parallel. With version HTTP/2, using a single connection is actually much faster.

3) Efficient frontend design

The key principle of frontend optimization is to make the browser's life as easy as possible by avoiding necessary work and streamlining what needs to be done. To **minimize page weight**, it is essential to remove nonessential artifacts (e.g. unused HTML, and dispensable scripts or stylesheets) and to minify or compress all remaining resources to improve bandwidth efficiency. Once the dead freight has been removed, the next step is to **optimize the critical rendering path (CRP)**, i.e. the sequence of actions necessary to render the page. The CRP should not only be as short as possible, but should also reflect the

order in which elements become visible on the page. In particular, the resources needed to display the above-the-fold (i.e. the immediately visible area) should be minimized, for example by inlining the critical CSS. Also, loading scripts asynchronously can greatly reduce the number of critical resources. **Server-side image optimization** can further reduce the amount of loaded data by resizing images at the server or CDN before they are sent to the client: Instead of transferring a high-resolution image which is then scaled down in the browser anyways, every client receives a picture that is already pixel-perfect for the given screen dimensions. When images are encoded in WebP or Progressive JPEG, the browser can even start displaying them before they are fully loaded, thus further reducing perceived waiting time.

4) Progressive web app features

Modern websites are delivered as Progressive Web Apps (PWAs) to provide advanced functionality and increased usability for the (mobile) user base. PWAs rely on the new Service Worker Web standard for executing custom code and making efficient use of both the network and client-local caches: In fact, **device caching** is one of the strong points of Progressive Web Apps as it allows loading websites from data stored within the browser – without even requesting data from the network at all. Building on both service workers and device caching, the **offline mode** displays cached content instead of an error message whenever the user loses connection (or even when the website experiences actual downtime): A website with offline mode thus appears to be blazingly fast, when a traditional website would not even be usable at all. Through **push notifications**, a PWA further allows sending messages from the server to your users. Web push can thus be used to remind users of abandoned activities and thereby increase their engagement.

5) Continuous performance monitoring

Apart from the actual optimization efforts, performance tracking and analysis is also required on different levels of the application stack to monitor the user experience and correlate it with business key performance indicators (KPIs) such as conversion rate or revenue. As mentioned in Section 2 already, the **Chrome User Experience Report (CrUX)** is a Google service to help you understand how users experience a website. CrUX captures when content is displayed (e.g. First or Last Contentful Paint) or how fast a website reacts (e.g. First Input Delay) and is based on opt-in performance tracking data collected by Chrome users. Seeing that the Google search rank of a website is partly determined on its basis, the Google CrUX report should further be considered SEO-critical. Providing an even more detailed view of performance, two weeks for **synthetic testing** generate meticulous logs of what happened during the page load. Most notably, the waterfall diagram contains timing information on when the individual resources were requested, from which domain and over what kind of connection each of them was served, and how long transmission took. Studying these data points can be the first step towards finding and resolving performance bottlenecks. To complement this information, **real-user monitoring (RUM)** collects information on the client side and sends it to the backend for further analysis. Typically collected information does not only include various timers to capture network and rendering performance, but also info on what the user clicked and how much revenue he or she generated. RUM is therefore required to evaluate not only the technical, but also the business performance of your workshop.

Speed checklist (1/2)

Scalable backend processing

- [ ] Server stack efficiency
- [ ] Horizontal scalability
- [ ] High availability

Full-stack network optimization

- [ ] Optimize entire protocol stack
- [ ] CDN caching
- [ ] HTTP/2

Efficient frontend design

- [ ] Minimize page weight
- [ ] Optimize critical rendering path
- [ ] Server-side image optimization

Speed checklist (2/2)

Progressive web app features

- ◯ Device caching
- ◯ Offline mode
- ◯ Push notifications

Continuous performance monitoring

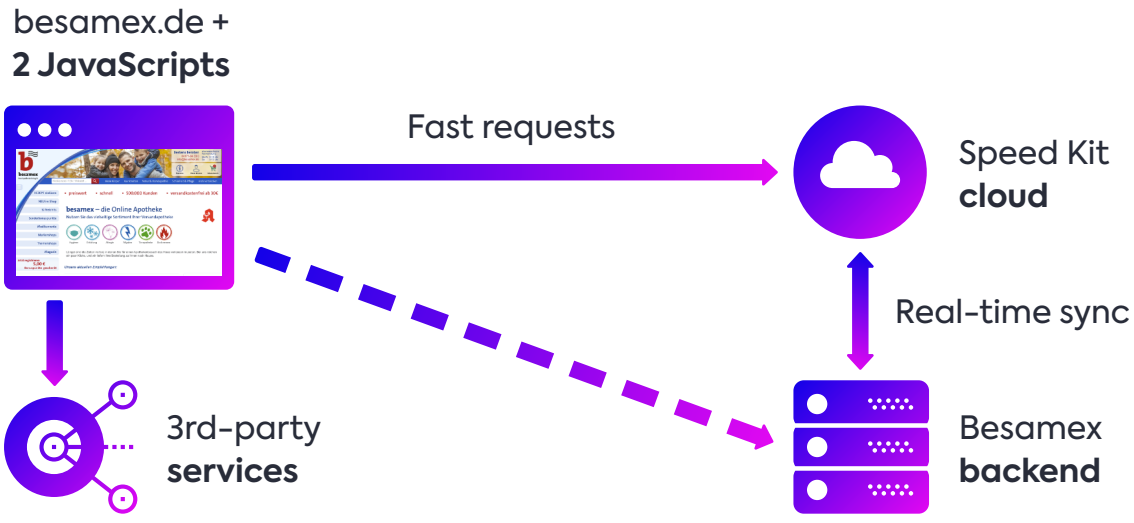
- ◯ Chrome user experience report
- ◯ Synthetic testing
- ◯ Real-user monitoring

Speed Kit – The all-in-one solution

- ✓ 1.5 – 3x page load time improvement in one week
- ✓ A/B-tested PoC with quantified performance uplift
- ✓ Improved customer experience, SEO, and bounce rate

04 Case study: Optimizing besamex.de

The conventional methods to improve website loading times as described in the previous section are all complex, time consuming, and expensive. Furthermore, investing in one of the 5 areas mentioned above is often considered a bet as the resulting performance improvements cannot be foreseen and therefore may or may not be worth the investment. A totally different approach is taken by the tool Speed Kit: As a JavaScript-based technology, it is compatible with all technology stacks and only requires small changes in the front-end, without changes to the backend. The uplift potential is further assessed in an upfront performance report by the Speed Kit team and can be confirmed with a statistically sound A/B test.



Speed Kit is a one-click solution to accelerate e-commerce websites. By rerouting a portion of the web traffic through Speed Kit's caching infrastructure, it achieves a typical performance boost between factor 1.5x and 3x. Built on innovative caching algorithms, Speed Kit

accelerates even dynamic and personalized content. Based on Service Workers, a new browser technology, Speed Kit can perform an acceleration from within the client's browser. This new technology makes Speed Kit a one-of-a-kind approach. Speed Kit is fully functional within just a few days and delivers immediate results.

Performance improvement for besamex.de

As one of the early movers of the German online pharmacy market, Besamex has been a state-licensed mail-order pharmacy since 2004. A special focus for Besamex is top-in-class service for their clients, as well as quality and product safety. A flawless user experience on the besamex.de website is a key factor in the pursuit of a great overall customer satisfaction. Loading speeds have been a known issue and strategic target area of improvement, especially considering the impact of site speed on the SEO ranking algorithm by Google. For Besamex, it was an immediate decision to try out Speed Kit due to the ease of implementation and the significant page speed uplift provided out-of-the-box.

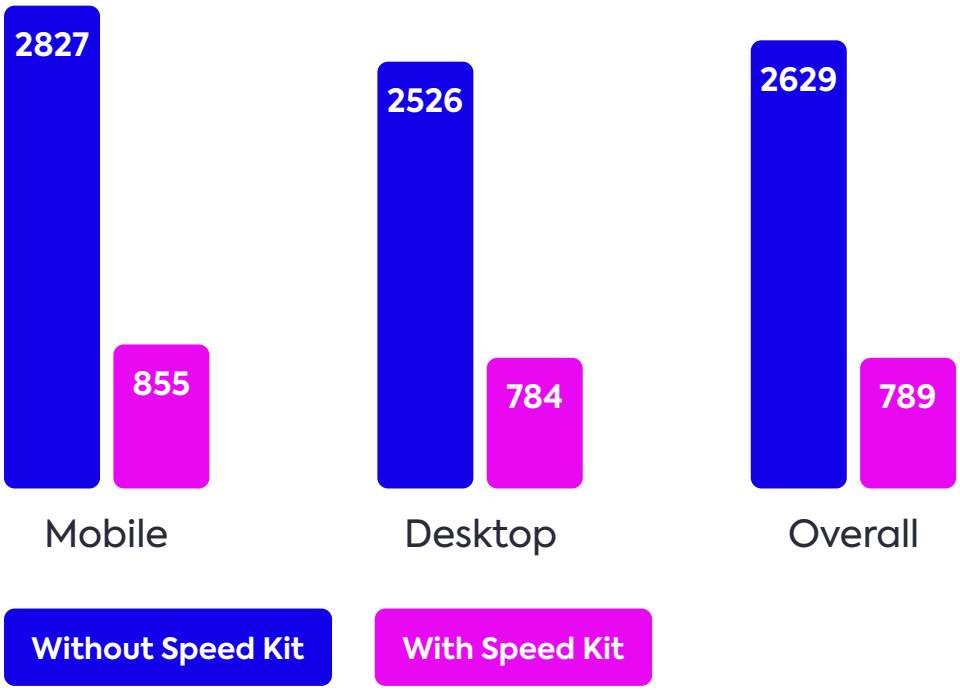
Speed Kit was implemented within just a few days and showed an immediate and noticeable effect on the Besamex shop. Among other automatic optimizations, Speed Kit uniquely provides caching for dynamic content that is typically considered uncacheable: While user-tailored content is indispensable for modern e-commerce, HTML pages cannot be accelerated with other state-of-the-art approaches when they contain server-generated elements like product recommendations, a shopping cart counter, dynamic pricing, or product availability labels. Through the concept of Dynamic Blocks, it is the only approach on the market that is able to accelerate such dynamic content.

Unlike the traditional methods of loading time improvements (see Section 3), Speed Kit can be tested with scientific methods using an A/B test. The results of such a performance test on the Besamex

website showed a significant increase in all relevant performance metrics.

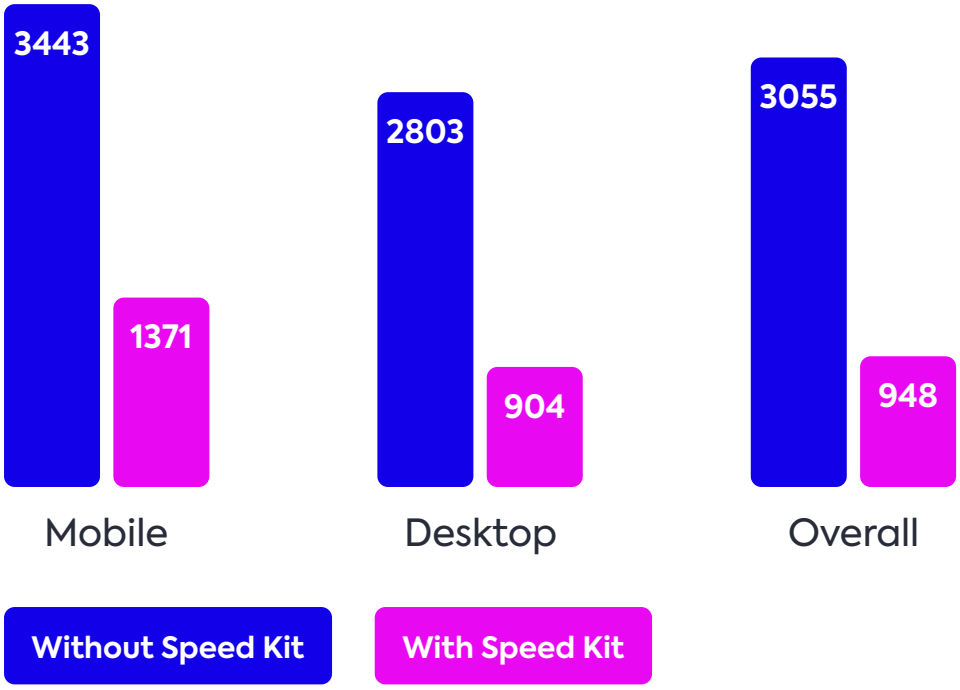
The below graphs contrast the performance of the original Besamex website with a Speed Kit-accelerated version of the same website. The provided numbers are the median values for both mobile and desktop versions of the website, as well as the overall traffic.

***Time To First Byte** (ms):*



The Time To First Byte (TTFB, also known as the server response time) represents how long the end user has to wait for the first bit of information, after sending the first browser request. The TTFB is notoriously hard to optimize as it is a technical baseline metric which heavily relies on the given technical infrastructure and shop system. Improvements here have a positive influence on all other performance metrics. Speed Kit delivers the TTFB on the Besamex websites 3.3 times as fast, compared with the original version of the website.

***First Contentful Paint** (ms):*

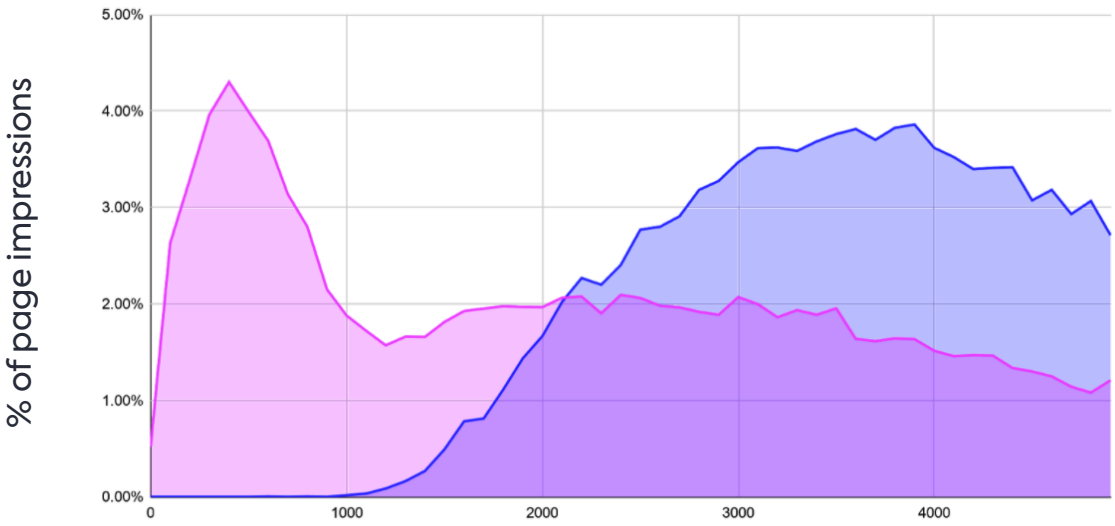


The First Contentful Paint (FCP) is a more user-focused metric as it represents the time from navigation until the first content becomes visible. Since the FCP captures the first visual feedback of the website that keeps the user engaged, it plays a particularly crucial role in evaluating overall website performance. It is therefore also one of the metrics collected in Google 's Chrome User Experience (CrUX) reports, which is highly relevant for SEO as detailed in Section 2. Overall, Speed Kit was able to serve the FCP 3.2 times faster than the original backend.

> Speed Kit delivers the Time To First Byte **3.3x faster** and serves the First Contentful Paint **3.2x faster** than the original backend.

The traffic of the besamex.de website during the Speed Kit pilot shows a stark difference between the two tested variants of the website: The histogram below shows the complete performance distribution, with the percentage of the overall page impressions on the Y axis and the time in milliseconds on the X axis.

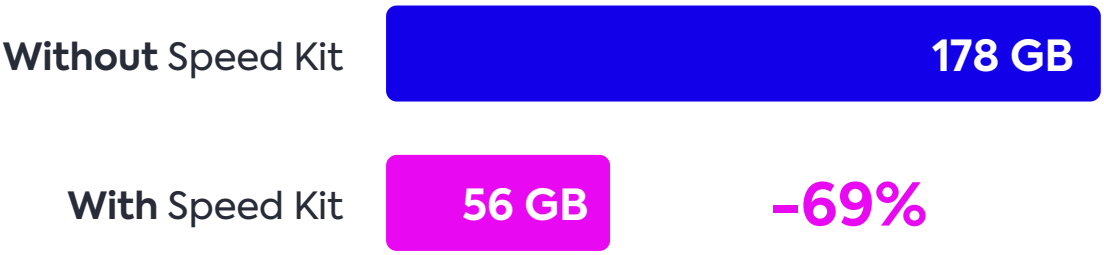
Largest Contentful Paint *(ms):*



The Largest Contentful Paint (LCP) is the time until the main content of the page is presented to the user and it is certainly one of the most important web performance metrics to optimize. While the FCP represents the first visual change experienced by the user, the LCP captures the largest visual change during the page load. Users typically perceive websites with a low LCP as very fast, since the biggest change happens early during the load and the website consequently converges to its final layout very fast. Understandably, it is also one of the core metrics of Google's Web Vitals that influence the SEO rank. Compared to the original performance of the website

(blue), the performance of the website with Speed Kit (pink) has experienced a strong shift to the upper left corner of the chart: This means that the largest portion of page views are delivered below 2500ms with Speed Kit, while nearly none of the page views from the original backend were delivered that fast. Within the classification of Google's Web Vitals, an LCP of 2500ms or below is considered good. The amount of individual page views with such a rating has increased from just 10% to over 46% with Speed Kit on the Besamex website.

Another improvement that Speed Kit offers out-of-the-box is automatic image optimization. Since Speed Kit is based on the Service Worker technology which operates from within the browser of the user, it can use client-specific information about screen resolution, device pixel ratio, or supported image formats to optimize content in ways that are not available for traditional technologies such as content delivery networks (CDNs). Images can therefore be requested in an ideal format and size right away. All this happens automatically and on-the-fly with Speed Kit.



> The automatic image optimization decreased unnecessary image traffic by **69% without any loss in quality**.

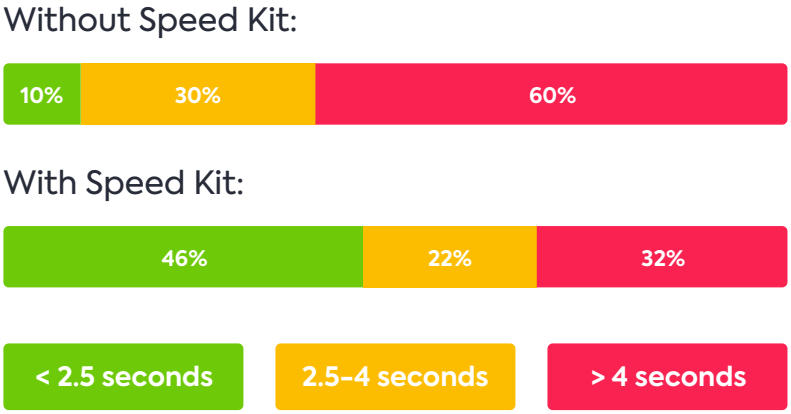
During the Speed Kit pilot on the Besamex website, only 56 Gigabytes of images were transmitted in the Speed Kit group of the A/B-Test, while 178 Gigabytes of images were transmitted in the corresponding group without Speed Kit. This means that Speed Kit decreased unnecessary image traffic by 69% without any loss in quality! Considering that over 9 million images are delivered to Besamex users every month, this is a remarkable efficiency gain.

These results illustrate that Speed Kit provides a considerable uplift to online pharmacies such as Besamex. With only minimal efforts and within just a few days, Speed Kit has fundamentally changed the user experience on besamex.de for the better.

> Optimizing the performance of our website is quite important for us. Speed Kit offers an easy to use approach that delivered **impressive results**.

Torben Berning, Managing Director besamex.de

Largest Contentful Paint



05 Preparing for a faster future

The pandemic has brought an unforeseen boom to mail-order pharmacies, so that the industry is developing at a rapid pace. The channel shift is significant and sustainable, customers are changing their consumer behavior, and social distancing opens up a new category in online shopping. An additional boost is expected from the introduction of the e-prescription 2021/2022 and the gradual digitalization of medical records. Experts expect that the e-prescription alone will increase sales of prescription drugs at German mail-order pharmacies from approximately 2% today to 5-10% by 2025.

This may sound like a wonderful economic dream for the pharmaceutical industry, if it weren't for the competition in the form of large platforms such as Amazon or Alibaba, for which Germany is one of the most important foreign markets. Sooner or later, they will also offer or extend their range of products and services in Germany. Thanks to their outstanding customer services in their home markets, they will once again challenge the pharmacy sector at the core of their success factors, such as the breadth of their product range, availability, price, convenience, and especially service and user experience.

Amazon is a force to be reckoned with

Across all categories, Amazon Germany already offers around 300 million available articles in its own assortment and marketplace. Due to the high share of OTC goods, Amazon is already the largest competitor of German online pharmacies.

Amazon is also unsurpassed in terms of convenience and service. Its activities are based on three strategic business areas: Voice & HealthCare (Alexa), telemedicine (Amazon Care), and pharmacy mail-order (Amazon Pharmacy).

According to the company's own statement, Amazon has sold over 100 million Alexa units to date and provides its customers with over 90,000 skills on demand. For example, in the U.S., Alexa users can check their risk level for COVID-19 at home: When asked for advice on how to handle COVID-19 symptoms, Alexa responds with a series of analytical questions about symptoms to narrow down the underlying disease. In the Corona Pandemic, a series of new Alexa skills were published by leading health care institutions and service providers, primarily to provide information to the population.

Compared to Alexa, telemedicine is still in an advanced beta phase. Amazon Care started in 2019, at first only for Amazon employees from the Seattle area and their families. The new program establishes a video chat between the help-seeking users with a doctor or other qualified medical personnel. Amazon Care thus provides fast access to information, accelerating diagnosis and therapy. The physician can create prescriptions via the app and send them directly to the patient. This saves travel, waiting times, and costs.

Amazon Pharmacy took over PillPack in 2018, one of the most innovative online pharmacies. PillPack's service is primarily aimed at chronically ill patients who have to take various medications on a regular basis. Instead of sending off-the-shelf drug packages, PillPack packages each of the products in the respectively required dose and labels the packages according to the medication schedule. Especially elderly people appreciate this service, as they often have to swallow many different pills and easily forget something or make mistakes when taking them.

Even if these examples do not yet occur in the reality of German life today, they are nevertheless real and outline a possible outcome of the digital transformation we are currently experiencing. Over the next 3-5 years, the structures and market shares of offline and online pharmacies will shift significantly in favor of digital business models within the customer interface. Only those who offer useful and relevant products and services in a high-performance and competitive manner will be able to operate successfully and sustainably in the future.

For all operators of online pharmacies, it is therefore already imperative today to exploit their real, latently unused onsite optimization potential. Loading time performance is consequently becoming one of the key success factors in the online pharmacy sector.

Subsecond load times are the new norm

From a customer perspective, e-commerce companies like Amazon or OTTO set the standard of expectation for website performance. A direct comparison (online pharmacies vs. top-10 retail fashion) illustrates how clearly German pharmacies lag behind the state of the art and therefore also customer expectations.

With broad availability of ultra-fast 5G nets coming in 2021/22, the huge differences in page speed among digital offerings will become more and more obvious to customers: The page load times in online pharmacies will seem excruciatingly slow when held against their lightning-fast biggest platform competitors. Current studies leave no doubt whether and where customers are migrating in frustration.

Page speed does not have to be complex nor expensive

Legacy IT (outdated backend and frontend infrastructures), limited resources (personnel, budget, investments, time, etc.), or an

overflowing backlog (too many projects and change requests) cannot be accepted as excuses for offering customers slow load times in the long run: Customers leave when page loads take too long.

Until recently, there was no approach for accelerating legacy infrastructure other than upgrading or rebuilding it – which is often prohibitive for service providers. But current browser technology enables large performance leaps through changes in the front and alone. Infrastructure offerings based on the latest research open up intrinsic potentials and provide a completely new approach for fast and sustained acceleration: Even "old" and "obstructed" IT systems can be accelerated by 1.3x to 4x in less than a week by using cutting-edge cloud infrastructures, without huge investments.

Page Speed Optimization as a Lever for Success

Catching up with the e-commerce leaders in terms of page speed is as easy as integrating 2 JavaScript snippets into the website and customizing few standardized plug-ins.

This saves budget and time and avoids blocking scarce capacities and resources through inferior web performance. Freeing up resources for marketing-relevant features can thus elevate the business model in terms of both the unique selling point (USP) and the comparative competitive advantage (CCV).

The 3 Main Factors of Online Business Success

In summary of the above, there are three key factors to facilitate sustained success in the German online pharmacy business.

1) Seize the hour of success and prepare the company for the upcoming digital transformation process. Whether large, medium or small, online or offline: Every German or European pharmacy will have to adapt to massive changes in the purchasing and usage behavior of

its customers in the medium term. The prospects and opportunities are enormous, if the time is used strategically. But those who wait and see will die.

2) Fully concentrate on your USP and CCV to anticipate, create, and articulate a relevant utilization vision for a changed market in 2023. With this goal in mind, subsequently create the corresponding technical and organizational structures.

Regulation will certainly slow down the process, but it will not be able to stop it. The current practice of differentiating oneself from other providers by price is not a sustainable business strategy for any market participant. As soon as Amazon enters the market with its optimized products and services, offline and online structures will be shaken due to Amazon's unbeatable offers and its ability to win over customers.

3) Ensure top-tier user experience and website performance to stay competitive. To leverage and monetise all existing on-site potential before and during the imminent platform change, updating legacy web shops to repay technical debt is strictly required.

For leading digital business models, page speed is a proxy metric for technical prowess and professionalism: The higher the online maturity level of an industry, the lower the page load times. The IT legacy of online pharmacies becomes particularly clear in direct comparison with these segments. Market-leading platforms such as Amazon have set the benchmark very high and out of reach for today's online pharmacies.

The Besamex case demonstrates how cutting-edge browser technology can solve this dilemma: Reducing page load times by more than fifty percent in less than a week is a reality with Speed Kit.

Start to load instantly

Speed Kit – The all-in-one solution

- 1.5 - 3x page load time improvement in one week
- A/B-tested PoC with quantified performance uplift
- Improved customer experience, SEO, bounce rate, etc.

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Authors: Puriss, Stefan; Wingerath, Wolfram; Wrage, Thies; Sköld, Kristian; Göhmann, Jan & Gessert, Felix: The Pandemic Response for Web Performance. Baqend (Whitepaper), October 2020 *https:/www.baqend.com/apo.pdf*

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