

Abstract

The Baqend GmbH develops the Backend-as-a-Service platform Baqend, which leverages new research results to achieve unique performance benefits. The platform empowers customers to develop data-driven websites and mobile apps with higher productivity while at the same time guaranteeing unprecedented performance in terms of response times and scalability. The target audience of the Baqend's cloud platform are Indie-developers, startups, agencies, e-commerce providers and software companies.

Page load times have an immense impact on user behavior and business metrics. Amazon for instance found that already 100 milliseconds lost during page load reduce revenue by 1%. Baqend's vision therefore is to enable developers to build applications with loading times below human perception. Through 5 years of intensive research and development at the database research group at the University of Hamburg, we were able to derive database and backend techniques to solve this problem. The technical core of this research is the Cache Sketch method, which we transparently employ to achieve global page load times that are by factor 2.5 - 8 below those of other providers.

Baqend Cloud offers this automatic caching technology through a Backend-as-a-Service, i.e. through SDKs and APIs for developers to build apps and websites using features such as data storage, queries, push, OAuth, user management, access control and server-side business logic. Our goal is hence to not only accelerate development but also making the end product faster and more scalable. Baqend Enterprise offers the same technology as a software for custom infrastructures from single servers to private clouds.

According to the New York Times, people will visit a web site less often if it is slower than a close competitor by 250 milliseconds. We give our customers the competitive advantage of faster page loads to lead the way towards a web without loading delays.

What problem are you solving?

Page load times have an immense impact on user behavior and business metrics. Amazon for instance found that already 100 milliseconds lost during page load reduce revenue by 1%. The Aberdeen Group found that if a website takes 1 second longer to load conversions will decrease by 7%, visits by 11% and user satisfaction by 16%. For a website that has a daily revenue of 100.000 USD the result is a yearly loss in revenue of 2.6 million USD. Thus, even small improvements in page load time significantly boost visits, time on site, conversions, revenue and traffic.

End users are usually only subconsciously aware of this effect: in A/B tests Google compared user behavior for displaying 10 versus 30 search results. Even though users said they

preferred 30 search results, traffic dropped by 20% in this group. The decrease was caused by a 500 millisecond slower page load that spread latent dissatisfaction and high bounce rates. There are many more studies showing similar effects (see baqend.com). However, not only user behavior is determined by speed, also search engines now include load time as a primary factor of ranking.

Our goal therefore is to solve the latency problem for web applications and mobile apps in an application-independent fashion.

What is your solution?

Through 5 years of intensive research and development at the database research group at the University of Hamburg, we were able to derive database and backend techniques to solve the latency problem. The technical core of this research is the Cache Sketch method, which we employ to achieve global page load times that are by factor 2.5 - 8 below those of comparable platforms. In our approach, expiration-based caches (e.g. browser caches and proxies) are kept consistent through a Bloomfilter-based data structure, whereas invalidation-based caches (e.g. content-delivery networks) are proactively updated.

Besides several evaluations published in the scientific community we also practically compared Baqend to market-leading Backend-as-a-Service providers (Parse, Azure Mobile Services, Kinvey and Apiomat). The application under test is a news website loaded and measured from different geographical locations.

The result: Baqend outperforms the other systems by an average factor of 6.8, achieving consistent sub-second page loads.

Side-by-side video comparing the page load (25% speed):
<http://www.baqend.com/vergleich.mp4>

As a chart: <http://www.baqend.com/vergleich.png>

Short business model

Baqend addresses the Backend-as-a-Service (BaaS) market with a focus on data-driven, performance-critical and scalable applications. We chose BaaS as our business model, since it allows us to offer and employ our acceleration technology for arbitrary applications. The main benefits of BaaS are a shorter time-to-market through more efficient programming and a smaller total cost of ownership due to automated, scalable and fully managed cloud infrastructure.

The market research institute TechNavio estimates the total BaaS market volume for 2014 to be 870 million USD and forecasts a growth to 29.17 billion USD in 2019, which corresponds to a compound annual growth rate of 101.88%. MarketsAndMarkets estimates a 217 million USD BaaS-market for 2012 and a growth to 7.7 billion USD by 2017.

Our target audience can be distinguished as follows:

a) Indie-developers and Startups

For them Baqend is relevant, as little backend know-how is required, enabling a fast time-to-market. Baqend's performance and scalability are necessary to permit fast growth and to handle strongly fluctuating workloads (e.g. after press mentions). Example application: social networking app

b) Web-, Ad- and App-Agencies

For these customers performance metrics are utterly important to improve business KPIs (e.g. conversions, page visits, traffic, etc.). In addition, fewer specialized backend developers are needed for projects so that faster development cycles are possible, which is crucial for agencies. Example application: Landing page for product campaign

c) Online businesses, Software Companies and E-Commerce

For this customer segment it is particularly important to be able to power high-performance and large-scale applications without having the in-house expertise for scalable data management and web performance. Example application: B2B web-platform

Baqend also cooperates with partners that offer full-stack Baqend-based development to customers. In the future, we will offer Baqend's technology not only as a Backend-as-a-Service but also through plug-in solutions to common content management systems (e.g. WordPress and SharePoint).

Baqend Enterprise is geared towards larger companies that need full control over the infrastructure their backend runs on or require in-depth support and coaching.

Our primary marketing channels are developer conferences and meetups, publications in scientific and practical journals as well as in blogs and an extensive free cloud tier for personal applications of which we expect a viral marketing effect.

What makes your solution unique?

Baqend is the first cloud backend for mobile and web applications that enables customers to achieve imperceptible load times.

Traction until now

Baqend Cloud beta was publicly launched in late February 2016. Roughly 150 applications have been registered and launched on our platform.

There are several production applications running on Baqend, for example Acto, a social-networking platform for organizing events and meetings among friends. With our partner dpa (the German Press Agency) we built a Baqend-based prototype of a news-serving dashboard for editors, which outperforms the legacy dpa system by more than 100x.

Of over 600 CIOs at the "Hamburger IT-Strategietage" conference, over 90% recently voted for Baqend as the best and most convincing startup pitch.

Your top 3 competitors (with URLs) and how do you differentiate yourself?

Kinvey: <http://www.kinvey.com/>

Kinvey is the leader for Backend-as-a-Service for large and enterprise customers. Due to their significant resources they have an advantage in terms of available SDK implementations and marketing.

Parse: <http://parse.com/>

Parse was the Backend-as-a-Service market leader when it comes to traction among developers. It was bought by Facebook in 2013 and unexpectedly shut down this year.

Apiomat: <https://apiomat.com/>

Apiomat is the only German competitor of Baqend and almost exclusively active in Germany.

All three competitors have the advantage of a longer presence in the market and hence have more programming language SDKs and more detailed documentations. Both are a question of available resource that we are confident to catch up with.

There are large performance disadvantages of these three competitors compared to Baqend directly translates to slower and less scalable applications. The difference was shown in the Pitch deck and the section "What is your solution?" - in summary, for a typical application Baqend is:

-734% faster than Kinvey

-391% faster than Parse

-657% faster than Apiomat

On the functional side Baqend implements several other features that came out of research and are missing in all of the other platforms:

-Scalable Cache Aware Transactions (SCOT) are fully ACID-compliant database transactions that Baqend supports to guarantee data integrity without sacrificing scalability and load distribution. The other providers cannot guarantee correctness of multi-statement transactions.

-Callbaq is a horizontally scalable streaming system for Baqend that allows customers to perform easy real-time communication between application instances on different devices.

-The Polyglot Persistence Mediator (PPM) is a novel research approach Baqend employs to map data and queries to databases that best address the functional and non-functional requirements a tenant declares for his application.

An advantage of our caching approach is that we can often answer requests directly in the client device or nearby CDN servers. The cost savings allow us to offer our platform at a more competitive price and to make higher profit margins.

Team

Felix Gessert (CEO) and Florian Bücklers (CTO) developed the technical groundwork of Baqend during their first years of their bachelor in computer science. They shared a passion for technologies that are now subsumed under the term "Big Data" and used most of their time as students to successfully advance Baqend's technology. Felix completed his studies of computer science as valedictorian. Currently he is finishing his PhD on Baqend's caching technology in the research group "databases and information systems". Since the foundation of Baqend he is not only working on the business model in his role as CEO but still pushes forward the research basis enabling Baqend's USPs. He regularly talks at scientific and developer conferences, publishes research results, does Big Data consulting for other companies and organizes the successful conference series "Scalable Cloud Data Management".

After his master degree in computer science, Florian Bücklers worked as a database developer for the Versant GmbH before he changed into the freelance web and app business. Simultaneously to that Felix and he were developing Baqend and acquired the first funding. Florian not only brought practical experience in the web development business into the team but also the a large network of potential customers and multipliers.

Before the first funding of Baqend Hannes Kuhlmann worked in one of Hamburg's largest web agencies (SinnerSchrader), where he already interned as a student. He wrote his master thesis under the supervision of Felix on web application development with Baqend focusing on techniques for search engine optimization and security.

As the son of a successful entrepreneurial family Malte Lauenroth has been working in the family business since 2007. After finishing his bachelor in business studies he helped

restructuring financial departments of large companies as a controller. He complements the technical competence of the team with business skills and is responsible for sales and finance.

The Baqend team thus has a lot of experience in productively working together and jointly solving problems. Erik Witt joined the team as the first employee after an exceptionally good master thesis on cache-compatible transaction processing in Baqend. Currently two other dissertations and many student theses are addressing Baqend's core technologies, too. With Prof. Norbert Ritter who chairs the database research group and is Felix's PhD supervisor, Baqend has a knowledgeable and influential mentor. 19F is a web agency that acts a multiplier by offering Baqend-based full-stack development.