PromonTech was founded by a team of experienced mortgage professionals who had a vision: to drive towards a mortgage industry that is transparent, efficient and understandable for all stakeholders. This includes lenders, regulators, investors, and importantly, borrowers.

They knew that the mortgage world had changed, but that most technology in the market hadn’t kept pace. Their approach to remedy this situation was to develop solutions from the ground up, solving today’s mortgage challenges with today’s technology.

With CTO Michael Kolbrener at the helm, it was Back End Engineering Architect Michael Kazarian’s role to identify and implement the most appropriate technology to solve these challenges, along with Data Engineering Architect Dean McCall and Front End Engineering Architect Ted Coleman.

Early on, when the company was just an idea, Kazarian started meeting with experts in the mortgage space, many of whom would later become the senior leadership of PromonTech. One particular conversation made a lasting impression. It was with a business architect of many years’ experience, who had a deep understanding of the overall business aspects of mortgage origination. Having worked in numerous roles in compliance and risk, she detailed the many pain points she had observed in the mortgage space during her long career.

What really resonated with Kazarian were the following:

- Why is auditing so difficult? We should be able to easily find out how, when and why things happen and how, when and why certain decisions were made.
- Why is the number of states in a system limited?
- Why can’t we recognize that there are a number of events occurring during a loan life cycle, such as applicant applied, underwriting completed or credit report filed? We need to be able to react to those events in different ways.

These shortcomings in the systems used by the mortgage industry formed the basis of Kazarian’s analysis, and ultimately, PromonTech’s technology selection.
Why Axon Framework?

After his meeting with the business analyst, Kazarian started researching different options around event-based architecture such as DDD and CQRS. What he found was that despite CQRS and event sourcing looking like a match made in heaven, there was not a lot of information available. There were even fewer tools that were both relevant to his business requirements and had reached a sufficient level of maturity in production. Kazarian didn’t wish to add unnecessary risk to his tech stack.

From customer to partner

It was at this point that Kazarian reached out to Axon Framework initiator and Trifork software developer, Allard Buijze. Kazarian felt that the best way to capitalize on the opportunity Axon Framework presented was to partner with the source. This was the start of a valuable partnership between the Axon Framework team and PromonTech with many training and strategy sessions being held in Amsterdam and Denver in the two years since.

Now a company in its own right, AxonIQ continues to provide full-time consulting services to PromonTech. Part of the reason for this enduring partnership has been the dedication to quality of the Trifork and AxonIQ teams and the high intelligence and motivation of team members. In particular, PromonTech has been impressed by the developers’ ability to comprehend complex business topics in a domain where they have no hands-on experience.

Revolutionizing mortgage applications

PromonTech is currently pursuing a few major product initiatives, including one in production, but there is a long road ahead. Anyone who has applied for a mortgage understands that there is a lot of data to collect: employment and non-employment income; liabilities including credit cards, student loans and car loans, as well as existing assets and retirement funds. Not to mention all the methods of capturing data such as screenshots, scans and (often erroneous) manual entry. A single applicant on a single loan can have anywhere from 1500-7000 data points, and this multiplies with every co-applicant.

PromonTech’s Borrower Wallet, currently in production, is taking the complexity out of the mortgage application process and enhancing the user experience for borrowers. The Borrower Wallet gives mortgage applicants an easy and transparent way to provide the information their lender needs. This improved experience is combined with education so that applicants know what the data is used for and how it influences their loan approval process. The app also offers communication and chat capabilities so borrowers can stay updated on what is, in all likelihood, the largest transaction in their lives.

Future – transparency and security for lenders and bankers

PromonTech has a vision to make the lender and banker experience better as well. A key feature will be the ability to capture the choices that the processors or underwriters are making based on the information they have received. In the case of a credit-worthiness determination, the lender can easily look back through the events and see that this decision was made based on a specific value of a credit report and this credit report is tied to a specific document located in the document storage system. This improves the auditing capability of lenders and can minimize error and re-work during the loan approval process and in the secondary market.

How does Axon Framework help?

PromonTech leverages the capabilities of Axon Framework in all state changes in the system. For example, when calculating liabilities there might be an event such as “credit liability recorded” followed at the end of the month by another event, for example, “updated outstanding debt amount” on that liability. This functionality gives PromonTech the ability to understand the time-order sequence of events. In addition, Axon Framework allows the application to combine different event processing capabilities to project these events in a consumable way to the user interface.

Further, the underlying architectural principles of DDD and CQRS allow concurrent access to the information already in PromonTech’s system, such as loan details, components of the aggregates and domain objects. It also allows concurrent mutating states, with very small lock-in windows of the microseconds that it takes for the command handler to do its work. This is a capability that not many systems have and represents a high potential efficiency gain for the industry.

In the event of concurrent mutating states, a consistent state for all users is ensured because the aggregate is replaying from a single source of truth, the event store. This means that you can queue a number of commands up, execute quickly, and reject commands if in the wrong state.

Consider an example where two users wish to update a loan’s state. The first user wins the lock and changes the state to “applied” and a microsecond after the lock is released, the event is written to the event store as “loan applied”. Then, a second command comes in that, due to some defined rule, can’t be executed when the loan is in an “applied” state. In this case, the command handler will always reject the second command.

This is because the command handler is in the context of the aggregate and the aggregate is built off the state of the event store. This functionality is baked into Axon Framework’s implementation of CQRS.
A final aspect is the security that Axon Framework’s robust auditing capabilities provide. The event store is immutable and cannot be changed without PromonTech’s knowledge. This capability gives a level of confidence that Kazarian feels that he simply does not get with other systems. The audit log details when, where and why each event occurred, and even allows events to be replayed to reveal exactly what happened in a prior state.

The architecture journey
[from MongoDB + Kafka to simple architecture]

In any green-field project, there is a temptation to pull together the coolest tools to create your dream tech stack. This dream stack often ends up being an operational nightmare in the context of the restricted resources of a startup environment.

After the proof of concept was completed with the Axon Framework, PromonTech started crafting their full tech stack. For their event store they opted for a MongoDB database with a Kafka mechanism to project the data to Postgres de-normalized views. Samza was then used to pull data from a low-level oplog in MongoDB which pushed the data to Kafka. Samza would then project that data to Postgres. Kazarian describes what happened:

“...We were spending too much time solving a problem of extreme scalability that we didn’t have to address yet...this was at the cost of impacting our ability to build our product, which should be our focus...Our business product is our differentiator, not the fact that we’re using Kafka or Samza or any of those technologies.”

What they found was that it wasn’t trivial to maintain or manage their “dream stack” and that the team was spending more time on operations management than product development. So Kazarian went about stripping pieces out of Kafka and Samza, and began using Axon Framework’s event processors and projection capability to build their event subscribers. These subscribers would then write directly to the Postgres databases in the de-normalized view. This simplified the stack considerably.

But Kazarian’s team wasn’t finished. They began thinking about their motivation for using MongoDB.

MongoDB, as the team realized, was only being used as the event store and not to project data. At the same time, Postgres was only being used to project data in de-normalized views but not as event store. Given the performance of Postgres and its ability to do document-type storage, and with the event store capabilities of Axon Framework at their disposal, the team decided to remove MongoDB from their tech stack. This greatly simplified both operations and local development.

Current architecture

The current architecture has evolved so that PromonTech makes use of Postgres for the event store, using Axon Framework’s generic schema (although PromonTech has stopped short of letting Axon Framework actually build the schema). The schema is built through PromonTech’s own scripting, as it allows PromonTech to be highly selective with the types of rights that are put on top of the Postgres users who write to the event store.

On top of that, Postgres is used for some projections where there are a couple of consumers of data. One of these is the analytics database which is a dimensional model, built from projected events using Axon Framework. This takes advantage of Axon Framework’s projection capabilities. In this database there is no event writing; only event consumption, and acts as its own microservice.
Highlights and what can others learn from PromonTech

One of the biggest challenges for PromonTech has been the transition to a CQRS mentality for the development team. As Kazarian puts it:

“It requires somewhat of a remap of your brain to read side/write side, especially if you are used to thinking in layers.”

And while Kazarian hasn’t been immune from this challenge, the added flexibility and functionality that this architectural pattern provides has been well worth it.

The other big learning curve for PromonTech’s development team has been the over-eagerness they experienced when selecting their initial tech stack, which included MongoDB and Kafka. The operational overhead from such a large stack impeded the pace of development early on. The Axon framework and event store offered PromonTech the opportunity to start small and scale out later.

While PromonTech does make use of containerized microservices, this is only done where it makes sense for a particular feature or requirement. Rather than “doing microservices” for the sake of it, PromonTech makes smart use of them where appropriate. Some of these services are built in Axon Framework, and some aren’t. This flexibility is part of the underlying architecture.

About AxonIQ

Amsterdam-native tech start-up AxonIQ offers a software platform, services and education to expedite software development of modern systems based on microservices architecture. Our proven tools and methods enable companies to design, build and deploy future-proof applications faster than anyone else. Robust features such as extensive auditing and scalability are at the core of our offering.

Developing AxonIQ software platform is the natural next step for the team behind the Axon Framework – a small team who found themselves repeatedly solving the same problems in many different projects. As projects built using the open-source Axon Framework matured, the team noticed a lack of adequate tooling to deal with the high volume of messages in large event-driven systems.

AxonIQ is an elegant and practical solution that takes the stress out utilizing an event-driven architecture and offers extensive tooling, professional support and education. You could develop everything yourself but why would you?

About PromonTech

PromonTech has a vision of a mortgage industry that is transparent, efficient and understandable for all: borrowers, lenders, regulators, and investors. They see a future where mortgage data can be traced to its source at any point, from origination through securitization. They're creating that future right now, with technology that lenders and consumers can use collaboratively, using accessible, auditable and accurate loan transaction data.

PromonTech is part of The Promontory MortgagePath family of companies which was founded by a team of experienced mortgage professionals including Gene Ludwig, former head of the U.S. Office of the Comptroller of the Currency. Promontory MortgagePath is led by Bruce Witherell, who was Chief Operating Officer of Freddie Mac and CEO of several lending platforms both in the US and abroad. PromonTech is led by Chief Technology Officer Michael Kolbrener and is based in Denver, Colorado, a mile high in the western US.