Behind the scenes of the Atari Coldfire Project

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1 Introduction

In the past time only a low amount of background information about the Atari Coldfire Project (ACP) was made public. The reason was to prevent ungrounded euphory about the new Atari clone. So all released information was based on concrete decisions and was sensively formulated. E.g. When we specified the price of the board with ca. 1000 Euro we based this value on very pessimistic estimations to assure that the final price will not transcent the promised value.

Anyhow, the newer past makes it neccessary to provide some more detailed and uncertain information to the public. The primary reason is to make you understand what is our project about and where our decisions come from.

This text is written from the viewpoint of one member of the Atari Coldfire team, namely Norman Feske. It needs not to be representive for the opinion of the whole team. Anyhow, the author influenced decisions of the ACP team multiple times - so this text tries to explain these decisions from his viewpoint.

At first the meaning, the aims and the principles of ACP are reiterated. After that a current issue - the 'Wilhelm' board - is discussed. Finally this text will outline the future of the project and perspectives for the Atari world.

2 The past years of the Atari world

In the past a lot of promising hardware for our beloved Atari system was announced. Everytime, when someone announced a new project I got excited about it. Sadly, the majority of these projects where canceled. So during the years as Atari user I was hoping for an Atari Falcon040, a Phenix, a Tempest accellerator card, a Riored and a Milan2 - just to name a few. Although I was and am very happy with my Atari Falcon030 I waited patiently for the progress of these projects over the years. Meanwhile the Atari-world got more and more mature and almost every Atarian is thirsty for new hardware - so I am.

3 XTOS and Frontier Systems

When the Milan2 project was stopped, I was very sad once again. Probably I was not the only one because shortly after the canceling of the Milan2 the XTOS project was announced. The announcement was incredible: a new TOS compatible computer based on Motorola Coldfire processors should be available in just some months at a low price. Again I was excited about a new hardware project. My expectations where very high because Fredi Aschwanden - a well known hardware developer - was involved. I contacted the XTOS coordinator Ulrich Gîssel to show my interest and to offer my help. Sadly, I had to discover that the project was not that straightly evolving as I expected.

At the same time I got in contact with Oliver Kotschi - the chief of Frontier Systems - because I was wondering who this crazy guy was, who bought the rights of the Deesse DSP card from Rodolphe Czuba. I was very happy when both parties (XTOS and Frontier Systems) wanted to join their forces.

Abbildung 1: Fredi and Markus discussing the hardware design

4 Developer meeting in Dresden

From this time on Oliver Kotschi got very serious about the hardware project and organized the first developer meeting in Dresden. A lot of people who where interested in a new Atari hardware platform where there such as Mariusz Buras (Deesse driver developer), Fredi Aschwanden (hardware developer of the XTOS board), Oliver Kotschi (Frontier Systems), Markus Fichtenbauer (PCIBIOS developer), Frank Naumann (MiNT kernel maintainer) - just to name a few. We had to discover that the XTOS project did not progress very well until this point. Only the general design of the hardware (on paper) was ready at this point. A lot of issues where still unsolved:

- How to realise the graphics component? PCI? AGP? Graphics chip?
- How to finance the project? Who pays the production of the prototypes?
- How to manage the bootstapping?
- What operating system should be used?

At this meeting Oliver Kotschi took over the leading role of the project because he was not only supporting the discussions in a very positive way but he was responsible for the developer meeting at all. He also provided a solution to finance our project.

4.1 The birth of the Atari Coldfire Project

Consequently, the hardware project dissociated from the former XTOS project and ACP was founded. The foundation of ACP is idealism. No member of the project has financial interests in it - so all involved developers would work for free. The aim of the project is to develop and build an Atari-clone for die-hard Atari fans. I for myself was also thinking of the very active Atari demo

Abbildung 2: Mariusz presenting his Deesse DSP software interface

Abbildung 3: general discussion (left to right): Holger Schulz, Thomas Raukamp, jk28, Norman Feske, Matthias Jaap, Ulrich Gössel, Markus Fichtenbauer, Fredi Aschwanden

scene because a lot of demo scene people are also very active developers beside the demo scene (e.g. a lot of MiNT applications came from demo scene). All developers at the meeting agreed to dedicate their work to the remaining Atari people - not to make financial profit out of it.

So ACP had nothing in common with XTOS except the hardware developer Fredi Aschwanden! Ulrich Gîssel, the founder of XTOS put his new focus on his ATSF initative and is not related to ACP in any way.

4.2 Core members

At this point the Atari Coldfire Project constisted of the following core members:

- Oliver Kotschi, who is the project coordinator and provides the financial foundation. This does not mean that Oliver pays all our bills but he enables us to build prototypes etc.
- Fredi Aschwanden, who was responsible for developing the motherboard
- Elmar Hilgart, who maintaines smaller pieces of hardware such as the Deesse card.
- Markus Fichtenbauer, who develops the PCI-BIOS and also plays an important role during the hardware design process.
- Mariusz Buras, who is responsible for the operating system and the software side of the Deesse DSP card.
- Norman Feske, who is responsible for the operating system and different smaller tasks, such as the website.

4.3 Additional members

Additionally, there are members, who do not directly take part in the hardware design process but support the project in many ways:

- Frank Naumann, the maintainer of the MiNT kernel declared to lend us a helping hand, while porting the operating system.
- Richard Gordon Faika, who is one of the most active application developers on the Atari platform. He played a big role during the discussions of the hardware concept.
- Thomas Raukamp, who is our contact to Milan Computer and the ST-Computer magazine.
- Matthias Jaap, who is an experienced software developer and thus, he can bring in a lot of good ideas during our discussions. He is also a very active writer at Atari related bulletin boards.

- Leon O'Reilly, who is our graphics-guru. Since he is employed at Electronic Arts he has great experience in programming graphics hardware.
- Robert Wetzel and Jens Syckor, who want to write device drivers.

4.4 Resolutions

We - as Atari Coldfire Project - wanted to do our job in a better way than previous project: We only wanted to announce definitive things to avoid a big raise of expectations from the people. So we where very careful with releasing technical details, price and release date because everything depended on a lot of things (availability and prices of the chips, production costs, success of porting an OS, sparetime of the developers, availability of documentation). So we only released a pessimistic estimation of the price of the final board.

5 The graphics issue

During the following weeks everyone was very enthusiastic about the projects. We tried to get our hands on technical specification of hardware components and discussed how the remaining issues could be solved etc.

Especially, obtaining the documentation of graphics components is nearly impossible for a small project as ours:

- NVIDIA does not provide any documentation about their products. Even Leon O'Reilly - programmer at the Electronic Arts gaming company with good contacts to NVIDIA - was not possible to get the desired documentation.
- ATI only hand out the programmers documentation for the 2D functionality of their graphics chips. Documentation about 3D functionality is only available in the form of source code fragments or not at all. It was not easy to get access to the developer section of the ATI website from ATI - tons of emails had to be written. Technical information about ATI graphics chips (pinouts, reference design) are only available for big OEM manufacturers.
- Matrox provided a very good documentation, but Leon O'Reilly was not satisfied with this solution because Matrox got really behind the other vendors.

Including AGP on the Coldfire board had been a very big problem for Fredi. Building a Coldfire-PCI hostbrige is a very hard job - including AGP is even a harder nut to crack. Using PCI graphics cards leads to availability problems. Additionally, the transfer bandwidth to a PCI graphics card is a very limiting fact.

This issue just show - how big is the amount of problems when designing a new computer hardware. The graphics component is only one aspect.

Anyway, we where full of enthusiasm and waited impatiently for news from Fredi.

6 The big breakdown

Messages from Fredi were a very rare thing. I did not want to trouble Fredi with unimportant things so that he could spend all his energy in developing the new Coldfire board. When Fredi left the developer meeting in Dresden he told me that he wanted to provide a hardware description (hardware addresses etc.) four weeks later. He expected to build the first prototype within the following three months. So I wondered after I did not hear any message from Fredi for a long while. After three months we got a short life sign from Fredi. He told us about big personal problems and that he was not in the condition to continue his development. He claimed, that it should not be a big problem for us to find a similar talented hardware developer who can take over his job - definitely a heavy understatement!

7 Searching for new solutions

After Fredi discontinued the development of the board we got several offerings of people who where willing to help us:

- Rodophe Czuba had the idea to design a new board from scratch for us. The technical data of his board sounded like a dream to me. Sadly, Rodolphe also told us about his very low amount of time he could spend for the development. While I am really fascinated by the technically expertise of Rodolphe I am also aware of the high risk of an 'eternal' development. When looking at the long delay of the CT60 what time range we should expect when Rodophe designed a whole board during his spare time?
- Doug Hodson, an FPGA developer from the USA offered his help for doing FPGA programming.
- Lyndon Amsdon also offered a helping hand. While he is not very experienced in doing big hardware projects yet, he is very motivated.
- jk28 a student at the university, where I am studdying also showed his great interest in such a project

Beside that there is Elmar Hilgard, who is already a member of the ACP team. The only remaining question was: What to do now? .-) Sadly, Fredi did not send over his current state of development to us. So we only have the basic ideas of his design, that he presented in Dresden. Cautiously, we started to think about initiating a new development. - This time not done by a single person but by a motivated team of developers.

8 Wilhelm Elektronik

Suddenly a new perspective popped up. Oliver Kotschi got the offering by the german company 'Wilhelm Elektronik' to use an aleady existing hardware solution for our project. When Oliver called me and told me the technical data of the 'Wilhelm' board I was very excited about it:

- Motorola Coldfire4 processor with 300 MIPS
- on board: 2xUSB 1.1, audio I/O, 2xIDE, 2xserial, parallel, floppy controller, 4xPCI slots
- ethernet 10/100 Mbit
- graphics solution with up to 1600x1200x65k at 85Hz
- with a price of about 600,- euro

I know the company Wilhelm Elektronik because I own a Charly-scanner, that was produced by Wilhelm Elektronik. Especially the software - Charly Image - is a masterpiece. So I believe in the high potential of this company.

Sadly the amount of technical information of the 'Wilhelm-board' was very low. So Oliver organized a developer meeting to give Wilhelm Elektronik a chance to present their board to us - this time the meeting was hold in Rimbach.

9 Developer meeting in Rimbach

Oliver invited the core ACP team and - of course - Jörg Wilhelm, the chief of the company Wilhelm Elektronik. In fact, the meeting was hold because Jörg wanted to present his hardware solution to us.

Before we attended to the meeting I read at st-computer.net some news, that came directly from Wilhelm Elektronik - including some technical information and a release date for the new hardware. Strangely, Wilhelm Elektronik spread these news without asking us. They stated that preorderings will be possible from mid of october - this was completely new for me. The weirdst thing about this news-message was, that Wilhelm Elektronik wanted to be contacted directly by potential customers. So Wilhelm Elektronik obviously want to communicate directly with potential customers without involving us - the ACP team.

When we (jk28 and me) arrived at Rimbach after travelling 7 hours Oliver told us that Jörg will not come to the meeting because some problems with his car. Oliver even proposed to pick up Jörg from the Frankfurt main station, but Jörg refused to come over to us. So we were a bit dissapointed - so was Markus Fichtenbauer after he traveled 9 hours to come to our meeting. Anyhow, we had a long talk with Jörg via telephone and so we where able to get an idea of the proposed board. There was some confusion along us because some of the things, Jörg Wilhelm told us where right contradictoy.

Of course there were a lot of open questions such as:

Abbildung 4: brooding about the Coldfire hardware (left to right): Markus Fichtenbauer, Oliver Kotschi, Elmar Hilgart, Alexander Feige

- Why do we need to use an ARM processor can't we connect mouse and keyboard directly to the Coldfire CPU card?
- Wilhelm Elektronic wants to use a PCI graphics solution, that is not produced anymore. Concretely, he spoke about a PCI Rage graphics card - a graphic card, that is not even be sold anymore. Alternatively, he wanted to use a SIS graphics card, that was even unknown by me until then. I personally am sceptical about the performance of such a graphics solution, since my concrete measurements of the bus transfer bandwidth of a Matrox G440 2xAGP graphics card, connected to a PC was just about 33MB/sec - and this solution is even advanced to the proposed PCI solution. The transfer bandwith to the graphic card plays an important role for demos, games and other multimedia applications.

Beside that, the overall design is not exactly what we expected. Instead of having one motherboard there are plently of PCI cards providing the desired functionality.

The design of the 'Wilhelm-board' makes it complicate to port TOS and TOS-applications to it:

- The PCI-BIOS must be completely rewritten.
- Mouse and Keyboard drivers must be implemented on the ARM processor - a processor I have practically no experience with.
- No single hardware register is mapped to the original ST address with its original meaning. So not only the whole BIOS/XBIOS layers of TOS must be rewritten - we need also a new harddisk driver. Since the Coldfire4 CPU has no MMU, addresses must be mapped by an external address mapper. Wilhelm does not want to include such an address mapper for us. Wilhelm proposed that a harddisk driver could be implemented on the ARM processor - but this solution is contradictory: Only one of both

(ARM and Coldfire) processors can be the host processor for the PCI bus and thus receive interrupts from other PCI devices. So if the ARM wants to receive interrupts from the IO-device it must be the host. Consequently, the Coldfire PCI card can not be the host processor. If so, the Coldfire can not handle interrupts of the other PCI devices. Beside that, this solution must be implemented into TOS somehow - I personally have no clue how to do that.

- Midi plays a big role for Atari. Since a lot of Midi-applications use the Midi-hardware addresses directly for gaining more speed on original STs none of them will run on this board, because the Midi-hardware registers do not exist anymore.

There are even more things, that rises my scepticism toward the solution by Wilhelm Elektronik: Wilhelm Elektronik will not provide schematics of the board to us. In contrast to that Wilhelm Elektronik does not want to pay licency fees for the operating system and want that our work will be open source. Wilhelm Elektronik sets us - the ACP team - under high pressure. They announced the availability of the new Atari clone for the beginning of 2003 without having any operating system. So if we would port the operating system, we needed to do that within three months to fulfill the expectations of the people - this is illusionary because we all work only in our spare time. The only reason for this time schedule I can imagine is, that Wilhelm Elektronik wants to make financial profit out of our project. This would contradict the original intensions of the Atari Coldfire Project.

Beside all that - the Atari Coldfire Project is a project of hobbyists. So it should make fun for us. Where is the fun when we have to work under time pressure? What is our benefit when the final result will be not something we would proudly call 'our system'?

The idealistic foundation of the Atari Coldfire Project makes it independent of economical conditions. This property gets lost as soon as we put ourselfs in dependence of a economically thinking company. With other words: If Wilhelm Elektronik will not make profit with the Atari market the natural consequence would be the dropping of the project by Wilhelm Elektronik. I am not illusionary enough to believe in financial winnings of an Atari clone.

10 Future and perspectives

Instead of porting TOS to the 'Wilhelm' based computer I personally prefer to initiate the development of an own hardware platform. This had several advantages:

- There are several developers, who could work together - I am sure that this will be a great experience for all involved people.
- We can take our demands much better into acount while designing the new platform.

- The plans by Fredi are already widely discussed along the members of the Atari Coldfire Project. Thus, we already have very concrete ideas of what to do. There exist already concrete ideas of how to solve a lot of problems (e.g. general design).
- There are now four interested hardware developers, who can put their ideas, energy and creativity into our project. Additionally, we have a lot of friends along the atari scene who are willing to help us (e.g. Rodolphe Czuba, the Atari demo scene)
- The swedish developers Nature are currently busy with developing a graphics solution for the CT60 - this would be also a great option for a graphics solution for our Coldfire based platform too. So the currently active software developers (and demo coders) could join their forces and concentrate their focus to one graphics option. We are already in contact with Nature and they are very interested in a cooperation. Until now - this is only an idea, but a great one :-) The graphics solution of Nature would fit much better into the range of the Atari range of Computers than standard PC graphics cards. Its biggest advantage is the great screen memory bandwith, which would enable incredible pixel fill rates of software based graphics routines (ideal for demos and games). Beside that, it is compatible with the Videl graphics chip of the Atari Falcon 030 - so together with the Deesse DSP card the new Coldfire based computer would be a real Falcon successor.
- We can act independently of economical conditions and do not need to rely on a company.
- The distributed development, based on open source, prevent the dependence of one single person (e.g. like Fredi Aschwanden).
- We could keep the ST compatibility much better since we can map or emulate some important Falcon hardware registers (e.g. IDE, ACIA, MIDI, Videl in the case of using the Nature-graphics card) via a custom made FPGA. This would make the porting of the operating system much simpler and would keep up the compatibility of a lot of existing applications.
- The final result would be a system we could proudly call 'our system'!

Of course there is a drawback: The new computer will not be available tomorrow. But is this _that_ important? ACP is not about doing half hearted work to sell a lot of average hardware to make a lot of profit. ACP is about having fun while developing. ACP is about friendship. ACP is about dedication.

Everyone, who is seriously interested in joining us and help to realise our visions of a new Atari clone is warmly welcome!

Abbildung 5: the Atari Coldfire Project on its way to the future