

(OEM) LICENSE AND SOFTWARE DEVELOPMENT AGREEMENT

This agreement (this "Agreement") is made and entered into as of this 03 day of ~~October~~ ^{November} 2001,

by and between:

1. Amiga Inc. (hereafter: "Amiga"), a State of Washington, U.S.A. corporation with its administrative seat at 34935 SE Douglas Street, Snoqualmie, WA 98065, USA

and

2. Hyperion VOF (hereafter : "Hyperion"), a Belgian corporation with its administrative seat at Brouwersstr. 1B, B-3000 Leuven;

3. Eyetech Group Ltd. (hereafter: "Eyetech"), an English corporation with its administrative seat at The Old Bank, 12 West Green, Stokesley, N. Yorkshire , TS9 5BB, England.

RECITALS

WHEREAS Amiga intends to release a new version of its Classic Amiga operating system tentatively called "Amiga OS 4.0";

WHEREAS Amiga has decided to contract with Eyetech for the development of the Amiga One product;

WHEREAS Hyperion has partnered with Eyetech Ltd. in the AmigaOne project;

WHEREAS the successful roll-out of the AmigaOne hardware hinges in part on the availability of Amiga OS 4.0;

WHEREAS Amiga has decided to contract with Hyperion for the development of Amiga OS 4.0;

NOW, THEREFORE, for good and valuable consideration, receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound, the parties hereto agree as follows:

**Article I.
DEFINITIONS**

1.01 **Definitions.** For purposes of this Agreement, in addition to capitalized terms defined elsewhere in this agreement, the following defined terms shall have the meanings set forth below:

"Amiga One" means the PPC hardware product developed by Escena GmbH for the Amiga One Partners, initially intended to operate in conjunction with an Amiga 1200;

"Amiga One Partners" means Eyetech and Hyperion collectively;

"Amiga OS Source Code" means the Source Code of the Classic Amiga OS including but not limited to the Source Code of Amiga OS 3.1, 3.5 and 3.9;

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"Classic Amiga OS" means the operating system owned and developed by Amiga Inc. and largely based on the

operating system shipped with the Commodore Amiga line of computers sold in the 1980's and early '90's,

"Confidential information" means any business and technical information of a party hereto that is treated as confidential by such party and furnished to the other party, and which includes but is not limited to computer programs, Source code, Object code, algorithms where such information, if in writing, is identified in writing to the other party as confidential prior to or concurrently with the transmission of such information, and, if conveyed orally, is identified orally as confidential prior to or concurrently with the transmission of such information and confirmed in writing within seven (7) days thereafter. Source Code is hereby designated as Confidential Information.

"Object Code" means software in a machine readable form that is not convenient to human understanding of the program logic, and that can be executed by a computer using the appropriate operating system without compilation or interpretation. Object Code specifically excludes Source Code.

"OS 4.0" means the version of the Classic Amiga OS developed by Hyperion pursuant to this Agreement with the functionality described in Annex I hereof;

"OS 4" means any version of the Classic Amiga OS developed by Hyperion pursuant to this Agreement;

"Software" or "the Software" means the Source Code of Amiga OS 3.1 and the upgrades of Amiga OS 3.1 including but not limited to OS 3.5 and 3.9 and associated "Boing Bags";

"Source Code" means software when written in a form or language understandable to humans, generally in a higher level computer language, and further including embedded comments in the English language.

"Target-Hardware" means the PPC based hardware developed and marketed for the Amiga platform including but not limited to the hardware developed and marketed by Phase 5, DCE and the AmigaOne hardware developed by Escena under contract with the Amiga One Partners.

ARTICLE II. OBLIGATIONS OF THE AMIGA ONE PARTNERS; APPOINTMENT

2.01 **Appointment.** Amiga hereby grants the Amiga One Partners a right and license to use and modify the Software and an exclusive right and license to market and distribute OS 4 as a standalone version for the Target Hardware and as an OEM version shipped with the Amiga One. Amiga furthermore grants the Amiga One Partners a right and license to use the Amiga trademarks in conjunction with the Amiga One. Hyperion shall develop Amiga OS 4.0 for the Target-Hardware with the minimal feature-set set out in Annex I and pursuant to the development guidelines set out in Annex I. Amiga acknowledges and accepts that Hyperion will bring in third party contractors (Annex II) to fulfill its contractual obligations.

2.02 **Timeline.** Hyperion shall use best efforts to ensure that Amiga OS 4.0 is ready for release before March 1, 2002.

2.03 **Royalties.**

(A) **Standalone version.** Other than for OS 4.0 for which no royalties shall be due by Hyperion, Hyperion shall pay Amiga a royalty of 20 USD for each standalone version of any subsequent versions of OS 4 developed by Hyperion pursuant to this Agreement.

(B) **OEM version.** Eyetech shall pay Amiga a royalty of 25 USD per unit of Amiga OS 4, said royalty shall moreover be considered payment in full for the Amiga One Partners right and title to use the Amiga trademarks in conjunction with the Amiga One.

(C) **Upgrades.** In the event upgrades are made available at a price which exceeds a reasonable amount for shipping and administrative costs, Hyperion and/or Eyetech shall pay Amiga a pro rata royalty which shall be calculated by comparing the suggested retail price (SRP) in Germany of a standalone version of OS 4 with the

SRP in Germany of the upgrade package.

2.04 Records and inspection. During the term of this Agreement, the AmigaOne Partners shall deliver to Amiga bi-monthly reports within thirty (30) days after the end of bi-monthly period setting forth the sales of the OS 4. Following such bi-monthly report, accrued royalties shall promptly be wired to Amiga. Amounts of less than Two Thousand (2000) USD shall be carried over to the next bi-monthly period. The AmigaOne Partners shall maintain or acquire complete and accurate records of sales to permit the determination of the sums payable by the AmigaOne Partners to Amiga. The AmigaOne Partners shall, upon fourteen (14) days advance written notice by Amiga, permit reasonable inspection of such records by Amiga or its outside accountants. The finding of errors in such records shall not of itself constitute a material breach of this Agreement. Amiga shall bear all of its own costs of such inspection even if it finds errors in the Amiga One Partners' records unless the inspection reveals more than 5% underpayment on the part of one of the Amiga One Partners in which case said partner shall bear the costs of inspection which shall not be unreasonable.

2.05 Interest. Interest shall accrue on any delinquent amount owed by the AmigaOne Partners at the rate of one percent (1%) per month, or the maximum rate permitted by the law of the State of Washington, U.S.A, whichever is less.

2.06 Ownership. Amiga shall retain ownership of the Software. Other than the rights and licenses granted to the AmigaOne Partners and Hyperion and Eyetech individually, nothing in this Agreement shall be construed as limiting Amiga's right and title in the Software. At any time prior to the completion of OS 4.0 and no later than six (6) months thereafter and provided Amiga makes the payment pursuant to article 3.01 hereof, Hyperion shall transfer all Source Code, interest and title in OS 4.0 to Amiga to the extent it can do so under the agreements concluded with third party contractors. Hyperion shall use best efforts to secure the widest possible rights from third party contractors. Amiga hereby acknowledges and accepts that some third parties may only grant an Object Code license or may otherwise restrict the rights granted to Hyperion.

2.07 Bankruptcy. In the event Amiga files for bankruptcy or becomes insolvent, the Amiga One Partners are granted an exclusive, perpetual, world-wide and royalty free right and license to develop (at their sole expense), use, modify and market the Software and OS 4 under the "Amiga OS" trademark.

2.08 Contingency. In the event Amiga decides to halt development of the Classic Amiga OS for the Target Hardware, the Amiga One Partners are granted an exclusive, perpetual, worldwide right and license to develop, use, modify and market the Software and OS 4 under the "Amiga OS" trademark and at their sole expense. Royalties due to Amiga shall be calculated in accordance with article 2.03 hereof. Amiga shall be deemed to have halted development of the Classic Amiga OS in the event that no substantially new version of the Classic Amiga OS for the Target Hardware is released within 6 (six) months after the completion of OS 4.0 by Hyperion.

ARTICLE III. OBLIGATIONS OF AMIGA.

3.01 Amiga may, at any time but no later than six (6) months after the completion of OS 4.0, elect to pay Hyperion Twenty Five Thousand USD (25,000 USD) in order to acquire the Object Code, Source Code and intellectual property of OS 4.0 pursuant to and within the limits set out in article 2.06 hereof. Said payment will first be applied against the balance of any outstanding invoices by the AmigaOne Partners vis ^ vis Amiga. In the event Amiga does not elect to carry out the aforementioned payment, all ownership and title in the enhancements of and additions to the Software effected by Hyperion and its subcontractors pursuant to this Agreement, shall rest with Hyperion.

3.02 Amiga shall provide Hyperion with all necessary Source Code and documentation to allow Hyperion to carry out its contractual obligations under this Agreement.

ARTICLE IV. WARRANTIES AND INDEMNIFICATIONS

4.01 Warranty and Covenant of Original Development by Amiga. Amiga represents, warrants and covenants that: (a) it is and shall be the owner of all intellectual property rights in the Software under copyright, patent, trademark, trade secret, and other applicable law; (b) the Software delivered or licensed to the Amiga One Partners hereunder is and shall be of original development by employees of Amiga in the conduct of their duties as employees or by third parties who prepared such materials for Amiga pursuant to a contract between Amiga and said third parties and who assigned to Amiga his or its entire right, title and interest in the Software; (c) the Software does not and shall not infringe or otherwise violate any patent, copyright or trade secret of any third party anywhere in the world; (d) it has not received, as of the date of the delivery of the Software to Hyperion, actual notice of any claim that the Software or the use thereof infringes any intellectual property right of any third party anywhere in the world or that any third party has any proprietary interest in or to the software, or any invention, patent, work of authorship, copyright, trade secret, know-how or a similar right to the software.

4.02 Indemnification. Amiga shall indemnify and hold Hyperion harmless from and against all claims, suits, demands, actions, judgments, penalties, damages, costs and expenses (including attorney's fees and costs), losses or liabilities of any kind arising from a claim that the Software infringes a patent, copyright or other intellectual property right of any other person anywhere in the world.

4.03 Indemnification. Hyperion shall indemnify and hold Amiga harmless from and against all claims, suits, demands, actions, judgments, penalties, damages, costs and expenses (including attorney's fees and costs), losses or liabilities of any kind arising from a claim that OS 4.0 or any other version of the Classic Amiga OS developed pursuant to this Agreement infringes a patent, copyright or other intellectual property right of any other person anywhere in the world.

4.04 Notice. Amiga and Hyperion shall promptly notify the other party of any actions brought or claims asserted whose outcome may affect the rights granted to Hyperion and/or Amiga pursuant to this Agreement.

4.05 Organization and Standing. Hyperion is a corporation duly organized, validly existing and in good standing under the laws of the kingdom of Belgium. Amiga is a corporation duly organized, validly existing and in good standing under the laws of the State of Washington, USA. Eyetech is a corporation duly organized, validly existing and in good standing under the laws of England.

4.06 Power to grant rights. Amiga represents and warrants that: (a) it has the right, power and authority to grant the rights and licenses granted in this Agreement and fully perform its obligations hereunder; (b) the making and performance of this Agreement by Hyperion does not and shall not violate any separate agreement, right or obligation existing between Amiga and any third party; and (c) there are no outstanding liens, security interests or other encumbrances of any kind whatsoever in or to the Software or to any of the intellectual property rights therein.

ARTICLE V. CONFIDENTIALITY

(a) Each party may disclose to another party Confidential Information as may be necessary to further the performance of this Agreement. Each party agrees to treat another's Confidential Information in the manner prescribed herein.

(b) Amiga and the Amiga One Partners shall protect any other party's Confidential Information as follows:

(I) Except as specifically provided herein or otherwise permitted by the other parties in writing, any party may disclose Confidential Information of another party only to those employees and agents required to have knowledge of same to perform their duties pursuant to this Agreement. Each party shall require each such employee or agent to enter into a written non-disclosure agreement containing provisions substantially consistent with the terms hereof prior to the disclosure of Confidential Information to such employee or agent. Each party shall treat the Confidential Information of another party with the same degree of care as it protects its own Confidential Information, and in no event less than a reasonable degree of care.

(II) Except as may specifically be permitted herein, upon the termination of this Agreement, each party shall

return to the other, or, if so requested, destroy all Confidential Information of the other party in its possession or control, except such Confidential Information as may be reasonably necessary to exercise the rights that survive the termination of this Agreement.

(c) The foregoing obligations of confidentiality shall not apply with respect to any party's Confidential Information to the extent that it:

(I) is within or later falls within the public domain through no fault of the party receiving the Confidential Information; or

(II) is, or becomes, available to the receiving party from third parties, who, in making such disclosure, have breached no written confidentiality agreement; or

(III) is previously known by the receiving party;

(IV) is independently developed by or for the receiving party without use of the Confidential Information.

(d) In the event any party receives a request to disclose any Confidential Information under the terms of a valid and effective subpoena or order issued by a court of competent jurisdiction or a governmental body, such party shall (I) immediately notify the party that furnished such Confidential Information of the existence, terms and circumstances surrounding such request, (II) consult with such party on the advisability of taking legally available steps to resist or narrow such request, and (III) exercise reasonable best efforts, at the expense of the party producing such Confidential Information, to obtain an order or other reliable assurance that confidential treatment will be accorded to such portion of the Confidential Information as may be disclosed.

ARTICLE VI. TERM; TERMINATION

6.01 **Term.** This Agreement shall continue indefinitely, unless terminated as provided herein.

6.02 **Termination for Material Breach.** Any party may, at its option, terminate this agreement in the event of a material breach by another party. Such termination may be effected only through a written notice to another party, specifically identifying the breach or breaches on which termination is based. Following receipt of such notice, the party in breach shall have thirty (30) days to cure such breach or breaches and this Agreement shall terminate in the event that such a cure is not made by the end of such period. The claim of material breach justifying termination shall be limited to the specific breached set forth in the above written notice as explained, supported and negated by evidence.

6.03 **Consequences of Termination.** In the event this Agreement is terminated in accordance with article 6.02 hereof, this Agreement shall remain in force with respect to the parties other than the party found in material breach of this Agreement pursuant to article 6.02 hereof. Articles IV, V, VI and VII shall in any event survive termination of this Agreement.

Article VII. Miscellaneous

7.01 **Four Corners.** This Agreement collectively sets forth the entire agreement and understanding between the parties hereto with respect to the subject matter hereof and, except as specifically provided herein, supersedes and merges all prior oral and written agreements, discussions and understandings between the parties with respect to the subject matter hereof, and neither of the parties shall be bound by any conditions, inducements or representations other than as expressly provided for herein.

7.02 **Independent Contractors.** In making and performing this Agreement, Amiga and the Amiga One Partners act and shall act at all times as independent contractors and nothing contained in this Agreement shall be

construed or implied to create an agency, partnership or employer and employee relationship between Amiga and the AmigaOne Partners. At no time shall either party make commitments or incur any charges or expenses for or in the name of the other party.

7.03 Amendments; Modifications. No amendment, modification or attempt to supersede or cancel any of the terms, covenants, representations, warranties or conditions hereof shall be effective unless such amendment, modification or direction to supersede or cancel such term, covenant, representation, warranty or condition is executed in writing by Amiga and Hyperion or, in the case of a waiver, by or on behalf of the party waiving compliance. No waiver by any party of any condition, or of any breach of any term, covenant, representation or warranty contained in this Agreement, in any one or more instances, shall be deemed to be a further or continuing waiver of any such condition or breach or a waiver of any other condition or of any breach of any other term, covenant, representation or warranty.

7.04 Severability. The provisions of this Agreement shall be severable, and if any of them are held invalid or unenforceable for any reason, such provision shall be adjusted to the minimum extent necessary to cure such invalidity. The invalidity or unenforceability of one or more of the provisions contained in this Agreement shall not affect any other provisions of this Agreement.

7.05 Waivers. The waiver of any breach of any provision of this Agreement or failure to enforce any provision hereof shall not operate or be construed as a waiver of any subsequent breach.

7.06 Governing Law. This Agreement shall be governed by and interpreted in accordance with the internal laws of Washington State, USA without regard to conflicts of laws principles. The obligations set forth in this Agreement are intended to supplement and not to supersede the protections afforded Amiga under the Uniform Trade Secrets Act or similar law or laws as may be in effect from time to time within the State of Washington.

7.07 Dispute settlement. Before filing any suit (with the exception of injunctive relief related to the protection of intellectual property) both parties shall submit to mediation to be completed within 30 days after written notice. In the event of any dispute between the parties that arises out of this Agreement, the substantially prevailing party shall be entitled to reimbursement for its attorneys' and experts' costs, fees and expenses. The provisions of this Agreement shall not be construed as limiting any rights or remedies that either party may otherwise have under applicable law and shall be in addition to all other rights and remedies of such party, including any which may arise out of any other written agreement involving the parties.

7.08 Forum. The exclusive jurisdiction and venue of any lawsuit between the parties arising under this Agreement or out of transactions contemplated hereby shall be the Superior Court of Washington for King County or the United States District Court for the Western District of Washington at Seattle and each of the parties hereby submits itself to the exclusive jurisdiction and venue of such court for the purposes of such lawsuit.

7.09 Counterparts. This Agreement may be executed in any number of counterparts, each of which when so executed shall be deemed to be an original and all of which when taken together shall constitute one Agreement.

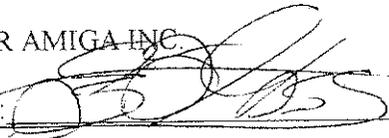
7.10 Signatures by Facsimile. Any facsimile signature of any party hereto shall constitute a legal, valid and binding execution hereof by such party.

7.11 Construction. This Agreement is the product of joint draftmanship and shall not be construed against one party more strictly than against another.

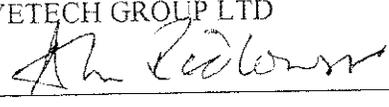
7.12 Effect. The Agreement shall be binding upon and inure to the benefit of each party hereto, and their successors and assigns. Neither party shall assign or subcontract the whole or any part of this Agreement without the other party's prior written consent.

7.13 Headings. The headings in this Agreement are inserted merely for the purpose of convenience and shall not affect the meaning or interpretation of this Agreement.

IN WITNESS WHEREOF, the parties, by their authorized representatives, have executed this Agreement.

FOR AMIGA INC.
BY: 
NAME (PRINTED) Barrie Jan Moss
TITLE CTO, Amiga.

FOR HYPERION VOF
BY: 
NAME (PRINTED) BEN HERMANS
TITLE Managing partner

FOR EYETECH GROUP LTD
BY: 
NAME (PRINTED) A. M. Redtman
TITLE Managing Director

OS 4 Schedule and Feature List

Hans-Jörg Frieden,
Senior software engineer, Hyperion Entertainment

This document describes the tasks required to get to OS 4 running on the AmigaOne and CyberStorm PPC hardware. Tasks are categorized as *essential*, *important* or *optional* depending on their importance. *Essential* tasks must be carried out to get bare minimum functionality. *Important* tasks are task that are not essential for functionality, but are to be considered so fundamental that OS 4 would rather be incomplete without them. Finally, *optional* tasks are things that can be considered if time and resources don't run out. They would be nice to have, but not critical.

Design Goals of OS 4

The following summarizes the desired design goals of OS 4.0:

- Essentially, OS 3.9 running on the AmigaOne and CyberStorm PPC without using the 68k CPU, using a 68k Emulator, possibly the JIT compiler, but may work with a non-JIT for starters. The kernel is a PPC native Exec with Haage & Partner's emulator (or the JIT emulator under development by a third party) running instead of the on-board 68k.
- As much PPC-native as necessary as soon as possible. This in combination with the 68k emulation (as opposed to cache-flushing needed to keep both CPU's memory image in sync) would mean a tremendous boost in performance, also carried by the fact that the memory interface and PCI/AGP bus can achieve a substantially faster throughput as the old Zorro III or PCI-Bridges. Not to mention that the CPU will be a good deal faster.
- New file system replacing the old FFS, preferably PPC-Native if possible. The old file system has turned out to be one of the major bottlenecks. It is outperformed by e.g. Linux ext2 by a factor of 10.
- Virtual Memory System. Most modern games, most modern applications require a tremendous amount of memory. Having virtual memory as part of the system is a key factor for tighter development schedules.
- Runs on the AmigaOne as well as the "classic" hardware. Blizzard version probably undesirable/impossible (performance reasons), but CyberStorm PPC required. Anything else would mean replacing one small market of weak machines with another small market with strong machines. The key factor must be for software developers to widen the market, making Amiga development feasible, and offer an upgrade path for A1200 owners to a top-of-the-line hardware.

Tasks

Task: Port Exec to PPC, adapt WarpOS and the 68K emulator
Priority: Essential
Prerequisite: AmigaOne
Required for: AmigaOne
Performed by: Alexander Lohrmann, Almos Rajnai, Hyperion & Haage&Partner
Estimated time: ?

It was decided that the cleanest and technologically most satisfying solution is a PPC port of Exec which handles both the PPC tasks and the emulated 68K tasks.

Porting WarpOS will essentially mean writing a new warphw.library. This should be relatively straightforward, since this was one of the design goals for WarpOS. Once this is done, the emulator must be adapted to run on this. Possibly, there would need to be some adaptations to the G3 processor.

The emulator would either be the 68K emulator by Haage & Partner or the JIT emulator by Almos Rajnai or a combination of both. Whilst JIT emulation is to be preferred because of its higher speed, it is unclear at this point if the JIT emulator will be finished in time to coincide with release of OS 4.0.

Task: CyberStorm SCSI driver / SCSI PCI card
Priority: Essential
Prerequisite: n/a
Required for: OS 4 on classic hardware + Amiga One SCSI on PCI support
Performed by: Ignatios Souvatzis
Estimated time: 2 months

Work on the CyberStorm SCSI drivers is already underway. The basic motivation is that the original cybppc.device does not work on the emulator due to MMU page size restrictions. Furthermore this driver may be later adapted to work with PCI SCSI cards as a lot of existing users have SCSI rather than IDE based hardware.

Task: Disk drivers for the AmigaOne hardware
Priority: Essential
Prerequisite: AmigaOne hardware
Required for: AmigaOne only
Performed by: ?
Estimated time: ?

Since this task might be very similar to the aforementioned CyberStorm SCSI driver, it might be conceivable to contract Mr. Souvatzis for this task, too. Maybe a solution would be to use a PCI SCSI controller in the AmigaOne with the same chipset as the CyberStorm PPC.

Task: Picasso96-Drivers for the CyberVisionPPC and possibly G-REX/Predator
Picasso96-Drivers for the Matrox G450/G550, Voodoo 3/4/5, Permedia 2
Priority: Essential

Prerequisite: n/a
Required for: OS 4 on classic hardware
Performed by: Mark Olsen, Alexander Kneer, Tobias Abt
Estimated time: ?

The Picasso96 RTG system must fully support all hardware that is targeted for AmigaOS 4. Therefore the most frequently used card, the CyberVisionPPC, must also be supported. Work on this is already underway, but made more complicated by the fact that the CSPPC's flash rom already sets up some of the Permedia2 for the passthrough option.

With Picasso96 drivers already present for the Prometheus PCI bridge as well as the Mediator solution (albeit still with the issue of non-conformance with the Picasso96 authors' license), the only remaining PCI boards to be supported would be G-REX or the Predator. Support of these boards requires cooperation with DCE/Thomas Dellert.

Supported graphics card for OS4 should at the least cover Permedia2, Voodoo 3 and possible S3 ViRGE (the latter because of its still wide-spread use and cheap PCI versions).

Task: Integration of changes in OS 3.5 and OS 3.9 into the 3.1 CVS
Priority: Essential
Prerequisite: n/a
Required for: OS 4
Performed by: Olaf Barthel and/or others.
Estimated time: ?

Changes made after OS 3.1 must be incorporated into the main tree in the CVS repository. If a new kickstart ROM is desired, this would include the kickstart source code as well as all modifications done by the SetPatch program.

There might be license issues involved with this, for example for the Reaction GUI system. License issues are outside the scope of this document.

Task: Warp3D/Ami3D drivers for all supported graphics cards
Priority: Important to Essential
Prerequisite: G550, working G450, other cards including Permedia 2, Voodoo 3/4/5
Required for: OS 4
Performed by: Hans-Jörg Frieden, Thomas Frieden
Estimated time: 1.5 month per card (assuming full-time work, partially done)
All graphics cards supported by OS 4 should have proper 3D graphics support. Note that drivers for the Voodoo 3, Permedia2 and ViRGE graphics chips are already present. This means that essentially only the Matrox cards would need to be handled at this point.

Note that the estimated time for this task does not include changes on the API or naming scheme for Ami3D. However, the author's opinion on this is that for OS 4 the name "Warp3D" and the naming scheme "Warp3D.library" and "Warp3DPPC.library" should still be employed, and Ami3D should come with OS 4.2, or later as a boing bag for OS 4.

Task: OpenGL implementation based on Mesa
Priority: Important
Prerequisite: 3D hardware
Required for: OS 4.0
Performed by: Hans-Jörg Frieden, Thomas Frieden
Estimated time: 1.5 month

OpenGL is the only cross-platform API for handling 3D graphics (in contrast with Direct3D which is a proprietary Microsoft API). The availability of an OpenGL implementation would allow for simplified porting of OpenGL based games and applications to Amiga OS.

The proposed OpenGL implementation would be based on Mesa 4.0, an open source implementation of the OpenGL 1.3 specification (see: <http://mesa3d.sourceforge.net>).

Task: Fast File System rewrite
Priority: Essential
Prerequisite: n/a
Required for: OS 4
Performed by: Olaf Barthel
Estimated time: Already in beta-test

The rewrite of the fast file system should be regarded as a performance issue, and therefore essential. Since the

FFS2 is already in beta-test, the only remaining issue (besides bugfixes) is conversion to PPC.

Task: New TCP/IP Stack
Priority: Important to Essential
Prerequisite: n/a
Required for: OS 4
Performed by: Olaf Barthel
Estimated time: Already in beta-test

No operating system is complete without a tcp stack. Possibly old systems like Miami and/or Genesis/AmiTCP may not work anymore.

Like with the FFS2 conversion to PPC is still required.

Task: Virtual Memory System
Priority: Essential
Prerequisite: n/a
Required for: OS 4
Performed by: Haage & Partner
Estimated time: PPC conversion pending, probably low time requirements.

According to Haage & Partner, this task is already finished except for PPC conversion, which they said should be a very easy task.

Task: Minimal USB stack
Priority: Highly optional
Prerequisite: AmigaOne hardware/USB Hardware
Required for: OS 4 on AmigaOne, PCI USB card
Performed by: ?
Estimated time: ?

In order to enable stand-alone usage of the AmigaOne board, a minimal USB stack would be "a cool thing to have", i.e. It is not required to actually get the project done, but would a) allow the AmigaOne to be used in standalone mode and b) would help those people related to the project that do not have access to an A1200. It might be possible to recycle some source code from Linux for that, or alternatively from a BSD clone because of the more liberal license (Microsoft **do** have a point about the GPL's viral properties).

As I said, this is highly optional.

Task: PPC-Native RTA system (AmiRTA)
Priority: Optional, probably OS 4.2 only
Prerequisite: n/a
Required for: n/a
Performed by: ?
Estimated time: ?

The current Audio systems is either hardware-dependent (audio.device, direct DMA sound access) or AHI (and hence slow, 68k only, and with a lot of shortcomings). A new Audio system is absolutely required for at least OS 4.2, preferably earlier. This system should be able to cope with modern sound cards including 3D-Sound, and should be useful for both game programmers as well as multimedia programmers/studio musicians.

What's wrong with AHI? The API is divided in a low-level or high-level API. Both are rather awkward to use (for example, the low-level API only offers a callback mechanism that is triggered when a samples buffer *starts* playing, not when it finishes playing or reaches a certain position in the sample stream). Also, essential functionality is missing (for example, find out where the current sample playback position is). It also doesn't support any features of modern soundcards, or features of Amiga-specific sound cards like the Delfina. More importantly, it is known to be extremely slow. Its mixing routines are slow, so people roll their own. Even with sound cards is is much slower than the audio device (compare Shogo or Wipeout XL with or without AHI sound).

Task: Various enhancements (PPC datatypes, new HD Toolbox, AHI Soundblaster driver, clipboard functionality, various bugfixes)
Priority: Important, OS 4.0
Prerequisite: Hardware (Soundblaster EMU 101k)
Required for: OS 4.0
Performed by: Oliver Roberts, Andrea Vallinotto, Martin Blom, Philippe Ferrucci
Estimated time: ?

General Notes

Olaf Barthel will function as the build master (apologies to Olaf because his name is mentioned quite frequently throughout this document).

Work should start as soon as possible on the CyberStorm PPC hardware. To work around the lack of a SCSI driver, the initial work can be carried out with an IDE disk connected to the A4000's internal IDE port.

Admittedly this is not the fastest option, but a workable one.

All parties involved should have read access to the CVS at all time, and also have access to nightly/weekly builds of the OS. A mailing list should be established. From time to time a meeting of all parties involved would be desirable.

Future Work

It is clear that the primary concern should be to get OS 4 up and running on both the AmigaOne as well as the CyberStorm PPC cards as soon as possible. After the basic work is done, further updates and goodies may be made available as being bag upgrades on the road to OS 4.2. Listed below are a few things that come to mind:

WarpInput. WarpInput is an API drafted by Hyperion Entertainment (draft available on request. Contact Hans-JoergF@Hyperion-Entertainment.com), the purpose of which is to allow unified access to multimedia controller devices like Joysticks, steering wheels, trackballs and similar devices as well as the mouse and keyboard, from a multimedia or games programmers point of view. Could be renamed "AmiInput" (or some more prosaic name) and reused on AmigaDE and OS 4.2.

PPC-Native GUI system. At the moment it is painful to write fast applications with GUI's PPC-native. This is because every call like `intuition.library/GetMsg()` requires a cross-CPU context switch. Porting Boopsi to PPC and also porting a toolkit like Reaction would help this effort tremendously.

Gradual changes to PPC code. More OS code can be moved to PPC as time permits.

Appendix: Migration to PPC-Native libraries (Proposal)

OS 4.0 could provide a way to implement PPC native libraries and devices incrementally, that is, allow libraries and devices to coexist as the original 68k version as well as a new PPC native version. This document tried to outline the principle.

There is one fixed address in the Amiga system. This is address 0x4, the `ExecBase`. To open a library (or a device, which is a special form of library) you call the `Exec` function `OpenLibrary` to obtain a base pointer. Currently there is only one address 0x4.

The principle doesn't change when the 68k emulator is involved – yet. However, this may be changed. An MMU setup will be able to write- and read-protect the first page of the Amiga memory. This way an exception is generated when a read access to the `ExecBase` pointer is performed. The system may now decide if a PPC task or an emulated 68k task tried to access the `ExecBase` and return a different pointer, one for the traditional `ExecBase`, and one for a special PPC version of `ExecBase`.

We now have a way to have a PPC-native `Exec` library that can provide the same functionality as the traditional `Exec`, plus new functions that are unique to the PPC/OS4 version. The new functionality can be implemented this way without interfering with 68k programs.

The new PPC `Exec` can now provide its own `OpenLibrary` function to open other PPC-native libraries. Theoretically, there could be a PPC-Native version of e.g. `Intuition`, as well as a 68k version. However, this is not needed in all cases, and can be a continuous process.

If a PPC program tries to open a library that is not available as a PPC native library, the runtime system could generate a PPC stub library on the fly, by generating a library base with stubs that automatically hand over control to the appropriate 68k function via the emulator. The same could be done for 68k programs, making it possible to replace system libraries completely.

Example:

Consider the following:

```
struct Library *ExampleBase;

ExampleBase = (struct Library *)OpenLibrary("example.library", 0);
if (!ExampleBase) exit(0);
```

```
// Call an example library function
int i = ExampleFunc(x,y);
```

What happens is the following: To call the `OpenLibrary` function, the compiler generates an address lookup at `_SysBase`, which is usually internally taken from address `0x00000004` at program startup. To call the function, the appropriate jump address is taken from the `_SysBase` minus the offset of the function. The resulting address is what the program jumps to. On a PPC this jump mechanism works a bit different from the 68k, but in principle this is the same. The only problem is that a PPC program wants PPC code that it can jump to, while a 68k program expects 68k code at the jump target.

The only solution is to have separate base pointers for libraries on PPC and 68k. For `exec.library` this is done by providing a PPC-native (or almost PPC-native) `exec` with all the functionality as its 68k counterpart. A PPC program reading address four will generate a page fault, and the runtime system will be able to return a different address than that of the 68k base.

As soon as this distinction is made, the rest of the system will fall in place automatically. On 68k, the call to `OpenLibrary` will proceed normally; on PPC, the PPC `exec` might for example look in a different directory (for example, `PPCLIBS:` as opposed to `LIBS:`), or add a prefix/suffix ("`ppcexample.library`" as opposed to "`example.library`"), or any other way to keep them apart.

In any case, the result is that a program can be compiled on both PPC and 68k from identical source code. Furthermore, the two `exec`'s can cooperate; for example, signaling, message passing and semaphores can be shared between them (remember that we can re-compile `exec` and also make modifications to the 68k version). In the above example, the `ExampleBase` pointer returned is a PPC library on the PPC side, and a 68k library on the 68k side. Furthermore, this system works dynamically, as will be outlined below.

Migration

In order to allow incremental development of OS 4 into as much PPC native code as possible, the PPC version of the `OpenLibrary` call can actually verify if there is a PPC version of the library in question and selectively choose to *fail* if this is not the case, or instead construct a new library on-the-fly from the 68k counterpart. The PPC `exec` would look up the library on the 68k side, and if found, construct a new base and substitute all entries by simulated context switches into the 68k side, using the 68k emulator. If the need should arise, a scheme could be applied in which a PPC library need only implement parts of its own functionality, and make automatic context switches/emulator jumps into its 68k counterpart. This way for example a PPC version of `Intuition.library` could still use the 68k version of `OpenScreen`, but have its own PPC implementation of the more frequent calls like `OpenWindow` or similar. On a related topic, this scheme could be applied to time-critical functions in other system library, for example the drawing functions in `graphics.library`.

Likewise, the original library may be patched (either via `SetFunction` or via a newly compiled version) to use the new PPC version. This requires some possibility of the 68k emulator to inline PPC code, for example by executing an `INVALID` function, or by a jump to an uneven address (the emulator would strip out the LSB to get a new address with PPC code instead of 68k code).

To summarize the critical points:

1. The runtime system must be able to decide which "CPU" (either the PPC or the emulated 68k) is accessing address `0x00000004` to decide which value to return. If this is not possible, the new scheme could only be applied to programs written for OS4, and the startup code would need to be modified to ignore the usual base address and load a different one.
2. A scheme must be derived where both 68k and PPC libraries with the same name can co-exist. This does not only apply to on-disk representations, but also to in-memory representations. `Exec` in its current form stores all resident libraries in a list in its base; since we have two bases, there may be two lists. However, some libraries depend on being run from their `ROMTAG` or resident structure.
3. The runtime system must be able to construct a library on the fly at an `OpenLibrary` call. This is no problem at all, since this is exactly what is done when a library is first loaded from disk (`exec.library/MakeLibrary`, `exec.library/AddLibrary`). Furthermore, it must be able to decide which offsets are valid (i.e. Point to PPC code) and which must be redirected; setting these to invalid `NULL` jumps, or invalid instructions would be a possibility.
4. The emulator must be able to switch from 68k and from 68k to PPC quickly, so that replacing original 68k functions with PPC functions gives a noticeable speedup even for old 68k programs. Good speed-up candidates for this kind of optimizations are `dos.library`, `graphics.library`, `intuition.library` and `Picasso96API.library`. Since there is already work being done for a PPC-native `Picasso96`, this work can be recycled this way and even give "old" programs a bit of extra speed

(Most notably for thinks like C2P/WritePixelFormat etc.)

Annex II - List of subcontractors (subject to change)

- Hyperion Entertainment VOF

Hans-Joerg Frieden, Thomas Frieden, Steffen Haeuser, Peter Annuss, Joe Sera etc.

- Haage & Partner GmbH

Jochen Becher, Markus Poelmann, Martin Steigerwaldt etc.

- Olaf Barthel

- P96 team (Kneer & Abt GbR)

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- Almos Rajnai

- Mark Olsen

- Ignatios Souvatzis

- Andrea Vallinotto

- Martin Blom

- Philippe Ferrucci

- Oliver Roberts