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fautes d'orthographe. Today, 30% of our visitors use Ad-Block to block ads. We understand your pain with ads, but without ads, we won't be able to provide you will see, we have a lot of helpful information to share. 64-
bit extension of the ARM architectureARM AArch64 (64-bit)Introduced2011; 14years ago(2011)VersionARMv8.7-A, ARMv8.1-A, AR
AArch32/A32 use 32-bit instructions, AArch32/T32 (Thumb-2) uses mixed 16- and 32-bit instructions[1]EndiannessBi (little as default)ExtensionsSVE, SVE2, SME, AES, SM3, SM4, SHA, CRC32, RNDR, TME; All mandatory: Thumb-2, Neon, VFPv4-D16, VFPv4; obsolete: JazelleRegistersGeneral-purpose31 64-bit instructions[1]Floating point32 128-
bit registers[1] for scalar 32- and 64-bit FP or SIMD FP or integer; or cryptographyAArch64 or ARMv8-A, architecture family. It was first introduced with the Armv8-A architecture family. It was first introduced with the Armv8-A, defines the number of bits in the
primary processor registers, the available instruction sets, and other aspects of the processor's execution state. [3]64-bit Execution state: AArch64 Execution states, the 64-bit AArch64 Execution state and the 32-bit Execution state.
AArch32.Instruction sets: A32 + T32.Example: ARMv8-R, Cortex-A32.[4]New instruction set, A64:Has 31 general-purpose 64-bit registers. Has dedicated zero or stack pointer (SP) register (depending on instruction). The program counter (PC) is no longer directly accessible as a register. Instruction set, A64:Has 31 general-purpose 64-bit registers.
(with LDM/STM instructions and most conditional execution dropped). Has paired loads/stores (in place of LDM/STM). No predication for most instructions (except branches). Most instructions can take 32-bit or 64-bit arguments. Addresses assumed to be 64-bit. Advanced SIMD (Neon) enhanced: Has 32 128-bit registers (up from 16), also accessible via
VFPv4.Supports double-precision floating-point format.Fully IEEE 754 compliant.AES encrypt/decrypt and SHA-1/SHA-2 hashing instructions also use these registers. A new exception system: Fewer banked registers and modes. Memory translation from 48-bit virtual addresses based on the existing Large Physical Address Extension (LPAE), which was
designed to be easily extended to 64-bit. Extension: Data gathering hint (ARMv8.0-DGH). AArch64 was introduced in ARMv8-A, and is included in ARMv8-A and is included in ARMv8-A, and in all versions of ARMv8-A, and in all v
selecting which group an A64 instruction belongs to is at bits 2528.A64 instruction formatsTypeBit31302928272625242322120191817161514131211109876543210Reserved0op00000VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated0001SVE0010VariesUnallocated00001SVE0010VariesUnallocated00001SVE0010VariesUnallocated00001SVE0010VariesUnallocated00001SVE001
Otherssf1000111RdBranches + System Instructionsop01010p10p2bata Processing Floating Point and SIMDop01110p10p2op3See also: Comparison of ARMv8-A processorsArmv8-A platform with Cortex-A57/A53 MPCore big.LITTLE CPU chipAnnounced in
October 2011,[5] ARMv8-A represents a fundamental change to the ARM architecture. It adds an optional 64-bit Execution state, "AArch32", supporting the 32-bit "A32" (original 32-bit Arm) and "T32" (Thumb/Thumb-2) instruction sets. The latter
instruction sets provide user-space compatibility with the existing 32-bit ARMv7-A architecture. ARMv8-A allows 32-bit ARMv7-A architecture and a 32-bit OS, an
compatible core (Cyclone) in a consumer product (iPhone 5S). AppliedMicro, using an FPGA, was the first to demo ARMv8-A SoC from Samsung is the Exynos 5433 used in the Galaxy Note 4, which features two clusters of four Cortex-A57 and Cortex-A53 cores in a big.LITTLE configuration; but it will run only in AArch32 mode.
[8]ARMv8-A includes the VFPv3/v4 and advanced SIMD (Neon) as standard features in both AArch32 and AArch64. It also adds cryptography instructions support one or both of AArch32 and AArch64; it may support AArch32 and AArch64 at lower Exception
levels and only AArch64 at higher Exception levels.[10] For example, the ARM Cortex-A32 supports only AArch32,[11] the ARM Cortex-A34 supports only AArch64 at all Exception levels, and may support AArch32 at EL0.[10]In
December 2014, ARMv8.1-A,[14] an update with "incremental benefits over v8.0", was announced. The enhancements fell into two categories: changes to the exception model and memory translations. Additions to the
Advanced SIMD instruction set for both AArch32 and AArch64 to enable opportunities for some library optimizations: Signed Saturating Rounding Doubling Multiply Accumulate, Returning High Half. The instructions are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations: Signed Saturating Rounding Doubling Multiply Accumulate, Returning High Half. The instructions are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations: Signed Saturating Rounding Doubling Multiply Accumulate, Returning High Half. The instructions are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations: Signed Saturating Rounding Doubling Multiply Accumulate, Returning High Half. The instructions are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations: Signed Saturating Rounding Doubling Multiply Accumulate, Returning High Half. The instructions are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations are added in vector and scalar forms. A set of AArch64 to enable opportunities for some library optimizations are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and scalar forms. A set of AArch64 to enable optimization are added in vector and sc
load and store instructions that can provide memory access order that is limited to configurable address regions. The optional CRC instructions in v8.0 become a requirement in ARMv8.1. Enhancements for the exception model and memory translation system included the following: A new Privileged Access Never (PAN) state bit provides control that
prevents privileged access to user data unless explicitly enabled. An increased VMID range for virtualization; supports a larger number of virtualization for hardware updated, dirty bit mechanism. The Virtualization Host Extensions (VHE). These prevents privileged access to user data unless explicitly enabled. An increased VMID range for virtualization for hardware updated, dirty bit mechanism. The Virtualization Host Extensions (VHE). These prevents privileged access to user data unless explicitly enabled.
enhancements improve the performance of Type 2 hypervisors by reducing the software overhead associated when transitioning between the Host of the extensions allow the Host of the extensions allow the Host of the extensions allow the Host of the extension that the extension is allow the Host of the extension that the extension is allow the Host of the Host of the extension is allow the Host of the Extension is allowed the Host 
system use, where the hardware support is not needed by the OS.Top byte ignore for memory tagging.[16]ARMv8.2-A was announced in January 2016.[17] Its enhancements fall into four categories:Optional half-precision floating-point data processing (half-precision was already supported, but not for processing, just as a storage format.)Memory
model enhancements. Introduction of Reliability, Availability and Serviceability Extension (RAS Extension). Introduction of statistical profiling. The Scalable Vector Extension of high-performance computing scientific workloads. [18][19] The
specification allows for variable vector lengths to be implemented from 128 to 2048 bits. The extension is complementary to, and does not replace, the NEON extensions. A 512-bit SVE variant has already been implemented on the Fugitsu A64FX ARM processor; this computer in the
world for two years, from June 2020[21] to May 2022.[22] A more flexible version, 2x256 SVE, was implemented by the AWS Graviton3 ARM processor.SVE is supporting C intrinsics. As of July 2020[update], LLVM and clang support C and IR intrinsics. ARM's own fork
of LLVM supports auto-vectorization.[23]In October 2016, ARMv8.3-A was announced. Its enhancements fell into six categories:[24]Pointer authentication (PAC)[25][26] (AArch64 only); mandatory extension (based on a new block cipher, QARMA[27]) to the architecture (compilers need to exploit the security feature, but as the instructions are in NOP
space, they are backwards compatible albeit providing no extra security on older chips). Nested virtualization (AArch64 only). Advanced SIMD complex number support (AArch64 only). Advanced SI
change to the memory consistency model (AArch64 only); to support the (non-default) weaker RCpc (Release Consistent processor consistent) model of C++11/C11 (the default C++11/C11 consistency model was already supported in previous ARMv8). ID mechanism support for larger system-visible caches (AArch64 and AArch32). ARMv8.3-A
architecture is now supported by (at least) the GCC 7 compiler.[29]In November 2017, ARMv8.4-A was announced. Its enhancements fell into these categories:[30][31][32]"SHA3 / SHA512 / SM3 / SM4 crypto extensions." I.e. optional instructions.Improved virtualization support.[33]Memory Partitioning and Monitoring (MPAM) capabilities.A new
Secure EL2 state and Activity Monitors. Signed and unsigned integer dot product (SDOT and UDOT) instructions. In September 2018, ARMv8.5-A was announced. Its enhancements fell into these categories: [34][35][36]Memory Tagging Extension (MTE) (AArch64). [37]Branch Target Indicators (BTI) (AArch64) to reduce "the ability of an attacker to
execute arbitrary code". Like pointer authentication, the relevant instructions are no-ops on earlier versions of ARMv8-A.Random Numbers conforming to various National and International Standards". On 2 August 2019, Google announced Android would adopt Memory
Tagging Extension (MTE).[38]In March 2021, ARMv9-A also adds:Scalable Vector Extension 2 (SVE2). SVE2 builds on SVE's scalable vectorization for increased fine-grain Data Level Parallelism (DLP), to allow more work done per instruction. SVE2 aims to
bring these benefits to a wider range of software including DSP and multimedia SIMD code that currently use Neon. [42] The LLVM/Clang 9.0 and GCC 10.0 development codes were updated to support for Hardware Transactional Memory (HTM).
and Transactional Lock Elision (TLE). TME aims to bring scalable concurrency to increase coarse-grained Thread Level Parallelism (TLP), to allow more work done per thread.[42] The LLVM/Clang 9.0 and GCC 10.0 development codes were updated to support TME.[43]Confidential Compute Architecture (CCA).[44][45][46]In September 2019,
ARMv8.6-A was announced. Its enhancements fell into these categories:[34][47]General Matrix Multiply (GEMM).Bfloat16 format support.SIMD matrix manipulation instructions, BFDOT, BFMMLA, BFMLAL and BFCVT.Enhancements for virtualization, system management and security.And the following extensions (that LLVM 11 already added
support for [48]): Enhanced Counter Virtualization (ARMv8.6-ECV). Fine-Grained Traps (ARMv8.6-FGT). Activity Monitors virtualization (ARMv8.6-AMU). For example, fine-grained traps, Wait-for-Event (WFE) instructions, Enhanced PAC2 and FPAC. The bfloat 16 extensions for SVE and Neon are mainly for deep learning use. [49] In September 2020,
ARMv8.7-A was announced. Its enhancements fell into these categories:[34][50]Scalable Matrix Extension (SME)(ARMv9.2 only).[51] SME adds new features to process matrices efficiently, such as:Matrix tile storage.On-the-fly matrix transposition.Load/store/insert/extract tile vectors. Matrix outer product of SVE vectors. "Streaming mode"
SVE.Enhanced support for PCIe hot plug (AArch64). Atomic 64-byte load and stores to accelerators (AArch64). Wait For Interrupt (WFI) and Wait For Event (WFE) with timeout (AArch64). Branch-Record recording (ARMv9.2 only). Call Stack RecorderIn September 2021, ARMv8.8-A and ARMv9.3-A were announced. Their enhancements fell into these
categories:[34][52]Non-maskable interrupts (AArch64).Instructions to optimize memcpy() and memset() style operations (AArch64).Enhancements to PAC (AArch64).Hinted conditional branches (AArch64).Instructions to optimize memcpy() and memset() style operations (AArch64).Enhancements to PAC (AArch64).Enhance
System Architecture (VMSA) enhancements. Permission indirection and overlays. Translation hardening. 128-bit translation tables (ARMv9 only). Scalable Matrix Extension 2 (SME2) (ARMv9 only). Multi-vector instructions. Multi-vector predicates. 2b/4b weight compression. 1b binary networks. Range Prefetch. Guarded Control Stack (GCS) (ARMv9 only).
only).Confidential Computing.Memory Encryption Contexts.Device Assignment.In October 2023, ARMv9.5-A was announced, including:[55]FP8 support (E5M2 and E4M3 formats) added to:SME2SVE2Advanced SIMD (Neon)Live migration of Virtual Machines using Hardware Dirty state tracking structures (FEAT_HDBSS)Checked Point
ArithmeticSupport for using a combination of the PC and SP as the modifier when generating or checking Pointer Authentication codes. Support for non-secure only in the Granule Protection Tables and the ability to disable certain Physical Address Spaces (PAS). EL3 configuration
write-traps.Breakpoint support for address range and mismatch triggering without the need for linking. Support for efficiently delegating SErrors from EL3 to EL2 or EL1. In October 2024, ARMv9.6-A was announced, including:[56] Improved SME efficiency with structured sparsity and quarter tile operationsMPAM Domains to better support shared-
memory computer systems on multi-chip systems on multi-chip systems on multi-chip systems and Data Placement Granular Protection Tables (GPT) for large memory control for Confidential Compute Bitwise locking of EL1 systems registers Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling of Granular Protection Tables (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling (GPT) for large memory control for Trace and Statistical Profiling on virtual machines Improved Scaling (GPT) for large memory control for Trace and Statistical Profiling (GPT) for large memory control for Trace and Statistical Profiling (GPT) for large memory control for Trace and Statistical Profiling (GPT) for large memory control for Trace and Statistical Profiling (GPT) for large memory control for Trace and Statistical Profiling (GPT) for large memory control for Statistical Profiling 
systemsNew SVE instructions for expand/compact and finding first/last active elementAdditional unprivileged load and store instructions to enable OS to interact with application memoryNew compare and branch instructional citations.
You can help by adding to it. Relevant discussion may be found on Talk:AArch64. (May 2021) The ARM-R architecture, specifically the Armv8-R profile, is designed to address the needs of real-time applications, where predictable and deterministic behavior is essential. This profile focuses on delivering high performance, reliability, and efficiency in
embedded systems where real-time constraints are critical. With the introduction of optional AArch64 support in the Armv8-R profile, the real-time capabilities have been further enhanced. The Cortex-R82[57] is the first processor to implement this extended support, bringing several new features and improvements to the real-time domain.
[58]AArch64 Instruction Set (A64):The A64 instruction[28] set in the Cortex-R82 provides 64-bit data handling and operations, which improves performance for certain computational tasks and enhances overall system efficiency.[57]Example Instruction Set (A64):The A64 instructio
bit operation allows for larger and more complex calculations compared to the 32-bit operations of the previous A32 instructions to ensure proper ordering of memory operations, which is critical in real-time systems
where the timing of memory operations must be strictly controlled. [59]Data Synchronization Barrier (DSB): Ensures that all data accesses before the barrier are completed before any memory accesses
after the barrier can proceed. Example: In a real-time automotive control system, DSB might be used to ensure that sensor data is fully written to memory before the system proceeds with processing or decision-making, preventing data corruption or inconsistencies. Improved Address Space: 64-bit Addressing: AArch64 allows the Cortex-R82 to address
a much larger memory space compared to its 32-bit predecessors, making it suitable for applications requiring extensive memory. Example: A complex industrial automation system performance and capability. Real-Time Performance
Enhancements:Interrupt Handling: With AArch64 support, the Cortex-R82 can handle interrupts with lower latency and improved predictability, crucial for real-time operations. Example: In a robotics application, the Cortex-R82's enhanced interrupt handling can ensure timely responses to external stimuli, such as changes in sensor data or control
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Reference Manual Supplement - Armv8, for Armv8-R AArch64 architecture profile". Arm Ltd. ^ "Cortex-R82 Technical Reference Manual".Arm DeveloperRetrieved from " software whose full use is limited in timeShareware is a type of proprietary software that is initially shared by the owner for trial use at little or no cost.[1] Often the software has
limited functionality or incomplete documentation until the user sends payment to the software developer. [2] Shareware is often offered as a download from a website. Shareware differs from freeware, which is fully-featured software distributed at no cost to the user but without source code being made available; and free and open-source software,
in which the source code is freely available for anyone to inspect and alter. There are many types of shareware and, while they may not require an initial up-front payment, many are intended to generate revenue in one way or another. Some limit use to personal non-commercial purposes only, with purchase of a license required for use in a business
enterprise. The software itself may be time-limited, or it may remind the user that payment would be appreciated. Trialware or demoware is a program that limits the time that it can be effectively used, commonly via a built-in time limit, number of uses, or only allowing progression up to a certain point (e.g. in video games, see Game demo). [3] The
user can try out the fully featured program until the trial period is up, and then most trialware reverts to either a reduced-functionality (freemium, nagware, or crippleware) or non-functional mode, unless the user purchases a full version.[4] Trialware has become normalized for online Software as a Service (SaaS).[citation needed] WinRAR is a
notable example of an unlimited trialware, i.e. a program that retains its full functionality even after the trial period has ended. The rationale behind trialware is to give potential users the opportunity to try out the program to judge its usefulness before purchasing a license. According to industry research firm Softletter, 66% of online companies
surveyed had free-trial-to-paying-customer conversion rates of 25% or less. SaaS providers employ a wide range of strategies to nurture leads, and convert them into paying customers. Main article: FreemiumFreemium works by offering a product or service free of charge (typically digital offerings such as software, content, games, web services or
other) while charging a premium for advanced features, functionality, or related products and services. For example, a fully functional features disabled until a license fee is paid. The word freemium combines the two aspects of the business model: "free" and "premium".[5] It has
become a popular model especially in the antivirus industry. Main article: Adware dware, short for "advertising-supported software", is any software package which automatically renders advertisements in order to generate revenue for its author. Shareware is often packaged with adware to lower the shareware fees or eliminate the need to charge
users a fee. The advertisements may take the form of a banner on an application window. The functions may be designed to analyze which websites the user visits and to present advertisements may take the form of a banner on an application window. The functions may be designed to analyze which typically
are more intrusive and may appear as pop-ups, as is the case in most ad-oriented spyware.[6] During the installation of the intended software, the user is presented with a requirement to agree to the terms of click through an end-user license agreement or similar licensing which governs the installation of the software.[7]Main articles
Crippleware Crippleware has vital features of the program, such as printing or the ability to save files, disabled or unwanted features like watermarks on screencasting and video editing software. This allows users to take a close look at the features of a program without being able to use it to generate output. The
distinction between freemium and crippleware is that an unlicensed freemium program has useful on its own. Main article: Donationware is a licensing model that supplies fully operational unrestricted software to the user and requests an optional donation between freemium program has useful on its own. Main article: Donationware is a licensing model that supplies fully operational unrestricted software to the user and requests an optional donation between freemium and crippleware is that an unlicensed freemium program has useful on its own. Main article: Donationware is a licensing model that supplies fully operational unrestricted software to the user and requests an optional donation between freemium and crippleware is that an unlicensed freemium program has useful on its own. Main article: Donationware is a licensing model that supplies fully operation and crippleware is that an unlicensed freemium program has useful on its own.
paid to the programmer or a third-party beneficiary (usually a non-profit).[9] The amount of the donation may also be stipulated by the author, or it may be left to the discretion of the user, based on individual perceptions of the software's value. Since donation ware comes fully operational (i.e. not crippleware) with payment optional, it is a type of
 freeware. In some cases, there is a delay to start the program or "nag screen" reminding the user that they haven't donated to (paid for) the software. Nagware (also known as begware, annoyware or a nagscreen) is a pejorative term for
shareware that persistently reminds the user to purchase a license.[10] It usually does this by popping up a message when the user starts the program, or intermittently while the user to purchase a license.[10] It usually does this by popping up a message when the user starts the program, or intermittently while the user is using the application. These messages can appear as windows obscuring part of the screen, or as message boxes that can quickly be closed. Some nagware keeps the
message up for a certain time period, forcing the user to wait to continue to use the programs that support printing may superimpose a watermark on the printed output, typically stating that the output was produced by an unlicensed copy. Some titles display a dialog box with payment information and a message that paying will
remove the notice, which is usually displayed either upon startup or after an interval while the application is running. These notices are designed to annoy the user into paying. Postcardware, also called just cardware, is a style of software distribution similar to shareware, distributed by the author on the condition that users send the author
postcard. A variation of cardware, emailware, uses the same approach but requires the user to send the author an email. Postcardware, like other novelty software distribution terms, is often not strictly enforced. Cardware is similar to beerware. The concept was first used by Aaron Giles, author of JPEGView.[11] Another well-known piece of
postcardware is the roguelike game Ancient Domains of Mystery, whose author collects postcards from around the world. Orbitron is distributed as postcardware. [12] Caledos Automatic Wallpaper Changer is a "still alive" project cardware. "Empathy" is a
 postcardware for password-protected executables. Dual Module Player and Linux were also postcardware for a long time.[13] An example for emailware is the video game Jump 'n Bump.[14] Another popular postcardware for a long time.[13] An example for emailware is the video game Jump 'n Bump.[14] Another popular postcardware for a long time.[13] An example for emailware is the video game Jump 'n Bump.[14] Another popular postcardware for a long time.[13] An example for emailware is the video game Jump 'n Bump.[14] Another popular postcardware for a long time.[15] An example for emailware is the video game Jump 'n Bump.[14] Another popular postcardware for a long time.[15] An example for emailware is the video game Jump 'n Bump.[16] Another popular postcardware for a long time.[18] An example for emailware is the video game Jump 'n Bump.[18] Another popular postcardware for a long time.[18] An example for emailware is the video game Jump 'n Bump.[18] Another popular postcardware for a long time.[18] An example for emailware is the video game Jump 'n Bump.[18] Another popular postcardware for emailware is the video game Jump 'n Bump.[18] Another popular postcardware for emailware is the video game Jump 'n Bump.[18] Another popular postcardware for emailware for 
 framework, which are postcardware licensed, and all shown at their website.[15]In 1982, Andrew Fluegelman created a program for the IBM PC called PC-Talk, a telecommunications program, and used the term freeware; he described it "as an experiment in economics more than altruism".[16] About the same time, Jim "Button" Knopf released PC
File, a database program, calling it user-supported software. [17] Not much later, Bob Wallace produced PC-Write, a word processor, and called it shareware. Appearing in an episode of Horizon titled Psychedelic Science originally broadcast 5 April 1998, Bob Wallace said the idea for shareware came to him "to some extent as a result of my
psychedelic experience".[18]Fluegelman said that his experience as a book publisher and author discouraged him from finding a traditional software publisher. KQED pledge drives inspired his distribution method, as well as his not knowing how to implement copy protection.[19]In 1983 Jerry Pournelle wrote of "an increasingly popular variant" of
free software "that has no name, but works thus: 'If you like this, send me (the author) some money. I prefer cash.'"[20] In 1984, Softalk-PC magazine had a column, The Public Library, about such software. Public domain is a misnomer for shareware, and Freeware was trademarked by Fluegelman and could not be used legally by others, and User-
Supported Software was too cumbersome. So columnist Nelson Ford had a contest to come up with a better name submitted was Shareware, which was being used by Wallace. However, Wallace acknowledged that he got the term from an InfoWorld magazine column by that name in the 1970s[failed verification][citation]
needed], and that he considered the name to be generic, [21] so its use became established over freeware and user-supported software. [22]By 1984 Knopf reported receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was receiving about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [23] and by 1985 Fluegelman was received about $1,000 a day for PC-File, [25] and $1,000 a day for PC-File, [25] and $1,000 a day for PC-File, [25] an
[19] He, Knopf, and Wallace clearly established shareware as a viable software distribution model by becoming wealthy. [24] [25] Prior to the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access, shareware was often the popularity of the World Wide Web and widespread Internet access.
or BBS access could download software and distribute it amongst their friends or user groups, who would then be encouraged to send the registration fee to the author, usually via postal mail. During the late 1980s and early 1990s, shareware software was widely distributed over online services, bulletin board systems and on diskettes. Contrary to
commercial developers who spent millions of dollars urging users "Don't Copy That Floppy", shareware developers encouraged users to upload the software and share it on disks. Commercial shareware developers encouraged users to upload the software and share it on disks. Commercial shareware developers encouraged users to upload the software and share it on disks. Commercial shareware developers encouraged users to upload the software and share it on disks. Commercial shareware developers encouraged users to upload the software and share it on disks. Commercial shareware developers encouraged users to upload the software and share it on disks. Commercial shareware distributors such as Educorp and Public Domain Inc printed catalogs describing thousands of public domain and shareware programs that were
available for a small charge on floppy disk. These companies later made their entire catalog available on CD-ROM. One such distributor, Public Software Library (PSL), began an order-taking service provider CompuServe enabled people to
pay (register) for software using their CompuServe accounts. When AOL bought out CompuServe accounts. When AOL bought out CompuServe accounts to use SWREG as a
back office to accept various payment methods including credit, debit and charge cards, Paypal and other services in multiple currencies. This worked in realtime so that a client could pay for software and instantly download it which was novel at the time. SWREG was eventually bought by Digital River, Inc. Also, services like Kagi started offering
applications that authors could distribute along with their products that would present the user with an onscreen form to fill out, print, and mail along with their payment. Once telecommunications became more widespread, this service also expanded online. Toward the beginning of the Internet era, books compiling reviews of available shareware
were published, sometimes targeting specific niches such as small business. These books would typically come with one or more floppy disks or CD-ROMs containing software from the book.[26]As Internet use grew, users turned to downloading shareware programs from FTP or web sites. This spelled the end of bulletin board systems and shareware
disk distributors. At first, disk space on a server was hard to come by, so networks like Info-Mac were developed, consisting of non-profit mirror sites hosting industry, the authors of shareware programs started their own sites where the public
could learn about their programs and download the latest versions, and even pay for the software online. This erased one of the chief distinctions of shareware, as it was now most often downloaded from a central "official" location instead of being shared samizdat-style by its users. To ensure users would get the latest bug-fixes as well as an install
untainted by viruses or other malware, some authors discouraged users from giving the software to their friends, encouraging them to send a link instead. Major downloads. Popular software was sorted to the top of the list, along with
products whose authors paid for preferred placement. If features are disabled in the freely accessible version, paying may provide the user with a license key or code they can enter into the software to disable the notices and enable full functionality. Some pirate web sites publish license codes for popular shareware, leading to a kind of arms race
between the developer and the pirates where the developer disables pirated codes, using the opportunity to educate users on the economics of the shareware model. [27] Some shareware relies entirely on the user's honesty and the pirates attempt to find or generate new ones. Some software publishers have started accepting known pirated codes, using the opportunity to educate users on the economics of the shareware model.
requires no password. Simply checking an "I have paid" checkbox in the application is all that is required to disable the registration notices. [28][29]Main article by adding citations to reliable sources. Unsourced material may be challenged and
removed. Find sources: "Shareware "news newspapers books scholar JSTOR (December 2016) (Learn how and when to remove this message) In the early 1990s, shareware distribution was a popular method of publishing games for smaller developers, including then-fledgling companies Apogee Software (also known as 3D Realms), Epic MegaGames
(now Epic Games), Ambrosia Software and id Software and it gave consumers the chance to play the game before investing money in it, and it gave them exposure that some products would be unable to get in the retail space. With the Kroz series, Apogee introduced the "episodic" shareware model that became the most popular incentive for buying a
game.[30] While the shareware game would be a truly complete game, there would be additional "episodes" of the game that were not shareware episode. In some cases these episodes were neatly integrated and would feel like a longer version of the game, and in other cases the later
episodes would be stand-alone games. Sometimes the additional content was completely integrated with an undefeatable ship, would periodically harass and destroy the player after they reached a certain
level representing the end of the trial period. Racks of games on single 51/4-inch and later 3.5-inch floppy disks were common in retail stores. However, computer shows[citation needed] and bulletin board systems (BBS) such as Software Creations BBS were the primary distributors of low-cost software. Free software from a BBS was the motivating
force for consumers to purchase a computer equipped with a modem, so as to acquire software at no cost. The success of shareware games, including id Software hits Commander Keen and Doom, depended in part on the BBS community's willingness to redistribute them from one BBS to another across North America. The reasons for redistribution
included allowing modem users who could not afford long-distance calls the opportunity to view the games. [31] The important distinguishing feature between a shareware game and a game demo is that the shareware game is (at least in theory) a complete working software program albeit with reduced content compared to the full game, while a game
demo omits significant functionality as well as content. Shareware games commonly offered both single player and multiplayer modes plus a significant fraction of the full game content for registered users. By contrast a
game demo may offer as little as one single-player level or consist solely of a multiplayer map, this makes them easier to prepare than a shareware game. There are several widely accepted standards and technologies that are used in the development and promotion of shareware game. There are several widely accepted standards and technologies that are used in the development and promotion of shareware game. There are several widely accepted standards and technologies that are used in the development and promotion of shareware game.
shareware distribution packages. Portable Application Description (PAD) is used to standardize shareware application descriptions. PAD file is an XML document that describes a shareware product according to the PAD specification. [32] Dynamic PAD extends the Portable Application Description (PAD) standard by allowing shareware
vendors to provide customized PAD XML files to each download site or any other PAD-enabled resource. DynamicPAD is a set of server-side PHP scripts distributed under a GPL license and a freeware DynamicPAD file is through the RoboSoft application by Rudenkcron for 32-bit Windows. The primary way to consume or submit a DynamicPAD file is through the RoboSoft application by Rudenkcron for 32-bit Windows.
Software, the DynamicPAD author. DynamicPAD web site. Code signing is a technology that is used by developers to digitally sign their products. Versions of Microsoft Windows XP Service Pack 2 show a warning when the user installs unsigned software. This is typically offered as a security measure to
prevent untrusted software from potentially infecting the machine with malware. However, critics see this technology as part of a tactic to delegitimize independent software development by requiring hefty upfront fees and a review process before software can be distributed.[33]Association of Software ProfessionalsCarewareKeygen^ Bink, Thomas
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Garland, Texas, USFounderScott MillerHeadquartersAalborg, DenmarkKey peopleFrederik Schreiber (CEO)ProductsList of 3D Realms gamesParentSaber Interactive (2021present)Website3drealms.com3D Realms game
Garland, Texas, in 1987 as Apogee Software Productions to release his game Kingdom of Kroz. In the late 1980s and early 1990s, the company popularized a distribution model where each game consists of three episodes, with the first given away free as shareware and the other two available for purchase. Duke Nukem was a major franchise created
by Apogee to use this model, and Apogee published Commander Keen and Wolfenstein 3D the same way. Apogee began using the brand name 3D Realms to focus on traditionally-published 3D titles. Duke Nukem 3D (1996) was released under this name to great success
3D Realms largely ceased its publishing and development until being taken over by another studio in 2001, and Duke Nukem Forever (2011), which remained under development until 2009. The "Apogee Software" name, library, and logo
 were licensed to Terry Nagy in 2008, who established Apogee Software LLC to develop and publish ports and spinoffs of Apogee titles. In 2009, 3D Realms, citing financial issues, laid off its development team and the majority of its staff, effectively ceasing operations. In March 2014, the company was acquired by SDN Invest, a Danish holding
company and part-owner of Interceptor Entertainment, and relaunched later that year as 3D Realms Entertainment ApS, headquartered in Denmark. 3D Realms Entertainment has since served as a games publisher. Miller remained an advisor for the company until 2021, when he and Nagy acquired the Apogee brand and relaunched Apogee Software
LLC as Apogee Entertainment, an independent games publisher. In August 2021, 3D Realms Entertainment was acquired by Embracer in March 2024. In the early 1980s, Scott Miller often spent time in the computer lab of the high school he was attending, programming text
adventures on the facility's Apple II and getting to know fellow student George Broussard.[1] Following graduation, both of them took jobs at local amusement arcade The Twilight Zone, allowing Miller dropped out of the University of
Dallas to focus entirely on video games, including participating in tournaments as well as programming his own games.[1] At that time, he found a special interest in the Turbo Pascal programming language and its easy integration on IBM Personal Computers.[2] Miller subsequently figured that his knowledge on video games should earn him more
 money than he made at The Twilight Zone, wherefore he, with assistance by Broussard, wrote a manual-style book on "how to beat video game critic for The Dallas Morning News and minor game-centric papers.[1] After four years of writing for
the newspaper, he decided that he was capable of creating games that were better than those that the had to review and quit his job. Miller acquired a 16.5k modem, which he installed in his parents' house in Garland, Texas, and started operating as a full-time independent game developer.[1]The Apogee Software logoMost games developed by Miller
at the time used extended ASCII characters as graphics.[1][3] The format appeared popular to him but ultimately proved unsuccessful when pitching them to publishers, adding to him not having a college degree or any professional experience in game development.[1] As such, he considered self-printing copies of his games, or distributing them
freely through bulletin board systems (BBS), where the boards' users make voluntary donations, a model known as shareware distribution.[1] As the prior option seemed too expensive to Miller, he had to choose the latter, despite being urged not to by friends and colleagues.[1] Miller released Beyond the Titanic and Supernova as shareware games in
1986 and 1987, respectively, but income was low, at roughly US$10,000 donated in a year for both games combined.[1] Miller's next game, Kingdom of Kroz, was developed to include 60 levels, more than what he wanted to release to the public for no cost.[1] As such, he developed a new distribution model, dubbed the "Apogee model", in which only
a fraction of the game would be made available to play for free on BBS, which, upon completion, would display Miller's mailing address to the player and ask them to contact him to buy the rest of the game.[1] He applied this model to Kingdom of Kroz by breaking it up into three parts, named episodes, and sharing the first one over BBS while
retaining the other two for sale.[1][2] Released on November 26, 1987, Kingdom of Kroz was the first game to bear the name of Miller's one-man company, Apogee Software Productions.[2] The game proved successful, with checks sent to Miller amounting to roughly US$80,000US$100,000 and him receiving between US$100 and US$500 every
single day.[2] Broussard later joined Apogee, merging his own, lesser-known game company Micro-FX into it.[4]In 1994, Apogee decided to launch different brand names for each genre of games they published; it created 3D Realms for 3D games, publishing Terminal Velocity in 1995 and developing the 1996 Duke Nukem 3D under the name, with the
other titles released in those years still under Apogee [5] In late 1996, however, Apogee renamed the company itself to 3D Realms to associate their brand with newer, 3D titles, and stopped using the Apogee brand name.
as 3D games like Duke Nukem became the company's focus. 3D Realms launched a brand for pinball games, Pinball Wizards, in February 1997, but only published Balls of Steel (1997) under the name.[5] Beginning in 1997 3D Realms shifted from episodic MS-DOS titles to non-episodic console and personal computer games. In the process it
abandoned the shareware model in favor of a traditional publishing model; it also largely ceased its activities as a development until 2001 when it was transferred to Human Head Studios, and Duke Nukem Forever (2011), which
famously stayed in development at 3D Realms as vaporware until 2009.[7][8]The "Apogee Software" name, library, and logo were licensed to Terry Nagy in 2008, who formed Apogee Software, LLC as a separate company that would handle distribution, remakes, and other developments related to older Apogee games. 3D Realms retained the
corporate name of Apogee Software, Ltd. Apogee Software, Ltd. Apogee Software, Ltd. Apogee Entertainment in 2021.[6]After Prey was transferred away from 3D Realms in 2001, the only project under development at the company was Duke Nukem Forever, originally announced in 1997. The release date of the game was "when it's done."[9] 3D Realms
continued some operations as a publisher as part of the Gathering of Developers publishing group, but otherwise served only as the publisher and licensee of Duke Nukem Forever was halted, and major staff cuts were initiated with the entire
development team and most other employees laid off.[10][11] According to Miller, the development was using up much of the company's funds as they struggled to bring in new 3D rendering technology for the game, leading to the decision to cut their staff and sell the company.[12]On May 14, 2009, Take-Two, holders of the publishing rights of Duke
has not closed and is not closing", but that due to lack of funds development operations were ceasing and the company would continue to "license and co-create games based upon the Duke Nukem franchise." They accused Take-Two Interactive
announced that development of Duke Nukem Forever had been shifted over to Gearbox Software, effectively ending 3D Realms remained credited as a co-development. 3D Realms remained credited as a co-development of Duke Nukem Forever, due to their involvement in developing most of the game. The rights and intellectual
property were sold to Gearbox, however, who became the owners of the Duke Nukem franchise.[16]An external developer, Interceptor Entertainment, started work on a fan-project remake of Duke Nukem 3D: Reloaded.
However, after Duke Nukem Forever's release and negative reception in 2011, Duke Nukem 3D: Reloaded was put on hold indefinitely. In an interview conducted with several projects underway, all fairly smallnot any big console games. Once [Duke
Nukem Forever comes out we'll be definitely looking to invest into other projects, and maybe other up-n-coming [sic] teams who are blazing new trails on smaller platforms, like smart phones and XBLA."[17] 3D Realms did not publish any released titles over the next few years, however. In June 2013, 3D Realms sued Gearbox for unpaid royalties as
new game called Duke Nukem: Mass Destruction. Gearbox stated that it was still the rights holder of the Duke Nukem franchise, and permission had not been granted by them to develop the game. 3D Realms soon after released a statement admitting its wrongdoing. [19] The lawsuit was settled in August 2015, with Gearbox stressing that it was still
the lawful owner of the Duke Nukem intellectual property. [20] In March 2014, SDN Invest, the part-owner of Interceptor Entertainment, acquired 3D Realms, [21] Mike Nielsen, the founder and chairman of SDN Invest, became the new chief executive officer of 3D Realms, [22] headquartered in Aalborg, Denmark and
incorporated in 2015 as 3D Realms Entertainment ApS.[23][24] Miller remained with the company as a creative consultant,[25] while Apogee Software LLC retained the license to the Apogee brand and library.[26]In May 2014, 3D Realms announced they were to publish Bombshell by Interceptor Entertainment,[27] and in October 2014 the company
returned to distributing its own titles with a digital anthology collection. [28][29] Bombshell was released on January 29, 2016, as 3D Realms announced the game Ion Maiden, a prequel to Bombshell, developed by Voidpoint and using Ken Silverman's Build Engine. In May 2019, the
company was hit with a $2 million trademark infringement lawsuit by heavy metal group Iron Maiden who claimed Ion Maiden was "nearly identical to the Iron Maiden trademark in appearance, sound and overall commercial impression" and was "attempting to trade off on Iron Maiden trademark infringement lawsuit by heavy metal group Iron Maiden was "nearly identical to the Iron Maiden was "nearly identical to 
the name of Ion Maiden to Ion Fury to end to the lawsuit. Ion Fury was released on August 15, 2019. Since then, 3D Realms published Ghostrunner (2020) and announced several projects which have been under development for multiple years without further notice.[31]In April 2021, Miller and Nagy acquired the Apogee name from 3D Realms and
relaunched Apogee Software LLC as Apogee Entertainment.[32] In 2022, Miller stated in a blog post that he was now uninvolved with 3D Realms and that "[the company] no longer than in name only" because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name only because he was no longer than in name on longer than in name 
they acquired the company through Saber Interactive, which will be the parent company. [34] 3D Realms published Cultic on October 13 (2022). In March 2023, 3D Realms announced that they hired Justin Burnham (formerly of Devolver Digital, Good Shepherd) to the position of CCO. [35] On September 30, 2023, 3D Realms held its 4th annual Realms
Deep event modernizing the company's branding and announcing release dates for several previously-unreleased titles. Two days later on October 24, 2023, 3D Realms published Ripout into early access in collaboration with developer Pet Project Games
[37] On November 16, 3D Realms published The Kindeman Remedy in collaboration with developer Troglobyte Games. [38] On December 5, 2023, 3D Realms co-published (with Interplay) the Slipgate Ironworks was laid off as part of Embracer's
restructuring.[40] Layoffs continued into January 204.[41]On January 24, 2024, 3D Realms co-published (with Fulgrum Publishing) the Slipgate Ironworks and Killpixel Games-developed Wrath: Aeon of Ruin out of
early access.[43]In March 2024, Saber Interactive was sold to Beacon Interactive was sold to 
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