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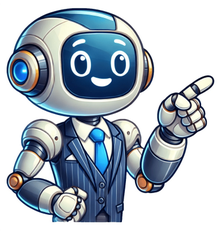

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International Organization for StandardizationOrganisation internationale de normalisation (French)Международная организация по стандартизации (Russian)AbbreviationISOPredecessorInternational Federation of the National Standardizing Associations (ISA)Formation23 February 1947; 78 years ago (1947-02-23)TypeNon-governmental organizationPurposeInternational standards developmentHeadquartersGeneva, SwitzerlandMembership170 members (39 correspondents and 4 subscribers)[1]Official languages EnglishFrenchRussian[2]PresidentSung Hwan ChoWebsitewww.iso.org RemarksUID: CHE-105.816.788 CH-ID: CH-660-3098013-3 The International Organization for Standardization (ISO /ˈaɪsoʊ/;[3] French: Organisation internationale de normalisation; Russian: Международная организация по стандартизации) is an independent, non-governmental, international standard development organization composed of representatives from the national standards organizations of member countries.[4][5] Membership requirements are given in Article 3 of the ISO Statutes.[6] ISO was founded on 23 February 1947, and (as of July 2024[update]) it has published over 25,000 international standards covering almost all aspects of technology and manufacturing. It has over 800 technical committees (TCs) and subcommittees (SCs) to take care of standards development.[7] The organization develops and publishes international standards in technical and nontechnical fields, including everything from manufactured products and technology to food safety, transport, IT, agriculture, and healthcare.[7][8][9][10] More specialized topics like electrical and electronic engineering are instead handled by the International Electrotechnical Commission.[11] It is headquartered in Geneva, Switzerland.[7] The three official languages of ISO are English, French, and Russian.[2] The International Organization for Standardization in French is Organisation internationale de normalisation and in Russian, Международная организация по стандартизации (Mezhdunarodnaya organizatsiya po standartizatsii). Although one might think ISO is an abbreviation for "International Standardization Organization" or a similar title in another language, the letters do not officially represent an acronym or initialism. The organization provides this explanation of the name:Because 'International Organization for Standardization' would have different acronyms in different languages (IOS in English, OIN in French), our founders decided to give it the short form ISO. ISO is derived from the Greek word isos (ίσος, meaning "equal"). Whatever the country, whatever the language, the short form of our name is always ISO.[7]During the founding meetings of the new organization, however, the Greek word explanation was not invoked, so this meaning may be a false etymology.[12] Both the name ISO and the ISO logo are registered trademarks and their use is restricted.[13] Plaque marking the building in Prague where the ISO predecessor, the ISA, was foundedThe organization that is known today as ISO began in 1926 as the International Federation of the National Standardizing Associations (ISA), which primarily focused on mechanical engineering. The ISA was suspended in 1942 during World War II but, after the war, the ISA was approached by the recently-formed United Nations Standards Coordinating Committee (UNSCC) with a proposal to form a new global standards body.[14] In October 1946, ISA and UNSCC delegates from 25 countries met in London and agreed to join forces to create the International Organization for Standardization. The organization officially began operations on 23 February 1947.[15][16] ISO Standards were originally known as ISO Recommendations (ISO/R), e.g., "ISO 1" was issued in 1951 as "ISO/R 1".[17] ISO is a voluntary organization whose members are recognized authorities on standards, each one representing one country. Members meet annually at a General Assembly to discuss the strategic objectives of ISO. The organization is coordinated by a central secretariat based in Geneva.[18] A council with a rotating membership of 20 member bodies provides guidance and governance, including setting the annual budget of the central secretariat.[18][19] The technical management board is responsible for more than 250 technical committees, who develop the ISO standards.[18][20][21][22] Main article: ISO/IEC JTC 1 ISO has a joint technical committee (JTC) with the International Electrotechnical Commission (IEC) to develop standards relating to information technology (IT). Known as JTC 1 and entitled "Information technology", it was created in 1987 and its mission is "to develop worldwide Information and Communication Technology (ICT) standards for business and consumer applications."[23][24] There was previously also a JTC 2 that was created in 2009 for a joint project to establish common terminology for "standardization in the field of energy efficiency and renewable energy sources".[25] It was later disbanded. Further information: Countries in the International Organization for Standardization A map of ISO members as of November 2020[update] ISO member countries with a national standards body and ISO voting rights Correspondent members (countries without a national standards body) Subscriber members (countries with small economies) other places with an ISO 3166-1 code who are not members of ISO As of 2022[update], there are 167 national members representing ISO in their country, with each country having only one member.[7][26] ISO has three membership categories,[1] Member bodies are national bodies considered the most representative standards body in each country. These are the only members of ISO that have voting rights. Correspondent members are countries that do not have their own standards organization. These members are informed about the work of ISO, but do not participate in standards promulgation. Subscriber members are countries with small economies. They pay reduced membership fees, but can follow the development of standards. Participating members are called "P" members, as opposed to observing members, who are called "O" members. ISO is funded by a combination of:[27] Organizations that manage the specific projects or loan experts to participate in the technical work Subscriptions from member bodies, whose subscriptions are in proportion to each country's gross national product and trade figures Sale of standards See also: List of ISO standards International standards are the main products of ISO. It also publishes technical reports, technical specifications, publicly available specifications, technical corrigenda (corrections), and guides.[28][29] International standards These are designated using the format ISO[/IEC] [/ASTM] [IS] nnnnn[-p]:[yyyy] Title, where nnnnn is the number of the standard, p is an optional part number, yyyy is the year published, and Title describes the subject. IEC for International Electrotechnical Commission is included if the standard results from the work of ISO/IEC JTC 1 (the ISO/IEC Joint Technical Committee). ASTM (American Society for Testing and Materials) is used for standards developed in cooperation with ASTM International. yyyy and IS are not used for an incomplete or unpublished standard and, under some circumstances, may be left off the title of a published work. Technical reports These are issued when a technical committee or subcommittee has collected data of a different kind from that normally published as an International Standard,[28] such as references and explanations. The naming conventions for these are the same as for standards, except TR prepended instead of IS in the report's name. For example: ISO/IEC TR 17799:2000 Code of Practice for Information Security Management ISO/TR 19033:2000 Technical product documentation – Metadata for construction documentation Technical and publicly available specifications Technical specifications may be produced when "the subject in question is still under development or where for any other reason there is the future but not immediate possibility of an agreement to publish an International Standard". A publicly available specification is usually "an intermediate specification, published prior to the development of a full International Standard, or, in IEC may be a 'dual logo' publication published in collaboration with an external organization".[28] By convention, both types of specification are named in a manner similar to the organization's technical reports. For example: ISO/TS 16952-1:2006 Technical product documentation – Reference designation system – Part 1: General application rules (later withdrawn and replaced by ISO/TS 81346-3:2012, which was later withdrawn) ISO/PAS 11154:2006 Road vehicles – Roof load carriers (later revised in ISO 11154:2023, which does not have the "PAS" abbreviation in its name) Technical corrigenda When partnering with IEC in their joint technical committee, ISO also sometimes issues "technical corrigenda" (where "corrigenda" is the plural of corrigendum). These are amendments made to existing standards to correct minor technical flaws or ambiguities.[28] ISO guides These are meta-standards covering "matters related to international standardization".[28] They are named using the format "ISO[/IEC] Guide N:yyyy: Title". For example: ISO/IEC Guide 2:2004 Standardization and related activities – General vocabulary ISO/IEC Guide 65:1996 General requirements for bodies operating product certification (since revised and reissued as ISO/IEC 17065:2012 Conformity assessment — Requirements for bodies certifying products, processes and services).[30] ISO documents have strict copyright restrictions and ISO charges for most copies. As of 2020[update], the typical cost of a copy of an ISO standard is about US$120 or more (and electronic copies typically have a single-user license, so they cannot be shared among groups of people).[31] Some standards by ISO and its official U.S. representative (and, via the U.S. National Committee, the International Electrotechnical Commission) are made freely available.[32][33] A standard published by ISO/IEC is the last stage of a long process that commonly starts with the proposal of new work within a committee. Some abbreviations used for marking a standard with its status are:[34][35][36][37][38][39][40] PWI – Preliminary Work Item NP or NWIP – New Proposal / New Work Item Proposal (e.g., ISO/IEC NP 23007) AWI – Approved new Work Item (e.g., ISO/IEC AWI 15444-14) WD – Working Draft (e.g., ISO/IEC WD 27032) CD – Committee Draft (e.g., ISO/IEC CD 23000-5) FCD – Final Committee Draft (e.g., ISO/IEC FCD 23000-12) DIS – Draft International Standard (e.g., ISO/IEC DIS 14297) FDIS – Final Draft International Standard (e.g., ISO/IEC FDIS 27003) PRF – Proof of a new International Standard (e.g., ISO/IEC PRF 18018) IS – International Standard (e.g., ISO/IEC 13818-1:2007) Abbreviations used for amendments are:[34][35][36][37][38][39][40][41] NP Amd – New Proposal Amendment (e.g., ISO/IEC 15444-2:2004/NP Amd 3) AWI Amd – Approved new Work Item Amendment (e.g., ISO/IEC 14492:2001/AWI Amd 4) WD Amd – Working Draft Amendment (e.g., ISO 11092:1993/WD Amd 1) CD Amd / PDAmd – Committee Draft Amendment / Proposed Draft Amendment (e.g., ISO/IEC 13818-1:2007/CD Amd 6) FPDAmd / DAM (DAmd) – Final Proposed Draft Amendment / Draft Amendment (e.g., ISO/IEC 14496-14:2003/FPDAmd 1) FDAM (FDAmd) – Final Draft Amendment (e.g., ISO/IEC 13818-1:2007/FDAmd 4) PRF Amd – (e.g., ISO 12639:2004/PRF Amd 1) Amd – Amendment (e.g., ISO/IEC 13818-1:2007/Amd 1:2007) Other abbreviations are:[38][39][41][42] TR – Technical Report (e.g., ISO/IEC TR 19791:2006) DTR – Draft Technical Report (e.g., ISO/IEC DTR 19791) TS – Technical Specification (e.g., ISO/TS 16949:2009) DTS – Draft Technical Specification (e.g., ISO/DTS 11602-1) PAS – Publicly Available Specification TTA – Technology Trends Assessment (e.g., ISO/TTA 1:1994) IWA – International Workshop Agreements (e.g., IWA 1:2005) Cor – Technical Corrigendum (e.g., ISO/IEC 13818-1:2007/Cor 1:2008) Guide – a guidance to technical committees for the preparation of standards International Standards are developed by ISO technical committees (TC) and subcommittees (SC) by a process with six steps:[36][43] Stage 1: Proposal stage Stage 2: Preparatory stage Stage 3: Committee stage Stage 4: Enquiry stage Stage 5: Approval stage Stage 6: Publication stage The TC/SC may set up working groups (WG) of experts for the preparation of a working drafts. Subcommittees may have several working groups, which may have several Sub Groups (SG).[44] Stages in the development process of an ISO standard[35][36][37][40][43][41] Stage code Stage Associated document name Abbreviations DescriptionNotes 00 Preliminary Preliminary work item PWI 10 Proposal New work item proposal NP or NWIPNP Amd/TR/TS/IWA 20 Preparatory Working draft or drafts AWIAWI Amd/TR/TSWDWD Amd/TR/TS 30 Committee Committee draft or drafts CDCD Amd/Cor/TR/TSPDAmd (PDAM)PDTRPDTS 40 Enquiry Enquiry draft DISFCDFPDAmdDAmd (DAM)FPDISPDTRDTS (CDV in IEC) 50 Approval Final draft FDISFDAmd (FDAM)PRFPRF Amd/TTA/TR/TS/SupplFDTR 60 Publication International Standard ISOTRTSIWAAmdCor 90 Review 95 Withdrawal It is possible to omit certain stages, if there is a document with a certain degree of maturity at the start of a standardization project, for example, a standard developed by another organization. ISO/IEC directives also allow the so-called "Fast-track procedure". In this procedure, a document is submitted directly for approval as a draft International Standard (DIS) to the ISO member bodies or as a final draft International Standard (FDIS), if the document was developed by an international standardizing body recognized by the ISO Council.[36] The first step, a proposal of work (New Proposal), is approved at the relevant subcommittee or technical committee (e.g., SC 29 and JTC 1 respectively in the case of MPEG, the Moving Picture Experts Group). A working group (WG) of experts is typically set up by the subcommittee for the preparation of a working draft (e.g., MPEG is a collection of seven working groups as of 2023). When the scope of a new work is sufficiently clarified, some of the working groups may make an open request for proposals—known as a "call for proposals". The first document that is produced, for example, for audio and video coding standards is called a verification model (VM) (previously also called a "simulation and test model"). When a sufficient confidence in the stability of the standard under development is reached, a working draft (WD) is produced. This is in the form of a standard, but is kept internal to working group for revision. When a working draft is sufficiently mature and the subcommittee is satisfied that it has developed an appropriate technical document for the problem being addressed, it becomes a committee draft (CD) and is sent to the P-member national bodies of the SC for the collection of formal comments. Revisions may be made in response to the comments, and successive committee drafts may be produced and circulated until consensus is reached to proceed to the next stage, called the "enquiry stage". After a consensus to proceed is established, the subcommittee will produce a draft international standard (DIS), and the text is submitted to national bodies for voting and comment within a period of five months. A document in the DIS stage is available to the public for purchase and may be referred to with its ISO DIS reference number.[45] Following consideration of any comments and revision of the document, the draft is then approved for submission as a Final Draft International Standard (FDIS) if a two-thirds majority of the P-members of the TC/SC are in favour and if not more than one-quarter of the total number of votes cast are negative. ISO will then hold a ballot among the national bodies where no technical changes are allowed (a yes/no final approval ballot), within a period of two months. It is approved as an International Standard (IS) if a two-thirds majority of the P-members of the TC/SC is in favour and not more than one-quarter of the total number of votes cast are negative. After approval, the document is published by the ISO central secretariat, with only minor editorial changes introduced in the publication process before the publication as an International Standard.[34][36] Except for a relatively small number of standards,[32] ISO standards are not available free of charge, but rather for a purchase fee,[46] which has been seen by some as unaffordable for small open-source projects.[47] The process of developing standards within ISO was criticized around 2007 as being too difficult for timely completion of large and complex standards, and some members were failing to respond to ballots, causing problems in completing the necessary steps within the prescribed time limits. In some cases, alternative processes have been used to develop standards outside of ISO and then submit them for its approval. A more rapid "fast-track" approval procedure was used in ISO/IEC JTC 1 for the standardization of Office Open XML (OOXML, ISO/IEC 29500, approved in April 2008), and another rapid alternative "publicly available specification" (PAS) process had been used by OASIS to obtain approval of OpenDocument as an ISO/IEC standard (ISO/IEC 26300, approved in May 2006).[48] As was suggested at the time by Martin Bryan, the outgoing convenor (chairman) of working group 1 (WG1) of ISO/IEC JTC 1/SC 34, the rules of ISO were eventually tightened so that participating members that fail to respond to votes are demoted to observer status. The computer security entrepreneur and Ubuntu founder, Mark Shuttleworth, was quoted in a ZDNet blog article in 2008 about the process of standardization of OOXML as saying: "I think it de-values the confidence people have in the standards setting process", and alleged that ISO did not carry out its responsibility. He also said that Microsoft had intensely lobbied many countries that traditionally had not participated in ISO and stacked technical committees with Microsoft employees, solution providers, and resellers sympathetic to Office Open XML:[49] When you have a process built on trust and when that trust is abused, ISO should halt the process... ISO is an engineering old boys club and these things are boring so you have to have a lot of passion ... then suddenly you have an investment of a lot of money and lobbying and you get artificial results. The process is not set up to deal with intensive corporate lobbying and so you end up with something being a standard that is not clear. International Workshop Agreements (IWAs) are documents that establish a collaboration agreement that allow "key industry players to negotiate in an open workshop environment" outside of ISO in a way that may eventually lead to development of an ISO standard.[42] On occasion, the fact that many of the ISO-created standards are ubiquitous has led to common use of "ISO" to describe the product that conforms to a standard. Some examples of this are: Disk images ending in the file extension "ISO" to signify that they are using the ISO 9660 standard file system as opposed to another file system—hence disc images commonly being referred to as "ISOs". The sensitivity of a photographic film to light (its "film speed") is described by ISO 6, ISO 2240, and ISO 5800. Hence, the speed of the film often is referred to by its ISO number. As it was originally defined in ISO 518, the flash hot shoe found on cameras often is called the "ISO shoe". ISO 11783, the communication protocol for the agriculture industry, which is marketed as ISOBUS. ISO 13216, the standardized attachment points for child safety seats, which is marketed as ISOFIX. ISO 668, the standardized intermodal containers, sometimes called "ISO containers". ISO presents several awards to acknowledge the valuable contributions made in the realm of international standardization:[50] The Lawrence D. Eicher Award: This award acknowledges outstanding standards development. It is available to all ISO and ISO/IEC technical committees. The ISO Next Generation Award: Aimed at young professionals from ISO member nations, this award highlights those who advocate for sustainability-centric standardization and emphasize the importance of partnerships. The ISO Excellence Award: Dedicated to recognizing the endeavors of ISO's technical professionals, any individual nominated as an expert, project leader, or convenor in a committee working group is eligible for this award. Science portalEngineering portalTechnology portal Countries in the International Organization for Standardization – Members of ISO Ecma International – Standards organization for information and communication systems European Committee for Standardization (CEN) – Standards organization Global Reporting Initiative – International standards organization – for sustainability information and linking up with reporting on their 17#GlobalGoals indicators GOST – CIS technical standards – a set of technical standards maintained by the Euro-Asian Council for Standardization, Metrology, and Certification IEEE Standards Association – Operating unit within IEEE Institute of Environmental Sciences and Technology Interface 2010 – the Interface Marketing Supplier Integration Institute International Classification for Standards – Classification system for technical standards The International Customer Service Institute – International partnership organisation for sharing of best practices in customer service International Electrotechnical Commission (IEC) – International standards organization International healthcare accreditation – International healthcare accreditation organisation International Telecommunication Union – Specialized agency of the United Nations Internet Engineering Task Force – Open internet standards organization List of ISO standards Standardization – Implementation of technical standards based on the consensus of different parties Standards organization – Organization that develops standards Terminology planning policy Some of the 834 Technical Committees of the International Organization for Standardization (ISO) include:[7] ISO/TC 37 - Language and terminology – Terminology and other language content resources ISO/TC 46 - Information and documentation - Libraries, archives, indexing and information science ISO/TC 68 - Financial services - Banking, securities and financial services ISO/TC 176 - Quality management and quality assurance ISO/TC 211 - Geographic information/Geomatics - Geographic data and information ISO/TC 215 - Health informatics - Health-related data/information ISO/TC 262 - Risk management - Risk management ISO/TC 289 - Brand evaluation - Brand evaluation and valuation ISO/TC 292 - Security and resilience - Security of society ^ a b "ISO members". 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MIT Innovations and Entrepreneurship Seminar Series. Wikimedia Commons has media related to ISO. Official website Publicly Available Standards, with free access to a small subset of the standards. Advanced search for standards and/or projects Online Browsing Platform (OBP), access to most up to date content in ISO standards, graphical symbols, codes or terms and definitions. Retrieved from " 2ISO standard For two-letter country codes, see ISO 3166-1 alpha-2. S-twist and Z-twist ISO 2 is an international standard for direction of twist designation for yarns, complex yarns, slivers, slubbings, rovings, cordage, and related products.[1] The standard uses capital letters S and Z to indicate the direction of twist,[2] as suggested by the direction of slant of the central portions of these two letters. The handedness of the twist is the direction of the twists as they progress away from an observer. Thus Z-twist is said to be right-handed, and S-twist to be left-handed. The convention of using these two letters to unambiguously designate twist direction was already used in the cordage industry by 1957.[3] ^ International Organization for Standardization (1973), ISO 2:1973 Textiles — Designation of the direction of twist in yarns and related products, retrieved 2013-08-04 ^ The International Bureau For The Standardisation of Man-Made Fibres (BISFA) (2009), Terminology of man-made fibres (PDF), p. 49, archived from the original (PDF) on 2015-11-23, retrieved 2013-08-04 ^ Himmelfarb, David (1957). The Technology of Cordage Fibres and Rope. London: Leonard Hill. p. 116. ISO 2:1973 Textiles — Designation of the direction of twist in yarns and related products Preceded byISO 1 Lists of ISOsISO 2 Succeeded byISO 3 This standards- or measurement-related article is a stub. You can help Wikipedia by expanding it.vte Retrieved from " Portable Document Format, a digital file format For other uses, see PDF (disambiguation). Portable Document FormatAdobe PDF iconFilename extension.pdfInternet media type application/pdf,[1] application/x-pdf application/x-bzpdf application/x-gzpdf Type codePDF [1] (including a single trailing space)Uniform Type Identifier (UTI)com.adobe.pdfMagic number%PDFDeveloped byAdobe Inc. (1991–2008) ISO (2008–)Initial releaseJune 15, 1993; 31 years ago (1993-06-15)Latest release2.0 Extended toPDF/A, PDF/E, PDF/UA, PDF/VT, PDF/XStandardISO 32000-2Open format?YesWebsiteiso.org/standard/75839.html Portable Document Format (PDF), standardized as ISO 32000, is a file format developed by Adobe in 1992 to present documents, including text formatting and images, in a manner independent of application software, hardware, and operating systems.[2][3] Based on the PostScript language, each PDF file encapsulates a complete description of a fixed-layout flat document, including the text, fonts, vector graphics, raster images and other information needed to display it. PDF has its roots in "The Camelot Project" initiated by Adobe co-founder John Warnock in 1991.[4] PDF was standardized as ISO 32000 in 2008.[5] The last edition as ISO 32000-2:2020 was published in December 2020.[6] PDF files may contain a variety of content besides flat text and graphics including logical structuring elements, interactive elements such as annotations and form-fields, layers, rich media (including video content), three-dimensional objects using U3D or PRC, and various other data formats. The PDF specification also provides for encryption and digital signatures, file attachments, and metadata to enable workflows requiring these features. Main article: History of PDF The development of PDF began in 1991 when John Warnock wrote a paper for a project then code-named Camelot, in which he proposed the creation of a simplified version of PostScript called Interchange PostScript (IPS).[7] Unlike traditional PostScript, which was tightly focused on rendering print jobs to output devices, IPS would be optimized for displaying pages to any screen and any platform.[7] Adobe Systems made the PDF specification available free of charge in 1993. In the early years PDF was popular mainly in desktop publishing workflows, and competed with several other formats, including DjVu, Envoy, Common Ground Digital Paper, Farallon Replica and even Adobe's own PostScript format. PDF was a proprietary format controlled by Adobe until it was released as an open standard on July 1, 2008, and published by the International Organization for Standardization as ISO 32000-1:2008,[8][9] at which time control of the specification passed to an ISO Committee of volunteer industry experts. In 2008, Adobe published a Public Patent License to ISO 32000-1 granting royalty-free rights for all patents owned by Adobe necessary to make, use, sell, and distribute PDF-compliant implementations.[10] PDF 1.7, the sixth edition of the PDF specification that became ISO 32000-1, includes some proprietary technologies defined only by Adobe, such as Adobe XML Forms Architecture (XFA) and JavaScript extension for Acrobat, which are referenced by ISO 32000-1 as normative and indispensable for the full implementation of the ISO 32000-1 specification.[11] These proprietary technologies are not standardized, and their specification is published only on Adobe's website.[12][13][14] Many of them are not supported by popular third-party implementations of PDF. ISO published version 2.0 of PDF, ISO 32000-2 in 2017, available for purchase, replacing the free specification provided by Adobe.[15] In December 2020, the second edition of PDF 2.0, ISO 32000-2:2020, was published, with clarifications, corrections, and critical updates to normative references[16] (ISO 32000-2 does not include any proprietary technologies as normative references).[17] In April 2023 the PDF Association made ISO 32000-2 available for download free of charge.[15] A PDF file is often a combination of vector graphics, text, and bitmap graphics. The basic types of content in a PDF are: Typeset text stored as content streams (i.e., not encoded in plain text); Vector graphics for illustrations and designs that consist of shapes and lines; Raster graphics for photographs and other types of images; and Other multimedia objects. In later PDF revisions, a PDF document can also support links (inside document or web page), forms, JavaScript (initially available as a plugin for Acrobat 3.0), or any other types of embedded contents that can be handled using plug-ins. PDF combines three technologies: An equivalent subset of the PostScript page description programming language but in declarative form, for generating the layout and graphics. A font-embedding/replacement system to allow fonts to travel with the documents. A structured storage system to bundle these elements and any associated content into a single file, with data compression where appropriate. PostScript is a page description language run in an interpreter to generate an image.[7] It can handle graphics and has standard features of programming languages such as branching and looping.[7] PDF is a subset of PostScript, simplified to remove such control flow features, while graphics commands remain.[7] PostScript was originally designed for a drastically different use case: transmission of one-way linear print jobs in which the PostScript interpreter would collect a series of commands until it encountered the showpage command, then execute all the commands to render a page as a raster image to a printing device.[18] PostScript was not intended for long-term storage and real-time interactive rendering of electronic documents to computer monitors, so there was no need to support anything other than consecutive rendering of pages.[18] If there was an error in the final printed output, the user would correct it at the application level and send a new print job in the form of an entirely new PostScript file. Thus, any given page in a PostScript file could be accurately rendered only as the cumulative result of executing all preceding commands to draw all previous pages—any of which could affect subsequent pages—plus the commands to draw that particular page, and there was no easy way to bypass that process to skip around to different pages.[18] Traditionally, to go from PostScript to PDF, a source PostScript file (that is, an executable program) is used as the basis for generating PostScript-like PDF code (see, e.g., Adobe Distiller). This is done by applying standard compiler techniques like loop unrolling, inlining and removing unused branches, resulting in code that is purely declarative and static.[18] The result is then packaged into a container format, together with all necessary dependencies for correct rendering (external files, graphics, or fonts to which the document refers), and compressed. Modern applications write to printer drivers that directly generate PDF rather than going through PostScript first. As a document format, PDF has several advantages over PostScript: PDF contains only static declarative PostScript code that can be processed as data, and does not require a full

values, as was defined in PDF 1.4. AcroForms can keep form field values in external stand-alone files containing key-value pairs. The external files may use Forms Data Format (FDF) and XML Forms Data Format (XFDF) files.[59][57][60] The usage rights (UR) signatures define rights for import form data files in FDF, XFDF, and text (CSV/TSV) formats, and export form data files in FDF and XFDF formats.[38] In PDF 1.5, Adobe Systems introduced a proprietary format for forms; Adobe XML Forms Architecture (XFA). Adobe XFA Forms are not compatible with ISO 32000's AcroForms feature, and most PDF processors do not handle XFA content. The XFA specification is referenced from ISO 32000-1/PDF 1.7 as an external proprietary specification and was entirely deprecated from PDF with ISO 32000-2 (PDF 2.0). Anyone may create applications that can read and write PDF files without having to pay royalties to Adobe Systems; Adobe holds patents to PDF, but licenses them for royalty-free use in developing software complying with its PDF specification.[61] See also: Adobe Acrobat § Security In November 2019, researchers from Ruhr University Bochum and Hackmanit GmbH published attacks on digitally signed PDFs.[62] They showed how to change the visible content in a signed PDF without invalidating the signature in 21 of 22 desktop PDF viewers and 6 of 8 online validation services by abusing implementation flaws. At the same conference, they additionally showed how to exfiltrate the plaintext of encrypted content in PDFs.[63] In 2021, they showed new so-called shadow attacks on PDFs that abuse the flexibility of features provided in the specification.[64] An overview of security issues in PDFs regarding denial of service, information disclosure, data manipulation, and arbitrary code execution attacks was presented by Jens Müller.[65][66] PDF files can be infected with viruses, Trojans, and other malware. They can have hidden JavaScript code that might exploit vulnerabilities in a PDF, hidden objects executed when the file that hides them is opened, and, less commonly, a malicious PDF can launch malware.[67] PDF attachments carrying viruses were first discovered in 2001. The virus, named OUTLOOK.PDFWorm or Peachy, uses Microsoft Outlook to send itself as an attached Adobe PDF file. It was activated with Adobe Acrobat, but not with Acrobat Reader.[68] From time to time, new vulnerabilities are discovered in various versions of Adobe Reader,[69] prompting the company to issue security fixes. Other PDF readers are also susceptible. One aggravating factor is that a PDF reader can be configured to start automatically if a web page has an embedded PDF file, providing a vector for attack. If a malicious web page contains an infected PDF file that takes advantage of a vulnerability in the PDF reader, the system may be compromised even if the browser is secure. Some of these vulnerabilities are a result of the PDF standard allowing PDF documents to be scripted with JavaScript. Disabling JavaScript execution in the PDF reader can help mitigate such future exploits, although it does not protect against exploits in other parts of the PDF viewing software. Security experts say that JavaScript is not essential for a PDF reader and that the security benefit that comes from disabling JavaScript outweighs any compatibility issues caused.[70] One way of avoiding PDF file exploits is to have a local or web service convert files to another format before viewing. On March 30, 2010, security researcher Didier Stevens reported an Adobe Reader and Foxit Reader exploit that runs a malicious executable if the user allows it to launch when asked.[71] For a more comprehensive list, see List of PDF software. Many PDF viewers are provided free of charge from a variety of sources. Programs to manipulate and edit PDF files are available, usually for purchase. There are many software options for creating PDFs, including the PDF printing capabilities built into macOS, iOS,[72] and most Linux distributions. Much document processing software including LibreOffice, Microsoft Office 2007 (if updated to SP2) and later,[73] WordPerfect 9, and Scribus can export documents in PDF. There are many PDF print drivers for Microsoft Windows, the pdfTeX typesetting system, the DocBook PDF tools, applications developed around Ghostscript and Adobe Acrobat itself as well as Adobe InDesign, Adobe FrameMaker, Adobe Illustrator, Adobe Photoshop, that allow a "PDF printer" to be set up, which when selected sends output to a PDF file instead of a physical printer. Google's online office suite Google Docs allows uploading and saving to PDF. Some web apps offer free PDF editing and annotation tools. The Free Software Foundation was "developing a free, high-quality and fully functional set of libraries and programs that implement the PDF file format and associated technologies to the ISO 32000 standard", as one of its high priority projects.[74][75] In 2011, however, the GNU PDF project was removed from the list of "high priority projects" due to the maturation of the Poppler library,[76] which has enjoyed wider use in applications such as Evince with the GNOME desktop environment. Poppler is based on Xpdf[77][78] code base. There are also commercial development libraries available as listed in List of PDF software. The Apache PDFBox project of the Apache Software Foundation is an open source Java library, licensed under the Apache License, for working with PDF documents.[79] Raster image processors (RIPs) are used to convert PDF files into a raster format suitable for imaging onto paper and other media in printers, digital production presses and prepress in a process known as rasterization. RIPs capable of processing PDF directly include the Adobe PDF Print Engine[80] from Adobe Systems and Jaws[81] and the Harlequin RIP from Global Graphics. In 1993, the Jaws raster image processor from Global Graphics became the first shipping prepress RIP that interpreted PDF natively without conversion to another format. The company released an upgrade to its Harlequin RIP with the same capability in 1997.[82] Agfa-Gevaert introduced and shipped Apogee, the first prepress workflow system based on PDF, in 1997. Many commercial offset printers have accepted the submission of press-ready PDF files as a print source, specifically the PDF/X-1a subset and variations of the same.[83] The submission of press-ready PDF files is a replacement for the problematic need for receiving collected native working files. In 2006, PDF was widely accepted as the standard print job format at the Open Source Development Labs Printing Summit. It is supported as a print job format by the Common Unix Printing System and desktop application projects such as GNOME, KDE, Firefox, Thunderbird, LibreOffice and OpenOffice have switched to emit print jobs in PDF.[84] Some desktop printers also support direct PDF printing, which can interpret PDF data without external help. This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. (November 2023) (Learn how and when to remove this message) PDF was selected as the "native" metafile format for macOS (originally called Mac OS X), replacing the PICT format of the earlier classic Mac OS. The imaging model of the Quartz graphics layer is based on the model common to Display PostScript and PDF, leading to the nickname Display PDF. The Preview application can display PDF files, as can version 2.0 and later of the Safari web browser. System-level support for PDF allows macOS applications to create PDF documents automatically, provided they support the OS-standard printing architecture. The files are then exported in PDF 1.3 format according to the file header. When taking a screenshot under Mac OS X versions 10.0 through 10.3, the image was also captured as a PDF; later versions save screen captures as a PNG file, though this behavior can be set back to PDF if desired. This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. (November 2023) (Learn how and when to remove this message) See also: Comparison of note-taking software Adobe Acrobat is one example of proprietary software that allows the user to annotate, highlight, and add notes to already created PDF files. One UNIX application available as free software (under the GNU General Public License) is PDFedit. The freeware Foxit Reader, available for Microsoft Windows, macOS and Linux, allows annotating documents. Tracker Software's PDF-XChange Viewer allows annotations and markups without restrictions in its freeware alternative. Apple's macOS's integrated PDF viewer, Preview, does also enable annotations as does the open-source software Skim, with the latter supporting interaction with LaTeX, SyncTeX, and PDFSync and integration with BibDesk reference management software. Freeware Qiqqa can create an annotation report that summarizes all the annotations and notes one has made across their library of PDFs. The Text Verification Tool exports differences in documents as annotations and markups. There are also web annotation systems that support annotation in pdf and other document formats. In cases where PDFs are expected to have all of the functionality of paper documents, ink annotation is required. PDF's emphasis on preserving the visual appearance of documents across different software and hardware platforms poses challenges to the conversion of PDF documents to other file formats and the targeted extraction of information, such as text, images, tables, bibliographic information, and document metadata. Numerous tools and source code libraries support these tasks. Several labeled datasets to test PDF conversion and information extraction tools exist and have been used for benchmark evaluations of the tool's performance.[85] Main article: Open XML Paper Specification § Comparison with PDF See also: EPUB The Open XML Paper Specification is a competing format used both as a page description language and as the native print spooler format for Microsoft Windows since Windows Vista. Mixed Object: Document Content Architecture is a competing format. MO:DCA-P is a part of Advanced Function Presentation. ebook Web page XSL Formatting Objects Page margin PDF portfolio

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