

Sustainability of Digital Formats: Planning for Library of Congress Collections

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RAR Archive File Format Family

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Format Description Properties

- ID: fdd000450
- Short name: RAR_Family
- Content categories: aggregate
- Format Category: family
- Other facets: container-bundle, compression
- Last significant FDD update: 2017-03-28
- Draft status: Full

Identification and description

Full name	RAR Archive File Format Family
Description	<p>RAR, or the Roshal ARchive format thanks to its namesake creator software developer Eugene Roshal, is a proprietary archive file format that supports data compression, error recovery and file spanning. There are at least six main versions and subversions of the RAR format and because the early versions have little formal documentation, only selected versions currently are described at this site. The early versions RAR1.3 and especially RAR1.5 are thought to be the base for later versions but no public documentation is available about these early versions. Comments welcome.RAR4 is also known as RAR version 2.9 in some documentation. The current version as of this writing is RAR5. See Relationships below for more details.</p> <p>Similar in purpose to ZIP files, RAR files are data containers in which one or more files are stored in compressed form. RAR is a proprietary format under copyright, along with RAR's compression applications and libraries to Alexander Roshal, brother of Eugene Roshal. RAR files are the native format for WinRAR software and can only be created through this tool which is licensed to win.rar GmbH although there are several options to open RAR files. See External Dependencies for details.</p>

Structurally, a [RAR file](#) is comprised of variable length blocks of required and optional data. The precise composition of the blocks evolved over time with the versions. At its core, a RAR file is comprised of a marker or introductory block, an archive block which includes the archive header and file header, and closing block which includes additional comments or other information needed to correctly process the file. The order of these blocks may vary, but the first block must be a marker block followed by an archive header block. The **archive block** is the most complex because it contains the headers for the archive itself as well as the file headers:

- Self-extracting module (optional): Also known as SFX, this means any data preceding the file signature and the block size and contents are not defined.
- The RAR file signature is specific to the version of the format and must be searched for from the beginning of the file past the maximum SFX module size. According to the ad hoc description at RARLab and to PRONOM, the file signatures for RAR2.0, RAR3, RAR4, and RAR5 all begin with "Rar!" (Hex: 52 61 72 21). See subtypes for more details. See [File Signatures](#).
- Archive encryption header (optional): Present only in archives with encrypted headers. Every next header after this one is started from 16 byte AES-256 initialization vector followed by encrypted header data. Size of encrypted header data block is aligned to 16 byte boundary. Encryption version is declared in the tag of the same name with only AES-256 (value = 0) supported for RAR5.
- Main archive header which, among other things, includes the optional Locator tag to quickly access the positions of different service blocks without scanning the entire archive.

After the main archive header but still within the archive block comes one or more file headers, one for each file within the archive. File headers are followed by optional Service headers.

- File header: Includes among other data the Compression Record (stored as values 0 - 5 where 0 means no compression) and an optional Hash record for the standard CRC32 checksum. If another hash algorithm is used, it is stored in the extra area record.
- Service headers: Optional headers that store supplementary information.

The End of Archive Marker follows the last File Header to close out the archive block, after which RAR does not read anything to permit third party tools to add extra information such as a digital signature to archive.

Relationship to other formats

Has subtype

RAR1.3, RAR Archive File Format, Version 1.3. No information available. Not described on this site at this time.

Has subtype

RAR1.5, RAR Archive File Format, Version 1.5. Often described as the basis for subsequent versions but no detailed information available. Not described at this site at this time.

Has subtype

[RAR2](#), RAR Archive File Format, Version 2

Has subtype

[RAR3](#), RAR Archive File Format, Version 3

Has subtype

[RAR4](#), RAR Archive File Format, Version 4. RAR4 is also known as RAR version 2.9.

Has subtype

[RAR5](#), RAR Archive File Format, Version 5

LC experience or existing holdings	RAR files have appeared in various personal papers collections as a submission format for large PST email files.
LC preference	None

Sustainability factors

Disclosure	Proprietary format with limited public information.
Documentation	The full specification is not publicly available but file structure information for RAR5 is available through the RARLab website.
Adoption	According to one report , RAR format has gained much popularity over these years as compared to its competitor archive formats like 7Z, zip, etc ... [because it has] better data compression rate than ZIP and uses a lossless compression.
Licensing and patents	RAR is a proprietary file format created solely by the compression software WinRAR . The decompression code is available for use in other programs and the license holder allows for its distribution, but with a license provision (detailed in the license.txt file from the UnRAR source code) that "Unrar source may be used in any software to handle RAR archives without limitations free of charge, but cannot be used to re-create the RAR compression algorithm, which is proprietary. Distribution of modified Unrar source in separate form or as a part of other software is permitted, provided that it is clearly stated in the documentation and source comments that the code may not be used to develop a RAR (WinRAR) compatible archiver."
Transparency	Transparency is low because the compression algorithms are proprietary and not publicly available.
Self-documentation	<p>RAR files contain supporting metadata in headers to easily identify and organizing the compressed files within.</p> <p>Accessibility Features</p> <p>No specific features in the file format. Features to support accessibility would be found in the bundled and compressed files (such as embedded captions and subtitles in audiovisual content, tagged and structured text in textual documents, and alt text for images). Aggregate files can also contain separate files for transcripts, timed text or captions as part of the bundled package. See Relationships to other formats for details.</p>
External dependencies	RAR files can only be created by WinRAR software but can be opened in other tools (aside from WinRAR) including The Unarchiver , PeaZip , RAR Opener , 7-Zip and many others. The now-defunct unrarLib tool only works with RAR files up to version 2.
Technical protection considerations	RAR supports optional AES encryption , a type of block cipher which uses an algorithm that encrypts data on a per-block basis. There are various forms of the AES standard and the implementation used by RAR has changed with different versions of the format. RAR5 (current version as of this writing in March 2017) uses AES-256, a change from AES-128 used in RAR4.

Quality and functionality factors

Aggregate	
Compression	RAR uses proprietary compression algorithms and the compression ratio is stored in the Compression Record tag in the file header.
Support for Error Detection	RAR used optional CRC-32 hash values until RAR5 when the method switched to 56 bit length BLAKE2sp hash. In addition, RAR archives have

an optional recovery record structure in the archive header.

File type signifiers and format identifiers

Tag	Value	Note
Filename extension	rar	For the data volume set
Filename extension	rev	For the recovery volume set
Filename extension	r00	According to Wikipedia , in early versions of the format, multi-volume files were split with the first file name .rar followed by .r01, .r02 etc.
Internet Media Type	application/x-rar-compressed	From File-Extensions.org
Internet Media Type	application/vnd.rar	From PRONOM
File signature	See note.	Wikipedia states that RAR1.3 lacks a signature. Forensics Wiki states that "older versions of the RAR file format have a file signature of "52 45 7E 5E" but there is no documentation to support this. Comments welcome . See subtypes for details.
Pronom PUID	x-fmt/264	For RAR2. See http://www.nationalarchives.gov.uk/PRONOM/x-fmt/264
Pronom PUID	fmt/411	PRONOM labels this as RAR version 2.9 but other documentation including WinRAR 5.0 and RAR for Android refer to this version as RAR4. See http://www.nationalarchives.gov.uk/PRONOM/fmt/411
Pronom PUID	fmt/613	For RAR5. See http://www.nationalarchives.gov.uk/PRONOM/fmt/613
Wikidata Title ID	Q243303	No version distinctions. See https://www.wikidata.org/wiki/Q243303 .

Notes

General	According to the RARLab website, RAR has several advantages over ZIP files including "more convenient multipart (multivolume) archives, tight compression including special solid, multimedia and text modes, strong AES-128 encryption, recovery records helping to repair an archive even in case of physical data damage, Unicode support to process non-English file names and a lot more." In addition, RAR archives usually provide a noticeably higher compression ratio than ZIP file format.
History	

Format specifications

- [Specification documentation from RARLab for RAR 5.0 archive format, the current version as of April 2017.](http://www.rarlab.com/technote.htm) (<http://www.rarlab.com/technote.htm>).
- File Format Details for Older Versions
 - [RAR version 2.02 - Technical information](http://libxad.cvs.sourceforge.net/viewvc/libxad/support/formats/RAR202.txt) (<http://libxad.cvs.sourceforge.net/viewvc/libxad/support/formats/RAR202.txt>).
 - [RAR version 3.00 - Technical information](http://www.iesleonardo.com/ele/gs/Utilidades/WinRAR/TechNote.txt) (<http://www.iesleonardo.com/ele/gs/Utilidades/WinRAR/TechNote.txt>).
 - [RAR version 3.62 - Technical information](http://www.itu.dk/~cvn/rar/TechNote.txt) (<http://www.itu.dk/~cvn/rar/TechNote.txt>).
 - [RAR version 3.93 – Technical information](http://acritum.com/winrar/rar-format) (<http://acritum.com/winrar/rar-format>).
 - [RAR version 4.11 - Technical information](http://www.forensicswiki.org/w/images/5/5b/RARFileStructure.txt) (<http://www.forensicswiki.org/w/images/5/5b/RARFileStructure.txt>).
 - [RAR version 4.20 - Technical information](http://rescene.wikidot.com/rar-420-technote) (<http://rescene.wikidot.com/rar-420-technote>).

Useful references

URLs

- [RARLab WinRAR and RAR archiver downloads](http://www.rarlab.com/download.htm) (<http://www.rarlab.com/download.htm>).
- [Specification for the Advanced Encryption Standard \(AES\), 2001, Federal Information Processing Standards Publication 197](http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.197.pdf) (<http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.197.pdf>).
- [Forensics Wiki entry on RAR file format](http://www.forensicswiki.org/wiki/RAR) (<http://www.forensicswiki.org/wiki/RAR>).
- [Frequently Asked Questions about RAR from Unique RAR File Library](http://www.unrarlib.org/faq.html) (<http://www.unrarlib.org/faq.html>).
- [Wikipedia entry about WinRAR software](https://en.wikipedia.org/wiki/WinRAR) (<https://en.wikipedia.org/wiki/WinRAR>).
- [WinRAR 5.0 introduces the new RAR 5 format. What you need to know from ghacks.net](http://www.ghacks.net/2013/04/29/winrar-5-0-introduces-the-new-rar-5-format-what-you-need-to-know/) (<http://www.ghacks.net/2013/04/29/winrar-5-0-introduces-the-new-rar-5-format-what-you-need-to-know/>).
- <http://www.softpedia.com/get/Compression-tools/WinRAR.shtml> Details on file size limits for RAR5
- [PRONOM entry for x-fmt/264](http://www.nationalarchives.gov.uk/pronom/x-fmt/264) (<http://www.nationalarchives.gov.uk/pronom/x-fmt/264>). Information in PRONOM from UK National Archives about RAR2. PUID: x-fmt/264.
- [PRONOM entry for fmt/411](http://www.nationalarchives.gov.uk/pronom/fmt/411) (<http://www.nationalarchives.gov.uk/pronom/fmt/411>). Information in PRONOM from UK National Archives about RAR4 (also known as RAR version 2.9). PUID: fmt/411.
- [PRONOM entry for fmt/613](http://www.nationalarchives.gov.uk/pronom/fmt/613) (<http://www.nationalarchives.gov.uk/pronom/fmt/613>). Information in PRONOM from UK National Archives about RAR5. PUID: fmt/613.
- [Wikidata entry for Q243303](https://www.wikidata.org/wiki/Q243303) (<https://www.wikidata.org/wiki/Q243303>). Information in Wikidata about RAR. No version information. Wikidata Title ID: Q243303.
- [Download site with many past and current versions of WinRAR, RAR for Android and UnRAR](ftp://ftp.rarlab.com/rar/) (<ftp://ftp.rarlab.com/rar/>).
- [Differences between RAR4 and RAR5 Compression](http://www.remosoftware.com/info/differences-between-rar-and-rar5-compression) (<http://www.remosoftware.com/info/differences-between-rar-and-rar5-compression>).
- [Wikipedia entry for RAR file format](https://en.wikipedia.org/wiki/RAR_(file_format)) ([https://en.wikipedia.org/wiki/RAR_\(file_format\)](https://en.wikipedia.org/wiki/RAR_(file_format))).

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