Software Metadata Recommended Format Guide

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Authors and Contributors

Allan Christophersen (The Royal Danish Library); Elena Colón-Marrero (Bentley Historical Library); Dianne Dietrich (Cornell University Library); Patricia Falcao (Tate); Claire Fox (Yale University Library); Karen Hanson (Portico); Allen Kwan (Government of Ontario); Matthew McEniry (Texas Tech University)

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Abstract

The Software Metadata Recommended Format Guide (SMRF) summarizes and defines the metadata elements recommended by the Software Preservation Network to describe software materials in the context of a wide range of collections. It aims to be adaptable, so that it can be used in different contexts and systems across libraries, museums, archives, and repositories. It is not meant to be exhaustive but provides a framework for cultural institutions and collections to define which metadata to capture for their own collections.

Introduction

The Software Metadata Recommended Format Guide (SMRF) provides guidance on descriptive practice for software materials from the perspective of those working in libraries, museums, archives, and repository managers. For the purpose of this document, we are broadly defining software as "a collection of instructions that tell a computer how to work" as borrowed from Wikipedia[1].It aims to identify the essential technical and descriptive components of software that support discovery, access, and reuse of a range of software types (ranging from, but not limited to, commercially produced software to code supporting research data analysis). To enhance the usability of this guide, these components have been organized into familiar categories and labels, but the authors stress that this is not meant to suggest that catalogers must use the elements exactly as they have been named or arranged within the guide. The guide has been deliberately written quite broadly; its aim is not to capture all possible variations and complexities of software collections (or software within mixed-media collections), but rather to provide the cataloger an approximate framework to use to handle their materials. It is deliberately schema agnostic, so that it can be adapted to a variety of situations and systems. When working through this guide, consider the level of description that makes the most sense for the collection needs at hand, whether that be applying the concepts to individual items or aggregates. The authors made every attempt to identify a wide range of concepts that are important to software cataloging, but admit that there may be gaps in this guide. Users are

[1] "Software." Wikipedia. Wikimedia Foundation, October 4, 2021. https://en.wikipedia.org/wiki/Software.

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encouraged to incorporate additional elements, as needed, to complete the cataloging of their materials.

The guide is organized into key sections that address the following broad questions:

1. **What is the software?**
2. **How is the software distributed?**
3. **Who is responsible for the software?**
4. **What is required to run the software?**
5. **What is the software made of?**

Throughout the guide, there are several elements that are repeated in multiple sections. This is designed to maximize flexibility for the cataloger to identify where best a particular piece of information could be organized or mapped to within their own system. It too is not prescriptive: a cataloger may conclude that a particular concept fits best within another section, or a section not identified in this guide when mapped to their own local context.

In order to help connect the conceptual framework in this guide to specific examples, after the description of the elements, there are several cataloging examples and a crosswalk mapping conceptual elements of the guide to fields from MARC, Dublin Core, MODS, Wikidata and Codemeta.

We recognize that a broad guide like the SMRF guide may not fulfill all users' needs. We recommend also consulting the following resources for additional software metadata guidelines:

Di Cosmo, R. (2020). biblatex-software style. https://www.ctan.org/tex-archive/macros/latex/contrib/biblatex-contrib/biblatex-software (Accessed November 2, 2021.)

CIDOC CRM Special Interest Group. CIDOC Conceptual Reference Model (CRM). International Council of Museums. http://www.cidoc-crm.org/ (Accessed November 2, 2021.)

The CodeMeta Project. CodeMeta Terms. https://codemeta.github.io/terms/ (Accessed November 2, 2021.)

Delve J., A. Ciuffreda, L. Konstantelos. (2011). TOTEM: Trusted Online Technical Environment Metadata - A Long-Term Solution for a Relational Database / RDF Ontologies. iPRES 2011 - Proceedings of the 8th International Conference on Preservation of Digital Objects. http://hdl.handle.net/11353/10.294265

O'Donohoe, E., C. Röck, J. de Vos. (2021). Preservation Metadata for Software - Describing Software in Archives. Zenodo. https://doi.org/10.5281/zenodo.5503994

Research Data Alliance. FAIR for Research Software (FAIR4RS) WG. https://www.rd-alliance.org/groups/fair-research-software-fair4rs-wg (Accessed November 2, 2021.)

This list is not exhaustive, but the referenced documents do touch or expand on the metadata elements that will be presented within this guide.

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Guidance

What is the software?

This section includes prompts for metadata that describe the software itself; how to uniquely identify it or disambiguate it from related software.

The use of the elements in this section is left to the discretion of individual institutional policies, but the scope of "software" can vary as needed. For example, it is possible to describe a software suite (i.e. Adobe Creative Suite), or individual applications found within a software suite (i.e. After Effects), or specific software libraries (i.e. scikit-learn).

An institution may also wish to contextualize the software in relation to other material in one of the elements below. For example, a software item held by the institution may have been included as part of a software bundle, or it may have been included with the release of another text, such as a CD released with a magazine or textbook.

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Title	Required	The title of the item, as it appears associated with the item being cataloged.		VGA Planets 3 EaglePOPd Web Interactive VisiWord Subtitled Public
Description	Optional	A narrative description of the software's purpose, core functionality, and/or relevant history.	Provide the coverage and level of detail that is most appropriate for your local standards and use cases.	Software capable of reading and writing spreadsheets. A Python command line tool that can perform named entity extraction from text in 3 languages (English, Italian, and Spanish). The project was maintained via GitHub between 2013 and 2015 and was the subject of a

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
				panel at XYZ conference, Someplace in 2015.
Date, Date Subtype	Recommended	An indication of the period(s) of time associated with the software.	This definition is deliberately broad, so that the cataloger can capture the date and date subtype (e.g., copyright, publication, release, version, creation) that makes the most sense for the item that is being cataloged. There are different types of dates that a cataloger might want to capture. It is recommended to capture at least one	Copyright Date: 1993, 1994 Publication Date: 2019 Creation Date: 2006; Software has versions from 2006, 2008, and 2018

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			date or date range and specify what type it is. For example, a piece of software might have a date its copyright was registered or a date it was published (note that criteria for publication may vary, depending on the discipline).	
Genre / Type	Optional	Category of the software based on either common function, type, or field of use.	The description can be broad, such as application software, programming tools, system software, etc., or more specific, such as business software, computer-aided design, spreadsheets, etc.	Video game Interactive installation

Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			A hierarchical nomenclature or a taxonomy with an index can be used for standardization across systems.	
Identifier	Recommended	An identifier is a unique string used to permanently identify an object. Identifiers may be global, such as a DOI or ARK (a unique alphanumeric string used to permanently identify an object and provide a persistent link to its location on the web) or it may be local to a particular system.	The identifier used here could refer to one of a range of source types, some of which have different uses (for example: noting a version, or a publication). What is important here is that the identifier is unique. If an identifier is local, it is helpful to indicate its context.	UUID v4: 6afe4e4a-932a-48fc-8425-cecfc3abbfe9 DOI: https://doi.org/10.7298/q4m1-se95 PUID: x-sfw/54 Wikidata: Q2634567

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Version	Recommended	The number, letter, or other schema that identifies a unique state of computer software during development and release.	Use version to identify which specific edition or release of your software is being documented. Version information can contain multiple parts, including but not limited to a major version identifier, minor version identifier, a revision identifier, and/or a release identifier. It is preferable to indicate if a version complies with a standard (such as semantic versioning).	3.2 1.2

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Accompanying Documentation and/or Materials	Optional	Lists any documentation and/or materials supplied with or about the software.	This element can refer to physical objects or online resources that provide information about the software, its functionality, and how to use it.	Printed Manual for Photoshop 8 Link to the Media Area Net website: https://mediaarea.net/en/MediaInfo Setup information guide; Quick start course; User's Guide; Pocket Reference PLINK: a tool set for whole-genome association and population-based linkage analyses (doi: 10.1086/519795)

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How is the software distributed?

This section includes elements that aim to describe how the software is made available to a collecting institution, or more broadly to users. It should allow stakeholders to assess how they may get access to software, and, when relevant, limitations to that access. For some implementations, it may be appropriate to describe the layers within the top-level distribution format. For example, software may be distributed in a tar.gz file, virtual machine, or container software (e.g. Docker) but the resources within these may also be considered useful to document. In these instances, the appropriate elements within this section can be repeated or expressed hierarchically as needed.

Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
File Format	Recommended At least one of File Format or Physical Media Format should have a value.	The format of the digital file or files that comprise the software.	This can align technically with the *Distribution Mechanism*, so if it's distributed in a .tar file, then "tar" is the file format. The value could be narrative, or use a standard form such as MIME/Media Type or PRONOM format IDs. Some may wish to express more information about	ZIP file of a Git repository containing the source code for a Python project. Disk Image of the computer supplied by the artist, contains Windows XP and 3 executable files application/tar,

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			the formats within the distribution file, in which case a hierarchical arrangement or more detailed narrative may be implemented. In this case it is helpful to indicate what aspect of the format is being described. This refers specifically to the format of the software, and not the file formats that the software supports reading or writing.	application/exe, image/jpeg, application/pdf, plain/txt info:pronom/fmt/726
Physical Media Format	Recommended At least one of File Format or Physical Media Format should have a value.	Physical Media Format refers to "a physical piece of computer-readable hardware that contains some number of digital		3.5" or 5.25" floppy disk

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
		files." (From Digital Archives Technical Glossary, DANNNG)		
Size	Required	Refers to the displayed size of a file or aggregate set of files, before expansion, installation, or compressing.	When identifying size, it can be helpful to note when a file is known to be compressed.	Approximately 1 MB, compressed 1TB
Condition	Recommended	Describes specific digital or physical condition of the media format held in the collection.	Primarily for highlighting variations in the condition of the material that may have an impact on use or playback.	The outer packaging of the second copy is marked Volume 2, Number 1. However, the CD itself is Volume 2, Number 2. Missing documentation.

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
				Complete and fully functional. 3 of the 14 files that form the software were corrupted in the supplied package. Repairs were successfully applied and both versions are available.
Download URL	Recommended	The URL to download the software, if available.	It is recommended that this element be used as a way to flag to users that the software referenced is available online, and, as such, it is strongly recommended that this value consist of a URL. However, this might not	https://mediaarea.net/en/MediaInfo (accessed 21/10/2020) https://archive.org/details/vp320

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			be practical in all situations, so free text can be used to specify or clarify how one can download the software. When providing a URL, it may be helpful to indicate the last access date.	
License	Recommended	Governs the use of the software, including the right to modify, reuse, and redistribute the software.	Software licenses can range from extremely permissive to completely proprietary and can impact the level of access an institution can provide to a piece or collection of software. Use license to indicate the primary license that applies to the software. It may have additional licenses based	GNU General Public License MIT, Open Source Copyright Rafael Lozano-Hemmer (artist)

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			on the original platform it was published or hosted on, or within secondary software dependencies incorporated in the software. These can be listed in metadata or referenced elsewhere. SPDX provides a list of licenses that can be referenced by URL. Note that this is not the same as license keys that might be attached to the software. It is recommended to include License keys in the Additional Dependencies element.	

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Accompanying Documentation and/or Materials	Optional	Lists any documentation and/or materials supplied with or about the software.	This element can refer to physical objects or online resources that provide information about the software, its functionality, and how to use it.	Printed manual for Photoshop 8 Setup information guide; Quick start course; User's guide; Pocket reference PLINK: a tool set for whole-genome association and population-based linkage analyses (doi: 10.1086/519795)
Distribution Mechanism	Optional	Describes how the software is made available to users.		On a CD-ROM, contained with perpetual license. Downloadable on subscription Shareware version

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
				via BBS distribution Docker-generated tar file with built images included, available for Internet download.
Location / Website / Repository	Optional	Refers to the location, website or repository where the software's binaries, source code, metadata and/or documentation are stored.	This could be internal to the cataloguing organization or an external link.	Github page: https://github.com/codemeta/codemeta Or project page: https://mediaarea.net/en/MediaInfo Computer History Museum Tate

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Who is responsible for the software?

This section includes elements that identify who is involved with the software. The elements in this section are specifically tailored to be software-specific roles. Note that there may be additional roles that might be helpful to identify; it is expected that the cataloger will use their judgment as to whether additional roles are appropriate for their material and metadata system of record.

The metadata used to describe the technical aspects of a software item can be mapped to preservation metadata encoding standards such as PREMIS and may align with your institution's existing processes for distributing such metadata in XML or RDF.

Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Creator	Optional if at least one of Creator, Programmer, Developer, Maintainer, Publisher, or Copyright Owner has a value	The entity who has created or designed the software, or conceived of its concept or idea.	Use “creator” to identify the person or persons who have created or designed the software; sometimes this is distinct from a publisher entity.	Creator: Westwood Studios (1997) Artist: Rafael Lozano-Hemmer
Programmer	Optional if at least one of Creator, Programmer, Developer,	The entity responsible for writing any original code in the software		Programmer: Louis Castle Programmer: Conroy

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
	Maintainer, Publisher, or Copyright Owner has a value	and/or overseeing the project. This may be an individual or a group.		Badger Programmer: Brenda Hanley
Developer	Optional if at least one of Creator, Programmer, Developer, Maintainer, Publisher, or Copyright Owner has a value	The entity responsible for writing any original code in the software and/or overseeing the project. This may be an individual or a group.		Developer: Westwood Studios
Maintainer	Optional if at least one of Creator, Programmer, Developer, Maintainer, Publisher, or Copyright Owner has a value	The entity responsible for the regular maintenance of the software, and may be distinct from the original creator or programmer. This may be a person or a corporate entity.		Maintainer: Nightdive Studios
Publisher	Optional if at least one of Creator,	The publisher is the entity that makes the	Software publishers often have additional	Originally published by Virgin Interactive

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
	Programmer, Developer, Maintainer, Publisher, or Copyright Owner has a value	content available for sale or for free.	roles, including licensing software from developers, production of physical components of the software (i.e., physical media, instruction manuals), providing technical support, and marketing. Use the publisher element to identify the entity who has made the software available, as identified at the time of the release of the software. This may be the name of a company, or it may be an individual. Include the year of publication when available and appropriate.	Republished by Nightdive Studios Publisher: VisiCorp

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Copyright Owner	Optional if at least one of Creator, Programmer, Developer, Maintainer, Publisher, or Copyright Owner has a value	The entity that is listed as the copyright owner of the software. See usage notes for more details.	The usage of Copyright Owner is left at the discretion of the individual institution and a clear definition should be provided for its use. For example, the Copyright Owner may refer to the entity that owns the copyright at the time of the software's initial publication, or it may refer to the current copyright owner if the rights to the software have been sold or otherwise relinquished since the initial publication date.	Copyright Owner (at time of publication, 1997): Westwood Studios

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Contact information	Optional	Contact information for the person or entity responsible for the software.	This element can be used to provide the contact information for the active person or entity responsible for maintaining or creating the software. Additionally, this element could be used to provide the contact information for the institution where the software is stored. This element can be made public or can be limited to internal users.	Maintainer: John Doe (555) 555-5555 fake@email.domain Institutional Repository: Computer History Museum

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What is needed to run the software?

This section includes elements that specify the hardware and software required for a piece of software to run, and if applicable, under which terms a user can operate the software.

Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
System Requirements	Required	Refers broadly to the configuration that a system must have in order for a hardware or software application to run smoothly and efficiently.	System requirements are specified in multiple ways: for example, minimum, recommended, required. Requirements can be derived from the software packaging, manuals, or other supplied ways and/or supplied based on observation or knowledge of the cataloger. It should be denoted when	R studio Microsoft Access database version 1.1 or later For best quality text, use Apple's TrueType fonts or Adobe Type Manager fonts.

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			system requirements are exact wording supplied by some aspect of the entity itself (e.g. creator or maintainer notes, packaging) and when it is based on observation or knowledge of the cataloger.	
Operating System	Recommended	Software that supports a computer's basic functions, such as scheduling tasks, executing applications, and controlling peripherals.	Operating system is defined as separate from system requirements, despite often being a system requirement. Operating system can either be a limit or a range: software could have multiple operating systems that it is compatible with.	DOS 5 or Windows 3.1 DOS 1.1 or 2.0 Windows XP

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
			It is recommended to use what is supplied with the software itself; if there are multiple compatible operating systems, these can be included in separate entities.	
System Libraries	Optional	Refers to a resource that is intended for reuse by other computer programs. System libraries can be used by multiple higher-level programs.	While system libraries can be seen as a type of system requirement, there are some cases where it may be helpful to identify them specifically in this element.	Active X

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
Runtime Environment	Optional	Used to identify components relating to the execution phase of the software.	These attributes include any runtime platforms or dependencies that would be necessary for running or emulating the software at a later point, such as .NET framework version, virtual machines or compilers.	.NET Framework 4.8 Java virtual machine Android Runtime
Hardware	Optional	Refers to physical components of a computer or any peripherals, including the processor, motherboard, monitor, mouse or pointing device, sound and graphics cards, and storage devices.	While not relevant for all software, it can be helpful to specify hardware requirements when indicated in documentation, when known by the cataloger, or when it is appropriate for the collection or institution.	DOS version requires a colour VGA card and a 286 processor. Computer network of at least 2 computers, usually 5. It also required surveillance video cameras and video projectors.

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Suggested Element Name	Obligation	Definition(s)	Usage Notes	Example
				IBM Personal Computer & XT; also COMPAQ and 100% IBM compatibles; 192K user memory; one disk drive; Printer and two disk drives recommended.
Additional Dependencies	Optional	Any other requirements for the software that do not fit into the above categories.	This element is provided in case none of the above categories are appropriate to describe the requirements needed to run the software. This can include digital rights management components such as license keys, hardware dongles, or key servers.	Additional R packages required; shinyBS, shiny, MASS, popdemo, rmarkdown

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What is the software made of?

This section includes elements that describe the makeup and composition of software.

Suggested Element Name	Obligation	Definition	Usage Notes	Example
Programming Language Codebase	Optional	A programming language is the underlying rules that allow a set of pre-written instructions to execute a specific task.	The element can be used to indicate the programming language or languages used by a programmer or developer in the creation of a piece of software. Note that programming languages have versions, and may be important to capture as well here. For certain types of software this may also include higher	Flappy Bird (2013) was programmed using Objective C. Half-Life 2 (2004) was programmed using C++ for Source Engine 2004. R Delphi

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Suggested Element Name	Obligation	Definition	Usage Notes	Example
			order frameworks such as game engines for video games.	
Configuration Language	Optional	The language used in the setup, documentation, and/or interface of the software.		English French Russian

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Examples

This section provides examples of a variety software items that are cataloged according to the above guide. These examples include the information that was available at the time. Empty values means that the authors could not find the corresponding metadata information on the software item or accompanying materials.

Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Title	VGA Planets 3	EaglePOPd Web Interactive	Blade Runner	Subtitled Public
Description				

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Date, Date Subtype	Copyright Date: 1993, 1994	Publication Date: 2019	Copyright Date: 1997	Creation Date: 2006. Software has versions from 2006, 2008 and 2018
Genre/Type	Video game		Video game	Interactive installation
Identifier		https://doi.org/10.7298/q4m1-se95		
Version	3.2			

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Accompanying Documentation and/or Materials				

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
How is the software distributed?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
File Format	ZIP file	2 ZIP files with code and validation bundle, plus 1 PDF ReadMe file.		Disk Image of the computer supplied by the artist, Windows XP and 3 executable files
Physical Media Format	3.5" or 5.25" floppy disk		CD-ROM	
Size	Approximately 1 MB, compressed.	Approximately 800 kB in total (compressed).		1TB
Condition				

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
How is the software distributed?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Download URL	https://archive.org/details/vp320	Multiple; see DOI		
License	Copyright Tim Wisseman	MIT, Open Source		Copyright Rafael Lozano-Hemmer (artist)
Accompanying Documentation and/or Materials	Help file and Referee Expansion file.		Manual guide book; The Westwood Studios Catalog	Display and installation instructions for the artwork, calibration instructions for the software.

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
How is the software distributed?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Distribution Mechanism	Shareware version via BBS distribution. Full version on floppy disks via mail order.			
Location / Website / Repository	Internet Archive	eCommons (https://ecommons.cornell.edu)		Tate

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
Who is responsible for the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Creator	Creator: Tim Wisseman			Artist: Rafael Lozano-Hemmer
Programmer		Programmer: Brenda Hanley	Programmer: Louis Castle	Programmer: Conroy Badger
Developer			Developer: Westwood Studios, Inc.	

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
Who is responsible for the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Maintainer			Maintainer: Nightdive Studios	
Publisher			Publisher: Westwood Studios, Inc.	
Copyright Owner				
Contact Information				

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is needed to run the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
System Requirements		R Studio Version 1.1.463	DirectX 5.0	
Operating System	DOS 5 or Windows 3.1		Windows 95 and Windows NT 4.0 (with service pack 3.0 or higher)	Windows XP
System Libraries				ActiveX
Runtime environment				

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is needed to run the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Hardware	DOS version requires a colour VGA card and a 286 processor.		Minimum requirements: IBM or 100% compatible Pentium 90 MHz CPU, 16 MB of RAM, 16 bit SVGA graphics card with 2 MB video RAM, hard drive with 175 MB available, 4x CD-ROM drive, Microsoft compatible mouse and mouse driver.	Computer network of at least 2 computers, usually 5. It also required surveillance video cameras and video projectors

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is needed to run the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
			Recommended: Pentium 133, 82 MB of RAM, 300 MB available on hard drive. Voice and music support: Windows 95 and Windows NT supported sound cards.	
Additional Dependencies		Additional R packages required: shinyBS, shiny,	System Agent software available for Windows 95	

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is needed to run the software?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
		MASS, popdemo, rmarkdown	(Plus! Pack) can cause peculiar behavior during the Blade Runner install process. Recommend against running System Agent software while installing the game.	

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Suggested Element Name	Shareware Diskettes	Research Code	Mass-market published software	Artist's software
What is the software made of?	VGA Planets 3 Example from: https://archive.org/details/vp320	EaglePOPd Web Interactive Example from: https://hdl.handle.net/1813/66308	Blade Runner	Subtitled Public Software drives an interactive installation. https://lozano-hemmer.com/subtitled_public.php
Programming Language Codebase	Unknown	R		Delphi
Configuration Language	English	English	English	English

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Crosswalk

Note: Empty values in the crosswalk table below indicate that the authors did not find a suitable mapping in the target schema. If you have suggestions for those values, or any other existing mapping, please do let us know. We will review and place it under consideration for an update of this guide.

What is the software?

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Title	245 - Title Statement https://www.loc.gov/marc/bibliographic/bd245.html	Title https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/title/	<titleInfo> https://www.loc.gov/standards/mods/userguide/titleinfo.html	title (P1476) https://www.wikidata.org/wiki/Property:P1476	name
Description	520 - Summary, Etc. https://www.loc.gov/marc/bibliographic/bd520.html	Description https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/description/	<abstract> https://www.loc.gov/standards/mods/userguide/abstract.html		description

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Date, Date Subtype (Creation)	260 - Publication, Distribution, etc. https://www.loc.gov/marc/bibliographic/bd260.html 388 - Time Period of Creation https://www.loc.gov/marc/bibliographic/bd388.html	Date https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/date/ Date Created https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/created/	<originInfo> <dateCreated> https://www.loc.gov/standards/mods/userguide/origininfo.html	inception (P571) https://www.wikidata.org/wiki/Property:P571	dateCreated
Date, Date Subtype (Publication)	260 - Publication, Distribution, etc. https://www.loc.gov/marc/bibliographic/bd260.html	Date https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/date/	<originInfo> <dateIssued> https://www.loc.gov/standards/mods/userguide/origininfo.html	publication date (P577) https://www.wikidata.org/wiki/Property:P577	datePublished

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Date, Date Subtype (Release)	260 - Publication, Distribution, etc. https://www.loc.gov/marc/bibliographic/bd260.html	Date https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/date/ Date Available https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/available/	<originInfo> <dateIssued> https://www.loc.gov/standards/mods/userguide/origininfo.html	publication date (P577) https://www.wikidata.org/wiki/Property:P577	datePublished
Date, Date Subtype (Version)	260 - Publication, Distribution, etc. https://www.loc.gov/marc/bibliographic/bd260.html	Date https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/date/	<originInfo> <dateOther> https://www.loc.gov/standards/mods/userguide/origininfo.html#dateother		datePublished

DOI: 10.7298/xe9s-3b15

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Date, Date Subtype (Copyright)	260 - Publication, Distribution, etc. https://www.loc.gov/marc/bibliographic/bd260.html 542 - Information Relating to Copyright Status https://www.loc.gov/marc/bibliographic/bd542.html	Date Copyrighted https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/dateCopyrighted/	<originInfo> <copyrightDate> https://www.loc.gov/standards/mods/userguide/origininfo.html#copyrightdate	copyright date (Q59584702) https://www.wikidata.org/wiki/Q59584702	datePublished
Genre/Type		Type https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/type/	<genre> https://www.loc.gov/standards/mods/userguide/genre.html <typeOf Resource> https://www.loc.gov/standards/mo	genre (P136) https://www.wikidata.org/wiki/Property:P136 instance of (P31) https://www.wikidata.org/	applicationCategory

DOI: 10.7298/xe9s-3b15

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
			ds/userguide/typeofresource.html	wiki/Property:P31	
Identifier	024 - Other Standard Identifier https://www.loc.gov/marc/bibliographic/bd024.html	Identifier https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/identifier/	<identifier> https://www.loc.gov/standards/mods/userguide/identifier.html	unique identifier (Q6545185) https://www.wikidata.org/wiki/Q6545185 Each type of identifier has its own Wikidata property.	identifier
Version			<originInfo> <edition> https://www.loc.gov/standards/mods/userguide/origininfo.html#edition	software version identifier (P348) https://www.wikidata.org/	version softwareVersion

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
				wiki/Property:P348 version type (P548) https://www.wikidata.org/wiki/Property:P548	
Accompanying Documentation and/or Materials			<note> https://www.loc.gov/standards/mods/userguide/note.html		releaseNotes

DOI: 10.7298/xe9s-3b15

How is the software distributed?

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
File Format	256 - Computer File Characteristics https://www.loc.gov/marc/bibliographic/bd256.html 347 - Digital File Characteristics https://www.loc.gov/marc/bibliographic/bd347.html 516 - Type of Computer File or Data Note https://www.loc.gov/marc/bibliographic/bd516.html	Format https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/format/	<physicalDescription><form> https://www.loc.gov/standards/mods/userguide/physicaldescription.html#form <physicalDescription><internetMediaType> https://www.loc.gov/standards/mods/userguide/physicaldescription.html#internetmediatype <physicalDescription> <digitalOrigin>	file format (P2701) https://www.wikidata.org/wiki/Property:P2701 distribution format (P437) https://www.wikidata.org/wiki/Property:P437	programmingLanguage runtimePlatform

DOI: 10.7298/xe9s-3b15

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
			https://www.loc.gov/standards/mods/userguide/physicaldescription.html#digitalorigin		
Physical Media Format	300 - Physical Description https://www.loc.gov/marc/bibliographic/bd300.html	Format https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/format/	<physicalDescription><form> https://www.loc.gov/standards/mods/userguide/physicaldescription.html#form	distribution format (P437) https://www.wikidata.org/wiki/Property:P437	
Size	347 - Digital File Characteristics https://www.loc.gov/marc/bibliographic/bd347.html	Extent https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/extent/	<physicalDescription><extent> https://www.loc.gov/standards/mods/userguide/physicaldescription.html#extent	data size (P3575) https://www.wikidata.org/wiki/Property:P3575	fileSize
Condition	583 $l - Actions Note (Status)		<physicalDescription>		

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
	https://www.loc.gov/marc/bibliographic/stmanf.html https://www.loc.gov/marc/bibliographic/bd583.html		<note type= "condition"> https://www.loc.gov/standards/mods/userguide/physicaldescription.html#note		
Download URL	856 - Electronic Location and Access https://www.loc.gov/marc/bibliographic/bd856.html		<location><url> https://www.loc.gov/standards/mods/userguide/location.html#url	download link (P4945) https://www.wikidata.org/wiki/Property:P4945	downloadUrl
License		License https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/license/	<access Condition> https://www.loc.gov/standards/mods/userguide/accesscondition.html	copyright license (P275) https://www.wikidata.org/wiki/Property:P275	License

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Accompanying Documentation and/or Materials					referencePublication
Distribution Mechanism				distribution format (P437) https://www.wikidata.org/wiki/Property:P437 distributed by (P750) https://www.wikidata.org/wiki/Property:P750	codeRepository
Location / Website / Repository	856 - Electronic Location and Access https://www.loc.gov/marc/bibliographic/bd856.html		<location><url> https://www.loc.gov/standards/mods/userguide/location.html#url	URL (P2699) https://www.wikidata.org/wiki/Property:P2699	codeRepository

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Who is responsible for the software?

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Creator	100 - Main Entry-Personal Name https://www.loc.gov/marc/bibliographic/bd100.html 110 - Main Entry-Corporate Name https://www.loc.gov/marc/bibliographic/bd110.html	Creator https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/creator/	<name> https://www.loc.gov/standards/mods/userguide/name.html	creator (P170) https://www.wikidata.org/wiki/Property:P170	author contributor
Programmer	100 - Main Entry-Personal Name https://www.loc.gov/marc/bibliographic/bd100.html 110 - Main Entry-Corporate Name	Contributor https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/contributor/	<name> https://www.loc.gov/standards/mods/userguide/name.html <name><role> https://www.loc.gov/standards/mo	programmer (P943) https://www.wikidata.org/wiki/Property:P943	author contributor

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
	https://www.loc.gov/marc/bibliographic/bd110.html		ds/userguide/name.html#role		
Developer	100 - Main Entry-Personal Name https://www.loc.gov/marc/bibliographic/bd100.html 110 - Main Entry-Corporate Name https://www.loc.gov/marc/bibliographic/bd110.html	Contributor https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/contributor/	<name> https://www.loc.gov/standards/mods/userguide/name.html <name><role> https://www.loc.gov/standards/mods/userguide/name.html#role	developer (P178) https://www.wikidata.org/wiki/Property:P178	author contributor
Maintainer	100 - Main Entry-Personal Name https://www.loc.gov/marc/bibliographic/bd100.html 110 - Main Entry-Corporate Name	Contributor https://www.dublincore.org/specifications/dublin-core/dcmi-terms/elements11/contributor/	<name> https://www.loc.gov/standards/mods/userguide/name.html <name><role>	maintained by (P126) https://www.wikidata.org/wiki/Property:P126	author contributor

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
	https://www.loc.gov/marc/bibliographic/bd110.html		https://www.loc.gov/standards/mods/userguide/name.html#role		
Publisher	100 - Main Entry-Personal Name https://www.loc.gov/marc/bibliographic/bd100.html 110 - Main Entry-Corporate Name https://www.loc.gov/marc/bibliographic/bd110.html 260 - Publication, Distribution, etc. https://www.loc.gov/marc/bibliographic/bd260.html	Publisher https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/publisher/	<originInfo> <publisher> https://www.loc.gov/standards/mods/userguide/origininfo.html#publisher	publisher (P123) https://www.wikidata.org/wiki/Property:P123	author contributor

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Copyright Owner	542 - Information Relating to Copyright Status https://www.loc.gov/marc/bibliographic/bd542.html				copyrightHolder
Contact Information					maintainer

DOI: 10.7298/xe9s-3b15

What is needed to run the software?

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
System Requirements	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html	Requires https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/requires/	<note> https://www.loc.gov/standards/mods/mods-notes.html		processorRequirements softwareRequirements memoryRequirements storageRequirements
Operating System	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html	Requires https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/requires/	<note> https://www.loc.gov/standards/mods/mods-notes.html	operating system (P306) https://www.wikidata.org/wiki/Property:P306	operatingSystem targetProduct System
System Libraries	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html	Requires https://www.dublincore.org/specifications/dublin-core/dcmi-	<note> https://www.loc.gov/standards/mods/mods-notes.html	depends on software (P1547) https://www.wikidata.org/wiki/Property:P1547	softwareRequirements

DOI: 10.7298/xe9s-3b15

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
		terms/terms/requires/			
Runtime environment	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html	Requires https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/requires/	<note> https://www.loc.gov/standards/mods/mods-notes.html		runtimePlatform
Hardware	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html	Requires https://www.dublincore.org/specifications/dublin-core/dcmi-terms/terms/requires/	<note> https://www.loc.gov/standards/mods/mods-notes.html	platform (P400) https://www.wikidata.org/wiki/Property:P400	processorRequirements
Additional Dependencies	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html	Requires https://www.dublincore.org/specifications/dublin-core/dcmi-	<note> https://www.loc.gov/standards/mods/mods-notes.html		

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Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
		terms/terms/requires/			

What is the software made of?

Suggested Element Name	MARC	Dublin Core	MODS	Wikidata	Codemeta
Programming Language Codebase	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html		<note> https://www.loc.gov/standards/mods/mods-notes.html	programming language (P277) https://www.wikidata.org/wiki/Property:P277	programmingLanguage
Configuration Language	538 - System Details Note https://www.loc.gov/marc/bibliographic/bd538.html				

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References

Di Cosmo, R. (2020). biblatex-software style. https://www.ctan.org/tex-archive/macros/latex/contrib/biblatex-contrib/biblatex-software (Accessed November 2, 2021.)

CIDOC CRM Special Interest Group. CIDOC Conceptual Reference Model (CRM). International Council of Museums. http://www.cidoc-crm.org/ (Accessed November 2, 2021.)

The CodeMeta Project. CodeMeta Generator. https://codemeta.github.io/codemeta-generator/ (Accessed November 2, 2021.)

The CodeMeta Project. CodeMeta Terms. https://codemeta.github.io/terms/ (Accessed November 2, 2021.)

Delve, J., A. Ciuffreda, L. Konstantelos. (2011). TOTEM: Trusted Online Technical Environment Metadata - A Long-Term Solution for a Relational Database / RDF Ontologies. iPRES 2011 - Proceedings of the 8th International Conference on Preservation of Digital Objects. http://hdl.handle.net/11353/10.294265

Force11. Software Citation Implementation Working Group. https://www.force11.org/group/software-citation-implementation-working-group (Accessed November 2, 2021.)

O'Donohoe, E., C. Röck, J. de Vos. (2021). Preservation Metadata for Software - Describing Software in Archives. https://doi.org/10.5281/zenodo.5503994

Katz, D.S., et al (2019). Software Citation Implementation Challenges. https://arxiv.org/abs/1905.08674

Research Data Alliance. FAIR for Research Software (FAIR4RS) WG. https://www.rd-alliance.org/groups/fair-research-software-fair4rs-wg (Accessed November 2, 2021.)

Software Preservation Network Metadata Working Group. (2018). Software Metadata Crosswalk V.2 https://docs.google.com/spreadsheets/d/1Xq3eqblDUkxcxK69iYI6qZ5Ubd39NZ5bTg3ErJKFY60/edit?usp=sharing