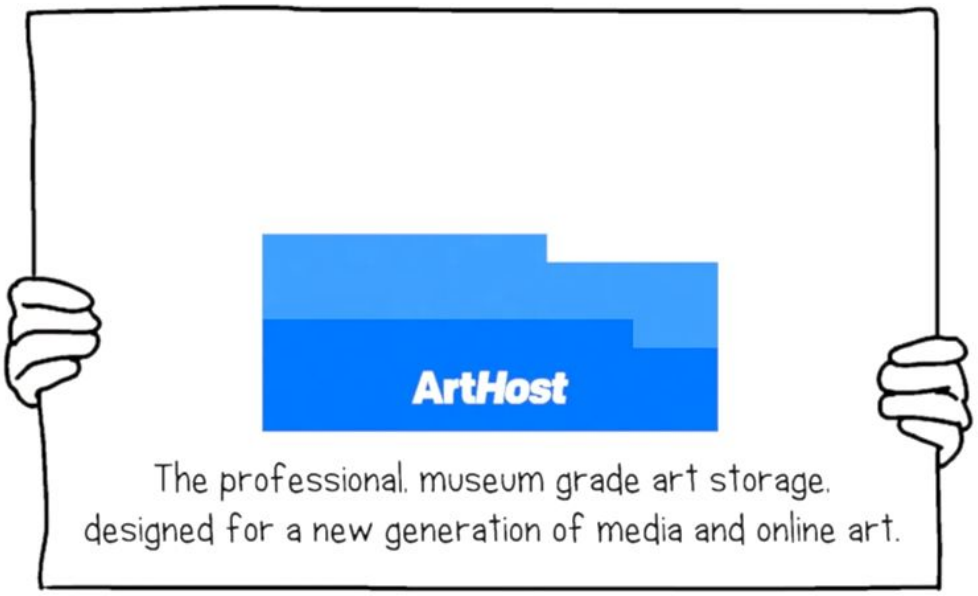
LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl



ArtHost report 2017 - 2018[1]

The ArtHost project (LIMA in cooperation with DullTech) examines how to deal with contemporary works of art that depend on dynamic, digital technology, in particular web-based artworks. Central to this research is the question of how these works can be stored, documented and accessible for the longer term. The development of a method for the preservation of net art is still in its infancy. LIMA contributes to the development of guidelines for conservation and management of net art. Also we want to make artists more aware of conservation issues and involve them in the preservation of their work.

In addition to the challenges that digital art in general has to deal with (including bit rot, obsolescence of carriers and equipment, compatibility, etc.), a number of additional specific issues need to be taken into account when conserving net art. The disappearance or replacement of plug-ins, system updates, licensing, renewal of domain names, bugs and errors in software and the possibility of hacking and viruses make internet artworks extra vulnerable.

[1] This project is made possible with the support of Creative Industries Fund NL

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

It is these kinds of potential changes that not only pose a risk to survival, but also affect, for example, the aesthetics of a work.

The archiving of websites can be done via a technique called harvesting. Here, web pages (including images, design, and downloadable documents) are retrieved from the web server using special software. This harvester approaches the website like a user and 'sees' the website only at the front: on the client-side. Diverse harvesting tools were investigated. In the case of ArtHost the backbone is archived: server-side archiving,. The artists and collectors provide us with the works, files, sources and information so harvesting does not apply to us.

The research focuses in 2017 on server-side archiving and workflow and in 2018 on emulation and documentation.

In order to arrive at a methodology and to answer the research question, the following topics are covered:

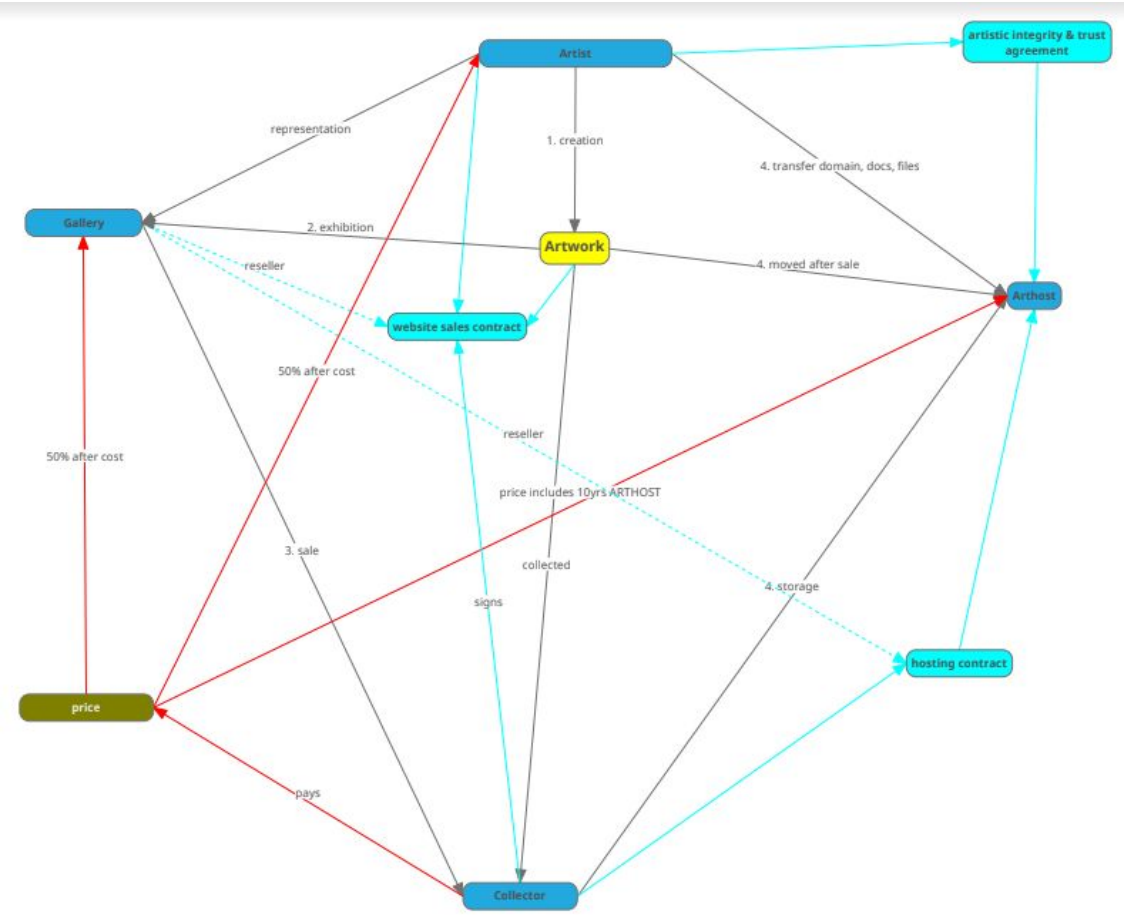
- Documentation of net art as a strategy. Further development of standards (what documentation is needed?) And workflows. → "biography of the artwork" (exhibition history, concept, installation instructions, certificate of authenticity, etc.)
- Development / adaptation Collection Information System (the current CIS are not designed for dynamic art as a net-art)
- Version management, technical components as browsers etc. and the artworks have versions, iterations, emulations etc. How to deal with versions (gitlab?)
- Storage (and virtualisation: setting up a system of 'virtual servers', including: Monitoring and interpreting changes in software.
- Emulation (when will the work be replaced by emulation?) Which version will be used as a source? Who decides? For LIMA it is important to record the authorization for emulation by the artist.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

- Development of a workflow for the storage and maintenance of net art, where emulation is an integrated part.
- Checking and monitoring change. How to and what tools are available? How to interpret change?
- The role of the artist in the conservation process.
- To what extent is the artist responsible for the preservation and management of his work, for example for documentation and maintenance of his website?
- When does LIMA take this over?
- What is the term of maintenance? (Authorization emulation?).
- The development of contracts between LIMA and artist, and between artist and collector

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

The project investigates a total of 20 web-based works of art, a large part of which were made by Constant Dullaart, initiator and collaborator in this ArtHost research project.



Mindmap Constant Dullaart ArtHost, 2018

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

2017, ArtHost Server Side and Workflow Research

In the first phase of ArtHost, the research focused on the server side of the preservation and the workflow.

On the ArtHost server, three functions must run that are necessary for preserving net art:
1. Virtual web servers
2. Virtual web browsers
3. The ability for customers to upload required files. Customers can register for this option. After registration, one can enter artworks and upload the corresponding files.

LIMA prefers to work with open-source solutions. Open source is a software development model where the source code is made freely available and may be redistributed and modified by anyone. This development model is all about collaboration. A community of many individuals and groups contribute to a specific project. Open source is not managed by a company, foundation or other organisation, but rather a community of many individuals and groups who contribute to a specific project. This keeps open source software available (including old versions). Debian is usually used as an operating system because it has a fairly comprehensive distribution. However, when installed on a LIMA server, with a decent capacity – 4 x 1 TB SSD (3.2 TB in RAID 5 configuration), 31 GB ram, Xeon E5620 processor – it did not recognise the network cards. Therefore, we use Ubuntu, which is based on Debian, but more extensive.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

We investigated three options for hosting different websites on a server:

1. Apache web server virtual hosts: Very efficient; however, any modification to the system has consequences for all virtual sites.
2. Docker containers: All virtual servers run in their own container but retain common elements in the system.
3. KVM (Kernel-based Virtual Machine): Every website operates under its own virtual machine. Every virtual machine can have its own configuration and is independent of the underlying system. This is the least cost-effective solution.

LIMA opted for KVM to prevent dependence problems (of mutual servers or the host) from occurring in the ArtHost pilot. In addition, various operating systems can run under KVM (emulations of Linux, Windows, Apple). We developed the system in collaboration with GND, who has extensive experience with KVM. It uses Libvirt and its own scripts, which enables Lima to continue maintaining the system. Extensive documentation is available and checked. At the moment we can host an estimated maximum of one hundred sites. A script has been created that checks daily whether the hosted sites work. The script is still quite simple; it checks whether the sites still show the original page. This is possible because the test sites consist of static pages. For interactive sites and sites that generate random content, the script has to review the pages on predetermined criteria to determine whether they still function correctly.

In 2017 the components documentation, storage (a virtual server per work), workflow and different roles of the artist are explored and clarified. It appeared that to guarantee sustainability, the domain name and source code should preferably be transferred to LIMA, so nobody forgets to extend the domain name and, in case of a total malfunction, the work can be re-executed by using the source code and documentation. All websites, associated files, source codes, video documentation and domain names from the case studies have been transferred and in collaboration with the artists and collectors.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

Artist Documentation Tool

The choice for a 'perishable' medium means that digital artists often have specific ideas about the future and the continuity of their work. Moreover, the artist is often the only one who can provide insight into the creative process of the work and provide technical data that are necessary for future accessibility. Therefore, in addition to its support and service to museums and collections, LIMA emphatically focuses on support and services for artists. The artist is an active participant in the conservation process of his own work. Management and preservation of digital heritage starts with production. The earlier implemented in the process, the more effective the digital sustainability.[2] Documenting and preserving works of art is also not easy for artists, or can be complicated by lack of knowledge, time and resources. That is why LIMA has developed the Artwork Documentation Tool to make artists aware of the problems and to support them in the DIY preservation of their own work.[3]

At the institutional level, the tool can provide in one document the relevant information for acquisition, exhibition and preservation. We made the tool available to academies in 2018 and gave various workshops. In 2017, the ADT, including workshops, was presented at Future Proof!? in Schiedam and at other symposia.

[2] 'Born digital cultureel erfgoed is bedreigd erfgoed: Op weg naar een generieke workflow voor born digital erfgoed binnen de domeinen kunst, film, fotografie en architectuur' (Born digital cultural heritage is endangered heritage: Towards a generic workflow for born digital heritage in art, film, photography and architecture) by Gaby Wijers and Hannah Bosma, CCDD, DEN and LIMA, 2015.
[3] https://www.li-ma.nl/adt/

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

2018, ArtHost Browser Side, Documentation and Emulation Research

In 2018, in the second phase of ArtHost, the research focused on emulation, documentation, contracts and the business model. A time will inevitably arise when a web-based artwork can no longer function in its original online environment, as a result of, for example, updated internet protocols, programming languages, browser development, redundant links and Internet platforms, obsolescent plug-ins, obsolescent display and other user interfaces. Two possible future approaches to accessing outdated net art would be to replace the original work with an emulation or with documentation.

Emulation

'What characteristics of the work are crucial for emulation?' Answering this is perhaps the most complex part of the emulation task. A first step in the emulation process is determining the moment of replacement. In other words, when does the work end? Another critical point is how to determine the reference point for emulation. Emulation is only possible when the work still functions. Therefore, LIMA makes an emulation as soon as a work arrives; this is done as part of the preservation workflow.

Emulation cannot offer a solution for problems associated with broken links, the disappearance of platforms or the change of platform APIs (the interface between platform and web server). Therefore, we propose combining the emulation of the web server (backend) with an emulation of the browser environment (frontend) in which the webpage is viewed. In the case of client-side scripting (for example, use of javascript, flash, shockwave), specific browser versions and plug-ins are indispensable for viewing the website's content.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

For emulation (of the browser or client-side) and its implementation in LIMA's CIS and repository workflow we collaborate with Rhizome. Rhizome developed oldweb.today based on the emulation of old systems in which an old browser is running. The screen output of the emulation in which the old browsers are running is visible within a modern browser. Rhizome uses a different technique to ours; they use a web recorder to harvest and save sites. The display/access is done from these stored files. Lima files source code and documentation from the artists and collections and has servers that deliver the data, at Lima display/access is from these stored files. The system Rhizome uses for olbweb.today is based on Docker containers, and it proved suitable for 'live websites', the system that Lima uses. Both systems can be implemented side by side on the same host server. It makes the emulation of

Promotional video by Constant Dullaart

the web server directly accessible in a web browser without forcing the user to install an emulator in order to install an outdated browser. We currently have the following old browsers installed: Netscape 2.02, Netscape 3.0g, Netscape 4.8, Internet Explorer 4, Firefox 4.9, Firefox 5.6, Firefox 5.7, Chrome 5.3, and Chrome 6.0. GND extensively documented the implementation of the Docker system with virtual computers and web browsers.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

Agreements are made about matters such as ‘When is emulation used, when (online) emulation is no longer possible, does documentation then take the place of the artwork?’

In addition, four possible scenarios have been developed for:

1. Repair in case of malfunction
2. Online emulation
3. Offline emulation
4. Online documentation.

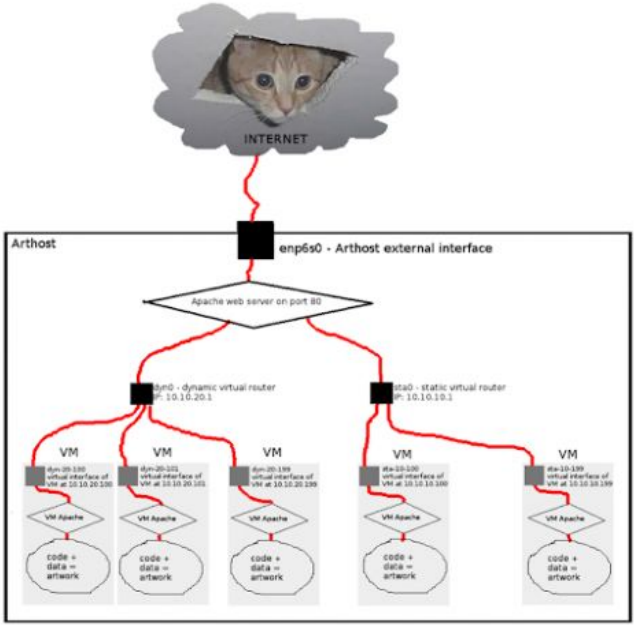
We base our 10-year contracts on the Escrow model. We had several meetings with Rhizome to discuss collaboration on the browser emulation (from the client-side). They developed oldweb.today and Webrecorder for archiving websites.

Arthost is built on top of **libvirt** and **KVM**.

The system consists of several bash scripts to automate VM creation and management, build by gnd/

Libvirt is a open-source virtualization API that supports several virtualization approaches: KVM, Xen, LXC.

KVM (Kernel-based Virtual Machine) is a virtualization technology that relies on hardware on-CPU virtualization instructions and is part of the Linux kernel.



LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

Documentation

Documenting artworks that rely on dynamic technology requires a different approach to documenting artworks not reliant on such technologies. For artworks on the web, the artworks themselves change through user input, interaction with bots and APIs, or by the hand of the artist and evolving technologies, such as display and interaction interfaces, internet protocols, etc. all of which both influence and threaten the artwork. Since these technologies continuously change, software or web-based artworks must constantly adapt to these changes and change by themselves. An important question in this regard is: what is an acceptable change? When is the work still the work? When does it become a version or something completely different? Identifying properties are defined to answer this question. By defining the characteristics of a work, an acceptable change can be defined.

In addition to the files, description, and Source code, the artists were asked to provide available documentation and to answer the following questions:

1). Introduction

- Concept/idea meaning of work. What is the work; from what does it consist? Describe the work in a few sentences

2). Interaction and (historical) context

- What do we see?
- Interaction: How does the work function in essence?
- How is the work ideally displayed outside of its natural environment, for example, in an exhibition context? (Minimum requirements for exhibition)

3). Technical specs and parameters for preservation

- Creating process. What tools used and how applied etc.
- Versions: Is the work variable? Until when is the work ‘the work’, when would you consider the work to be a new version/or would it stop existing? (Parameter change / significant properties)
- Response time within the work/Duration. What is this based on and is that essential to the work? What if speed increases due to future technological developments?

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

- How is the work shown ideally? Artist-approved browser? Type of computer?
- Future tasks. When to switch to emulation? Documentation?

A screen capture of the work is preferably made or provided. LIMA has developed a service for this and can provide a documentation video with split screen setup according to Documenting Internet-based Art | The Dullaart-Sakrowski Method.[4]

Version control

Version control systems, such as GitLab or GitHub, were originally created for text-based objects, usually source code. Therefore, it is useful to store the source code of the website in such a version control system. It is less obvious whether other digital objects, such as database inputs, images, video, can or should be stored there and how changes to the website can be recorded and integrated into the operating system for version control. Julie Boschat Thorez suggests using bots to harvest such changes on a website. After the artist or curator has evaluated these changes, they can be recorded. Each commit (conglomerate of changes) in a version control system that has a unique identifier (URL) and can be easily cited in any documentation.

We have considered using a Git repository at LIMA. The result was a large amount of data that could serve as an excellent tool for research purposes. The practical process of using Git requires the management of large amounts of data that interpretation thereof exceeds LIMA's capacity.

[4] Documenting Internet-based Art The Dullaart-Sakrowski Method: Video Vortex Research report / Kimberley Spreeuwenberg In collaboration with: Annet Dekker, Constant Dullaart, Sandra Fauconnier, Sabine Niederer, Robert Sakrowski, and Ward ten Voorde. Amsterdam: Video Vortex, 2012

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

UBERMORGEN case study

Since 2005 Julie Boschat Thorez has been investigating strategies for preserving, re-exhibiting and distributing Chinese Gold from UBERMORGEN. The work consists of partly fictitious research into the generation of online currency within the World of Warcraft online game. It was unclear whether the videos in distribution at LIMA were the work itself, or documentation of the work. It turned out to be a video element of a large cluster of productions in which UBERMORGEN shows gamers who use a shortcut to generate extra in-game currency. The project is representative of the challenges facing UBERMORGEN and others, both in terms of distribution and preservation: it is a complex research process or, perhaps better, a process in which different productions have taken place, each with a concept, manifestations and archive. The conceptual nature of the work requires:

- a more in-depth insight into the artist's intentions, thinking and working process, the online context, crucial for its development, is an ever-growing source of information about the work and the theme;
- the exhibition history and the artists' decisions to reveal a deliberate uncertainty about the evolution of the work;
- the work is subject to the influence of third parties who have in some way contributed to the creation of the work's core material (found material) or have been influenced by curatorial decisions or commentary.

Artist and researcher Julie Boschat Thorez has no background in archiving but has conducted research, based on her artistic and scientific background, into databases, documentation, transfer and materialisation of artworks.

Upload

ArtHost includes an upload tool for artists, museums, collectors and galleries to place digital art with ArtHost. Every artist and owner have a page where they can enter and describe various works (source material, the actual work and documentation). The link with the Lima CIS is currently done manually. The uploader enters data into the CIS in a standard way. The entered files are checked, confirmed, and then linked.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

Domain names

A function that is not handled by the server is the management of domain names. For the time being, LIMA has transferred this task to TransIP, with good result. TransIP handles the most common top domains (.com, .org, .nl, etc.), for the more obscure domains ('.000 for example) we use 101domain.com, which is somewhat cumbersome and more expensive.

Symposium ArtHost

LIMA's annual symposium Transformation Digital Art on 22 and 23th March 2018 was dedicated to Art Host, 2019 presented the promoclip. During Transformation Digital Art 2018, international participants from an array of professional backgrounds ask what
strategies can be developed in order to take artworks of an inherently digital, performative and processual nature into the future. Best practices, research and cases studies concerning both artist-led and institutional strategies, traditional and new approaches geared towards the future presentation of born-digital and software-based art were shared.
Participants were a.o. Josephine Bosma (critic), Ives Bernard (iMAL), Jeanette Bisschops (Stedelijk Museum Amsterdam), Serena Cangiano (SUPSI), Louise Cone (SMK Denmark), Annet Dekker (University of Amsterdam), Harm van den Dorpel (artist), Constant Dullaart (artist), Patrícia Falcão (Tate Modern), Paulien 't Hoen (SBMK), Aurora Loerakker (Van Abbemuseum), Geert Lovink (INC), Aymeric Mansoux (artists), Rachel Somers Miles (LIMA), Arthur van Mourik (Centraal Museum), Geert Mul (artists), Martine Neddam (artists), Marcel Ras (NDE), Joost Rekveld (artist), Morgane Stricot (ZKM), Sylvia van Schaik (RCE), Mila van der Weide (LIMA) and Gaby Wijers (LIMA).

Research and service are presented at international symposia and Transformation Digital Art in 2018 and 2019. With HeK (Basel), iMAL (Brussel), Tate (Londen) and NDE (The Hague) we discuss the functionality

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

and use of ArtHost. With Rhizome (New York) we collaborate on browser emulation.

ArtHost, developed by LIMA in cooperation with DullTech (Constant Dullaart) is worldwide an unique service for sustainable access to net art and will be available as a service in 2019.

www.arthost.nl

Research Team

Julie Boschat Thorez (Case UBERMORGEN)
Dulltech - Constant Dullaart (advice and concept development)
Peter Gonda (GND)
Manique Hendricks (communication)
Claudia Röck (Case Geert Mul Shan Shui and Tracenoiser)
Rachel Somers Miles (Artwork Documentation Tool)
Wiel Seuskens (coördinator technical research)
Jurian Strik (communication advice)
Mila van der Weide (documentation Cases Constant Dullaart)
Gaby Wijers (project coordination)
Axelle Van Wynsberghe (research Constant Dullaart and escrow)
Jim Wraith (enquête and webcrawling)

stimulerings fonds creatieve industrie

Annexe I

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

Follow-up investigation ArtHost 2019 – 2020

- Further development, in collaboration with Rhizome, of emulation scenarios and workflow and criteria for saving and availability of old browserversions.
- Further develop the storage of dynamic sites and version management.
- Extend the control of the correct functioning of the websites. For example, solutions must be found for websites whose content is continuously being updated or is random. The operation of flash and java applets cannot be checked with HTML.
- Further testing and development upload tool: The subscribe and upload tool is in its first version. There will be requests for adjustments and extensions to the functionality – for example, download and other extensive file management by the owner and Lima, keeping notes and requesting history.
- Working out if different types of net art may require different types of management.
- Offer the service broadly and further develop the business model.

What else should be developed in the (near) future?

- Planning a scalable hardware solution. For this pilot, all functions have been placed on one server. With the expansion of web servers and browsers, all functions are spread over different servers. Several servers will be needed to host hundreds of virtual web servers. The maintenance of this must be transparent.
- Every virtual server has its own IP number. At present, all websites have the same IP number, therefore the virtual servers are not completely separated. If, for example, activities take place on a server, as a result of which the IP number ends up on a blacklist, all virtual servers are therefore on that blacklist.
- Further cooperation with Rhizome includes the (automatic) development of various old versions of browsers. Consequently, there is the automatic setting up of the virtual environments in which they run (pipeline) so that they are accessible to the public.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

- Explore the possibilities of a kickstarter campaign.
- It has now been agreed with one gallery to link the sale of the ArtHost service to the sale of the websites. We want to expand this.
- Further develop contracts the with artists and collection holders.
- Consultation with Google? Google is a dominant actor on the internet; a lot depends on them. For example, Google maintains a list of suspicious sites. - -
- Modern web browsers refer to this list before displaying a page. When a site is blacklisted, instead of seeing the site, a warning is displayed instead. This list already blocks several sites we host.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

Annexe II

ArtHost Questionnaire Summarized Responses

Annexe III

Webarchiving / webcrawling research summary

Annexe IV Short Bibliography

- Aziosmanoff, Florent et al. "*Digital art posterity: building a data model for digital art corpora*" Bailey, Jefferson et al. NDSA Results of a Survey of Organizations Preserving Web Content February 2017. ndsa.org/documents/WebArchivingintheUnitedStates_A2016Survey.pdf
- Connor, Michael, Aria Dean and Dragan Espenschied (eds.) *The Art Happens Here: Net Art Anthology*. Rhizome: 2019. pp. 292. https://anthology.rhizome.org/the-revolving-internet
- Dekker, Annet *Collecting and Conserving Net Art: Moving Beyond* Conventional Methods, Routledge 2018
- *Emulation as a Service* http://eaas.uni-freiburg.de/eaas.html
- Falcao, Patricia, Alistair Ashe, Brian Jones. *Virtualisation as a Tool for the Conservation of Software-Based Artworks*.
- Ghidini, Marialaura. "On Collecting Websites: Constant Dullaart's The Revolving Internet" Account of a conversation with the artist in his studio at the white building,
- London – 18 nov 2013Guez, Emmanuel, Morgane Stricot, Lionel Broye and Stéphane Bizet. "The afterlives of network-based artworks". Journal of the Institute of Conservation, vol. 40, No. 2. 2017
- *Handreiking webarchivering overheidswebsites: deel 1, publiekscommunicatie*, Concept Nationaal Archief, 2017
- Cat Hope, John Charles Ryan, *Digital Arts: An Introduction to New Media* 2014.

LIMA
Arie Biemondstraat 111
1054 PD Amsterdam
The Netherlands
+31 (0)20 389 20 30
info@li-ma.nl | www.li-ma.nl

- Innocenti, Perla. *"Bridging the Gap in Digital Art Preservation: Interdisciplinary Reflections of Authenticity, Longevity and Potential Collaborations".* In: The Preservation of Complex Objects. JISC, UK, pp. 71-84. (2012)
- iMal & Packed, "*Resurrection Lab*". September 2017
- Ippolito, Jon. *10 Myths of Internet Art*, 2002.
- Rechert, Klaus, Isgandar Valizada, Dirk von Suchodoletz and Johann
- Latocha. *"bwFLA - A Functional Approach to Digital Preservation"*.
- Rechert, Klaus, Tom Ensom and Patricia Falcao. *"Introduction to an emulation-based preservation strategy for software-based artworks"*, 2016.
- Roëck, Claudia*. Preservation strategies for a web-based artwork yesterday, today and tomorrow*, 2018.
- Spreeuwenberg, Kimberley in collaboration with: Annet Dekker, Constant Dullaart, Sandra Fauconnier, Sabine Niederer, Robert Sakrowski and Ward ten Voorde. *Documenting Internet-based Art The Dullaart-Sakrowski Method : Video Vortex Research report.* Amsterdam : Video Vortex, 2012
- Wijers, Gaby en Hannah Bosma. *Born digital cultureel erfgoed is bedreigd erfgoed : Op weg naar een generieke workflow voor born digital erfgoed binnen de domeinen kunst, film, fotografie en architectuur.* Amsterdam, Den Haag : CCDD, DEN en LIMA, 2015