

EUROMED 2020
Todd Swanson
Digital Imaging Manager, The J. Paul Getty Trust | Getty Digital

Getty

November 3, 2020

Building and Supporting Getty's Technical and Computational Imaging Capability

Getty

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Getty advances and shares the world's visual art and cultural heritage for the benefit of all.

Getty is a cultural and philanthropic institution dedicated to the presentation, conservation, and interpretation of the world's artistic legacy.

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Getty Programs
Getty Museum
Getty Research Institute
Getty Conversation Insititute
Getty Foundation





Getty Digital
The Getty Digital Imaging Department collaborates with Getty programs to provide high-quality digital surrogates of the Getty's holdings in support of the programs' needs, the Getty's strategic goals, scholarly research, publication, online discovery, and preservation.

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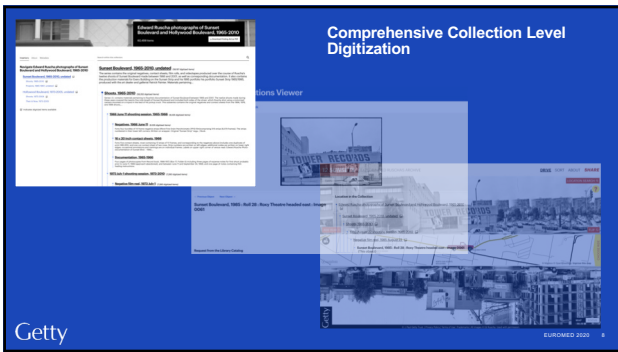
Getty Digital Imaging Labs

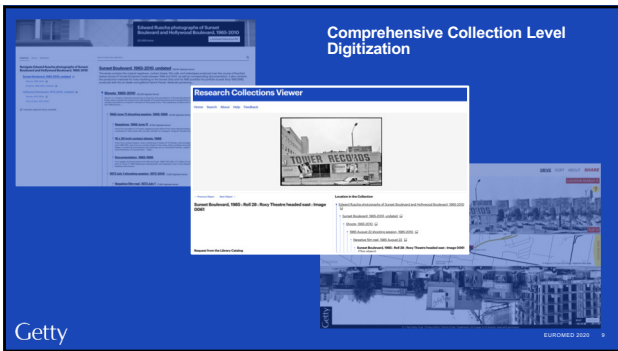


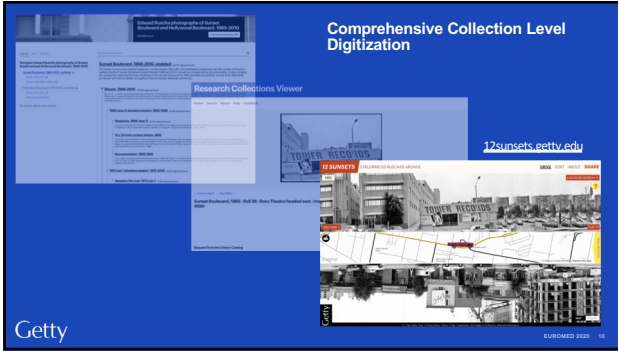
Museum Research Institute Villa

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Evolving CH Imaging Field

Getty

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Getty Digital Content Strategy

- Provide Authoritative Content to a Broad Range of Audiences
- Rethink How We Deliver Our Content
- Experiment and Innovate
- Be Willing to take risks and Learn
- Enrich the Lives of People Around the World
- Advance the Knowledge of Art History, Conservation, and Related Fields.

Summary

Getty needs to be recognized as among the most authoritative sources of knowledge in its field and subject matter and as an innovator in engaging audiences across the world with digital content. The mission is to create authoritative and useful content, provide relevant and useful digital content, and to create informative and engaging content for various audiences and regions with our virtual and physical assets.

To achieve these goals, we must:

1. Develop engaging and authoritative content for a variety of audiences, from professionals and scholars to art enthusiasts, teachers, and students, as well as the global general public.
2. Manage virtual digital assets effectively to support our content.
3. Create innovative approaches to engage our audiences that involve location, interaction, and new forms of storytelling.
4. Identify the best partners, platforms and outlets to "push" our content out.
5. Engage the Getty Council and boards and identify to meet these new approaches to online digital engagement.
6. Establish a Digital Content Steering Committee at the leadership level to make decisions and set priorities.

Getty is among the leading institutions worldwide in the depth of its content across art history, conservation, and related fields. Our unparalleled collections, archives, conservation and scientific research, and historical data are uniquely positioned to provide authoritative content to a broad range of audiences. This is our current focus in the area of digital strategy and content creation. Our digital strategy is based on the collection and preservation of our content. The most authoritative digital content is based on our collections and preservation of our content. The most authoritative digital content is based on our collections and preservation of our content. The most authoritative digital content is based on our collections and preservation of our content.

While we want to expand our digital reach to these audiences, we also want to be recognized as a leader in a digital content that is relevant to research and discovery in the field. We want to expand our reach through virtual projects, for example, online exhibitions, virtual tours, and other initiatives that are relevant to our audiences. A major challenge is to create digital content that is relevant and engaging, and to ensure that our content is accessible to all. This is our current focus in the area of digital strategy and content creation. Our digital strategy is based on the collection and preservation of our content. The most authoritative digital content is based on our collections and preservation of our content.

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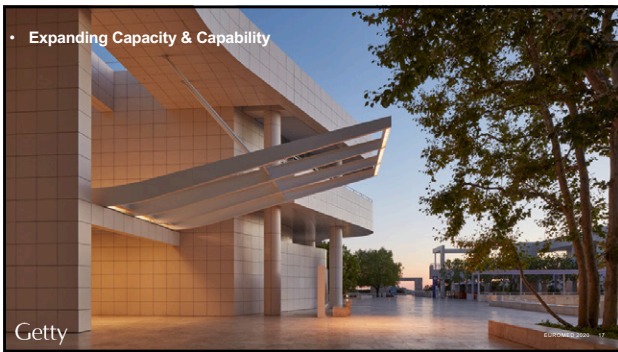
Building and Supporting Getty's Technical and Computational Imaging

- Expanding Capacity & Capability
- Supporting Internal Projects
- External Collaboration
- Platforms and Tools of Interest

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Technical Imaging Capability

- Equipment and Expertise

Building and Restoring Getty's Technical Imaging Capability

While arts institutions, cultural heritage objects are most often photographed traditionally in light visible to the naked eye. There exists, however, a large of imaging techniques relevant to technical imaging, used to capture, record and analyze data. These techniques include: for imaging in the visible spectrum, photogrammetry to measure multiple positions of camera viewing records of the "real" world. These techniques include: for imaging in the visible spectrum, photogrammetry to measure multiple positions of camera viewing records of the "real" world. These techniques include: for imaging in the visible spectrum, photogrammetry to measure multiple positions of camera viewing records of the "real" world.

In order to support all of the programs at the Getty as well as further secure our share as a leader in the digital cultural heritage imaging, the implementation of research and development of projects and the practice of technical imaging, that is, the creation of digital images, will be necessary. This collaborative initiative will leverage the professional expertise of the research and library collections, along with the skills of the IT and research services staff and ITU members. By combining the Getty's digital expertise in these areas, the Getty will be able to contribute significantly to the knowledge of the field. The goal of this will be to advance imaging techniques and techniques to meet the needs of the program and the research and public life.

In order to further the progress of this work, it will be necessary to establish special agreements to make the necessary research to create this data. Working with technology partners such as the French Institute for Research, Scientific, and Technological Innovation, and the National Gallery of Art in Washington, DC, the Getty will work with research institutions and experts to share their expertise and to share their expertise with the Getty to support the Getty's research and public life.

To fund this initiative, Getty Digital is applying for one-time funding to purchase specialized equipment that will be used for imaging and related to the Getty Digital Imaging Department as well as for a small team of specialists and personnel with expertise in imaging and related to the Getty. This staff member is currently a part-time position and will be a full-time position. The staff member is currently a part-time position and will be a full-time position. The staff member is currently a part-time position and will be a full-time position.

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Software Based Photogrammetric Data Acquisition



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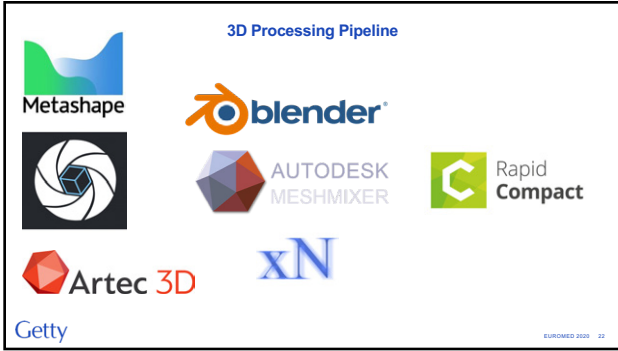
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Hardware Based 3D Acquisition



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Hardware Based 3D Scanning & Software Based Photogrammetry



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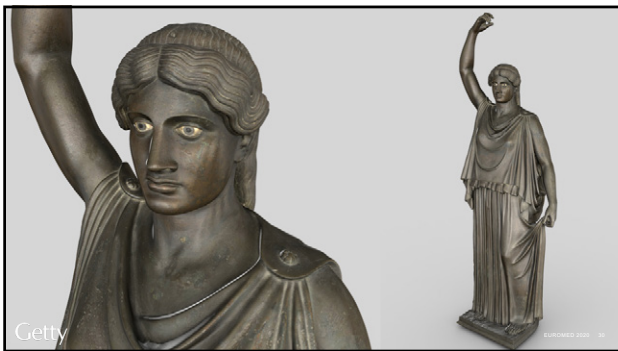


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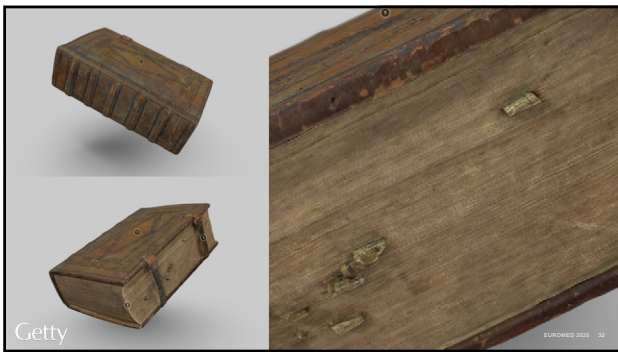
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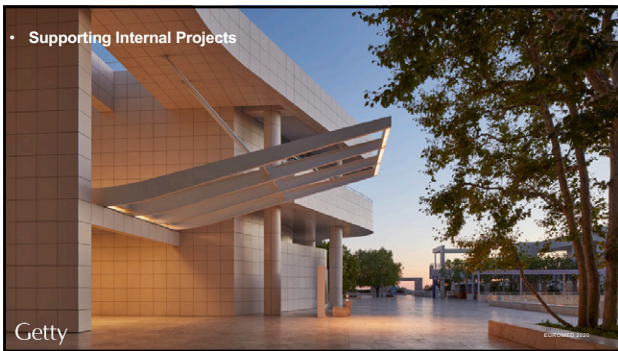













Research Projects

**Understanding the Architectural Model:
Research Applications for 3D Imaging**
March 10-11, 2020



Special Collections
Person ID: 40719
Password: Workshop

TUESDAY, MARCH 10, 2020
("See below for full guest list, including titles and institutional affiliations")

9:15 a.m. Group takes Angeleno Shuttle up to the Getty Center (please meet at the front desk)

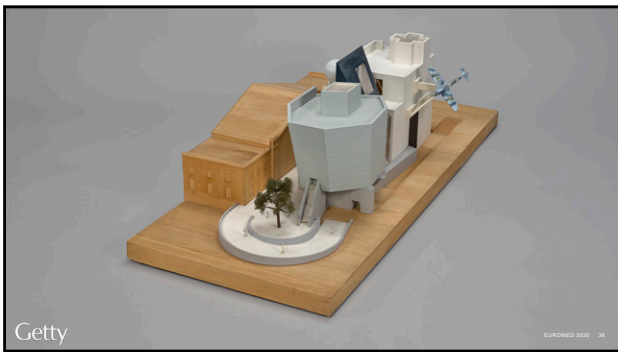
9:30 a.m. – 10:00 a.m. Breakfast and Introductions – L3 Seminar Room
Welcome remarks, Andrew Purchak

10:10 a.m. – 12:30 p.m. **SESSION 1, part 1 of 1.3 seminar)**
The Architectural Model: Challenges and Opportunities (25 min)
Maristella Casciato and Emily Pugh

3D Imaging in Cultural Heritage: State of the Field (25 min)
Todd Swanson and Vincent Rossi

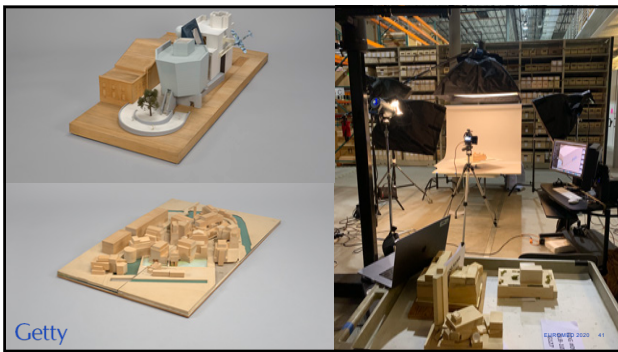
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UNIVERSITY OF CALIFORNIA LIBRARY

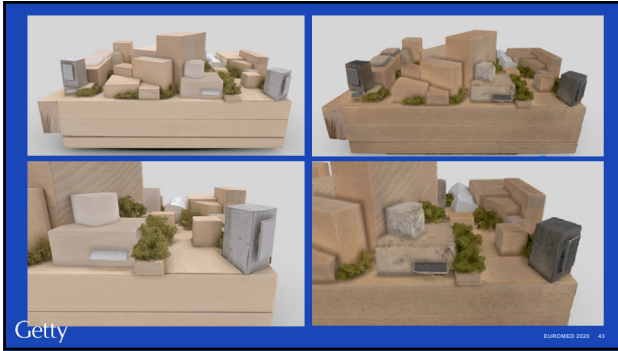




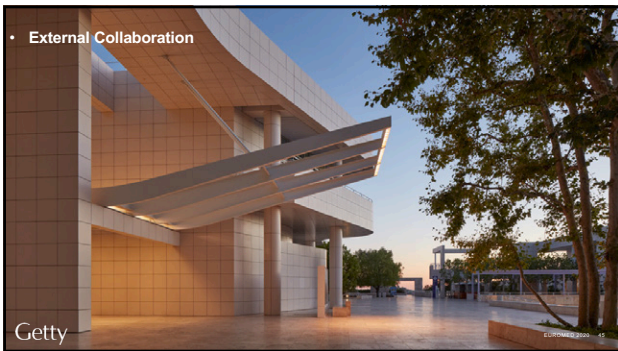


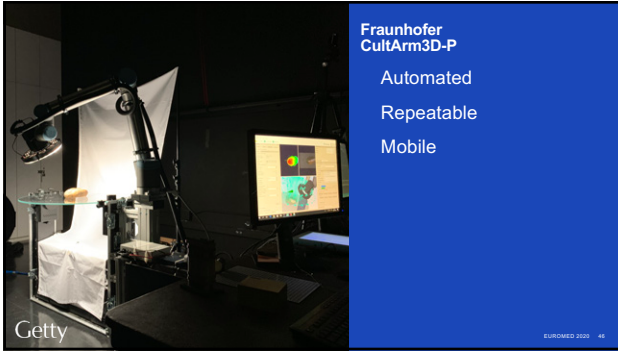




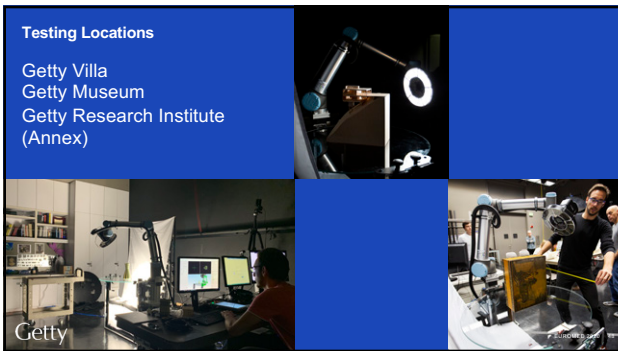


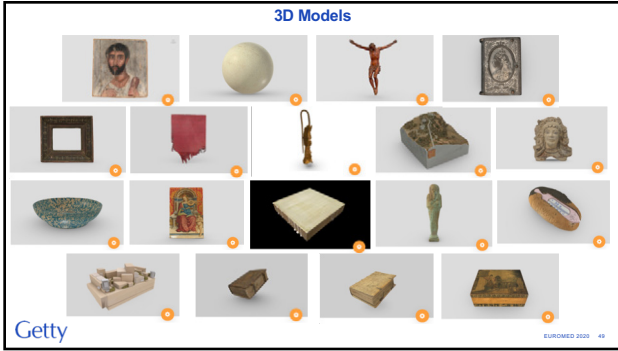


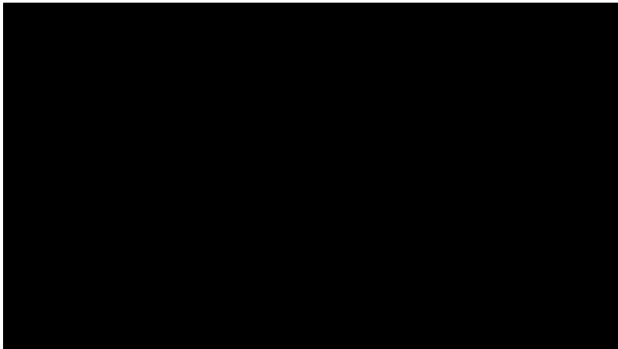




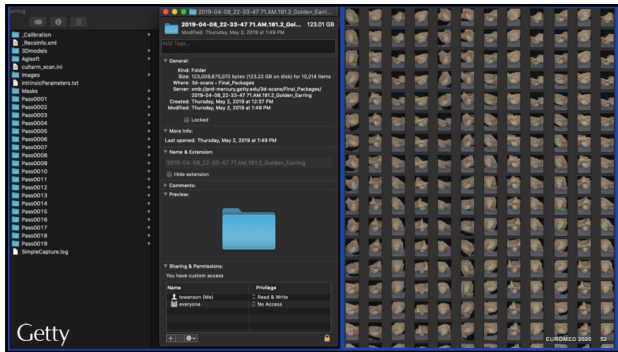


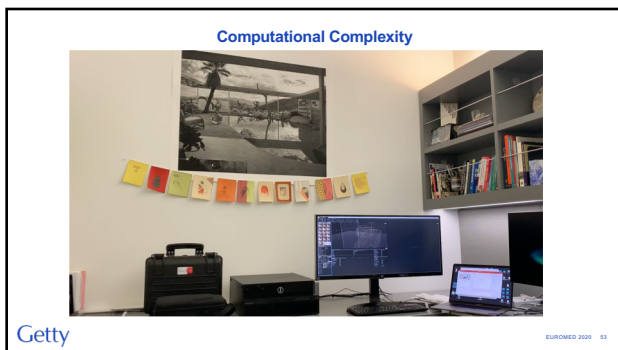












Computational Complexity

-Why HPC for Photogrammetry?
 Algorithm complexity, hours-days of computation for small-medium photo sets;
 weeks for larger data sets on a good workstation

<p>Coordinates: (X, Y, Z) - point in the local camera space (u, v) - projected point in the image plane w, h - image width and height</p> <p>Camera: f - focal length cx, cy - principal point offset K1, K2, K3, K4 - radial distortion coefficients P1, P2, P3, P4 - tangential distortion coeffs B1, B2 - affinity and non-orthogonality coeffs</p>	<p>Solve these systems of equations for every point on every photos in photo set:</p> $x = X / Z$ $y = Y / Z$ $r = \sqrt{(x^2 + y^2)}$ $x' = x(1 + K_1 r^2 + K_2 r^4 + K_3 r^6 + K_4 r^8) + (P_1 r^2 + 2P_2 xy) / (1 + P_3 r^2 + P_4 r^4)$ $y' = y(1 + K_1 r^2 + K_2 r^4 + K_3 r^6 + K_4 r^8) + (P_2 r^2 + 2P_1 xy) / (1 + P_3 r^2 + P_4 r^4)$ $u = w * (0.5 + cx + x'f + y'B1 + y'B2)$ $v = h * (0.5 + cy + y'f)$
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INTERNET FOUNDATION 2020

CENIC

The Getty Joins CENIC's Broadband Network to Speed Transmission of Scientific Data and Digitized Artwork

MARCH 18, 2019 CULTURAL & SCIENTIFIC TAGS: GETTY

La Mirada, CA & Los Angeles, CA March 18, 2019 – The Getty has joined CENIC's California Research and Education Network (CALREN), a high-speed computer network serving the vast majority of academic institutions across California. The move will provide the Getty with 10 times the capacity of its previous connection.

The Getty is the world's largest arts institution, conducting research and conservation all over the world. Joining CENIC, at 10 gigabits per second, will greatly improve speed and capacity, enabling the Getty and its partners to better share the tremendous amount of scientific data, digitized artworks, and vast research databases that scholars, scientists, curators, and researchers all over the world use every day.

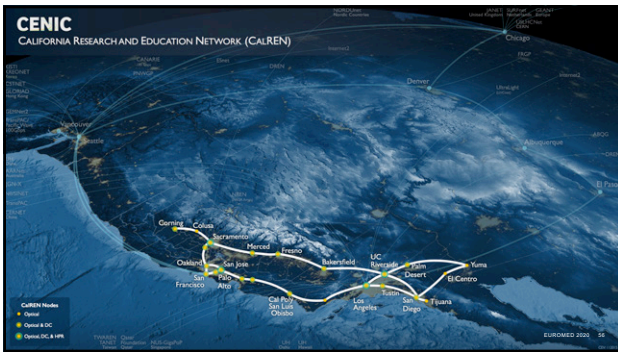
"Getty scholars and scientists are delighted to join their academic colleagues on CENIC," said Paul Fagan, vice president and chief digital officer of the J. Paul Getty Trust. "We receive more than 8 million queries a year from scholars all over the world, and CENIC will make a measurable difference in the Getty's work and the work of its partners."

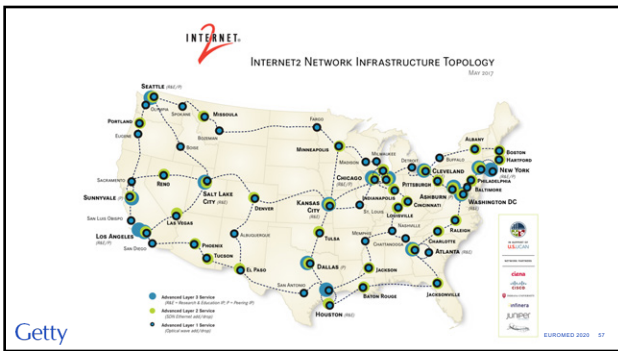
CENIC connectivity will improve access to more than 150,000 digitized artworks that the Getty makes available online, more than 2 million records in the Getty Vocabulary, and another 2 million records in the Getty Provenance Index. The new 10-Gbps connection will also enhance the Getty's ability to share the large multi-terabyte and TB datasets produced by its advanced digitization efforts.

"Bandwidth should never constrain the work of California's scientific, arts, and cultural organizations," said Louis Fox, CENIC president and CEO. "The Getty is now part of a network that links 12,000 research and education organizations within California to tens of thousands of research and education institutions around the globe – a fiber network and equity transporter, a human network."

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Comparing Run Times

Carbonate HPC at Indiana University

256 GB of RAM per node, scripted 4 nodes

Google Cloud Virtual Machine

256 GB of RAM and 4GPUs

Getty VFX machines

256 GB of RAM and 5GPUs

All files run at IU transferred using Globus, a high-performance GridFTP service designed for secure data movement between networked endpoints.



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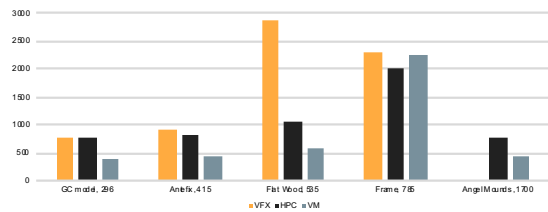
Runtimes

Object	# Images	Image Set Size (GB)	Processor	Matching	Alignment	Depth Maps	Dense Cloud	Mesh	UV	Blending	Total (min)	Total (hrs)
Antefix	415	8.8 RED	GCP	79	12	602	38.5	26.5	2	34.5	794.5	13.2
			VFX	88	27	449	250		4	92	910	15.2
			GCP	12	24.5	152	127	44.5	2.5	55.5	418	7
GettyCenterModel	296	3.5 RED	GCP	4	2	70	254	39.5	1.5	20	391	6.5
			VFX	143	2	201	381		2	60	789	13.2
			GCP	3	10	90	362	80	2	41.5	578.5	9.8
Flat Wood	535	4.7 RED	GCP	248	7	675	1,444.00	398	10	61	2,643.00	47.4
			VFX	117	13	806	31.5	39	3.5	43	1,053.00	17.6
			GCP	6	7	141	2,040.00	30	0.5	36	2,260.00	37.7
Frame	785	5.3 RED	GCP	203	26	555	1,446.00	21	3	55	2,309.00	38.5
			VFX	189	21.5	1,312	436	15	1	49	2,023.50	33.7
			GCP	6	7	141	2,040.00	30	0.5	36	2,260.00	37.7
AngelMounds Drone	1700	37.5 RED	GCP	59	6	485	20.5	132	3	43	748.5	12.5
			VFX	7	19	83	117	183	3.5	32	444.5	7.4

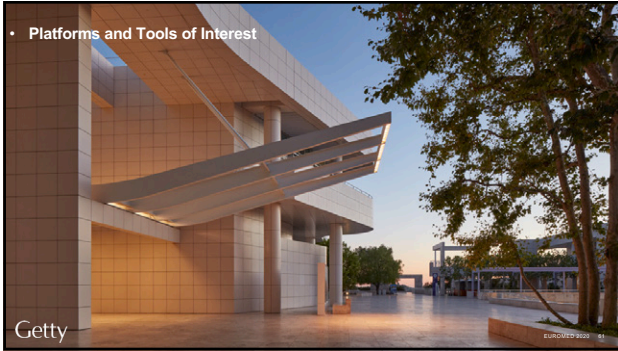


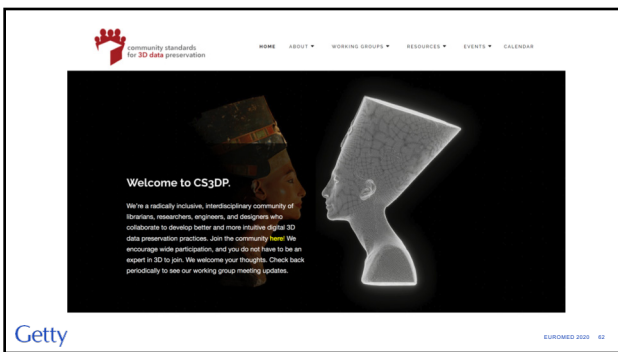
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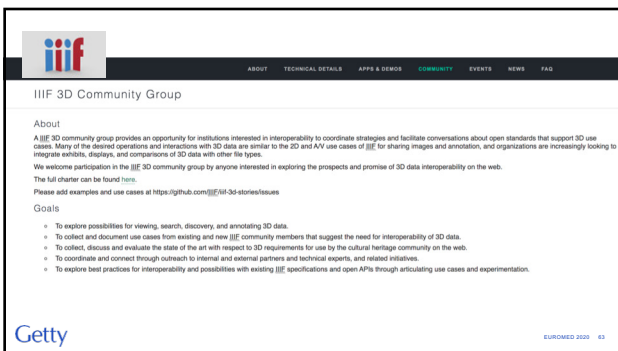
VFX, HPC, Google Virtual Machine Comparison



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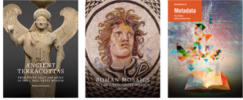


Platforms & Tools

quire™

A New Publishing Tool

We are developing Quire, a new publishing tool—optimized for publication discoverability and longevity—that uses a static-site generator, [Hugo](#), to create and output titles in multiple formats from plain text files. E-book files are distribution-ready for Amazon, Apple, and other vendors; PDF files are print-on-demand ready. And the online edition can be hosted on any web server, with no special configurations or installations necessary and no backend databases or content management system to update and support over the long term.



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Thank you.

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