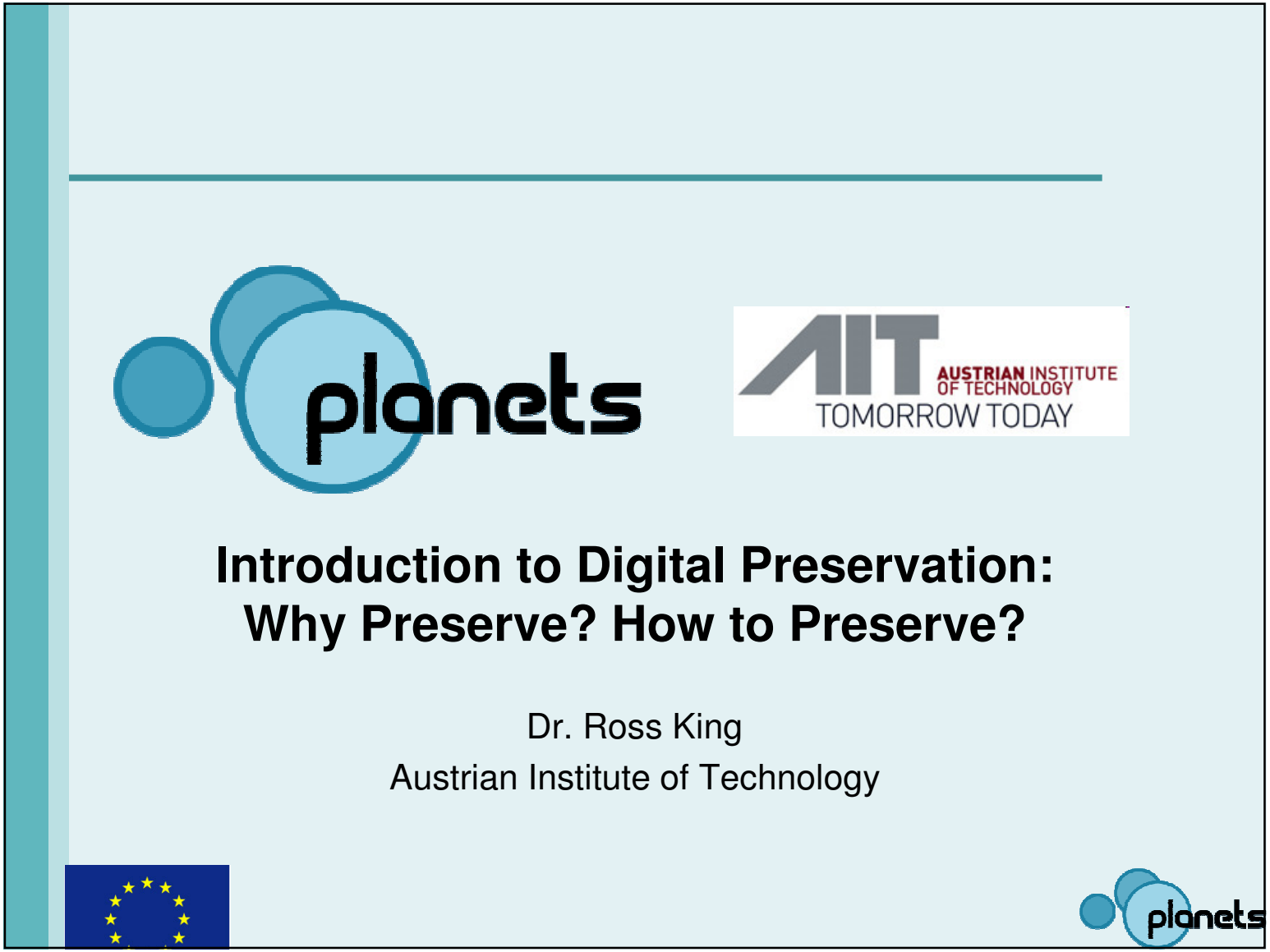
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AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY
Introduction to Digital Preservation:
Why Preserve? How to Preserve?
Dr. Ross King
Austrian Institute of Technology
planets

Outline

- Introduction: Digital Universe
- Digital Preservation Challenges
  - Information Retrieval past and present
  - Bit-stream Preservation
  - Logical Preservation
- Digital Preservation Incentives
  - Markets
  - Incentives
  - Risks
- Conclusions

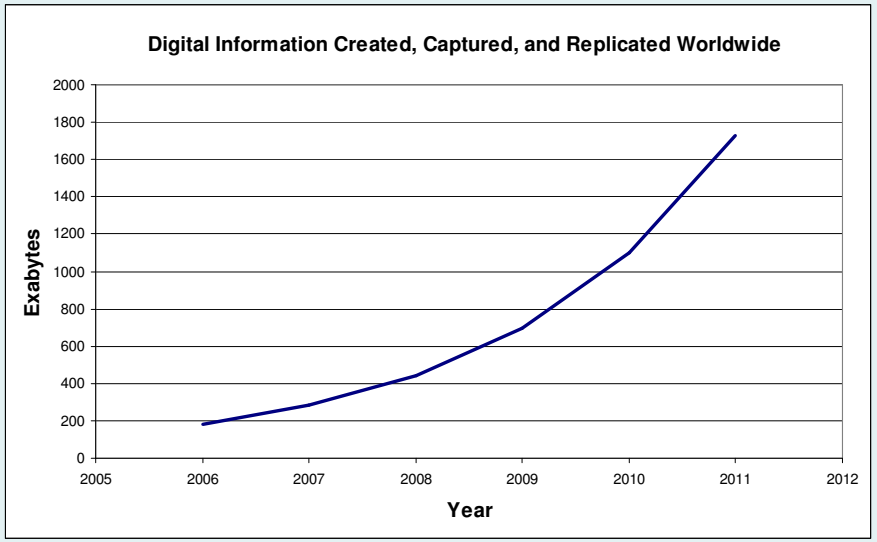
Introduction

The Digital Universe

The Digital Universe

- Estimated volume of digital information worldwide in 2007: 281 Exabytes
- Estimated growth rate: ca. 60%
- → 700 Exabytes in 2009!

1000	k	kilo
1000^2	M	mega
1000^3	G	giga
1000^4	T	tera
1000^5	P	peta
1000^6	E	exa
1000^7	Z	zetta
1000^8	Y	yotta



source:
"The Diverse and Exploding Digital Universe"
IDC White Paper, March 2008
http://www.emc.com/collateral/analyst-reports/diverse-exploding-digital-universe.pdf

The Digital Universe

- Information creation is beginning to exceed storage capacity
- Much of this information is
  - transient
  - redundant

The Digital Universe

Issues:

- What is worth preserving?
- How to preserve?
- How to preserve so much?
- How to ensure quality?
- How to create incentives to preserve?

The Digital Universe

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Part 1

Digital Preservation Challenges

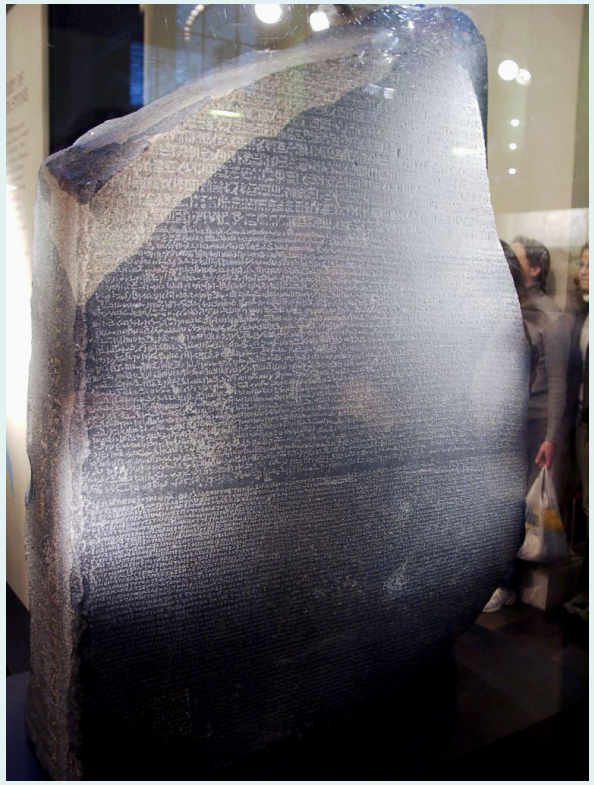
Digital Preservation

- standards, best-practices, and technologies utilized in order to ensure access to digital information over time

"Digital documents last forever – or five years, whichever comes first."

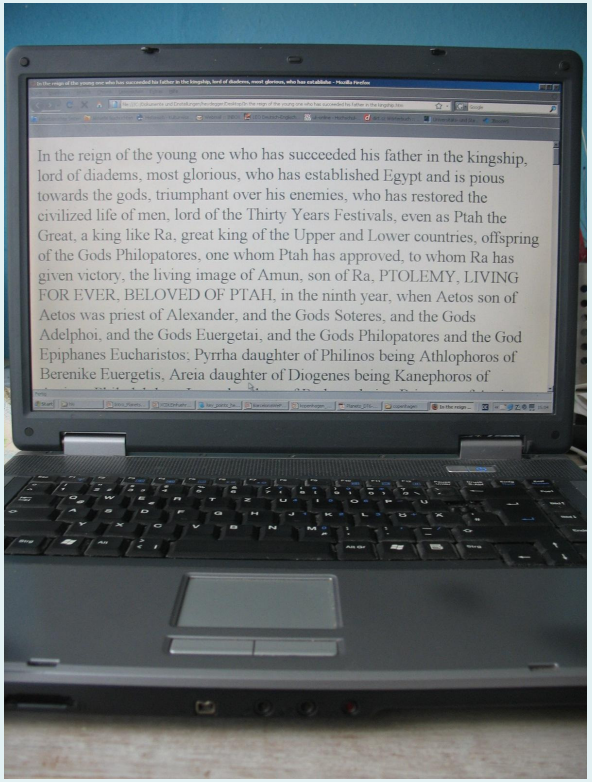
  - http://www.clir.org/pubs/reports/rothenberg/introduction.html

Information Retrieval – 196 BC



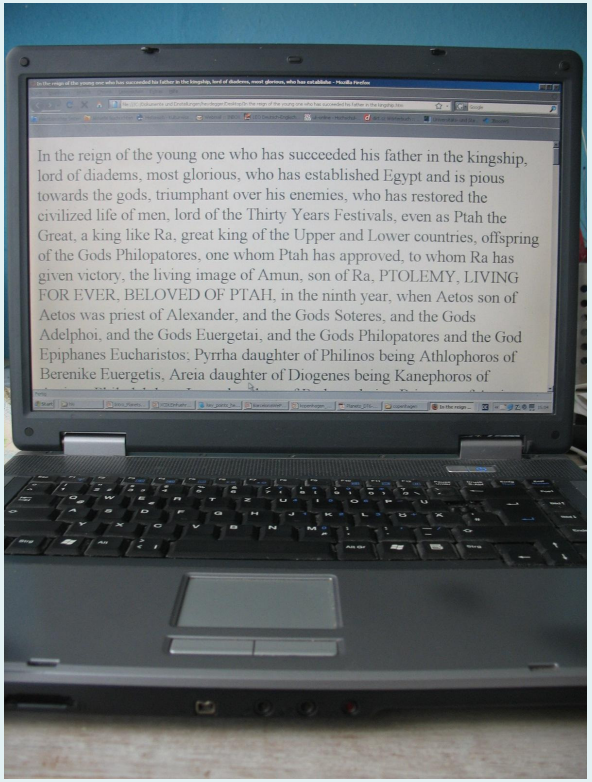
- Carrier
  - Solid material (granodiorite)
  - 114 x 72 x 28
  - 760 kg
- Encoding
  - Human-readable characters
  - Three language scripts (hieroglyphic, demotic, ancient greek)
- How to get the information?
  - Human, capable of reading (at least) one of the scripts

Information Retrieval – 2009 AD



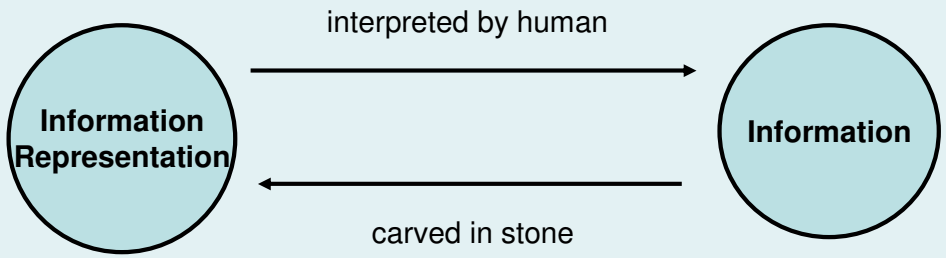
- Hardware
  - Storage medium (hard disk, optical disc, …)
  - Rendering environment (display, printer, …)
- Software
  - Low level software (operating system)
  - Application software (webbrowser, texteditor, …)

Information Retrieval – 2009 AD

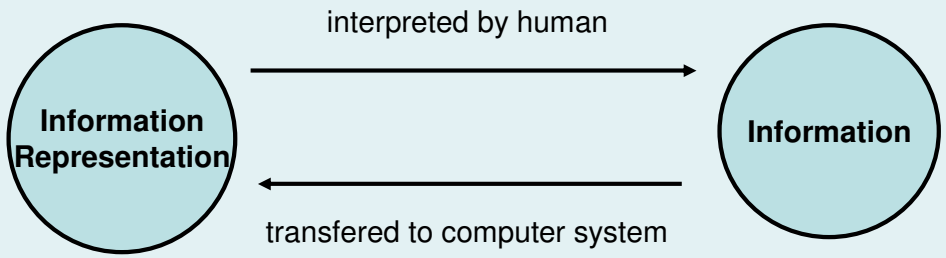


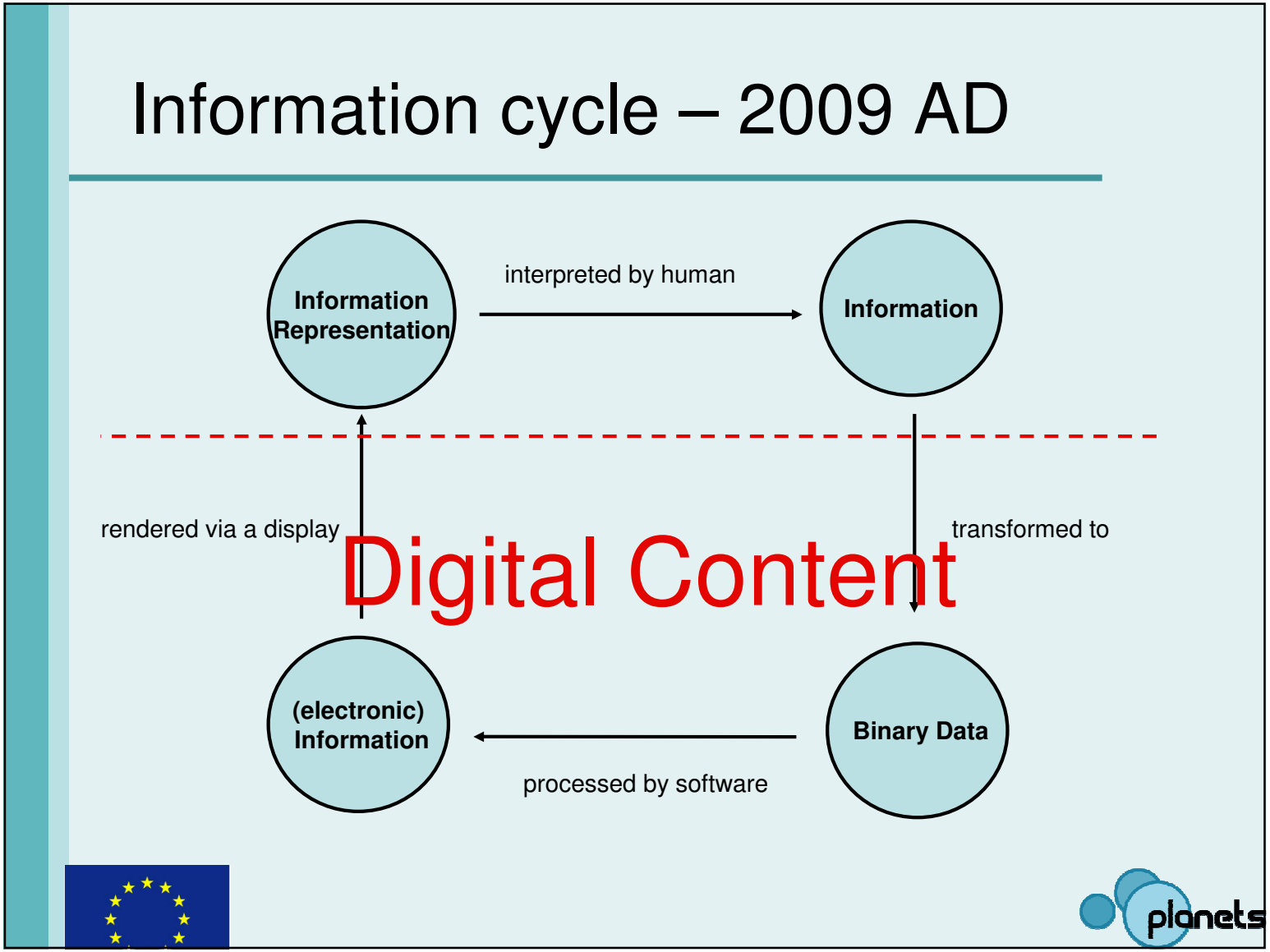
- Encoding
  - Machine-readable: Binary data
  - Human-readable: Characters
- How to get the information?
  - Human, capable of undestanding english language
  - We need software
  - We need representation facilities

Information cycle – 196 BC



Information cycle – 2009 AD (simplified)




Information cycle – 2009 AD
Information Representation
interpreted by human
Information
rendered via a display
Digital Content
transformed to
(electronic) Information
processed by software
Binary Data
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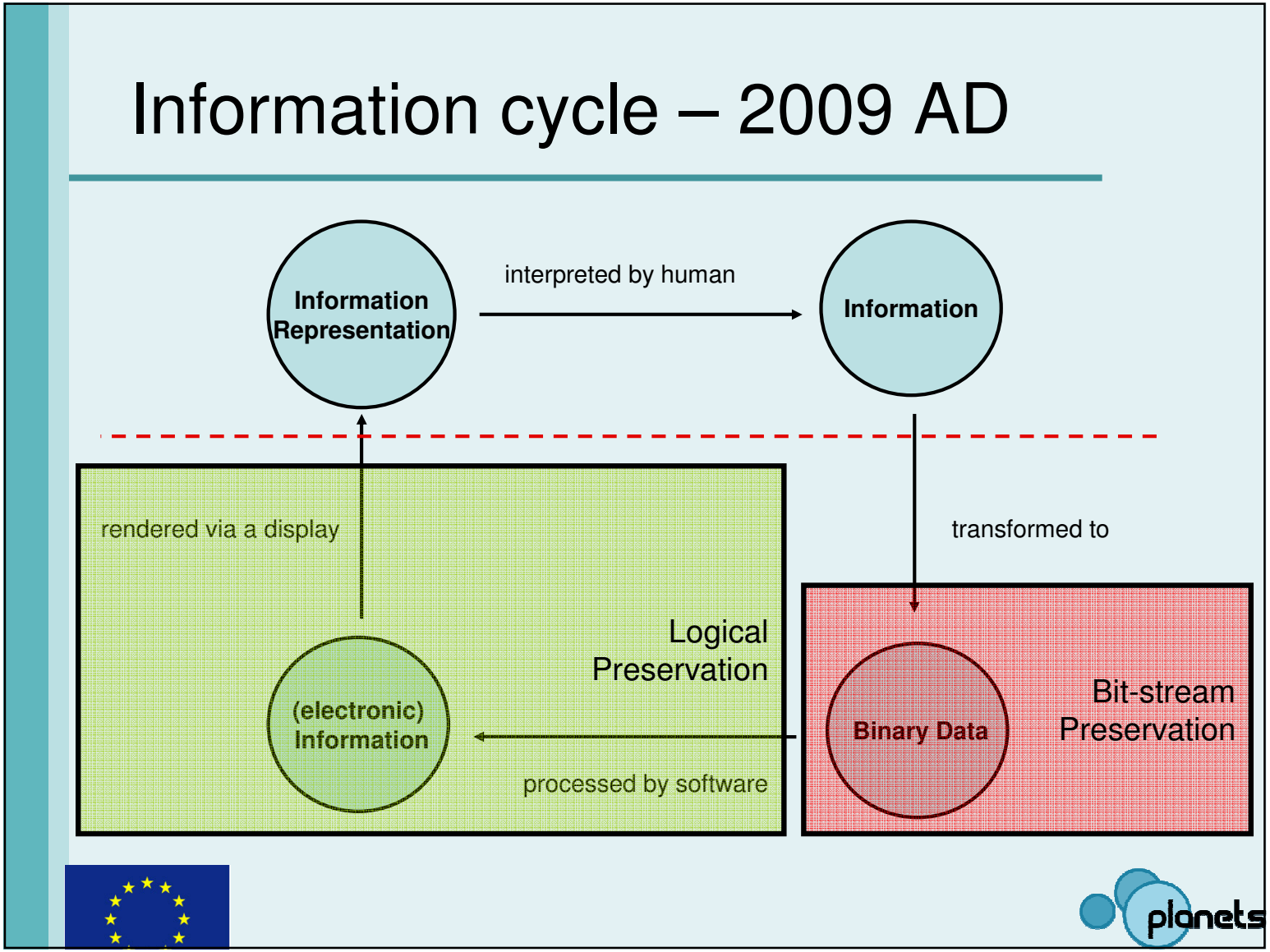

Information cycle – 2009 AD
Information Representation
interpreted by human
Information
rendered via a display
transformed to
Logical Preservation
(electronic) Information
processed by software
Binary Data
Bit-stream Preservation
planets

(Some) risks for digital information

- Media obsolescence
- Hardware obsolescence

Bit-stream Preservation

- Software obsolescence
- Format obsolescence
- Loss of context

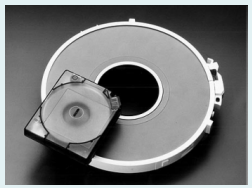
Logical Preservation

Bit-stream Preservation

- Problem: digital media do not last forever
  - media deterioration
- Problem: hardware for accessing digital media does not last forever
  - hardware obsolescence

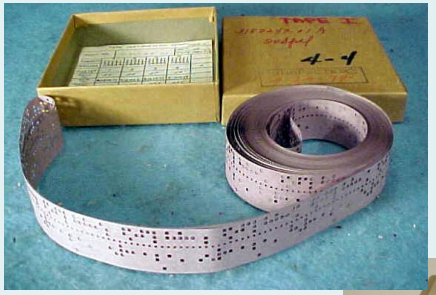
Bit-stream Preservation: Lifespan of Media

- Parchment: 1000 years
- Microfilm: 500 years
- Paper: 50 – 200 years
  - high levels of acid can cause paper to disintegrate
- Magnetic Tape: 100 years
  - the binder that holds magnetic particles to the tape can decompose and cause the layers of tape to stick together in a reel
- CD-ROM: 10 years
  - poor manufacturing processes allow the reflective aluminum layer to oxidize

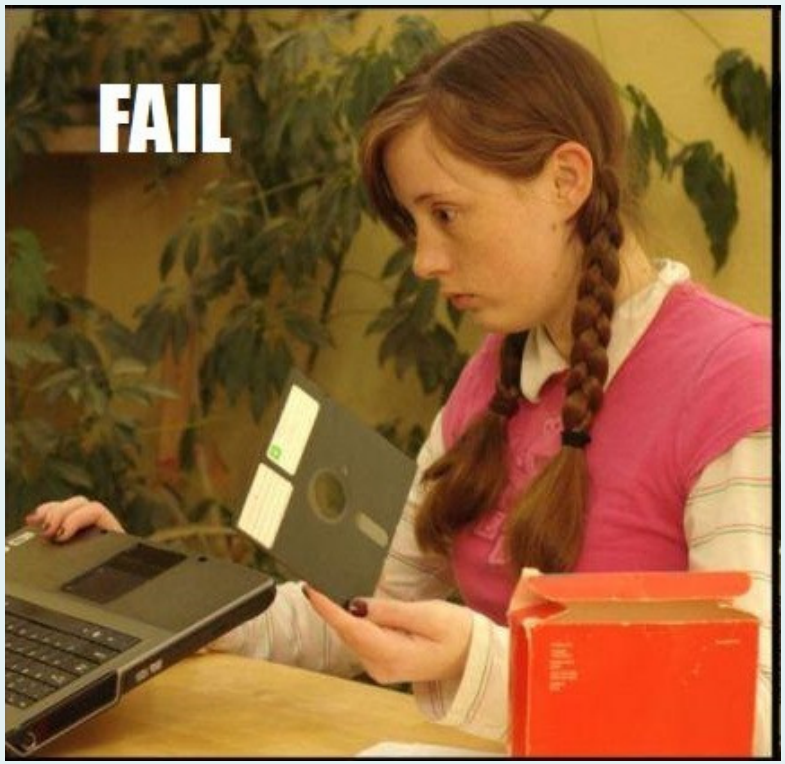


Is this progress?

Bit-stream Preservation: Lifespan of Hardware



Bit-stream Preservation: Lifespan of Hardware



Bit-stream Preservation

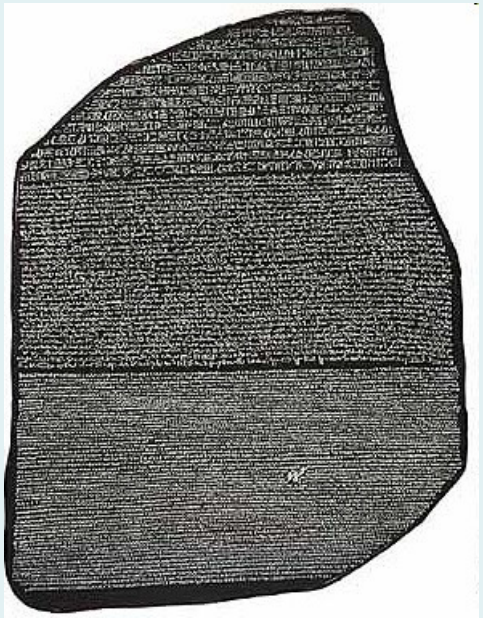
- Solution: migration
  - regular copying to new media
    - requires automation to handle volume and reduce expense
- Solution: hardware museums
  - expensive
  - depends on other obsolete hardware

Logical Preservation

- Problem: data formats are not supported forever
  - format obsolescence
- Problem: how to interpret preserved bit-streams

Logical Preservation

- Solution: Representation Information



From the DCC Digital Curation Manual: "Representation Information (RI) refers to all information required to access the information stored within a digital object. The term can be applied to all levels of abstraction and refers to both the structural and semantic composition. The use of RI is often recursive: using one element of RI in a meaningful manner requires further RI. This recursion continues until the contents of the original object are displayed in a form the user can understand."

Logical Preservation

- Solution: Emulation
  - use representation information to re-create the environment necessary to access the preserved bit-stream
- Solution: Migration
  - use representation information to identify endangered bit-stream formats and convert them to accessible (open, standardized) formats

How can Planets help?

- We must profile collections and identify risks
  → Pronom Technical Registry
- We must plan preservation to mitigate risks, which means making decisions regarding what to preserve and how to preserve it
  → Planets Preservation Tool (Plato)
- We must perform concrete preservation actions on digital objects
  → Planets Preservation Service Suite
  → Planets Service Developers Guidelines
  - We must characterise objects and control quality after migration
    → XCL Tool Suite

How can Planets help?

- We must quantitatively measure how preservation services act on digital objects - in a controlled environment

  → Planets Testbed

- We must be able to combine different preservation services in an orchestrated way in order to carry out different preservation workflows

  → Planets Interoperability Framework

Part 2

Digital Preservation Incentives

What is the market for Digital Preservation?

- Memory Institutions
- Governments
- Software Manufacturers
- ... and everybody else!
  - Companies and Individuals
  - All kinds of digital content
    - Documents
    - Photographs
    - Audio/Video
    - Databases
    - Emails
    - Spreadsheets
    - Websites
    - CAD
    - Simulations
    - …

Reasons to implement Digital Preservation

- compliance with legislation, for example on freedom of information, Sarbanes-Oxley, environmental information – and, of course, legal deposit
- providing the long-term guarantees of access to digital content needed to sustain the transition from paper to digital information societies and business processes
- where enforced by regulatory organisations, for example the European Medicines Agency and the US Food and Drug Administration in the case of pharmaceutical companies
- protecting the interests of the organisation and the rights of all present and future stakeholders
- providing evidence of IPR or patent rights
- providing evidence of good practice to defend against litigation
- protecting business critical information or allow data mining and analysis
- providing business continuity in the event of catastrophic data loss
- maintaining information of historical or scientific value
- maintaining life-long medical information
- maintaining information of personal value, such as e-mails, music and photographs
- …

What is stopping us?

- Business decisions are made based on the short-term, whereas preservation is a (relatively) long-term problem.
- Business decisions are made based on return on investment. How to calculate return on investment?

Perhaps preservation should not be about “return on investment”, but rather about **risk management**.

What is the financial risk?

In order to answer that question, we must ask:

- how many digital objects are produced?
- what are these objects worth?
- how long do digital objects retain their value?
- how many objects are in danger of digital obsolescence?

and then

- what does it cost to preserve?

If we can estimate the financial risk, we can justify the preventative investment in digital preservation...

[1] M.K. Bergman, “Untapped Assets: The $3 Trillion Value of U.S. Enterprise Documents,” BrightPlanet Corporation White Paper, July 2005, 42 pp
[2] P. Lyman, and H. Varian, "How Much Information", Technical Report 2003
[3] LIFE[1] and LIFE[2] projects: http://www.life.ac.uk/

Conclusions

- The volume of digital information being produced is staggering
- There are multiple challenges, some solutions, many open questions
- Planets can offer solutions for some aspect of the digital preservation challenge
- There are many incentives for digital preservation, but the long-term nature of the problem is a hindrance
- A risk management approach might serve to involve industry stakeholders and decision-makers

Thank you for your attention!

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