We Want You Just the Way You Are: The What, Why and When of **Fixity in Digital Preservation**

A new resource from the NDSA *Standards and Practices* and *Infrastructure* Working Groups

Kate Murray, Library of Congress
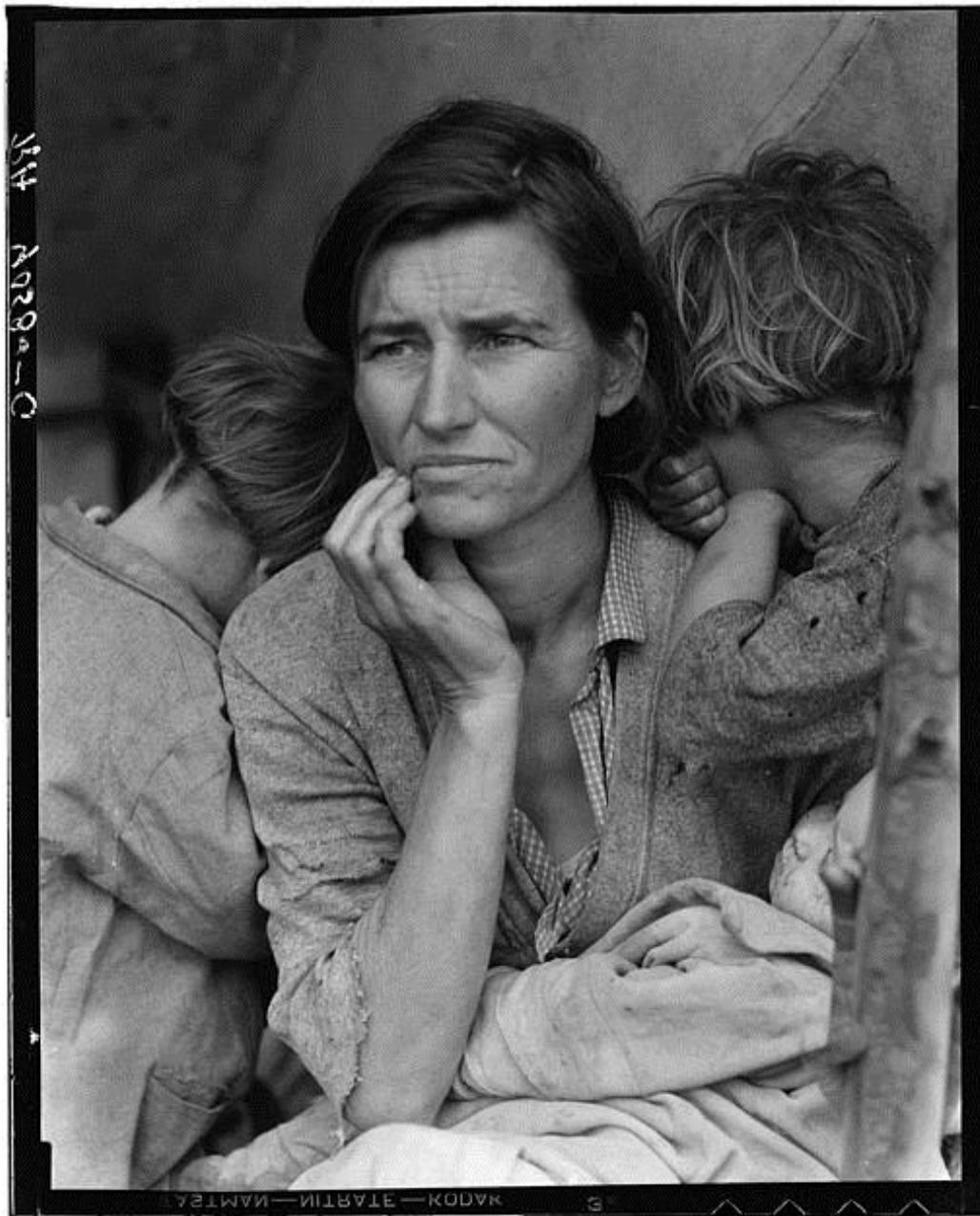NDSA Standards and Practices Co-Chair
Digital Preservation 2014 Lightning Talk

Photo Library of Congress Prints and Photographs Division, http://hdl.loc.gov/loc.pnp/fsa.8b29516

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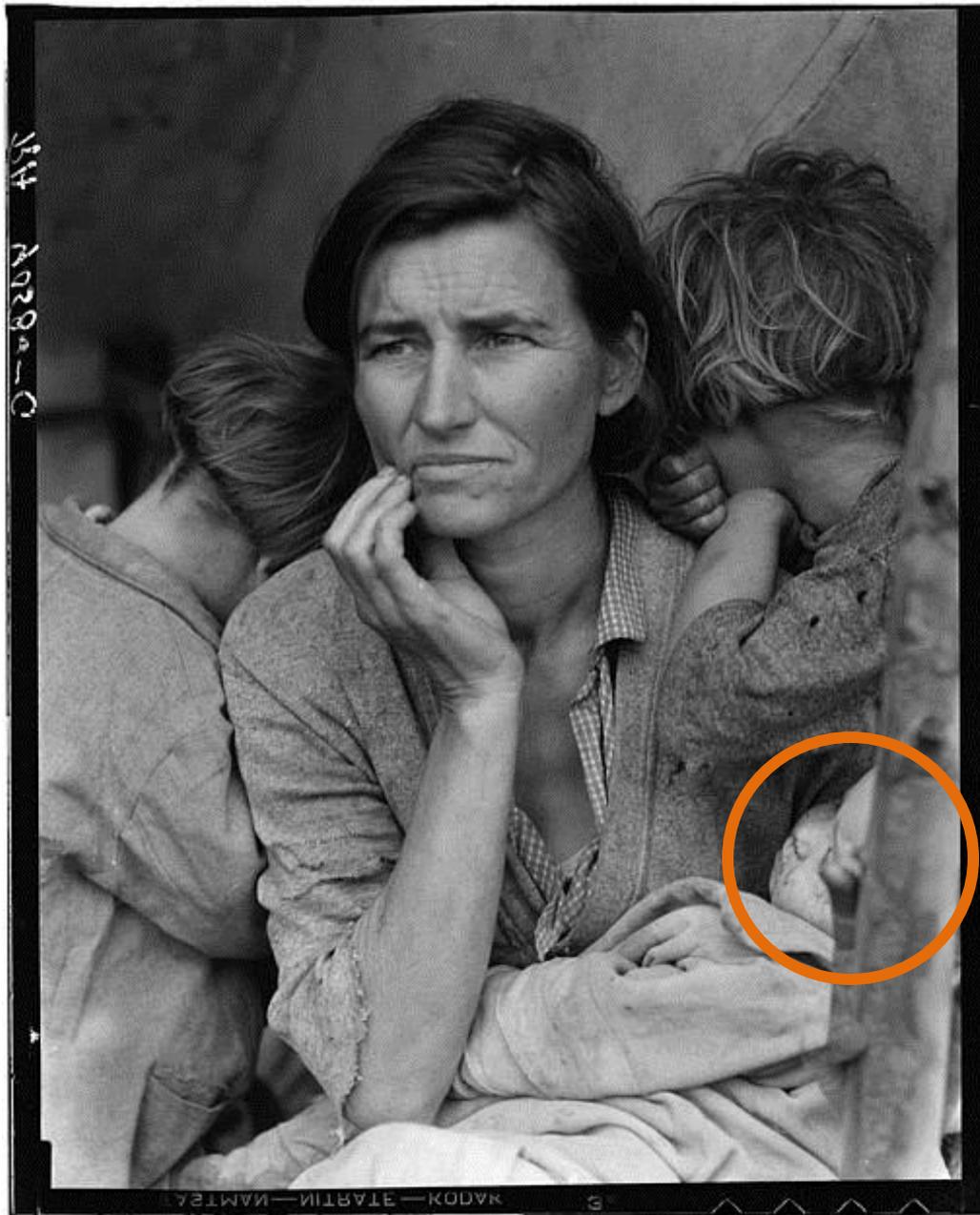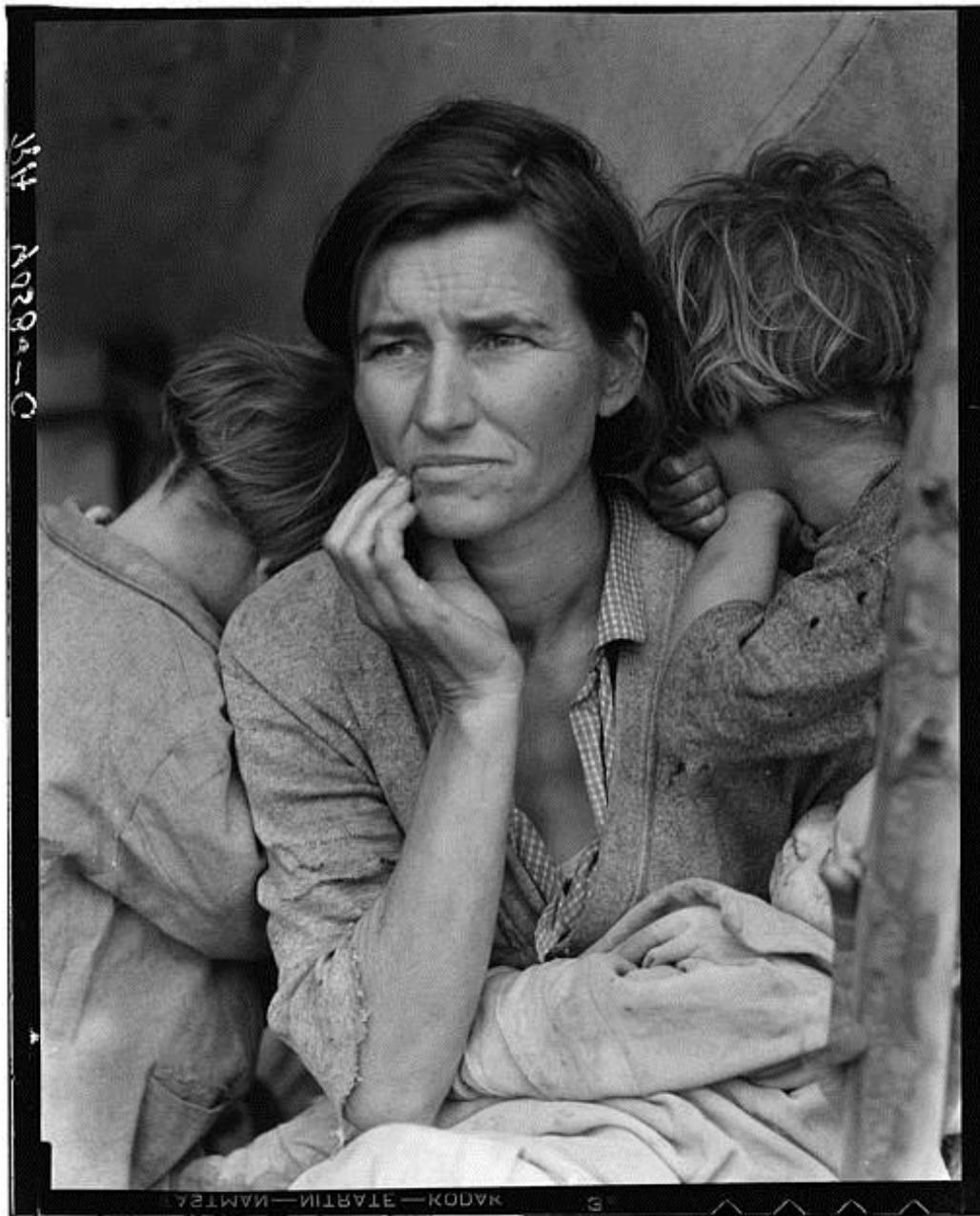
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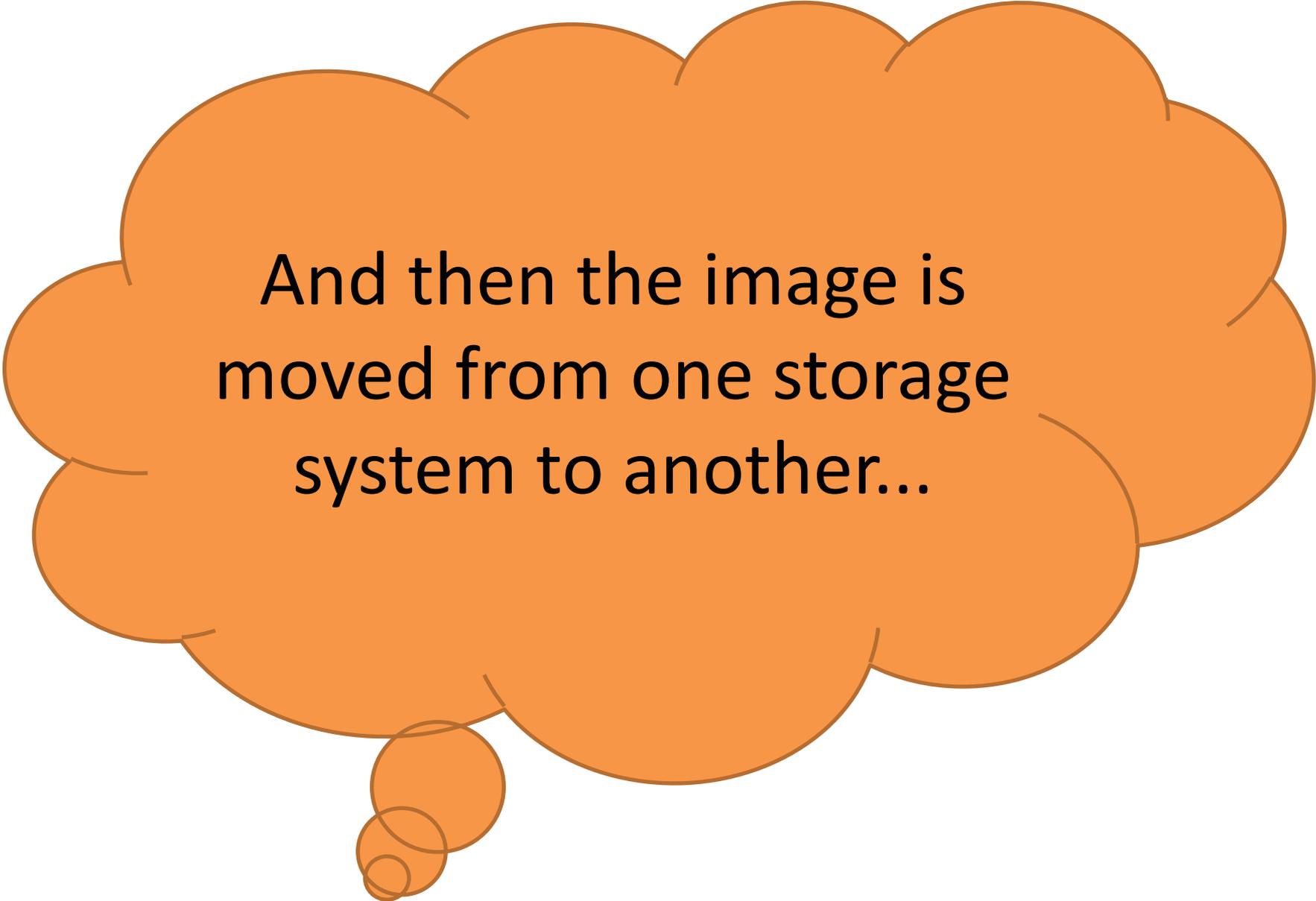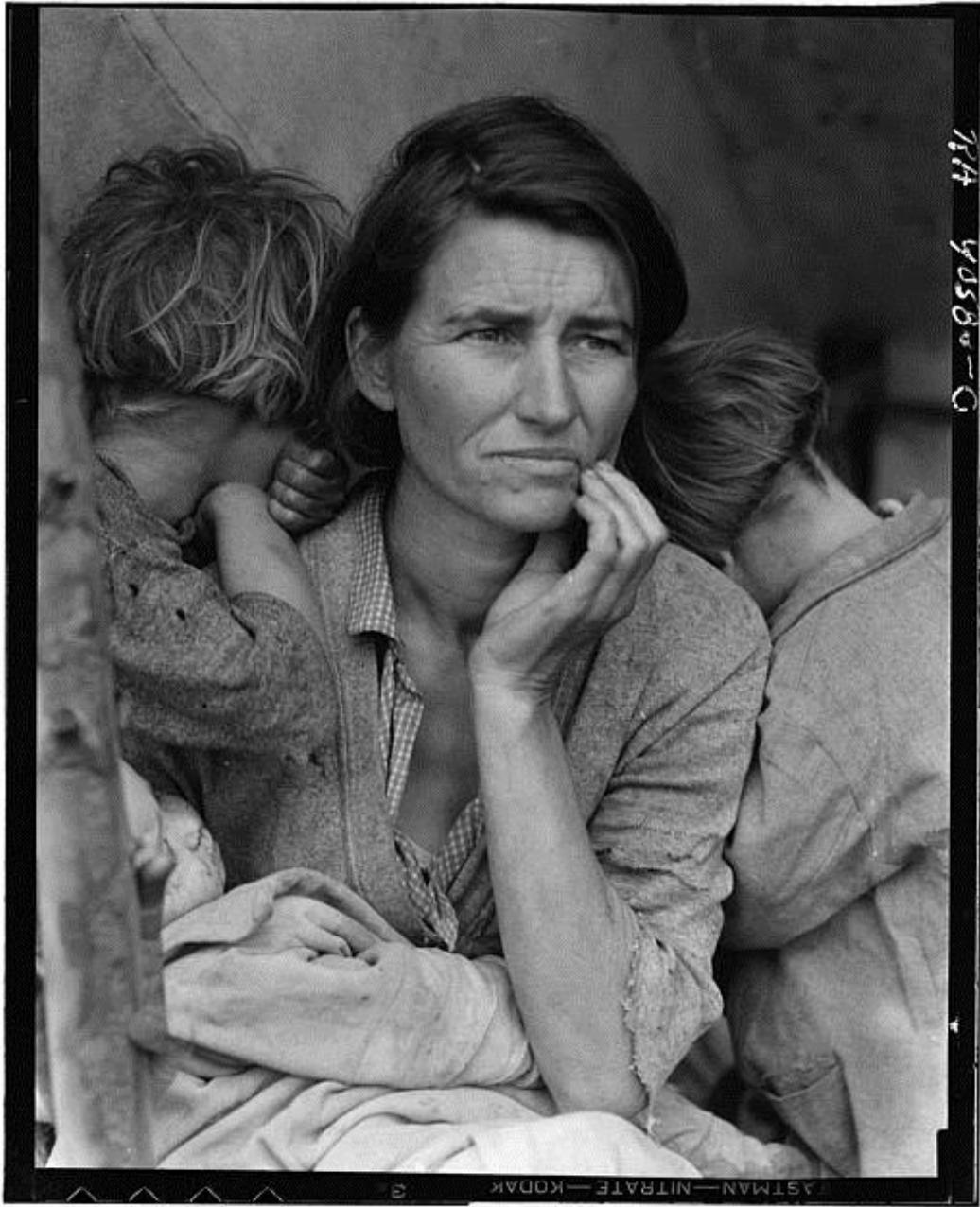
If only it were always that easy to spot a change in your digital objects.

Are These Files the Same?

Image on Old Server

```
FF D8 FF E0 00 10 4A 46    49 46 00 01 01 01 00 48
00 48 00 00 FF ED 3A 24    50 68 6F 74 6F 73 68 6F
70 20 33 2E 30 00 38 42    49 4D 04 25 00 00 00 00
00 10 00 00 00 00 00 00    00 00 00 00 00 00 00 00
00 00 38 42 49 4D 03 ED    00 00 00 00 00 10 07 08
00 00 00 01 00 01 07 08    00 00 00 01 00 01 38 42
49 4D 04 26 00 00 00 00    00 0E 00 00 00 00 00 00
00 00 00 00 3F 80 00 00    38 42 49 4D 04 0D 00 00
00 00 00 04 00 00 00 1E    38 42 49 4D 04 19 00 00
00 00 00 04 00 00 00 1E    38 42 49 4D 03 F3 00 00
00 00 00 09 00 00 00 00    00 00 00 00 01 00 38 42
49 4D 04 0A 00 00 00 00    00 01 00 00 38 42 49 4D
27 10 00 00 00 00 00 0A    00 01 00 00 00 00 00 00
00 01 38 42 49 4D 03 F4    00 00 00 00 00 12 00 35
00 00 00 01 00 2D 00 00    00 06 00 00 00 00 00 01
38 42 49 4D 03 F7 00 00    00 00 00 1C 00 00 FF FF
FF FF FF FF FF FF FF FF    FF FF FF FF FF FF FF FF
```

Image on New Server

```
FF D8 FF E0 00 10 4A 46    49 46 00 01 01 01 07 08
07 08 00 00 FF E1 10 C6    45 78 69 66 00 00 4D 4D
00 2A 00 00 00 08 00 00    00 00 00 0E 00 06 01 03
00 03 00 00 00 01 00 06    00 00 01 1A 00 05 00 00
00 01 00 00 00 5C 01 1B    00 05 00 00 00 01 00 00
00 64 01 28 00 03 00 00    00 01 00 02 00 00 02 01
00 04 00 00 00 01 00 00    00 6C 02 02 00 04 00 00
00 01 00 00 10 51 00 00    00 00 00 00 00 48 00 00
00 01 00 00 00 48 00 00    00 01 FF D8 FF DB 00 43
00 08 06 06 07 06 05 08    07 07 07 09 09 08 0A 0C
14 0D 0C 0B 0B 0C 19 12    13 0F 14 1D 1A 1F 1E 1D
1A 1C 1C 20 24 2E 27 20    22 2C 23 1C 1C 28 37 29
2C 30 31 34 34 34 1F 27    39 3D 38 32 3C 2E 33 34
32 FF DB 00 43 01 09 09    09 0C 0B 0C 18 0D 0D 18
32 21 1C 21 32 32 32 32    32 32 32 32 32 32 32 32
32 32 32 32 32 32 32 32    32 32 32 32 32 32 32 32
32 32 32 32 32 32 32 32    32 32 32 32 32 32 32 32
```

There Must Be An Easier Way

Original Image

```
FF D8 FF E0 00 10 4A 46    49 46 00 01 01 01 00 48
00 48 00 00 FF ED 3A 24    50 68 6F 74 6F 73 68 6F
70 20 33 2E 30 00 38 42    49 4D 04 25 00 00 00 00
00 10 00 00 00 00 00 00    00 00 00 00 00 00 00 00
00 00 38 42 49 4D 03 ED    00 00 00 00 00 10 07 08
00 00 00 01 00 01 07 08    00 00 00 01 00 01 38 42
49 4D 04 26 00 00 00 00    00 0E 00 00 00 00 00 00
00 00 00 00 3F 80 00 00    38 42 49 4D 04 0D 00 00
00 00 00 04 00 00 00 1E    38 42 49 4D 04 19 00 00
00 00 00 04 00 00 00 1E    38 42 49 4D 03 F3 00 00
00 00 00 09 00 00 00 00    00 00 00 00 01 00 38 42
49 4D 04 0A 00 00 00 00    00 01 00 00 38 42 49 4D
27 10 00 00 00 00 00 0A    00 01 00 00 00 00 00 00
00 01 38 42 49 4D 03 F4    00 00 00 00 00 12 00 35
00 00 00 01 00 2D 00 00    00 06 00 00 00 00 00 01
38 42 49 4D 03 F7 00 00    00 00 00 1C 00 00 FF FF
FF FF FF FF FF FF FF FF    FF FF FF FF FF FF FF FF
```

Flipped Image

```
FF D8 FF E0 00 10 4A 46    49 46 00 01 01 01 07 08
07 08 00 00 FF E1 10 C6    45 78 69 66 00 00 4D 4D
00 2A 00 00 00 08 00 00    00 00 00 0E 00 06 01 03
00 03 00 00 00 01 00 06    00 00 01 1A 00 05 00 00
00 01 00 00 00 5C 01 1B    00 05 00 00 00 01 00 00
00 64 01 28 00 03 00 00    00 01 00 02 00 00 02 01
00 04 00 00 00 01 00 00    00 6C 02 02 00 04 00 00
00 01 00 00 10 51 00 00    00 00 00 00 00 48 00 00
00 01 00 00 00 48 00 00    00 01 FF D8 FF DB 00 43
00 08 06 06 07 06 05 08    07 07 07 09 09 08 0A 0C
14 0D 0C 0B 0B 0C 19 12    13 0F 14 1D 1A 1F 1E 1D
1A 1C 1C 20 24 2E 27 20    22 2C 23 1C 1C 28 37 29
2C 30 31 34 34 34 1F 27    39 3D 38 32 3C 2E 33 34
32 FF DB 00 43 01 09 09    09 0C 0B 0C 18 0D 0D 18
32 21 1C 21 32 32 32 32    32 32 32 32 32 32 32 32
32 32 32 32 32 32 32 32    32 32 32 32 32 32 32 32
32 32 32 32 32 32 32 32    32 32 32 32 32 32 32 32
```

*Fixity* is the property of a digital file or object being fixed or unchanged.

Fixity information offers evidence that one set of bits is identical to another.

Fixity information includes checksums, cryptographic hashes and other methods such as expected file size and file count that provide basic fixity information.

Fixity in Action!

Original Image   571D78D3C356B842F098828F1E64045A

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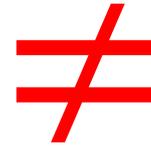
Flipped Image   C4A35727038C6C53C250A62E337DDB6E

These values should be the same if all went well when the file was copied to the new storage system.

The mismatch of the MD5 hash values tell us that the bits within the file on the new storage system are *not identical* to the bits within the file on the previous storage system.

Checking Your Digital Content: What is Fixity and When Should I be Checking It?
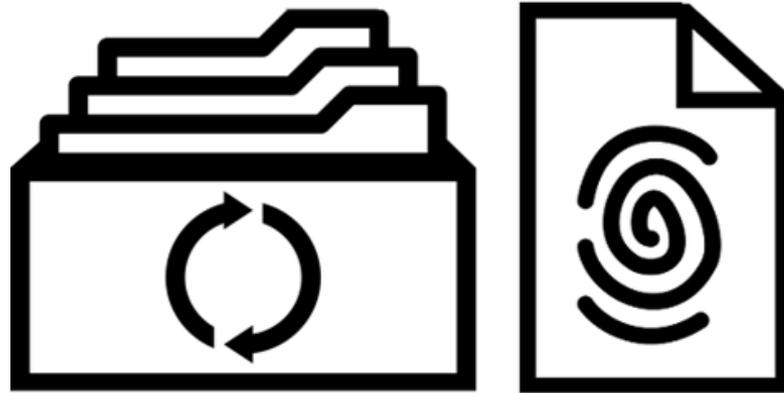
A joint project of the National Digital Stewardship Alliance *Standards and Practices* **and** *Infrastructure* **working groups**

http://blogs.loc.gov/digitalpreservation/2014/02/check-yourself-how-and-when-to-check-fixity/