Introduction to Data and Encoding

Speaker notes

No notes on this slide.

What do you think happens when you open a file?

Speaker notes

No notes on this slide.

How do you think a program/machine identifies a file?

Speaker notes

No notes on this slide.

How do you usually identify a file?

Speaker notes

No notes on this slide.

What is there to identify?

Speaker notes

No notes on this slide.

What is a digital file?

Wikipedia: Filename extension

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Most people identify what a file is, according to its filename - and the filetype according to its suffix after the “.” dot.

If all is well, usually a quick and sane choice, but there’s more…

What kind of files are there?

- documents?
- images?
- …?

Speaker notes

Write down some different types of data/files.

Examples:

- documents
- images
- audio
- video
- savegames
- other “application specific” format (CAD plans, 3D models, etc)

Understanding digital objects

- Bit:
  A single binary digit (0/1)
- Byte:
  A unit: 8 bits (half = Nibble)
- File:
  Stored segment or block of information available to a computer program
- File system:
  A mechanism for controlling and organizing bytes into structure (files/folders) for storage and retrieval
- File Format:
  A standard way that information is encoded in a computer file.

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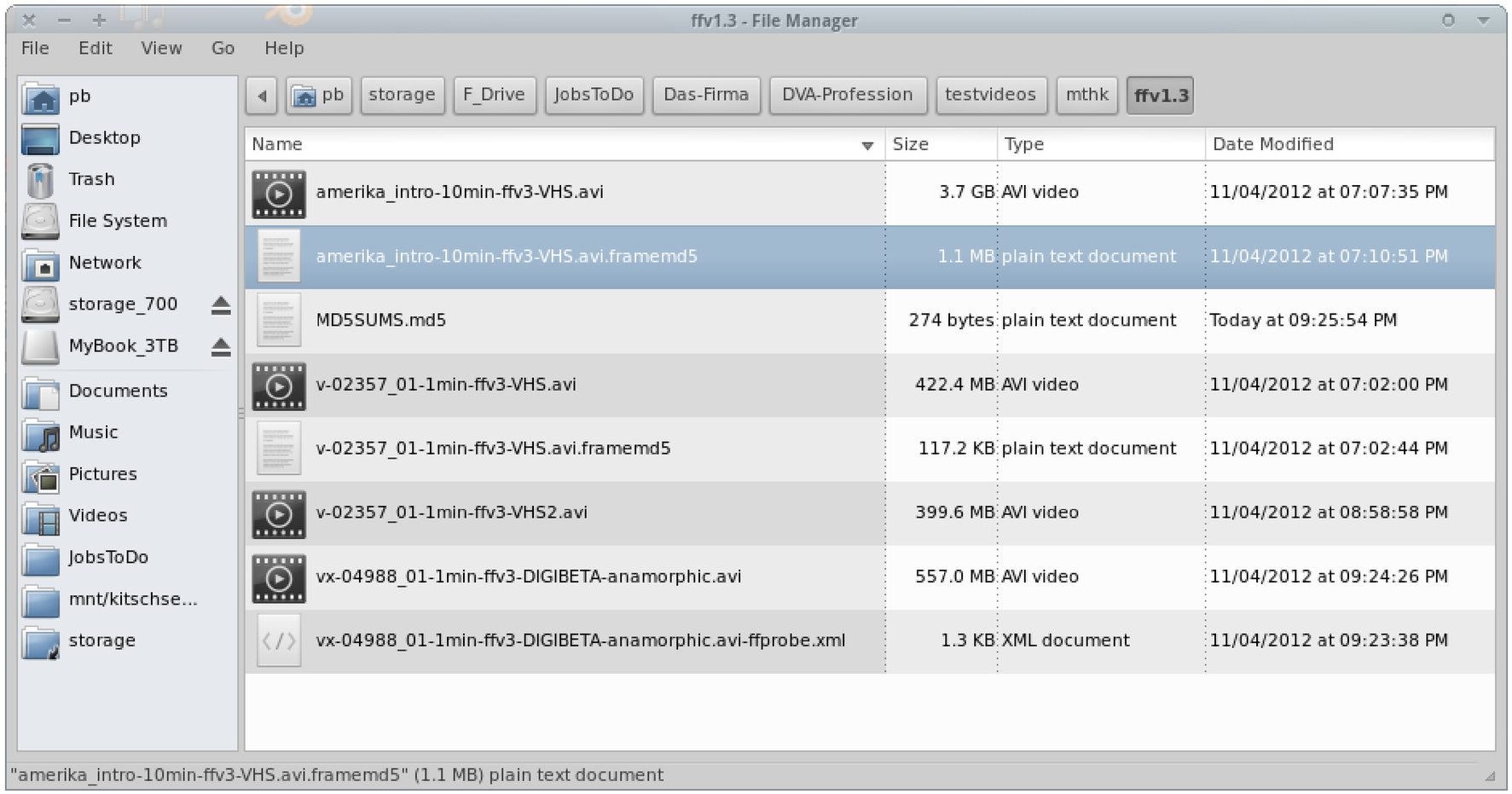
Identifying files



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What can you say about these files?

These file properties (filename, date/time, size, ownership, access rights, flags) can often be used to say something/more about a digital object, therefore it's good to consider preserving this layer of information too.

For example, when documenting the original state of externally acquired collections/objects. More about this in the metadata session…

The Filesystem

- Filename
- Date/time
- Filesize
- File extension
- Path
- Access rights

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Without a filesystem, data on a storage device is just a long string of numbers… No beginning, no end, no structure, no folders, no files. Just bytes!

If your filesystem is broken, you can’t access your data - although the “data” is actually exactly where it was. Untouched. But there’s no “map” to find where to go, and where a file starts or ends.

What is Data?

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No notes on this slide.

The 2 major types of Data

- Text
- Binary

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No notes on this slide.

Everything's a number

ASCII TABLE

https://commons.wikimedia.org/wiki/File:ASCII-Table-wide.svg

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

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Each byte in a file is a number. Depending on the encoding, each number maps to a certain character. This table shows a common character encoding: "ASCII" (American Standard Code for Information Interchange)

This view also shows the hexadecimal (short "hex") value which is more common and better to view data as, than decimal.

Character encoding

- ASCII (7 Bit)
- CP437
- ISO-8859-1
- ISO-8859-7 (Latin & Greek)
- …

See: Character sets, encodings, and Unicode (By Nick Gammon)

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Classic “code pages” work fine for the language/region they are designed for. Mixing characters from different languages is a problem with this approach though!

Mis-interpreting a character by applying the wrong codepage is the reason for encoding errors. For practical and history reasons, the ASCII set is usually mapped compatible across all codepages.

Encoding Interoperability

“Schner Tag. Recht hei. (□)”

`Schöner Tag. Recht heiß. (🙃)`

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□ (WHITE SQUARE, U+25A1): Replaces a missing or unsupported Unicode character. (REPLACEMENT CHARACTER, U+FFFD): Replaces an invalid or unrecognizable character. Indicates a Unicode error.

Unicode

> *“Unicode is a computing industry standard for the consistent encoding, representation, and handling of text expressed in most of the world’s writing systems.”*
>
> _ *Wikipedia: Unicode*

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Mixing languages

Лорем ипсум долор сит амет
側経意責家方家閉討店暖育田庁載社
पढाए हिंदी रहारुप अनुवाद कार्यलय
국민경제의 발전을 위한 중요정책의
旅口京青利セムレ弱改フヨス
غينيا واستمر العصبة ضرب قد. وباءت

See: UTF-8 encoding table

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No notes on this slide.

Unicode Symbols

- U+1F973
- U+262F ☯
- U+1F643 🙃
- U+1F9A0

See: Emoji List, Emojipedia

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Interesting fun-fact: The emoji now used to represent the Corona Virus, was proposed as “Microbe”. See Science Emoji Proposal for Unicode v2 (Date: April 18, 2017).

Comments?

Questions?

Speaker notes

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