0x0A, 0x0D

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Exploring End-Of-Line Characters in Computer Systems.

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Introduction

After years of frustration with Line Feed and Carriage Return, I have decided it's time we all took a long hard look at what they really mean, how we use them and how we misuse them.

Ever since the time of early mechanical typewriters we have had to advance paper to a new line and return the carriage to the start of that line. Computers were invented, first with teleprinters, and then VDU text displays. The physical carriage and platen roller were replaced by character displays, but the old terminology lingered.

My Misadventures

As an undergraduate student in the early 1990s, my college project was translating word processor protocols. The project was a long time ago and lost to history.

The project resulted in a piece of code that could open documents from any word processor, find the control codes used for headers, page breaks, form feeds, and new lines among others.

There were a handful of wordprocessors at the time; and the embedded data was minimal, basically proofreader's marks coded into the text. It was a compiler writing project, with a hefty amount of reverse engineering up front.

This project was where I first really became acutely aware of end of line characters and their close cousins of non-breaking spaces and form feeds.

My first few years in industry, in the early 90s, were a fun time. I had three different computers on my desk:

- Windows PC (386)
  - Windows 3.1
- Macintosh Quadra
  - System 7
- Acorn A5000

- RiscOS

Would you believe that all three systems had different ideas on how to create an end of line token? Exchanging files between them was quite painful.

Over the years, I have seen many situations where terminal programs help and hinder by manipulating end-of-line characters on both transmission and reception. I have sent part messages, because I wanted a paragraph break but the chat tool implemented enter as “send”. In other mail clients, I have had messages sit in a transmit buffer becuase I hit enter, expeting a send, only to find later I had started a new paragraph.

I’m not the only one. For all of you who have been confounded by end-of-line mix-ups, this book is for you.

Anatomy of a Typewriter

We all have a rough idea of what a typewriter looks like. In TV shows and movies we see authors and newspaper reporters typing at a furious rate, and we see detectives and inept businessmen pecking at their keyboard with just their index fingers.

So what are we looking at?

Paper insertion; you drop a sheet of paper in the top, and turn a knob on the side. That knob is at the end of the cylinder or roller.

The roller is more properly known as the platen. This is a term held over from printing presses. It's the surface that supports the medium to be printed on.

The platen is advanced for a new line of text. Mechanical typewriters use a lever attached to a ratchet to roll the platen a predetermined amount. Sometimes there is a control for how far the platen rotates, typically allowing one, one and a half or two line feeding. Electric and electronic typewriters use a motor or solenoid to do this.

That addresses what line we are on. Now which character are we typing?

Mechanical typewriters of the early 20th century had a spring loaded carriage that held the platen. As you type, the carriage is allowed to move leftward one character width at a time. Like in a clock, this controlled release mechanism is called the escapement.

Key presses were not the only way to advance the carriage, you also have tab keys (for tabulated format). Pressing the tab key allowed a free flow of the carriage until a moveable mechanical detent, a tab stop, was hit. How many tab stops varied from machine to machine, but typically you would have two as a minimum. These were used to set up your margins and maybe indents for tabulation.

There was a special tab for end stop. Several characters before an end stop, you would hear a bell. This warned you that you only had a few space left, and you would either complete the word, or drop a hyphen in after the current syllable, continuing the word on the next line.

Hyphenation seems to be a lost art, with the advent of auto wrapping text. It used to be an option in wordprocessors. Maybe it still is and I just live in a world of web editors and ragged right margins.

When you reached the end of your line you would advance the platen and return the carriage to its home position.

A few more terms for you. The actual printing element, the metal form of the character that stamps the ink onto the paper is known as a type slug, it's at the end of a typebar, one typebar per character key. All the typebars together with their control make up the typebasket. I'm telling you this so I can talk about typebaskets in the next paragraph.

Electric and electronic typewriters changed things up a bit. Instead of a fixed typebasket and a moving carriage, the platen was fixed relative to the width of the typewriter, and the typebasket moved.

Actually, it's not a moving type basket. There were two major forms of electric typewriter.

- Daisy wheel
- Golf ball

The typebars could be arranged in a circle in what is known as a daisy wheel. The actual wheel is interchangeable, allowing different typefaces to be used. The wheel is rotated until the correct character is aligned with the paper, then the character is typed. There is a delay between keypress and the actual impression being made.

With a golf ball typewriter, instead of a flat disc, a dome was used. Again, electro-mechanical control moved the ball across the paper and selected the character to strike.

With both of these, the mechanism was flipped so that it was the print head, not the medium that was moving. Even though the carriage was not returned mechanically, it was logically equivalent. The term carriage return persists to mean returning to the start of the line.

Let's recap that vocabulary

- carriage: The upper moveable portion of a mechanical typewriter comprised of

- platen: roller supporting the paper
- line space lever: lever to ratchet platen to next line
- line space control: adjuster to control how many detents platen is ratcheted.

And how did we start a new line? In practice, you push the line space lever in one long continuous action. The lever would rotate right under pressure, advancing the line. Once the limit of that rotation was met, the carriage would start moving. The line advance was a lightweight motion, moving the carriage was a heavier action as you were pushing against the main spring that moved the carriage while typing.

The natural order was

1. line feed
2. carriage return.

You could do a double line feed, or a line feed without a carriage return.

You can return the carriage without using the line space lever. Usually this was done by pushing on the platen knob, but you could push anywhere on the carriage.

Since both were frequently done “simultaneously”, that is, in a single long sweep of the typist hand, they are often considered a single action. It was the action to get a new-line.

References

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Telegraphy

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Notes to incorporate in text

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Enter or Return?

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Return

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Enter

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Context is Key

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Small text fields

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Text Edit Panes

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Chat Sessions

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Spreadsheets

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Notes

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New Line Versus Paragraph

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Appendices

A Few Words About Leanpub

At this time, I'm not going to make any secret of the fact that I am learning to write within LeanPub.

You would think Markdown is Markdown. There are dialects. The differences between Markua used here, the GFM (GitHub Flavored Markdown)and Pandoc's Markdown are subtle, all deviating from CommonMark.

How do I use them?

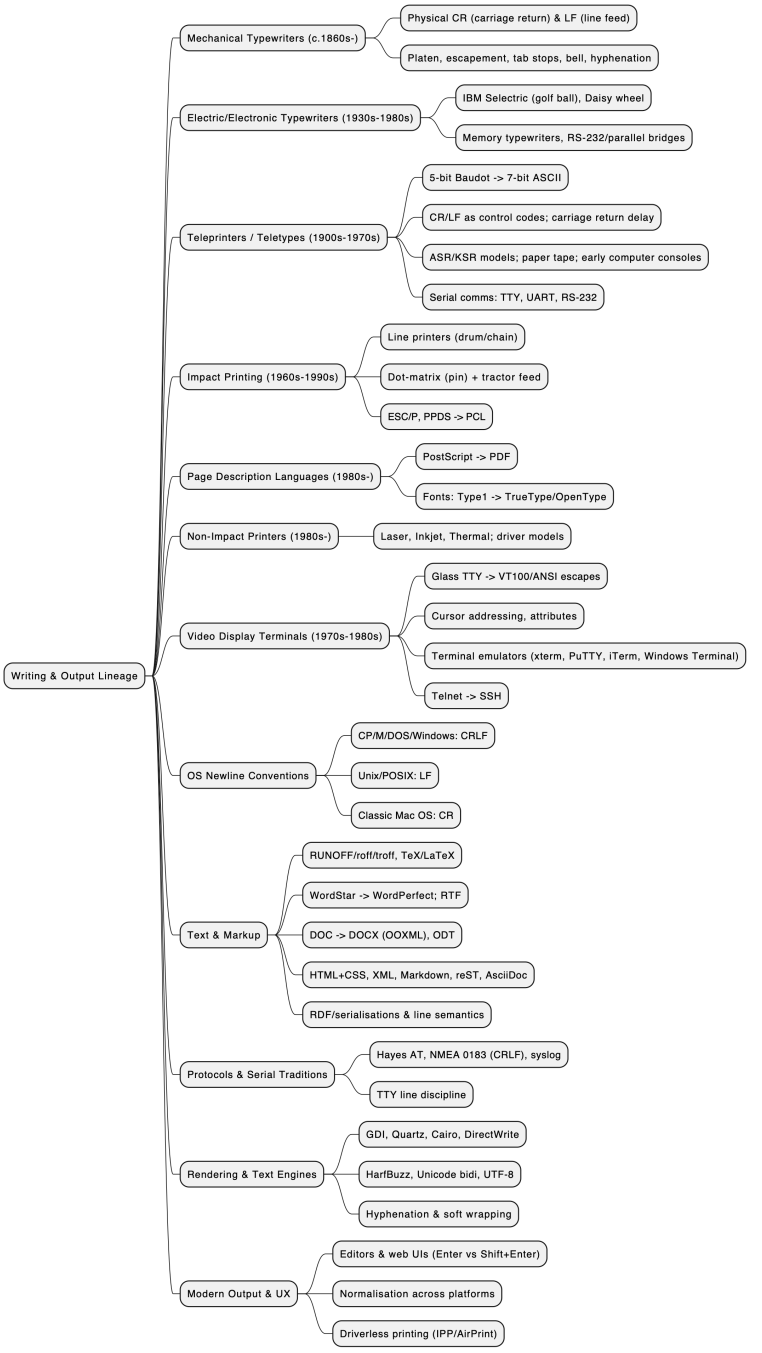
- Markua: For writing this book. It brings value added featuers exclusive to Leanpub.
- GFM: For documenting my code repositories, as it renders natively in GitHubs web portal.
- Pandoc's Markdown: Other book projects I created in .md files with LaTeX and HTML where plain Markdown just wasn't enough.

Leanpub is about agile publishing, "publish early, publish often". I am trying out that philosophy. It will be interesting to see how that goes, instead of a more traditional publishing process.

Shameless Plugs

For more of my content, take a look at my blog

- space and non-breaking spaces
- form feed, page break
- paragraph break
- html, markdown, rtf


Writing & Output Lineage
Mechanical Typewriters (c.1860s-)
Physical CR (carriage return) & LF (line feed)
Platen, escapement, tab stops, bell, hyphenation
Electric/Electronic Typewriters (1930s-1980s)
IBM Selectric (golf ball), Daisy wheel
Memory typewriters, RS-232/parallel bridges
Teleprinters / Teletypes (1900s-1970s)
5-bit Baudot -> 7-bit ASCII
CR/LF as control codes; carriage return delay
ASR/KSR models; paper tape; early computer consoles
Serial comms: TTY, UART, RS-232
Impact Printing (1960s-1990s)
Line printers (drum/chain)
Dot-matrix (pin) + tractor feed
ESC/P, PPDS -> PCL
Page Description Languages (1980s-)
PostScript -> PDF
Fonts: Type1 -> TrueType/OpenType
Non-Impact Printers (1980s-)
Laser, Inkjet, Thermal; driver models
Video Display Terminals (1970s-1980s)
Glass TTY -> VT100/ANSI escapes
Cursor addressing, attributes
Terminal emulators (xterm, PuTTY, iTerm, Windows Terminal)
Telnet -> SSH
OS Newline Conventions
CP/M/DOS/Windows: CRLF
Unix/POSIX: LF
Classic Mac OS: CR
Text & Markup
RUNOFF/roff/troff, TeX/LaTeX
WordStar -> WordPerfect; RTF
DOC -> DOCX (OOXML), ODT
HTML+CSS, XML, Markdown, reST, AsciiDoc
RDF/serialisations & line semantics
Protocols & Serial Traditions
Hayes AT, NMEA 0183 (CRLF), syslog
TTY line discipline
Rendering & Text Engines
GDI, Quartz, Cairo, DirectWrite
HarfBuzz, Unicode bidi, UTF-8
Hyphenation & soft wrapping
Modern Output & UX
Editors & web UIs (Enter vs Shift+Enter)
Normalisation across platforms
Driverless printing (IPP/AirPrint)