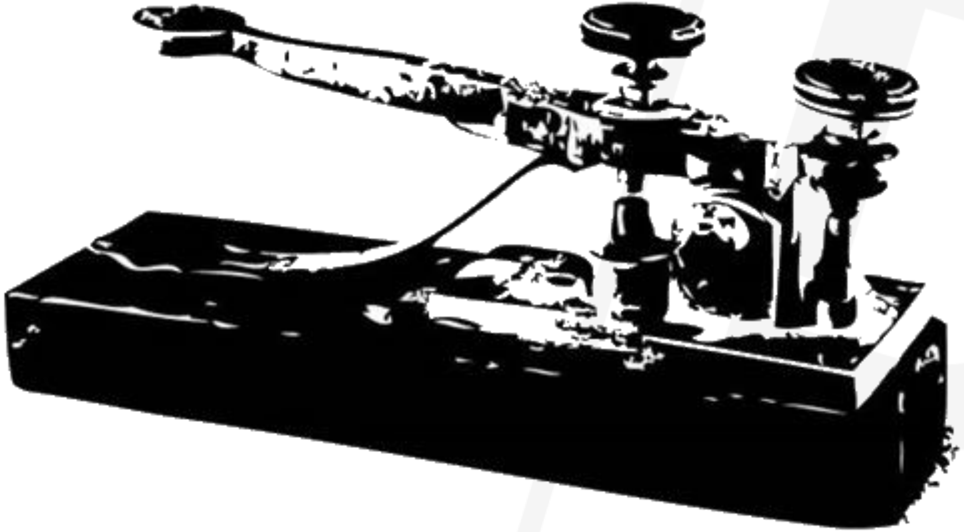
# DataFlex NextGen

Presenter: Harm Wibier

SYNERGY 2019

CRUISING TO NEW HORIZONS



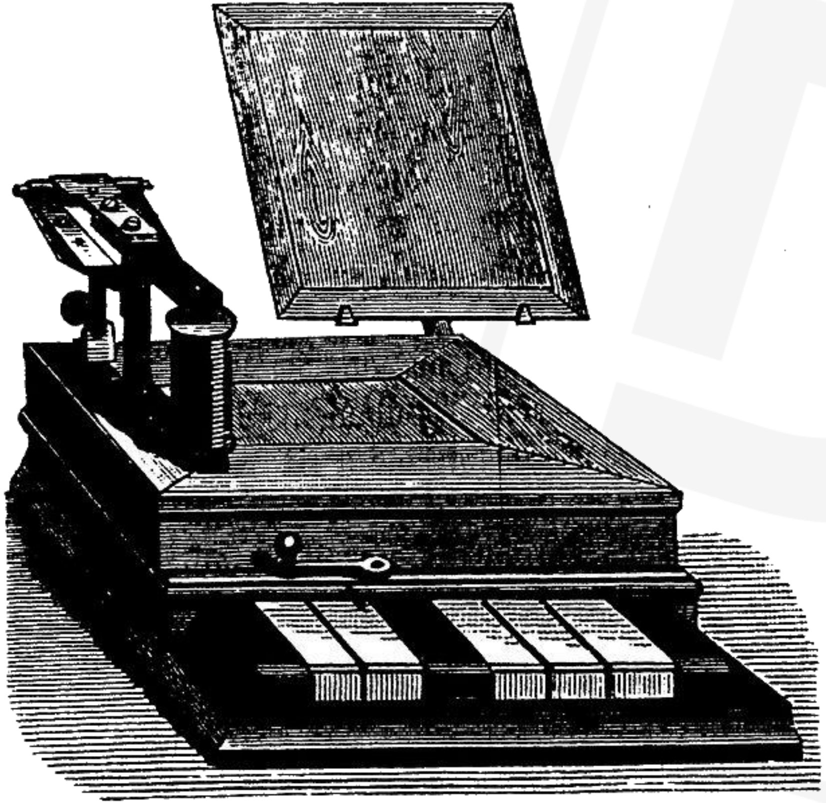
·—— ···· ·— —   ···· ·— — ····

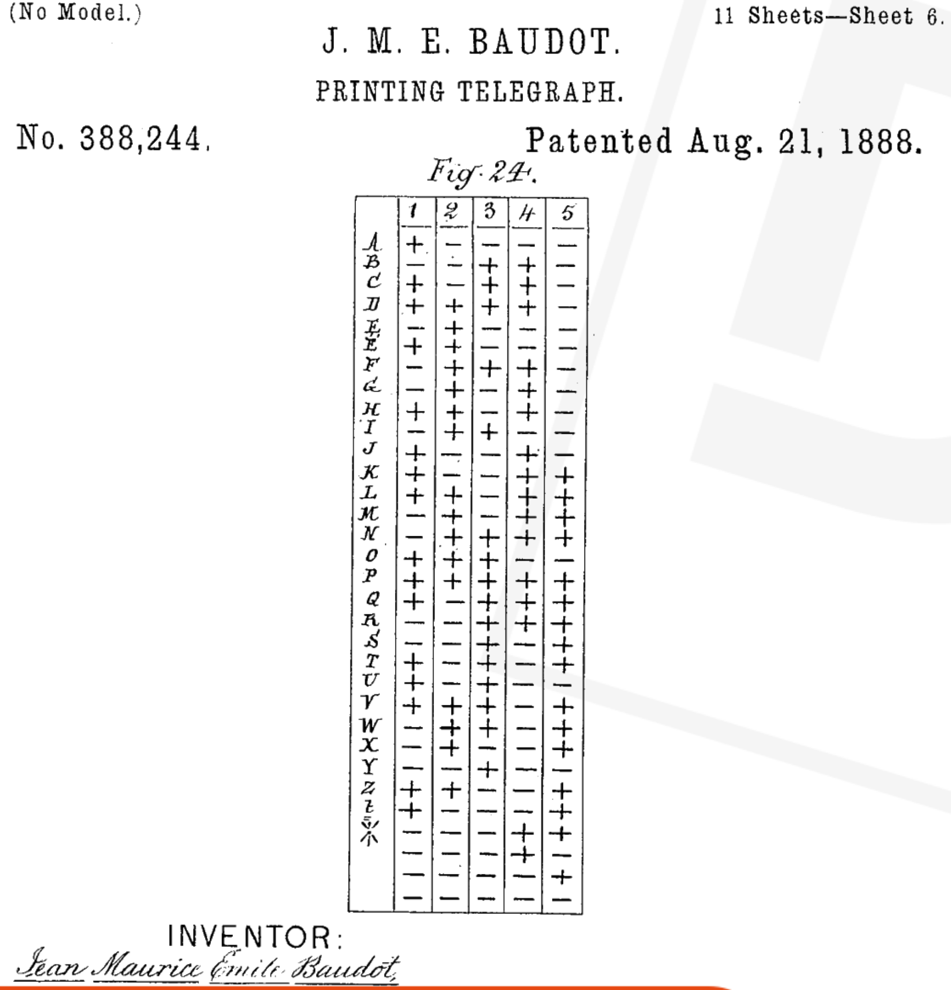
W H A T   H A T H

——· · · —··   ·—— · ·· · · ··— ——· ···· —

G O D   W R O U G H T

**SYNERGY 2019** CRUISING TO NEW HORIZONS





(No Model.) 11 Sheets—Sheet 6.

J. M. E. BAUDOT.

PRINTING TELEGRAPH.

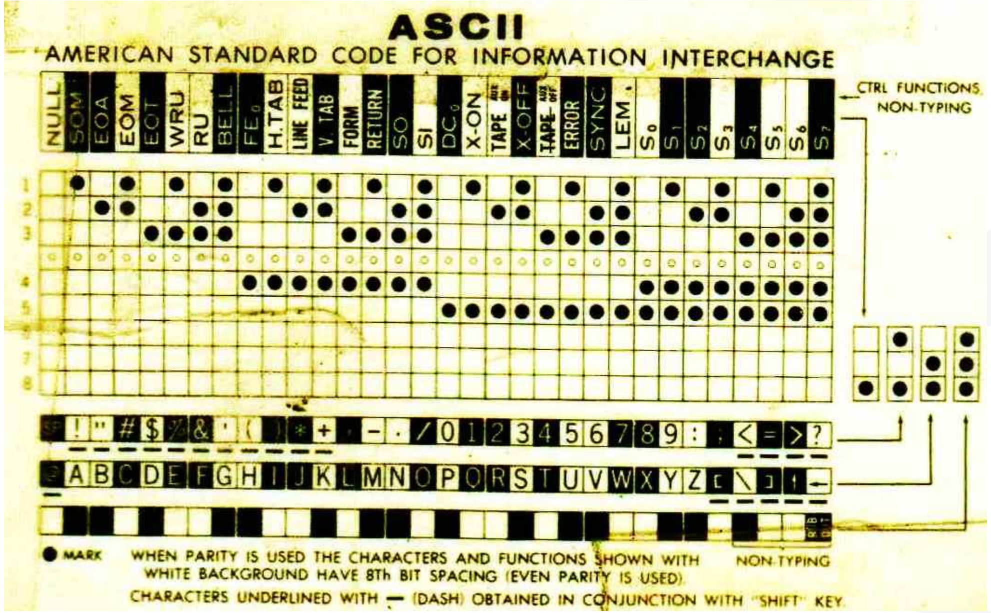
No. 388,244. Patented Aug. 21, 1888.

Fig. 24.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| A | + | − | − | − | − |
| B | − | − | + | + | − |
| C | + | − | + | + | − |
| D | + | + | + | + | − |
| E | − | + | − | − | − |
| É | + | + | − | − | − |
| F | − | + | + | + | − |
| G | − | + | − | + | − |
| H | + | + | − | + | − |
| I | − | + | + | − | − |
| J | + | − | − | + | − |
| K | + | − | − | + | + |
| L | + | + | − | + | + |
| M | − | + | − | + | + |
| N | − | + | + | + | + |
| O | + | + | + | − | − |
| P | + | + | + | + | + |
| Q | + | − | + | + | + |
| R | − | − | + | + | + |
| S | − | − | + | − | + |
| T | + | − | + | − | + |
| U | + | − | + | − | − |
| V | + | + | + | − | + |
| W | − | + | + | − | + |
| X | − | + | − | − | + |
| Y | − | − | + | − | − |
| Z | + | + | − | − | + |
| t | + | − | − | − | + |
| * | − | − | − | + | + |
| | − | − | − | + | − |
| | − | − | − | − | + |
| | − | − | − | − | − |

INVENTOR:

Jean Maurice Emile Baudot



# ASCII

## AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE

CTRL FUNCTIONS
NON-TYPING

| | NULL | SOM | EOA | EOM | EOT | WRU | RU | BELL | FE$_0$ | H.TAB | LINE FEED | V. TAB | FORM | RETURN | SO | SI | DC$_0$ | X-ON | TAPE AUX ON | X-OFF | TAPE AUX OFF | ERROR | SYNC | LEM | $S_0$ | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | $S_7$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● | | ● |
| 2 | | | ● | ● | | | ● | ● | | | ● | ● | | | ● | ● | | | ● | ● | | | ● | ● | | | ● | ● | | | ● | ● |
| 3 | | | | | ● | ● | ● | ● | | | | | ● | ● | ● | ● | | | | | ● | ● | ● | ● | | | | | ● | ● | ● | ● |
| | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 4 | | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● |
| 5 | | | | | | | | | | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| | ● | | ● |
| | | ● | ● |
| ● | ● | ● | ● |

SP ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?

@ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ↑ ←

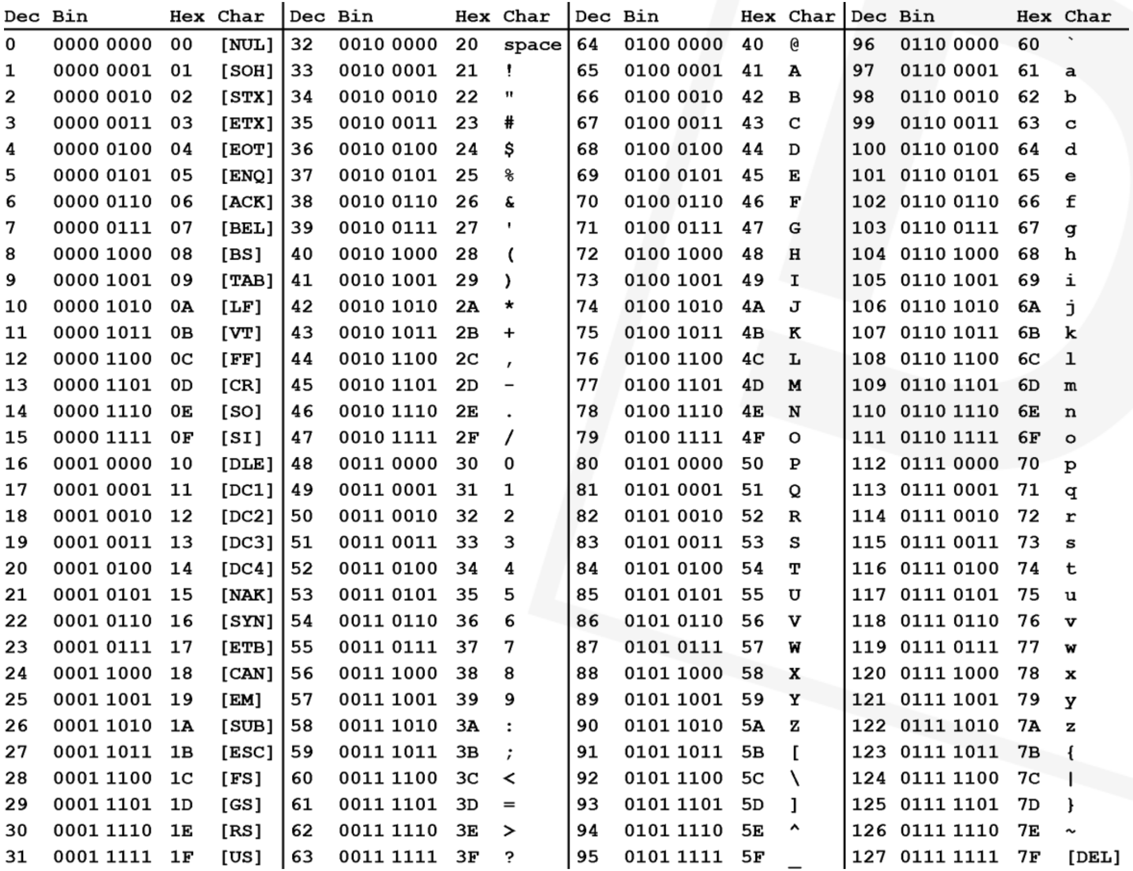
RUB OUT

● MARK

WHEN PARITY IS USED THE CHARACTERS AND FUNCTIONS SHOWN WITH WHITE BACKGROUND HAVE 8Th BIT SPACING (EVEN PARITY IS USED).

NON-TYPING

CHARACTERS UNDERLINED WITH — (DASH) OBTAINED IN CONJUNCTION WITH "SHIFT" KEY.



| Dec | Bin | Hex | Char | Dec | Bin | Hex | Char | Dec | Bin | Hex | Char | Dec | Bin | Hex | Char |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0000 0000 | 00 | [NUL] | 32 | 0010 0000 | 20 | space | 64 | 0100 0000 | 40 | @ | 96 | 0110 0000 | 60 | ` |
| 1 | 0000 0001 | 01 | [SOH] | 33 | 0010 0001 | 21 | ! | 65 | 0100 0001 | 41 | A | 97 | 0110 0001 | 61 | a |
| 2 | 0000 0010 | 02 | [STX] | 34 | 0010 0010 | 22 | " | 66 | 0100 0010 | 42 | B | 98 | 0110 0010 | 62 | b |
| 3 | 0000 0011 | 03 | [ETX] | 35 | 0010 0011 | 23 | # | 67 | 0100 0011 | 43 | C | 99 | 0110 0011 | 63 | c |
| 4 | 0000 0100 | 04 | [EOT] | 36 | 0010 0100 | 24 | $ | 68 | 0100 0100 | 44 | D | 100 | 0110 0100 | 64 | d |
| 5 | 0000 0101 | 05 | [ENQ] | 37 | 0010 0101 | 25 | % | 69 | 0100 0101 | 45 | E | 101 | 0110 0101 | 65 | e |
| 6 | 0000 0110 | 06 | [ACK] | 38 | 0010 0110 | 26 | & | 70 | 0100 0110 | 46 | F | 102 | 0110 0110 | 66 | f |
| 7 | 0000 0111 | 07 | [BEL] | 39 | 0010 0111 | 27 | ' | 71 | 0100 0111 | 47 | G | 103 | 0110 0111 | 67 | g |
| 8 | 0000 1000 | 08 | [BS] | 40 | 0010 1000 | 28 | ( | 72 | 0100 1000 | 48 | H | 104 | 0110 1000 | 68 | h |
| 9 | 0000 1001 | 09 | [TAB] | 41 | 0010 1001 | 29 | ) | 73 | 0100 1001 | 49 | I | 105 | 0110 1001 | 69 | i |
| 10 | 0000 1010 | 0A | [LF] | 42 | 0010 1010 | 2A | * | 74 | 0100 1010 | 4A | J | 106 | 0110 1010 | 6A | j |
| 11 | 0000 1011 | 0B | [VT] | 43 | 0010 1011 | 2B | + | 75 | 0100 1011 | 4B | K | 107 | 0110 1011 | 6B | k |
| 12 | 0000 1100 | 0C | [FF] | 44 | 0010 1100 | 2C | , | 76 | 0100 1100 | 4C | L | 108 | 0110 1100 | 6C | l |
| 13 | 0000 1101 | 0D | [CR] | 45 | 0010 1101 | 2D | - | 77 | 0100 1101 | 4D | M | 109 | 0110 1101 | 6D | m |
| 14 | 0000 1110 | 0E | [SO] | 46 | 0010 1110 | 2E | . | 78 | 0100 1110 | 4E | N | 110 | 0110 1110 | 6E | n |
| 15 | 0000 1111 | 0F | [SI] | 47 | 0010 1111 | 2F | / | 79 | 0100 1111 | 4F | O | 111 | 0110 1111 | 6F | o |
| 16 | 0001 0000 | 10 | [DLE] | 48 | 0011 0000 | 30 | 0 | 80 | 0101 0000 | 50 | P | 112 | 0111 0000 | 70 | p |
| 17 | 0001 0001 | 11 | [DC1] | 49 | 0011 0001 | 31 | 1 | 81 | 0101 0001 | 51 | Q | 113 | 0111 0001 | 71 | q |
| 18 | 0001 0010 | 12 | [DC2] | 50 | 0011 0010 | 32 | 2 | 82 | 0101 0010 | 52 | R | 114 | 0111 0010 | 72 | r |
| 19 | 0001 0011 | 13 | [DC3] | 51 | 0011 0011 | 33 | 3 | 83 | 0101 0011 | 53 | S | 115 | 0111 0011 | 73 | s |
| 20 | 0001 0100 | 14 | [DC4] | 52 | 0011 0100 | 34 | 4 | 84 | 0101 0100 | 54 | T | 116 | 0111 0100 | 74 | t |
| 21 | 0001 0101 | 15 | [NAK] | 53 | 0011 0101 | 35 | 5 | 85 | 0101 0101 | 55 | U | 117 | 0111 0101 | 75 | u |
| 22 | 0001 0110 | 16 | [SYN] | 54 | 0011 0110 | 36 | 6 | 86 | 0101 0110 | 56 | V | 118 | 0111 0110 | 76 | v |
| 23 | 0001 0111 | 17 | [ETB] | 55 | 0011 0111 | 37 | 7 | 87 | 0101 0111 | 57 | W | 119 | 0111 0111 | 77 | w |
| 24 | 0001 1000 | 18 | [CAN] | 56 | 0011 1000 | 38 | 8 | 88 | 0101 1000 | 58 | X | 120 | 0111 1000 | 78 | x |
| 25 | 0001 1001 | 19 | [EM] | 57 | 0011 1001 | 39 | 9 | 89 | 0101 1001 | 59 | Y | 121 | 0111 1001 | 79 | y |
| 26 | 0001 1010 | 1A | [SUB] | 58 | 0011 1010 | 3A | : | 90 | 0101 1010 | 5A | Z | 122 | 0111 1010 | 7A | z |
| 27 | 0001 1011 | 1B | [ESC] | 59 | 0011 1011 | 3B | ; | 91 | 0101 1011 | 5B | [ | 123 | 0111 1011 | 7B | { |
| 28 | 0001 1100 | 1C | [FS] | 60 | 0011 1100 | 3C | < | 92 | 0101 1100 | 5C | \ | 124 | 0111 1100 | 7C | \| |
| 29 | 0001 1101 | 1D | [GS] | 61 | 0011 1101 | 3D | = | 93 | 0101 1101 | 5D | ] | 125 | 0111 1101 | 7D | } |
| 30 | 0001 1110 | 1E | [RS] | 62 | 0011 1110 | 3E | > | 94 | 0101 1110 | 5E | ^ | 126 | 0111 1110 | 7E | ~ |
| 31 | 0001 1111 | 1F | [US] | 63 | 0011 1111 | 3F | ? | 95 | 0101 1111 | 5F | _ | 127 | 0111 1111 | 7F | [DEL] |

# ASCII

- First created in 1963
  - American Standards Institute
    - (in reality IBM and AT&T)
  - The ASCII-67 version is the one that stuck
    - First one with lowercase characters
- 7 bits per character
  - 128 characters

# Codepages

- Started around 1985
  - Used the 8th bit
  - Codepages for different languages
  - 128 characters match ASCII
  - OEM (IBM PC / DOS)
  - ANSI (Windows)
    - ISO-8859-*

# Unicode

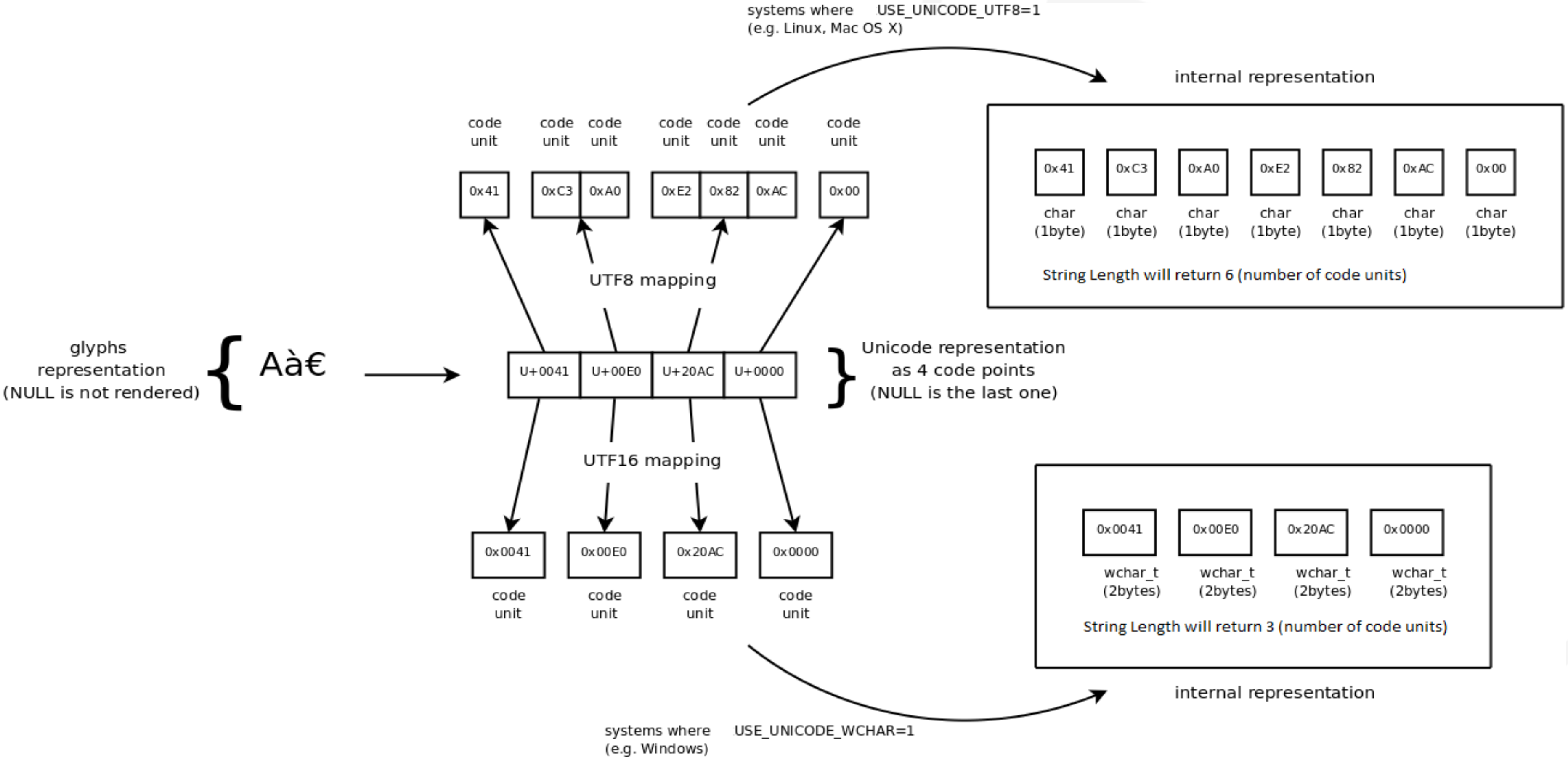
- Unicode Consortium started in 1991
  - Unicode 1.0
    - 16-bit (UCS-2)
  - Unicode 2.0
    - 21-bit (UTF-8, UTF-16, UTF-32)
    - UTF-8 & UTF16 are variable length encodings

# Unicode makes things easier?

- Different encodings
  - UCS-2
  - UTF-8
  - UTF-16
  - UTF-16BE
  - UTF-32

- Characters have different sizes in memory
  - Also with UTF-16, even with UTF-32
  - Exception is UCS-2 which is antiquated technology
  - Complicates string functions

- Unicode is pretty much just the set of characters



glyphs representation (NULL is not rendered) { Aà€

U+0041 | U+00E0 | U+20AC | U+0000

} Unicode representation as 4 code points (NULL is the last one)

UTF8 mapping

code unit 0x41 | code unit 0xC3 | code unit 0xA0 | code unit 0xE2 | code unit 0x82 | code unit 0xAC | code unit 0x00

systems where USE_UNICODE_UTF8=1
(e.g. Linux, Mac OS X)

internal representation

| 0x41 | 0xC3 | 0xA0 | 0xE2 | 0x82 | 0xAC | 0x00 |
|---|---|---|---|---|---|---|
| char<br>(1byte) | char<br>(1byte) | char<br>(1byte) | char<br>(1byte) | char<br>(1byte) | char<br>(1byte) | char<br>(1byte) |

String Length will return 6 (number of code units)

UTF16 mapping

0x0041 code unit | 0x00E0 code unit | 0x20AC code unit | 0x0000 code unit

systems where USE_UNICODE_WCHAR=1
(e.g. Windows)

internal representation

| 0x0041 | 0x00E0 | 0x20AC | 0x0000 |
|---|---|---|---|
| wchar_t<br>(2bytes) | wchar_t<br>(2bytes) | wchar_t<br>(2bytes) | wchar_t<br>(2bytes) |

String Length will return 3 (number of code units)

# Windows

- Started with ANSI (8-bit)
    - Support for OEM codepages
- Moved to UCS-2 (16-bit)
    - New widestring API’s (or double byte)
- Moved to UTF-16 (16-bit or more)
    - Changed their double byte API’s

# DataFlex today

- Strings in DataFlex are OEM
  - We never changed to ANSI
- Conversions are done for most Window API calls
- DataFlex uses the single byte Windows API's

# Project NextGen

# Codename: NextGen

- Work started 2,5 years ago
  - Planning started way before that
- Dedicated resources were hired for the project
- Goal is to make DataFlex:
  - **Fully Unicode**
  - **64-bit capable**

# DataFlex strings will be UTF-8

- Why?
  - UTF-8 provides backwards compatibility
    - First 128 characters match ASCII
  - The web is already UTF-8
  - UTF-8 is the best encoding
  - SQL Server 2019 will support UTF-8

- Microsoft is experimenting with UTF-8 as default ‘code-page’

# Source will become UTF-8

- Source files will be stored as UTF-8
  - Likely with a BOM, so the compiler can recognize old files that are still OEM
- Literals will support UTF-8
- Names will only support ASCII characters

# Demo…

# Database in NextGen

- SQL will be the expected database
- Possibilities for the DataFlex Embedded Database:
  - A Unicode version of the Embedded Database
    - No backwards compatibility
    - An OEM to Unicode data conversion utility would be provided
  - Continued support as OEM (without Unicode)
    - Collating sequence will be a challenge
    - Likely still incompatible with previous (32-bit OEM) Embedded Database
  - No embedded database at all

# What code changes are needed?

- Convert to the wide character windows API's
  - Since Windows is UTF-16 a conversion will be needed
  - Not using the W functions will work in a lot of cases, but non ASCII characters will display incorrectly
- Remove / change all conversions
  - ToOEM / ToANSI indicates that something needs to change
- Check string manipulations
  - Bytes do not equal code points any more

- Not a line of code changed in Order Entry

# Status

- Most native components are converted
  - Runtime, compiler, CDS
- Studio is mostly converted
- String functions are being implemented right now
- Open items
  - Embedded Database
  - Connectivity Kits
  - Tools (Database Explorer, Database Builder, …)

- Progress is steady…

# 64-bit

# What is 64-bit?

- The registry size of the processor
- Length of a memory address

- Since 1995 we used 32-bits
  - Addresses up to 4GB of memory
- Since 2001 64-bit versions of windows were available
  - Can address a lot more gigabytes of memory..
  - Not everyone moved to 64-bit directly
  - 64-bit windows can run 32-bit software

# Why do I need 64-bit?

- Because the world is moving towards 64-bit
- Communicate with other 64-bit software
- To be more competitive

# 64-bit capable

- You will choose per project between 64-bit and 32-bit
- We expect 32-bit to be around for a while
  - A 64-bit application cannot use 32-bit DLLs
    - This includes COM components
    - All third party components you use need to be 64-bit
  - You need time to migrate your code
- New projects should be 64-bit by default

# Language changes

- New LongPtr type
  - Integer type that is the same size of a pointer
    - 32-bit on 32-bit and 64-bit on 64-bit
- Integer stays 32-bit
- Pointer is now an Address
  - Used to be an integer
- Handle becomes LongPtr
- New compiler switch

```
#REPLACE Pointer Integer
#REPLACE Handle Integer
```

⇩

```
#REPLACE Pointer Address
#REPLACE Handle LongPtr
```

```
#IFDEF IS$WIN64

#ELSE

#ENDIF
```

# Package changes

- Various Integer to LongPtr changes
  - External API’s
  - Window messages
- Several Integer to Address changes
  - Invalid usage of Integer
    - Bad habits since the beginning of DataFlex ☺

# Internal changes

- Lots of changes in the C codebase of the runtime
  - Pointers were passed as integer a lot…
- Multiple expression evaluator changes
  - Caused by the new LongPtr type
- Brand new linker
  - The part of the compiler producing the executable
  - Already in 19.1 (embed manifest files!)
- Converted all dependencies

# Demo..

# Converting your application…

- All your third party dependencies need to be 64-bit
  - All DLL's / COM controls
  - COM API's might be slightly different on 64-bit
- Changes *might* be needed in your code
  - No pointers values in integers any more!
  - External API's might require the use of LongPtr
  - Most of these are in more low level code
- Not a line of code changed in Order Entry

- With 19.1 we start helping you prepare
  - See Stephen's "Getting your applications ready for DataFlex NextGen"

# The NextGen environment..

- All tools will be 64-bit (Studio, DB Explorer, ..)
  - Also builds and debugs 32-bit applications
- WebApp Server will be 64-bit
  - Also runs 32-bit applications
- Client installer will both 32-bit and 64-bit
  - Will work on 32-bit only machines

# Status

- Most of the work is done
- We have a pretty stable environment
- Lots of testing is being done
    - Most current work comes out of test results

# Moving forward..

# The current DataFlex..

- Will be continued to be supported for a while
  - Based on the current codebase
  - New features will be backported
  - So for a while there will be 2 versions DataFlex
- Gives the new DataFlex time to mature
  - Experience with converting will grow in the community
- Gives you more time to migrate

# When?

- After the 19.1 the focus of the entire team will shift to NextGen
  - It will become our default platform for developing new features
  - The entire team will start testing and reporting issues
- First technical previews should become available later this year..
- We are shooting for a first release the first quarter of 2020..

# Thank you for your time!

I'll be around for any questions you might have…