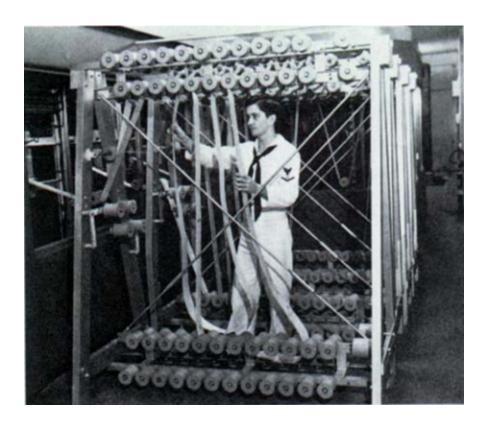
Once upon a time ...

A mechanic at his daily work ...



Immense

Mark I length 16m height 2,50m 765.000 components 650 km wires



WWII "Manhattan"

Calculation of implosions



<u>WWII – the Navy</u>



Salvo-calculations

$\underline{WWII - ENIGMA}$

Uncrackable German coding machine



Hardware

At first relais, very much of them ...



then electrotubes, very much of them



Hardware

Then magnetcores, very much of them



Followed by transistors, very much of them

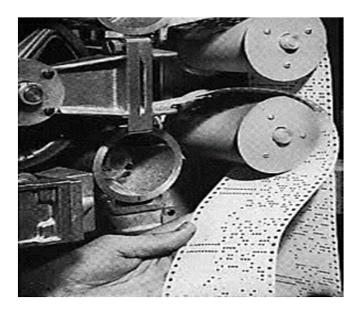


Data carriers

Punched tape Extremely vulnerable

Punched card

Still very vulnerable





Data carriers

Magnetic tape only serial access



Magnetic disk *Random access*



Punched-cards sorting machine



<u>Assembler:</u> Lowlevel Programming

Generates machine language

Varies per computer

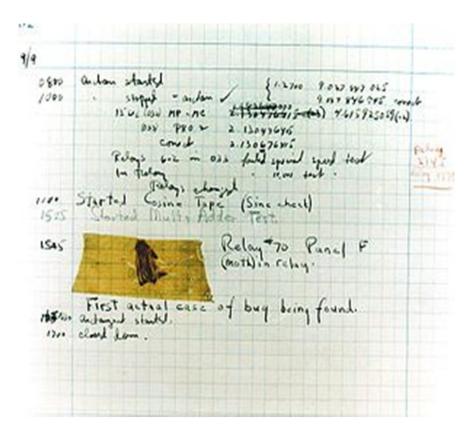
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						()		
		TIMINGS	SYS	TEM	TIMINGS	IBM 1401 Data Processing System Reference Card		
Key to abbreviations used La = Length of the Ad		emulas		98		INSTRUCTION FORMAT		
La = Length of the B-f			Punch a Cord	4	.0115 (L + 1) + 1/O	The IBM 1401 Data Processing System uses a variable was		
Lo = Length of Multipl		field	Read a Cord	1	.0115 (Li + 1) + 1/O	length concept, the length of an instruction can very from a		
Le = Length of Instruc			Read and Punch	5	.0115 (Lt + 1) + 1/O	to eight characters.		
Let = Length of Multipl			Select Stocker	к	$.0115 (L_1 + 1)$.0115 (L_1 + 3)	OP CODE A- or I-ADDRESS B-ADDRESS d-CHARACTER		
La = Length of Divisor			Start Punch Feed*	:	.0115 (L + 3)	X XXX XXX X Op Cede: This is always a single character which defines the		
La = Number of signif	leant d	laits in Divisor (Excludes binh-	Stort Read Feed*	11	.0115 (4 + 1)	hosis operation halon performed. A word mark is always on		
order 0's and bla			Store A-oddress Register*	l õ	.0115 (1. + 5)	sociated with the operation code position of an instruction.		
Ly = Length of A- or B			Store B-oddress Register*	н	.0115 (L + 4)	A-Address: This always consists of three characters. It can iden- tify the units position of the A-field, or it can be used to see		
Lx = Number of chara		o be cleared ack to right-most "O" in control field	Subtract (no recomplement)		.0115 (Ly + 3 + La + La)	lett a special unit or facture (tone unit, column biogra-		
Ly = Number of chara			Subtract (recomplement)	5	.0115 (L1 + 3 + La + 4 La)	feature, disk storage, inquiry, etc.).		
1/0 = Timing for Input			Write a Line Write and Punch	1	.0115 (L1 + 1) + 1/O	I-Address: Instructions that can cause program branches use the I-address to specify the location of the next instruction		
Fm = Forms movement	times.	Allow 20 ms for first space, plus 5 ms	Write and Punch Write and Read	:	$.0115 (l_4 + 1) + 1/0$.0115 (l_4 + 1) + 1/0	to be executed if a branch accurs,		
for each addition	al spa	•	Write, Read and Punch		.0115 (4 + 1) + 1/0	B-Address: This is a three-character storage address associated with the B-field. It usually addresses the units position of the		
T_ = Tope movement t		States and a state of the state	Zero and Add		.0115 (Li + 1 + La + La)	B-field, but in some operations, such as tape or disk record		
X = Number of fields	s inclu	ded in on operation	Zero and Subtract		.0115 (Li + 1 + La + La)	read and write, it specifies the high-order position of a record storage area.		
Add (no recomplement) Add (recomplement)	^	.0115 $(l_1 + 3 + l_2 + l_3)$.0115 $(l_2 + 3 + l_3 + 4 l_3)$	TAPE	a data	BRATIONS	d-Character. The d-character is used to modify an operation code. It is a single alphabetic, numerical, or special charac- ter, positioned as the last character of an instruction. It can be used with instructions of any length.		
Bronch	ŝ	0115 (1 + 1)	C = Character Rate			PROCESSING OVERLAP		
Bronch if Bit Equal*	w	.0115 (L1 + 2)	729 II at 200 epi = .06 at 556 epi = .02	7 ms		A-Address		
Branch if Character Equal		.0115 (L ₁ + 2)	729 IV et 200 cpl = .04	4 ms		The hundreds position of the A-address of a tape or input-		
Branch if Indicator On Branch if Ward Mark		.0115 (Lr + 1)	et 556 cpi = .01 7330 et 200 cpi = .13	6 ms				
and/or Zone	v	.0115 (1+ + 2)	et 556 cpi = .13	0 ms		to @. The symbol is used to signal an overlap operation with		
Clear Storage	1	.0115 (L + 1 + L)	729 Model II, Read 10.7 + 0	CN ma	= TAU interlocked	character reader, magnetic tope, paper tope, and data trans-		
Clear Word Mark	-	.0115 (L + 3)	10.5 + 0	Nms	Processing interlocked TAU interlocked	Overlag Mode		
Compare	c	.0115 (L) + 1 + La + La)	7.5 + 0	Nma	= Processing Interlocked	The following instructions are used when the system is in the		
Control Carriage		.0115 (Li + 1) + P.	729 Model IV, Read 6.8 + 0	N me	= TAU interlocked	overlap mode and card, printer or serial 1/O operations are		
Control Unit Divide (over.)*	2	$.0115 (L_1 + 1) + T_m$.0115 (L_1 +2 +7 La Le + 8 Le)	6.7 + 0	N ms	= Processing interlocked	to be performed.		
Halt		.0115 (L1 + 2 + 7 La L6 + 8 L6)	wine 7.8 + 6	None	TAU interlocked	INSTRUCTION FUNCTION		
Load Characters to A			7330 Read 20.5 + 0	Nm	= TAU interlocked	K1 Overlap On K(0)1 Overlap On And Branch		
Word Merk	L	.0115 (L) + 1 + 2 L)	7.7 + 0	Nms	= Processing Interlocked	Ke Overlap Off		
Modify Address*	#	.0115 (L1 + 9)	Write 20.3 + 0	Nms	= TAU interlocked = Processing interlocked	K(I) Overlap Off And Branch		
Move Characters to A or B Word Mark		.0115 (4 + 1 + 2 4=)	Rewind			K[] Resot Overlap		
Move Characters and Edit	2	.0115 (L + 1 + L + L + L + L + L)	729 Model II = 1.2 mil 729 Model IV = .9 mil	nutes/r	ree!	K(1)		
Move Characters to Record	-		737 Model IV = .9 mil 7330 (High Speed) = 2.3	nutes/r	test (real	1405 TIMING		
or Word Mork*	,	.0115 (L, + 1 + 2 L)	Skip and Blank Tope			1405 TIMING		
Move Characters and Suppress Zeros	z		(add to subsequent write tim	•)		TIMINOS (Medel 2) MAX. AVO. MIN.		
" Move and Insert Zeros"	ž	.0115 (L + 1 + 3 L) .0115 (L + 1 + 2 3 L + 3 L)	729 Model II = 40.5 m 729 Model IV = 27 m			Disk to Disk 800 ms 600 ms 450 ms		
Move Numeric	2	.0115 (1 + 3)	7330 = 103 ms			Track to Track 250 ms 175 ms 100 ms Record to Record, some Track 50 ms 25 ms		
Move Zone	Ŷ	.0115 (1+ 3)	Backspace (ofter Read)		Backspace (after Write)	20 ml		
Multiply (over.)*		.0115 (L+ +3 +2 Lo +5 Le Lx +7 Lx)	729 Model II = 46 + Ch 729 Model IV = 33 + Ch	-	729 Model II = 52 + CN ms 729 Model IV = 37 + CN ms	International Business Machines Corporation		
No Operation	N	.0115 (Lt + 1)	7330 = 428 + CN ms		7330 = 435 + CN ms	Data Processing Division		
· · · · · · · · · · · · · · · · · · ·	22,2,09	CANAR CONTRACTOR	CELEVAN AND STORE	14	CONTRACTOR CONTRACTOR PROCESSION	112 East Post Road White Plains, N. Y. 03 1959, 1960, 1961 by International Business Mathines Corporation		

<u>Compiler:</u> <u>Highlevel Programming</u>

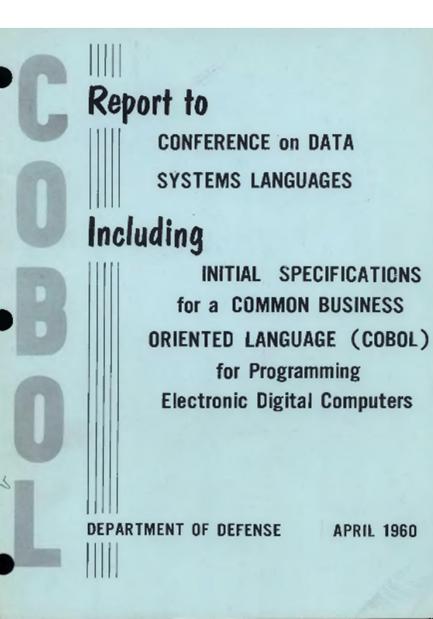
Generates assembler-code

1952 First compiler"FlowMatic"by Grace Hopper



<u>1959: COBOL</u>

Thanks to DoD...



Eisenhower president



Kennedy running



Revolution Fidel Castro



No Berlin wall yet



Deadlock

NO COBOL NO BID



First COBOL compilation

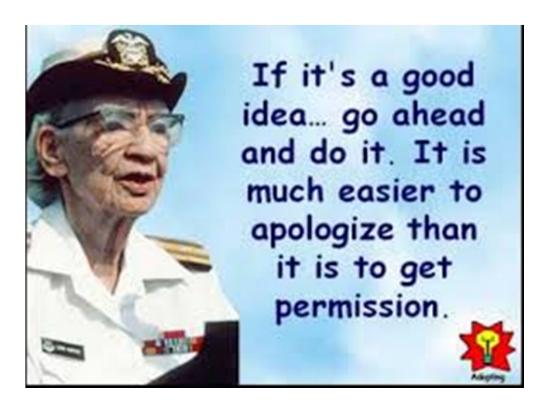
1961

A COBOL program compiled at two computers



1962 COBOL arrives in Europe

- in The Netherlands
- 2 teachers
- 16 students



1969 Microprocessors

Scale-decrease



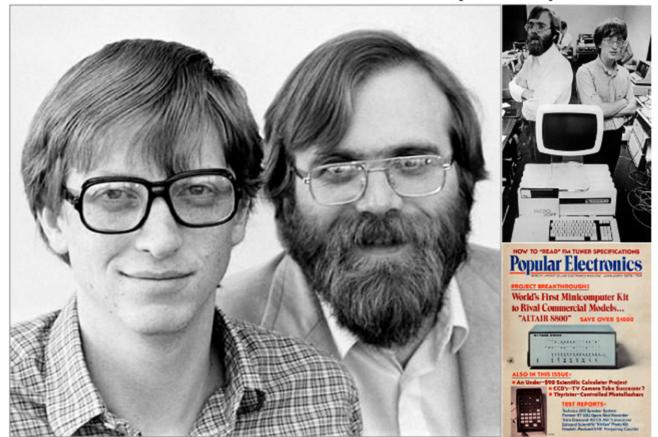
Used in Apollo AGC

25% COBOL





April 4, 1975: Bill Gates & Paul Allen form "Micro-soft" partnership



1975 Microsoft

And more ...





And only in 1998

Google (originally Googol)



30	earch the web using Google!
10 results	Google Search (I'm feeling lucky)

About Google!

Stanford Search Linux Search

Get Google! updates monthly!

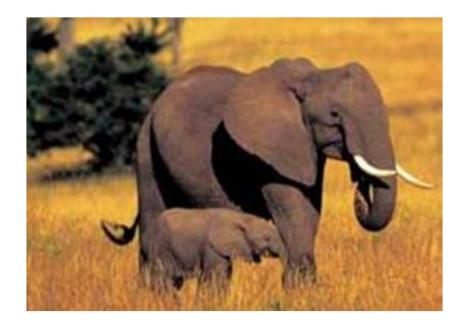
your e-mail

Subscribe Archive

Copyright @1997-8 Stanford University

Today's Ratio

COBOL : GOOGLE 7 : 1



Surprisingly after 58 Years



COBOL Alive and kicking! 25 billion financial transactions / day (13 x / day) 70-80% in COBOL

Creditcards ATM's Tickets Banking Mobile phones Stockmarkets Taxes Insurances



KLM		rfight Pesseng MOD	ar nama	KLM KLKD
Passenger	Date JAN	UARY 6, 2013		Passenger
Fight Number	Departure Airport	Board	Seg Care	San Franciaco to Ameterdam
KLM 39	SFO/T2	09	10 at D10	09:40 Economy
Boarding Priority	Where's my seat?		Departing	
1234	A22	+ =	09:40 >	A22
Frequent Flyer 2073621900	Economy			105525 11

17.34	-7.89% 254.23 126,888
34.89	+2.13× 100.08 120.000 +2.13× 564.23 988.000
23.67	-11. 6x V 120.34 380.000
34.64	+23.1x▲ 893.23 128.000 +5.56x▲ 128.98 328.000
12.78	-3.67% + 432.12 758.080
13.44	+2.54× 432.24 128,080



Impressive figures

 300 billion COBOL lines
 300.000.000.000

 5 billion new lines aeach year
 5.000.000.000

 Total investment 2 trillion
 \$ 2.000.000.000

And ... 1.500.000 COBOL developers



Impressive figures

You just don't throw that away



End of WW II

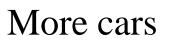


Explosion of data

- production
- Bank accounts
- transport and logistics
- government
- trading
- insurances



Worldwide communications







More telephones







Worldwide communications

More TV's and TV-stations





FOX	(B)	амс	FX	CINN	HGTV
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[adult swim]	Tis.		₽ %€	VICELAND	tru®.
Lifetime	travel		newşy	Bloomberg	
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New: satellites



Travelling

Travel-agencies

Airlines



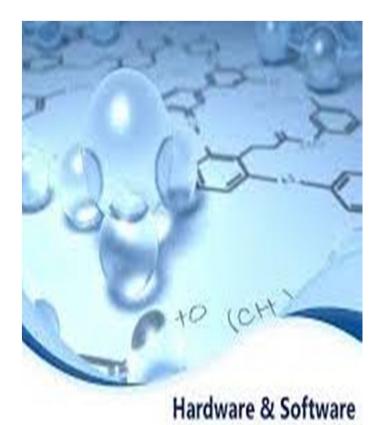
Railways

Hospitality



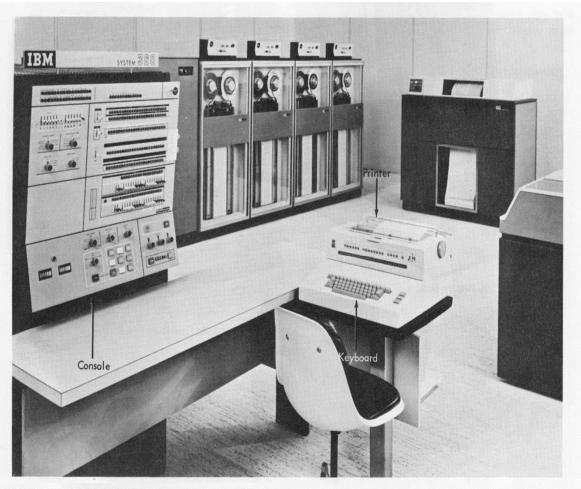
A growing need

- new hardware
- robust software
 - . fast
 - . data-driven
 - . reliable



Hardware

1964: IBM announces System 360



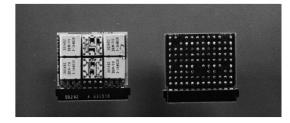
IBM System/360 Model 40 Console, Console Printer, and Keyboard

Break through

a. New technology

b. Smaller

c. Modular







Software: COBOL



Fast to learn

Robust

Reliable

Four unique characteristics

- 1. record-structuring
- 2. mass data-processing
- 3. decimal calculating
- 4. report generating



<u>1981 IBM-PC</u>

- Soon very popular

- sales far beyond estimations

- PC = IBM



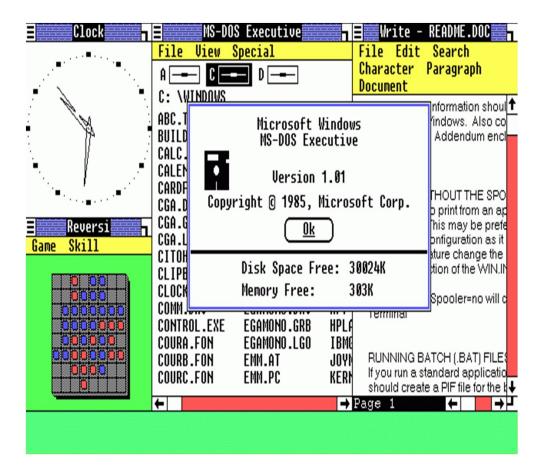
Software for PC's 1981

1st MS-DOS

Drives		Logical dri	un C: -		
HDD 80h	CIN	Logical all	ve u.		
Logical C:					
└→ Logical D:	Name	Size	Attrib	Date	Тіме
└→ Extended	MICROS~1	< <folder>></folder>		04.02.2002	
└→ Logical E:	MULTIM~1	< <folder>></folder>		14.10.2001	22:29
└→ Logical F:	PLATF0~1	< <folder>></folder>		15.03.2002	16:15
└→ Unallocated	PROGRA~1	< <folder>></folder>		14.10.2001	08:11
HDD 81h	RECYCLED			26.11.2001	
→ Unallocated	RECYCLER			07.02.2002	
HDD_82h	Темр			15.03.2002	
└→ Extended	WINNT			14.10.2001	
➡ Unallocated	WinHex	the second se		11.04.2002	
└→ Logical G:	AUTOEXEC BAT			14.10.2001	
	CONFIG SYS			14.10.2001	
	IO SYS			14.10.2001	
	MFT DAT			10.03.2002	
	MSDOS SYS			14.10.2001	
	NTDETECT COM			14.10.2001	
	boot ini			14.10.2001	
	ntldr			14.10.2001	
L PA Hala L	pagefile sys				
F1-Help Tab-Long names ENTER-Preview Ctrl+0-Copy					
Active® NTFS Reader for DOS v 1.0 2002 (C) Active Data Recovery Softwar <pre>KFREE></pre>					
CKLE7				пстр.// МММ	1112.0

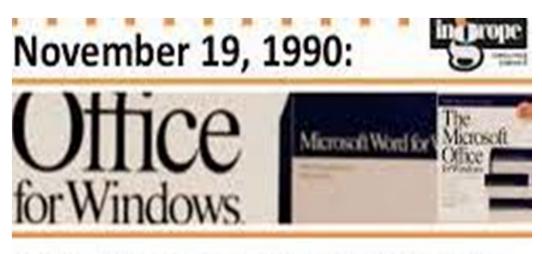
Software for PC's

1985 1st WINDOWS



Software for PC's

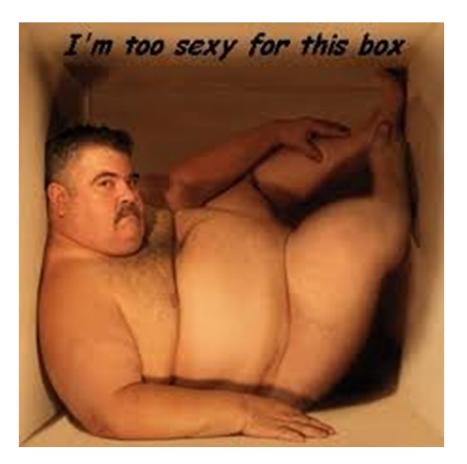
1990 1st WORD, EXCEL



Microsoft Office for Windows is released otherwise known as "Office 1.0". Office 1.0 contains Word 1.1, Excel 2.0 and Powerpoint 2.0.

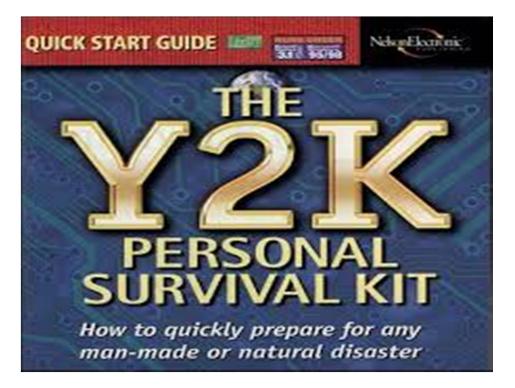
COBOL not sexy anymore

COBOL-scriber's image



<u>Y2K</u>

Catastrophic? Real problem? Hoax?



<u>GETTING OLDER</u>

And remain yourself



Developments

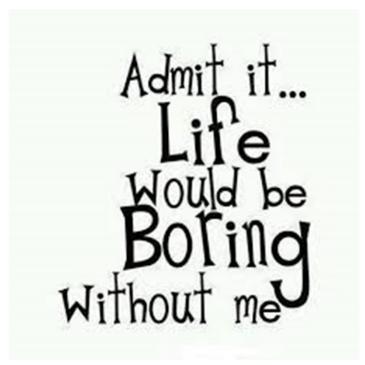
From primitive to advanced



From simple to complex



Boring



With deep sadness ...



Criminal act



<u>Old, so ...</u>



Useless! Get out! Never again! Or ...?



Metric versus Imperial

Meter: light in vacuum in 1/299.792.458 sec



Inch: 2,54 cm



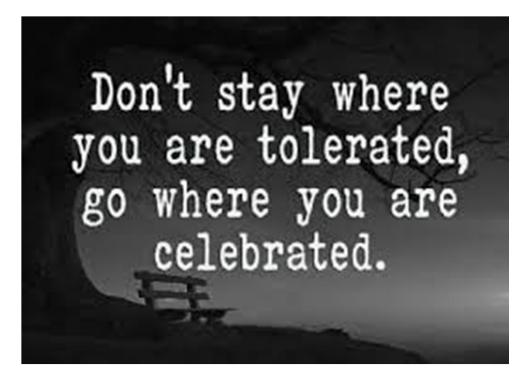
To switch or not to switch

- too expensive
- keep your investments
- hardly any ROI
- current system
- is efficient
- no real
- improvements



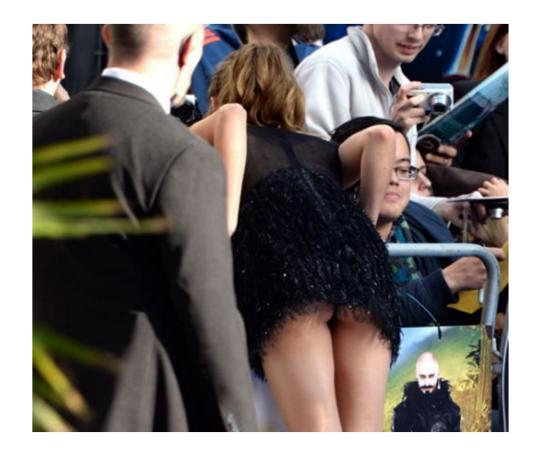
Effective AND good

Stick to what you have





COBOL programmers: becoming scarce



Comeback

Necessary
 Business along
 with education
 authorities



Pimping

– Change position

– Improve earnings

– User groups





Is your system really that bad?

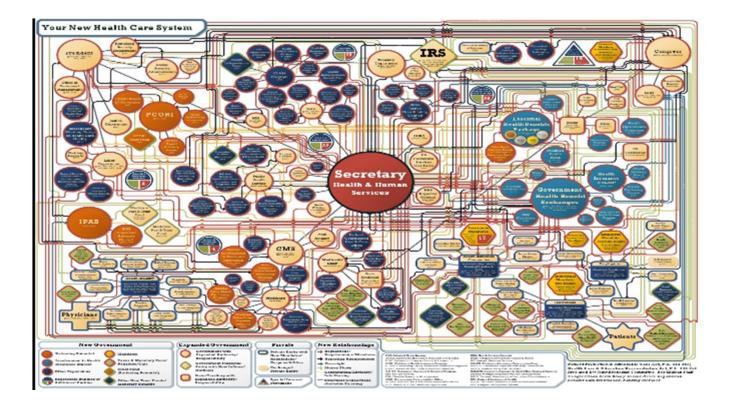


Performance

- . response-times
- . use of resources
- . availability
- . data management



Complexity = diversity * dependency



Replacing ...



*ADAM

or upgrading?





LastingCOBOL support

LifecycleCOBOL-market:long and strong



Migration

Pre-analysis:

. duplicates



- . unused routines
- . inefficiënt coding

Code-translation:

- inefficiencies being copied
- new inefficiencies
- more complex results
- increasedmaintenance



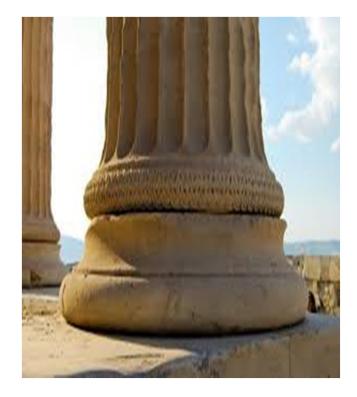
COBOL remains the fundament

- investments

committed vendors

- COBOL in 2050 still popular!

Special care: shortage of programmers



Consider migration when:

- . Change of database-systems
- . Change of functionality
- . Hardware adjustment
- . Integration of companies

```
By failing to
prepare, you are
preparing to
fail.
Benjamin Franklin
```

Migration risks:

- equal or less functionality
- maintenance problems
- increased runtime
- no added value



COBOL replaced?

In the long runNot by just one language

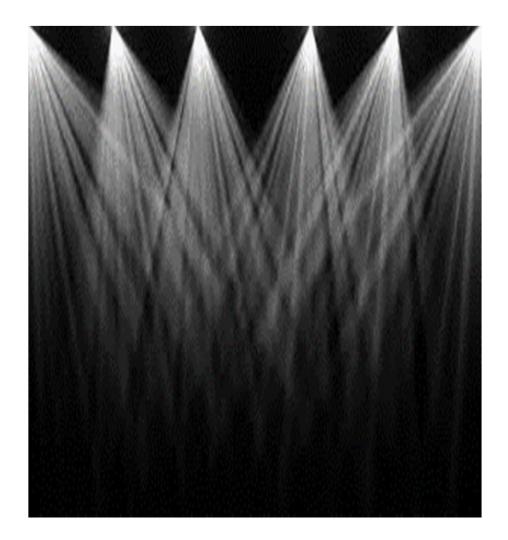


At the origin of IT: COBOL

- never matched
- no successor yet



Future



There is enough work to be done!

