IBM Systems & Technology Group

A Mainframe Retrospective

John Eells
IBM Poughkeepsie
4 December 2013

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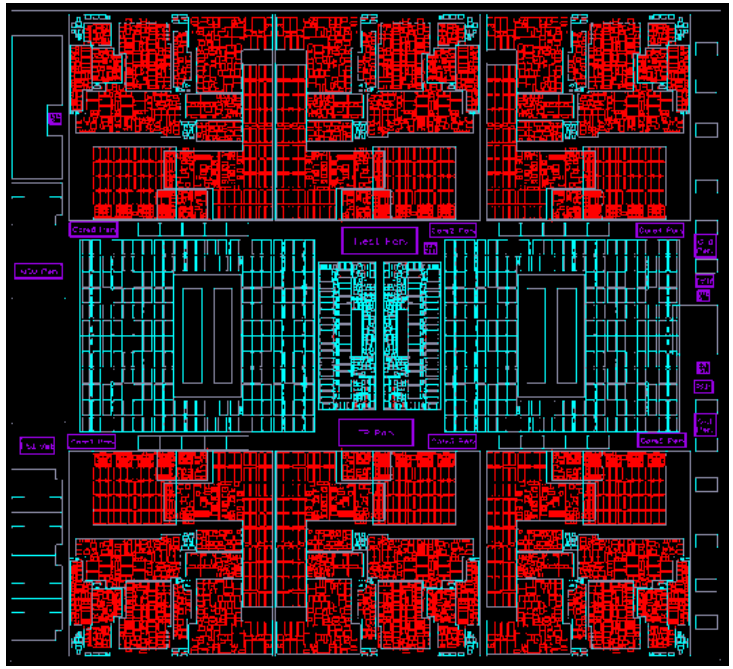
Leading edge technology

1947

1st Transistor
December 16th, 1947
Bardeen, Brattain, Shokley

IBM's zEC12 processor chip

2012



IBM's zEC12 processor chip
September 2012
Manufactured at IBM's 300mm chip fab in East Fishkill, N.Y.

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Where we are today…

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z/OS V2.1

Designed for a smarter computing with designs for:

Improving Usability and Skills

New z/OSMF Workflow & Software Management, CPM improvements; HCD/HCM HMC-wide Activate; Health Checking, zDAC improvements, Generic Tracker, Delete member name masking, D PPT,…

Integrating new Applications and Supporting Industry and Open Standards

More Batch Modernization; ASCII support in more z/OS UNIX® System Services shell commands and utilities; IXCNOTE; More mutexes and shared condition variables in z/OS UNIX; Generalized Alignment Support in the Binder, Font element, TSO/E REXX™, Nested PIPI, Heap check zones, IEBCOPY enhancements …

Scalability & Performance

100-way SMP, 2 GB pages, pageable 1 MB pages, transactional memory support on zEC12, zBC12; RLS for Catalogs, zFS V5, Serial CF structure rebuild, EXCP support for zHPF, 8-character Job classes, PDSE V2, CFLEVELs 18 & 19, Parallel recall for batch …

Enhancing Security

LPAP access to crypto, ICSF & RRSF enhancements, SAF job class control, Certificate enhancements, z/OS UNIX timeouts; System SSL support for TLS 1.2 and NSA Suite B, …

Improving Availability

JES3 dynamic spool volume removal, Dynamic System Symbol updates, Flash Express support, RRS improvements, FORCE TCB, DCCF support for WTOR Auto-Reply, HMC 3270 console support, …

Self Managing Capabilities

DFSMShsm™ Storage Tiers, Better JES3 support for SMS-managed tape, SMS Management Class support for tape, zBX SMF performance records, DCM support for cascaded switches, z/OS UNIX Automount improvements, …

Extending the Network

RoCE support, Enhanced Fastpath sockets, SACK support, new FTP security exits, TCP Profile syntax check, Intrusion Detection improvements, DVIPA affinity, …

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IBM zEnterprise EC12 (zEC12) System Functions and Features

- Five hardware models
- **Hexa-core 5.5 GHz processor chips**
- **Up to 101 processors configurable as CPs, zAAPs, zIIPs, IFLs, ICFs, or optional SAPs (up to 64-way on z/OS V1.10, 100-way on z/OS V1.11 and higher)**
- **Second generation out of order design**
- **Improvements to pre-fetch instructions**
- **Improved processor cache design**
- Up to 3TB of Redundant Array of Independent Memory **(**RAIM) – same as z196
- Twice the HSA versus z196 (32 GB vs 16 GB)
- **Decimal-Floating-Point Zoned-Conversion Facility**
- **Flash Express (Storage Class Memory-SCM)**
- **1 MB Pageable Large Pages**
- **Dynamic reconfiguration support for Flash Express**
- **2 GB Large Page Support**
- **Optional PLPA, COMMON page data sets**
- **Crypto Express4S cryptographic coprocessors and accelerators**
- **New support for IBM Enterprise PKCS #11 (EP11) coprocessor**
- **DUKPT for MAC and Data Encryption, Europay, Mastercard, and Visa (EMV) CCA enhancements**
- **New and enhanced instructions**
- **IBM zAware**
- **OSA-Express4S and OSA-Express5S (GbE LX and SX, 10 GbE LR and SR, and 1000BASE-T)**

GA1 z/OS® support in blue

2013 z/OS support in red

- **FICON Express8S**
- **24K subchannels for FICON® channels**
- **IBM zEnterprise Data Compression (zEDC) capability using zEDC Express**
- **RDMA (Remote Direct Memory Access) support for z/OS over Converged Enhanced Ethernet RoCE)**
- **Parallel Sysplex InfiniBand (PSIFB) Coupling Links**
- **High Performance FICON for IBM System z®**
- **CPU Measurement Facility**
- **CFCC Level 18 and 19 enhancements**
- **Transactional Execution Facility**
- **Runtime Instrumentation Facility**
- **Exploitation of new hardware instructions – XL C/C++ ARCH(10) and TUNE(10)**
- **CCA 4.4 and other enhancements: RKX Key Export Wrap, UDX Reduction/Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification**
- Optional Non Raised Floor
- Optional water cooling and DC Power
- Optional overhead Power and I/O cabling
- zBX Model 003 support of:
  - IBM WebSphere® DataPower® Integration Appliance XI50 for zEnterprise
  - Select IBM BladeCenter® PS701 Express blades or IBM BladeCenter HX5 blades
- **Unified Resource Manager (zManager) enhancements**

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Where we've been…

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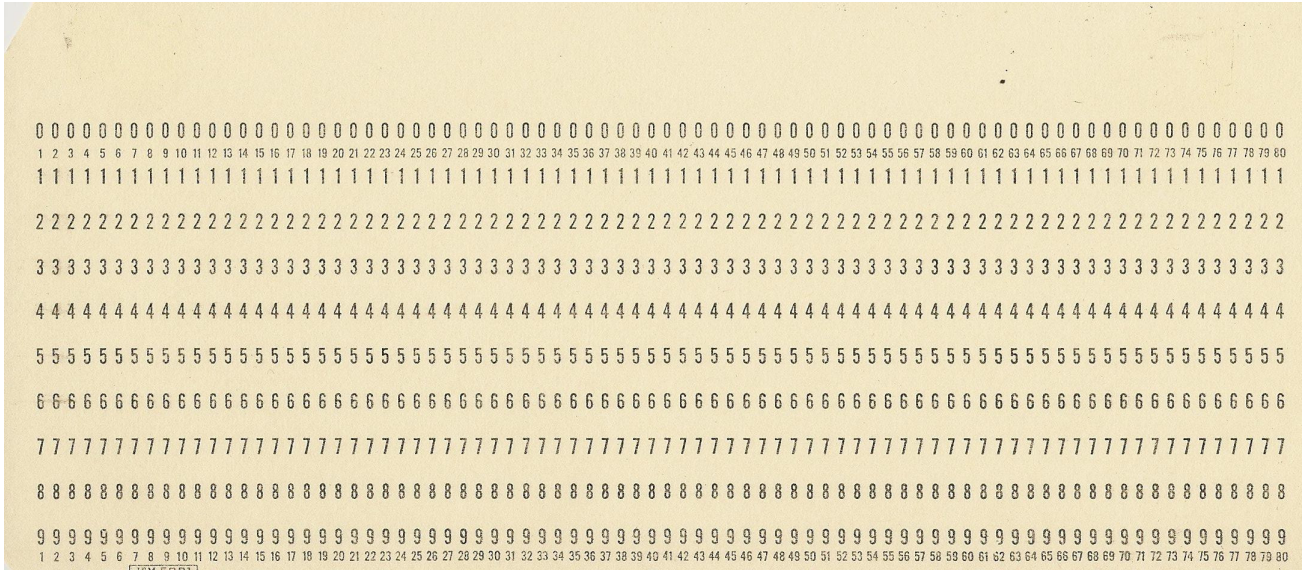
It all started with…

- …Herman Hollerith's punched cards…
- …and their influence continues to affect us today!

- Ever wonder…
  - Why the 3270 default screen size is 24x80?
  - Why we have a "block size" concept?
  - Why we have data sets with sequence numbers?



"The IBM card measures 7 3/8 inches by 3 ¼ inches and is .007 inches in thickness."
– Punched Card Data Processing Principles, Section 1, "The IBM Card and Its Preparation," IBM Corp., 1961

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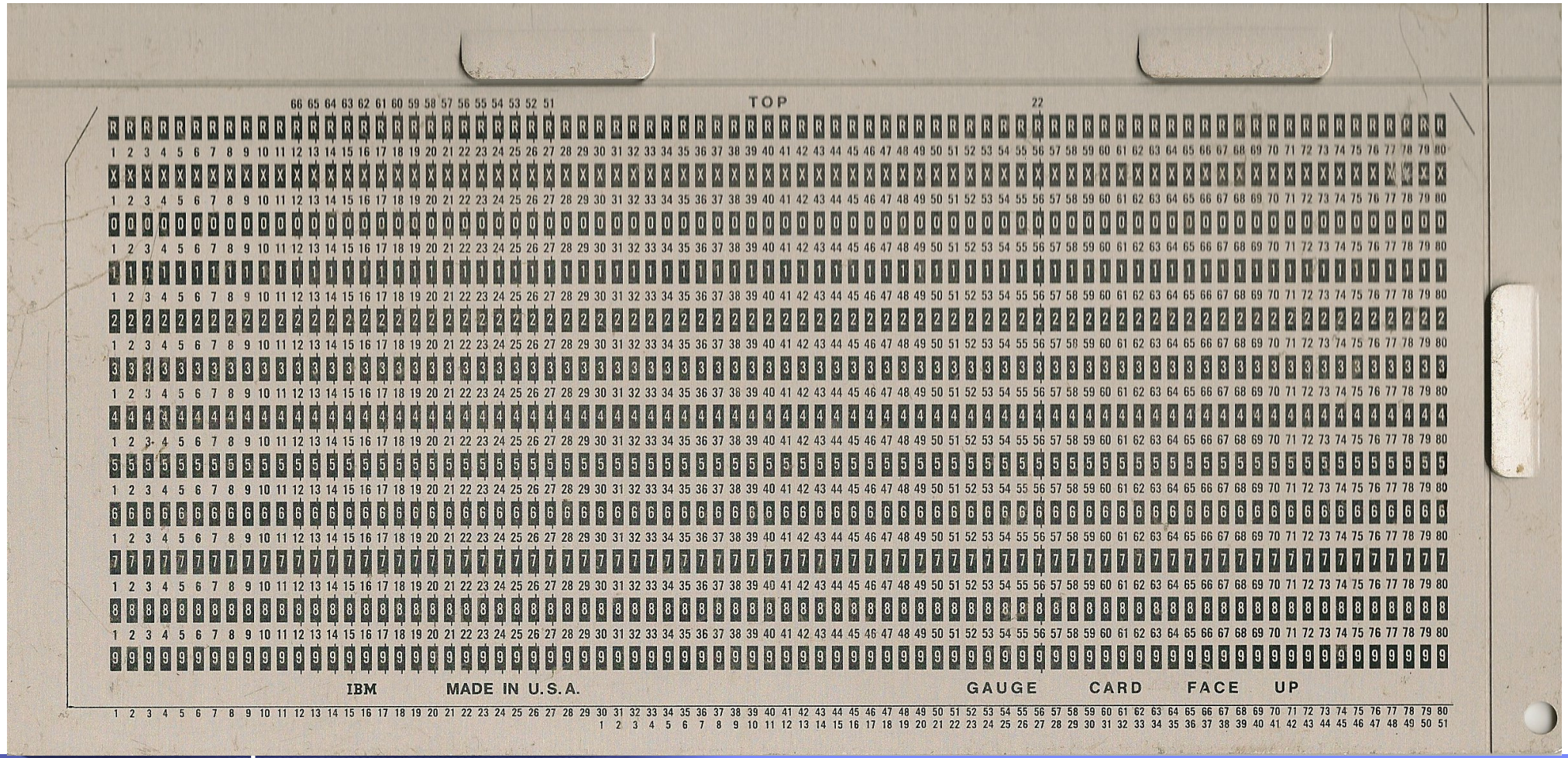
Punched Cards, Continued…

- How did you know the holes were in the right places?
- With a card registration plate, of course!
- Standard issue in the 1970's



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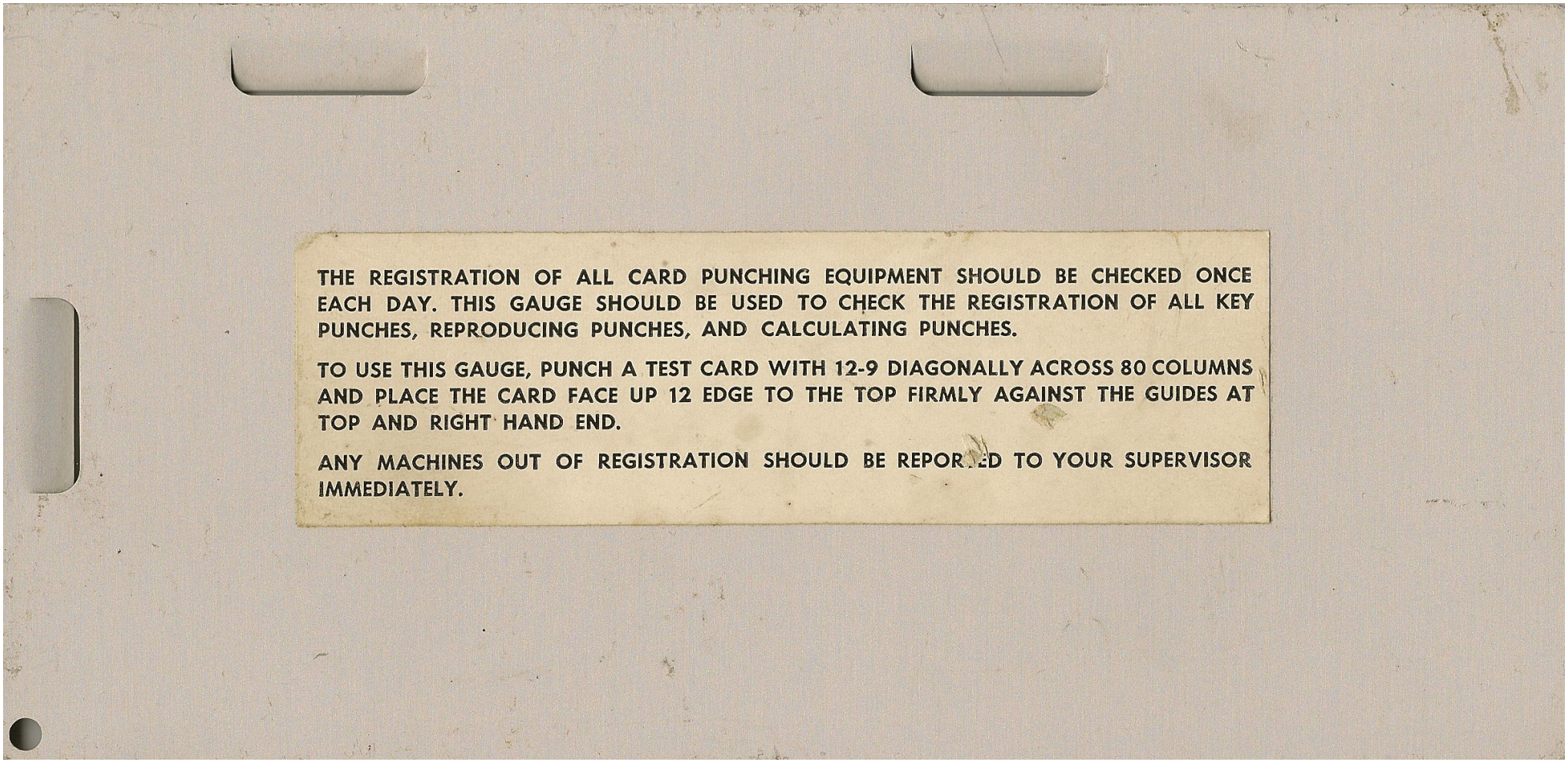
Punched Cards, Continued…

Rear view of card registration plate



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Punched Cards, Continued…

- It's hard to believe this now, but punched cards were pervasive!
- Many bills and warranty cards were printed on punched cards
- "Do not fold, spindle, or mutilate…"
- This card came with my garbage disposal many moons ago:

IMPORTANT TO PURCHASER

GFC310 GFC310--02 VG125726B 42

CONSUMER PRODUCT OWNERSHIP REGISTRATION

YOUR PROMPT COMPLETION AND RETURN OF THIS CARD WILL FACILITATE OUR CONTACTING YOU IN THE UNLIKELY EVENT A SAFETY MODIFICATION IS ISSUED FOR YOUR PRODUCT UNDER THE CONSUMER PRODUCT SAFETY ACT.

OWNER REGISTRATION
GENERAL ELECTRIC COMPANY
LOUISVILLE, KY. 40225

DATE PLACED IN USE
MONTH DAY YEAR

(PLEASE PRINT)

NAME _____ AREA CODE _____ TEL. NO. _____

APT. _____ STREET _____

CITY _____ COUNTY _____

STATE _____ ZIP _____

DEALER/BUILDER NAME _____

CITY _____ STATE _____

IMPORTANT–FILL IN AND MAIL THIS CARD TODAY!

DEALERS & BUILDERS: DO NOT REMOVE THIS CARD FROM THE PRODUCT

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What's a Card Jam?

- When two cards tried to fit into the space meant for one, how did you get them out?
- You used a card saw…
- Once standard issue in CE tool bags, the thin (.007" or so), spring-steel card saw was essential if you worked on card readers, punches, or keypunch machines.
- It would clear out the card jam…eventually.

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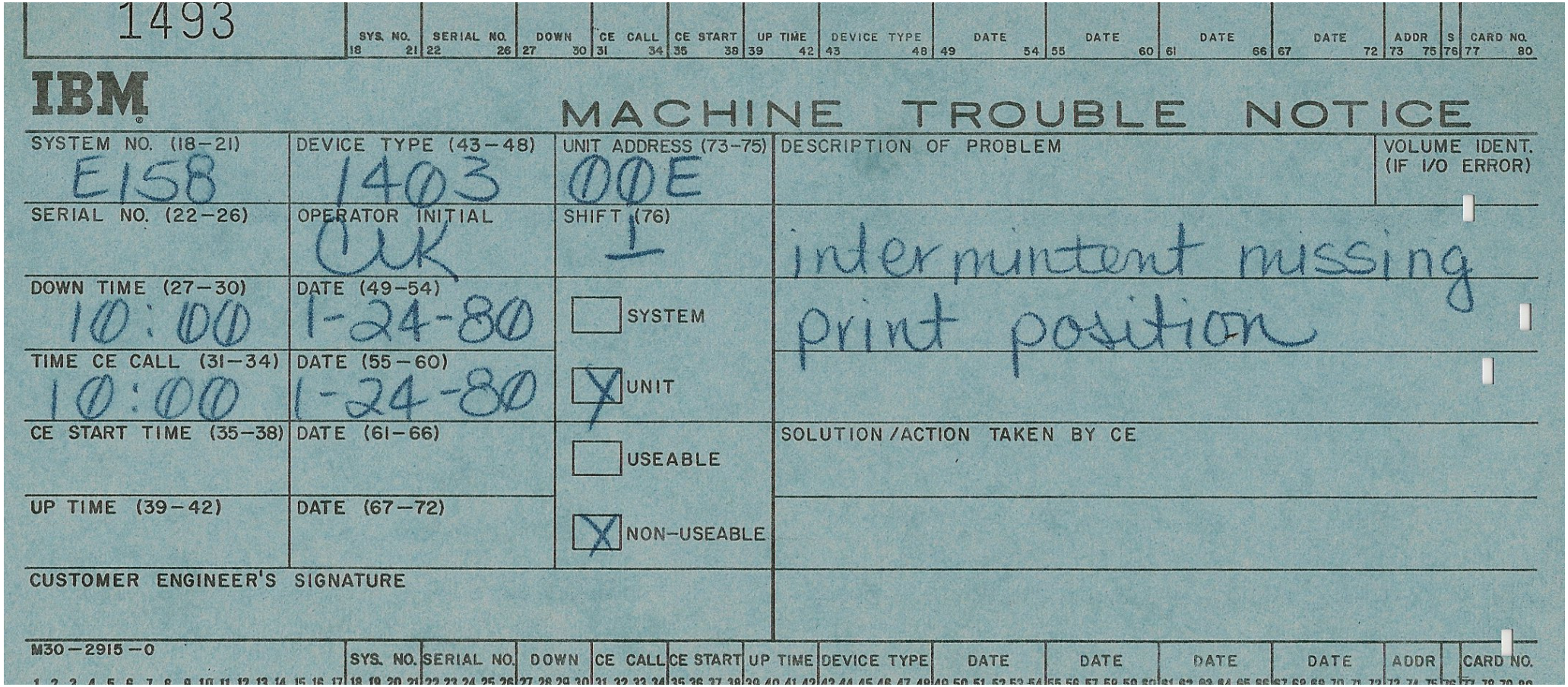
Punched Cards, Continued…

- Of course, IBM used punched cards, too:



1493

SYS. NO. 18–21	SERIAL NO. 22–26	DOWN 27–30	CE CALL 31–34	CE START 35–38	UP TIME 39–42	DEVICE TYPE 43–48	DATE 49–54	DATE 55–60	DATE 61–66	DATE 67–72	ADDR 73–75	S 76	CARD NO. 77–80

IBM

MACHINE TROUBLE NOTICE

SYSTEM NO. (18–21)	DEVICE TYPE (43–48)	UNIT ADDRESS (73–75)	DESCRIPTION OF PROBLEM	VOLUME IDENT. (IF I/O ERROR)
E158	1403	00E		
SERIAL NO. (22–26)	OPERATOR INITIAL	SHIFT (76)	intermintent missing	
	CK	1	print position	
DOWN TIME (27–30)	DATE (49–54)	☐ SYSTEM		
10:00	1-24-80			
TIME CE CALL (31–34)	DATE (55–60)	☒ UNIT		
10:00	1-24-80			
CE START TIME (35–38)	DATE (61–66)	☐ USEABLE	SOLUTION/ACTION TAKEN BY CE	
UP TIME (39–42)	DATE (67–72)	☒ NON-USEABLE		
CUSTOMER ENGINEER'S SIGNATURE				

M30–2915–0

SYS. NO.	SERIAL NO.	DOWN	CE CALL	CE START	UP TIME	DEVICE TYPE	DATE	DATE	DATE	DATE	ADDR	CARD NO.

An operator named Carol K. wrote this MTN against a printer I fixed in 1980…and I obviously forgot to return the card because I found it in my old tool bag in 2007!

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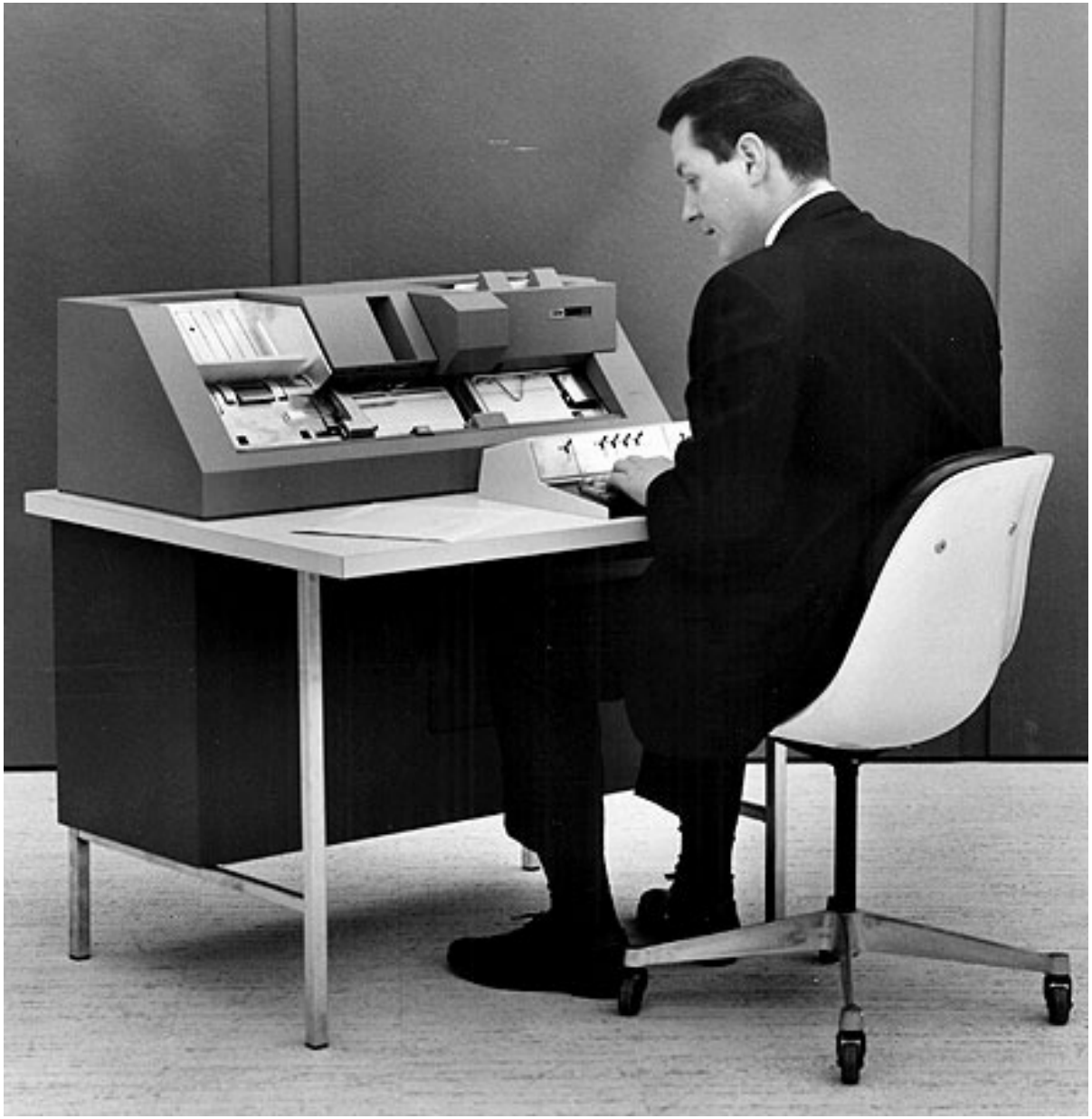
Punched Cards, Continued…

- An IBM 029 Keypunch, 1964
- Not exactly a laptop!
- It existed only to punch holes in cards
- Blank cards in feeder on top right; punched ones in stacker on left; chad bin underneath
- No error correction, of course; cards with typos went into the trash can (which is conspicuously absent in this photo)
- This is actually a model with an optional drum-mounted "program card" to speed things up by positioning cards and prepunching some fields



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```
ERROR: stackunderflow
OFFENDING COMMAND: ~

STACK:
```