Computer History Museum

Volunteer Information Exchange

Sharing what we know with those we know

Volume 5 Number 8 September 11, 2015

Contribute To The VIE

Long before the Neiman-Marcus "Kitchen Computer" and before any recipes on your PC, there was ECHO IV, a one-off home computer. Dave Cortesi writes a wonderful article describing this one-of-a-kind artifact.

Bill Worthington writes of his opportunity to visit the University of Manchester and the reconstructed "Baby." And he took some excellent pictures for us.

Thanks once more to Chris Garcia for telling us about three recent acquisitions.

As always, send us your stories, anecdotes and adventures in computing.

Jim Strickland jlstrick@aol.com

CHM Blog

Recent CHM Blog Entries

Kirsten Tashev keeps us up-to-date on new CHM blog entries.

- Guest blogger, Adam Spring writes on Amiga Computing. The Amiga computer celebrated its 30th birthday at CHM this July.

Docent Training: Women In Computing

Kate McGregor Aug 8

This fall we will be "gearing" up for festivities celebrating the life, work and creativity of Ada Lovelace, and I am excited to announce a new training program open to all qualified CHM docents!

Exact dates and details will follow, but please let us know now if you would like to join our Women in Computing tour team by signing up using the online form below:

Interest in Women in Computing Tour Training - Fall 2015

Training: Women in Computing Tour
Eligibility: CHM Qualified Docents Only
Time Frame: October/November 2015
Training Format: 3 classroom sessions and a qualification process
Location: CHM

We know our visitors will be excited to learn more about Ada and other incredible women of the computing era!

Please contact Kate directly with any questions.

Links You Might Enjoy

- Creation of Evans and Sutherland
- 10 Pictures of PCs in schools in the 80's
- Computer Art in 1969
- In Memoriam: Karl Taub, who started the Computer Science departments at Carnagie Mellon and Columbia Universities in the 70's.
- Ed Thelen sends along this link about the Librascope LGP-30.
- Kate McGregor sent this link about the several archiving activities at Cisco iwhich the CHM is leading.
- Happy 17th birthday, Google—Sept 4

Ken Shirriff has written several excellent and detailed articles recently about the innards of the 1401.

- 1402 Operations
- Details on 1401 Qui-Binary arithmetic
- 1403 Print mechanism – explanation and animation
- 1401 Core Memory Operation

Peter Hart will speak on "Making Shakey, the World's First Intelligent Robot on September 14. Click for details.

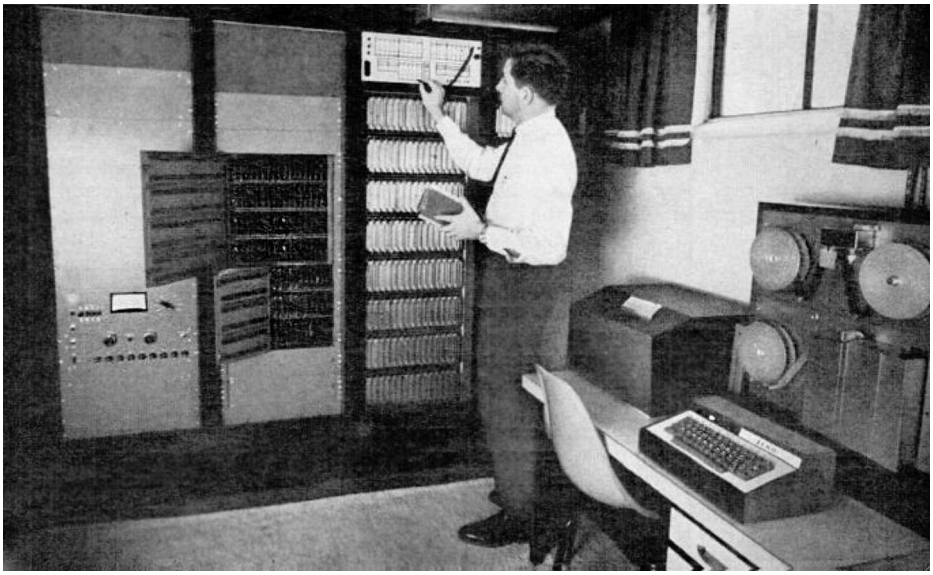
Contents

The First Home Computer

DAVE CORTESI

Like many dedicated engineers, Jim Sutherland couldn't resist the urge to take his work home with him. But Sutherland wasn't just any engineer: he worked for Westinghouse designing computers and nuclear power plant control systems, and over the course of a 38-year career won 25 patents. So when in the mid-1960s he decided to take some work home, the result was a full-scale computer in the family basement, and very likely the first-ever home computer.

In 1959, Westinghouse built a computer called the PRODAC IV, a machine for which Sutherland designed the ALU (Arithmetic and Logic Unit). In 1965, Westinghouse bought in a Univac design for a process-control computer to sell as the PRODAC 50. The PRODAC IV was decommissioned and its parts were made surplus.



Jim Sutherland, in his basement, checks the status lights on the ECHO IV console.

Sutherland, who knew the PRODAC IV technology intimately, asked permission to take home the boards and memory to experiment with a home computer, and his employers agreed. The parts were signed out on indefinite loan, and Sutherland began to build the Electronic Computing Home Operator, or ECHO IV (the "IV" was a tribute to his old work project).

As built, the ECHO IV occupied four bays approximately 2x2x6 feet each[1], and generated enough heat that Sutherland had to install an exhaust fan to cool the basement (the machine drew 3.5KW). By the summer of 1968, the ECHO IV was working well enough that the Westinghouse PR department publicized it to local media. The Pittsburgh *Post-Gazette* did a story featuring a delightful photograph of the Sutherland family gathered around the computer (see the picture gallery[0]), which was fancifully supposed to be able to order groceries and predict the weather.

Popular Mechanics did a feature story[2] that explored at length the useful things a home computer might do when properly programmed. However, this story contains a paragraph that tells volumes to any programmer about the state of ECHO IV programming:

> "Simple keyboard entry and printer output routines were the first ECHO programs the Sutherlands wrote. These were followed by the paper tape input and … punching routines... Jim is now devoting his time to writing such programs as multiply, divide, multiple precision add, subtract, and message writer routines."

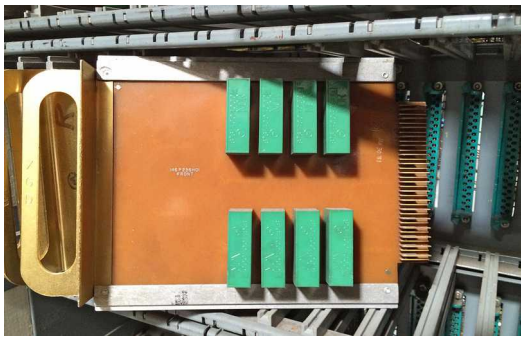
This shows that in 1968, Sutherland was still writing very basic system control functions, and the ECHO IV was a long way from being able to order groceries.

The ECHO IV did eventually become integrated into the Sutherland household. When Sutherland described the system to a meeting of the Pittsburgh section of the IEEE in 1994[3], he said that besides the keyboard, teletype and paper tape unit next to the machine, there was an IBM Selectric typewriter in the kitchen that could be used as a word-processor, and a numeric keypad in the living room that was used to instruct the ECHO to rotate the TV antenna to best receive a particular channel. (Hands up if you remember TV antenna rotators!)

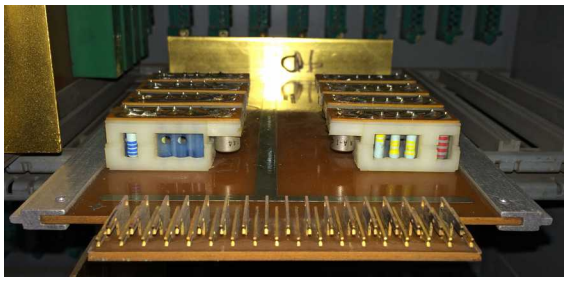
The ECHO also had connections to four "BCD clocks" around the house. These BCD (binary-coded decimal) clocks are mentioned in two articles, but alas, no pictures were published. They seem to have been an earlier Sutherland project, and apparently read out the time as binary, four small lights per digit. Sutherland's son recalled that "after Dad explained that three lights in a row meant seven, I could easily tell when it was 7:00 or 7:07..." The clocks apparently updated the minutes value independently. However, when the BCD clock on the Sutherland's bedroom ceiling approached the hour (one supposes, reading out "○●○●, ●○○●"), it triggered the ECHO IV in the basement to power up, run a self-test, then update the hour value of all four clocks before powering-off again.

What was the ECHO IV's technology? It was the same as the PRODAC IV from which all its parts came, but that computer seems to have evaporated from history, or at least, from the internet. CHM has some items related to

the PRODAC 50, the Univac-designed machine that sent the PRODAC IV out to pasture and made its parts available to Sutherland, but nothing earlier.



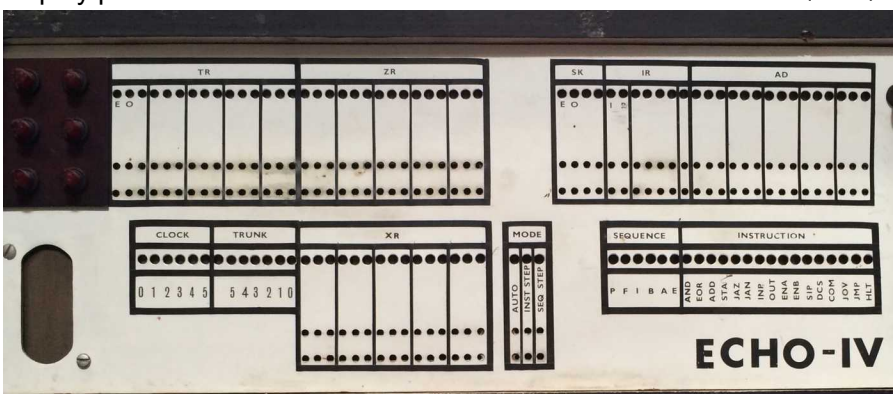
The ECHO plug-in modules, with their distinctive gold-toned extraction handles and brown circuit boards populated with little green boxes, are familiar to CCARP volunteers who have cataloged over 100 of them, apart from the hundreds more still resident in the ECHO IV cabinets now housed in Milpitas. But what is hiding in the green-covered sub-modules? Some have speculated that they were potted reed-relays.



However, on some of the boards the green caps have fallen off or been removed and we can see the contents of the sub-modules. Each is a plastic frame that holds one transistor and a cluster of resistors and capacitors in a vertical “cordwood” arrangement. (Control Data used “cordwood” stacked components in the CDC6600 line; there are a number of those modules in the collection.)

So the ECHO IV was a discrete-transistor machine. According to all sources, it had core memory with 8,192 memory “locations” or “words”. But what was the size of its memory units? According to home-computer pioneer Sol Libes in a *Byte* article[4], it “used a 4 bit word [and] had 8K bytes of core memory.”

However, the use of a “4 bit word” and a unit of “bytes” does not accord with other sources. In [1] we read it was “hand-coded in octal”. And then there is the console display panel itself.



The dominant theme here is functional blocks with 5 groups of 3. There are four such blocks headed TR, ZR, AD and XR. Without access to the documentation[5] we can only guess that the “R” in these names means “Register”. We still can't know the memory word size, but it almost surely was not a multiple of 4 bits. Very likely it was some multiple of 3 bits (one octal digit), possibly 15 bits or 5 octal digits.

All sources say the machine had a repertoire of “18 instructions”. However, the lower right of the display panel has lights and names for sixteen instructions, not eighteen. (The names shown are AND, EOR, ADD, STA, JAZ, JAN, INP, OUT, ENA, ENB, SIP, DCS, COM, JOV, JMP and HLT.) Anyone who has done assembly-language programming can probably intuit what most of those mean. Conspicuously absent is any opcode that sounds like “load accumulator,” so there may well be more instructions than listed. In any case, there's no indication that Sutherland ever implemented a symbolic assembler, let alone any higher-level language. So the ECHO would always have been programmed by entering the octal digits of its machine language, and debugged by single-stepping the program while reading out the lights (see the INST STEP position under MODE).

Despite its rudimentary technology, the ECHO IV ultimately did function as a household computer, at least to the extent of being some fashion of a word processor, a TV antenna aimer, and a clock manager. It kept the Sutherland basement comfortably warm from 1965 until 1975, when it was donated to the Boston Computer Museum, and eventually made its way to CHM and the Milpitas warehouse where it can be examined today.

Notes and Links

[0] A gallery of ECHO IV pictures: https://cortesi.smugmug.com/Other/ECHO-IV-article

[1] The *IEEE Annals* article[2] says “6x2x6” but that isn't correct. As received at CHM, the ECHO IV is in two cabinets, each about 6' high, 2' deep, and 4' wide, divided into two bays. That layout of four, 2-foot-wide bays is what shows in contemporary photographs.

[2] *Popular Mechanics*, April 1968 at Google Books: http://bit.ly/1fLjcNz

[3] *IEEE Annals of the History of Computing*, Vol 16 No 3, 1994 (PDF): http://bit.ly/1NEHvLZ

[4] “The First Ten Years of Amateur Computing”, Sol Libes, in *Byte*, July 1978: http://bit.ly/1UipB0u and turn to page 65.

[5] There is a “Manual” written by Sutherland among the CHM texts; it is catalog #102647711.
See also, “If You Can't Stand the Coding, Stay Out of the Kitchen,” Dag Spicer, *Dr. Dobb's Journal*, August 2000: http://ubm.io/UimrBs

Visit to Manchester Baby

WILLIAM C WORTHINGTON, docent

Well, I recently returned from a business meeting in Manchester, England. As an outing, my wife and I visited the Manchester Museum of Science and Industry (MOSI) on a damp day. It turned out to be a rather bright day because, we discovered that a group of French school children had just visited the Museum with a goal of seeing the University of Manchester's Small-Scale Experimental Machine (SSEM) – also known as Manchester Baby – demonstrated to them. (Jim Strickland wrote an article for *Volunteer Information Exchange*, Volume 5, Number 6 describing the history of Baby and I won't repeat his findings here.)

Unfortunately, our arrival coincided with parts of the replica having already been shut down so we didn't see the demonstration. (Normal demonstrations are scheduled for Tuesdays and Wednesdays from 10:00-15:00.) Baby is located in the first gallery you come to after entering the museum and admission was free.

I had a chance to talk with two of the team who had brought Baby back to life. It is a working replica of the original because Baby was cannibalized to build the "Manchester Mark 1" and then contributed to the Ferranti Mercury computer.

Wikipedia describes it as follows:

> Baby was designed as a test-bed for the Williams tube, an early form of computer memory, rather than as a practical computer. Work on the machine began in 1947, and on 21 June 1948 the computer successfully ran its first program, consisting of 17 instructions written to find the highest proper factor of 2^{18} (262,144) by trying every integer from $2^{18} - 1$ downwards. The program ran for 52 minutes before producing the correct answer of 131,072."

A group of volunteers decided to undertake building the replica in 1995 at the University of Manchester. When they couldn't locate original parts, they used parts from the same time period as those used by Baby. They were able to execute their first program in 1998 – the 50th anniversary of Baby.

Figure 1 – Plaque acknowledging Baby's rebuilding.

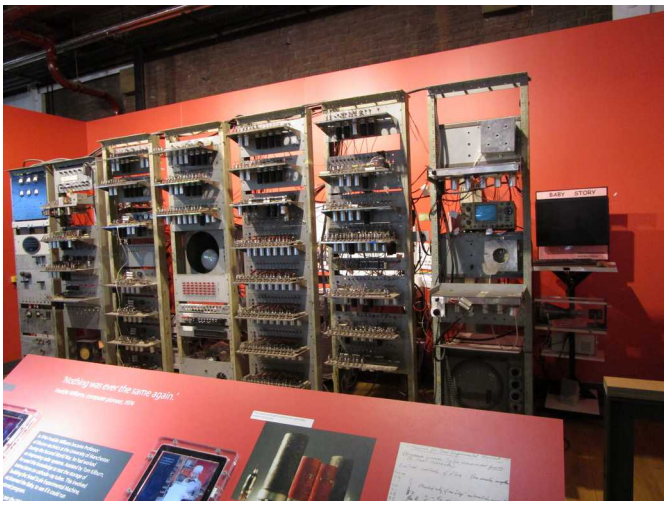


Figure 2 – Seven racks comprise Manchester Baby.

Note: There are two Williams-Kilburn tubes in the middle of the center and rightmost racks.

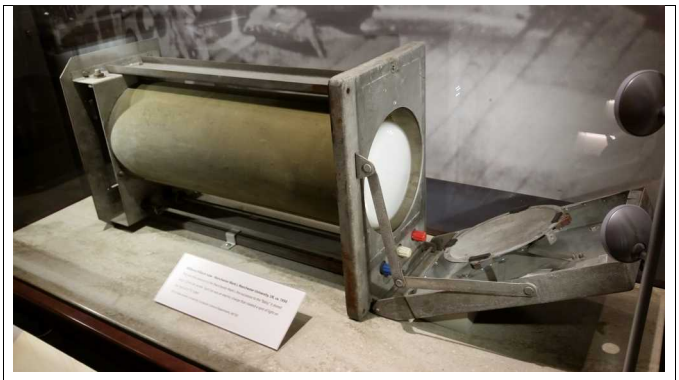


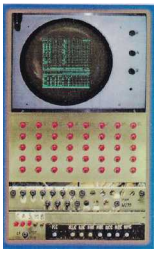
Figure 3 – Above is a picture of the Williams-Kilburn tube memory which is part of the Computer History Museum's artifacts and is currently on display in the Early Computers gallery.

In light of the 1401 restoration efforts, it was interesting to talk with the MOSI volunteers about how they sourced parts for the replica. There were lots of similarities in their techniques – tech stores, engineering slight of hand to make replacements, and some luck too.

An interesting discovery is that there is a simulator for Baby. Which runs on-line. The instructions for its setup and use are on the web.

Baby Info!

How to set up and use the simulator
http://goo.gl/HG6a6d
For the online simulator
www.davidsharp.com/baby
More Manchester computer history
www.computer50.org
www.digital60.org



Recent Acquisitions

CHRIS GARCIA

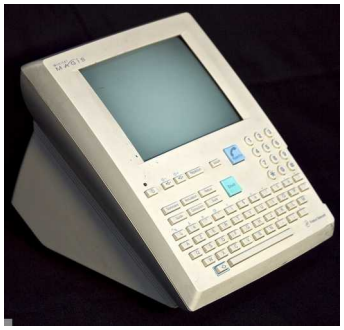
Wavetracer, Inc., Zephyr Model 4 Massively Parallel Personal Supercomputer, US, 1991
Designed for use in the physical sciences, Zephyr was a massively-parallel desk-side supercomputer. It came in two models, with 4,096 and 8,192 custom SIMD processors, and gave very high performance in a small physical space - roughly the size of a “tower”-style personal computer. The Model 4 could deliver up to 350 MIPS (million instructions-per-second) of performance and cost $85,000; the Model 8 up to 700 MIPS performance for $150,000. The system was programmed in a special version of the C programming language called Multi-C that was optimized for producing massively parallel code. Sales were poor and Wavetracer went out of business only two years later.

Gift of Shannon Steinfadt, 102741568

Peter Samson’s Music Player source code, US, 1965
Peter Samson, in addition to being one of the Museum’s most active volunteers, also developed several important pieces of software dating back to the late 1950s. MIT’s TX-0 computer (1956) was a groundbreaking system that introduced innovations many important in multimedia computing, including a music-playing program Samson wrote that used TX-0’s speaker to play melodies. Samson later wrote music players for various Digital Equipment Corporation (DEC) computer systems, including the PDP-7, -8, and -15. Tom McMahon donated a collection of materials related to Peter’s music player, including hand-written notes and diagrams. Peter later designed the System Concepts Digital Synthesizer, which is affectionately-known as the Samson Box.

Gift of Tom McMahon, X7573.2016

France Telecom, Magis Minitel terminal, France, ca. 1995
France’s Minitel system, fully deployed by 1982, connected millions of French citizens to a nationwide text-based computer network by the early 1980s. The system allowed users to look up telephone numbers, purchase train tickets, check stock prices, and access message boards covering a huge range of topics. Minitel-like teletext networks spread to other countries as well, though it never achieved the penetration it had in France. The Magis line of Minitel terminals was released in the mid-1990s, and included a built-in smart chip bank and credit card reader. The Minitel system was closed down in 2012.
Gift of Gerard Ladoux, X7570.2016



Computer in French

JIM STRICKLAND

A visitor stopped me after a tour and said, “You said you were with IBM. Well, do you know where the French word for computer came from?”

I said I did not and he went on, “In France, they don't want to 'import' English words, they want to have French words for new things. And IBM came up with the word 'ordinateur' as the word for computer and convinced the government to use that word. It was meant to signify “bringing order out of chaos” as God did, to give it a semi-religious aspect. And the Spanish pretty much copied that word.”

That sounded strange to me but Wikipedia tells a similar story. (The following is translated by Google from the French with some editing.)

> The word ”ordinateur" was introduced by IBM France in 1955 after François Girard, then responsible for the company's advertising department, had the idea to consult his former professor of literature in Paris, Jacques Perret, asking him to propose a French name for its new electronic machine for processing information (the IBM 650), not using the literal translation of the English word "computer" ("calculateur" or "calculatrice"), which at that time was mostly reserved for scientific machines.
>
> The professor proposed a compound word centered around d'ordonnateur'--he who puts in order, which also had the notion of ecclesiastical orders in the Catholic Church (ordaination).
>
> IBM France retained the word 'ordinateur' and planned at first to protect the name as a trademark. But the word was quickly adopted by users and IBM France decided after a few months to leave it in the public domain.

I couldn't find a similar story about Spain, but the word for computer in Spain is the very similar--ordenador, though the word computadora seems to be used in Latin

America. Its gender, in French and Spanish, is masculine.

Which brings up the old joke.

A Spanish teacher was explaining to her class that in French, unlike English, nouns are designated as either masculine or feminine.

"House," for instance, is feminine: "la maison."

"Pencil," however, is masculine: "le crayon."

A student asked, "What gender is 'computer'?"

Instead of giving the answer, the teacher split the class into two groups, male and female, and asked them to decide for themselves whether 'computer" should be a masculine or a feminine noun. Each group was asked to give four reasons for its recommendation.

The men's group decided that "computer" should definitely be of the feminine gender because:

1. No one but their creator understands their internal logic;
2. The native language they use to communicate with other computers is incomprehensible to everyone else;
3. Even the smallest mistakes are stored in long term memory for possible later retrieval; and
4. As soon as you make a commitment to one, you find yourself spending half your paycheck on accessories for it.

The women's group, however, concluded that computers should be masculine because:

1. In order to do anything with them, you have to turn them on;
2. They have a lot of data but still can't think for themselves;
3. They are supposed to help you solve problems, but half the time they ARE the problem; and
4. As soon as you commit to one, you realize that if you had waited a little longer, you could have gotten a better model.

(It is masculine. Son ordinateur – *His computer.)*

A recent visitor told me that he was student at UCLA in 1963 and he worked part-time in the computer science department. Now, it seems that every year UCLA has an “Ugliest Man on Campus” contest. And in 1963, the computer science department entered and won! The ugliest man on campus was an IBM 729 tape drive!

He said that the mouth they painted on helped but he thought it was the mustache that they attached that gave it the title.

Coming Events **(Click for details)**

Date	Day	Time	Event
Sept 17	Thur.	7:00 PM Program 8:30 PM Adjourn	Medium's Evan Williams & Steven Levy in Conversation with John Hollar. John Hollar, a former journalist himself, will sit down for an in-depth conversation with Medium's CEO Evan Williams, and the editor-in-chief of its tech hub Backchannel, Steven Levy
Sept. 22	Thur.	7:00 Program 8:30 Book signing	SuperBetter Author Jane McGonigal in Conversation with NPR’s Laura Sydell SUPERBETTER: A Revolutionary Approach to Getting Stronger, Happier, Braver and More Resilient - Powered by the Science of Games
Sept 24	Thur.	7:00 PM	MIT's Cynthia Breazeal and Microsoft Research's Eric Horvitz - two leaders in the field of artificial intelligence in a conversation with Museum CEO John Hollar to explore and update us on the challenge and promise of artificial intelligence.
Sept 26 Sept 27 Oct 17 Nov. 14	Sat. Sun. Sat. Sat.	9:30 AM Check in 10:00 AM Program starts 12:30 PM Lunch 3:00 PM End	Broadcom Presents: Design_Code_Build Broadcom Presents Design_Code_Build is a program of interactive STEM (Science, Technology, Engineering and Math) events led by the Computer History Museum.
Nov. 4	Wed.	7:00 PM 8:30 PM Book Signing	Hodding Carter III with Museum CEO John Hollar: Journalism After Snowden
Jan. 14	Thur.	7:00 PM 8:30 End	An Evening with the U.S. Digital Service Team Speakers from the U.S. Digital Services Team which is part of the Office of Management and Budget, in conversation with John Hollar.