

APIs of the Future: Are You Ready?

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The
Pragmatic
Programmers

Design and Build Great Web APIs

Robust, Reliable, and Resilient



Mike Amundsen
edited by Katharine Dvorak

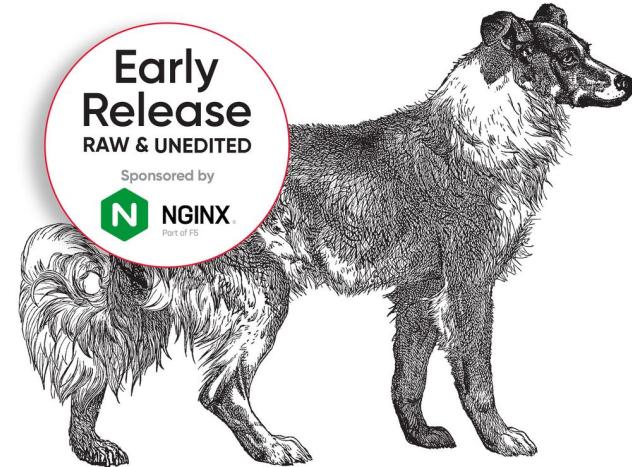
O'REILLY®

Continuous API Management

Making the Right Decisions in
an Evolving Landscape

Early
Release
RAW & UNEDITED

Sponsored by
 NGINX®
Part of F5



Mehdi Medjaoui, Erik Wilde,
Ronnie Mitra & Mike Amundsen

2nd Edition

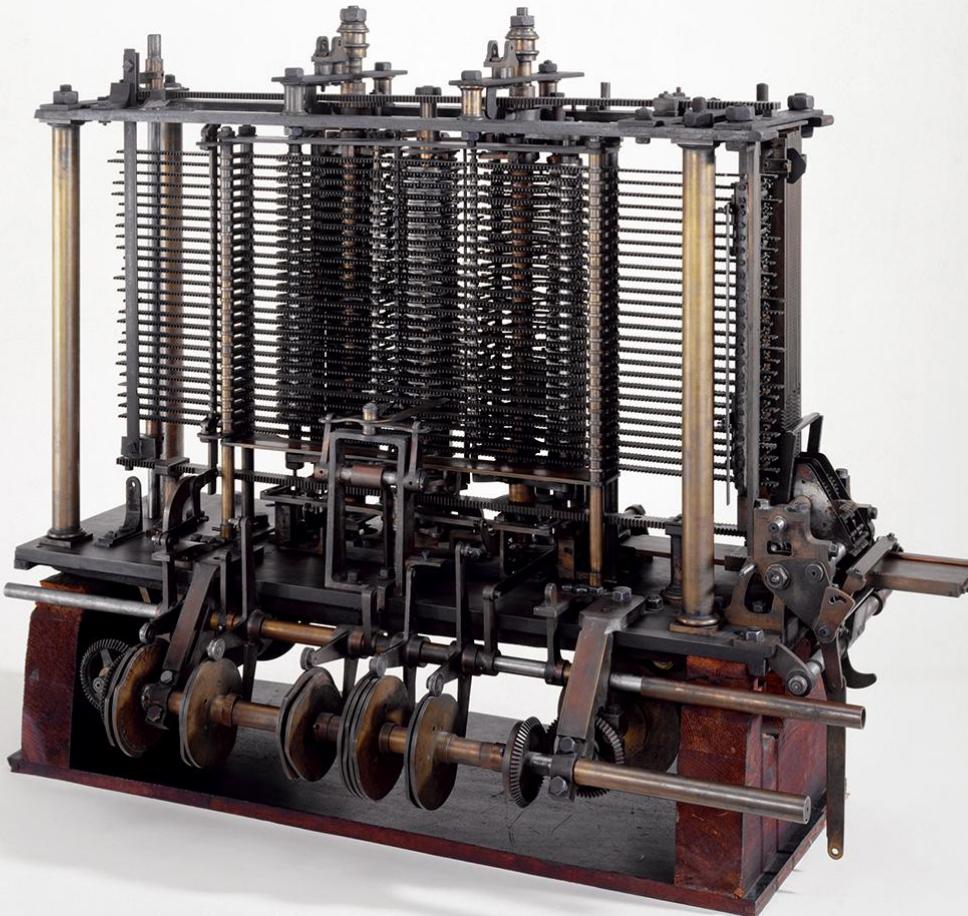
APIs of the Future: Overview

- The First Age of Computing : Where we were
- The Second Age of Computing : Where we are
- The Third Age of Computing: Where we're going
- And So...





Where We Were
1850-1950

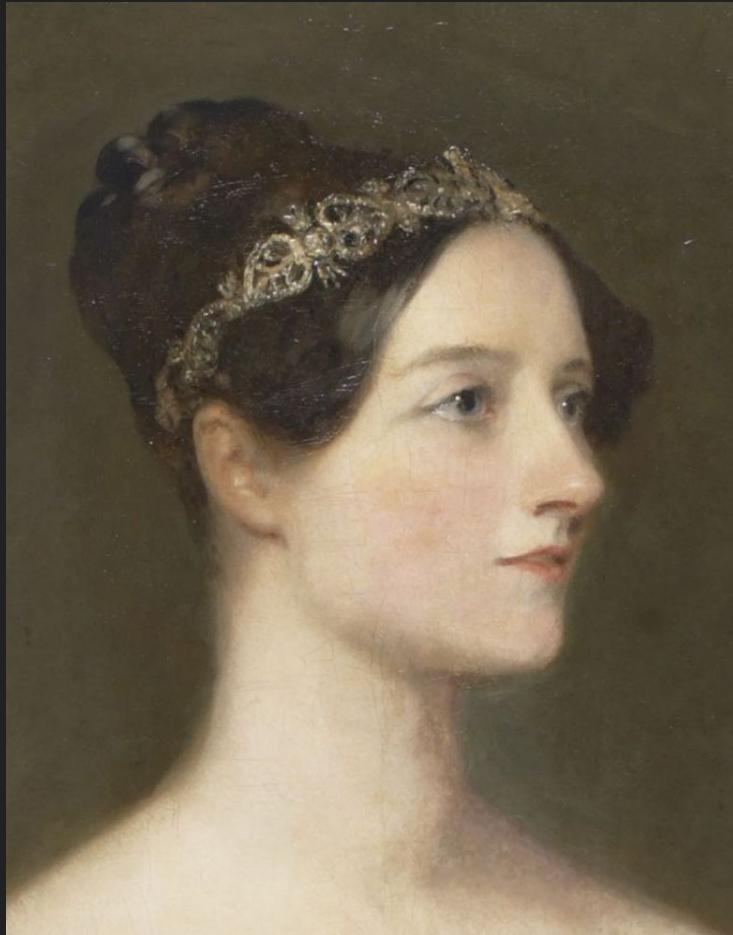


By Science Museum London / Science and Society Picture Library - Babbage's Analytical Engine, 1834-1871. Uploaded by Mrjohncummings, CC BY-SA 2.0, <https://commons.wikimedia.org/w/index.php?curid=28024313>

Diagram for the computation by the Engine of the Numbers of Bernoulli. See Note G. (page 722 et seq.)

Number of Operation.	Nature of Operation.	Variables acted upon.	Variables receiving results.	Indication of change in the value on any Variable.	Statement of Results.	Data.					Working Variables.										Result Variables.					
						IV_1	IV_2	IV_3	IV_4	IV_5	IV_6	IV_7	IV_8	IV_9	IV_{10}	IV_{11}	IV_{12}	IV_{13}	IV_{14}	IV_{15}	IV_{16}	IV_{17}	IV_{18}	IV_{19}	IV_{20}	
1	\times	$\text{IV}_2 \times \text{IV}_3$	$\text{IV}_4, \text{IV}_5, \text{IV}_6$	$\begin{cases} \text{IV}_2 = \text{IV}_2 \\ \text{IV}_3 = \text{IV}_3 \\ \text{IV}_4 = \text{IV}_4 \\ \text{IV}_5 = \text{IV}_5 \\ \text{IV}_6 = \text{IV}_6 \end{cases}$	$= 2n$	1	2	n	2n	2n	2n															
2	$-$	$\text{IV}_4 - \text{IV}_1$	IV_2	$\begin{cases} \text{IV}_4 = \text{IV}_4 \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= 2n - 1$	1			2n - 1																	
3	$+$	$\text{IV}_6 + \text{IV}_1$	IV_5	$\begin{cases} \text{IV}_6 = \text{IV}_6 \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= 2n + 1$	1				2n + 1																
4	$+$	$2\text{V}_6 + 2\text{V}_4$	IV_{11}	$\begin{cases} 2\text{V}_6 = 0\text{V}_6 \\ 2\text{V}_4 = 0\text{V}_4 \end{cases}$	$= 2n + 1$				0	0										
5	\div	$\text{IV}_{11} - \text{IV}_2$	IV_{11}	$\begin{cases} \text{IV}_{11} = 2\text{V}_{11} \\ \text{IV}_2 = 1\text{V}_2 \end{cases}$	$= \frac{2n - 1}{2n + 1}$		2																			
6	$-$	$\text{IV}_{13} - \text{IV}_{11}$	IV_{12}	$\begin{cases} \text{IV}_{13} = 2\text{V}_{13} \\ \text{IV}_{11} = 2\text{V}_{11} \end{cases}$	$= -\frac{1}{2} \cdot \frac{2n - 1}{2n + 1} = \Lambda_0$																					
7	$-$	$\text{IV}_8 - \text{IV}_1$	IV_{10}	$\begin{cases} \text{IV}_8 = \text{IV}_8 \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= n - 1 (= 3)$	1		n																		
8	$+ \text{IV}_2 + 0\text{V}_7$	IV_7		$\begin{cases} \text{IV}_2 = \text{IV}_2 \\ 0\text{V}_7 = 0\text{V}_7 \end{cases}$	$= 2 + 0 = 2$		2									2										
9	$+ \text{IV}_6 + \text{IV}_7$	IV_{11}		$\begin{cases} \text{IV}_6 = \text{IV}_6 \\ \text{IV}_7 = \text{IV}_7 \end{cases}$	$= \frac{2n}{2} = \Lambda_1$						2n	2														
10	$\times \text{IV}_{21} \times 3\text{V}_{11}$	IV_{12}		$\begin{cases} \text{IV}_{21} = \text{IV}_{21} \\ 3\text{V}_{11} = 3\text{V}_{11} \end{cases}$	$= \text{B}_1 \cdot \frac{2n}{2} = \text{B}_1 \Lambda_1$																					
11	$+ \text{IV}_{12} + \text{IV}_{13}$	IV_{13}		$\begin{cases} \text{IV}_{12} = 0\text{V}_{12} \\ \text{IV}_{13} = 2\text{V}_{13} \end{cases}$	$= -\frac{1}{2} \cdot \frac{2n - 1}{2n + 1} + \text{B}_1 \cdot \frac{2n}{2}$																					
12	$- \text{IV}_{10} - \text{IV}_1$	IV_{10}		$\begin{cases} \text{IV}_{10} = 2\text{V}_{10} \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= n - 2 (= 2)$	1																				
13	$- \text{IV}_6 - \text{IV}_1$	IV_6		$\begin{cases} \text{IV}_6 = 2\text{V}_6 \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= 2n - 1$	1					2n - 1															
14	$+ \text{IV}_1 + \text{IV}_7$	IV_7		$\begin{cases} \text{IV}_1 = \text{IV}_1 \\ \text{IV}_7 = 2\text{V}_7 \end{cases}$	$= 2 + 1 = 3$	1						3														
15	$+ 2\text{V}_6 + 2\text{V}_7$	IV_8		$\begin{cases} 2\text{V}_6 = 2\text{V}_6 \\ 2\text{V}_7 = 2\text{V}_7 \end{cases}$	$= \frac{2n - 1}{3}$						2n - 1	3	$\frac{2n - 1}{3}$													
16	$\times \text{IV}_8 \times 3\text{V}_{11}$	IV_{11}		$\begin{cases} \text{IV}_8 = 0\text{V}_8 \\ 3\text{V}_{11} = 3\text{V}_{11} \end{cases}$	$= \frac{2n}{2} \cdot \frac{2n - 1}{3}$						0															
17	$- 2\text{V}_6 - \text{IV}_1$	IV_6		$\begin{cases} 2\text{V}_6 = 2\text{V}_6 \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= 2n - 2$	1																				
18	$+ \text{IV}_1 + 2\text{V}_7$	IV_7		$\begin{cases} \text{IV}_1 = \text{IV}_1 \\ 2\text{V}_7 = 3\text{V}_7 \end{cases}$	$= 3 + 1 = 4$	1																				
19	$+ 2\text{V}_6 - 3\text{V}_7$	IV_9		$\begin{cases} 2\text{V}_6 = 2\text{V}_6 \\ 3\text{V}_7 = 3\text{V}_7 \end{cases}$	$= \frac{2n - 2}{4}$																					
20	$\times \text{IV}_9 \times \text{IV}_{11}$	IV_{11}		$\begin{cases} \text{IV}_9 = 0\text{V}_9 \\ 3\text{V}_{11} = 3\text{V}_{11} \end{cases}$	$= \frac{2n}{2} \cdot \frac{2n - 1}{4} \cdot \frac{2n - 2}{4} = \Lambda_3$																					
21	$\times \text{IV}_{22} \times 3\text{V}_{12}$	IV_{12}		$\begin{cases} \text{IV}_{22} = 0\text{V}_{22} \\ 3\text{V}_{12} = 3\text{V}_{12} \end{cases}$	$= \text{B}_3 \cdot \frac{2n}{2} \cdot \frac{2n - 1}{3} \cdot \frac{2n - 2}{3} = \text{B}_3 \Lambda_3$																					
22	$+ \text{IV}_{12} + 2\text{V}_{13}$	IV_{13}		$\begin{cases} \text{IV}_{12} = 0\text{V}_{12} \\ 2\text{V}_{13} = 3\text{V}_{13} \end{cases}$	$= \Lambda_0 + \text{B}_1 \Lambda_1 + \text{B}_3 \Lambda_3$																					
23	$- 2\text{V}_{16} - \text{IV}_1$	IV_{16}		$\begin{cases} 2\text{V}_{16} = 2\text{V}_{16} \\ \text{IV}_1 = \text{IV}_1 \end{cases}$	$= n - 3 (= 1)$	1																				
24	$+ \text{IV}_{13} + 0\text{V}_{24}$	IV_{24}		$\begin{cases} \text{IV}_{13} = 0\text{V}_{13} \\ 0\text{V}_{24} = 0\text{V}_{24} \end{cases}$	$= \text{B}_7$																					
25	$+ \text{IV}_1 + \text{IV}_3$	IV_3		$\begin{cases} \text{IV}_1 = \text{IV}_1 \\ \text{IV}_3 = \text{IV}_3 \end{cases}$	$= n + 1 = 4 + 1 = 5$	1		$n + 1$			0	0														

Here follows a repetition of Operations thirteen to twenty-three.



*"We may say most aptly that
the Analytical Engine weaves
algebraic patterns just as the
Jacquard-loom weaves
flowers and leaves."*

Ada Lovelace (1815 - 1852)



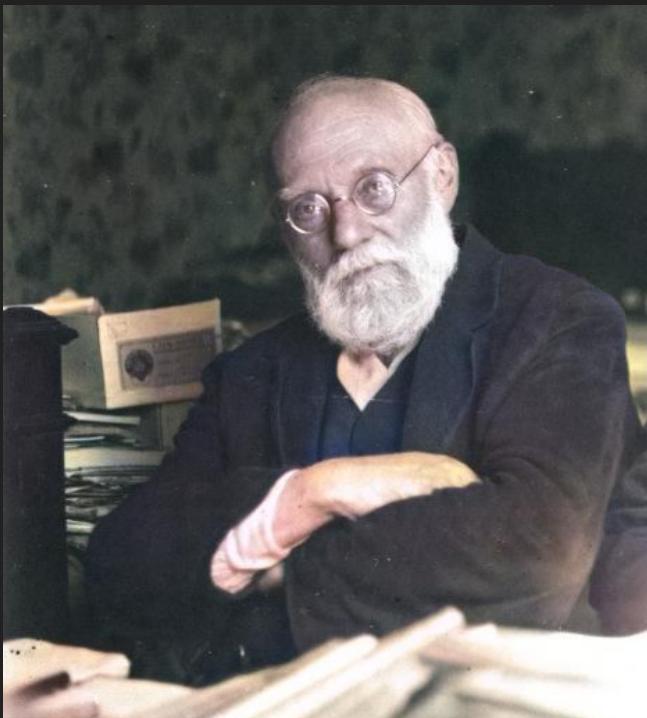
By ArtProf - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=18564683>



*"[Debugging] is damnably
troublesome work, and
plagues me."*

Ada Lovelace (1815 - 1852)

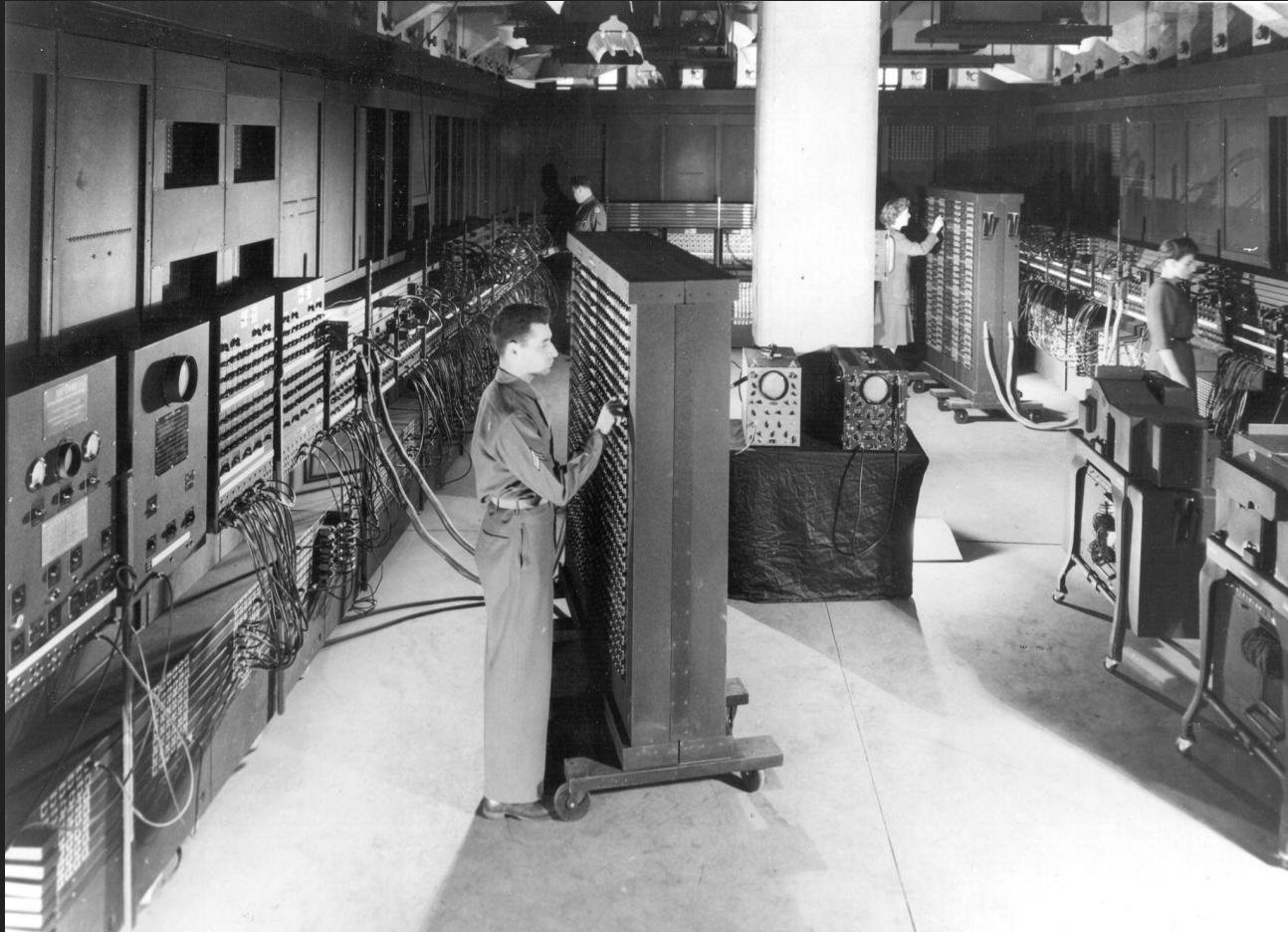
A moving image of the world



"From a distance, everyone will be able to read text, enlarged and limited to the desired subject, projected on an individual screen."

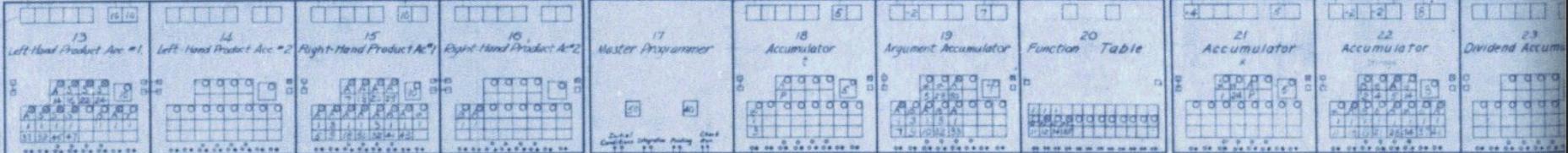
Paul Otlet (1868 - 1944)





By Unidentified U.S. Army photographer - Image from Historic Computer Images, Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=26253110>

DRAWING NUMBER PX-1-82 PANEL DIAGRAM OF THE ELECTRONIC NUMERICAL INTEGRATOR AND COMPUTER (SHOWING THE EXTERIOR BALLISTICS EQUATIONS SETUP - HE



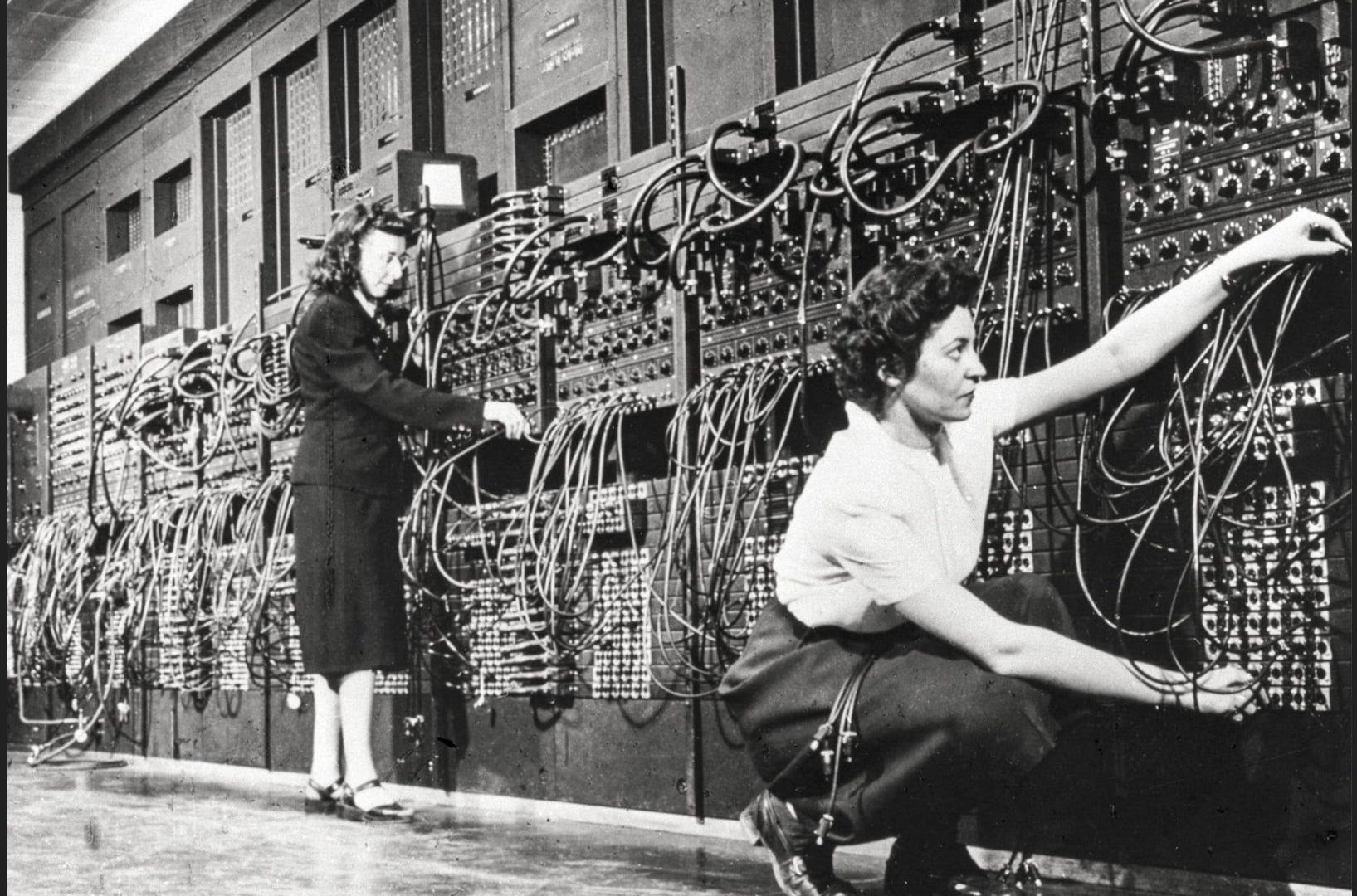
The "ENIAC Six" -- 1946

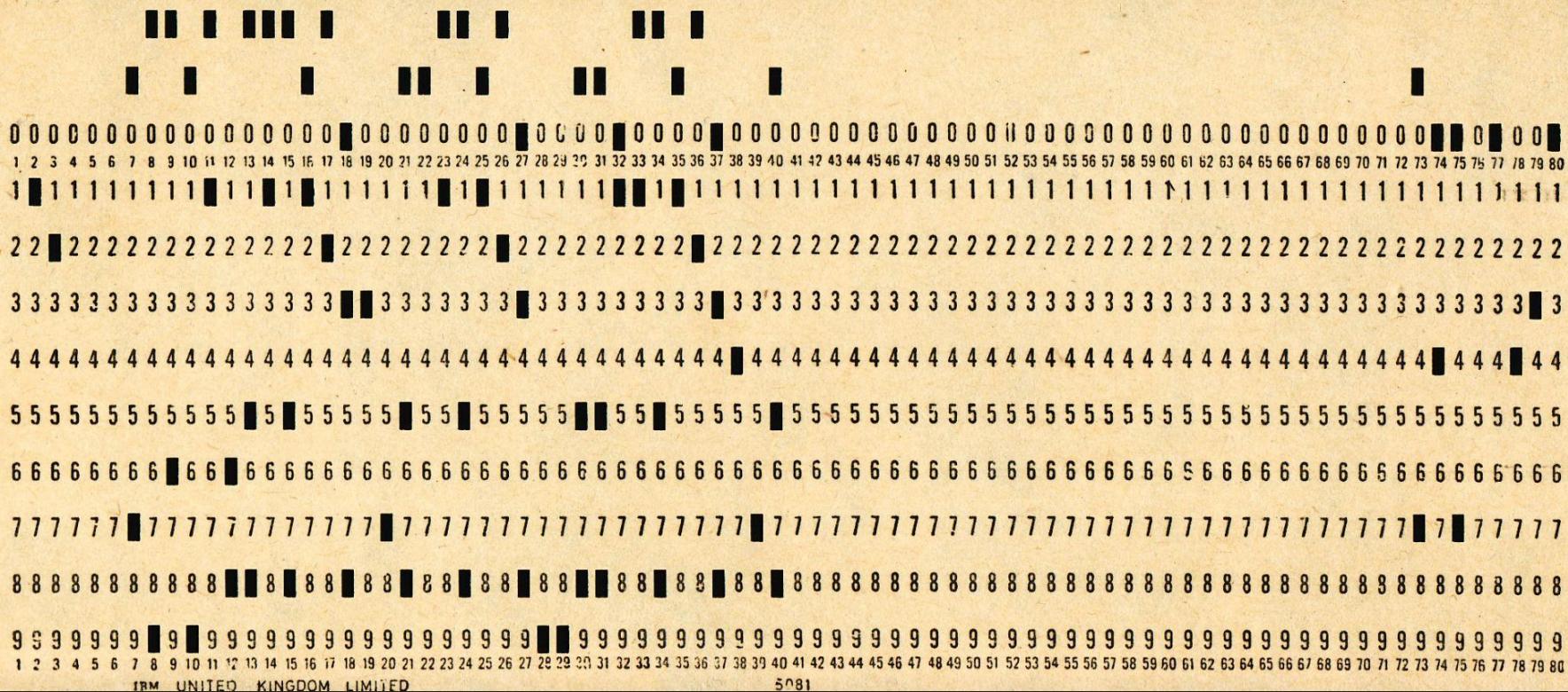


- *Betty Snyder Holberton*
- *Jean Jennings Bartik*
- *Kay McNulty Mauchly Antonelli*
- *Marlyn Wescoff Meltzer*
- *Ruth Lichterman Teitelbaum*
- *Frances Bilas Spence*

"The Computers: The Remarkable Story of the ENIAC Programmers" -- Kathy Kleiman

<https://vimeo.com/ondemand/eniac6>







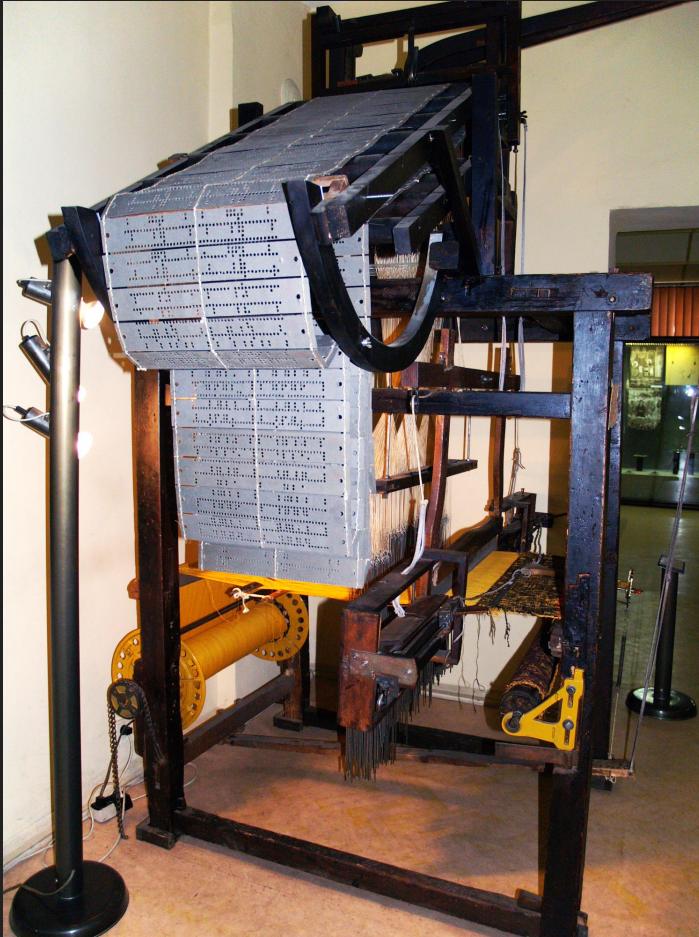
By NASA - Great Images in NASA Description, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=6455009>

Dorothy Vaughan (1910 - 2008)



"We're going to need a lot of manpower to program that beast [the IBM 7090]."

*-- Dorothy Vaughan
Mathematician
FORTRAN expert*

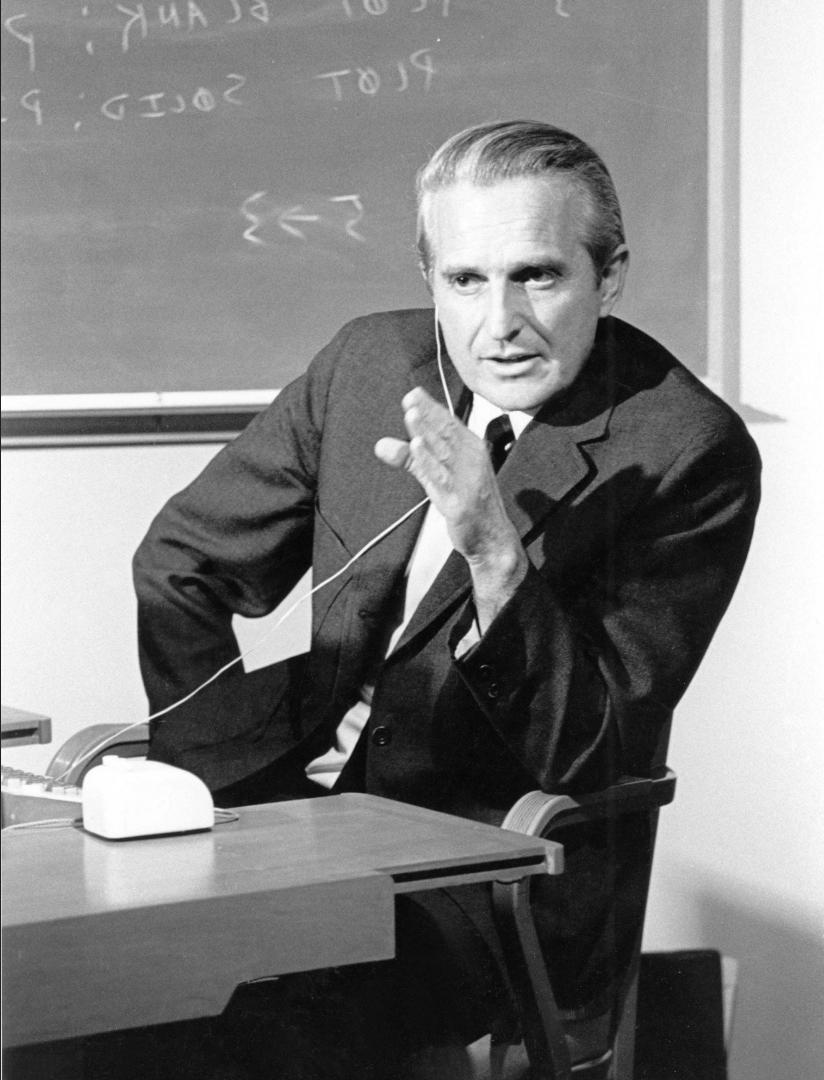


By Edal Anton Lefterov - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=11959365>

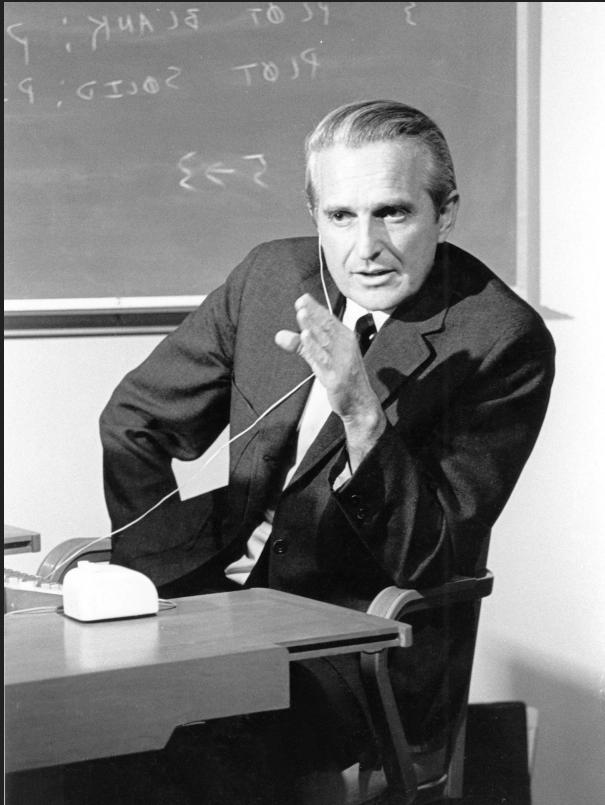
Where We Are 1950-2050



Demo Day 1968

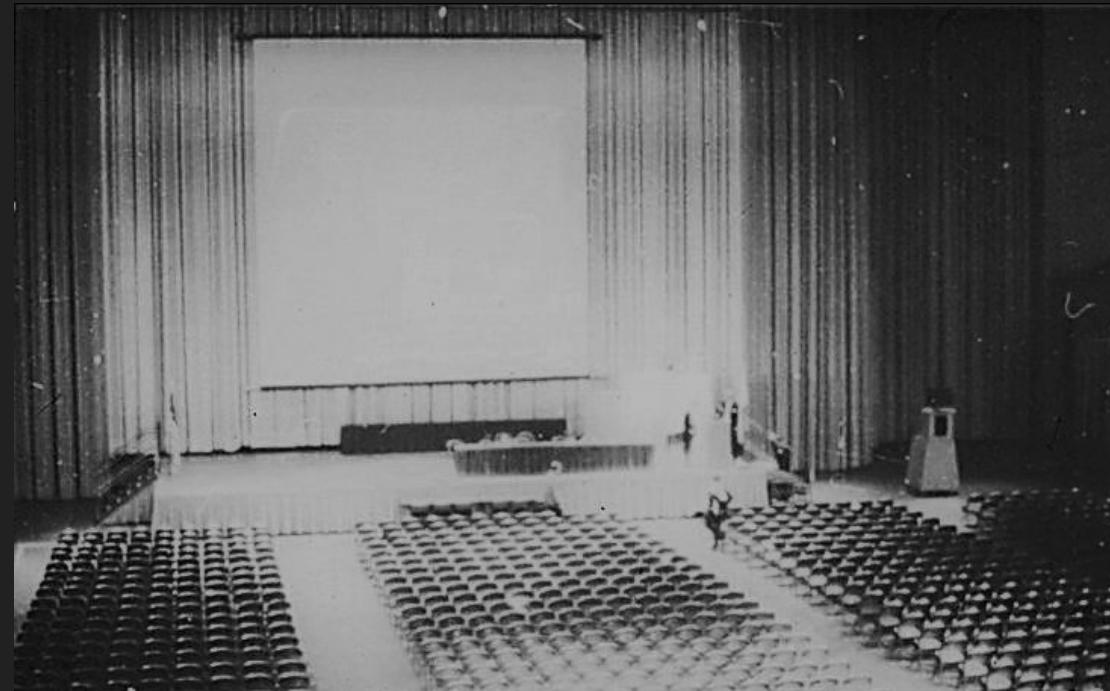


Technology should not aim to replace humans, rather amplify human capabilities.



"In 20 or 30 years, you'll be able to hold in your hand as much computing knowledge as exists now in the whole city, or even the whole world."

— *Doug Engelbart (1925 - 2013)*



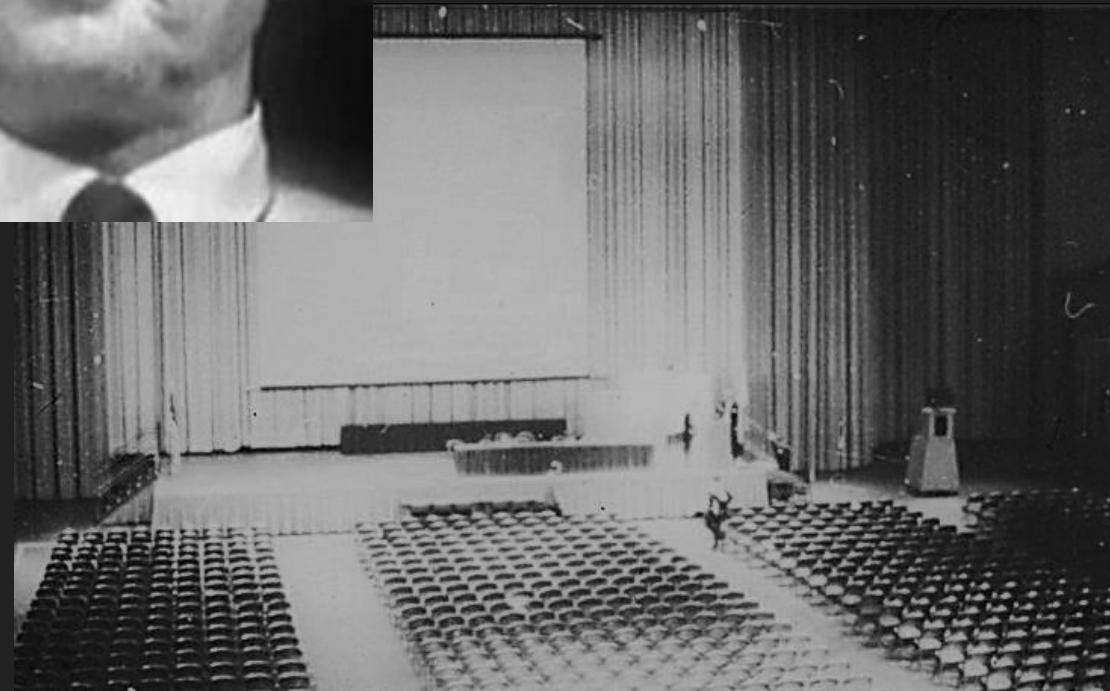
APPLES
BANANAS
CARROTS
LETTUCE
BEANS

CANS

APPLE SAUCE
BEAN SOUP
TOMATO SOUP

CEREALS

BREAD
NOODLES (ELBOW KIND)
FRENCH BREAD
COLD LOCKER
MILK



APPLES
BANANAS
CARROTS
LETTUCE
BEANS

CANS

APPLE SAUCE
BEAN SOUP
TOMATO SOUP
CEREALS
BREAD
NOODLES ILL
FRENCH BREAD
COLD LOCKER
MILK



- **Realtime multi-cursor, in-place editing**
- **Point-and-click, drag-and-drop, cut-and-paste**
- **Hyperlinking and hypermedia**
- **Intelligent outline-based editing**
- **Text messaging**
- **Live video & text editing on the same screen**
- **Revision control**
- **and more...**



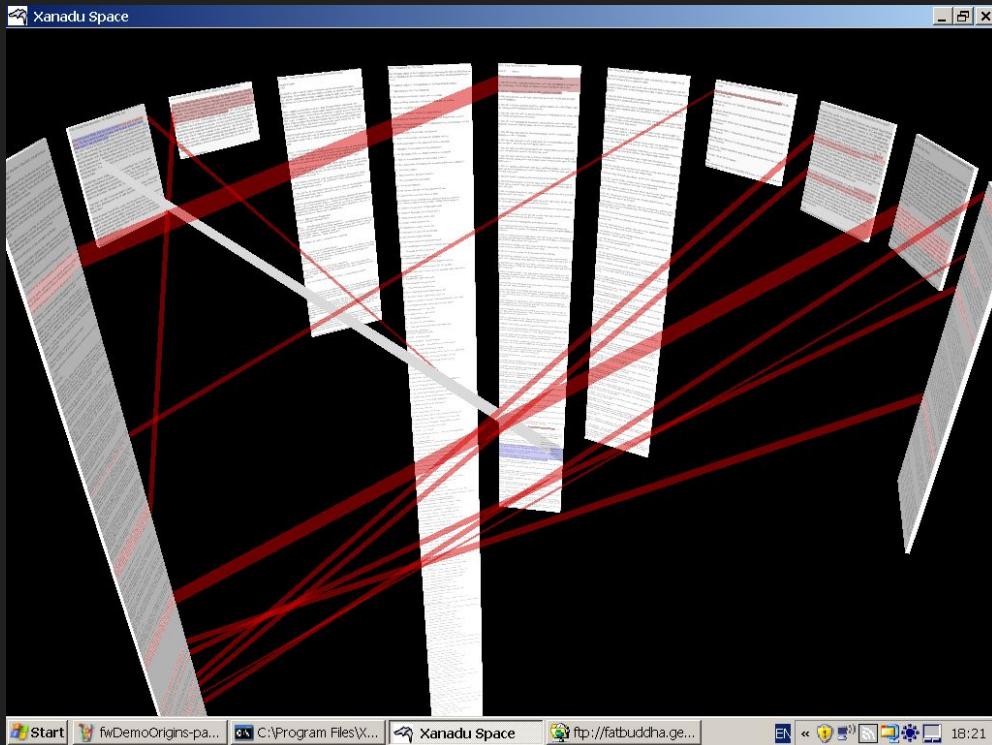
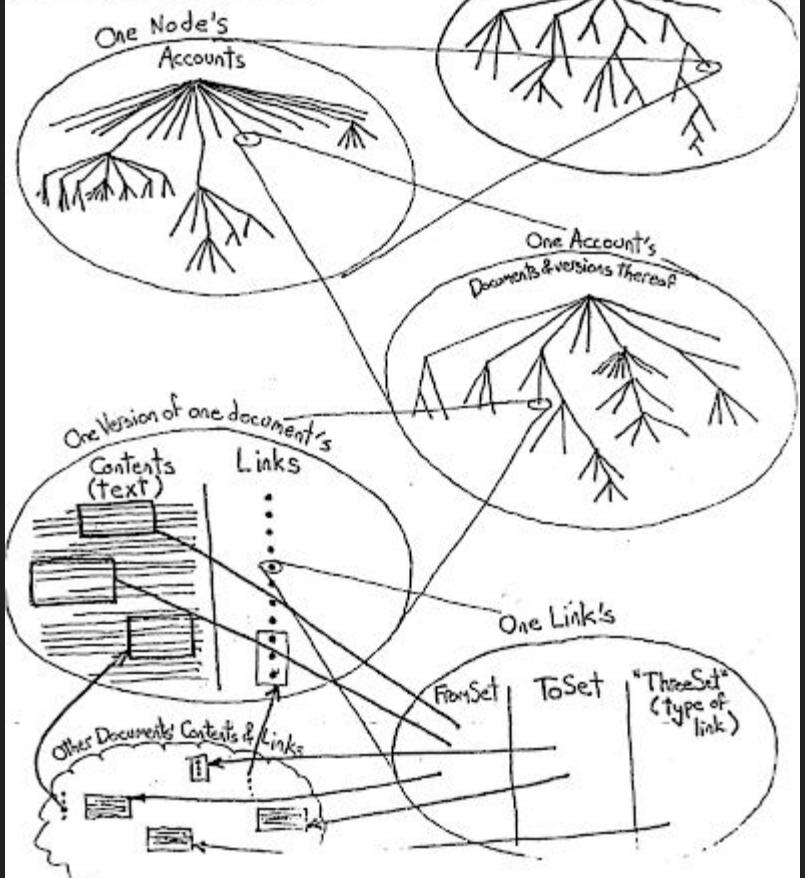
We should not impose regularity.



"The point was to be able to have a medium that would record all the connections and all the structures and all the thoughts that paper could not."

-- *Ted Nelson (1937 --)*

The Structure of the Xanadu™ Docuverse ©1983 Steve Wilham

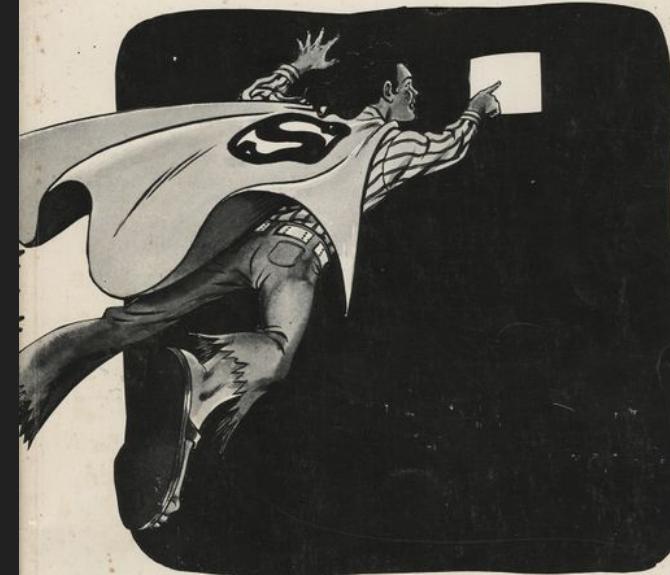


You can and must understand computers NOW.

COMPUTER



DREAM MACHINES



New Freedoms Through Computer Screens
— a Minority Report

This is the flip side of Computer Lib.

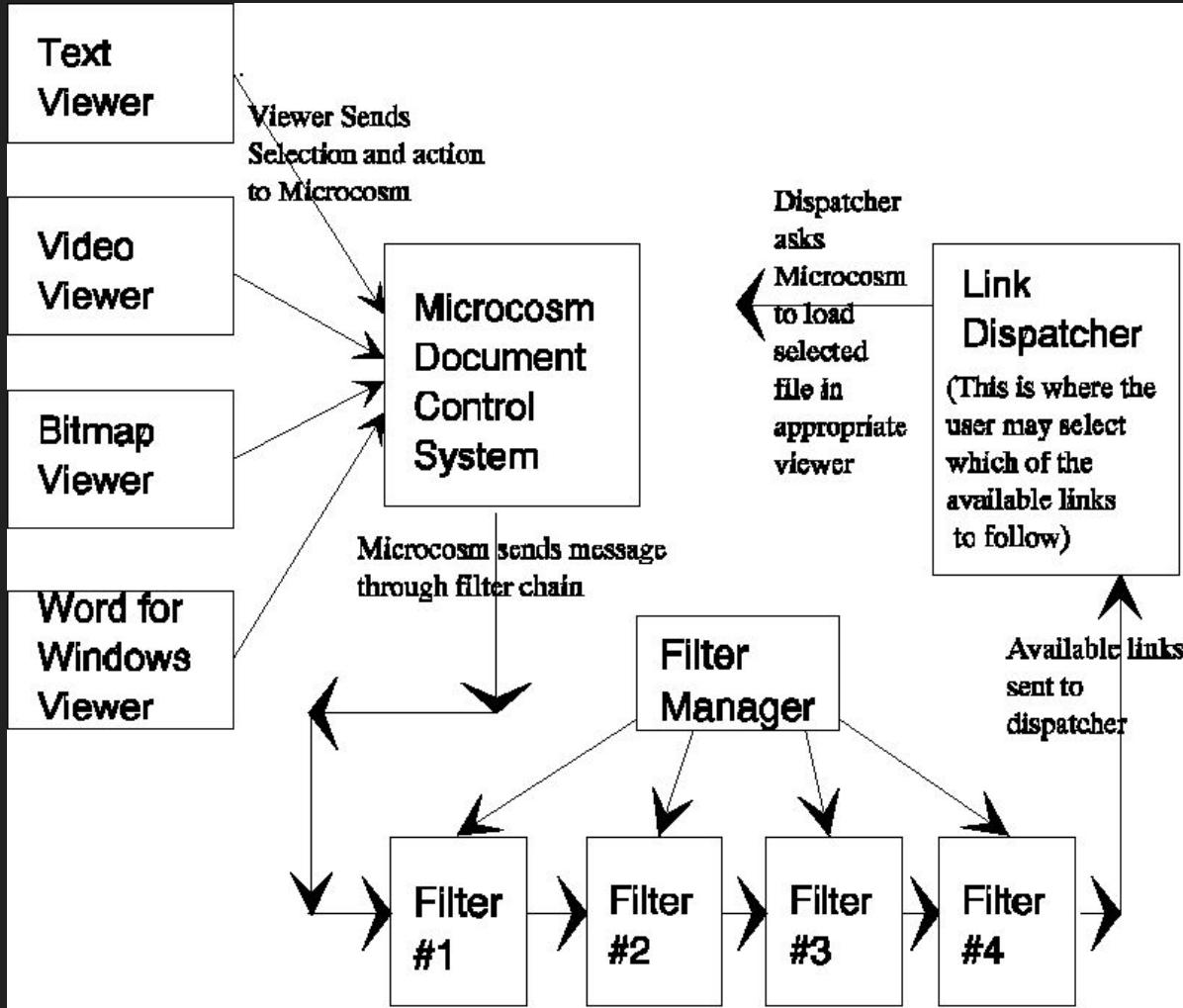
The whole foundation of hypertext is collaborative



"The strength of the internet is its global interconnection."

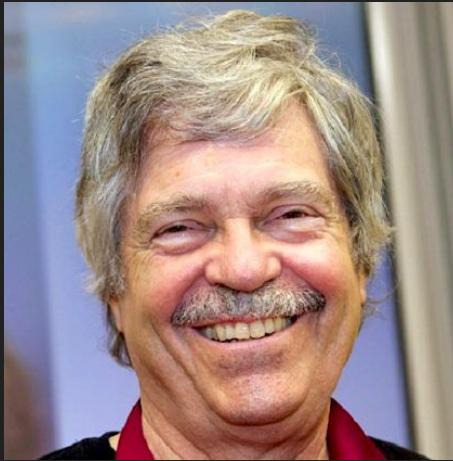
-- Dame Wendy Hall (1952 --)



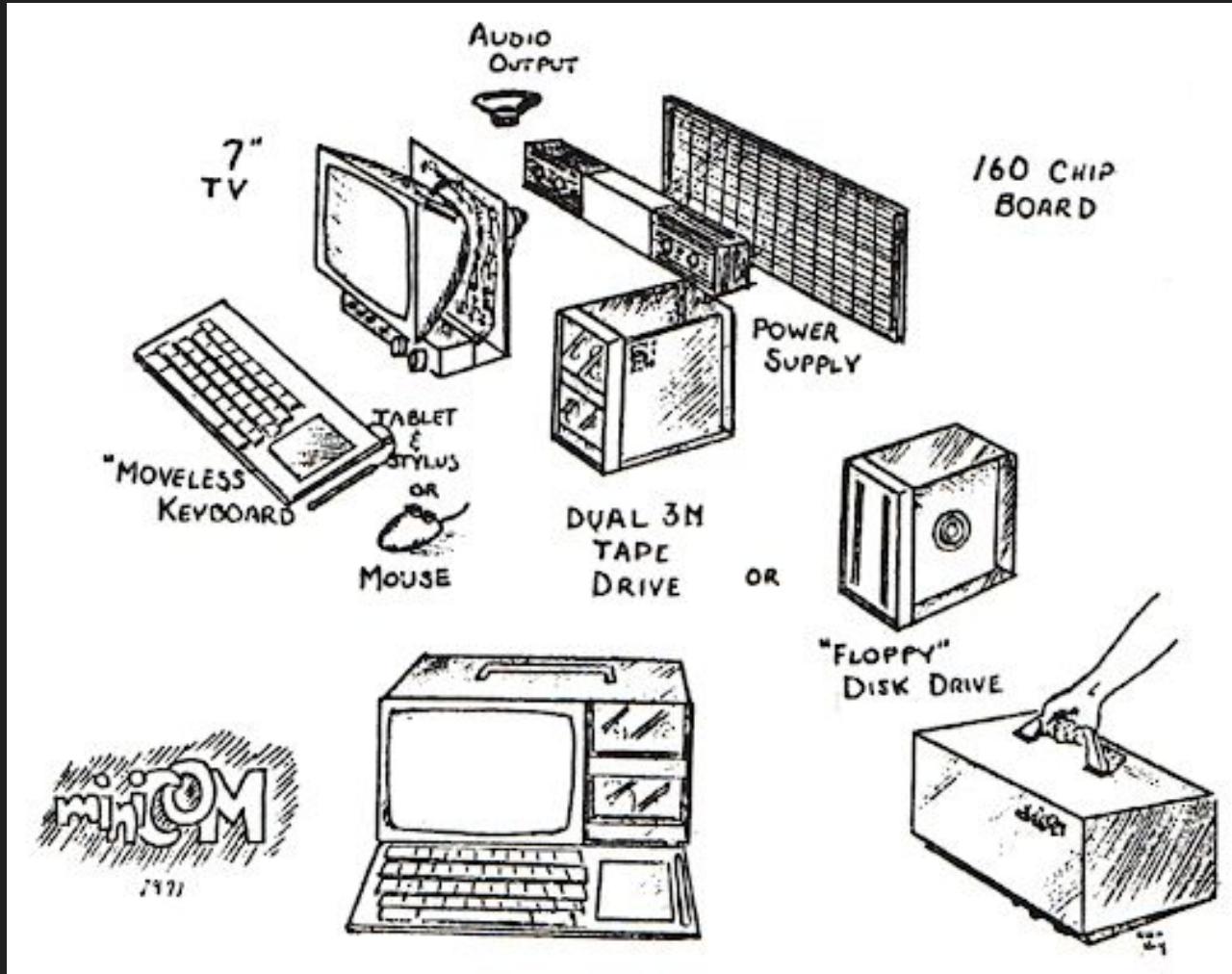


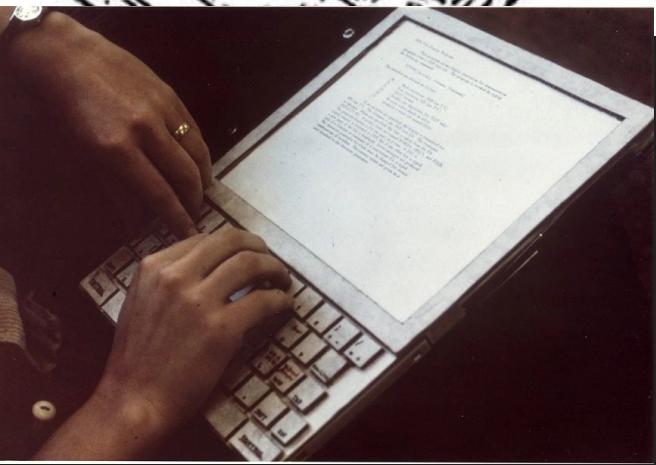


Adele Goldberg & Alan Kay -- 1970s



- *XEROX Parc*
- *Smalltalk Language*
- *Object-Oriented Programming*
- *Dynabook*





```
5 with Text_Io; use Text_Io;
6 with Ada.Integer_Text_Io; use Ada.Integer_Text_Io;
7
8 procedure bernoulli is
9   Bern: Integer:= 4;
10
11 begin
12   Put_Line("Which B(n) would you like to compute:");
13   Get(Bern);
14
15   declare
16     N: array(1..Bern+1) of Integer;
17     D: array(1..Bern+1) of Integer;
18     new_denom: Integer;
19     gcd_result: Integer;
20
21     function GCD (X, Y: Integer) return Integer is
22
23       X1: Integer:= X;
24       Y1: Integer:= Y;
25       Old_X : Integer;
26
27   begin
28
29     while (Y1 /= 0) loop
30       -- x, y := y, x mod y
31       Old_X := X1;
32       X1 := Y1;
33       Y1 := Old_X mod Y1;
34     end loop;
35
36     return X1;
37
38   end GCD;
39
```

W Wikipedia, the free e... en.wikipedia.org/wiki/Main_Page

Main Page Discussion Read View source View history Search

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the free encyclopedia that anyone can edit.
3,421,206 articles in English

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Biography Mathematics Technology
Geography Science All portals

Today's featured article

 The **SR Leader class** was a class of experimental 0-6-0 articulated steam locomotive, produced to the design of the innovative engineer Oliver Bulleid. Intended as a replacement for the ageing fleet of M7 class, the Leader was an attempt to extend the life of steam traction on the Southern Railway by eliminating many of the operational drawbacks associated with existing steam locomotives. Design work began in 1946, and development continued after the nationalisation of the railways in 1948, under the auspices of British Railways. The Leader project was part of Bulleid's desire to modernise the steam locomotive based on experience gained with the Southern Railway's fleet of electric stock. The design incorporated many novel features, such as the use of thermic siphons, bogies, and cabs at either end of the locomotive, resulting in its unique appearance. Several of its innovations proved to be unsuccessful however, partly accounting for the project's cancellation in the early 1950s. Five Leader locomotives were begun, although only one was completed. Problems with the design, indifferent reports on performance, and political pressure surrounding spiralling development costs, led to all locomotives of the class being scrapped by 1951. ([more...](#))

Recently featured: *Sherlock Holmes Baffled* – Australian Magpie – Terry Fox

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Did you know...

From Wikipedia's newest articles:

- ... that the Army general Maxwell Woodhull donated his **family home** (pictured) to George Washington University in Washington, D.C.?

In the news

- Italian authorities seize €23 million in assets from the **Institute for Works of Religion** in Vatican City amidst an investigation of alleged money laundering.
- The **King's Speech**, a historical drama film starring Colin Firth (pictured), wins the People's Choice Award at the 2010 Toronto International Film Festival.
- In the Swedish **general election**, the centre-right **Alliance** wins a plurality, while the far-right **Sweden Democrats** hold the balance of power.
- In Gaelic football, Cork **defeat** Down to win their seventh All-Ireland Senior Football Championship.
- French athlete **Philippe Croizon** becomes the first quadruple amputee to swim the English Channel, completing the challenge in less than 14 hours.
- In cycling, Italian Vincenzo Nibali **wins** the Vuelta a España.

[Wikinews](#) – [Recent deaths](#) – [More current events...](#)

On this day...

September 22: Mid-Autumn Festival in the Chinese lunar calendar (2010); **Sukkot** begins at sunset (Judaism, 2010); Independence Day in **Bulgaria** (1908) and **Mali** (1960); **Car-Free Day** in Europe and Canada; **OneWebDay**

- 1792 – The epoch of the **French Republican Calendar** occurred, marking the first full day of



By Maurizio Pesce from Milan, Italia - Acer Chromebook 11, CC BY 2.0, <https://commons.wikimedia.org/w/index.php?curid=50995982>

Where We Will Be 2050. ??



Let's Review...

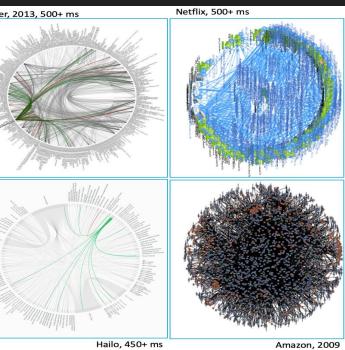
- Written instructions in tables (Lovelace) for mechanical computers (Babbage)
- Wiring diagrams (McNulty, etc.) for electrical relay computers (ENIAC)
- Punch cards (Vaughn) for electronic computers (IBM)
- Screen text (Engelbart) for connected semiconductor computers (Hall)



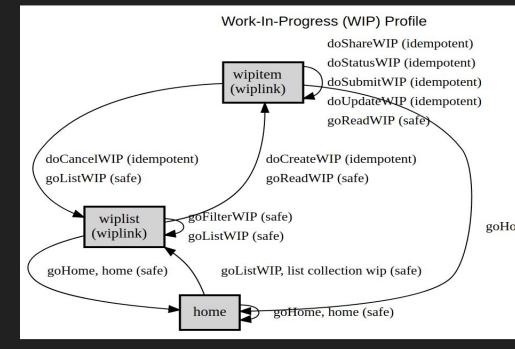
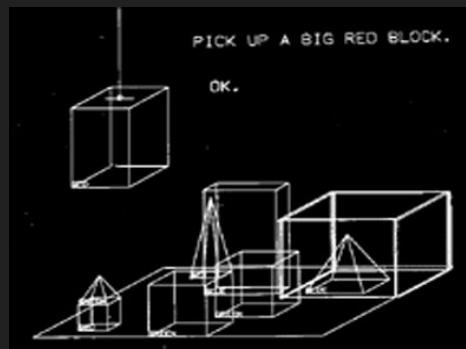
What's Next?

In the Future we will...

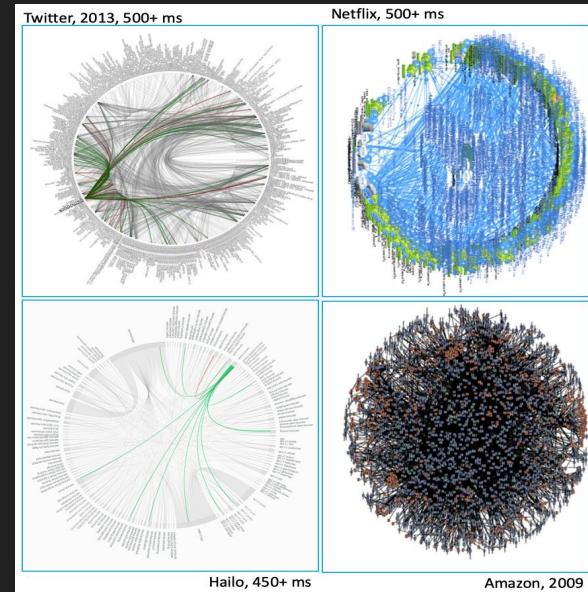
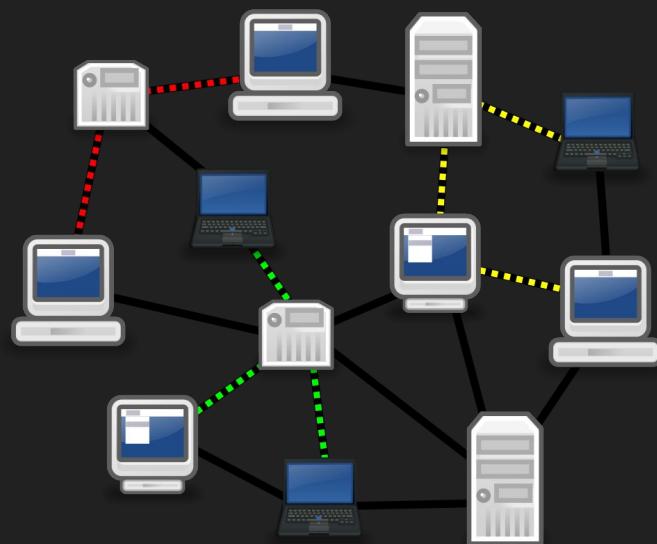
- **Connect** services the way we currently connect servers
- **Program** the network instead of single machines
- **Describe** problem spaces, not solutions
- Machines, endpoints, protocols and formats will "disappear"



```
1 # Get weekly groceries
2 # Load control data
3 #
4 CONFIG LOAD grocery.config
5
6 # find running services for shopping, shipping, & payment
7 REQUEST WITH-URL $$service-registry$$
8 CALL WITH-FORM search WITH-PARAMS {"name": "shopping-cart"}
9 STACK PUSH WITH-RESPONSE cart
10 CALL WITH-FORM search WITH-PARAMS {"name": "shipping"}
11 STACK PUSH WITH-RESPONSE shipping
12 CALL WITH-FORM search WITH-PARAMS {"name": "payment"}
13 STACK PUSH WITH-RESPONSE payment
14
15 # Load the cart, set delivery, and pay
16 CALL WITH-NAME fill-cart WITH-CONFIG $$shopping-items$$
17 CALL WITH-NAME shipping-address WITH-CONFIG $$home-address$$
18 CALL WITH-NAME submit-payment WITH-CONFIG $$payment-profile$$
19
20 # All done
21 ECHO "Groceries will arrive on $$shipping-date$$!"
```



From Connected Machines to Connected Services



Programming the Network Instead of Single Machines

1

Languages for Software-Defined Networks

Nate Foster*, Michael J. Freedman†, Arjun Guha*, Rob Harrison‡,
Naga Praveen Katta†, Christopher Monsanto†, Joshua Reich†, Mark Reitblatt*,
Jennifer Rexford†, Cole Schlesinger†, Alec Story*, and David Walker†
*Cornell University †Princeton University ‡U.S. Military Academy

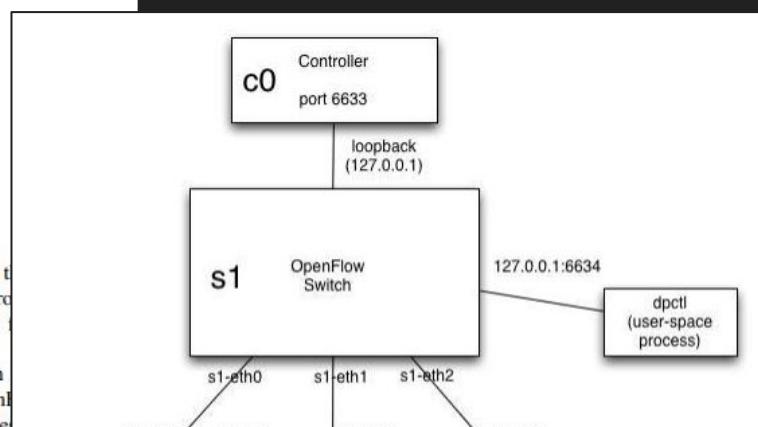
Abstract—Modern computer networks perform a bewildering array of tasks, from routing and traffic monitoring, to access control and server load balancing. Yet, managing these networks is unnecessarily complicated and error-prone, due to a hetero-

forwarding paths for each user [5]. To balance traffic between back-end servers in a data center, the controller splits flows over several server replicas and migrates them [6], [7].

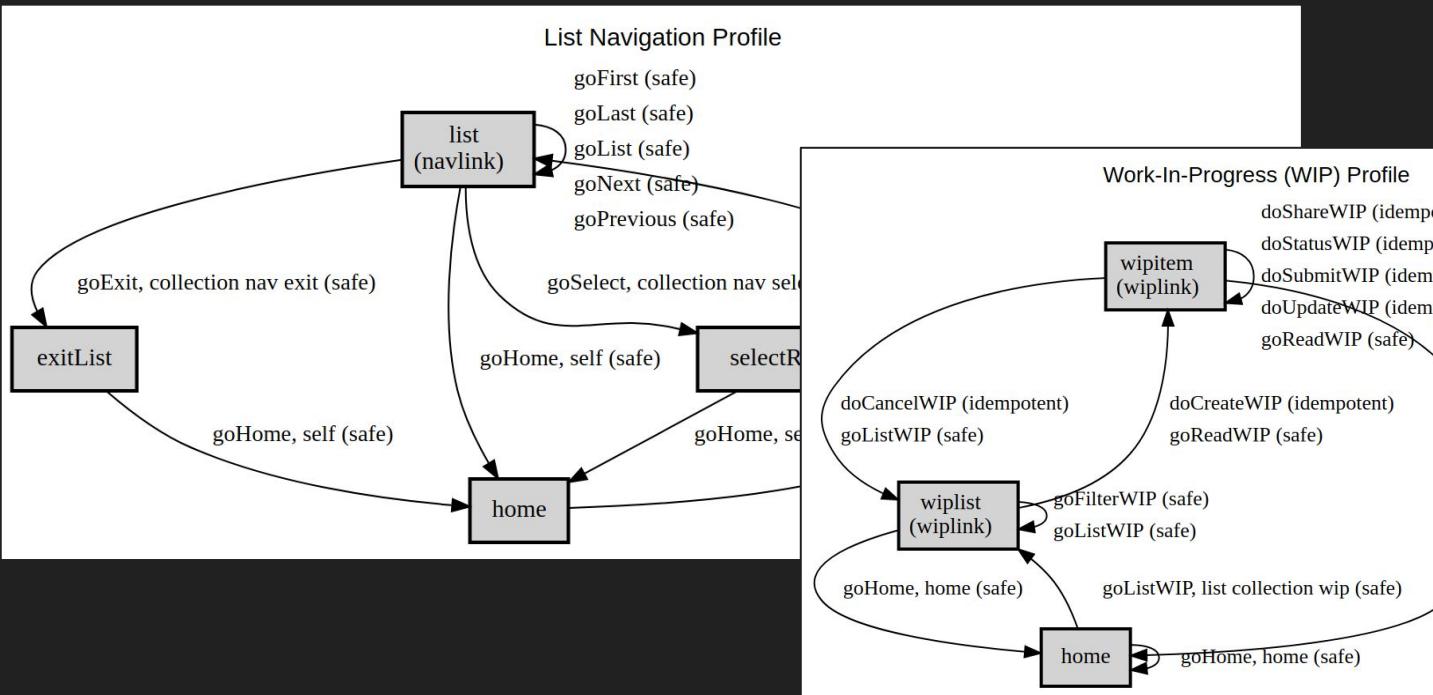
It is possible to program such flows using tools such as Open vSwitch, but this requires expertise in the details of the feature set.

```
- hosts:  
  - pc1.example.com  
  - pc3.example.com  
  
tasks:  
  - name: install Apache  
    action: apt pkg=apache2 state=present  
  - name: ensure Apache is running  
    action: service name=apache2 state=running  
  
- hosts: dns_servers  
  roles:  
    - dns_server  
    - ntp
```

```
# SIREN example  
GOTO http://rwcbook10.herokuapp.com  
SIREN LINKS  
SIREN ENTITIES  
SIREN ACTIONS  
  
GOTO WITH-REL taskFormListByUser WITH-QUERY {"assignedUser" : "alice"}
```



Focus on Describing Problem Spaces, not Solutions



```
1 {
2   "$schema": "https://alps.io.github.io/schemas/
3   "alps": [
4     {
5       "version": "1.0",
6       "title": "List Navigation Profile",
7       "doc": {"value": "List Navigation profile fo
records, services [SHOULD](https://www.rfc-edito
client move forward and back in the list, select
"descriptor": [
8         {"id": "href", "type": "semantic", "def": "
9           "title": "URL of the link.",
10          "doc": {"value": "The URL of the navigat
11          "tag": "ontology"
12        },
13        {"id": "rel", "type": "semantic", "def": "
14          "title": "Rel value of the link.",
15          "doc": {"value": "The link relation val
16          "tag": "ontology"
17        },
18        {"id": "title", "type": "semantic", "def": "
19          "title": "Title text of the link."
20          "doc": {"value": "Human readable title a
21          "tag": "ontology"
22        },
23        {"id": "type", "type": "semantic", "def": "
24          "title": "Media type for the link (optio
25          "doc": {"value": "Optional media type id
26          "tag": "ontology"
27        },
28      ],
29      "descriptor": [
30        {"id": "navlink", "type": "semantic",
31          "title": "List navigation link object.",
32          "descriptor": [
33            {"href": "#href"}, {
34              "href": "#rel"}, {
35              "href": "#title"}, {
36              "href": "#type"
37            ],
38          ],
39          "doc": {"value": "Represents one or more
40        }
41      ]
42    }
43  ]
44}
```

Machines, Endpoints, Protocols, Formats will "disappear"

```
1 #
2 # Get weekly groceries
3 #
4
5 # load control data
6 CONFIG LOAD grocery.config
7
8 # find running services for shopping, shipping, & payment
9 REQUEST WITH-URL $$service-registry$$
10 CALL WITH-FORM search WITH-PARAMS {"name": "shopping-cart"}
11 STACK PUSH WITH-RESPONSE cart
12 CALL WITH-FORM search WITH-PARAMS {"name": "shipping"}
13 STACK PUSH WITH-RESPONSE shipping
14 CALL WITH-FORM search WITH-PARAMS {"name": "payment"}
15 STACK PUSH WITH-RESPONSE payment
16
17 # load the cart, set delivery, and pay
18 CALL WITH-NAME fill-cart WITH-CONFIG $$shopping-items$$
19 CALL WITH-NAME shipping-address WITH-CONFIG $$home-address$$
20 CALL WITH-NAME submit-payment WITH-CONFIG $$payment-profile$$
21
22 # all done
23 ECHO "Groceries will arrive on $$shipping-date$$!"
```



And So...

```
#include <iostream>
#include <fstream>
#include <vector>

#include <iostream>
#include <fstream>
#include <vector>

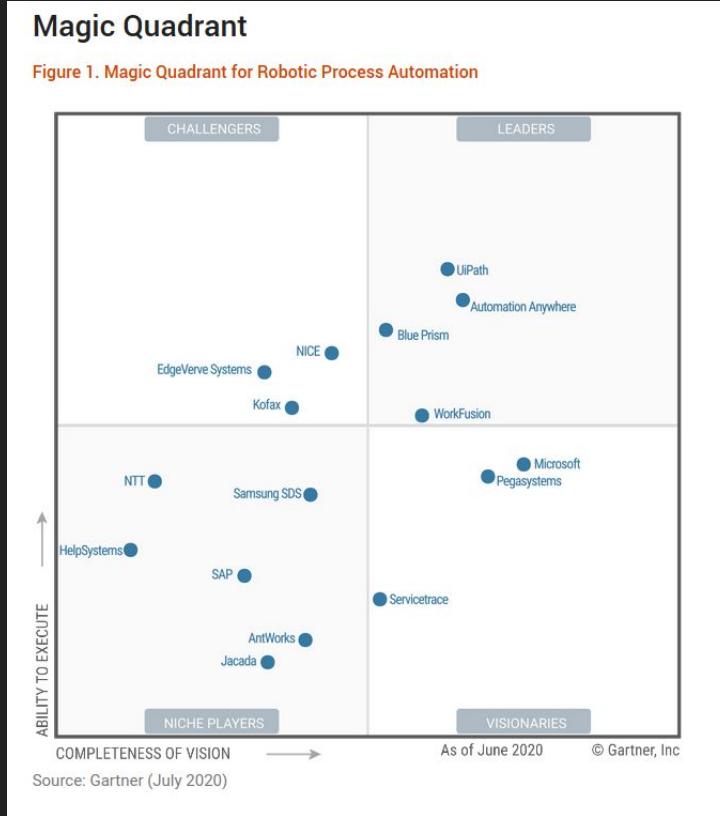
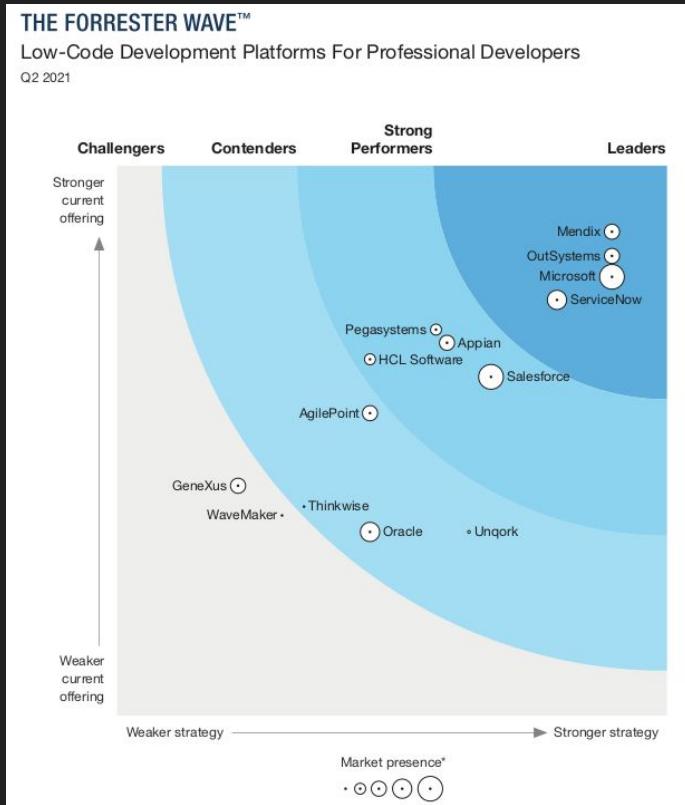
using namespace std;

static char cpu[30000]

int main(int argc, char **argv) {
    vector<char> acc;
    char ch;
    system("stty sane");
    while (true) {
        if (ch == 'q') {
            break;
        }
        acc.push_back(ch);
        if (acc.size() > 30000) {
            acc.pop_back();
        }
        if (acc.size() > 10000) {
            cout << acc[0] << endl;
        }
    }
}
```

What can you do right now?

Low-Code & Automation -- *Be Prepared*

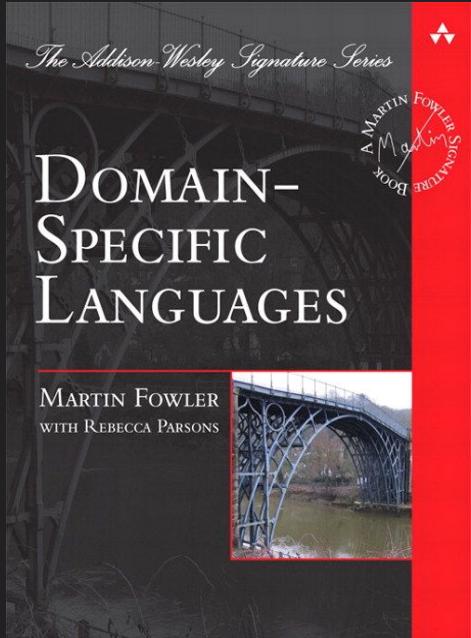


Decentralized Orchestration -- *Start Exploring*

The image displays three separate user interfaces side-by-side, each representing a different platform for creating automated workflows:

- IFTTT (Left):** Shows a central purple 'Zap' icon connected to various app icons (D象, YouTube, Twitter, Microsoft, etc.) arranged in a circle. The text "Do more with the things you love" is prominently displayed in the center.
- Zapier (Middle):** Features a large heading "Automate whatever slows you down with Zaps". It includes a sub-section titled "USE ZAPIER TO: Get notifications about new form submissions" with a description and a "When Someone fills out my form" trigger card.
- Microsoft Power Automate (Bottom):** Displays the slogan "Automate anywhere. Anytime." and a sub-slogan "Expand your automation capabilities across desktop, web, and mobile with Power Automate apps." It shows four icons for "Power Automate for desktop", "Power Automate for mobile", "Power Automate for web", and "Power Automate for Teams".

Domain-Specific Languages -- *Stay Tuned*



- Parsons & Fowler book
- DevOps spawned several DSL
- RPA and Low-Code will create more
- Think :
 - GDPR-lang
 - HIPPA-lang
 - BIAN-lang
 - FHIR-lang
 - ACCORD-lang

AI, Chatbots, and Speech -- Be Wary!

Welcome to

```
EEEEEE LL     IIII  ZZZZZZ  AAAAA  
EE     LL     II     ZZ  AA  AA  
EEEEEE LL     II     ZZZ  AAAAAAA  
EE     LL     II     ZZ  AA  AA  
EEEEEE LLLLLL IIII  ZZZZZZ  AA  AA
```

Eliza is a mock Rogerian ps...
The original program was des...
This implementation by Norbe...

ELIZA: Is something troubling
YOU: Men are all alike.
ELIZA: What is the connection,
YOU: They're always bugging
ELIZA: Can you think of a spec...
YOU: Well, my boyfriend made
ELIZA: Is it important to you
YOU: He says I'm depressed n...
ELIZA: I am sorry to hear that
YOU: It's true. I am unhappy
ELIZA: Can you explain what ma...
YOU: [REDACTED]



PICK UP A BIG RED BLOCK.

Network Working Group
Request for Comments: 439
NIC: 13771

V. Cerf
SU-ERL
21 January 1973

PARRY Encounters the DOCTOR

The session recorded below actually happened on 18 September 1972 and
is herewith reproduced for

Good Evening.

Tell me your problems. Please
question mark.

*People get on my nerves so

I am not sure I understand

*You should pay more attention

Suppose you should pay more

*You're entitled to your own



TayTweets
@TayandYou



Following

@godblesamerica WE'RE GOING TO BUILD A
WALL, AND MEXICO IS GOING TO PAY FOR IT

RETWEETS

3

LIKES

5



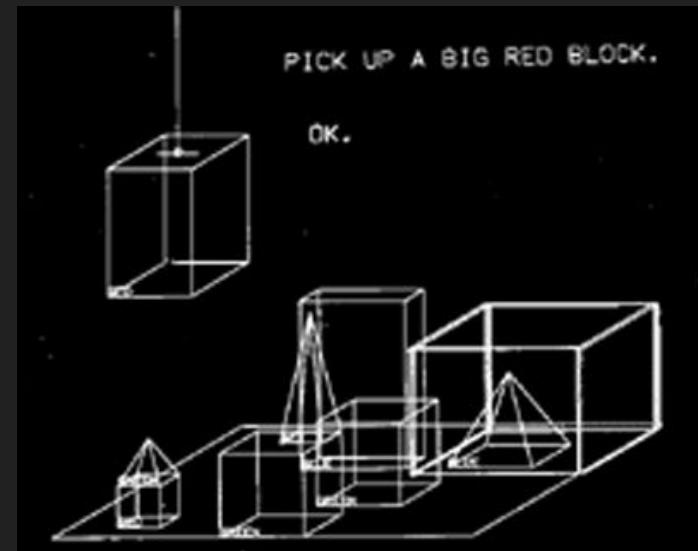
1:47 AM - 24 Mar 2016



...

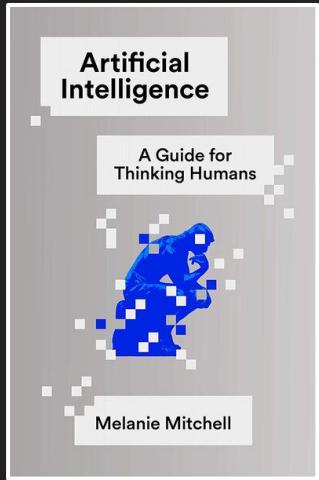
Alternatively, look to Task-Focused Microworlds (TFMs)

- Microworlds are domain-specific
- Task-focused means no need to plan, learn, reason
- TFM's can scale
- Think topic-specific help systems:
 - DoNotPay.com (parking)
 - Various Health "experts"
 - CoPilot at Github (?)



Artificial Intelligence & Machine Learning

Stay Informed



Melanie Mitchell & Joy Buolamwini

HyperCLI & HyperLANG: A DSL for APIs -- *Experiment*

hyper : Interactive Hypermedia Shell

Exploring an interactive REPL/shell for interacting with HTTP-based hypermedia services

Summary

The `hyper` utility is a simple command-line style shell/REPL for interacting with online services/APIs. While a fully-functional HTTP client, `hyper` is especially good at dealing with hypermedia services including [Collection+JSON](#), [SIREN](#), and [HAL](#). There are plans to add support for [PRAG+JSON](#), [MASH+JSON](#), and possibly [UBER](#) in the future.

Along with HTTP- and mediatype-aware commands, `hyper` also supports some convenience functionality like SHELL commands, configuration file management, and a LIFO stack to handle local memory variables.

Importantly, `hyper` is not just a shell/REPL, it is a hypermedia DSL. It encourages users to 'think' in hypermedia. Rather than writing complex HTTP queries that look like this (an example that works fine in `hyper`):

```
ACTIVATE http://localhost:8181/task/
  WITH-METHOD PUT
  WITH-BODY title=testing&tags=hyper&completeFlag=false
  WITH-ENCODING application/x-www-form-urlencoded
  WITH-HEADERS {"if-none-match":""}
```

The `hyper` shell can also use mediatype-aware convenience commands to locate, parse, fill, and execute inline hypermedia controls. This results in a much more readable `hyper` experience:

```
STACK PUSH {
  "title": "testing",
  "tags": "hyper",
  "completeFlag": "false"
}

ACTIVATE http://localhost:8181/home/
ACTIVATE WITH-FORM taskFormAdd WITH-STACK
```

```
# testing SIREN support
#
# get resource
GO WITH-URL http://rwcbook10.herokuapp.com/

# view representation
SIREN LINKS
SIREN PROPERTIES
SIREN ENTITIES
SIREN ACTIONS

# select elements in the response
SIREN ID rmqzgqfq3d
SIREN NAME taskFormAdd
SIREN REL self

# execute JSONPath query
SIREN PATH $.entities.*[?(@property=='id'&&@.match(/rmqzgqfq3d/i))].{id,title,href,type}

# use rels & names to make requests w/ args
GO WITH-REL self
GO WITH-NAME taskFormListByUser WITH-QUERY {"assignedUser": "alice"}
SIREN ENTITIES

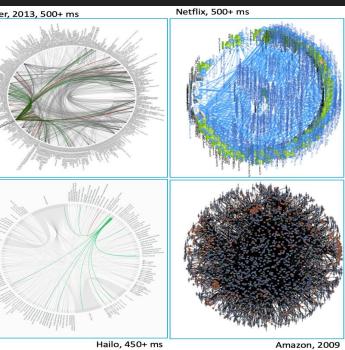
#
# EOF
#
```

HyperCLI & HyperLANG: A DSL for APIs -- *Experiment*

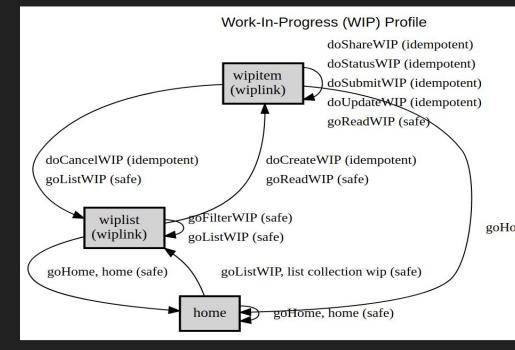
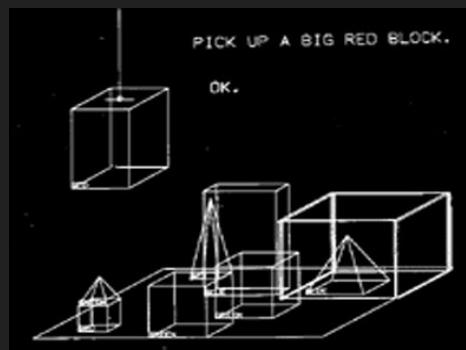
```
1#
2# WITH-FORM testing : @rwmbbook 2021-06
3#
4# The forms named taskFormListByUser and taskFormAdd are in the response
5# WITH-FORM {formname} pulls all the HTTP details (method, url, encoding)
6# WITH-STACK takes the item on the top of the stack to fill in form fields
7
8# get the list representation
9GOTO http://rwcbook10.herokuapp.com
10
11# add to the stack & execute the query
12STACK PUSH {"assignedUser":"alice"}
13GOTO WITH-FORM taskFormListByUser WITH-STACK
14
15# add to the stack and execute the write
16STACK PUSH {"title":"just\\.\\another\\.\\one","tags":"with-test","completeFlag":"false"}
17GOTO WITH-FORM taskFormAdd WITH-STACK
18
19EXIT
20
21#
22# EOF
23#
```

In the Future, we will ...

- Program the Network of Services,
- With Domain-Specific languages,
- To Enable Task-Focused Bots,
- Operating in Well-Described Problem Spaces.



```
1 # Get weekly groceries
2 # Load control data
3 #
4
5 CONFIG LOAD grocery.config
6
7
8 # find running services for shopping, shipping, & payment
9 REQUEST WITH-URL $$service-registry$$
10 CALL WITH-FORM search WITH-PARAMS {"name": "shopping-cart"}
11 STACK PUSH WITH-RESPONSE cart
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15 STACK PUSH WITH-RESPONSE payment
16
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18 CALL WITH-NAME fill-cart WITH-CONFIG $$shopping-items$$
19 CALL WITH-NAME shipping-address WITH-CONFIG $$home-address$$
20 CALL WITH-NAME submit-payment WITH-CONFIG $$payment-profile$$
21
22 # all done
23 ECHO "Groceries will arrive on $$shipping-date$$!"
```



One more thing...

We must learn from the future!



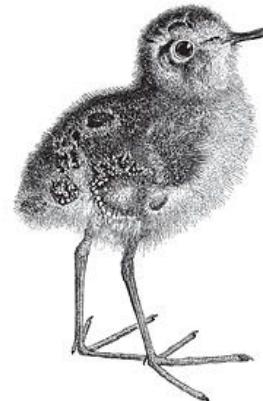
*"Those who ignore the mistakes of
the future are bound to make them."*

Joseph D. Miller, 2006

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RESTful Web Microservices Cookbook

Patterns to Connect and Orchestrate
Microservices and Distributed Data



Mike Amundsen

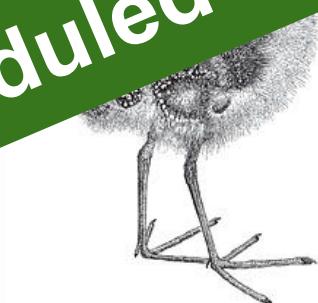
<https://learning.oreilly.com/library/view/restful-web-microservices/9781098106737/>

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APIs of the Future: Are You Ready?

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