

Cloud Computing Lab



DAS INTERNET

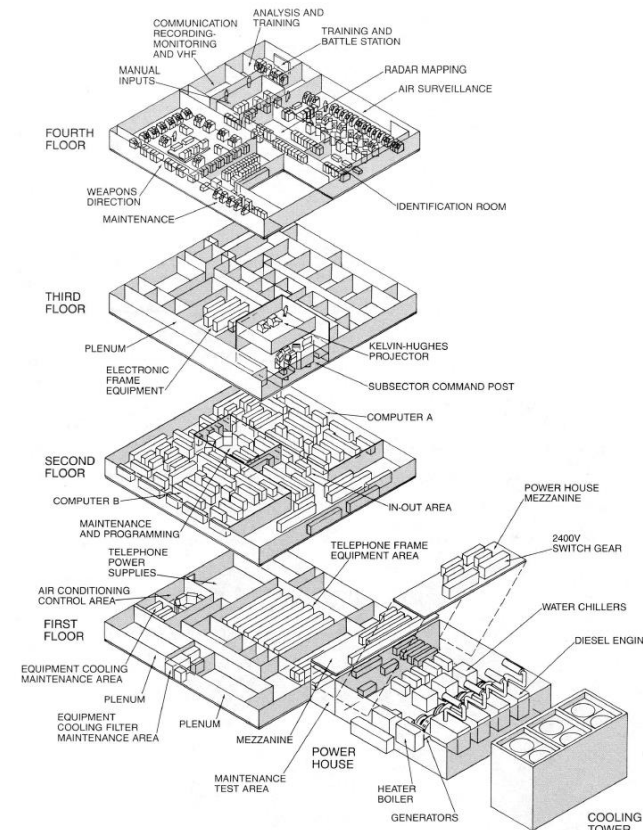
Ein Vortrag des

Cloud Computing Lab

Gefördert von der



SAGE (SEMI-AUTOMATIC GROUND ENVIRONMENT 1)



"Whirlwind II" war der größte jemals gebaute Röhrenrechner und das Kernstück von SAGE

Größe: 20 Fußballfelder

Gewicht: Airbus A380

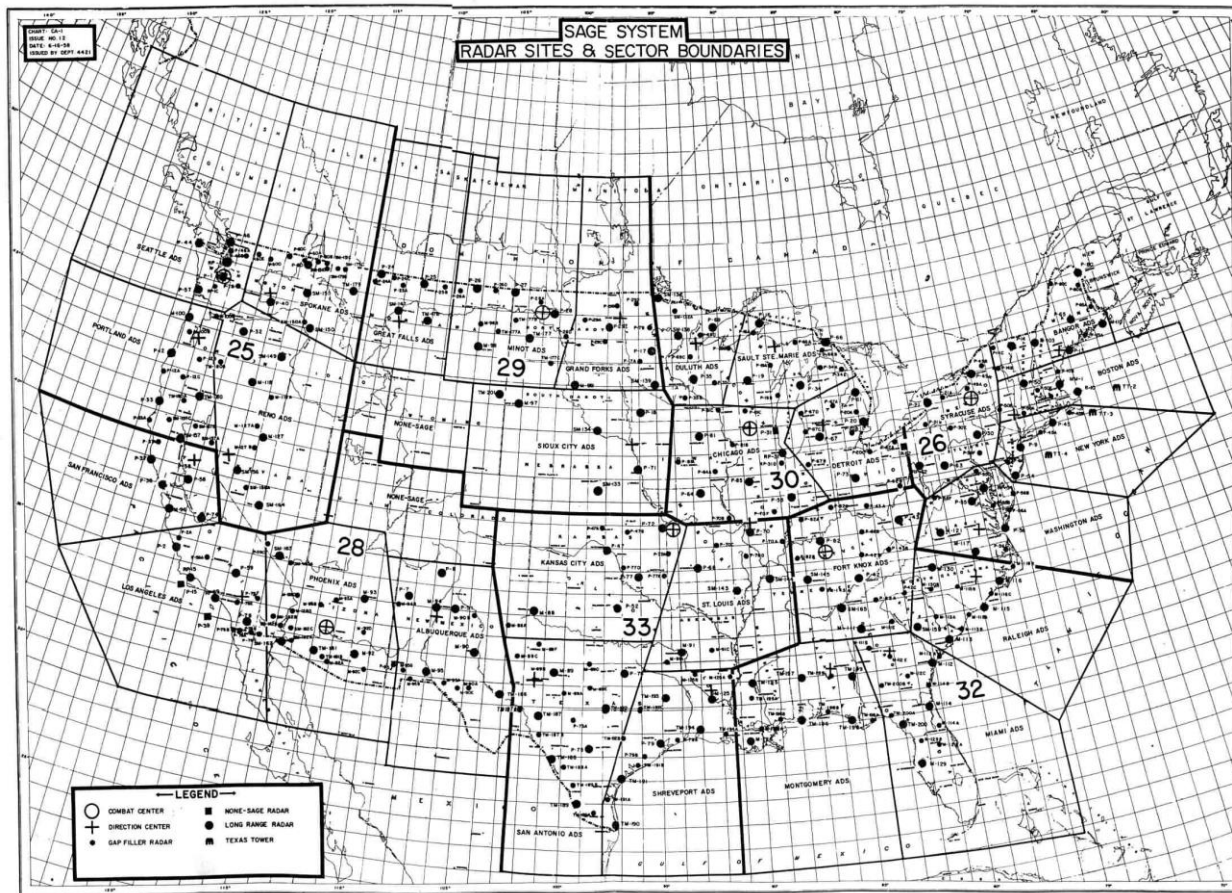
Strom: 6000 PCs

Taktrate: 75KHz

Gebaut: 24mal

Gebaut vom Massachusetts Institut of Technology (MIT) bzw. dessen "Lincoln Laboratory"

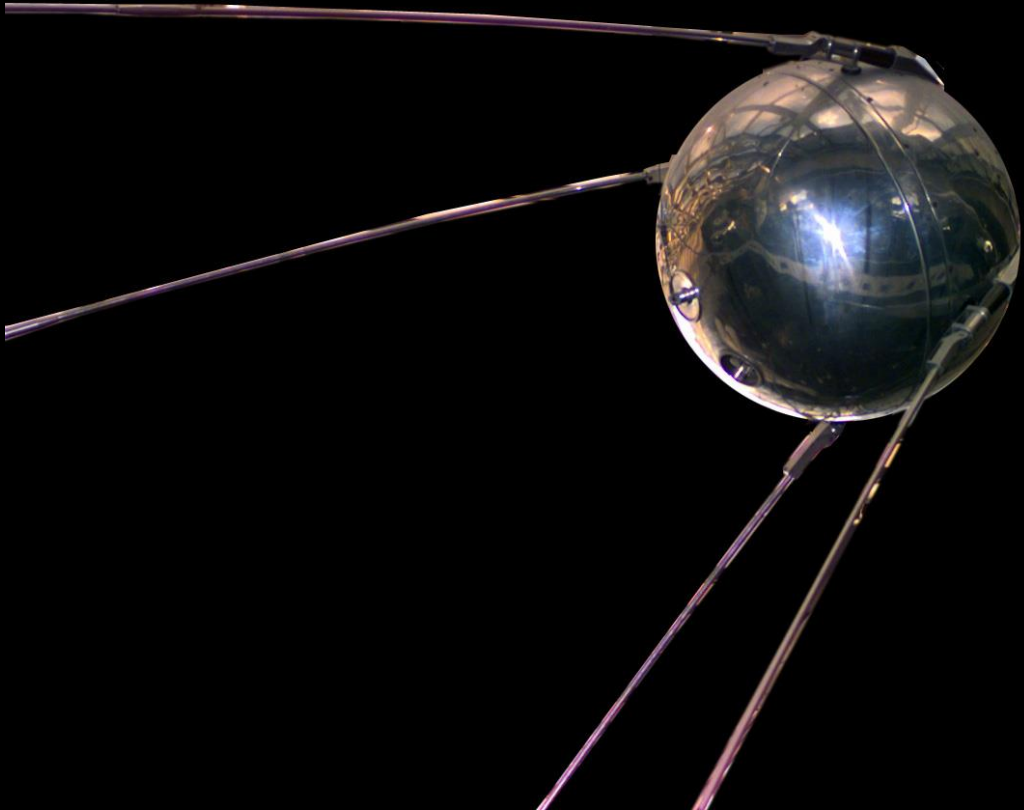
SAGE (SEMI-AUTOMATIC GROUND ENVIRONMENT) 2



Technologien & Nachwirkungen

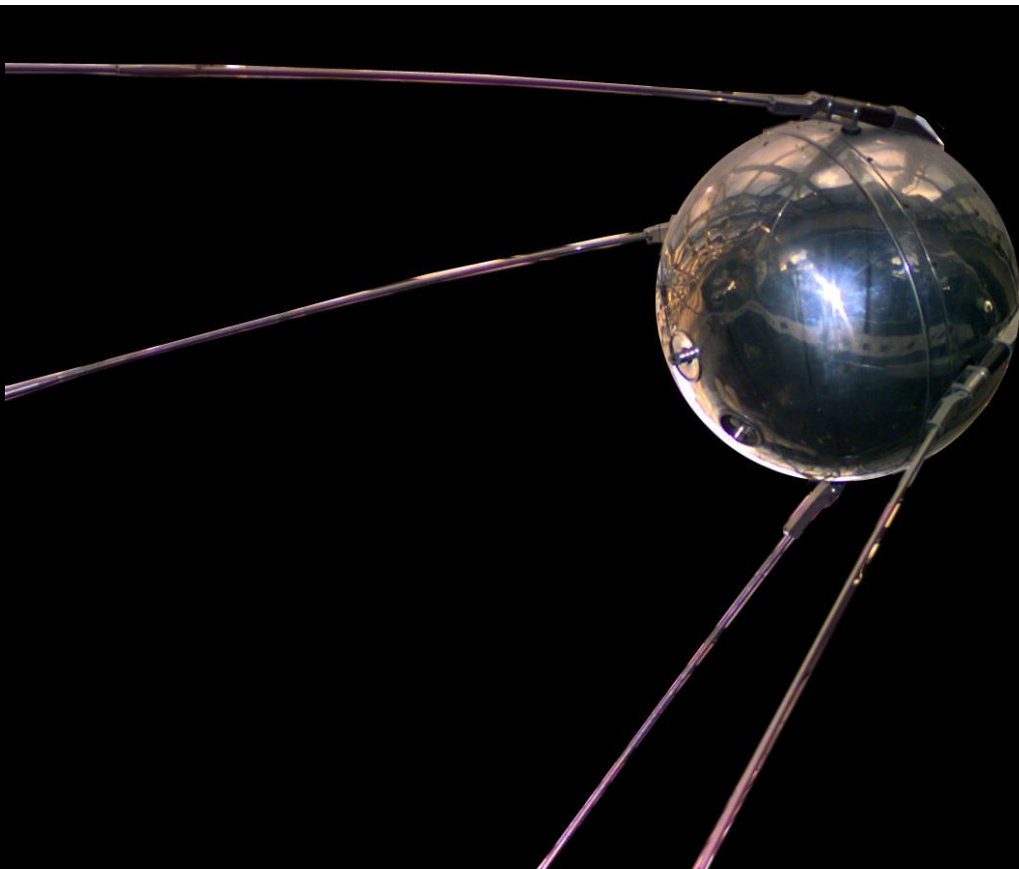
- Modem
- Speicher
- Interaktive Anzeigen
- Viele Sub-Projekte und tausende Programmierer





*Was ist das?
Was hat es mit dem
Internet zu tun?*

SPUTNIK



Monday Evening, October 5, 1957 (UP)—Moscow United Press PRICE: Five

Russians Win Race To Launch Earth Satellite

Man On Threshold Of Space Travel

By DANIEL F. GILMORE
United Press Staff Correspondent

LONDON (UP)—The pulsating radio "beep" of the first manmade earth satellite signalled today to the world that man had crossed the threshold into the age of travel through space.

The Soviet Union announced it had won the race into space by launching an earth satellite Friday, a 184-pound, 22-inch globe now orbiting the earth at 18,000 miles an hour, 560 miles up.

Millions of persons throughout the world heard the "beep...beep...beep..." rebroadcast today by local stations and realized that man had taken his first faltering steps into the new era.

Launching of the satellite was a tremendous victory for science. It was a more tremendous victory for Soviet propaganda to be able to trumpet to the world the Russians were the first to break through the frontiers of space.

Belsters ICBM Claims

Belsters ICBM Claims

How To Spot Satellite

By UNITED PRESS

Here's how to look for the Russian earth satellite which will be whizzing through the sky at 18,000 miles an hour.

The best time to spot it is at dawn or dusk when the sky is semi-dark. There is a chance that it could be seen if it travels across the face of the moon at night.

The best instruments to use are ordinary binoculars or telescopes. Powerful telescopes won't pick it up because of their narrow fields.

Through optical instruments, the satellite will look like the faintest star which can be seen with the naked eye.

Keep a sharp eye out.—The satellite travels so fast it may appear on the horizon for only seconds and chances of spotting it have been estimated at one in a hundred.

U. S. May Speed Up Satellite Program

By JOSEPH L. MYL

United Press Staff Correspondent

WASHINGTON (UP)—A scientist caught flatfooted by Russia's epic launching of man-made moon, indicated the United States may speed up its own earth satellite program.

Leaders of the U.S. atomic energy commission also said that it would rocket its 184-pound satellite into a gliding orbit with a rocket to an intercontinental missile.

That could mean Russia only has beaten this country's frontiers of space, but also has been called the "weapon" for modern day ICBM. This country has tested a successful ICBM. American diplomats said Russia had scored a notable

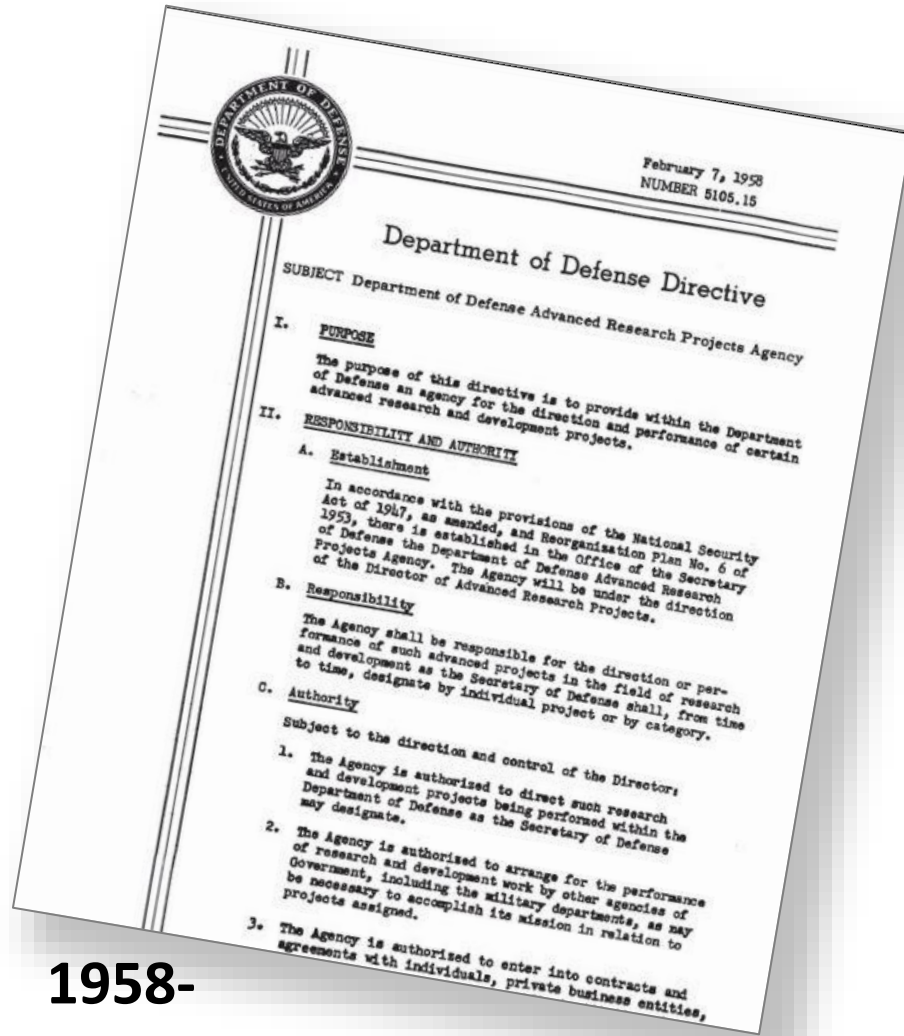
— WEATHER —

WEST VIRGINIA—Partly cloudy with highest in the 60s today and Sunday. Lowest tonight 54 and 40 east portions.

VIRGINIA—Fair with lowest 48 to 50 west and north and 50 to 55 southeast portions tonight, Sunday mostly sunny and a little warmer. Tides on the coast and lower bay will run a foot or two above normal.



DIE „ARPA“ DIREKTIVE



The Advanced Research Projects Agency *Initialer Fokus:*

- Raumfahrttechnologie
- Ballistische Raketenverteidigung
- Erkennung von Nuklearwaffentests

The Agency is authorized to enter into contracts and agreements with individuals, private business entities, educational, research or scientific institutions including federal or state institutions.

Die Agentur ist **autorisiert**, mit **Individuen, privaten Geschäftseinrichtungen, Institutionen für Lehre, Forschung oder Wissenschaft** aber auch staatlichen Einrichtungen **Verträge abzuschließen**.



1958-

INFORMATION PROCESSING TECHNIQUES OFFICE (IPTO)



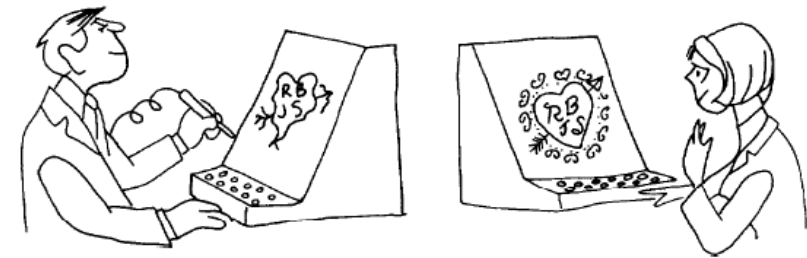
Erster Direktor dieser Abteilung der DARPA:
Joseph Carl Robnett Licklider
(Visionär, Psychologe)
Schreibt über das Konzept eines
"Intergalactic Computer Network"

1961-



Programme:

- Computer Science Departments an Unis
- Time-Sharing Systeme und
- Netzwerke

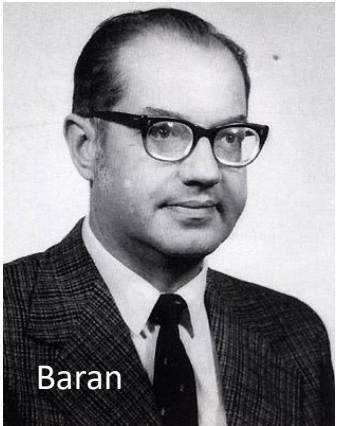


Paper
„Der Computer als
Kommunikationsgerät“

NEUE TECHNOLOGIE: PAKETVERMITTLUNG



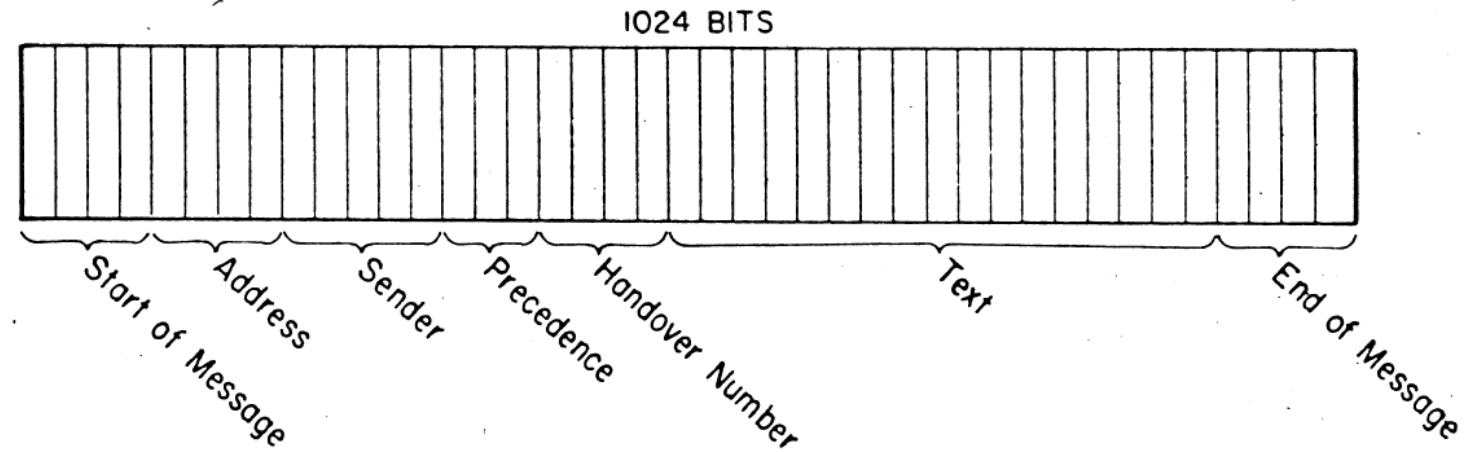
PAKETVERMITTLUNG UND FORSCHUNG



Baran



Davies



Aus welchen Teilen/Informationen besteht ein Paket?

- Quelladresse,
- Zieladresse,
- Größe,
- Nummer, wenn es mehrere davon gibt
- Art des Pakets (Groß, klein, Wichtig,...) und
- der Inhalt (Nutzlast) – die Daten (oder Text)

Paul Baran "On Distributed Communication Networks" (1962)

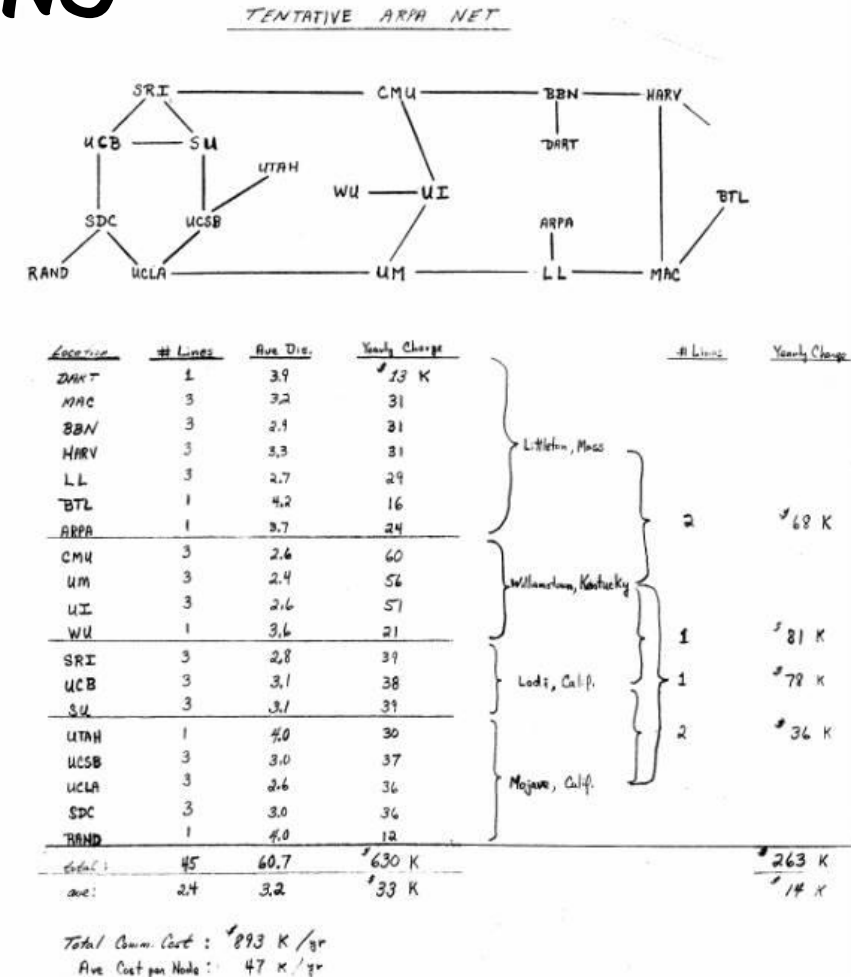
DAS ARPANET - DIE AUSSCHREIBUNG

Robert Taylor | 1968 Direktor der IPTO
Ehemaliger Assistent von Licklider

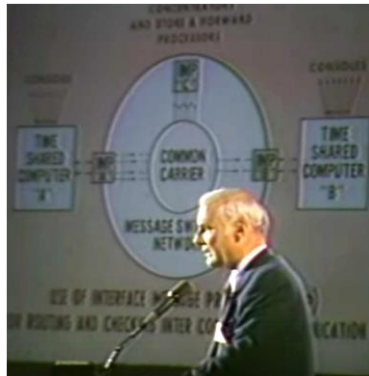


Lawrence "Larry" Roberts
1966 Programmleiter für die
„Information Processing Techniques Office“

1968-

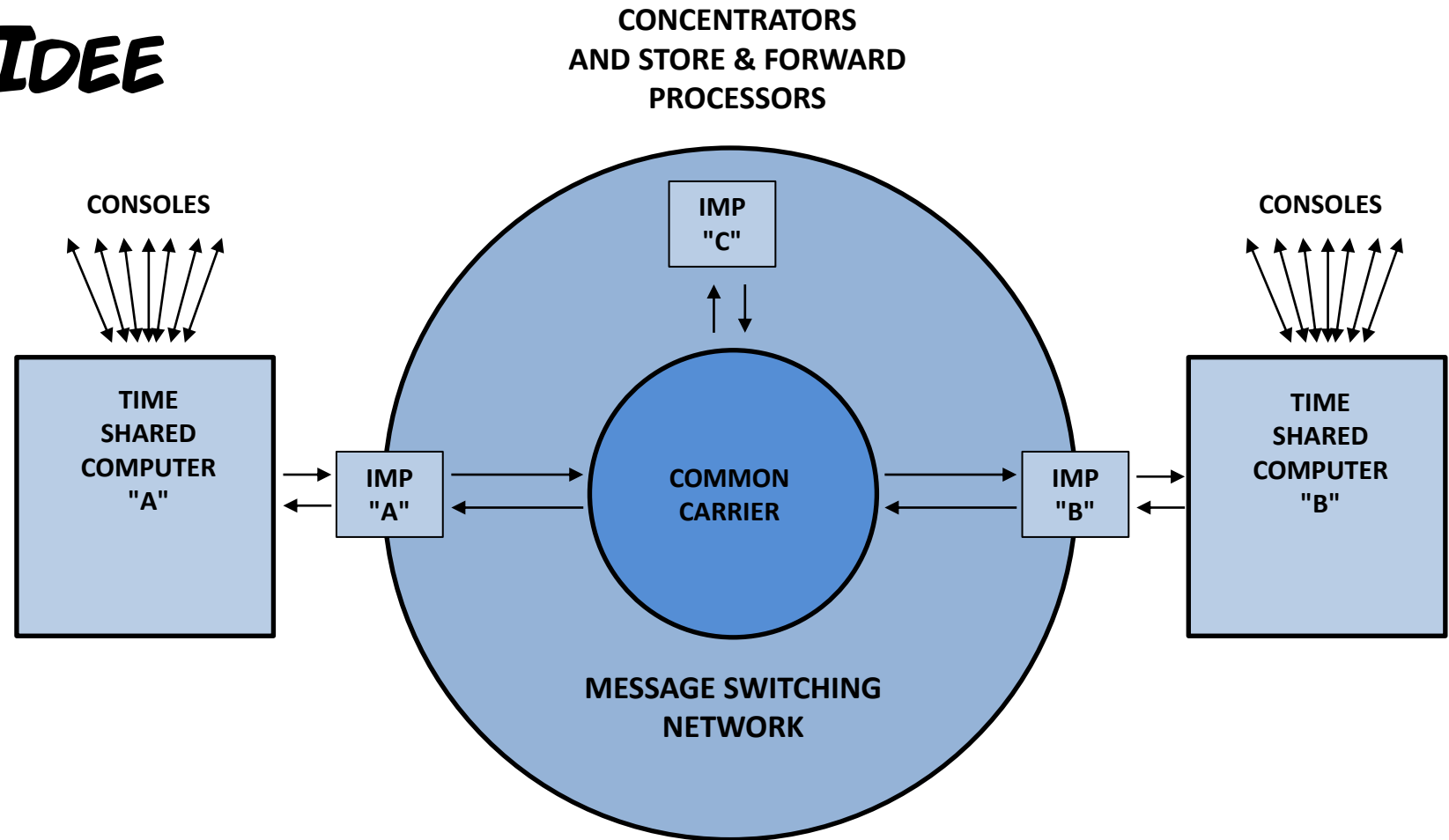


DIE ARPANET-IDEE



Nachbau aus Rede von
Larry Roberts (2016)

<https://www.youtube.com/watch?v=qkD4HVRnGJE>



**USE OF INTERFACE MESSAGE PROCESSORS (IMP)
FOR ROUTING AND CHECKING INTER COMPUTER COMMUNICATION**

DAS ARPANET - WER BAUT ES?



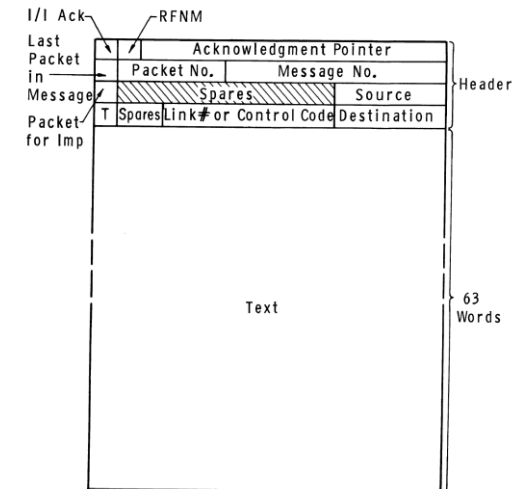
BOLT BERANEK AND NEWMAN INC
CONSULTING • DEVELOPMENT • RESEARCH



„Die
IMP
Jungs“

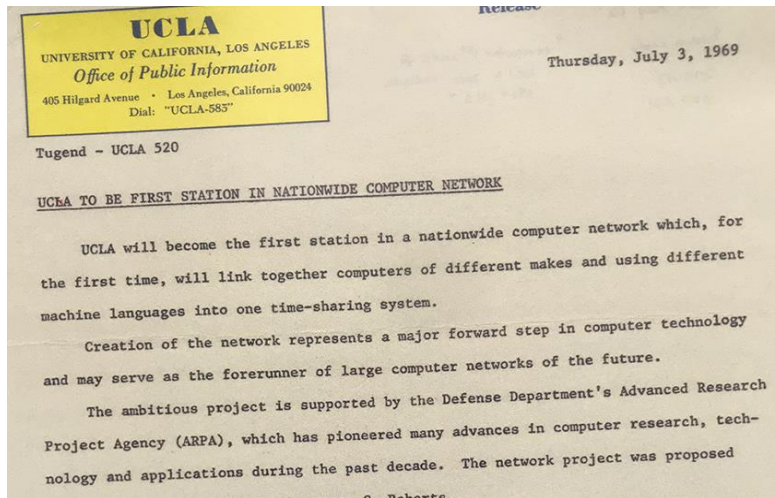


Der
„IMP“



DAS ARPANET - WO TESTEN WIR?

University of California - Los Angeles (UCLA)



Interface Message Prozessor
"Gateway/Router"
Protokoll 1822 (RFC802)

SDS Sigma 7
"32Bit Host"

1969-

DAS ARPANET - UND WER SOLL TESTEN?

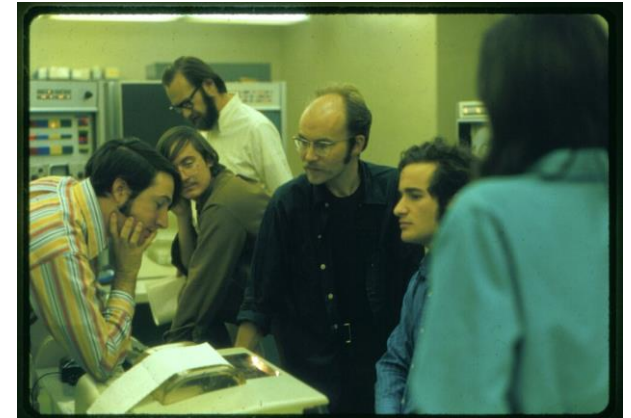
Professor Leonard Kleinrock



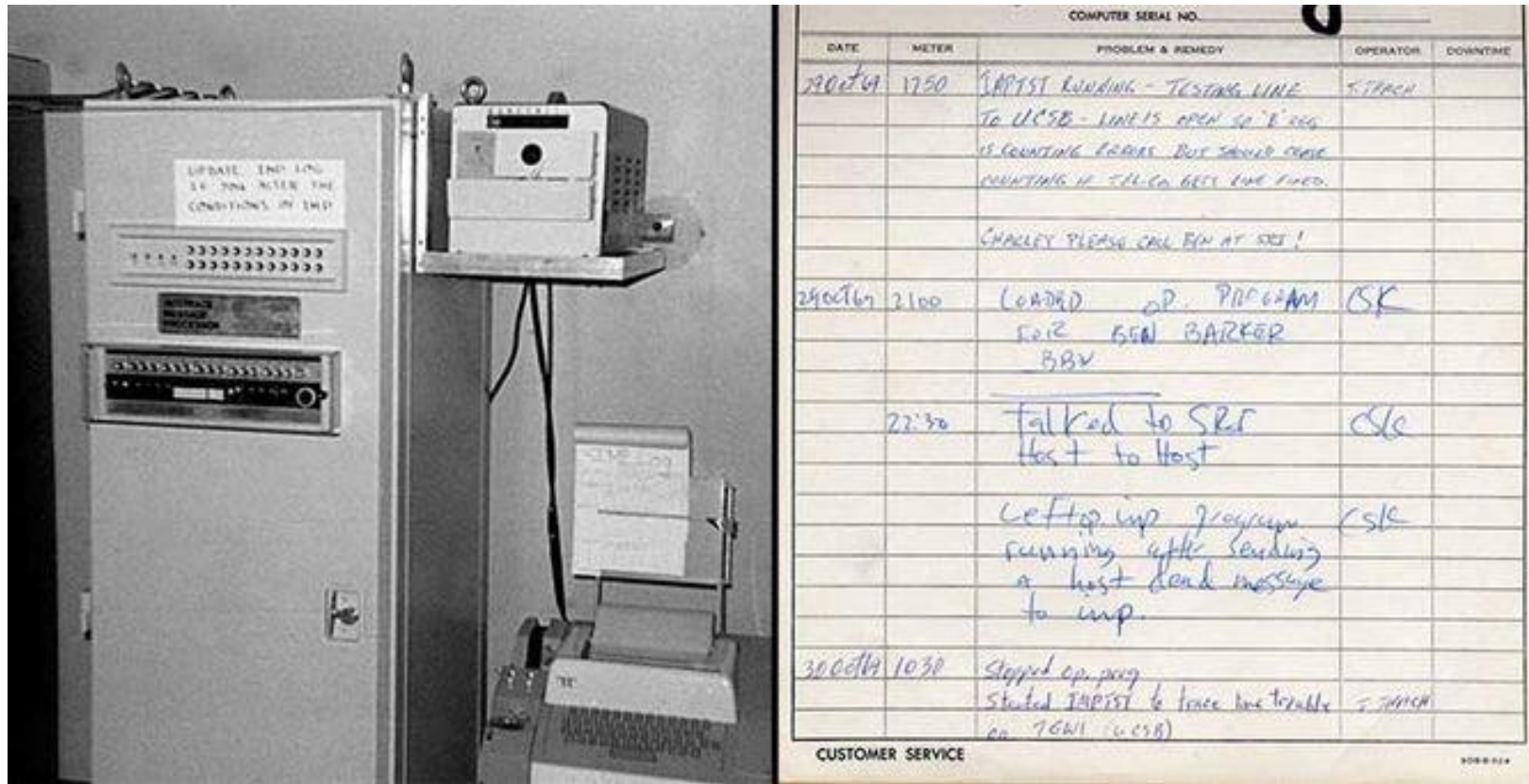
Bill Duvall
SRI



Charly Kline
UCLA

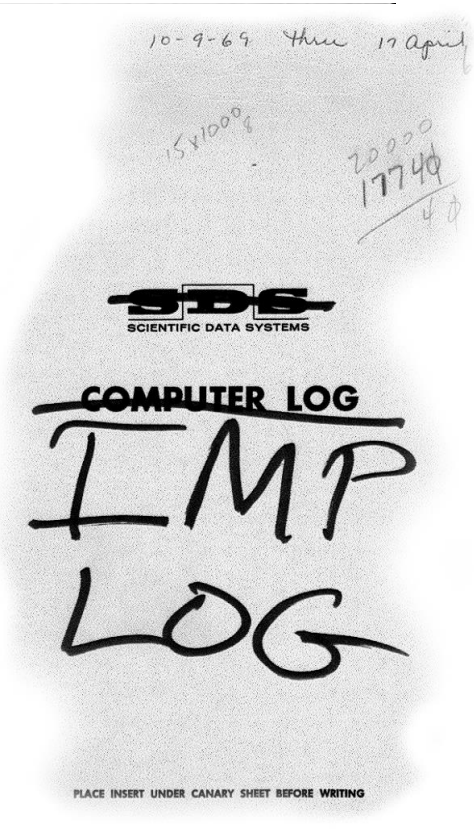


DAS ARPANET - DIE ERSTE NACHRICHT



DATE	METER	PROBLEM & REMEDY	OPERATOR	DOWNTIME
29 OCT 69	1750	TAPEST RUNNING - TESTING LINE To UCSB - LINE IS OPEN SO E REG IS COUNTING PAGES BUT SHOULD BE COUNTING IF TIL GO BEET LINE FIXED.	STEACH	
		CHARLEY PLEASE CALL BUN AT SRI!		
29 OCT 69	2100	LOADED OP. PROGRAM (SR) SRI BEN BARBER BBV		
	22:30	Talked to SRI Host to Host	CSK	
		Left op. prog. running after sending a host dead message to imp.		
30 OCT 69	1030	Stopped op. prog Started TAPEST to trace line trouble on TGM (UCSB)	STEACH	

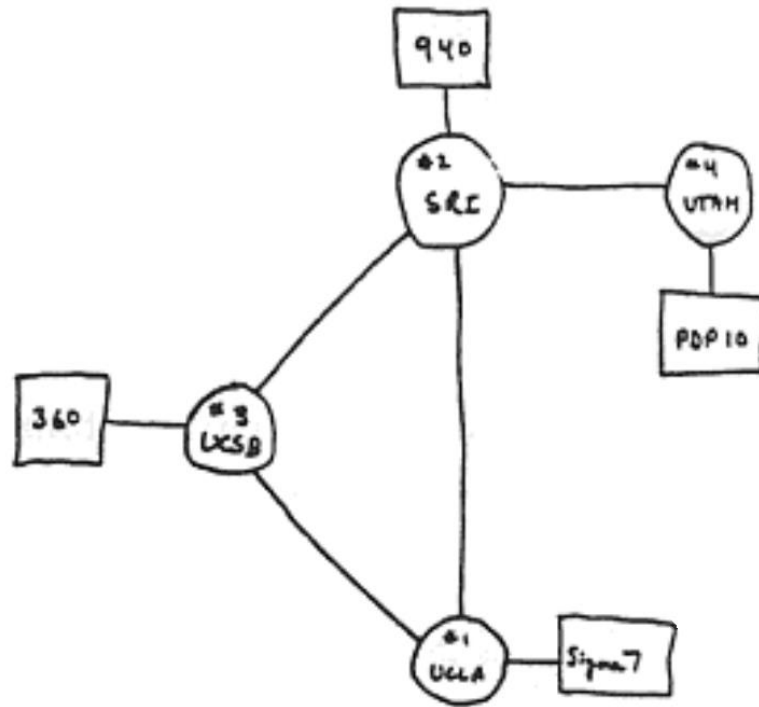
CUSTOMER SERVICE



"Talked to SRI Host to Host."
29.10.1969 22:30

Lo and Behold!

DAS ARPANET - KLEIN ABER FEIN

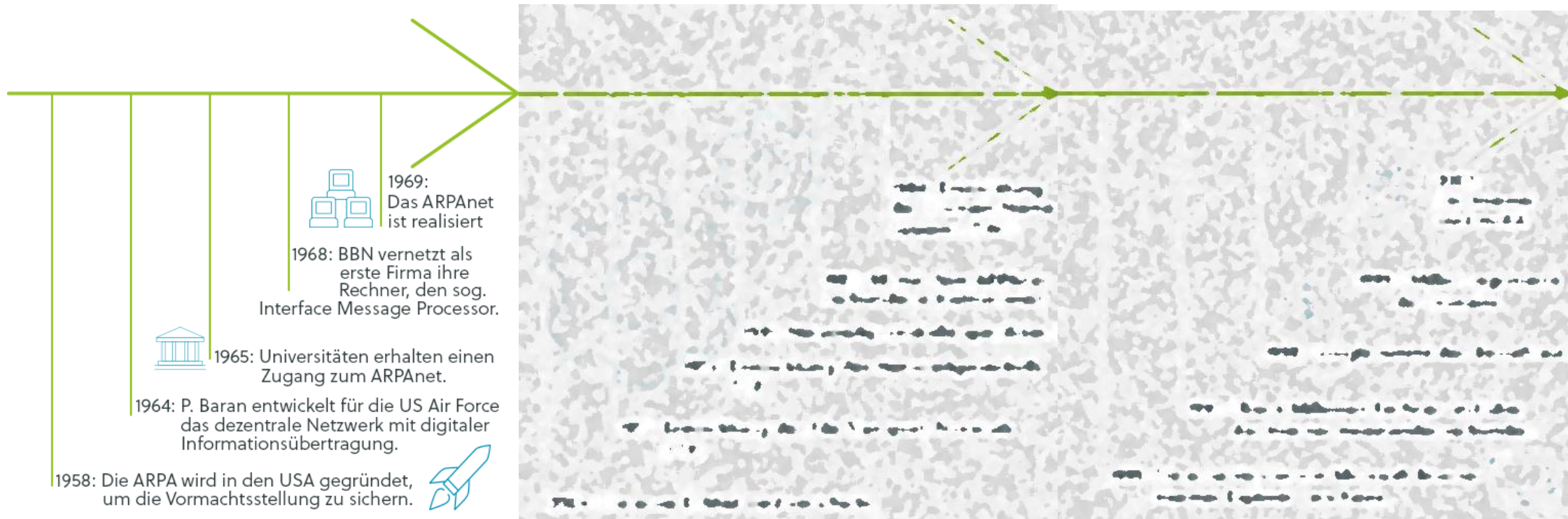


THE ARPA NETWORK

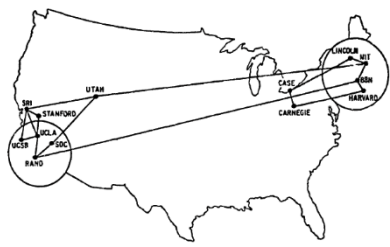


The ARPANET in December 1969

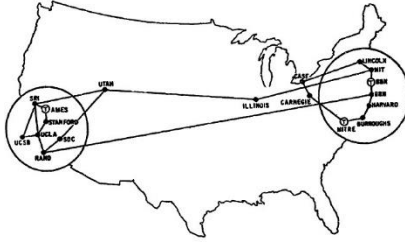
DIE ERSTE PHASE ZUM INTERNET



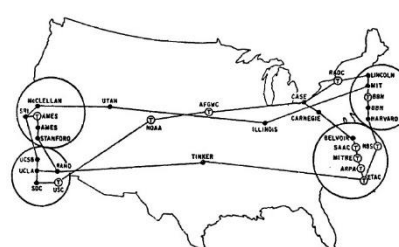
DAS ARPANET - DIE ENTWICKLUNG



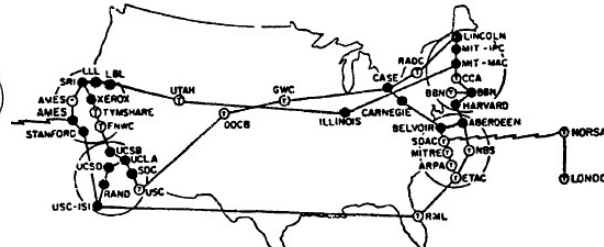
1970



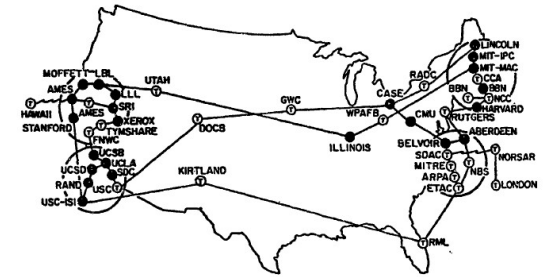
1971



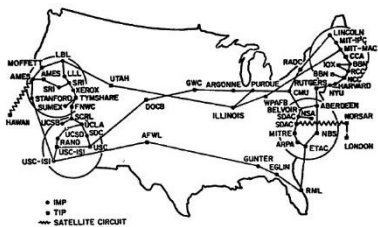
1972



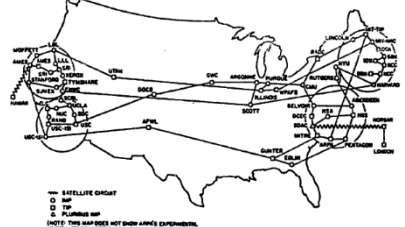
1973



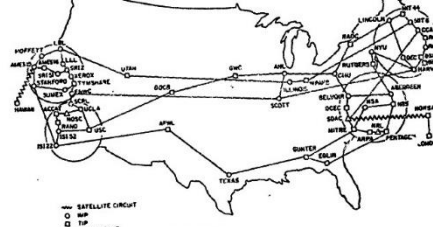
1974



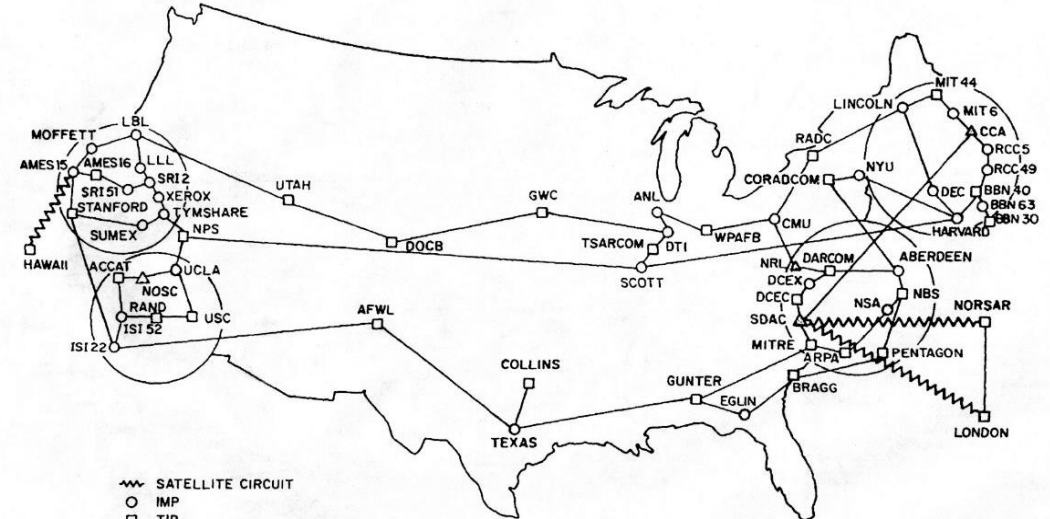
1975



1976



1977



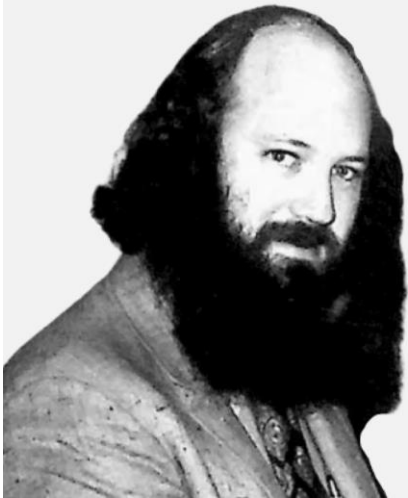
--- SATELLITE CIRCUIT
○ IMP
□ TIP
△ PLURIBUS IMP

(NOTE: THIS MAP DOES NOT SHOW ARPA'S EXPERIMENTAL SATELLITE CONNECTIONS)
NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

1969-1977

RFCs - REQUEST FOR COMMENTS

Stephen Crocker



```
Network Working Group                                Steve Crocker
Request for Comments: 1                               UCLA
                                                    7 April 1969

                Title:  Host Software
                Author:  Steve Crocker
                Installation:  UCLA
                Date:    7 April 1969
                Network Working Group Request for Comment:  1

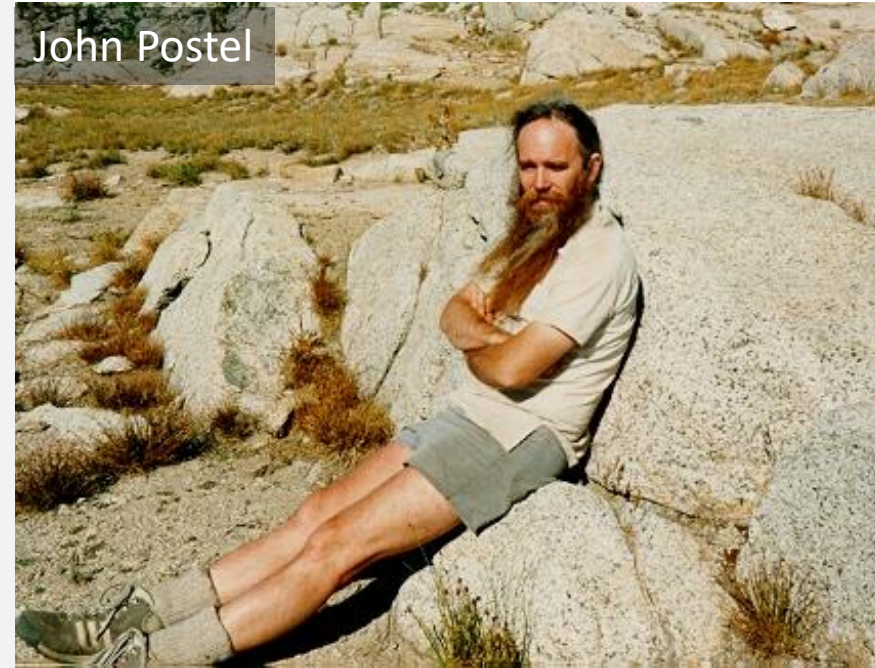
CONTENTS
INTRODUCTION

I. A Summary of the IMP Software
  Messages
  Links
  IMP Transmission and Error Checking
  Open Questions on the IMP Software

II. Some Requirements Upon the Host-to-Host Software
  Simple Use
  Deep Use
  Error Checking

III. The Host Software
  Establishment of a Connection
```

John Postel



RFCs? (Request for Comments!)

"We reject kings, presidents and voting. We believe in rough consensus and running code." -Dave Clark, MIT / IAB

- Keine zentrale Organisation für technische Spezifikationen
- Die Evolution der Internet Spezifikationen ist ein offener, "unkontrollierter" Prozess
- Jeder "Netizen" kann dran teilhaben, Anregungen werden eingereicht
- Basis: RFCs – Request for Comments (<http://www.rfc-editor.org/>)

1969-

A Standard for the Transmission of IP Datagrams on Avian Carriers (RFC1149)
The Infinite Monkey Protocol Suite (IMPS) (RFC 2795)
Electricity over IP (RFC 3251)
Management of IP Numbers by Peg-DHCP (RFC2322)

DAS ARPANET - EINE ERSTE DEMO



- User-Oriented
 - Interdisciplinary
 - International
 - Stimulating Program

Parry Paranoid schizophrener Bot
Eliza Simulation der klientenzentrierten
 Psychotherapie
... sprechen miteinander übers ARPAnet

PARRY — Good Evening.

ELIZA — Tell me your problems. Please terminate input with a period or a question mark.

People get on my nerves sometimes.

I am not sure I understand you fully.

You should pay more attention.

Suppose you should pay more attention.

You're entitled to your own opinion.

What makes you think I am entitled to my own opinion?

It bothers me just to be around people in general.

Please go on.

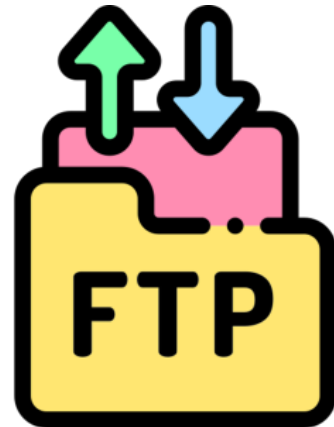
1972

```
Welcome to
EEEEEE LL      IIII 2222222 AAAA
EE      LL      II   ZZ  AA  AA
EEEEEE LL      II   222  AAAAAA
EE      LL      II   ZZ  AA  AA
EEEEEE LLLLLL IIII 2222222 AA  AA

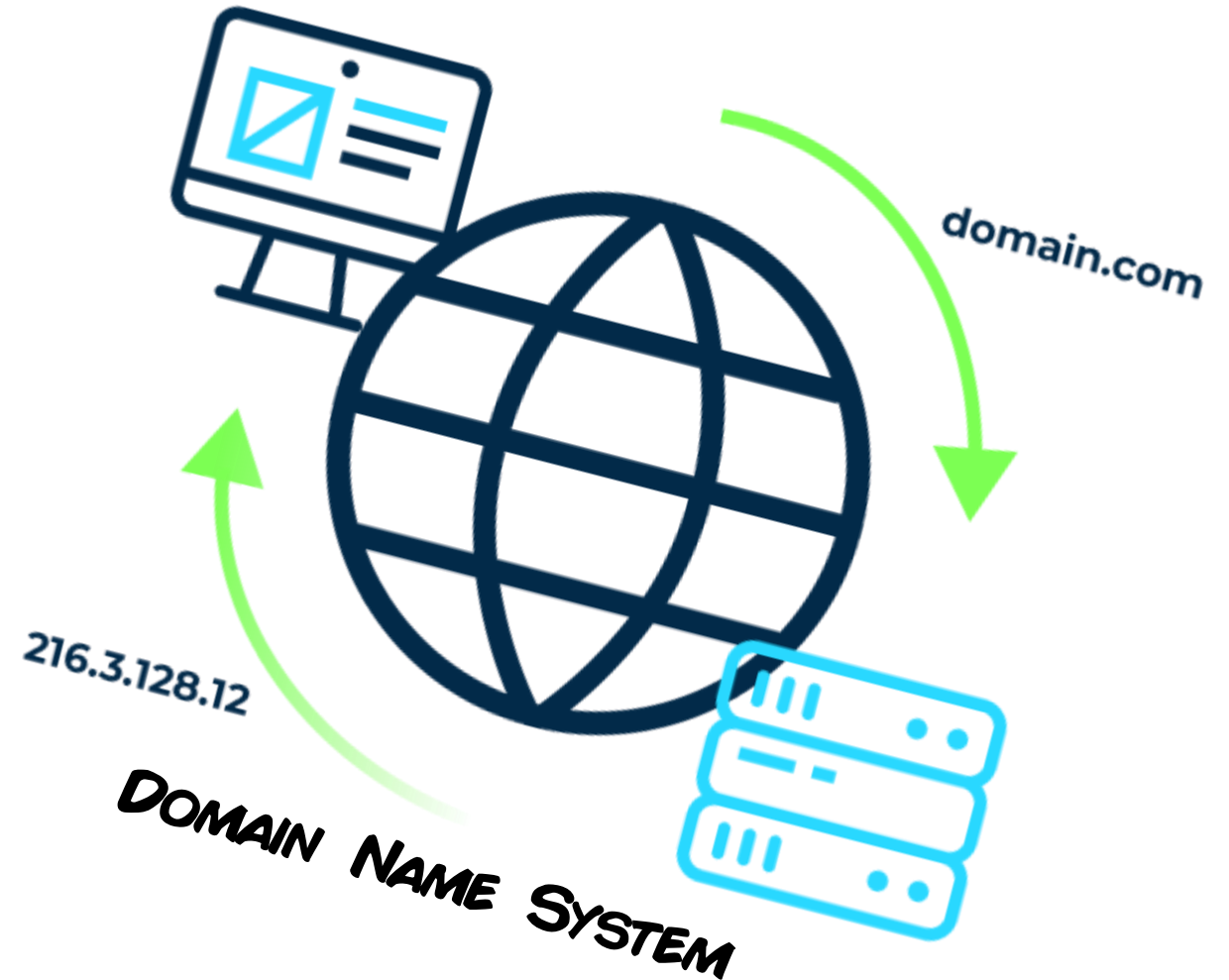
Eliza is a mock Rogerian psychotherapist.
The original program was described by Joseph Weizenbaum in 1966.
This implementation by Norbert Landsteiner 2005.

ELIZA: Is something troubling you ?
YOU:  Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:  They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:  Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:  He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:  It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:  █
```

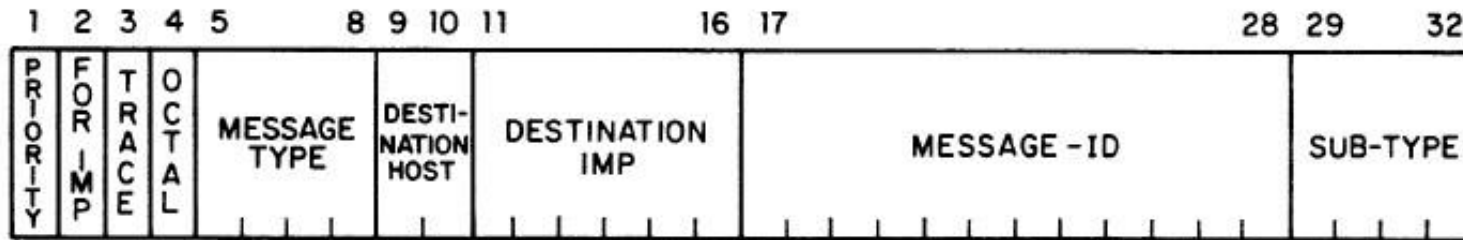

WICHTIGE DIENSTE IM ARPANET



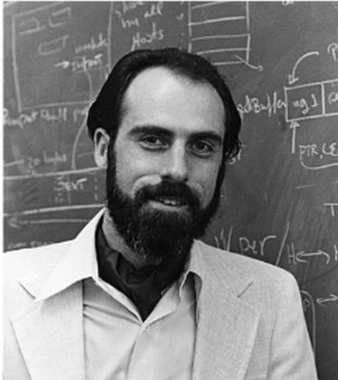
DATEITRANSFER



PROTOKOLLE - DIE SPRACHE IM INTERNET



Bob Kahn



Vint Cerf

Bob Kahn und Vint Cerf arbeiten an einem neuen Protokoll, dass die Kommunikation erheblich verbessern soll ...

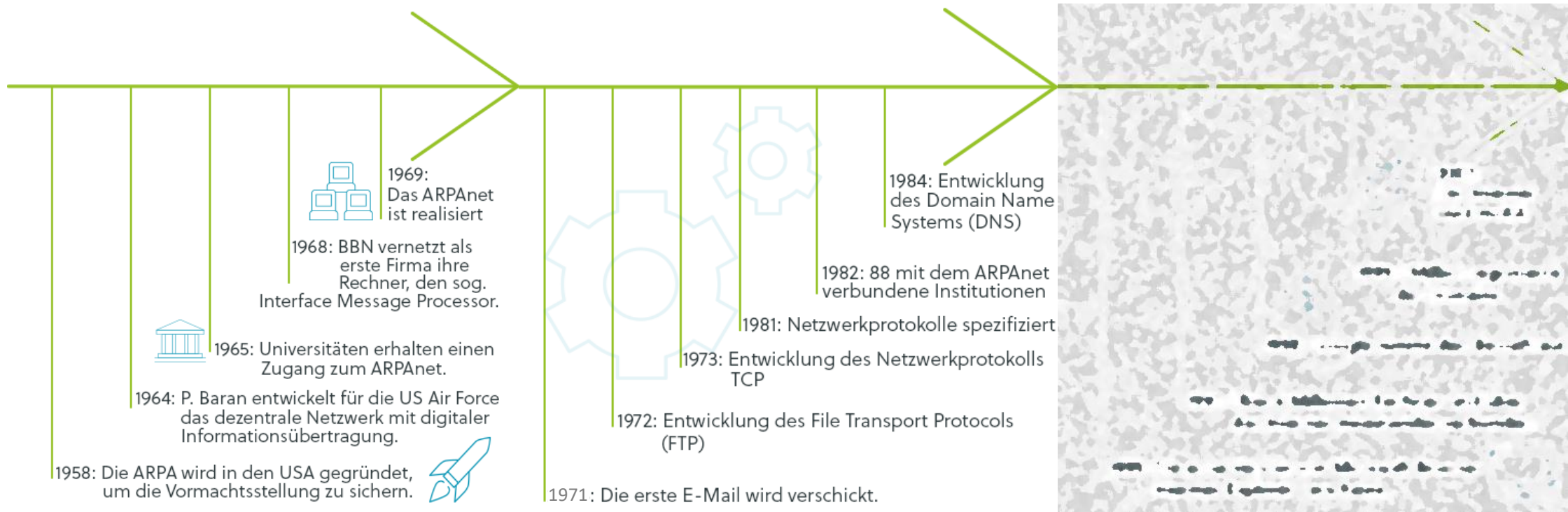


beide
gründen
später
die



Internet
Society

DIE ZWEITE PHASE ZUM INTERNET



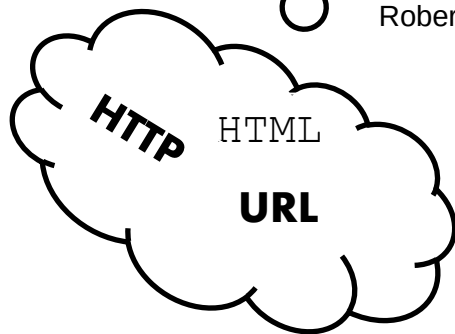
WWW - DAS WORLD WIDE NET



Tim Berners-Lee



Robert Cailliau

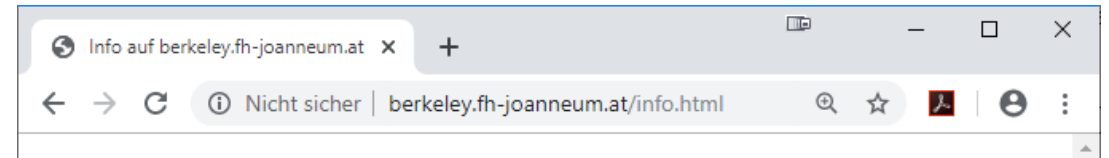


Der erste Web Server, auf dem die erste Webseite lief - <http://info.cern.ch/>



KOMMUNIKATION IM WWW 1

- **Client**
Web Browser
z.B. Google Chrome)
- **sendet**
über das Netzwerk eine
HTTP*- **Anfrage**
- an den
Web-**Server**
z.B. Apache 2
(*HTTP = Hypertext Transfer Protocol)



```
GET /info.html HTTP/1.1  
Host: berkeley.fh-joaanneum.at
```



KOMMUNIKATION IM WWW 2

Anwendungsdaten

```
GET / HTTP1.1  
Host:  
fh-joanneum.at
```

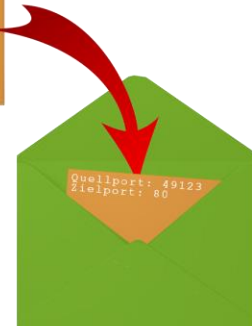
HTTP



Dienst

```
Quellport:  
49123  
Zielport:  
80
```

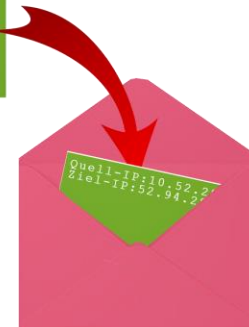
TCP



Logische Adresse

```
Quell-IP:  
10.52.20.1  
Ziel-IP:  
52.94.28.16
```

IP



Physische Adresse

```
Quell-MAC:  
8c:34:12:95:9a:00  
Ziel-MAC:  
00:08:e3:12:ff:00
```

Ethernet

Elektrische Signale



Kapselung von Nachrichten

Beispiel HTTP – Hypertext Transfer Protocol

Mit dem "Port" 80 wird hier ein Webserver angesprochen

Diese Nachricht ist eine Anfrage vom Browser an den Webserver der FH JOANNEUM.

Legende:

- IP ...** Internet Protokoll
Logische Adressierung
- MAC ...** Media Access Control
Hardware Adresse
Zugriff auf das Medium
Netzwerkkarte
- Port ...** "Nummer" des Dienstes,
der am Server angesprochen
wird- bzw. Nummer für "Rück-
Antwort" von diesem Dienst

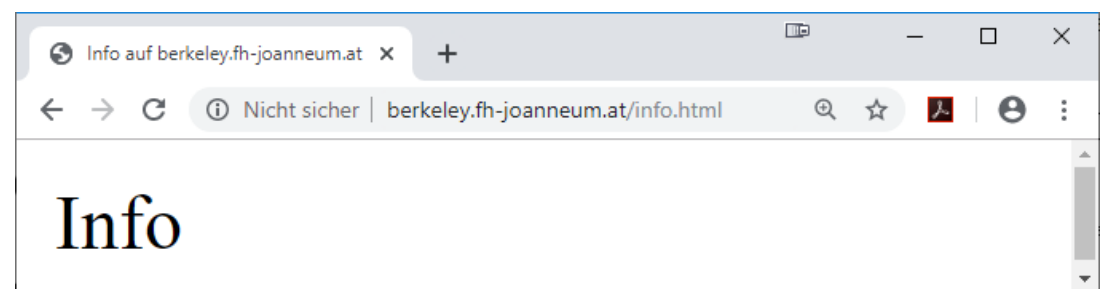
KOMMUNIKATION IM WWW 3

- Der **Server** sendet eine (HTTP-) **Antwort** an den **Client** (=Browser) zurück
- und deren Inhalt zeigt ein Browser als (HTML) **Dokument** gerendert an



```
HTTP/1.1 200 OK
Content-Type: text/html

<!DOCTYPE html>
<html>
  <head>
    <meta charset="UTF-8">
    <title>Info auf berkeley.fh-joeanneum.at</title>
  </head>
  <body>
    Info
  </body>
</html>
```



HTML - HYPERTEXT MARKUP LANGUAGE



```
<HEADER>
<TITLE>The World Wide Web project</TITLE>
<NEXTID N="55">
</HEADER>
<BODY>
<H1>World Wide Web</H1>The WorldWideWeb (W3) is a wide-area<A
NAME=0 HREF="WhatIs.html">
hypermedia</A> information retrieval
initiative aiming to give universal
access to a large universe of documents.<P>
Everything there is online about
W3 is linked directly or indirectly
```



WER REGIERT DAS INTERNET?

Grundsätzlich: Niemand – Verschiedene Institutionen bieten Richtlinien und Verfahrensanweisungen. Die meisten davon sind (meist U.S.) NPOs - Non-Profit Organisationen.

ICANN (Internet Corporation for Assigned Names and Numbers):

- Domains und DNS Routing (.com, .at, .net, ...)

- Dienste und „Ports“

IANA (Internet Assigned Numbers Authority)

- Untersteht ICANN in Koop. mit IETF

- IP Adressverteilung

IETF (Internet Engineering Task Force):

- Technische Spezifikationen → IAB (Internet Architecture Board) / RFC Editor

- Loose Organisation mit vielen Arbeitsgruppen für viele Bereiche

IEEE (Institute of Electrical and Electronics Engineers)

- Größter technische Berufsverband der Welt



<https://www.icann.org/>



<http://www.iana.org/>

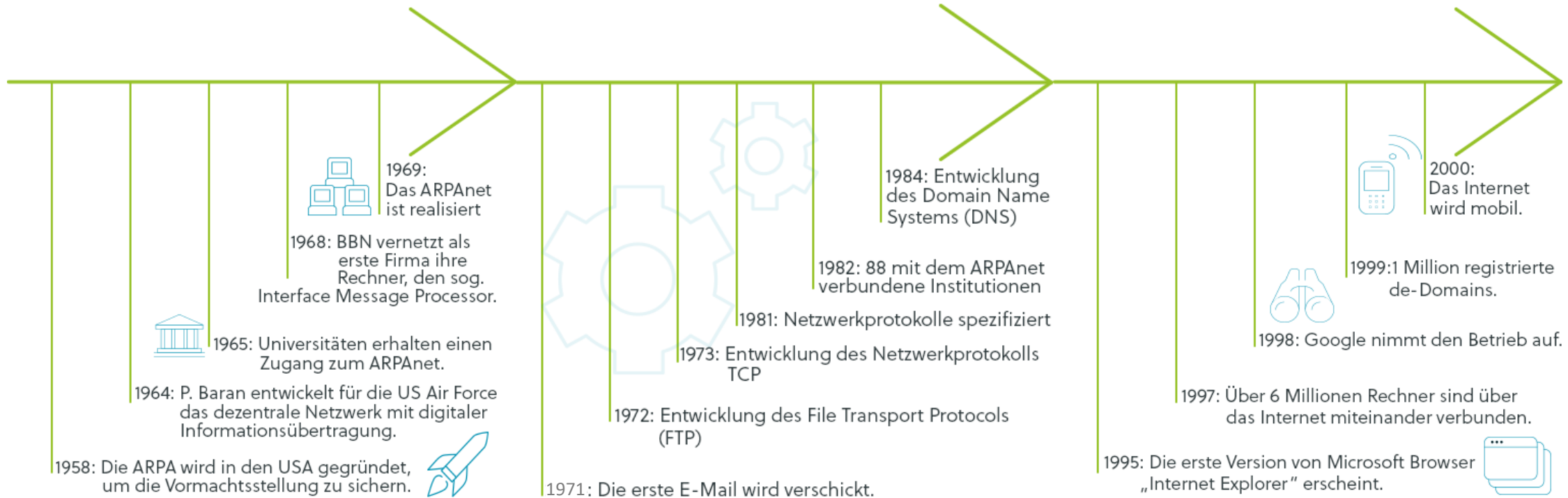


<https://www.ietf.org/>



<https://www.ieee.org/>

DIE DRITTE PHASE ZUM INTERNET



Cloud Computing Lab

