

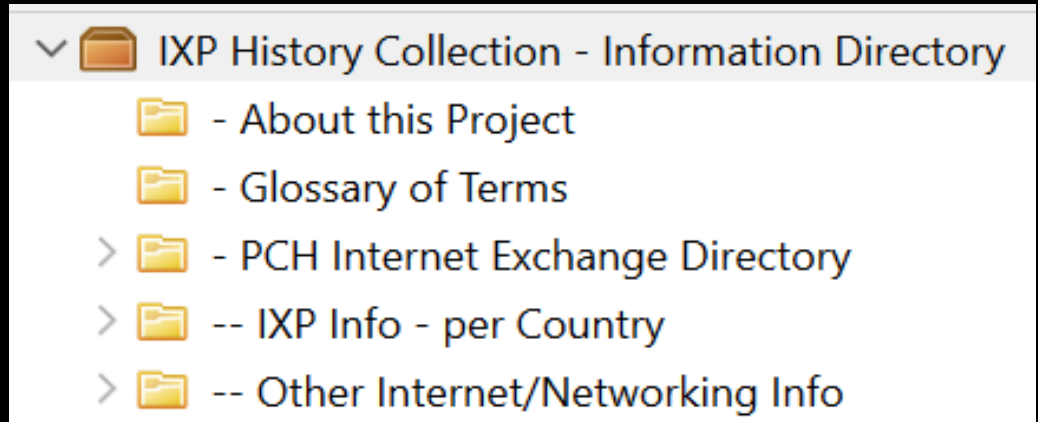
IIPC Web Archiving Conference 2025
09-10 April, National Library of Norway, Oslo

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The IXP History Collection is an ongoing project which seeks to record and document histories of the Internet Exchange Points (IXPs) which form the core of the Internet's topology.



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Oops
404
Page not Found

The UNESCO (2003) Charter on the Preservation of Digital Heritage, characterizes digital heritage as “unique resources of human knowledge and expression” that embrace

“cultural, educational, scientific and administrative resources, as well as technical, legal, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources. Where resources are ‘born digital’, there is no other format but the digital object.

[...] the disappearance of heritage in whatever form constitutes an impoverishment of the heritage of all nations”

IXPs - Internet Exchange Points

ISP: Internet Service Provider

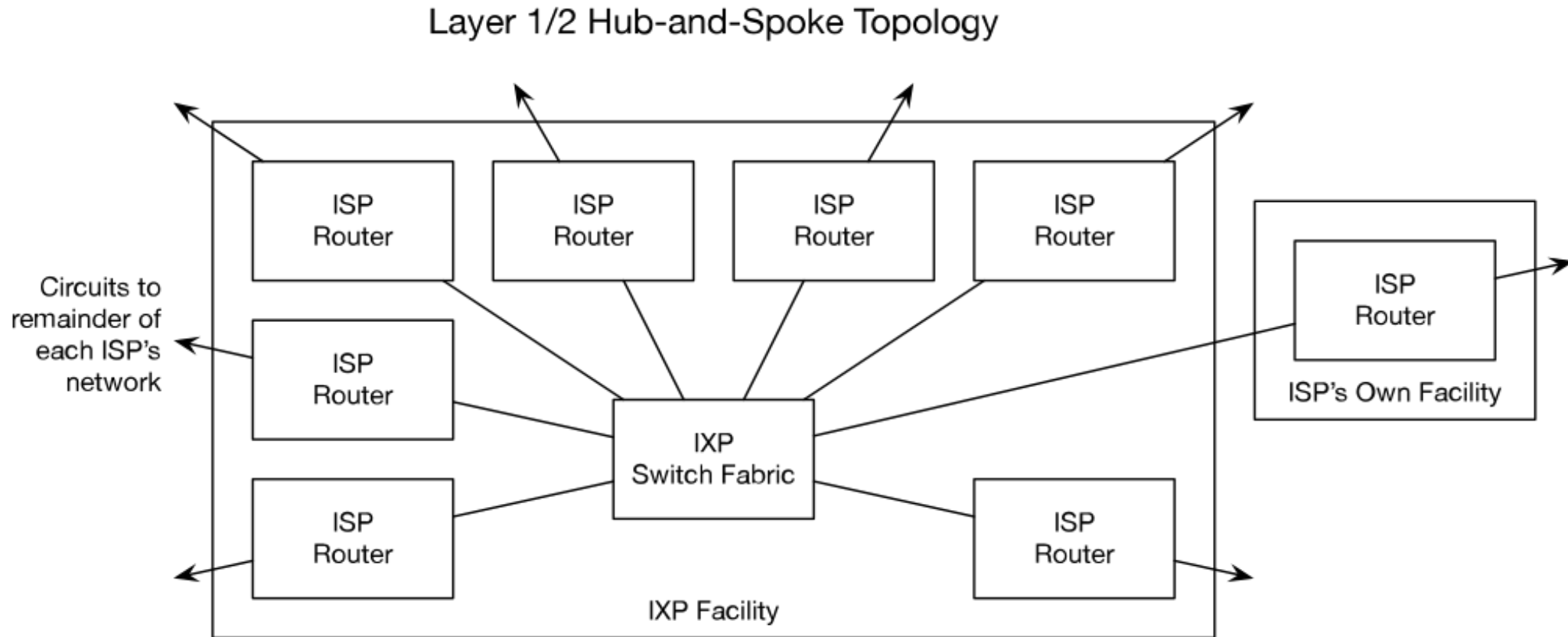


Diagram by Bill Woodcock, Packet Clearing House, rights released for use on Wikipedia

Circuit Switching V Packet Switching

Representation of Circuit Switching
(long-distance phone call)

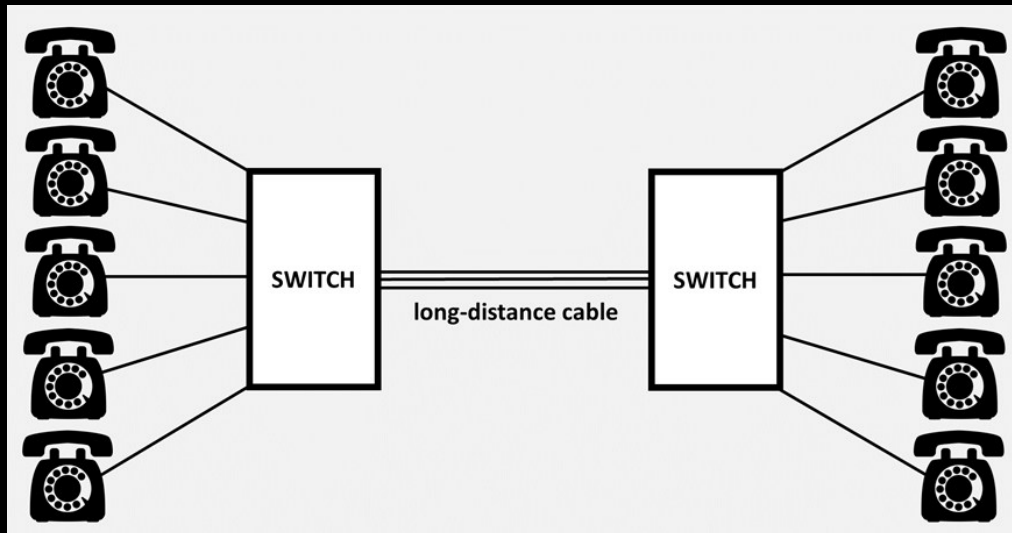


Image Source: Gillies & Caillau, 2000

Representation of Packet Switching
(data packets)

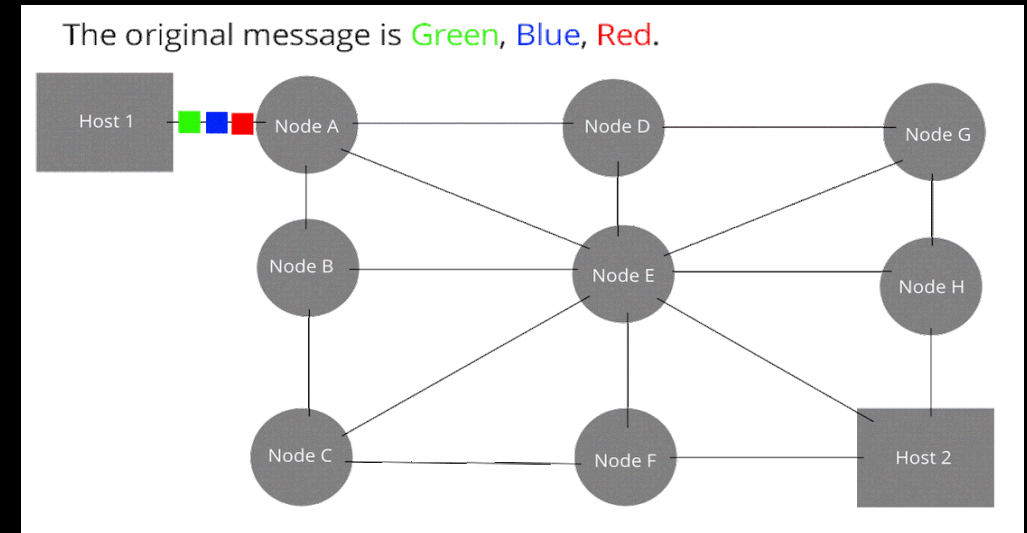


Image Source: Oddbodz, Wikipedia

ARPANET - Wide-Area Packet-Switched Network

Advanced Research Projects Agency Network

Sketch of ARPANET in December 1969

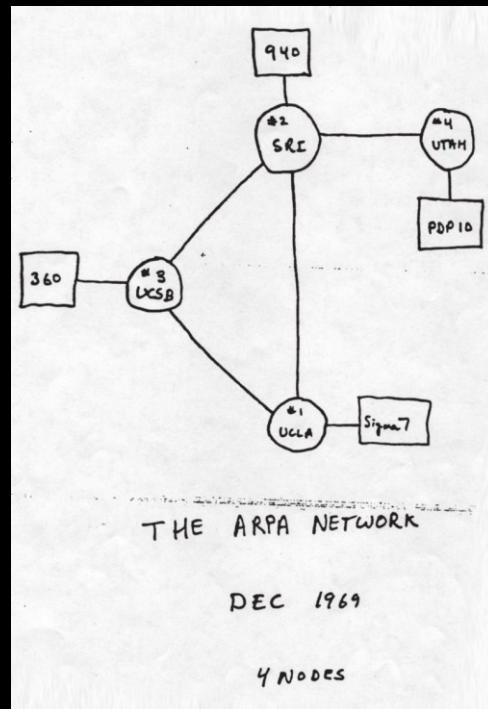


Image Source: Wikipedia

ARPANET access points in the 1970s

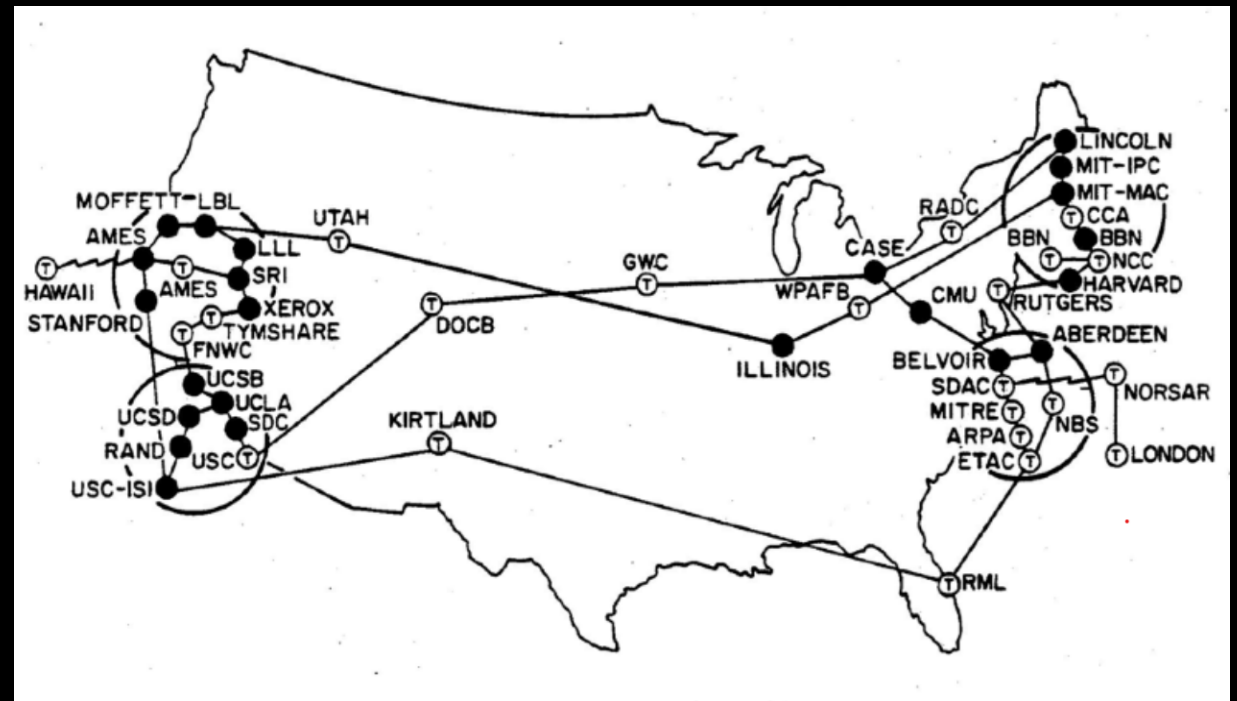


Image Source: Wikipedia

The Rise of NSFNET

National Science Foundation Network (1985-1995)

56K NSFNET Backbone, 1986-1988

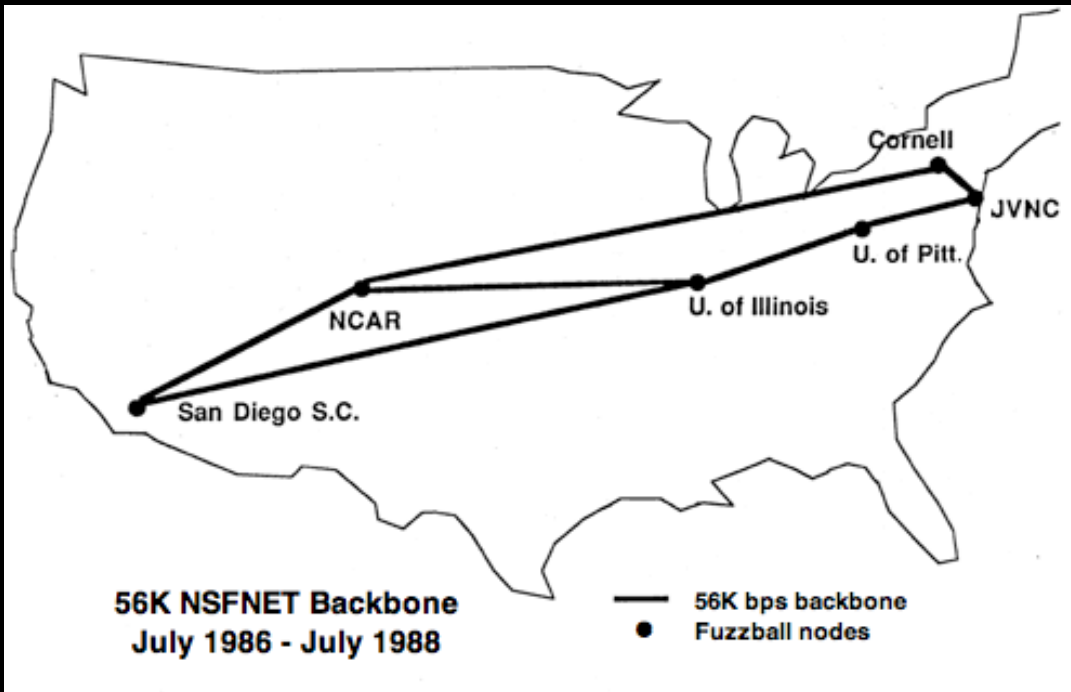


Image Source: Wikipedia

Physical Initial NSFNET Topology 1988

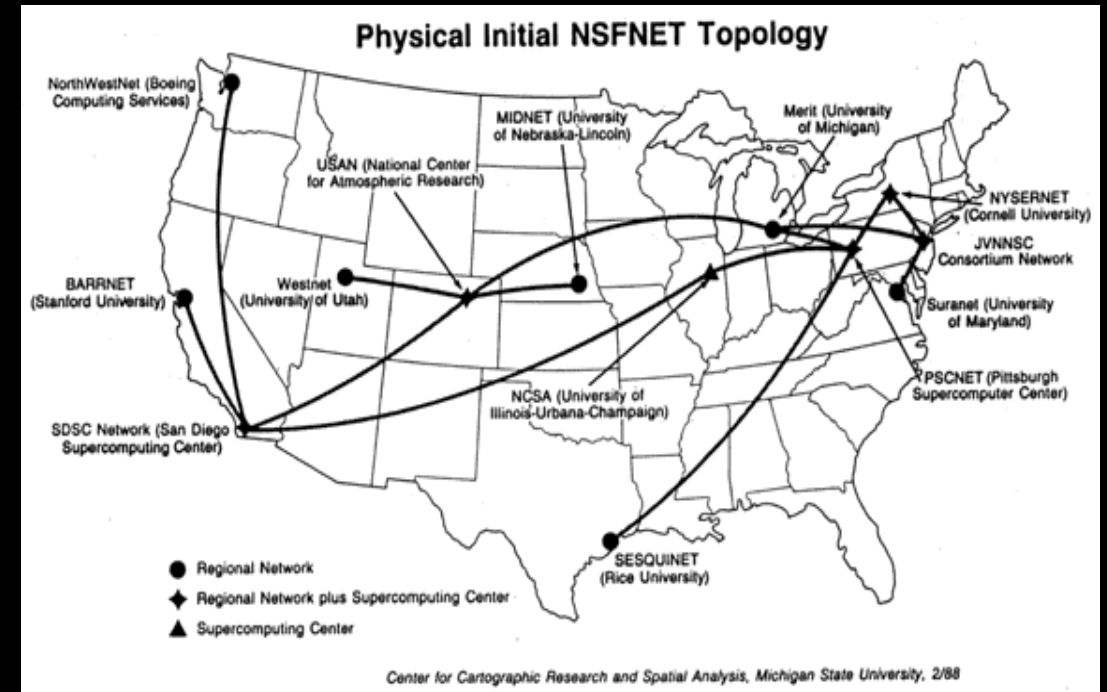


Image Source: Michigan State University

NSFNET Acceptable Use Policy (AUP)

NSFNET Traffic 1991

NSFNET BACKBONE ACCEPTABLE USE POLICY: GENERAL PRINCIPLE:

(1) NSFNET Backbone services are provided to support open research and education in and among US research and instructional institutions, plus research arms of for-profit firms when engaged in open scholarly communication and research. Use for other purposes is not acceptable.

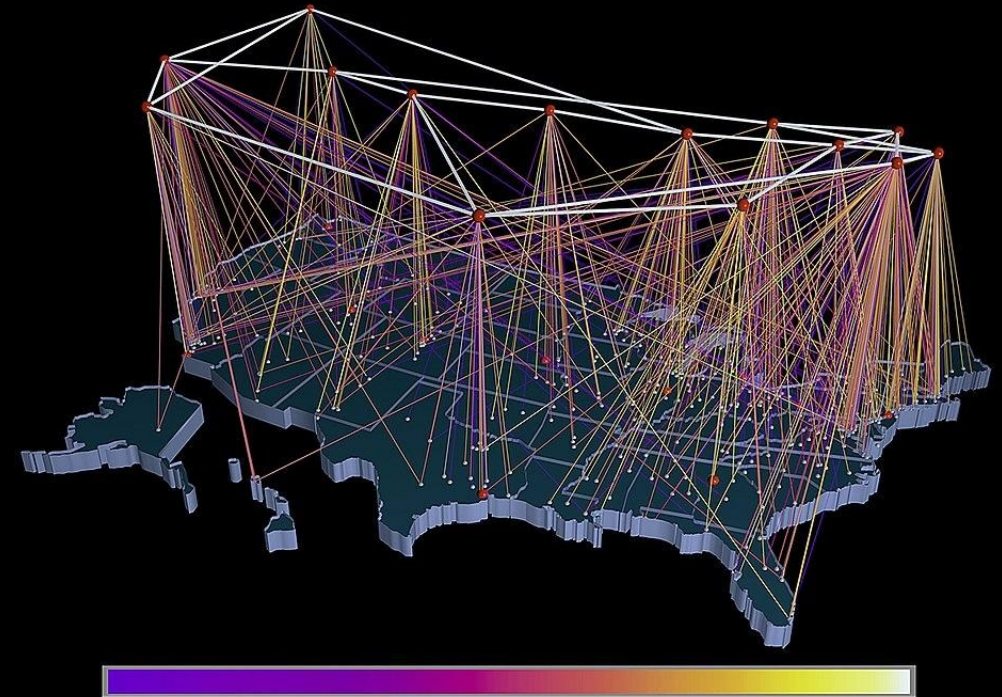
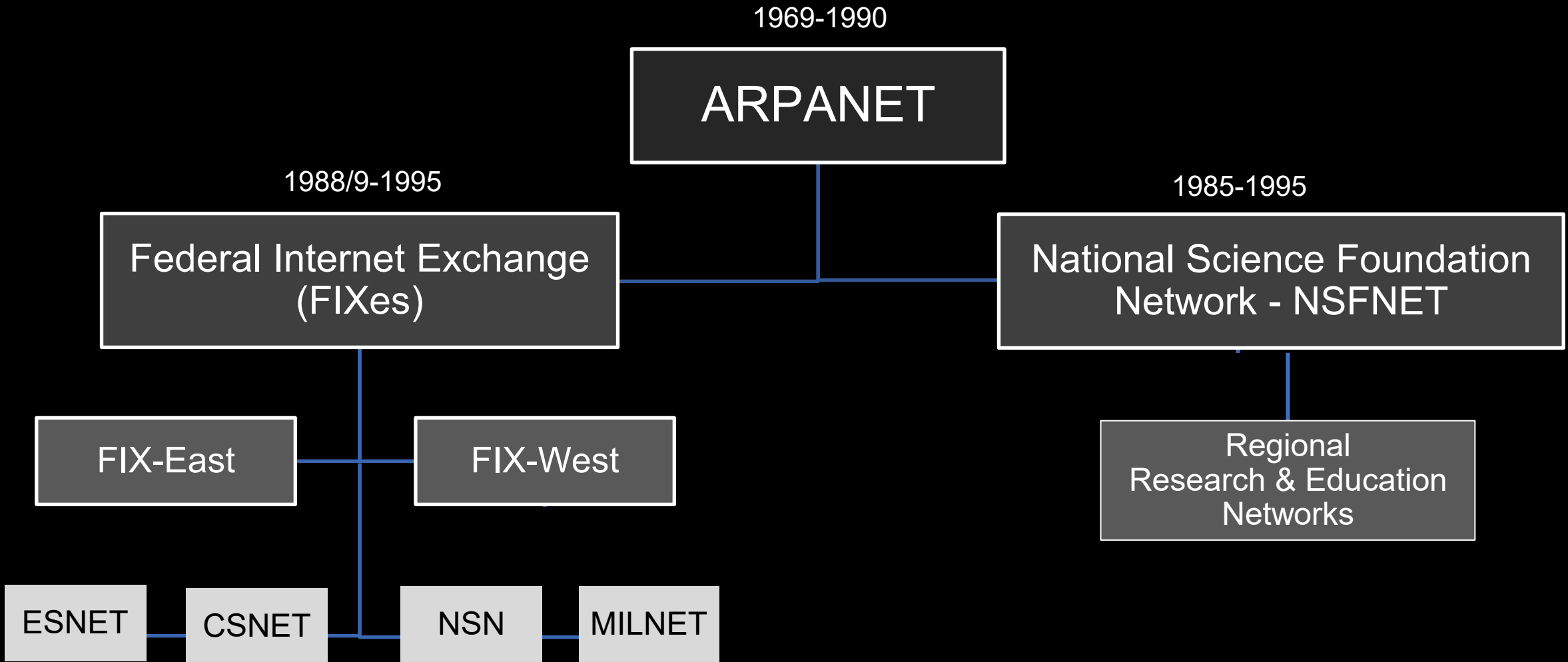


Image Source: Wikipedia

Federal Internet Exchange

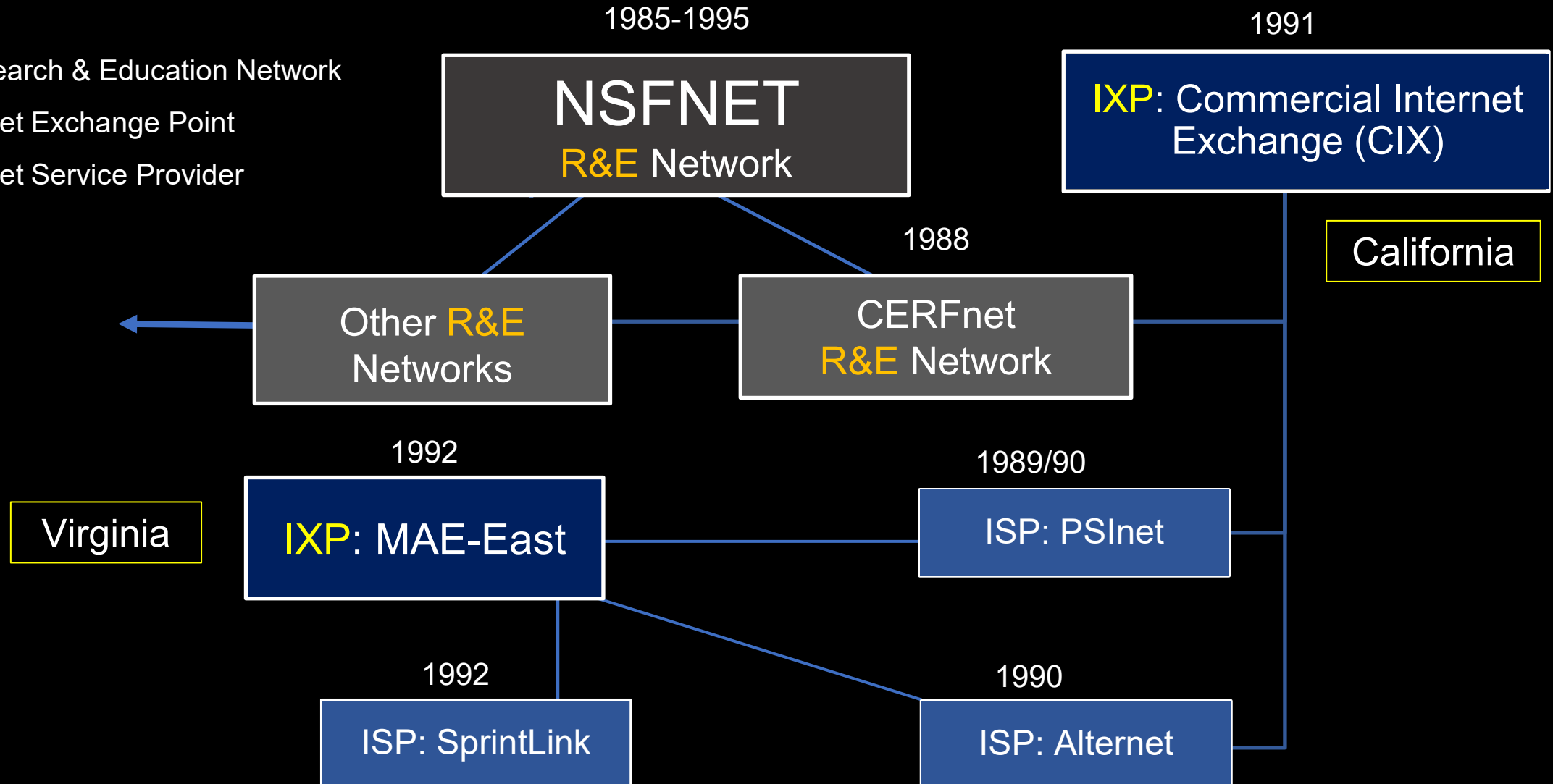


The First Commercial IXPs in the US

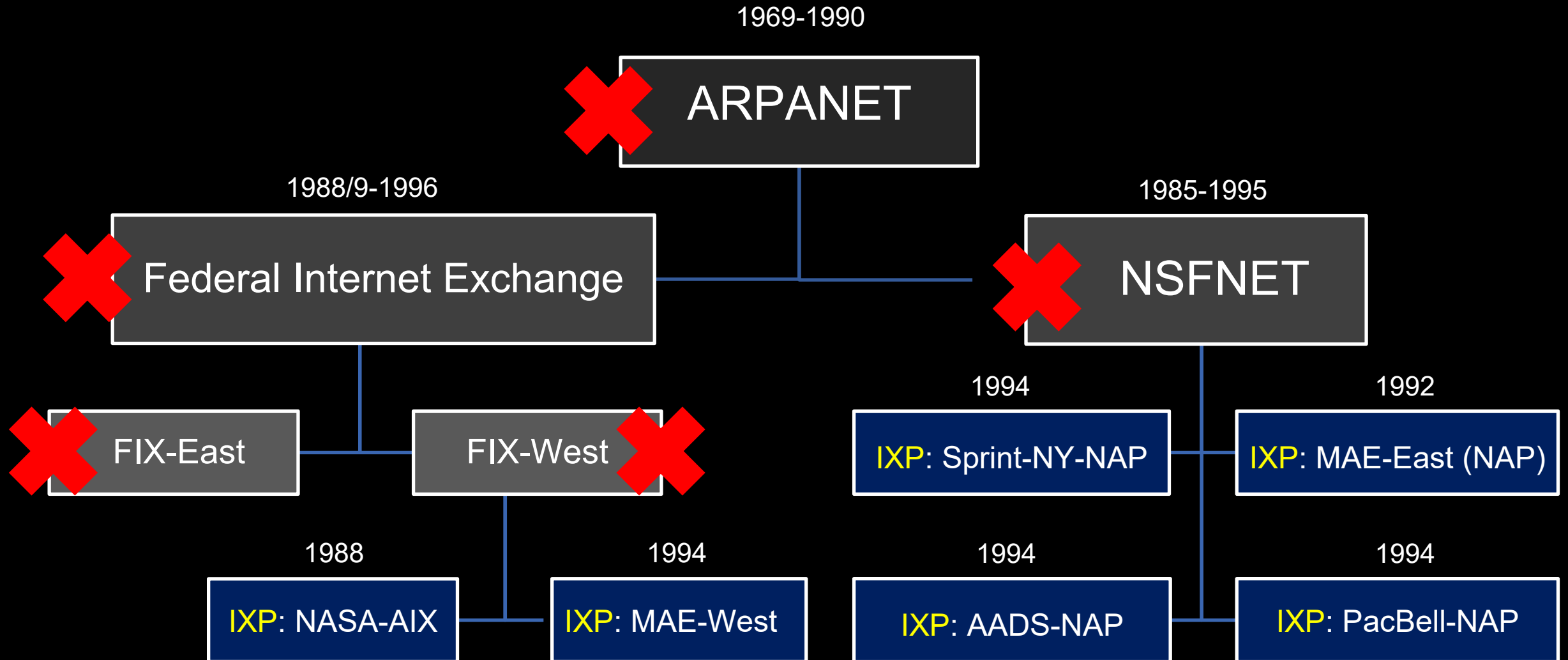
R&E: Research & Education Network

IXP: Internet Exchange Point

ISP: Internet Service Provider



The NSFNET Transition



Early IXPs – United States

Bottlenecks

- 1988: NASA-AIX - NASA Ames Internet Exchange (California)
- 1988/9: FIX - Federal Internet Exchange (Maryland, California)
- 1991: CIX - Commercial Internet Exchange (California)
- 1992: MAE-East (NAP) - Metropolitan Area Exchange, East (Virginia)
- 1994: AADS-NAP - Ameritech Chicago NAP (Illinois)
- 1994: PacBell-NAP - PacBell San Francisco NAP (California)
- 1994: Sprint-NY-NAP - Sprint New York NAP (New Jersey)
- 1994: PCH - Packet Clearing House (California)
- 1994: MAE-Chicago - Metropolitan Area Exchange, West (Illinois)
- 1994: MAE-NY- Metropolitan Area Exchange, New York City
- 1994: MAE-West - Metropolitan Area Exchange, West (California)
- 1995: MAE-LA - Metropolitan Area Exchange, Los Angeles (California)
- 1995: HIX - Hawaii Internet Exchange

Early International Networking Efforts



NORSAR in Norway became the first organization outside the US to be connected to ARPANET. NORSAR's TIP was installed in June 1973. NORSAR's ARPANET-connection was primarily used for seismic data exchange.



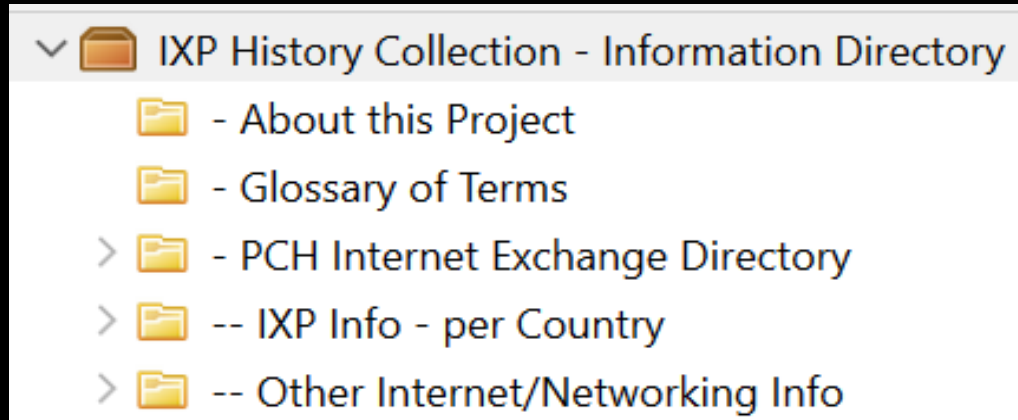
EUnet, an abbreviation for European Unix Network, was founded in 1982 as a pan-European cooperative computer network to provide networking services to academic and corporate research communities based on Unix operating systems and X.25.

Early IXPs Elsewhere

- 1992: D-GIX-Distributed Global Internet Exchange (Sweden)
- 1993: NIX-Norwegian Internet Exchange (Norway)
- 1993: FICIX-Finnish Communication and Internet Exchange (Finland)
- 1994: AMS-IX Amsterdam-Amsterdam Internet Exchange (Netherlands)
- 1994: DIX-Danish Internet Exchange (Denmark)
- 1994: LINX-London Internet Exchange (United Kingdom)
- 1994: Munich-IX - Munich Internet Exchange Service (Germany)
- 1994: NSPIX-1 - Network Service Provider IXP (Japan)
- 1995: GIGA-PIX - Gigabit Portuguese Internet Exchange Point (Portugal)
- 1995: HKIX: Hong Kong Internet Exchange (China)
- 1995: MSK-IX Moscow - Moscow Internet Exchange (Russia)
- 1995: SFINX - Service for French Internet Exchange (France)

Broad Aims

- a) develop a corpus of relevant information for documenting IXP histories, and
- b) develop a preservation strategy for the safe-keeping of such information.



PCH Internet Exchange Directory

PCH
Packet Clearing House

Login

About ▾ Services ▾ Tools ▲ Resources ▾

- Cable System
- Internet Governance Calendar
- IXP Directory
- Looking Glass
- Prefix-Sanity Checker

Packet Clearing House
is the intergovernmental treaty organization responsible for providing operational support and security to critical Internet infrastructure, including Internet exchange points and the core of the domain name system.

PCH Internet Exchange Directory

Region	Country	City	IXP Name	Participants	Peak	Avg	IPv6	Prefixes	Established ▲
Asia-Pacific	Australia	Adelaide	South Australian Internet Exchange	0	?	?	?	?	Jul 1996
Europe	Czech Republic	Prague	NIX.CZ - Neutral Internet eXchange for the Czech Republic	194	1.2T	?	?	?	31 Aug 1996
	Slovakia	Bratislava	Slovak Internet eXchange Bratislava	65	636G	369G	?	?	Oct 1996
Asia-Pacific	South Korea	Seoul	LGDACOM Internet Exchange	52	70G	?	?	?	Oct 1996
	Japan	Tokyo	Network Service Provider IXP (Distributed IX in Edo)	46	23G	?	?	11226	Oct 1996
	South Korea	Seoul	Korea Internet Exchange KIX	0	?	?	?	?	Oct 1996
	South Korea	Seoul	Korea Telecom Internet Exchange	0	?	?	?	?	Oct 1996
	New Zealand	Wellington	Wellington Internet Exchange	89	3.85G	?	?	6325	Dec 1996

Use Zotero to develop a corpus of relevant information for documenting the history of IXPs.

Zotero is a free, open-source research tool, created by the Center for History and New Media at George Mason University, with its first release in 2006.

The IXP History Collection – Information Directory is currently available as a work in progress:

https://www.zotero.org/groups/4944209/ixp_history_collection_-_information_directory/library



IXP History Collection – Information Directory

zotero

Groups Documentation Forums Get Involved **Item Types** Creator, Year

Other Group Libraries

- IXP History Collection - Informatio...
- About this Project
- Glossary of Terms
- PCH Internet Exchange Directory
- IXP Info - per Country
- Other Internet/Networking Info

Creator	Date	Title	Item Type
Rao	2017-03-21	¡Hola, Ecuador! Quito...	Web Page
Díaz	2012-07-22	¿Dónde colocar los s...	Web Page
Stackscale	2021-12-28	¿Qué es ESspanix? El n...	Web Page
Wikipedia	2004	.dk	Encyclopedia A...
Wikipedia	2004	.pt	Encyclopedia A...
Сетевое издание...	2009-06-11	«Инфосистемы Дже...	Web Page
Сетевое издание...	2007-11-07	«Ростелеком» будет ...	Web Page
Сетевое издание...	2008-03-31	«Ростелеком» и Рос...	Web Page
CNews.ru	2015-01-15	«Ростелеком» купил...	Web Page
Schuster	2016-06-10	» A brief history of in...	Web Page
JPIX Official	2022-08-16	【JPIX 25th Annivers...	Video Recording
Wikipedia	2006	@Home Network	Encyclopedia A...
@Home Network	1997-12-12	@Home Network	Web Page
Repucci	1992-12-18	** Merit/NSFNET Reg...	E-mail
CricketWeb Forum	2021-01-28	*Official* Australia in ...	Web Page
People-Centered ...	2020-01-16	#TDVNet connects fo...	Forum Post
GlobalCenter		• GlobalCenter • Vict...	Web Page

7783 items in this view

IXP History Collection – Information Directory

zotero Groups Documentation Forums Get Involved Log In

Other Group Libraries

- IXP History Collection - Informatio...
- About this Project
- Glossary of Terms
- PCH Internet Exchange Directory
- IXP Info - per Country
 - Algeria (DZ)
 - Angola (AO)
 - Argentina (AR)
 - Australia (AU)
 - Austria (AT)
 - Bahrain (BH)
 - Bangladesh (BD)
 - Belgium (BE)
 - Bolivia (BO)
 - Brazil (BR)
 - Cambodia (KH)
 - Canada (CA)
 - Chile (CL)

Organised by Country Folder System

Creator	Date	Title	Item Type
Rao	2017-03-21	¡Hola, Ecuador! Quito...	Web Page
Díaz	2012-07-22	¿Donde colocar los s...	Web Page
		es ESpanix? El n...	Web Page
			Encyclopedia A...
			Encyclopedia A...
Сетевое издание...	2009-06-11	«Инфосистемы Дже...	Web Page
Сетевое издание...	2007-11-07	«Ростелеком» будет ...	Web Page
Сетевое издание...	2008-03-31	«Ростелеком» и Рос...	Web Page
CNews.ru	2015-01-15	«Ростелеком» купил...	Web Page
Schuster	2016-06-10	» A brief history of in...	Web Page
JPIX Official	2022-08-16	【JPIX 25th Annivers...	Video Recording
Wikipedia	2006	@Home Network	Encyclopedia A...
@Home Network	1997-12-12	@Home Network	Web Page
Repucci	1992-12-18	** Merit/NSFNET Reg...	E-mail
CricketWeb Forum	2021-01-28	*Official* Australia in ...	Web Page
People-Centered ...	2020-01-16	#TDVNet connects fo...	Forum Post
GlobalCenter		• GlobalCenter • Vict...	Web Page

7783 items in this view

IXP History Collection – Information Directory

The screenshot shows the Zotero web interface for the 'IXP History Collection - Information Directory'. The left sidebar displays a folder structure under 'Other Group Libraries'. The main panel shows a list of items with columns for Creator, Date, Title, and Item Type. Two red arrows point to specific folders in the sidebar, each with a text box explaining the organization method.

Organised by Country Folder System

Organised by IXP Folder System

7783 items in this view

Creator	Date	Title	Item Type
Rao	2017-03-21	¡Hola, Ecuador! Quito...	Web Page
Díaz	2012-07-22	¿Donde colocar los s...	Web Page
		es ESpanix? El n...	Web Page
			Encyclopedia A...
			Encyclopedia A...
Сетевое издание...	2009-06-11	«Инфосистемы Дже...	Web Page
		«Ростелеком» будет ...	Web Page
		«Ростелеком» и Рос...	Web Page
		«Ростелеком» купил...	Web Page
Schuster	2016-06-10	» A brief history of in...	Web Page
JPIX Official	2022-08-16	【JPIX 25th Annivers...	Video Recording
Wikipedia	2006	@Home Network	Encyclopedia A...
@Home Network	1997-12-12	@Home Network	Web Page
Repucci	1992-12-18	** Merit/NSFNET Reg...	E-mail
CricketWeb Forum	2021-01-28	*Official* Australia in ...	Web Page
People-Centered ...	2020-01-16	#TDVNet connects fo...	Forum Post
GlobalCenter		• GlobalCenter • Vict...	Web Page

IXP History Collection – Information Directory

zotero

Groups Documentation Forums Get Involved Log In

Other Group Libraries

- IXP History Collection - Informatio...
- About this Project
- Glossary of Terms
- PCH Internet Exchange Directory
- IXP Info - per Country
 - Algeria (DZ)
 - Angola (AO)
 - Argentina (AR)
 - CABASE - Cámara Argenti...
 - CABASE-BHB - CABASE ...
 - CABASE-BUE - CABASE ...
 - CABASE-COR - CABASE ...
 - CABASE-DLC - CABASE ...
 - CABASE-LPL - CABASE I...
 - CABASE-MDQ - CABAS...
 - CABASE-MZA - CABASE...
 - CABASE-NQN - CABASE...
 - CABASE-POS - CABASE ...
 - CABASE-ROS - CABASE ...
 - CABASE-SFE - CABASE I...

Creator	Date	Title	Item Type
Rao	2017-03-21	¡Hola, Ecuador! Quito...	Web Page
Díaz	2012-07-22	¿Dónde colocar los s...	Web Page
Stackscale	2021-12-28	¿Qué es ESpanix? El n...	Web Page
Wikipedia	2004	.dk	Encyclopedia A...
Wikipedia	2004	.pt	Encyclopedia A...
Сетевое издание...	2009-06-11	«Инфосистемы Дже...	Web Page
Сетевое издание...	2007-11-07	«Ростелеком» будет ...	Web Page
Сетевое издание...	2008-03-31	«Ростелеком» и Рос...	Web Page
CNews.ru	2015-01-15	«Ростелеком» купил...	Web Page
Schuster	2016-06-10	» A brief history of in...	Web Page
JPIX Official	2022-08-16	【JPIX 25th Annivers...	Video Recording
Wikipedia	2006	@Home Network	Encyclopedia A...
@Home Network	1997-12-12	@Home Network	Web Page
Repucci	1992-12-18	** Merit/NSFNET Reg...	E-mail
CricketWeb Forum	2021-01-28	*Official* Australia in ...	Web Page
People-Centered ...	2020-01-16	#TDVNet connects fo...	Forum Post
GlobalCenter		• GlobalCenter • Vict...	Web Page

7783 items in this view

Efforts made to collect multilingual sources

IXP History Collection – Information Directory

The screenshot displays the Zotero web interface for the IXP History Collection. The left sidebar shows a tree view of group libraries, with 'IXP History Collection - Information Directory' selected. The main table lists items with columns for Creator, Date, Title, and Item Type. A search overlay on the right shows the search bar and a dropdown menu with options to search by 'Title, Creator, Year' or 'Title, Creator, Year + Full-Text Content'. A red arrow points from the 'SEARCH' button to the search bar. The text '7783 items in this view' is displayed at the bottom of the search overlay.

zotero Groups Documentation Forums Get Involved Log In **SEARCH**

Other Group Libraries

- IXP History Collection - Information Directory
 - About this Project
 - Glossary of Terms
 - PCH Internet Exchange Directory
 - IXP Info - per Country
 - Algeria (DZ)
 - Angola (AO)
 - Argentina (AR)
 - CABASE - Cámara Argenti...
 - CABASE-BHB - CABASE ...
 - CABASE-BUE - CABASE ...
 - CABASE-COR - CABASE ...
 - CABASE-DLC - CABASE ...
 - CABASE-LPL - CABASE I...
 - CABASE-MDQ - CABAS...
 - CABASE-MZA - CABASE...
 - CABASE-NQN - CABASE...
 - CABASE-POS - CABASE ...
 - CABASE-ROS - CABASE ...
 - CABASE-SFE - CABASE I...

Creator	Date	Title	Item Type
Rao	2017-03-21	¡Hola, Ecuador! Quito...	Web Page
Díaz	2012-07-22	¿Dónde colocar los s...	Web Page
Stackscale	2021-12-28	¿Qué es ESpanix? El n...	Web Page
Wikipedia	2004	.dk	Encyclopedia A...
Wikipedia	2004	.pt	Encyclopedia A...
Сетевое издание...	2009-06-11	«Инфосистемы Дже...	Web Page
Сетевое издание...	2007-11-07	«Ростелеком» будет ...	Web Page
Сетевое издание...	2008-03-31	«Ростелеком» и Рос...	Web Page
CNews.ru	2015-01-15	«Ростелеком» купил...	Web Page
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CricketWeb Forum	2021-01-28	*Official* Australia in ...	Web Page
People-Centered ...	2020-01-16	#TDVNet connects fo...	Forum Post
GlobalCenter		• GlobalCenter • Vict...	Web Page

Q Title, Creator, Year

Title, Creator, Year

Title, Creator, Year + Full-Text Content

7783 items in this view

IXP History Collection – Information Directory

The screenshot displays the Zotero web interface for the IXP History Collection. On the left, a sidebar lists 'Other Group Libraries' including 'IXP History Collection - Informat...', 'About this Project', 'Glossary of Terms', 'PCH Internet Exchange Direc...', and 'IXP Info - per Country' with sub-entries for various countries like Algeria, Angola, and Argentina. The main area shows a list of items with columns for Creator, Date, Title, and Item Type. The item 'La Nueva' from 2011-09-10 is selected. On the right, the 'Info' tab provides detailed metadata for this item.

Creator	Date	Title	Item Type
Robotex	2023-07	AS52375 AS52375 LA...	Web Page
Lanfranco and M...	2015	Ataques de amplifica...	Presentation
La Nueva	2011-09-10	Bajarían los costos de...	Web Page
BFA	2018-12-07	Blockchain Federal Ar...	Presentation
Bnamericas	2023-03-16	BNamericas - Cámara...	Web Page
OECD and Inter-...	2016-06-22	Broadband Policies f...	Book
TECNOZONA	2010-05-27	CABASE – NAP Neuq...	Blog Post
Blanco	2011-05-11	CABASE abre nodo d...	Web Page
Cámara Argentin...	2015	CABASE Events 2015	Document
COLSECOR Notici...	2011-03-11	Cabase instala un NA...	Web Page
Cámara Argentin...	2021-04-26	CABASE Internet Inde...	Web Page
BGPView	2023-04	CABASE IXP Córdoba...	Document
PCH Internet Exc...	2013	CABASE-BHB - CABA...	Document
Inflect		CABASE-BHB - Intern...	Web Page
PCH Internet Exc...	1998-04-01	CABASE-BUE - CABA...	Document
PCH Internet Exc...	2012	CABASE-COR - CABA...	Document
Inflect		CABASE-COR - Intern...	Web Page

Info Notes Tags Attachments Related

Item Type Web Page
Title Bajarían los costos de Internet
Author La Nueva
Website Title La Nueva
Date 2011-09-10
URL <https://www.lanueva.com/nota/20...>
Accessed 4/21/2023, 4:54:24 PM
Language es
Rights Web page, publicly-accessible-online
Extra [URL Memento: Wayback Machine, 2023-04-28]

Application of Metadata

Abstract

Los usuarios locales de Internet podrían ver disminuidos sus costos de conexión a la red, además de notar una visible mejora en la velocidad de acceso a contenidos. Esto sería posible a partir de la instalación

IXP History Collection – Information Directory

The screenshot displays the Zotero web interface for the 'IXP History Collection - Information Directory'. The left sidebar shows a hierarchical tree of group libraries, with 'CABASE - Cámara Argenti...' selected under 'Argentina (AR)'. The main table lists various items with columns for Creator, Date, Title, and Item Type. The item 'La Nueva' from 2011-09-10 is highlighted. A red arrow points from this item to a detailed metadata panel on the right. This panel includes fields for Item Type (Web Page), Title (Bajarían los costos de Internet), Author (La Nueva), Website Title (La Nueva), Date (2011-09-10), URL (https://www.lanueva.com/nota/20...), Accessed (4/21/2023, 4:54:24 PM), Language (es), Rights (Web page, publicly-accessible-online), and Extra (URL Memento: Wayback Machine, 2023-04-28). A black box with the text 'Application of Metadata' is overlaid on the bottom right of the metadata panel.

Creator	Date	Title	Item Type
Robotex	2023-07	AS52375 AS52375 LA...	Web Page
Lanfranco and M...	2015	Ataques de amplifica...	Presentation
La Nueva	2011-09-10	Bajarían los costos de...	Web Page
BFA	2018-12-07	Blockchain Federal Ar...	Presentation
Bnamericas	2023-03-16	BNamericas - Cámara...	Web Page
OECD and Inter-...		INTERNET ARCHIVE	Book
TECNOZONA		WayBackMachine	Blog Post
Blanco		ARQUIVO.PT	
Cámara Argentin...			Web Page
COLSECOR Notici...			
Cámara Argentin...			
BGPView	2023-04	CABASE IXP Cordoba...	Document
PCH Internet Exc...	2013	CABASE-BHB - CABA...	Document
Inflect		CABASE-BHB - Intern...	Web Page
PCH Internet Exc...	1998-04-01	CABASE-BUE - CABA...	Document
PCH Internet Exc...	2012	CABASE-COR - CABA...	Document
Inflect		CABASE-COR - Intern...	Web Page

DIY Web Archiving

Application of Metadata

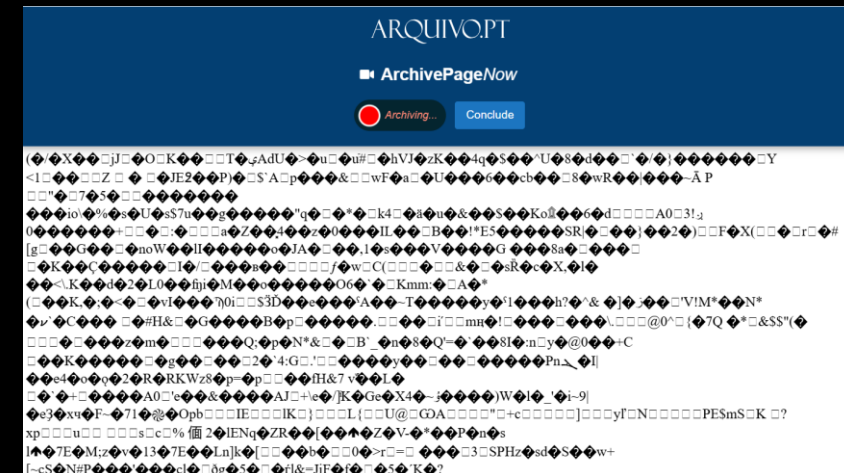
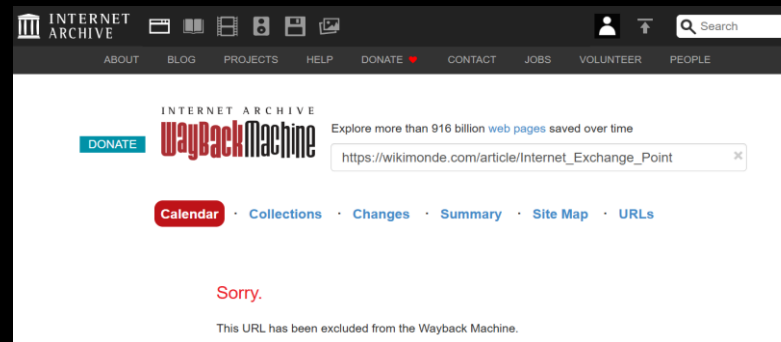
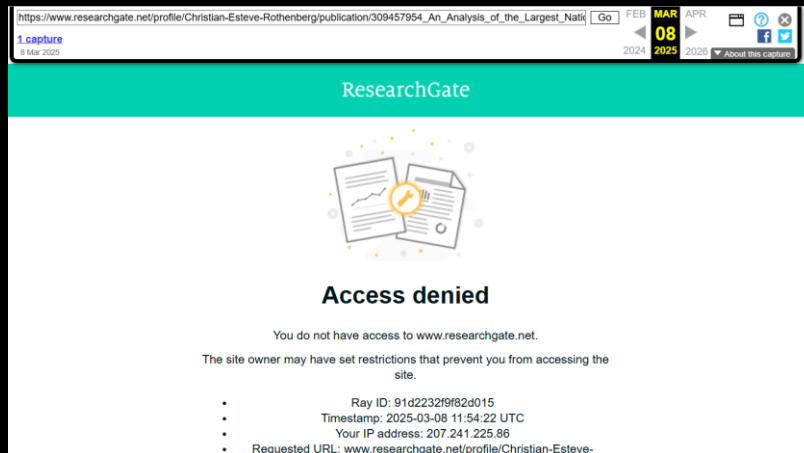
Abstract
Los usuarios locales de Internet podrían ver disminuidos sus costos de conexión a la red, además de notar una visible mejora en la velocidad de acceso a contenidos. Esto sería posible a partir de la instalación



DIY Web Archiving



Not Always Successful





DIY Web
Archiving



Not Always
Successful



PAYWALL Content

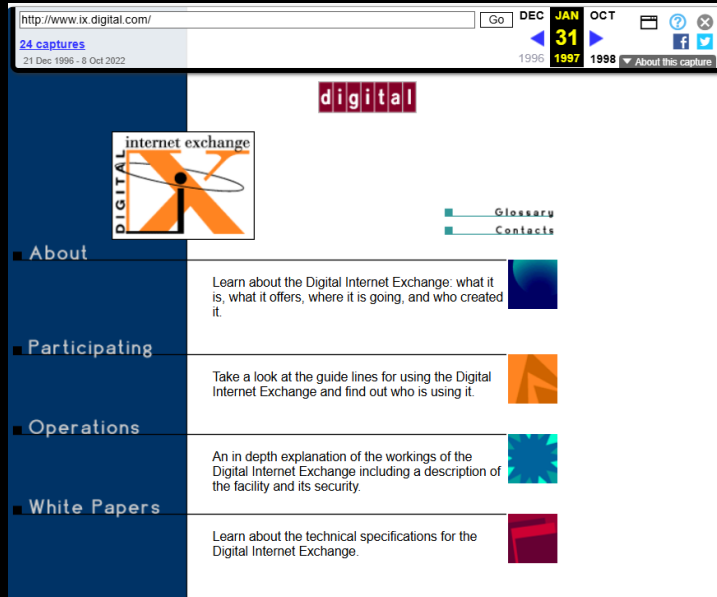
SOCIAL MEDIA Content (e.g., Facebook, Twitter, YouTube, etc.)

SLIDE SITES (e.g., SlideShare, SlideServe, etc.)

Important historical items – Screencasts or Screenshots

Important IXP History Found in Web Archives

Internet Archive – Wayback Machine



Difficult to track the history of Digital Internet Exchange, aka, Palo Alto Internet Exchange, aka, Equinix Palo Alto, due to multiple changes in ownership – Web Archives allow us to fill these gaps.

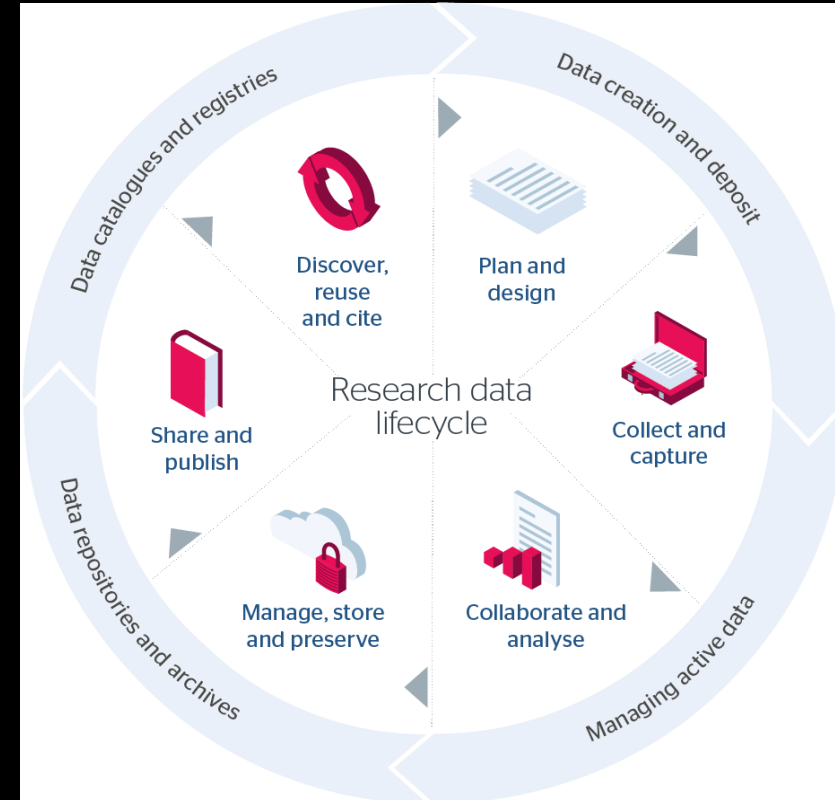
Combining **Web Archive** research with **Traditional** research

	Creator	Title	Date	Lan...	Rights	Extra
Tunisia (TN)	Chatzis and Smaragdakis	Quo vadis Open-IX?		es	Paper, publicly-...	[URL Memento: Wayback Machine, 2022-07-23]
> Uganda (UG)	PCH Internet Exchange Dir...	LINX - London Internet Exch...	1994-11-08	en	Document (web...	[URL Memento: Wayback Machine, 2023-02-26]
> Ukraine (UA)	Potter	> Europe must answer call for l...	1996-11-07	en	Newspaper arti...	[Paywall]
> United Arab Emirates (AE)	London Internet Exchange...	LINX Peering Details	1996-11-09	en	Web page, [we...	[Web archive: Wayback Machine, Timestamp: 19...
✓ United Kingdom (GB)	London Internet Exchange...	The London InterNet eXchan...	1996-11-09	en	Web page, [we...	[Web archive: Wayback Machine, Timestamp: 19...
✓ LINX - London Internet Exchange	London Internet Exchange...	The London InterNet eXchan...	1996-11-09	en	Web page, [we...	[Web archive: Wayback Machine, Timestamp: 19...
LINX - London	Allen	Advisory - tunneling of IP at ...	1997-11-26...	en	Email, publicly-...	[URL Memento: Wayback Machine, 2022-02-21]
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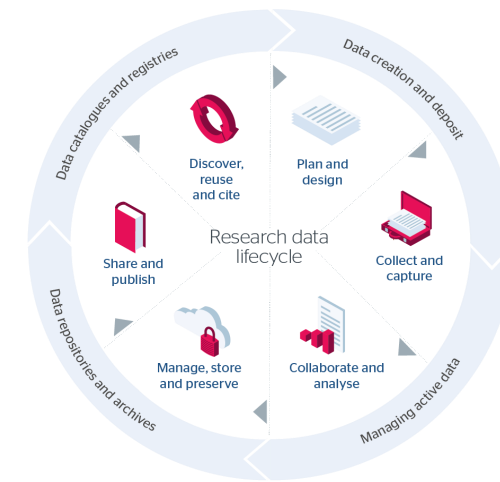
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