IXP HISTORY COLLECTION

IXP History Collection: Recording the Early Development of the Core of the Public Internet

PCH Packet Clearing House

IIPC Web Archiving Conference 2025

09-10 April, National Library of Norway, Oslo

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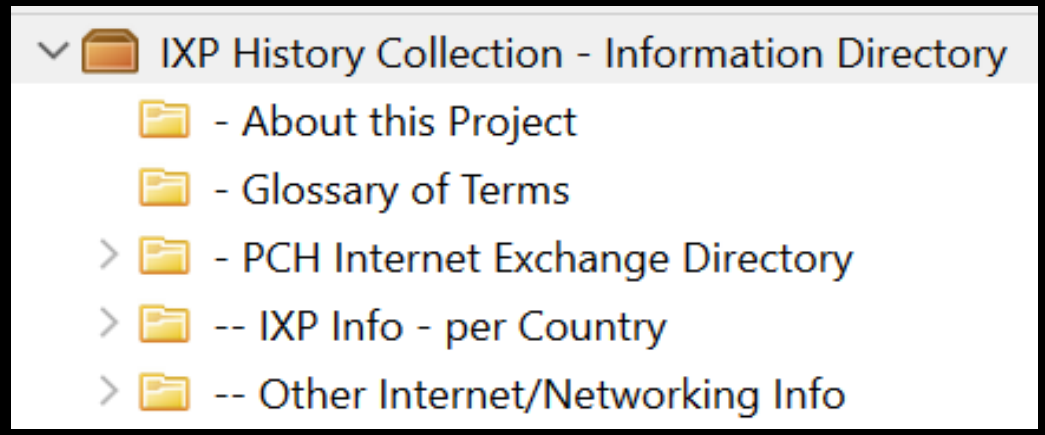
IXP HISTORY COLLECTION

The IXP History Collection Project

Packet Clearing House

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.



Collecting and Preserving Digital Heritage

IXP HISTORY COLLECTION

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Collecting and Preserving Digital Heritage

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Digital Heritage

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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”

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IXPs - Internet Exchange Points

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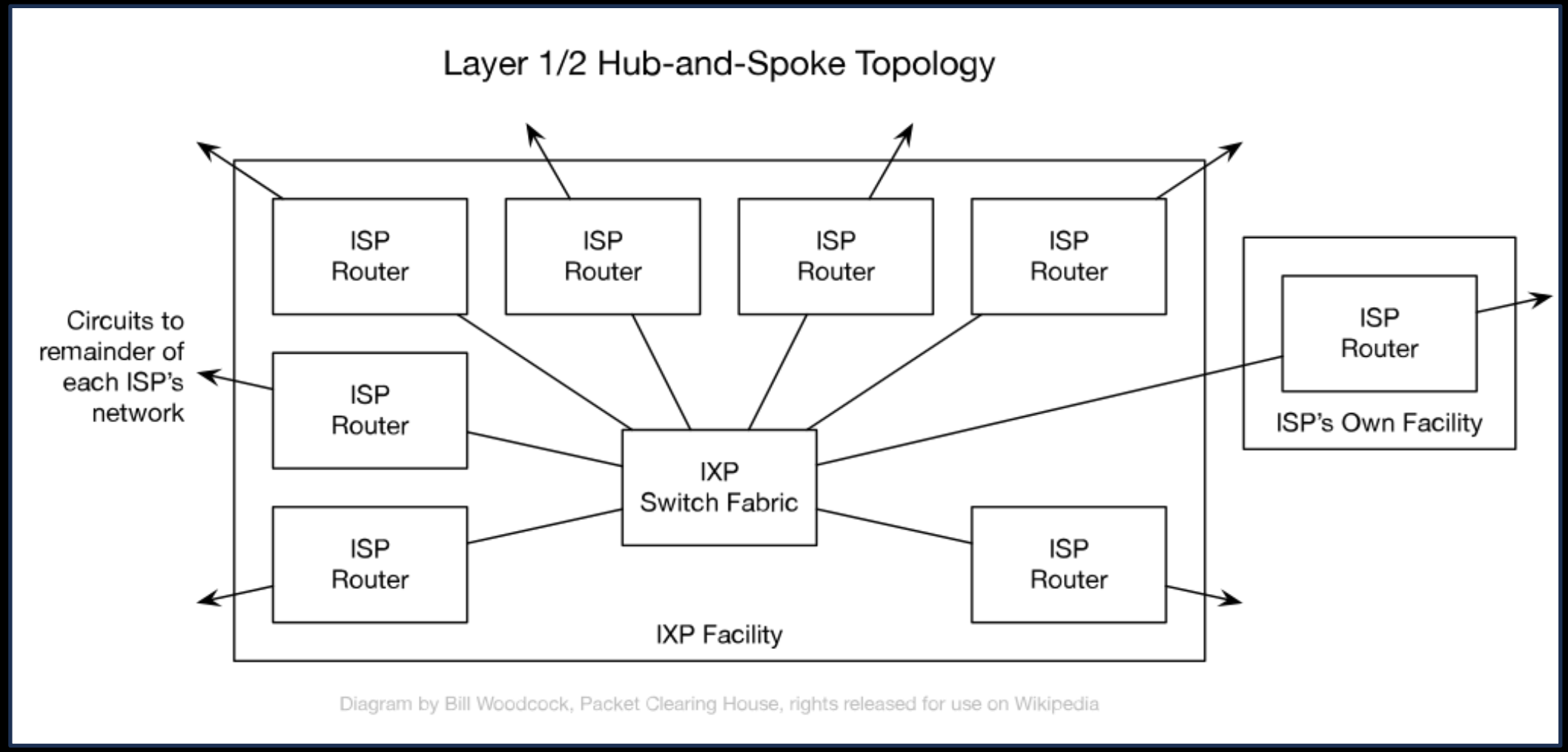
ISP: Internet Service Provider



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Circuit Switching to Packet Switching

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Circuit Switching V Packet Switching

Representation of Circuit Switching (long-distance phone call)

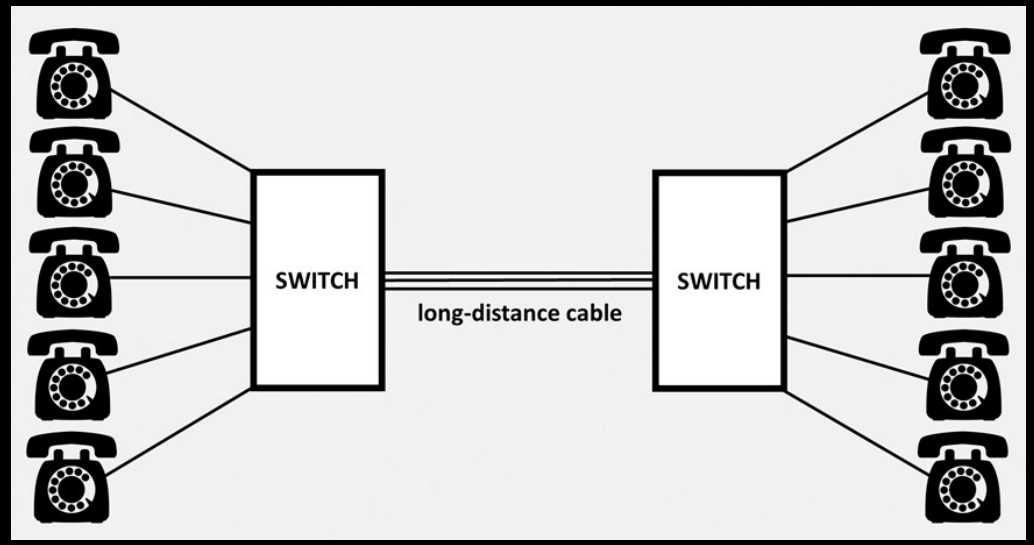

Image Source: Gillies & Caillau, 2000

Representation of Packet Switching (data packets)

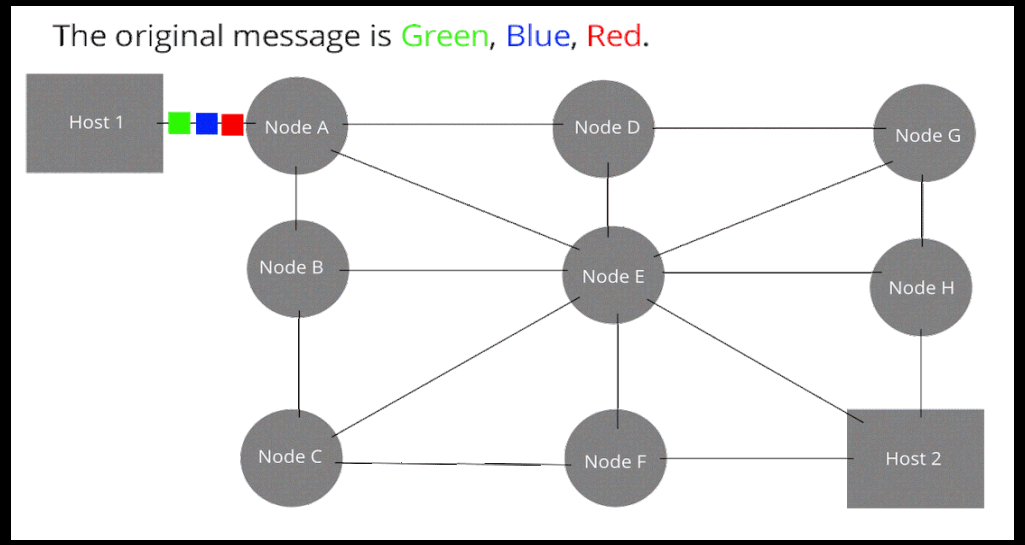

Image Source: Oddbodz, Wikipedia

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ARPANET - Wide-Area Packet-Switched Network

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Advanced Research Projects Agency Network

Sketch of ARPANET in December 1969

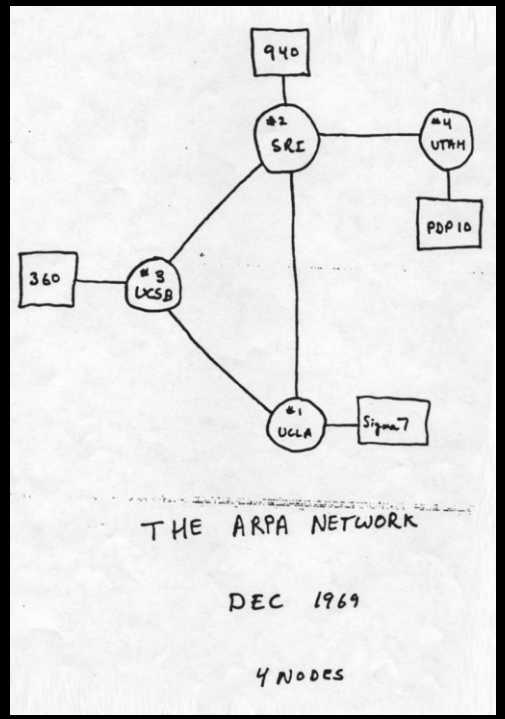

Image Source: Wikipedia

ARPANET access points in the 1970s

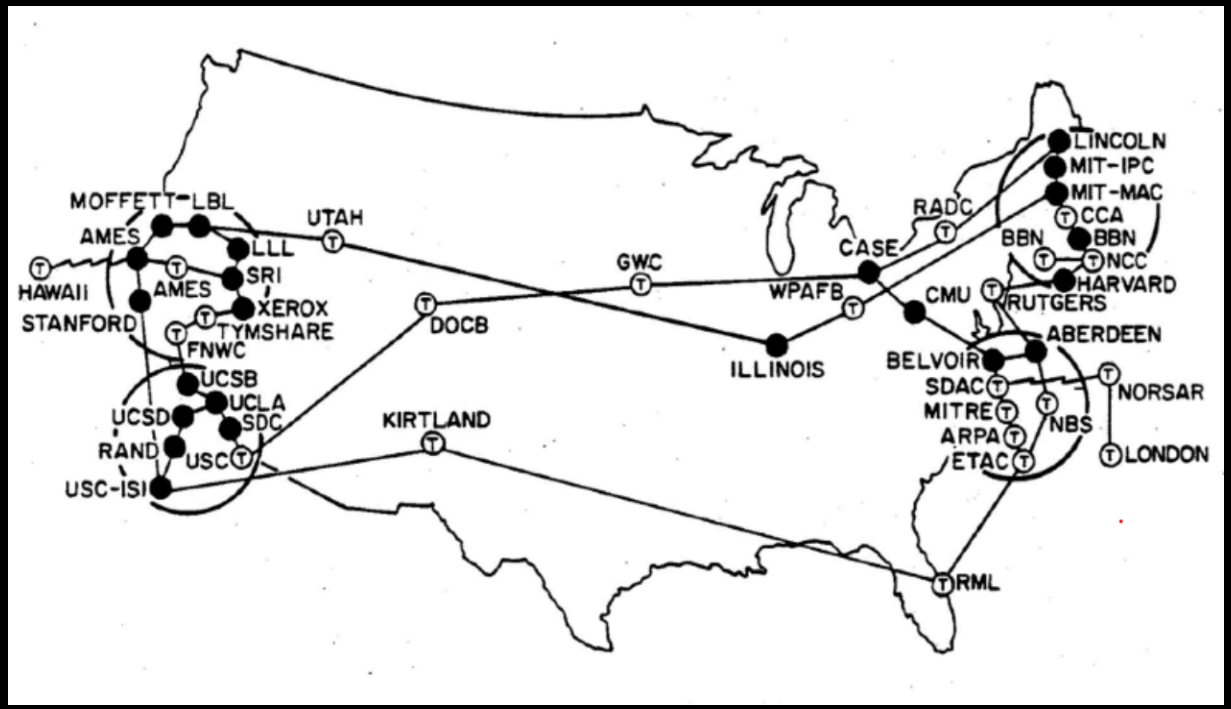

Image Source: Wikipedia

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The Rise of NSFNET

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National Science Foundation Network (1985-1995)

56K NSFNET Backbone, 1986-1988

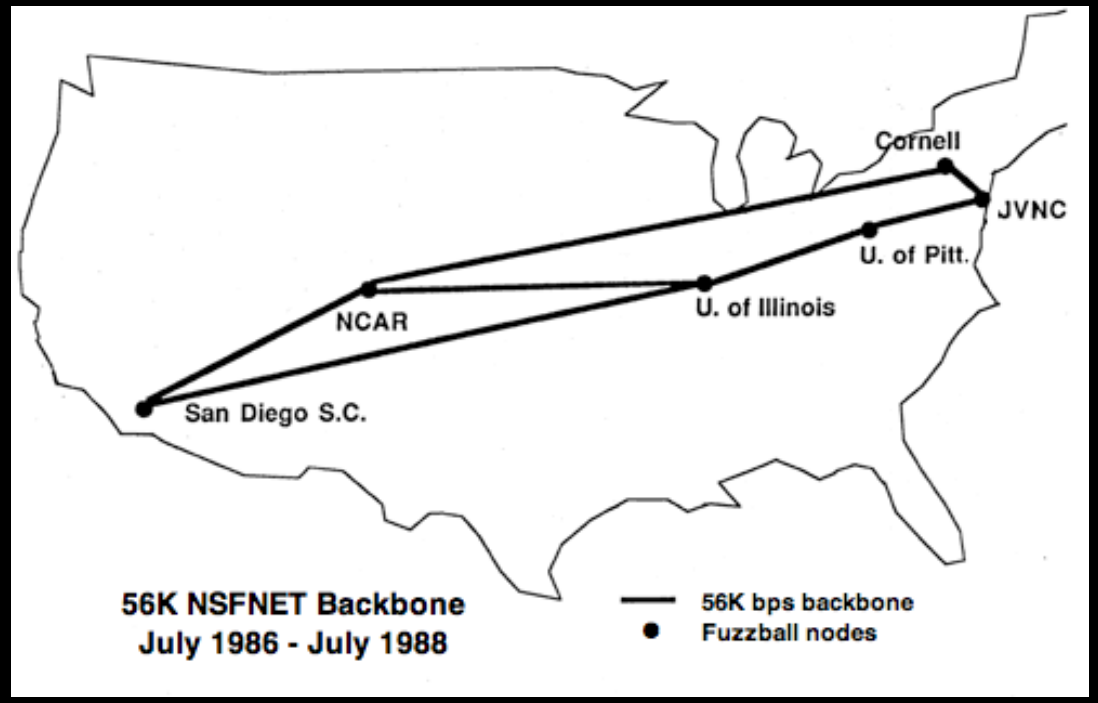

Image Source: Wikipedia

Physical Initial NSFNET Topology 1988

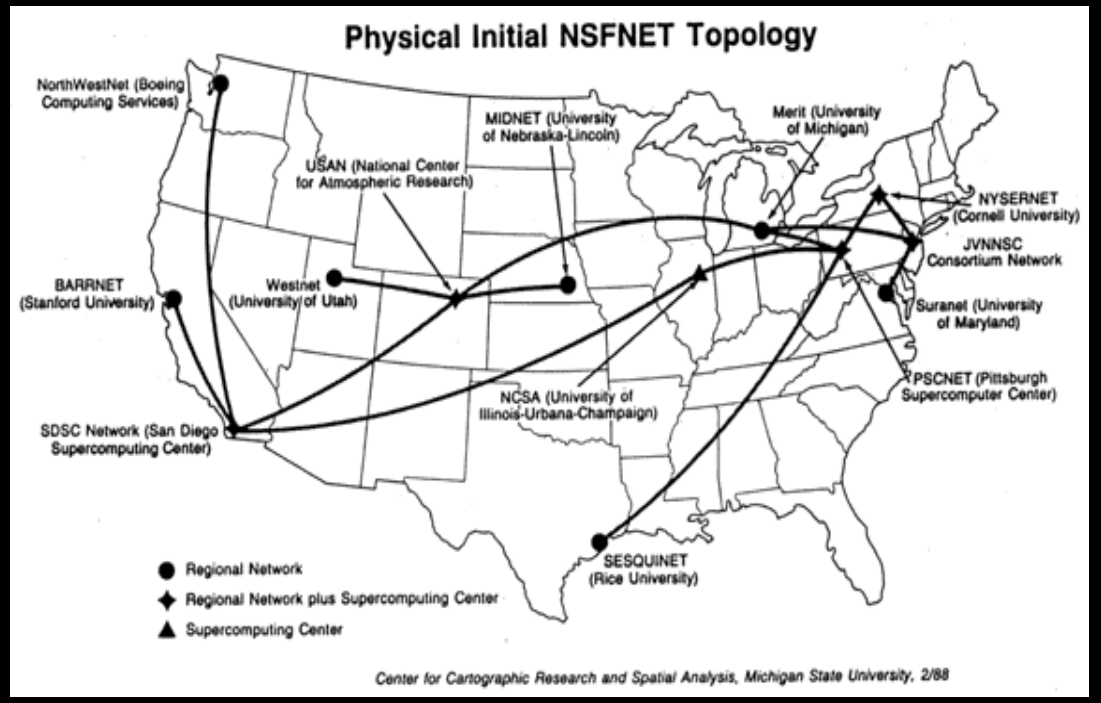

Image Source: Michigan State University

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NSFNET Acceptable Use Policy (AUP)

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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.

NSFNET Traffic 1991

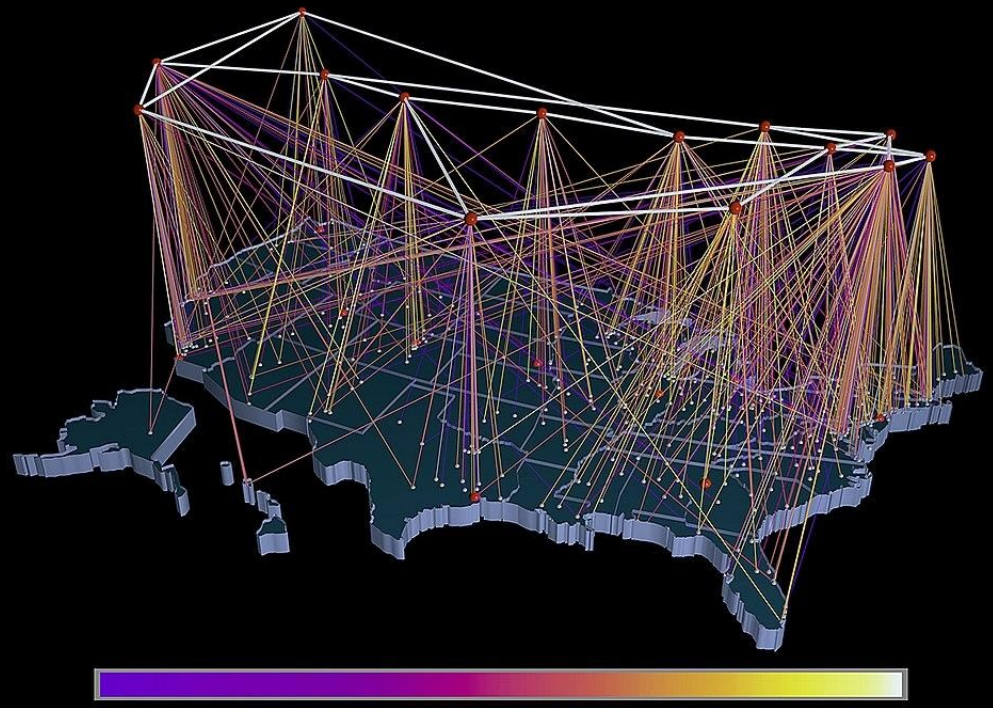

Image Source: Wikipedia

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Federal Internet Exchange

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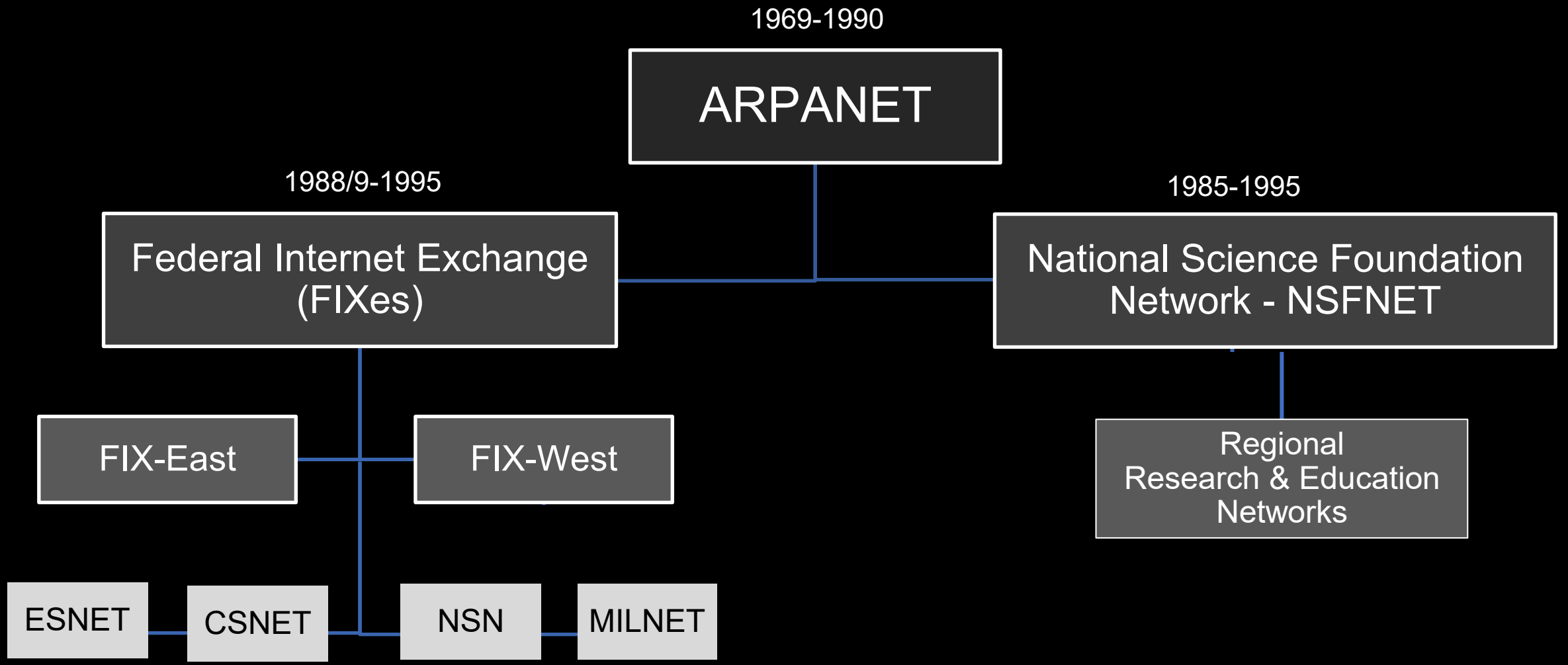

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The First Commercial IXPs in the US

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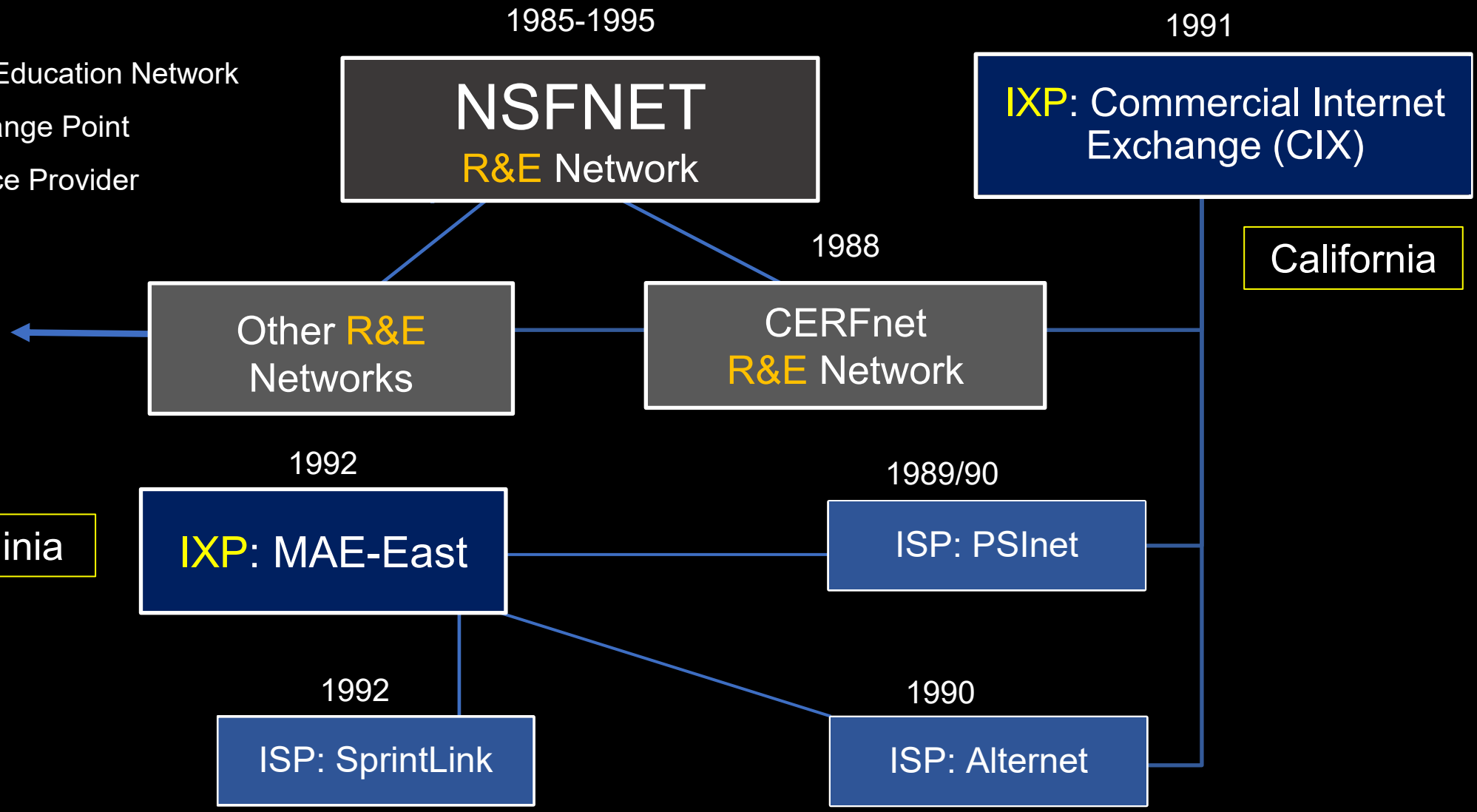
R&E: Research & Education Network

IXP: Internet Exchange Point

ISP: Internet Service Provider



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The NSFNET Transition

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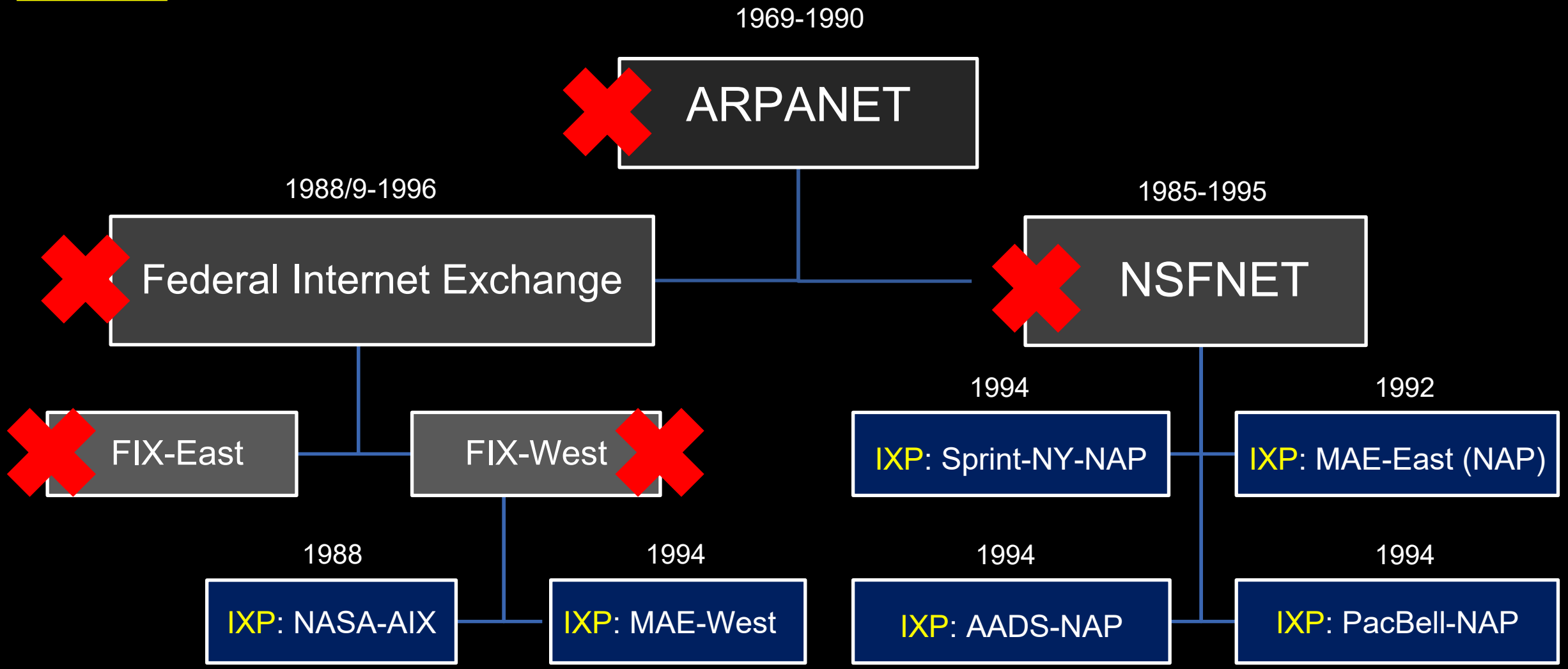

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Early IXPs – United States

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1988: NASA-AIX - NASA Ames Internet Exchange (California)

1988/9: FIX - Federal Internet Exchange (Maryland, California)

1991: CIX - Commercial Internet Exchange (California)

Bottlenecks

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

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Early International Networking Efforts

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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.

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Early IXPs Elsewhere

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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: NSPIXP-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)

IXP HISTORY COLLECTION

IXP History Collection - Methodology

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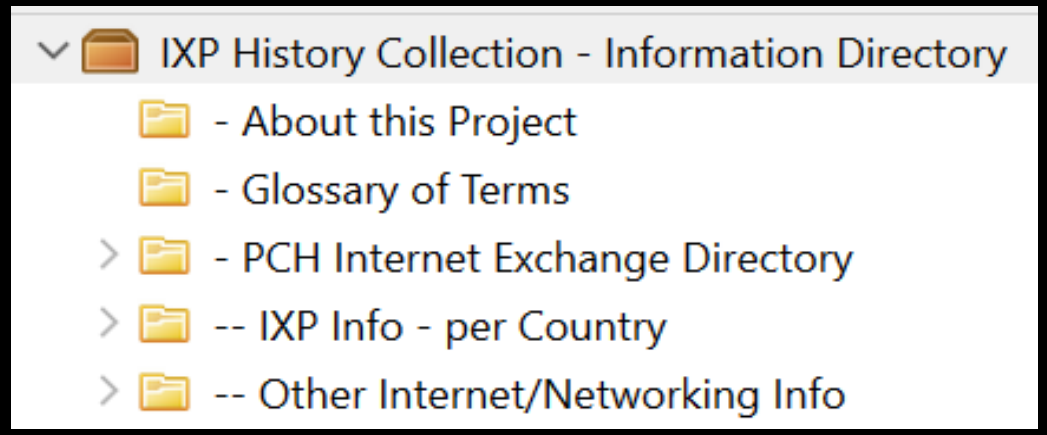
Broad Aims

a) develop a corpus of relevant information for documenting IXP histories, and

b) develop a preservation strategy for the safe-keeping of such information.



IXP HISTORY COLLECTION

IXP History Collection - Methodology

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PCH Internet Exchange Directory

Source: Packet Clearing House, CC BY-NC-SA 3.0 https://www.pch.net/ixp/dir

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IXP History Collection - Methodology

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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

Source: Packet Clearing House, CC BY-NC-SA 3.0 https://www.pch.net/ixp/dir

IXP HISTORY COLLECTION

IXP History Collection - Methodology

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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

IXP History Collection - Methodology

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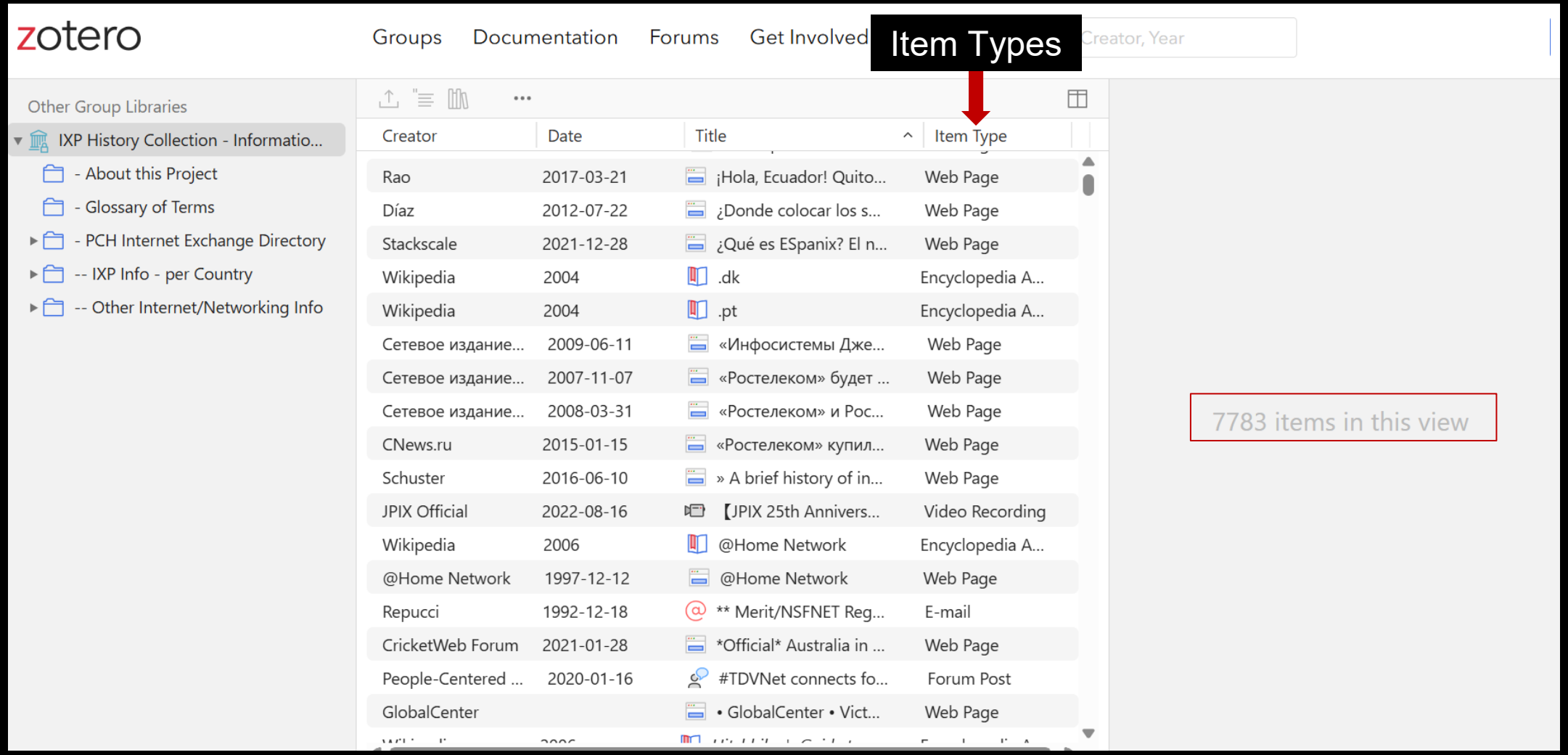
IXP History Collection – Information Directory



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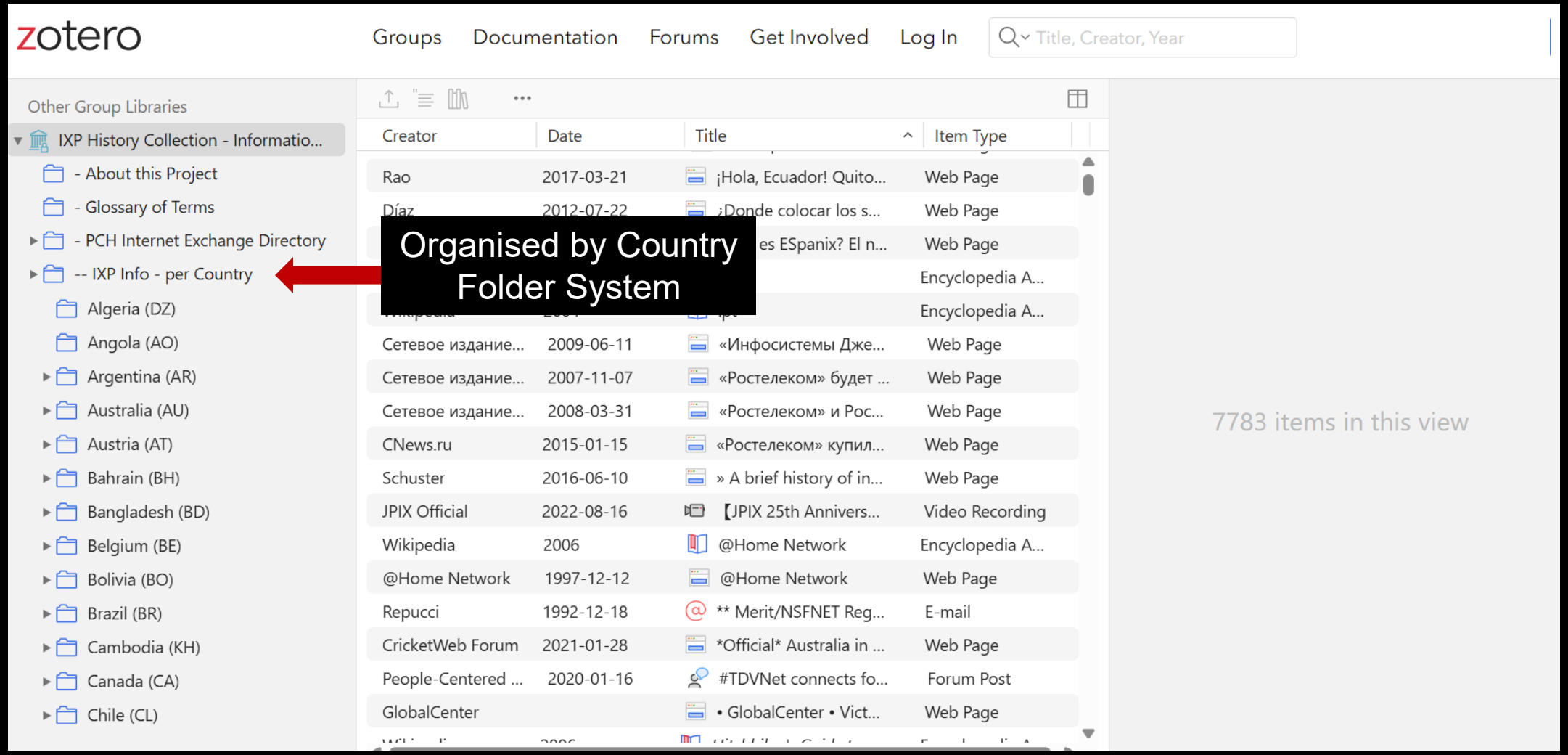
IXP History Collection – Information Directory



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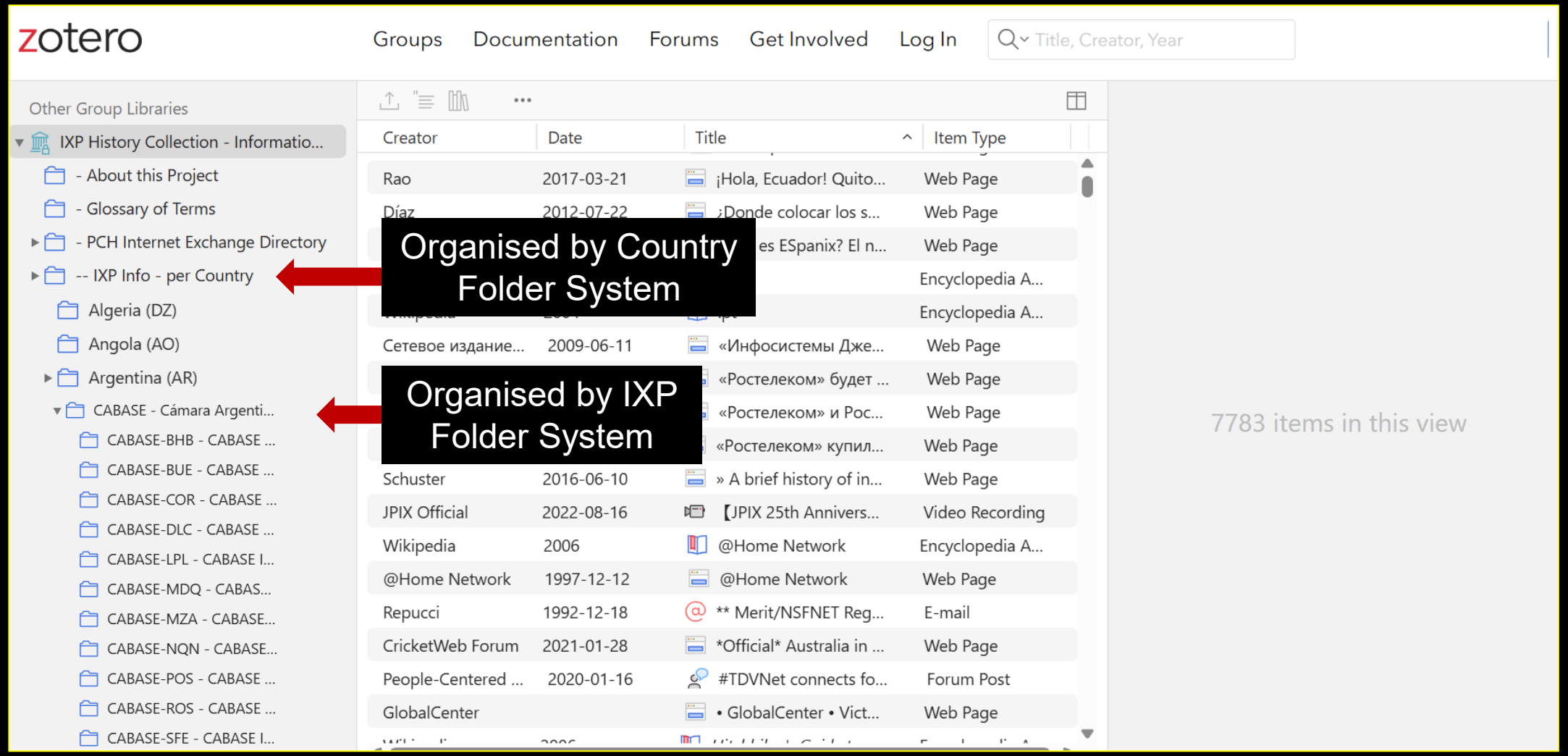

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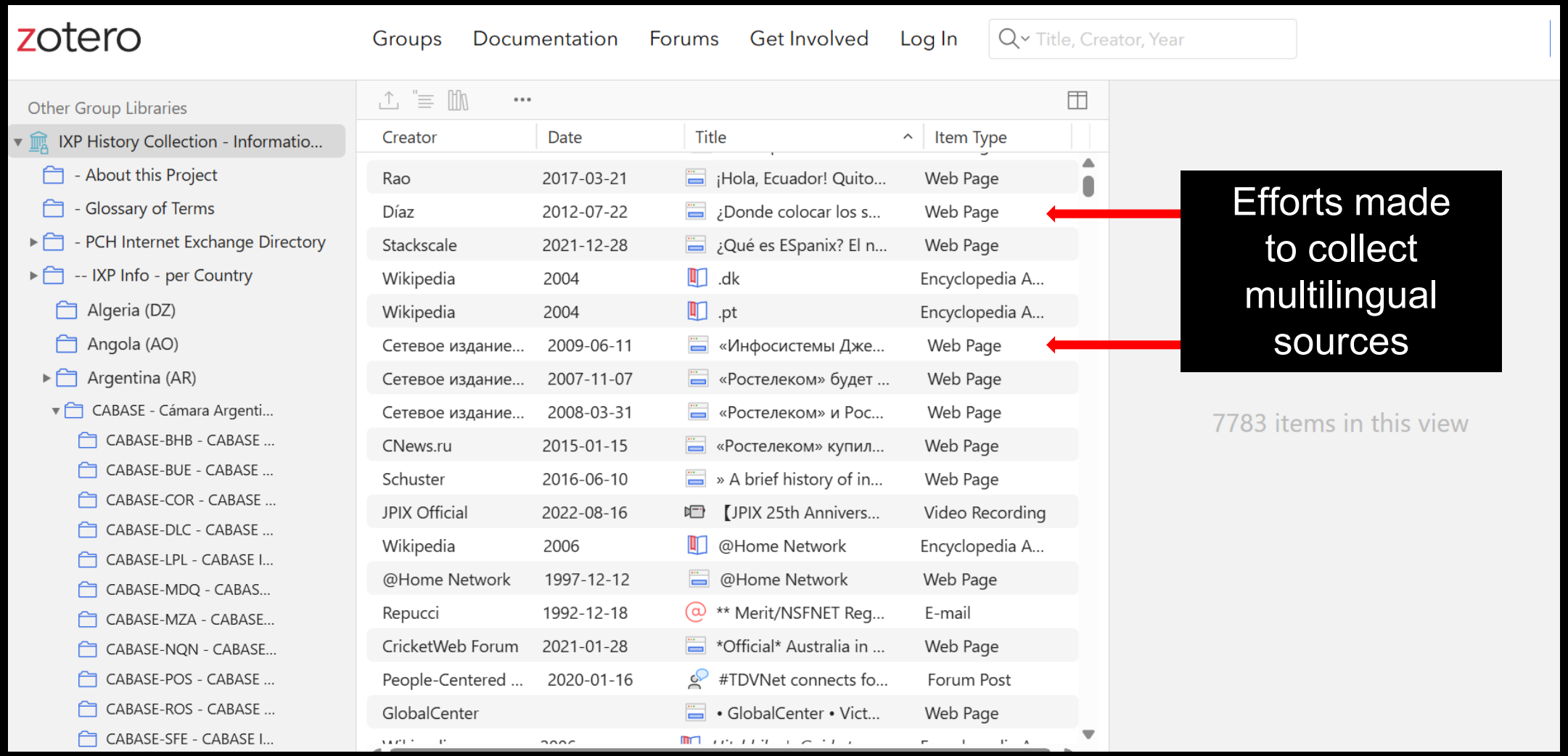

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IXP History Collection - Methodology

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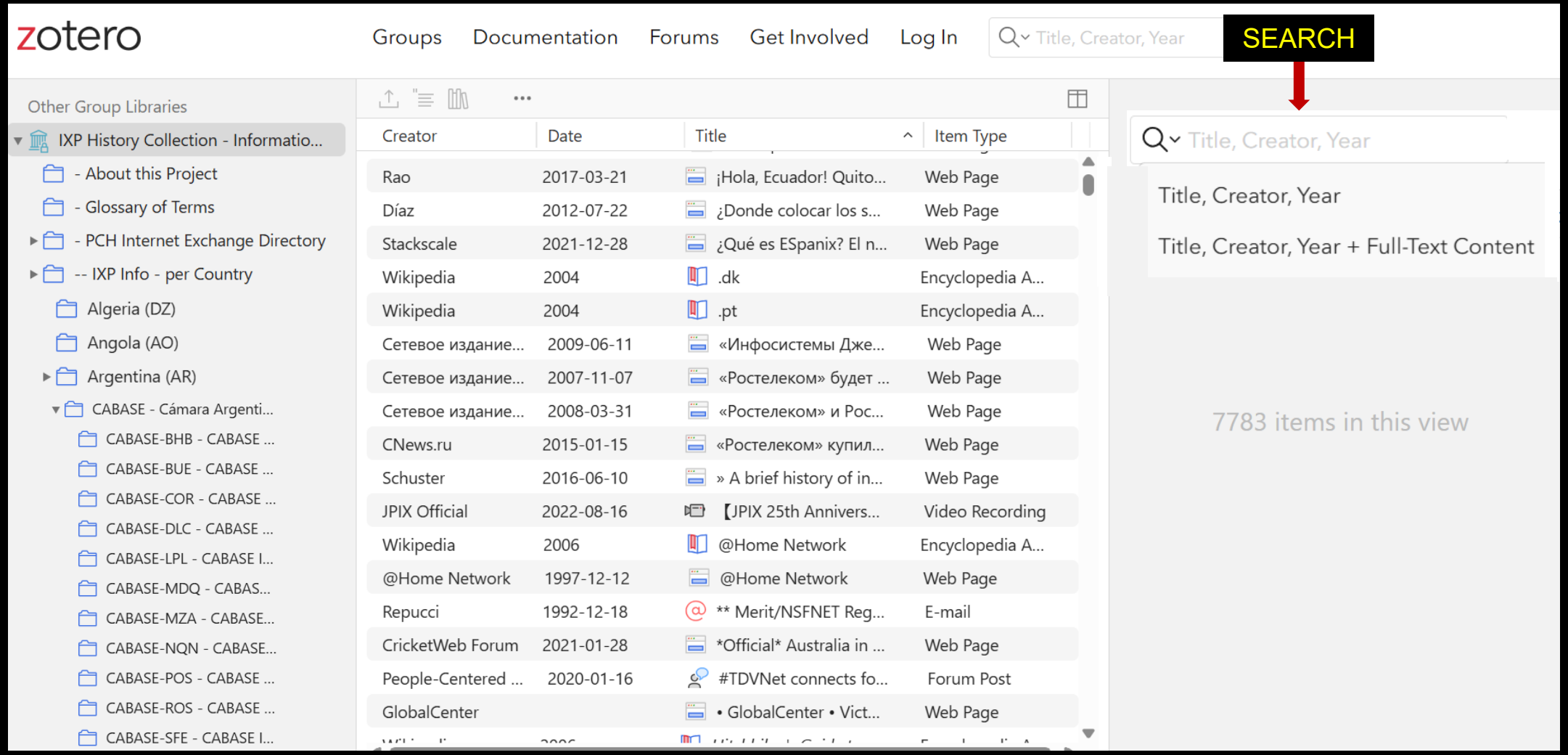

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IXP History Collection - Methodology - Metadata

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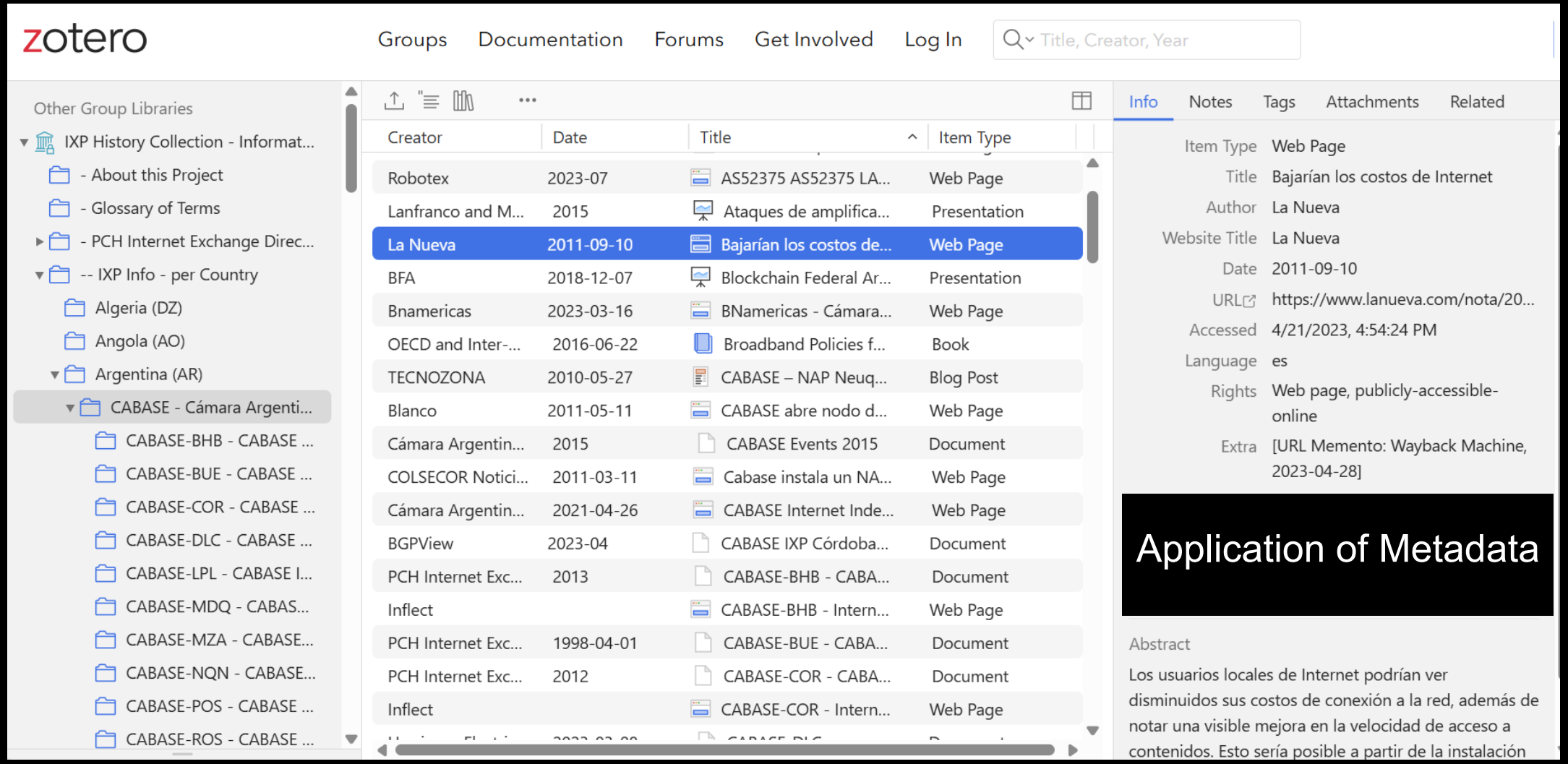
IXP History Collection – Information Directory



IXP HISTORY COLLECTION

IXP History Collection - Methodology - Metadata

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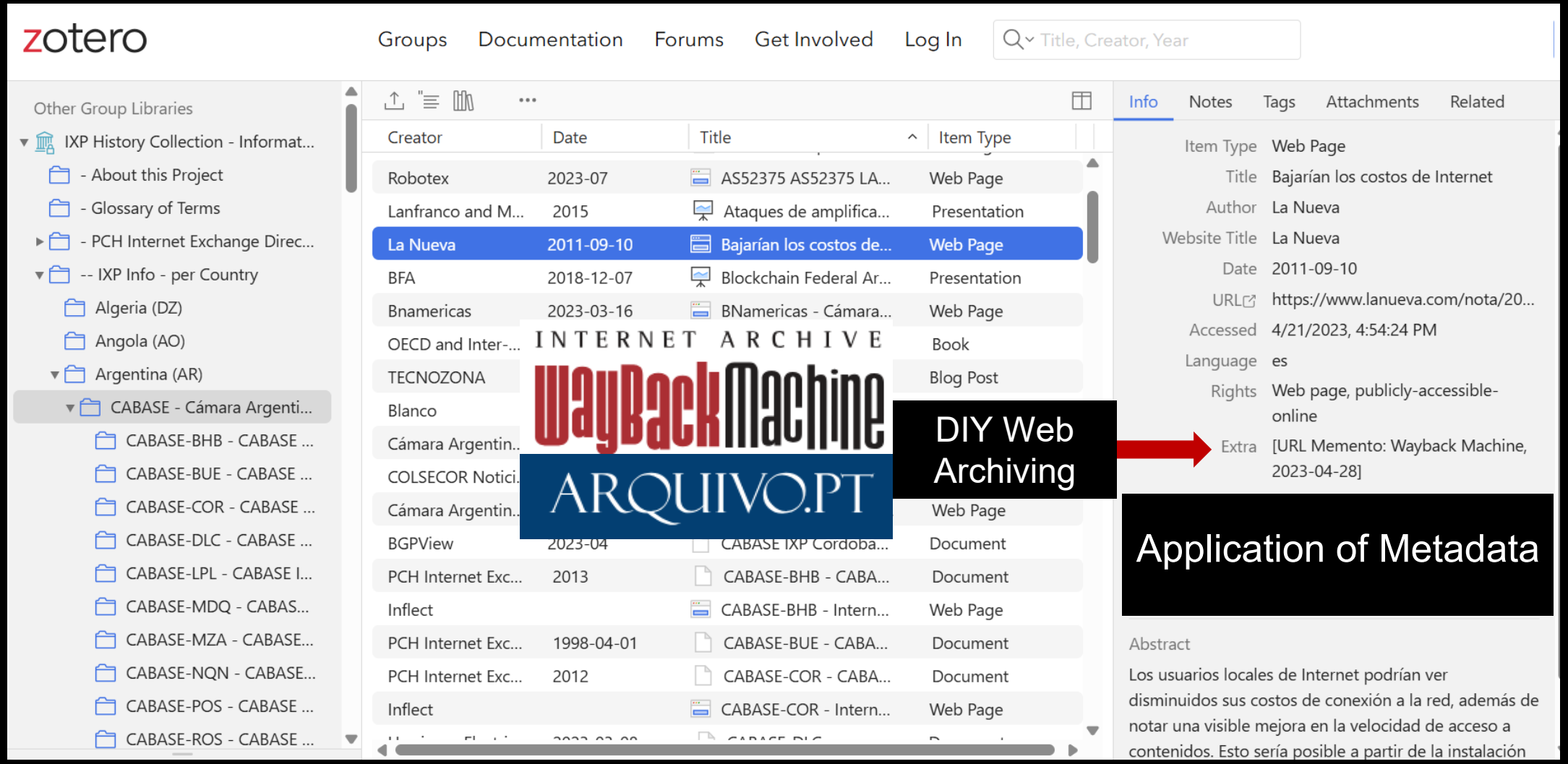

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IXP History Collection - Methodology - DIY Web Archiving

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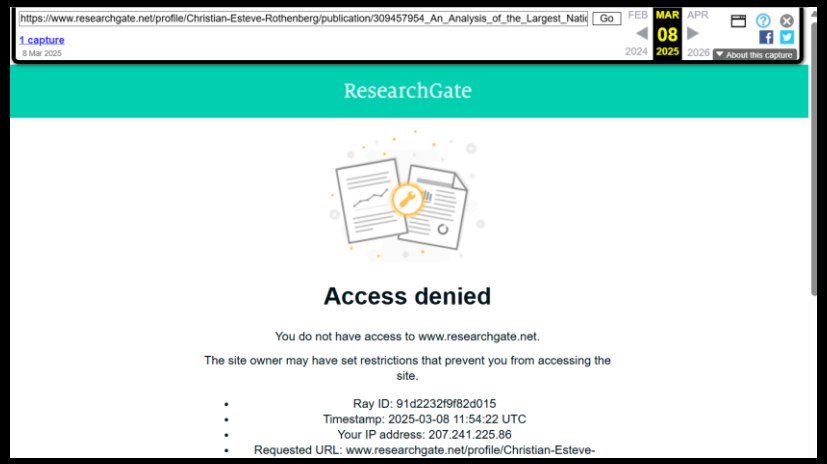
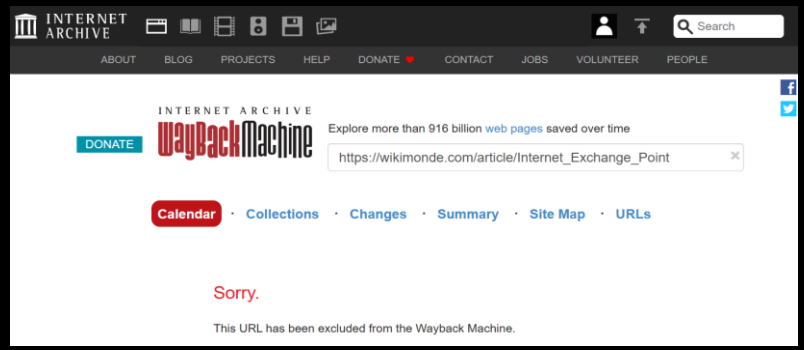
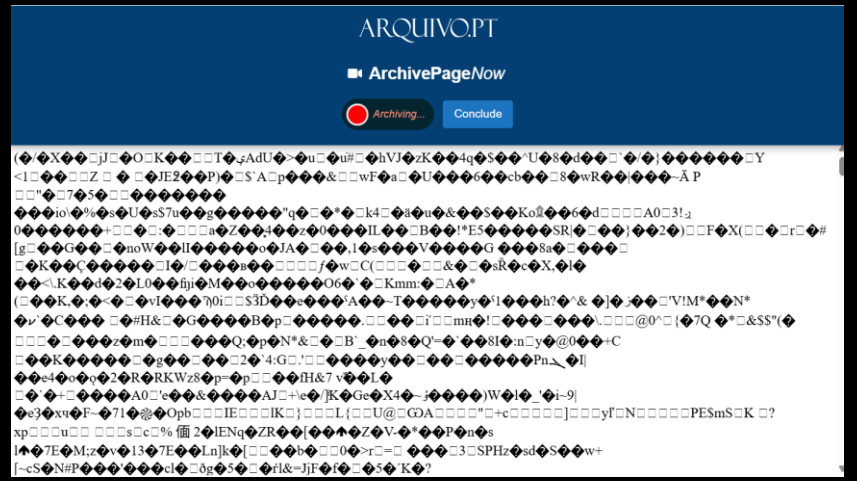
INTERNET ARCHIVE WayBackMachine

ARQUIVO.PT

DIY Web Archiving → Not Always Successful







IXP HISTORY COLLECTION

IXP History Collection - Methodology - DIY Web Archiving

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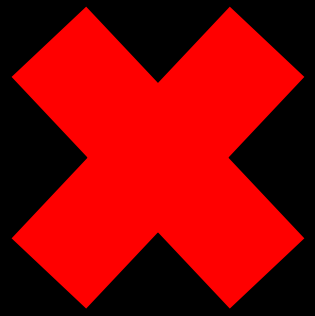
DIY Web Archiving → Not Always Successful



PAYWALL Content
SOCIAL MEDIA Content (e.g., Facebook, Twitter, YouTube, etc.)
SLIDE SITES (e.g., SlideShare, SlideServe, etc.)

Important historical items – Screencasts or Screenshots

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IXP History Collection - Methodology - Web Archives

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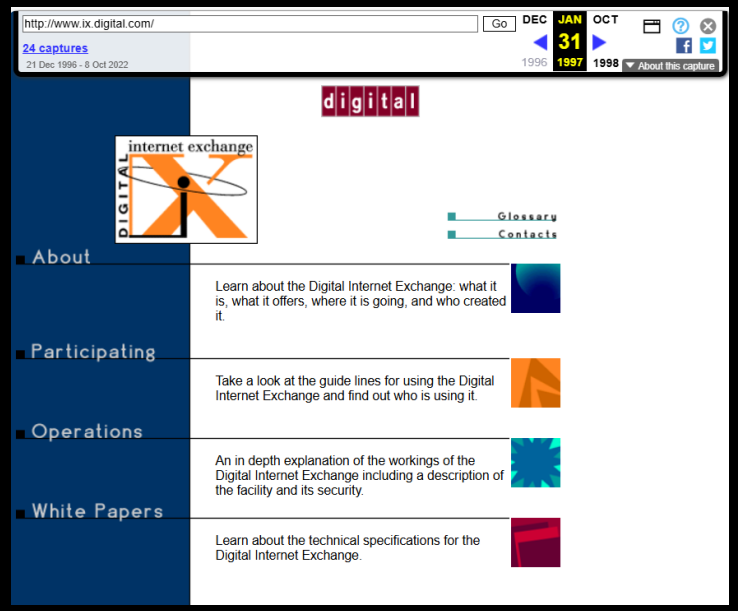
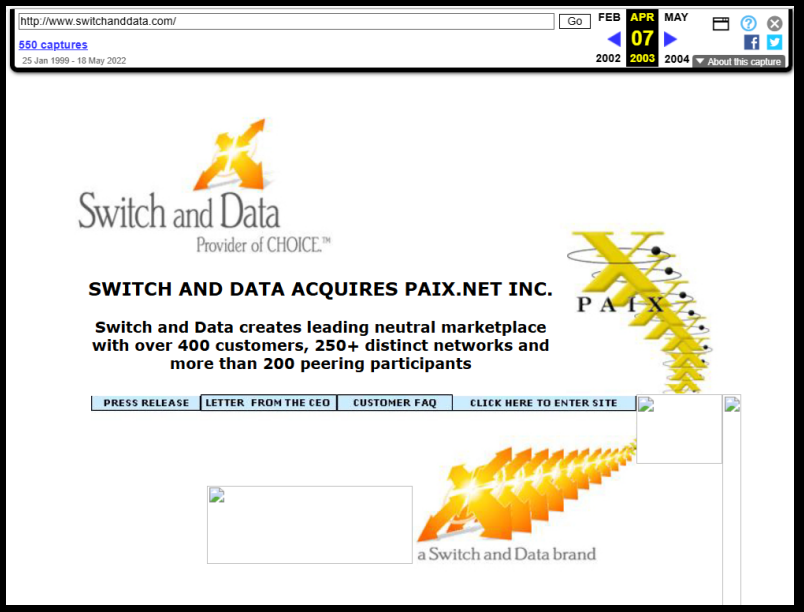
Important IXP History Found in Web Archives

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.

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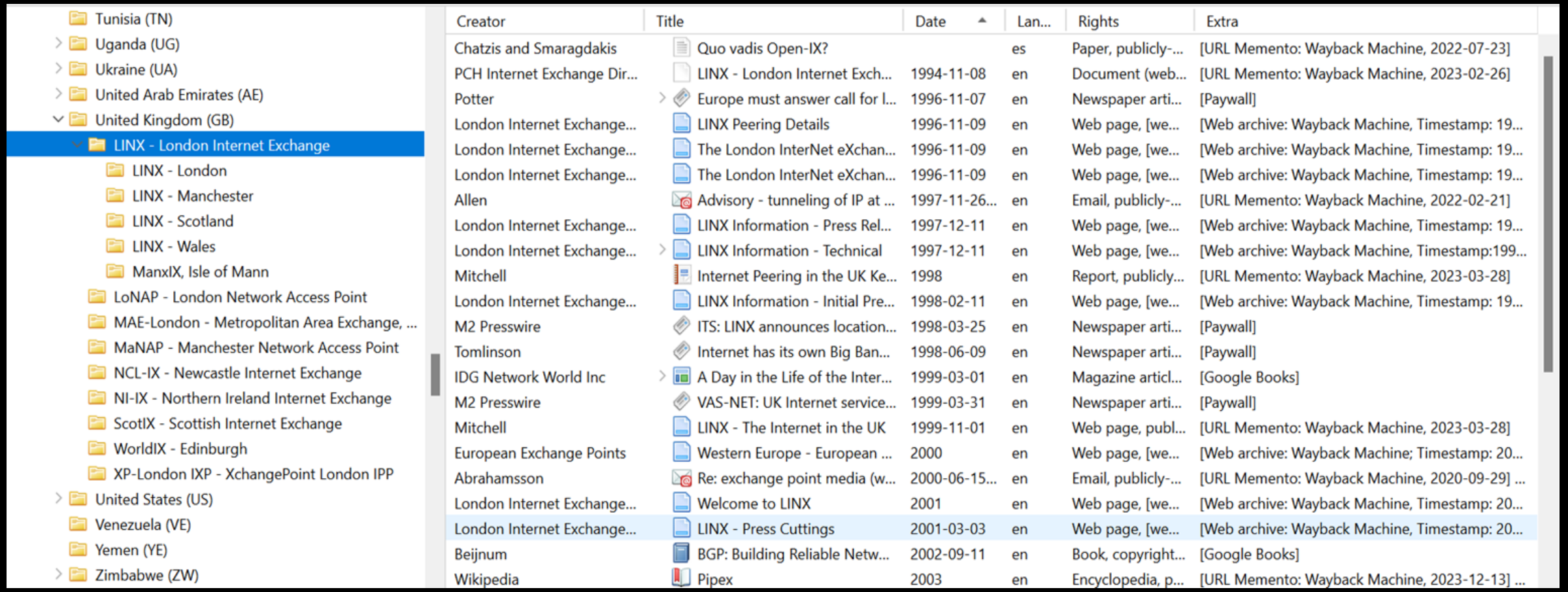
Combining **Web Archive** research with **Traditional** research



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IXP History Collection - Next Steps

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OSF

Long-term Preservation

JISC – Research Data Lifecycle

PCH
Packet Clearing House

INTERNET ARCHIVE
WayBackMachine

ARQUIVO.PT

WIKIPEDIA
The Free Encyclopedia

THANK YOU

Digital Record Object Identification
Loading...

OSF

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