Reimagining Open Educational Resources

Stephen Downes
National Research Council Canada
Open Education Conference
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https://www.downes.ca/534

This session introduces and demonstrates content-addressable resources for education, a set of tools and processes for the creation and storage of learning resources in a distributed peer-to-peer network.

Learning Outcomes

You will be able to:

- describe how content addressing works
- describe the use of content addressing to enable a secure and distributed resource network
- create and add their own open educational resources to the network
- access and reuse resources from the network
- appreciate how content addressing provides an alternative to license-based OER

Issues for Open Educational Resources

- Licensing alone is not enough

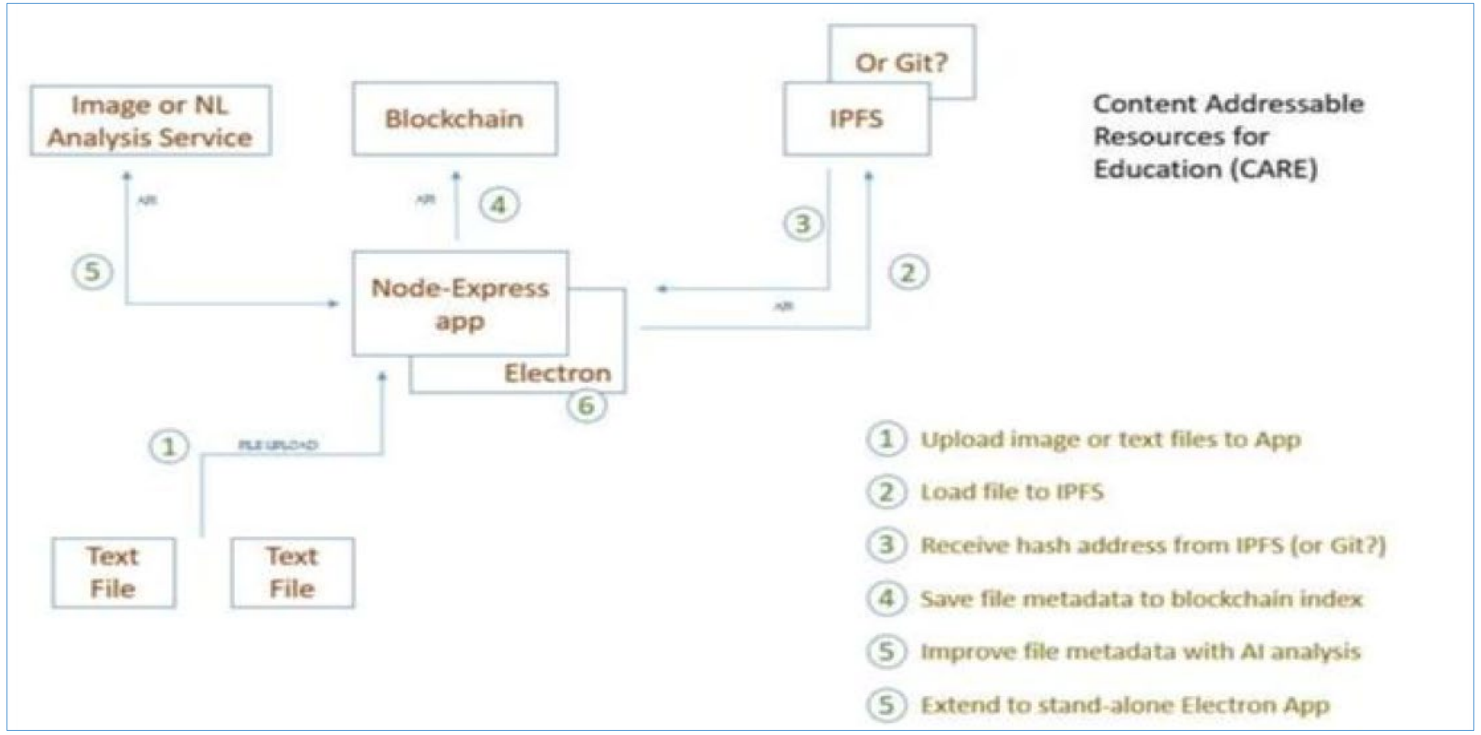
  “CC licenses and tools are proving indispensable in certain domains, most notably in the education and research sectors. However, they do not entirely address mainstream content sharing on the internet today. Indeed, most sharing occurs on proprietary platforms designed to keep users within their own systems.”

- Resources are no longer community-based

  “Our existing licenses and tools do not fully address the collateral damage caused by exploitative, decontextualized, unethical, and antisocial reuse of shared content. We cannot turn a blind eye.”

Creative Commons Strategy 2020 - Second Draft, November 2, 2020 https://docs.google.com/document/d/1oRDt7Lk0tp571xygWyDsS7rRvKWiK1BFPuiDm9jbF-c/edit?usp=sharing

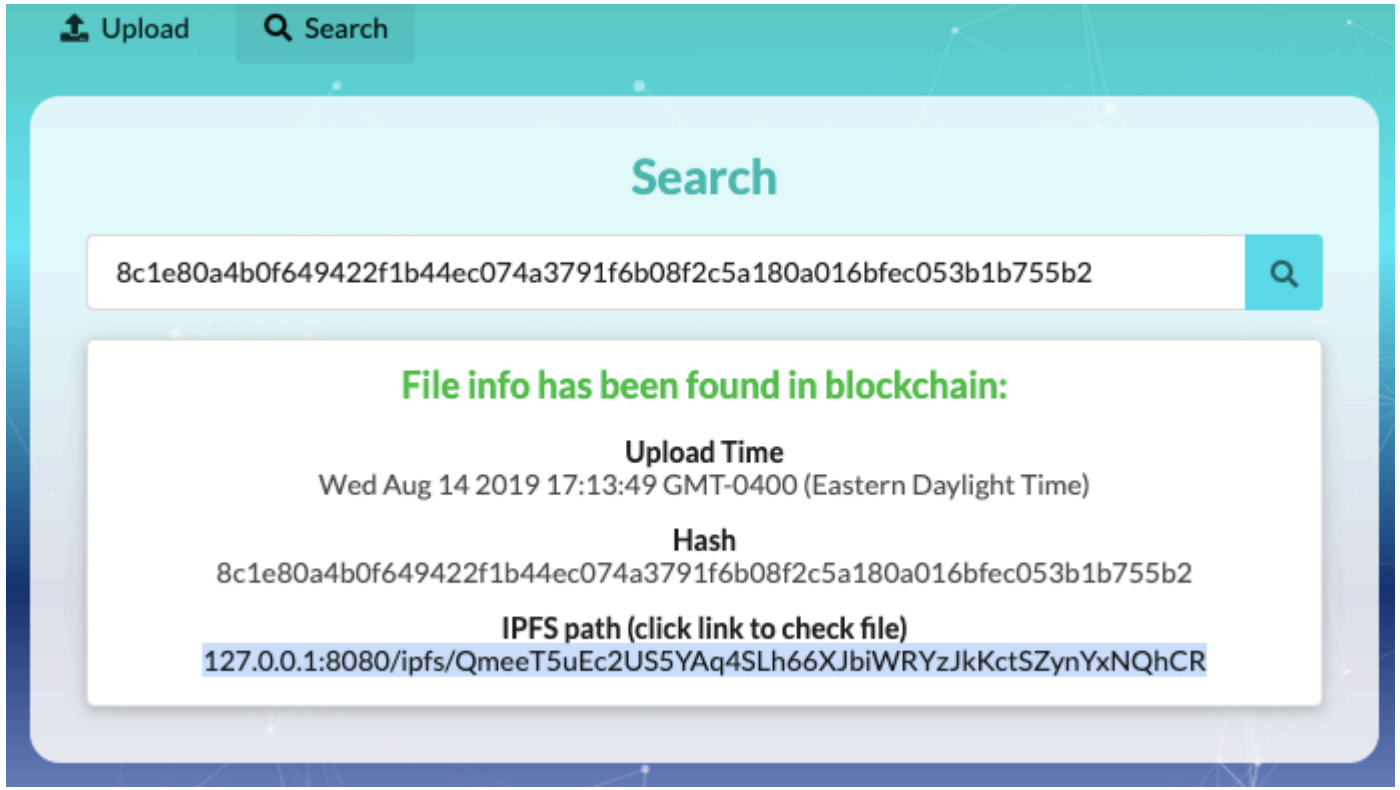
Content Addressable Resources for Education



- CARE are content-addressable, they are stored and access in the web as a whole
- CARE are also associated with each other in an Open Resource Graph (ORG)
- CARE can be *cloned* and *edited* by any user

https://github.com/Downes/CARE-project

Content Addressable Resources for Education



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Encryption Algorithms

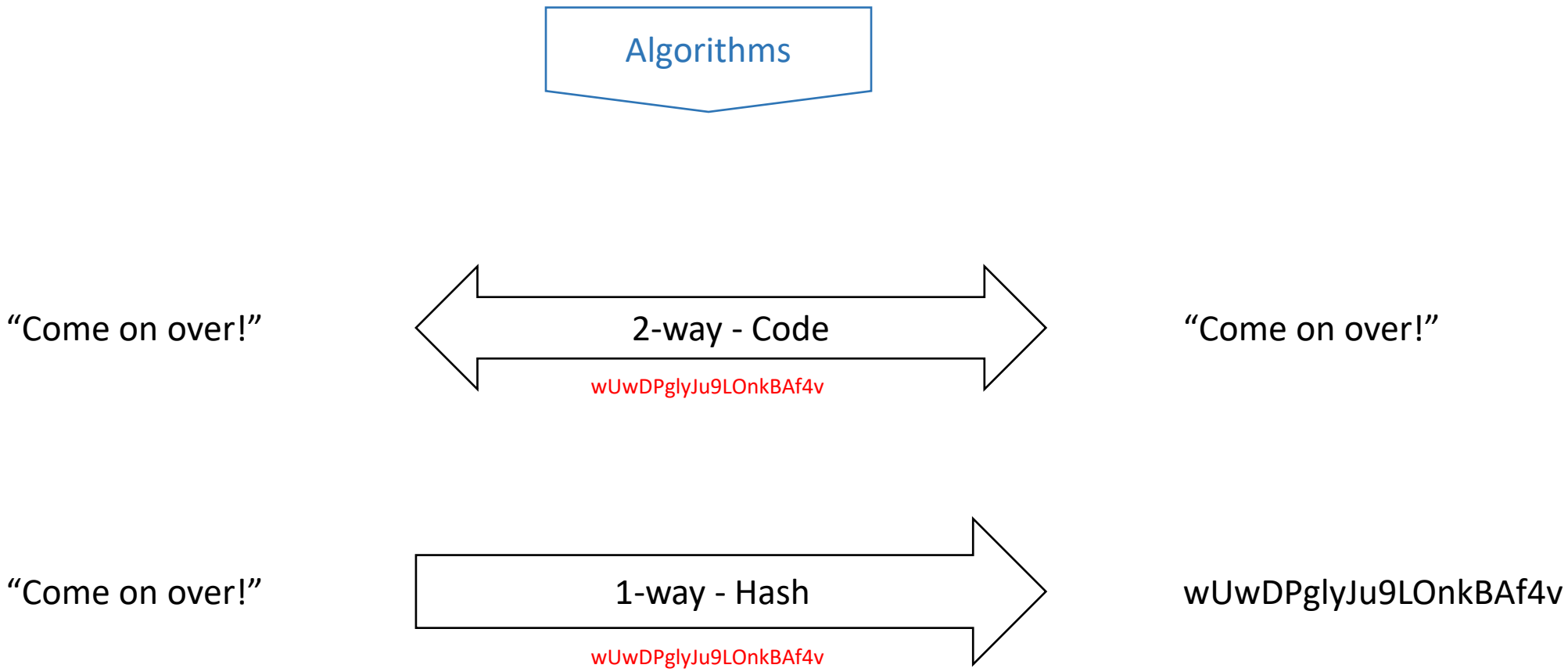
These are open source!

Algorithms

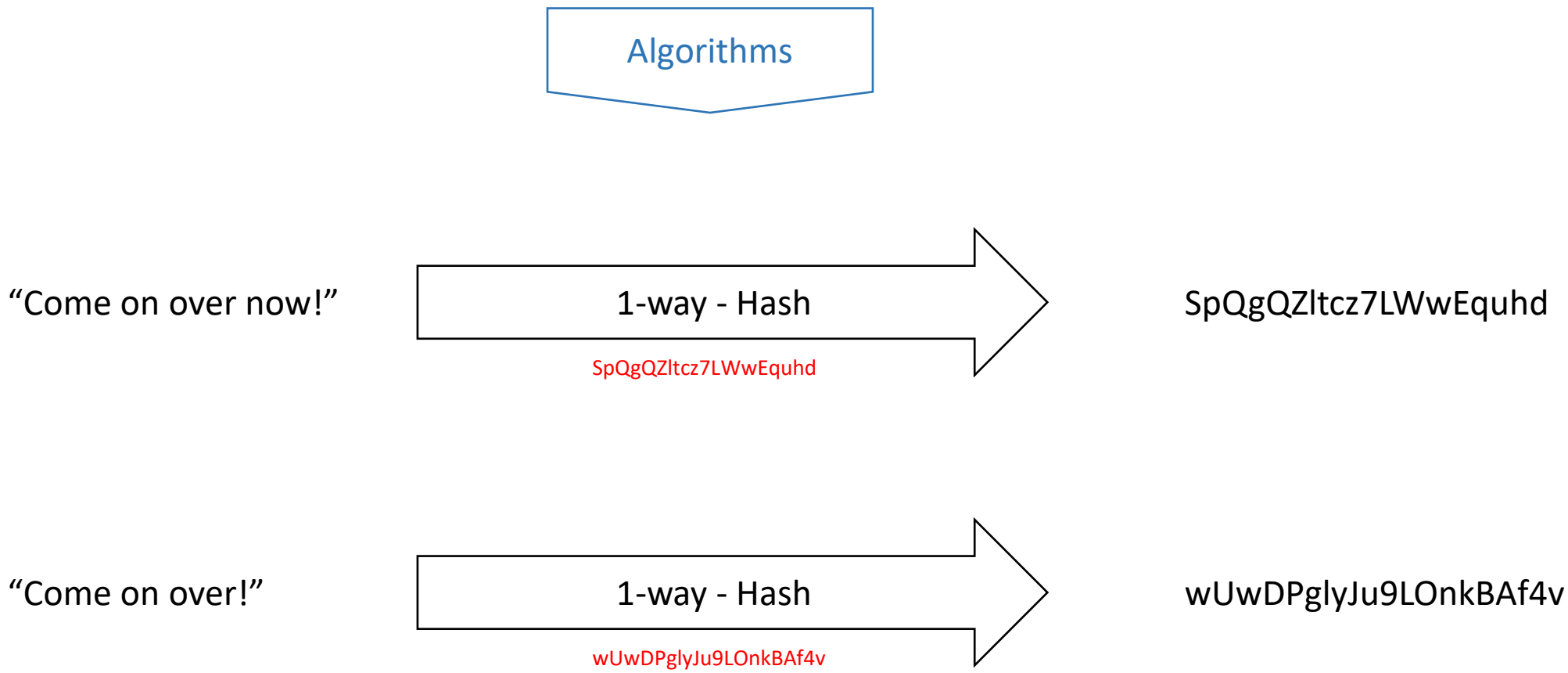
Algorithm and variant		Output size (bits)	Internal state size (bits)	Block size (bits)	Rounds	Operations
MD5 (as reference)		128	128 (4 × 32)	512	64	And, Xor, Rot, Add (mod 2^{32}), Or
SHA-0		160	160 (5 × 32)	512	80	And, Xor, Rot, Add (mod 2^{32}), Or
SHA-1						
SHA-2	*SHA-224* *SHA-256*	224 256	256 (8 × 32)	512	64	And, Xor, Rot, Add (mod 2^{32}), Or, Shr
	SHA-384 *SHA-512*	384 512	512 (8 × 64)	1024	80	And, Xor, Rot, Add (mod 2^{64}), Or, Shr
	SHA-512/224 *SHA-512/256*	224 256				
SHA-3	*SHA3-224* *SHA3-256* *SHA3-384* *SHA3-512*	224 256 384 512	1600 (5 × 5 × 64)	1152 1088 832 576	24[5]	And, Xor, Rot, Not
	SHAKE128 *SHAKE256*	*d* (arbitrary) *d* (arbitrary)		1344 1088		

https://en.wikipedia.org/wiki/Secure_Hash_Algorithms

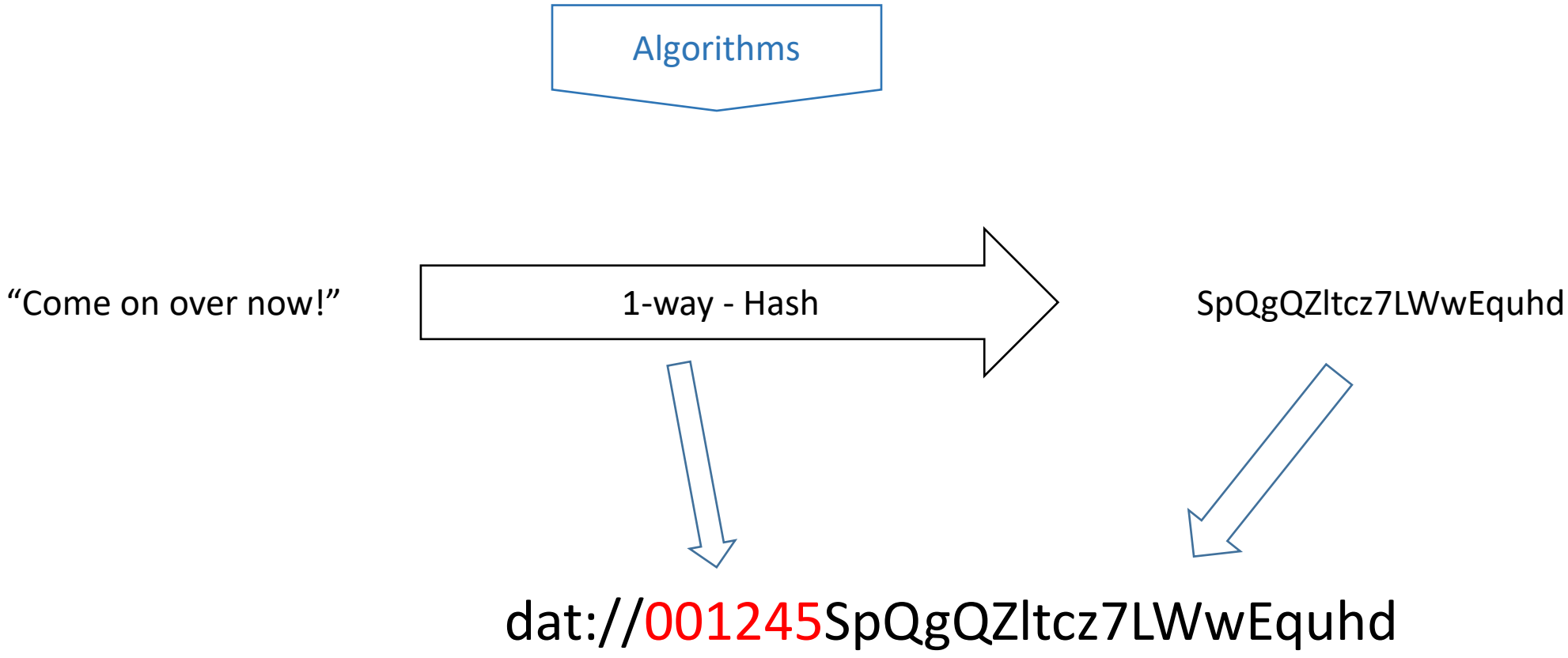
One-way Encryption



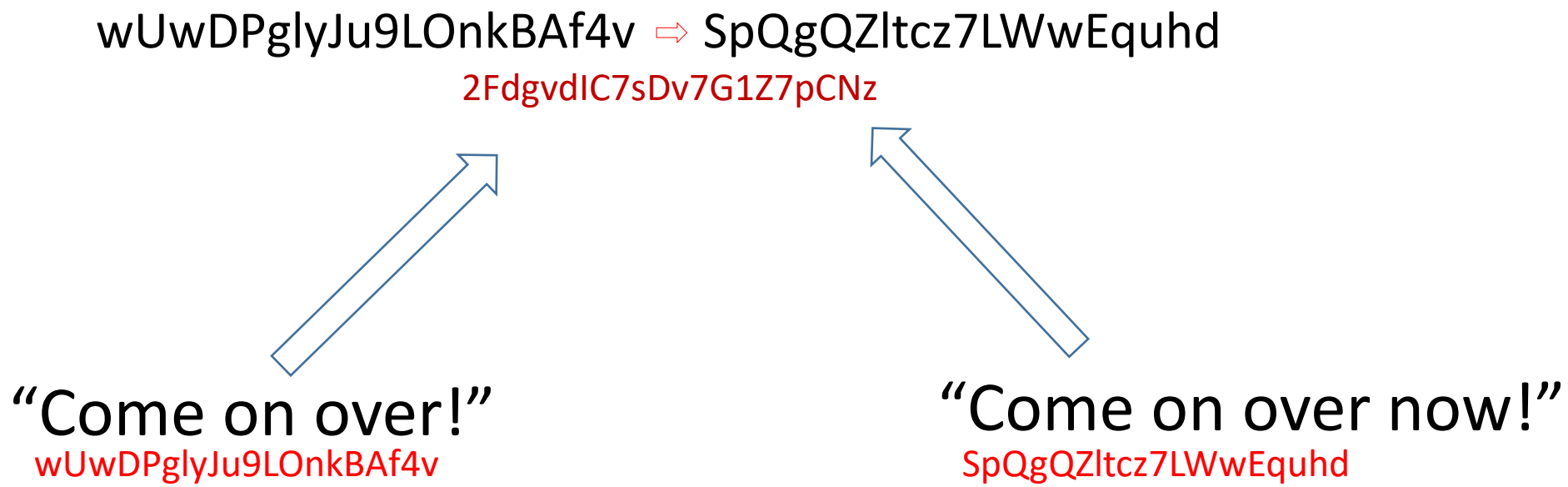
Uniqueness


Algorithms
“Come on over now!”
1-way - Hash
SpQgQZltcz7LWwEquhd
SpQgQZltcz7LWwEquhd
“Come on over!”
1-way - Hash
wUwDPglyJu9LOnkBAf4v
wUwDPglyJu9LOnkBAf4v

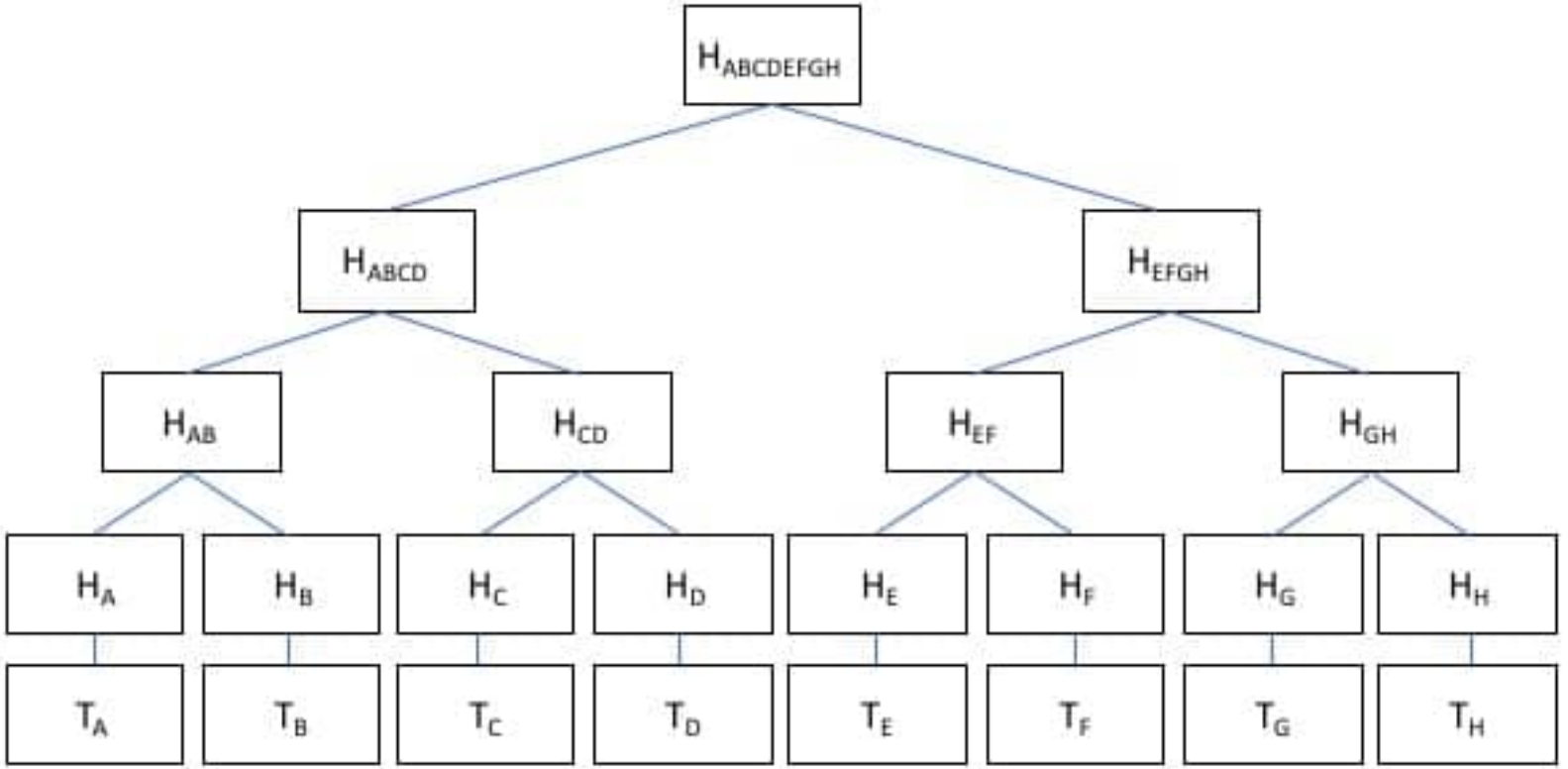
Content-based Address



Revisions

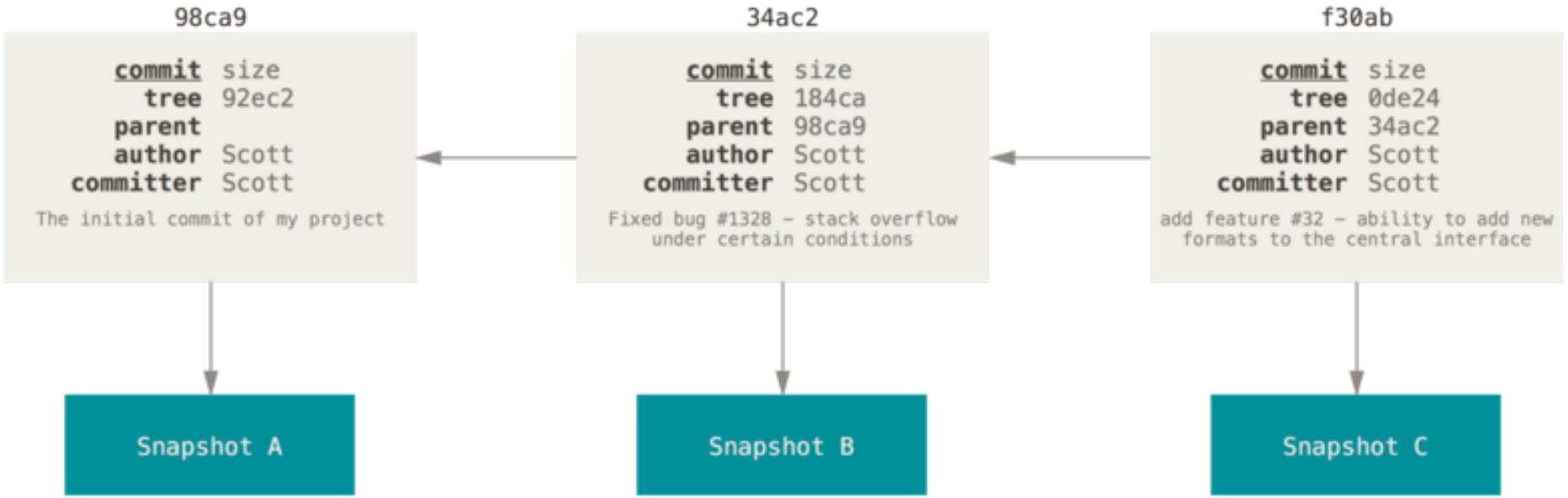

wUwDPglyJu9LOnkBAf4v ⇨ SpQgQZltcz7LWwEquhd
2FdgvdIC7sDv7G1Z7pCNz
“Come on over!”
wUwDPglyJu9LOnkBAf4v
“Come on over now!”
SpQgQZltcz7LWwEquhd

Merkle Chain



https://btc-investor.net/merkle-tree-hashing-blockchain/

How Git Uses Merkle Chains



https://git-scm.com/book/en/v2/Git-Branching-Branches-in-a-Nutshell

Hash trees are also used in the IPFS, Btrfs and ZFS file systems; Dat protocol; Apache Wave protocol; Git and Mercurial distributed revision control systems; the Tahoe-LAFS backup system; Zeronet; the Bitcoin and Ethereum peer-to-peer networks; the Certificate Transparency framework; and a number of NoSQL systems such as Apache Cassandra, Riak, and Dynamo. https://en.wikipedia.org/wiki/Merkle_tree

Peer-to-Peer Networks

Each node is a server. Some are big, some are small. They each connect to some, but not all, of the other servers, so nobody is overloaded.

https://www.kindpng.com/imgv/iTJwhxT_connection-png-page-network-effect-transparent-png/

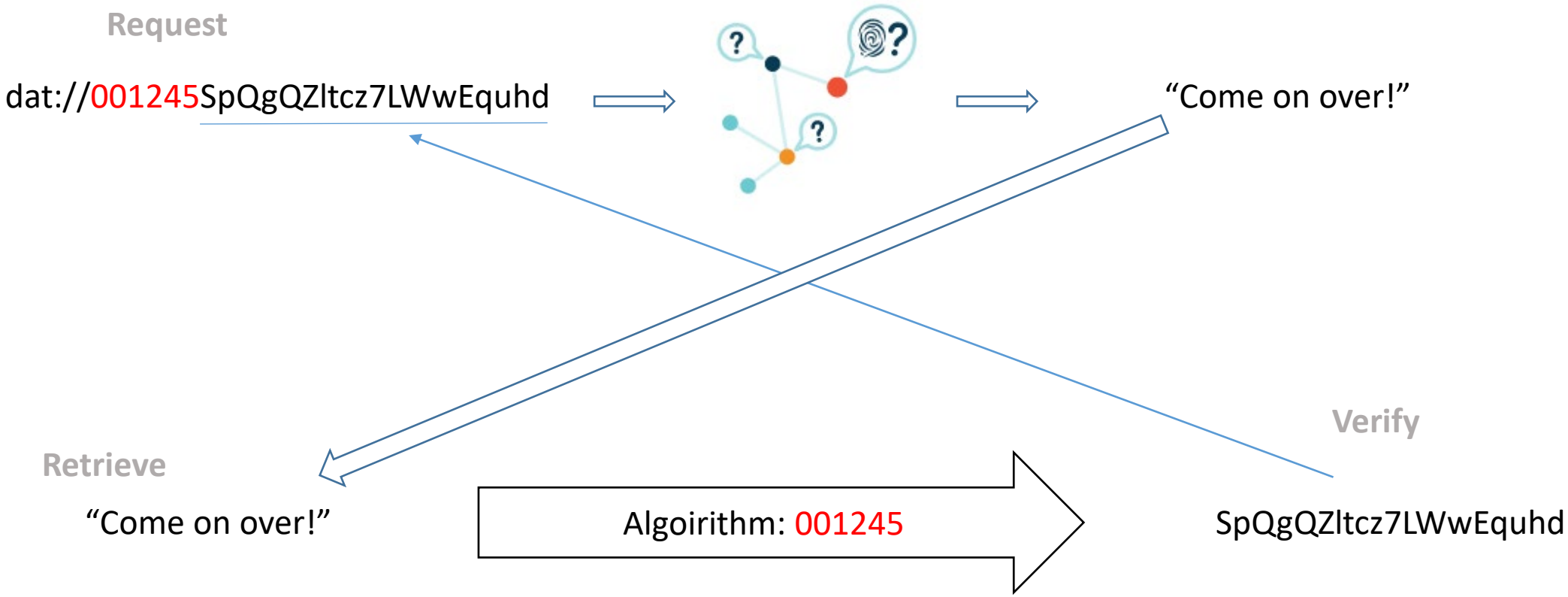
Peer-to-Peer Networks

Each network node stores only content it is interested in, plus some indexing information that helps figure out which node is storing what.

When you look up a file to view or download, you're asking the network to find the nodes that are storing the content behind that file's hash.

https://ipfs.io/#how

Secure Access



A Range of Applications

- Content-addressable resources could be used in combination with other graph-based technologies to create such features as:
  - learner-generated content
  - activity records, and
  - digital badges
- Because these records are stored and linked as one-way encrypted data, they are private and secure.
- Participants can determine for themselves whether any course-related activity is shared to a wider audience.

- The authors recently developed and used these resources in a MOOC, which will be shared. Participants can see how content-addressable resources could be used in combination with other graph-based technologies to create such features as learner-generated content, activity records, and digital badges. Because these records are stored and linked as one-way encrypted data, they are private and secure. Participants can determine for themselves whether any course-related activity is shared to a wider audience.

E-Learning 3.0 Course

E-Learning 3.0

Course Outline

Sign up for E-Learning 3.0 2019
Register Here

-1. Getting Ready
Connectivism is based on the idea that knowledge is essentially the set of connections in a network, and that learning therefore is the process of creating and shaping those networks. To get started we'll look at what to do to set up and how to learn in a connectivist course.

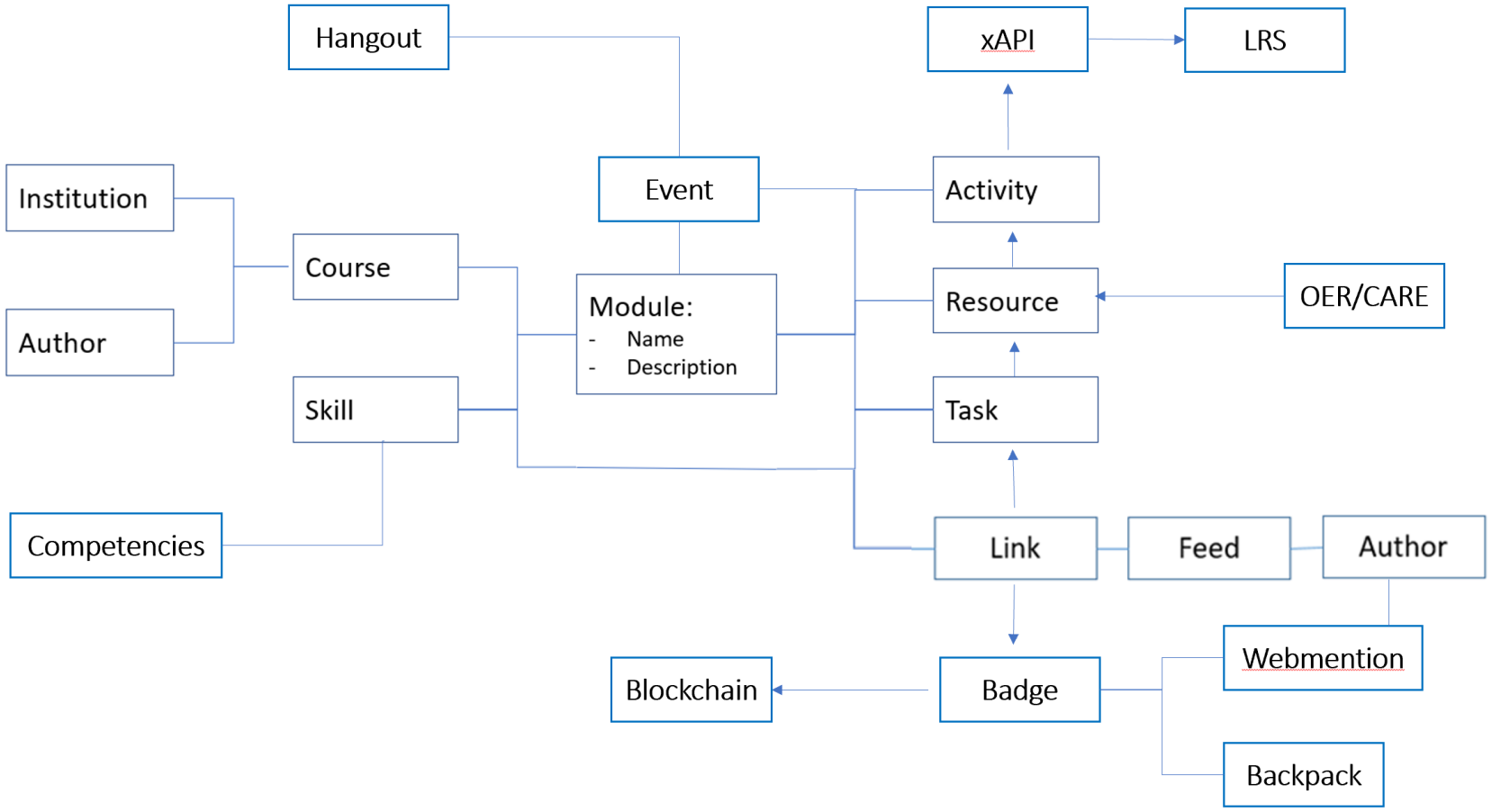
0. E-Learning 1 and 2
The premise of this course is that we are entering the third major phase of the world wide web, and that it will redefine online learning as it has previously. The first phase of the internet as it was originally developed in 1994, based on the client-server model, and focused on pages and files. The second phase, popularly called Web 2.0, created a web based on data and interoperability between platforms.

1. Data
This week the course addresses two conceptual challenges: first, the shift in our understanding of content from documents to data; and second, the shift in our understanding of data from centralized to decentralized.

2. Cloud
The joke is that "the cloud" is just shorthand for "someone else's computer." The conceptual challenge is that it doesn't matter whose computer it is, that it could change any time, and that we should begin to think of "computing" and "storage" as commodities, more like "water" or "electricity", rather than as features of a type of device that sits on your desktop.

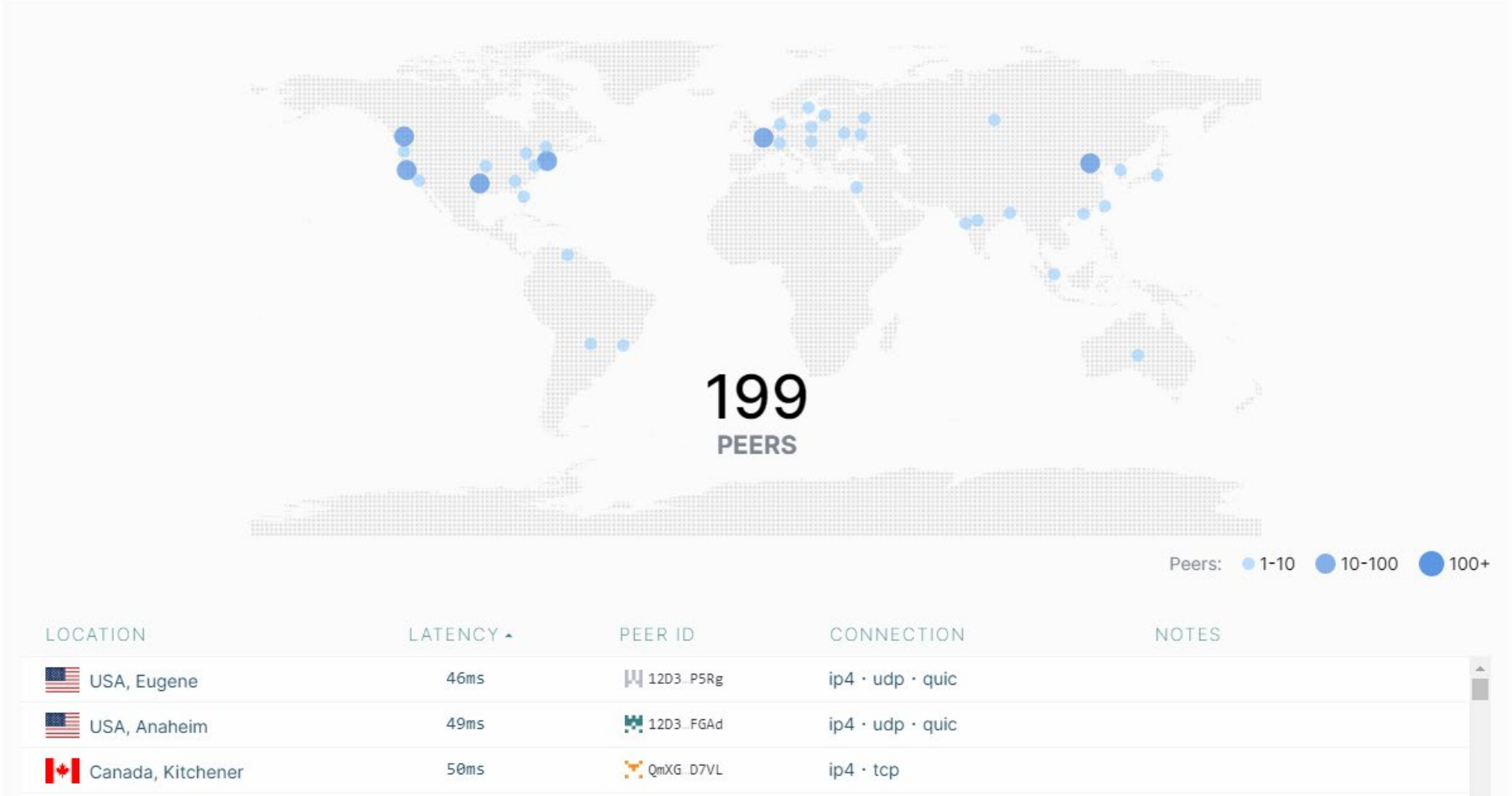
https://el30.mooc.ca/course_outline.htm

EL30 - A Course as Linked Open Data



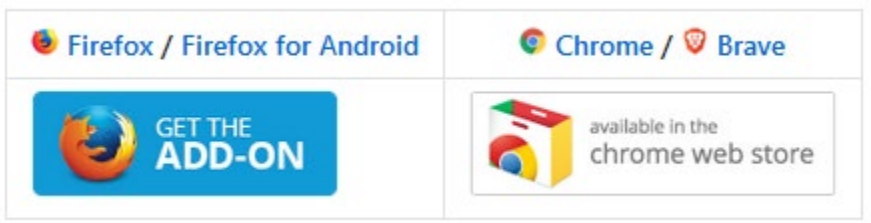
https://www.downes.ca/presentation/515

IPFS Desktop



https://ipfs.io/#install

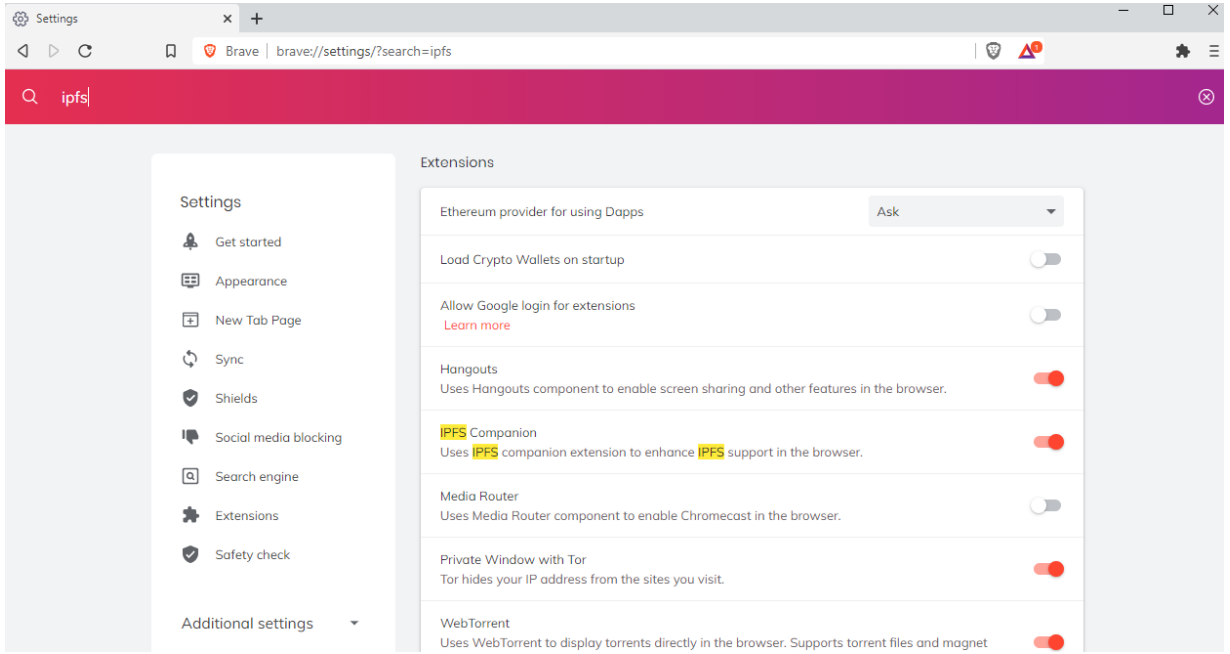
Browsing the IPFS Network



https://github.com/ipfs/in-web-browsers

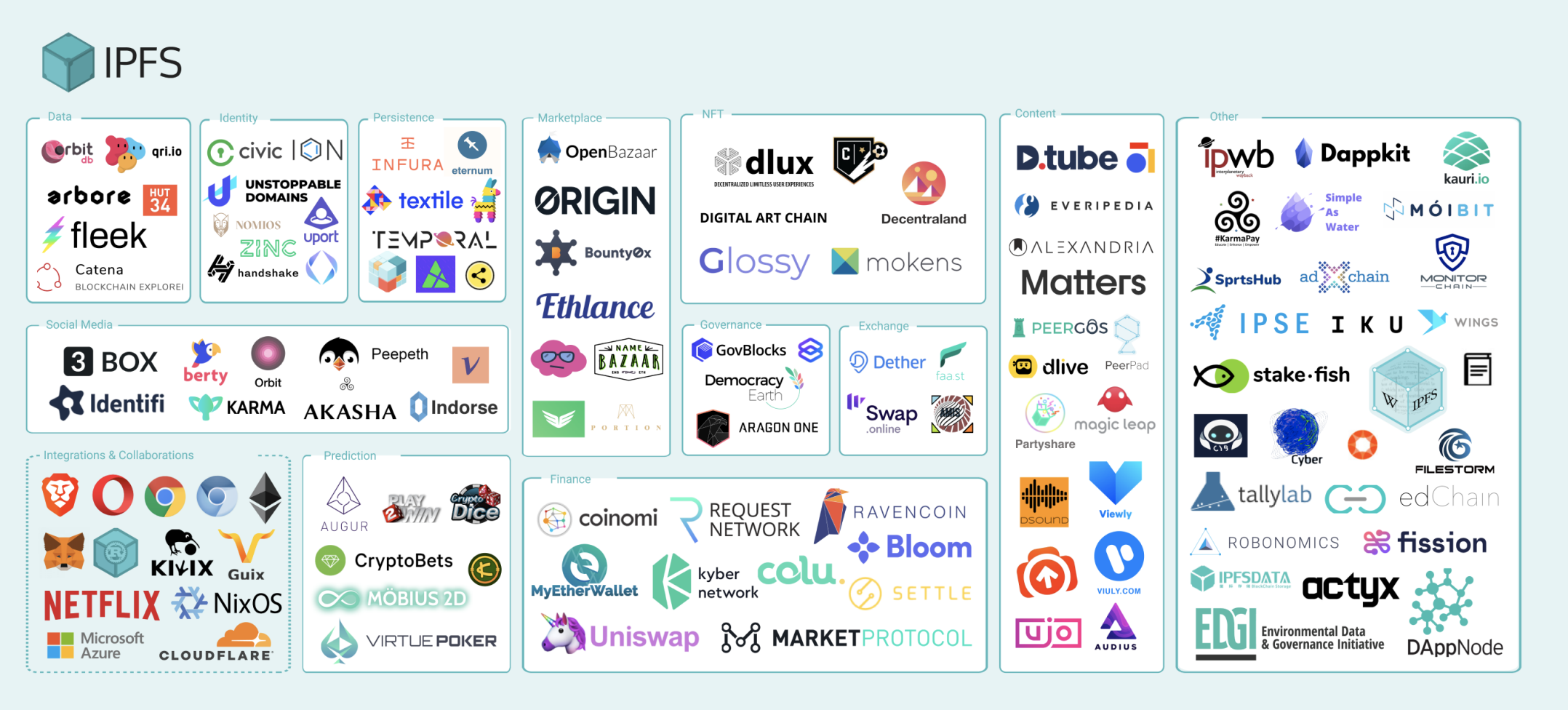
IPFS Web Hub

https://ipfs.io/ipfs/QmdmQXB2mzChmMeKY47C43LxUdg1NDJ5MWcKMKxDu7RgQm



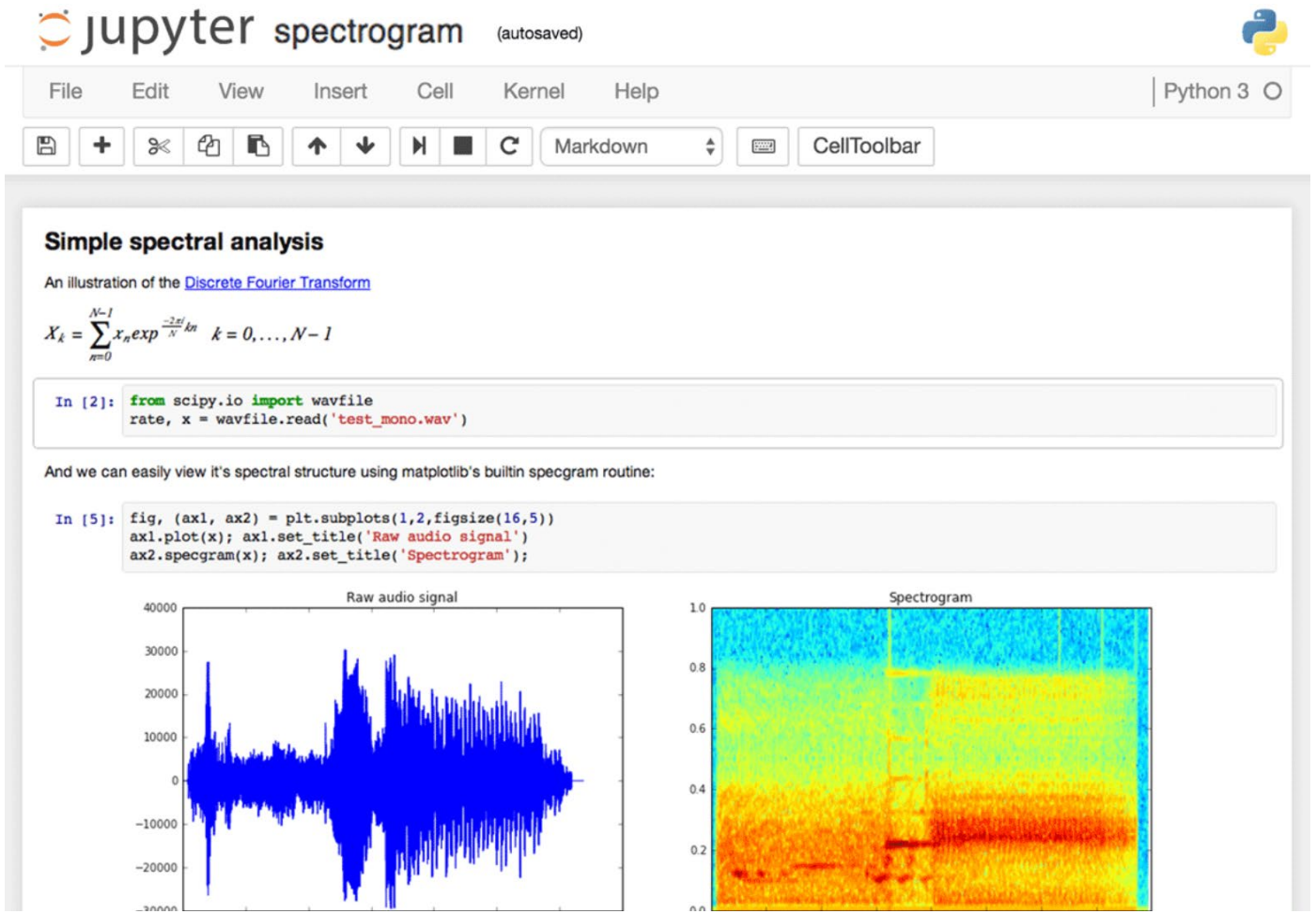
https://brave.com/

Interplanetary File System (IPFS)



https://ipfs.io/images/ipfs-applications-diagram.png

Example: Notebooks

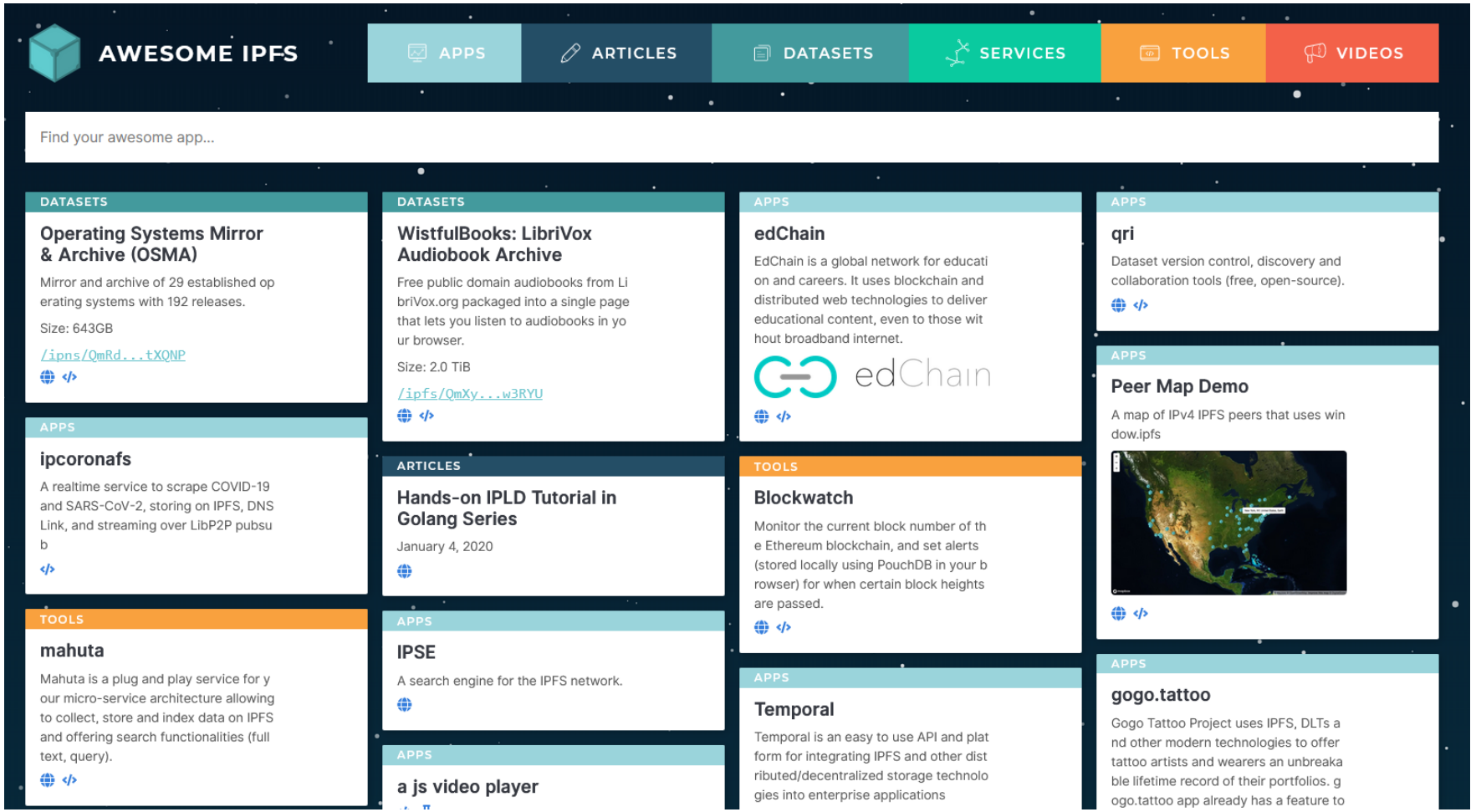


https://github.com/jupyter/jupyter/wiki/A-gallery-of-interesting-Jupyter-Notebooks#machine-learning-statistics-and-probability

OpenLearn Jupyter Books Remix, TM351 Notebooks in VM and Electron.

https://www.dataquest.io/blog/jupyter-notebook-tips-tricks-shortcuts/

Applications



https://awesome.ipfs.io/

Dweb

- One significant current project implementing such a protocol is called Dweb (for ‘distributed web’ or ‘decentralized web’). (Ayala, 2018)
- Based on the dat protocol, a mechanism for finding and distributing content

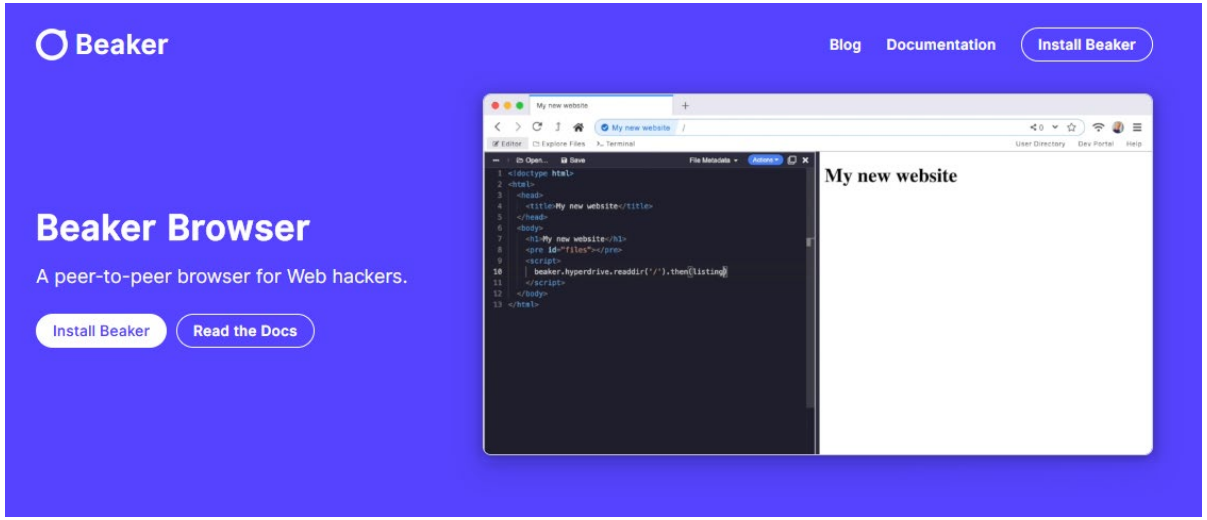
  dat://502bdf152d00a35f9785f78d107b9037b5eca9354bcf593e7b4995f9be97a614/

- This address is in fact the dat:// address for the first *Content Addressable Resource for Education* (CARE)

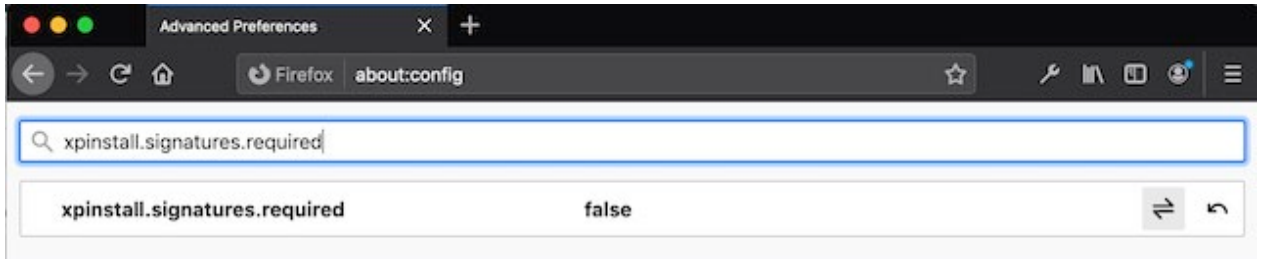
https://hacks.mozilla.org/2018/07/introducing-the-d-web/

https://www.datprotocol.com/

Browsing the Dweb Network



https://beakerbrowser.com/



https://sammacbeth.eu/blog/2020/05/08/install-dat-for-firefox.html

An important aspect of these resources is that they can be developed or modified by anyone. This supports not only content revision but also a common mechanism for community-based meta-tagging or content reviews and to, optionally, provide data on context and use. Thus participants will be able to appreciate how content-addressable resources can inhabit a rich ecosystem that provides an open alternative to published-based and controlled repositories.