Filecoin Foundation
for the Decentralized Web

Protocol Labs

Protocol Labs, Filecoin Foundation for the Decentralized Web, and The Starling Lab

Starling Lab: Establishing Trust in the Digital Records of Human History with the Starling Framework for Data Integrity

by Protocol Labs

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Key Highlights

- Protocol Labs, The Filecoin Foundation for the Decentralized Web, USC Shoah Foundation, and Stanford University have unveiled The Starling Lab, a new research center tackling the technical and ethical challenges of establishing trust in the most sensitive digital records of our human history using the latest advances in cryptography and decentralized web protocols.
- The Starling Lab's mission is to lead by example and show a path to deploy technology and methods that make the decentralized internet a viable platform for social impact.
- With an initial commitment of $2 million of funding from Protocol Labs and the Filecoin Foundation for the Decentralized Web, The Starling Lab is the first center in the world dedicated to using decentralized tools to advance human rights.
- The Starling Lab was co-founded by the USC Shoah Foundation and Stanford University's Department of Electrical Engineering. Technical contributors include: Protocol Labs, Hedera Hashgraph, Numbers, Hyperledger Fabric, The IBM Blockchain Platform, HTC and Project EXODUS, Hala Systems, GUN, Small Data Industries, WITNESS, The Internet Archive, and Hypha.
- The Starling Lab uses the Starling Framework, a host of open-source tools, best practices, and case studies across three key modules: capture, store, and verify.
- The Starling Lab has already completed four showcases using the Starling Framework:
    - **The 78 Days Showcase:** For 78 days, the teams at Starling Lab and Thomson Reuters documented the US presidential transition from Donald Trump to Joe Biden with an array of new image authentication technologies and decentralized web protocols.
    - **The Genocide Testimony Showcase:** The teams at Starling Lab and the USC Shoah Foundation have been permanently and immutably cataloguing the atrocities of global genocides by building a tamper-proof ledger of cryptographic survivor testimonies, including the Holocaust, the Armenian Genocide, and the Rohingya crisis,
    - **The Reuters Showcase:** The teams at Starling Lab and Reuters worked together to create and embed digital cryptographic signatures on photos taken by Reuters journalists to create location, time, and date metadata that cannot be altered when shared on newswires and other sources.

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THE PROBLEM

Data in the digital information age is difficult to verify because of crowdsourced content and technologies like artificial intelligence and deep fakes. This has caused the spread of misinformation and media distrust.

In the advent of the digital age, a number of technological issues make data integrity difficult to protect. The Internet is overrun with misinformation, and valuable data is intentionally obscured. This has led to a crisis of confidence. 74 percent of Americans are concerned about the spread of inaccurate information on the Internet, causing trust in the media to be at an all-time low.

Some of the issues attributing to the challenge of accurate data integrity include:

- Data today is crowdsourced: Anyone can capture media with a smartphone or camera, and limited tools exist to prevent individuals from altering captured data or attributing it incorrectly prior to them choosing to share it.
- It's easy to manipulate data: A host of artificial intelligence tools, "deep fake" technology, and other applications make it easy for parties to change written, photographic, and videographic data and obscure records of altercation.
- It's difficult to verify data: Current internet solutions do not offer an easy and comprehensive way for individuals to verify data integrity in a sustainable and trustworthy way at a global scale.

The Starling Lab addresses the need to:

1) provide a way for individuals to capture their crowdsourced data to establish a chain of custody from the start;
1) store data in a way that is decentralized and cannot be manipulated or altered; and
3) provide the ability to verify data trustlessly.

The Starling Lab created the Starling Framework to address these needs and provide open-source tools, best practices, and case studies that help to reduce information uncertainty in digital media.

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"The original promise of the internet was to use decentralized systems to give everyone a chance to expand human knowledge and understanding. That vision may seem distant, but it is more vital than ever before. We are passionate to help write a new chapter for the web, by innovating with technology and ethics that allow everyone to restore digital trust —again."

Jonathan Dotan, Founding Director of The Starling Lab

THE SOLUTION

In collaboration with the USC Shoah Foundation and Stanford University, Starling Lab is deploying technology and methods that make the decentralized internet a viable platform for social impact. Together, they created the Starling Framework for Data Integrity, a set of tools and methodologies to sustainably and confidently manage humanity's most vital information.

The Starling Framework rests on the fundamental need to capture, store, and verify information to protect its integrity.

Capture

From mobile phones to professional DSLR cameras, Starling Lab prototypes apps and firmware to create a chain of custody from cameras to digital platforms. Within Capture, a combination of hardware (HTC) and software (IPFS and Filecoin) technologies have been prototyped to create a chain of custody from the cameras to digital platforms. Images are paired with metadata from an array of sensors on the device to prove footage was taken at a specific time, date, and location. All this footage is then cryptographically hashed, creating a content identifier (CID) that serves as a unique fingerprint of that footage. (Key ecosystem contributors: HTC, Numbers, and Witness.org /Guardian Project).

Store

Using new Web 3.0 protocols, Starling Lab orchestrates the trusted distribution of files, using advanced cryptography to create computationally productive proofs of replications and storage over time. Within Store, data is replicated onto decentralized storage nodes, such as IPFS and Filecoin, which natively use content identifiers (CIDs) for addressability. If a single pixel is changed, the cryptographic algorithm will generate a completely different hash for the footage. If the data is fetched using a CID rather than a URL, viewing the intended version of that data is guaranteed. Filecoin and IPFS nodes also form a decentralized, global network that is far more difficult to hack than a centralized system. (Key ecosystem contributors: IPFS, Filecoin, SDI, IA, and Hypha).

Verify

Using both permissioned and public decentralized ledgers, the Starling Framework allows experts to analyze content and store those certifications on an immutable ledger with highly-available, fully decentralized ordering services. Within Verify, to deal with all the hashes generated during the capture and storage processes, the Starling Framework has a hash/certification management system that lets organizations engage multiple experts to verify footage. Each organization can then publish on their ledger, and this knowledge graph can be accessed by users on any platform. (Key ecosystem contributors: IBM and Hedera Hashgraph, Filecoin, Hala Systems, and Gun).

The Starling Lab has collaborated with a wide array of global teams in 25 cities around the world including academic institutions, nonprofits, and companies to create and implement the Starling Framework for Data Integrity with applications in media, historical preservation, and documentation of ongoing crises and conflicts.

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“The Starling Lab will accelerate the transition from Web2 to Web3, enabling more traditional Web2 companies to store, verify and preserve valuable data sets in powerful new ways using decentralized technologies like Filecoin and IPFS. As a founding partner, Protocol Labs is thrilled to be cementing its long-term commitment to the Starling Lab through funding and world-class mentorship.”

Colin Evran, Ecosystem Lead at Protocol Labs

RESULTS

The Starling Framework for Data Integrity has already been deployed by the Starling Lab in three major use cases in the following ways:

Protecting Election Coverage Showcase

The teams at Starling Lab and Reuters deployed the Starling Framework during the 2020 California Primary to explore how cryptography can enable and protect the work of their photojournalists in an era of misinformation. Through the Reuters showcase, Starling Lab sought to answer two questions:

- How can we protect against disinformation during an era when visual media can be manipulated easily?
- How can we use the Starling Framework to imbue some of our fundamental democratic processes with more trust and verification?

Reuters journalists explored prototypes to establish the provenance of photographs and make them more trusted by the public. Reuters used a Starling capture phone in addition to their Canon cameras, which allowed journalists to simultaneously hash the metadata - including the barometer, the gyroscope, the GPS data - and send all the information to Reuters. The result is a chain of information verifying that a photo was taken in the place and at the time Reuters says it was.

Learn More

78 Days: Creating A Photographic Archive of Trust

For the 78 during the U.S. presidential transition between the November 2020 election and Joe Biden's 2021 inauguration, the teams at Starling Lab and Reuters evaluated three challenges:

1) How can we securely capture digital photos?
2) How can we store the photos securely?
3) How do we verify the accuracy of their content?

Using the Starling Framework and the new Content Authenticity Initiative's attribution standard, Starling Lab created a prototype archive which allowed each photo to become a container of image pixels and additional metadata and links.

These data and metadata are securely embedded within the photo itself, stored decentralized and immutably on IPFS and Filecoin, and travel with the photo wherever it is published. By leveraging the framework, Starling Lab and Reuters have ensured the photographic evidence of that pivotal moment in the history of the United States is stored and verifiable for generations to come.

Visit 78 Days

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The Genocide Testimony Showcase

The teams at Starling Lab and the USC Shoah Foundation deployed the Starling Framework to cryptographically capture the testimonies of genocidal survivors from the Holocaust, the Armenian Genocide, and the Rohingya crisis. They had two challenges to address:

1) How can we secure and store the archive's current 55,000 video testimonials from nine different genocide events over the last century?

2) How can we start recording new video testimonials and establish a chain of custody right from the start?

To address these needs, the team first uploaded all of the USC Shoah Foundation's current data to IPFS and Filecoin so that it could be protected through decentralization on-chain. As more and more individuals engage with the content and contribute to storing it, the file seals become more secure and the historical records become more resilient.

Next, the team employed the Starling Framework to capture new interviews from survivors. Using mobile phones and DSLR cameras, the teams were able to Capture, Store, and Verify content right from the start, protecting the data and metadata of the interviews and storing it securely on IPFS and Filecoin. All of these videos have been added to the USC Shoah Foundation archives.

Learn More

"If people can't trust the data that they see, then how can they possibly create trust between themselves?"

Jonathan Dotan, Founding Director of The Starling Lab

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