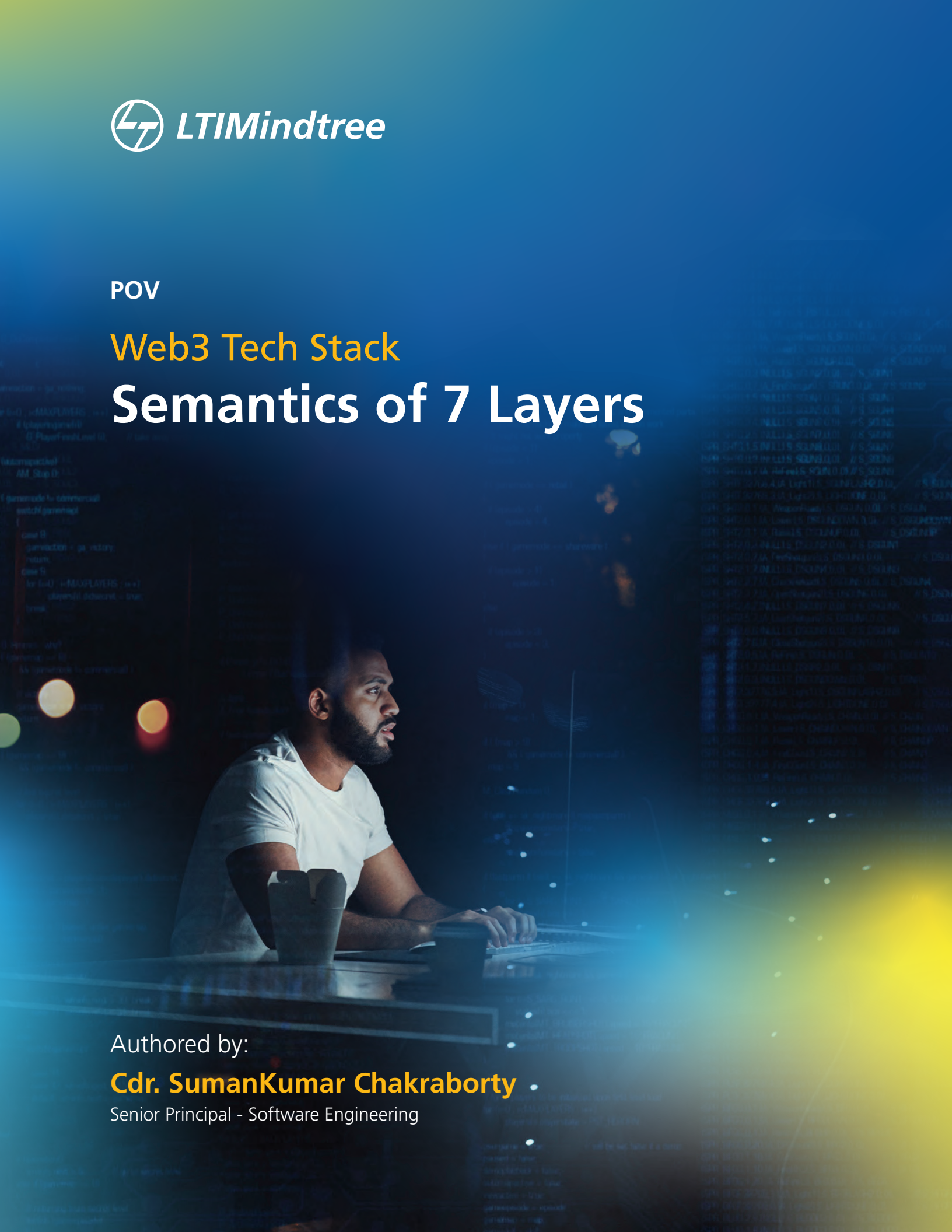
LTIMindtree

POV

## Web3 Tech Stack

# Semantics of 7 Layers



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# Abstract

Today's world revolves around data, and its movement across technology, layers, and frameworks define how smartly we can work. As data moves from the physical world to the digital universe, it becomes essential to understand how Web3 can enable this smoothly and efficiently. Since technology constantly evolves, each interface layer must interact with physically stored data, i.e., the interconnection of the physical and digital worlds is denoted by the term phygital. This Web3 tech stack quickly summarizes the programming languages, frameworks, and tools a developer would need to interface with the application. Because most coding languages have well-known performance attributes and limitations, the tech stack hints at the application's strengths and weaknesses. This POV aims to enable the developer who is coming up with a Web2 framework and is keen to transit.

# Introduction

Several factors have influenced how the web has changed, such as creating new tools and technology, user expectations and behavior modifications, and economic environment changes. Early in the 1990s, Hypertext Markup Language (HTML) was widely used, making it more straightforward for programmers to create multiple device-friendly websites.

HTML is easy to learn compared to programming languages such as Java. The introduction of new tools and technologies that make it easier for users to create online content has been a crucial element in the history of the web. Changes in the economic landscape and user behavior have also influenced the evolution of the web and helped shape the future of web development. Many such factors have led to the evolution of the web and will continue to do the same. On the other hand, the web will continue to substantially impact many people's daily lives for years to come.

# Who is behind Web3?

In the 1970s, a French research network launched the CYCLADES network based on the same packet-switching principles as the American ARPANET. But the network proposed an interconnected network where users exchange data from multiple nodes. Protocols were first created in the early 1970s by ARPA and the International Working Group - a global group of computer scientists. The protocols linked all networks and made a network of networks that worked independently until then. The Defence Advanced Research Projects Agency (DARPA), the research arm of the US Department of Defence (DoD), made the TCP/IP model for ARPANET, which was a system of networks that existed earlier than the internet.

However, a universal protocol was still needed to connect all these networks into one. In 1974, Bob Kahn and Vent Cerf from Stanford University published extensive research drawing from the French CYCLADES network. This formed base of the Transmission Control Protocol (TCP) and Internet Protocol (IP). Sharing research data formed the need for the National Science Foundation Network (NSFNET) in 1980 to create a network that connected all the supercomputers. Further accessing the NSFNET from outside the USA required rapid adoption of Domain Name Service (DNS) concepts and TCP/IP protocols. These advances eventually led to the establishment of Web 1.0, the first iteration of the internet.

# History of decentralization

TCP/IP established the groundwork to produce the web. Telecommunication relied on circuit switching before the TCP/IP concept. Circuit switching required the creation of a communication channel between two network nodes before the nodes could interact. However, the development of the TCP/IP model changed this. And just like the blockchain, it made it possible for a shared public network to be created and maintained without needing a centralized authority. It was withdrawn in 1990 after 30 years of testing and operation.

# Blockchain & TCP/IP

Blockchain shows remarkable similarities to the TCP/IP with its distributed ledger. Like TCP/IP, blockchain is a shared public ledger accessible to anyone. It reduces the cost of financial transactions and international payments, much like TCP/IP-enabled low-cost connections. As a result, it can create a dramatic change not only in the financial market but in all industries where records of transactions and files are the central part of any business. The original Open Systems Interconnection (OSI) layer (7 layers) has evolved into TCP/IP (4 layers), and revised protocols suit (5 layers). The proposed Web3 tech stack has seven layers based on the peer-to-peer framework on which the internet was primarily designed with no central control.

# What led to the rise of Web3?

Today, a handful of internet companies run over seventy percent of the internet landscape. In all its glory, the web was intended to be a space where decentralized hubs could share information. Such a centralized landscape makes it essential to have the latest technology to create the systems and infrastructure that will decentralize it again.

With increased data speeds, Web 3.0 will help boost the Internet of Things (IoT). The resultant better connectivity would help create smart and better consumer products. Decreasing data rates will help make the internet more ubiquitous and democratic. Blockchain was also intended to be decentralized through its layered distributed ledger. Companies and individuals can develop products and services using these 'layers' that have an interoperable open protocol.

With a shared public ledger that records all transactions across a peer-to-peer network, we can imagine a future where blockchains will record contracts embedded in digital code and stored in an untampered transparent database. Web3, Gavin Wood's (co-founder of Ethereum) definition, differs from Web3.0, Tim Berner Lee's (British computer scientist) definition.

As we transition to Web3, thanks to blockchain technology, this connectivity can be used to create intelligent and better consumer products.

The complementary nature of Web3 to the blockchain, being the framework, is depicted below. One can imagine them as concentric circles in a Venn diagram of everyday use cases. Web3's quick adoption depends highly on its interoperability. The Gartner Hype Cycle July 2022 has included Web3 independently because Web3 represents a larger ecosystem of innovations underpinned by blockchain.

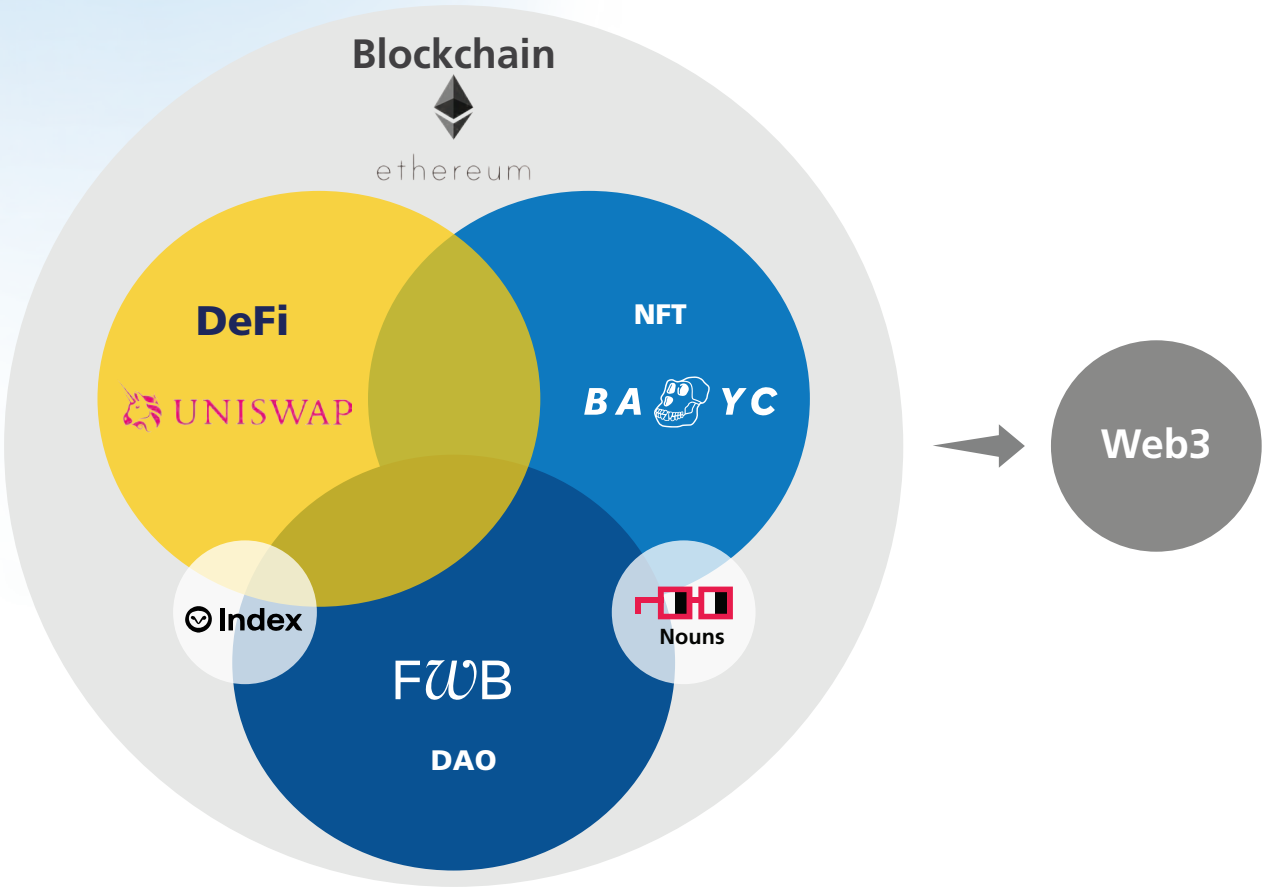



Fig1: Web3 Common Use cases

# Web3 stack explained

Web3 software stack radically differs from its earlier versions due to decentralized server storage that completely alters the client-server connection. What is a Web3 protocol? On Web3, data is stored in multiple copies of a Peer-to-Peer (P2P) network. The incumbent Web2 was structured as a frontend revolution (read-write), and Web3 is a backend revolution (ownership with creators). It's a set of blockchain-led protocols which aim to reinvent how the internet is connected in the backend. It does this by combining the internet's logic with the computer's logic. The transition, however, could be faster because blockchain technology is at its nascent stage, and complete conversion to Web3 would result in a loss of bandwidth. The change must be gradual and measured.

The Web3 architecture built by leveraging blockchain technology will have the following layers:

- Application layer: The application layer comprises the Access and Use Case layers.
    - Access layer: The Web3 dAPP will have the wallet id or address as the access point. The user's digital assets will be mapped to their wallet, where a secret key will reside. The aggregators will use these as unique ids to confirm the data exchange. Most Web2 platforms will transform into Web3 with this layer ensuring interoperability and composability.
    - Use Case layer: This software layer will facilitate user interaction across use cases. This layer will include dAPP browsers, decentralized applications, and various programming languages. Workable business plans will be determined by user preference patterns and the execution rules set by the certification authority within the peer groups. By business plans, this layer will cater to the users.w
- Service layer: This layer will operate and maintain the application layer. Decentralized Autonomous Organizations (DAOs) that use smart contracts will use this to ratify:
    - Smart contracts
    - Data feeds from the application layer
    - An off-chain computation layer for reducing the processing load on the blockchain (sidechain)
    - Private two-way channels for direct transactions between users
    - Digital wallets for storing cryptocurrencies
    - Blockchain oracles transmit real-world information for smart contracts and many other optional components

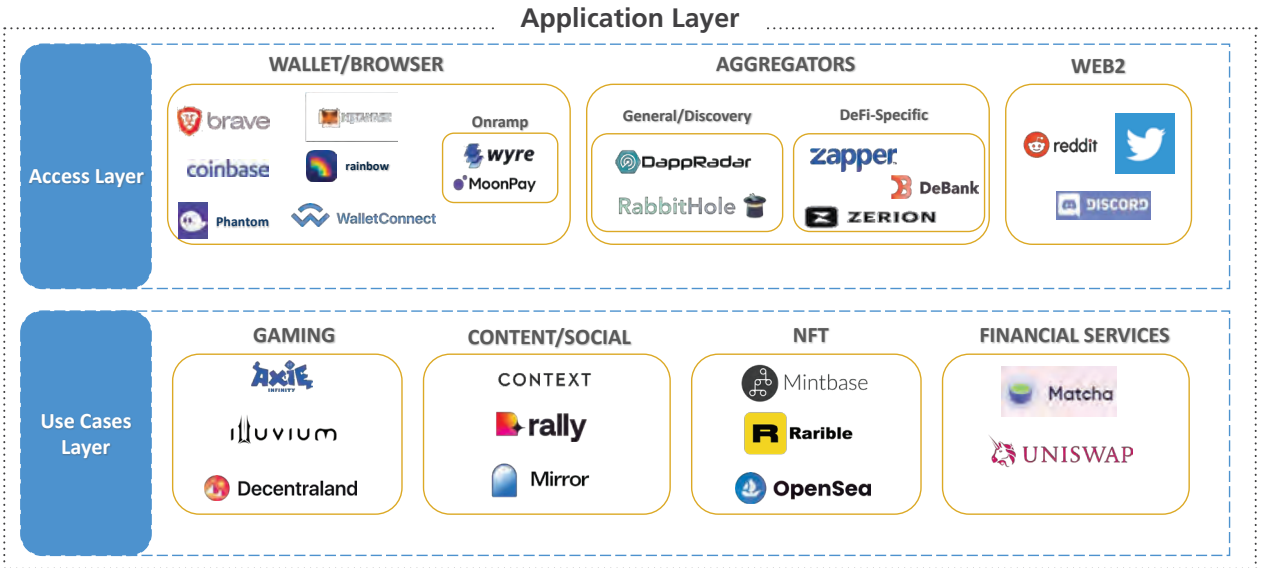
- Protocol/Presentation layer: This layer will constitute the root of all blockchain applications. This layer will consist of consensus algorithms that form the logic structure on which the different nodes are aligned. It will execute virtual machines and security systems that remotely scope out unreliable code from various nodes, preventing denial of service attacks, sidechains, etc. For the component to work, developers must add functionality and create a set of standardized rules in the form of protocols.
- Interaction layer: This layer will form the network used by the blockchain to create the P2P network. An essential function of this layer is as a transportation medium. This layer will move data, locate additional nodes, and establish connections to secure the transit further.
- Infrastructure layer: This layer will supply the means to create a blockchain. The systems and algorithms will provide
    - Blockchain as a service
    - Mining as a service
    - Robust network of nodes
    - Tokens, NFTs, etc.

Developers can use this technology and create solutions geared toward consumers.

- Network layer: This will be the preferred layer to configure the application on Ethereum Virtual Machine (EVM)/non-EVMs. Various layer 2 networks will rely on it as the fundamental support for roll-ups and off-chain transactions crucial to scalability and latency.

Along with the layers, it is also essential to list capable service providers for each layer.

Therefore, it will enable rapid prototypes for eventual MVPs, which is the desired outcome of our proposed incubation model.



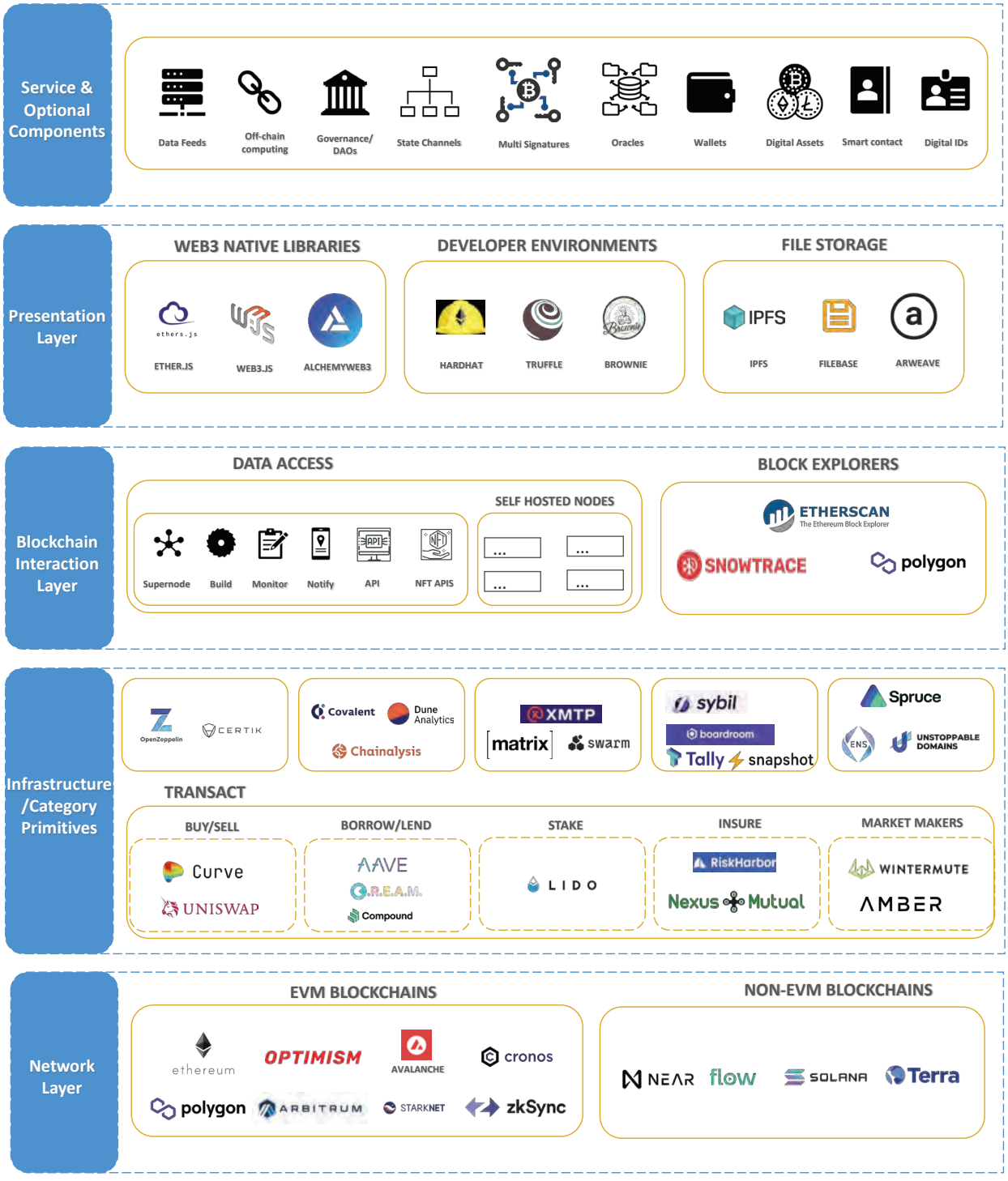



Fig 2: Web3 Tech Stack

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# Summary

Web3 shows immense promise in multiple ways, like direct ownership of individual assets, greater power to content creators versus platform owners, the opportunity to build decentralized autonomous organizations with decentralized decision-making on resources, trusted, secure, and anonymous identity, and no dependency on the third party.

Web3 has tremendous potential and is one of the up-and-coming technologies companies should incubate immediately to avoid disruption and meet market expectations. Decentralization in all three technical, economic, and legal/fiduciary areas will ensure that the alternate internet envisaged with creator/ownership is realized soon. These layers, as depicted above, are the capabilities or building blocks to achieve this composable model.

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Cdr. Suman Kumar Chakraborty is an NDA alumnus and a veteran of the Indian Navy, where he's held various appointments which have enabled modern tech adoption at scale during his 20+ years of service. A Gold Medalist in BTech and MTech has four masters to his name and was awarded by Dr. APJ Kalam for his project on Missile Auto Pilot. After pursuing his MBA in Strategy and Marketing from ISB, he has been in tech leadership roles in two successful start-ups. Firstly, as a founding CTO in healthcare and then as Head of Product for a Blockchain-based portfolio that included Web3 services and was acclaimed as one of the top 3 in India.

At LTIMindtree, he leads the WEB3 incubation team and spearheads various GTO initiatives in close collaboration with strategy teams and other stakeholders.