LESSON 8: COMPARING BLOCKCHAIN NETWORKS AND UNDERSTANDING LAYERS

A Prison Professors Self-Directed Course

Estimated time: 70–105 minutes

Educational Boundary:

> *This lesson compares technical systems for educational purposes. It does not recommend any network, company, product, or digital asset. It does not provide individualized financial, investment, legal, or tax advice. You do not need internet access, an account, a wallet, or a digital asset to complete the lesson.*

OPENING GUIDANCE

Lessons 5 through 7 introduced the basic structure of a blockchain, the relationship among blocks, transactions, and hashes, and the way nodes follow rules to reach agreement. We can now use those foundations to compare different networks.

When I compare systems, I try to avoid beginning with a conclusion. I begin with questions. What problem is the system designed to address? Who maintains it? What rules does it follow? What does it depend on? What benefits might it provide, and what tradeoffs come with those benefits?

This method is especially important in Web3 because a familiar name, a high price, or a label such as Layer 1 or Layer 2 can sound more informative than it really is. A label may help us organize an explanation, but it cannot replace careful analysis. I encourage you to practice separating the network from its native asset, the base layer from the systems connected to it, and technical claims from promotional claims.

PURPOSE AND ESSENTIAL QUESTION

Lesson 8 demonstrates that blockchain networks make different design choices and introduces the common language of Layer 1, Layer 2, and application layers.

Essential Question:

» What criteria should a careful learner use to compare blockchain networks, and when does a layer label clarify or oversimplify the system?

LEARNING OBJECTIVES

After completing this lesson, you should be able to:

- Compare Bitcoin, Ethereum, BNB Smart Chain, and a connected scaling system using consistent criteria.
- Distinguish a blockchain network from its native asset.
- Explain Layer 1 as a base blockchain network and Layer 2 as a system built on or connected to a base network for defined purposes.
- Explain why Layer 3 does not have one universal meaning.
- Evaluate network and layer claims without treating popularity, price, speed, or a label as proof of quality.

KEY TERMS

BLOCKCHAIN NETWORK

Definition: A group of connected computers running compatible rules and software to exchange information, validate activity, and maintain a shared blockchain record.

Sample sentence: The blockchain network continued processing valid transactions even though one node went offline.

NATIVE ASSET

Definition: A digital asset built into a blockchain protocol and commonly used for functions such as paying network fees or supporting network security.

Sample sentence: Ether is the native asset of Ethereum, but ether and the Ethereum network are not the same thing.

LAYER 1

Definition: A base blockchain network that maintains its own ledger, consensus rules, and transaction history.

Sample sentence: Bitcoin, Ethereum, and BNB Smart Chain can each be examined as a Layer 1 network.

LAYER 2

Definition: A system built on or connected to a Layer 1 that processes or organizes activity and relies on that base network in a defined way.

Sample sentence: A Layer 2 may group transactions before sending information to its Layer 1.

APPLICATION LAYER

Definition: The programs and services through which people or organizations use blockchain-related functions.

Sample sentence: A ticketing program may operate at the application layer while relying on one or more blockchain networks underneath.

SCALABILITY

Definition: A system's ability to handle greater demand while maintaining acceptable performance, cost, security, and reliability.

Sample sentence: A design that processes more transactions may improve scalability but still introduce other tradeoffs.

FINALITY

Definition: The point at which a network treats a transaction or block as settled under its rules.

Sample sentence: A comparison of networks should explain how each system reaches finality instead of using the word fast by itself.

MAIN LESSON

COMPARE SYSTEMS, NOT SLOGANS

Blockchain networks do not all pursue the same goals or make the same design choices. One may emphasize resistance to control and a narrow set of functions. Another may emphasize general-purpose programs. Another may prioritize lower fees or shorter block times by using a smaller or differently selected validator group. A connected scaling system may move part of the work away from a base network and later submit data, proofs, or results back to it.

Because the designs differ, a fair comparison needs consistent questions. Comparing one network's speed with another network's market price would mix unrelated measurements. Comparing advertised maximum capacity with observed ordinary use would also be misleading. The learner's task is to decide what is being measured, under what conditions, and at what cost.

A useful comparison begins with at least seven criteria:

1. Purpose: What problem is the system designed to address?
2. Record and consensus: Who maintains the ledger, and how does the system accept new history?
3. Participation: Who can run a node, produce blocks, validate activity, or influence upgrades?
4. Performance and cost: What demand can the system handle, and what resources or fees are required?
5. Settlement: How and when does the system treat activity as final?
6. Programmability: What kinds of transactions, programs, or applications does the system support?
7. Dependencies and governance: What other networks, operators, bridges, data sources, companies, or decision processes does the system rely on?

These criteria do not produce one automatic winner. They reveal tradeoffs and help a learner match a system's design to a particular use.

SEPARATE THE NETWORK FROM THE ASSET

People often use a network name and an asset name as if they mean the same thing. They do not. Bitcoin can refer to the network and protocol, while bitcoin or BTC can refer to the network's native asset. Ethereum is a network and computing platform; ether or ETH is its native asset. BNB Smart Chain is a blockchain network; BNB is the native asset used for fees and other protocol functions in the BNB Chain ecosystem.

This distinction matters because a network can continue operating while the market price of its native asset changes. A price chart does not explain the network's consensus design, node distribution, software quality, governance, or usefulness. In the other direction, a technically capable network does not prove that its native asset will rise in price or suit any person's financial circumstances.

A responsible comparison can discuss how a native asset functions without making a recommendation to acquire it. The network is the system. The native asset is one component within that system.

LAYER 1: THE BASE RECORDKEEPING NETWORK

A Layer 1 is a base blockchain. It maintains the authoritative ledger under its own consensus rules. Nodes receive and check transactions and blocks. Miners or validators perform specialized roles according to the design. The Layer 1 also defines how fees are paid, how finality is reached, and how protocol changes occur.

Bitcoin, Ethereum, and BNB Smart Chain are different Layer 1 examples. Calling all three Layer 1 networks does not mean they are identical. Bitcoin uses proof of work and was introduced as a peer-to-peer electronic cash system. Ethereum uses proof of stake and supports general-purpose smart contracts. BNB Smart Chain uses Proof of Staked Authority and supports applications compatible with the Ethereum Virtual Machine. Each system has different participants, security assumptions, governance practices, performance characteristics, and concentration questions.

The Layer 1 label therefore answers only one question: Is this the base blockchain in the relationship being described? It does not answer whether the system is more decentralized, secure, useful, or valuable than another system.

LAYER 2: CONNECTED SCALING WITH A DEFINED DEPENDENCY

A Layer 2 handles some activity in connection with a Layer 1. The general purpose may be to improve scale, cost, speed, privacy, or another function. A Layer 2 might collect many transactions, process them separately, and later send data or results to the base network. The exact security and settlement relationship varies by design.

The phrase built on top of can be useful, but it is only an image. Computers do not sit physically on one another. The important questions are technical: What information goes to the Layer 1? Who operates the Layer 2? How can an incorrect result be challenged or rejected? Where is transaction data available? How do users move information or assets between systems? What happens if the Layer 2 operator stops working?

Not every separate chain connected by a bridge should automatically be called Layer 2. Some connected chains use their own consensus and security rather than deriving security from the base network. Different communities also apply the label differently. A careful explanation states the dependency instead of relying on the label alone.

Layer 2 designs can increase capacity or reduce ordinary transaction cost, but they may add complexity. Users may depend on sequencers or other operators, bridges, proof systems, challenge periods, data-availability arrangements, and upgrade controls. Moving work away from the base layer changes where trust, risk, and responsibility appear; it does not eliminate them.

APPLICATION LAYER AND THE VARIABLE MEANING OF LAYER 3

Applications and services help people use the underlying networks. A decentralized application may combine a user interface, smart contracts, outside data, storage, and ordinary web services. The application layer is where a technical system becomes a tool for a particular purpose, such as tracking credentials, coordinating a community project, or managing digital records.

An application is not automatically decentralized in every part merely because one smart contract uses a blockchain. Its website, administrators, data sources, keys, hosting, or upgrade process may remain concentrated. Comparing applications therefore requires questions about both the blockchain components and the surrounding service.

The term Layer 3 requires special care because it does not have one universal definition. One source may use it for an application-specific network built on a Layer 2. Another may mean an interoperability or service layer. Another may use Layer 3 as another name for the application layer. Whenever the term appears, ask the writer to define it. The definition and dependency matter more than the number.

A NEUTRAL COMPARISON OF THREE LAYER 1 NETWORKS

Bitcoin, Ethereum, and BNB Smart Chain provide a useful introductory comparison when the same criteria are applied to each.

Bitcoin: The original design describes a peer-to-peer electronic cash system. The network uses proof of work, and BTC is its native asset. Its design emphasizes a publicly verifiable transaction history and resistance to changing confirmed history through accumulated computational work. Tradeoffs include substantial energy use, confirmation time, and a more limited base-layer programming model than general-purpose smart-contract platforms.

Ethereum: Ethereum is a general-purpose blockchain network for transactions and smart contracts. It uses proof of stake, and ETH is its native asset. Its programmability supports many applications and token standards. Tradeoffs can include demand-driven fees, application and smart-contract risk, protocol complexity, and dependencies introduced by scaling systems and services.

BNB Smart Chain: BNB Smart Chain is an Ethereum-compatible blockchain network using Proof of Staked Authority, and BNB is its native asset for network functions such as fees. Its design supports short block times and application compatibility. Its active validator and block-production design also makes validator selection, stake concentration, governance, and operational influence important comparison questions.

These summaries are starting points, not verdicts. Terms such as secure, fast, decentralized, and scalable need evidence and a defined measurement. Each network can change through software upgrades, governance decisions, participant behavior, and changing demand.

APPLIED EXAMPLE: BNB SMART CHAIN AND OPBNB

As of July 20, 2026, BNB Chain's official documentation describes BNB Smart Chain as a base blockchain network and opBNB as a Layer 2 scaling solution for BNB Smart Chain built with the OP Stack. This gives us a practical layer relationship to examine.

BNB Smart Chain maintains the base ledger and consensus under its Layer 1 rules. opBNB processes activity in a connected environment intended to increase capacity and reduce cost for certain uses. Applications can then operate through opBNB or interact directly with BNB Smart Chain, depending on their design.

The label Layer 2 does not complete the evaluation. A careful learner would still ask who orders transactions, what data and results are posted to BNB Smart Chain, how errors are detected, how withdrawals or cross-system messages work, what upgrade controls exist, and what happens during an outage. The answers may change as the software develops, so current project documentation must be checked before publication or use.

This example is educational. It is not an endorsement of BNB Smart Chain, opBNB, BNB, or any application. No learner needs to acquire an asset, create a wallet, connect to a network, or conduct a transaction.

TRADEOFFS MOVE; THEY DO NOT DISAPPEAR

Layered designs can divide work among systems with different strengths. A base layer may emphasize security and independent verification. A connected layer may process more activity or provide specialized features. An application may make the technology easier to use.

The arrangement can also distribute risk across more components. A user may depend on the base network, the Layer 2 operator or validator set, a bridge, a data-availability system, smart contracts, an application interface, and people who control upgrades. Failure at any important point can affect the experience or outcome.

For that reason, the best comparison question is rarely Which network is best? A better question is Which design fits this purpose, under these conditions, with which benefits, costs, dependencies, and risks? That question encourages judgment instead of loyalty to a brand or label.

APPLIED SCENARIO: THE "LAYER 3" CREDENTIAL PROPOSAL

A community organization receives a proposal for a digital credential system. The vendor says the product is a Layer 3 application and therefore must be faster, safer, and more decentralized than every Layer 1 or Layer 2 alternative.

The proposal does not define Layer 3. It does not identify the base network, explain where records are stored, state who can change the software, or describe what happens if the vendor closes. It provides a chart showing transaction speed but does not explain the testing conditions or security assumptions.

Reasoned response: The organization should not accept the layer label as proof. It should ask the vendor to map every component: application, connected network, base network, operators, data storage, keys, upgrade controls, fees, and recovery process. It should compare the proposal with non-blockchain alternatives using the same requirements. The label may become useful after the dependencies are clear, but it cannot replace evidence.

BENEFITS, LIMITATIONS, RISKS, AND MISCONCEPTIONS

POSSIBLE BENEFITS OF A LAYERED MODEL

- Separating base recordkeeping, scaling, and application functions can make a complex system easier to analyze.
- Layer 2 systems may increase capacity or reduce ordinary transaction cost for some uses.
- Application layers can turn technical functions into tools that serve a specific purpose.
- Multiple designs allow builders to choose among different performance, security, privacy, and programmability tradeoffs.
- Consistent comparison criteria can help learners evaluate claims without relying on price or popularity.

IMPORTANT LIMITATIONS AND RISKS

- Layer terminology is descriptive rather than universal, especially for Layer 2 boundaries and Layer 3.
- A connected system may introduce operators, bridges, proof systems, data services, or upgrade controls that become new points of dependence.
- Faster or cheaper processing may involve tradeoffs in decentralization, security, data availability, or finality.
- Native-asset prices can distract from technical evaluation and can change independently of network quality.
- Software defects, governance disputes, concentrated control, misleading benchmarks, and incompatible upgrades can affect any layer.

» Applications can remain highly centralized even when they use a public blockchain.

COMMON MISCONCEPTIONS

» "A network and its native asset are the same thing." The asset is one component of the network's economic and security design.
» "Layer 2 always means a separate blockchain with identical security to Layer 1." Designs and dependencies differ; the relationship must be explained.
» "Layer 3 is a universally agreed technical category." Sources use the term in different ways.
» "A higher layer number means better technology." Layer numbers describe a relationship, not a quality score.
» "The fastest network is automatically the best network." Performance must be compared with security, cost, participation, reliability, and purpose.
» "A popular or expensive native asset proves that its network is useful or safe." Price and popularity do not establish technical quality.
» "Moving work to another layer removes trust." Trust and risk usually shift to different components and operators.

OFFLINE EXERCISE: BUILD A NEUTRAL COMPARISON MATRIX

Estimated time: 25–30 minutes

Materials: Separate paper and a pencil.

Create a comparison matrix on separate paper. Use these five rows:

» Bitcoin
» Ethereum
» BNB Smart Chain
» opBNB
» The hypothetical credential application from the applied scenario

CREATE THESE SIX COLUMN HEADINGS:

1. Category: Layer 1, Layer 2, application layer, or unclear
2. Purpose: What is the system designed to do?
3. Dependencies: What network, participants, operators, or services does it rely on?
4. Possible benefit: What strength might the design provide?

5. Important tradeoff or risk: What cost, limitation, or concentration question matters?
6. Missing information: What would you need to verify before reaching a conclusion?

Complete every row using this lesson. When information is incomplete, write unknown—needs verification instead of guessing.

Then write a short response to these questions:

» Which examples are base networks?
» Which example depends on a base network as a scaling system?
» Which example is mainly an application or service?
» Why would price be a poor column for comparing technical design?
» Which two criteria would matter most for a credential system, and why?
» Where might control or failure become concentrated in each example?

Important limitation of the exercise: This matrix simplifies systems that contain many components and can change over time. It helps organize questions; it does not provide a complete security audit or prove that one system is superior.

KNOWLEDGE CHECK

MULTIPLE CHOICE

1. Which statement best distinguishes a blockchain network from its native asset?
   a. The network is the shared technical system; the native asset is one component used within that system.
   b. The native asset owns every node in the network.
   c. The network is only the asset's market price.
   d. There is no difference between the two terms.
2. Which description of Layer 1 is most accurate?
   a. Any website that displays blockchain information
   b. A base blockchain network with its own ledger and consensus rules
   c. A quality score assigned to the most popular asset
   d. A private key stored in a wallet
3. Which question is most useful when evaluating a claimed Layer 2 system?
   a. Does its name contain the number two?

b. Is its native asset rising in price today?
c. What does it process, what does it post to the base network, and what security dependencies does it introduce?
d. Does its advertisement call it the fastest?

TRUE OR FALSE

» The term Layer 3 has one universal definition that every blockchain project uses in the same way.

SHORT EXPLANATION

» In three or four sentences, explain why a higher layer number, faster advertised speed, or more expensive native asset does not by itself prove that a system is better.

SUMMARY AND PRACTICAL TAKEAWAYS

» Blockchain networks should be compared using consistent criteria, including purpose, consensus, participation, performance, finality, programmability, dependencies, and governance.
» A network and its native asset are related but different.
» A Layer 1 is a base blockchain network that maintains its own ledger and consensus rules.
» A Layer 2 processes or organizes activity in a defined relationship with a Layer 1.
» Applications and services interact with networks but may include both decentralized and centralized components.
» Layer 3 does not have one universal meaning; every use should be defined.
» Bitcoin, Ethereum, and BNB Smart Chain are Layer 1 networks with different designs and tradeoffs.
» Official documentation currently describes opBNB as a Layer 2 scaling system connected to BNB Smart Chain.
» Layer labels, speed claims, popularity, and asset prices do not replace evidence.

The practical skill is learning to map a system before judging it: identify the base record, connected layers, applications, participants, dependencies, benefits, and risks.

PROFILE JOURNAL ASSIGNMENT

Write one coherent journal entry of approximately 300–400 words. Do not submit a disconnected list of answers. Use the prompts below to organize a beginning, middle, and conclusion:

- Explain why blockchain networks should be compared with consistent criteria.
- Distinguish a blockchain network from its native asset.
- Define Layer 1, Layer 2, and the application layer in your own words.
- Explain why Layer 3 must be defined each time it is used.
- Compare two examples from the lesson using the same criteria.
- Identify one possible benefit and one important tradeoff of a layered system.
- Describe how you would respond to a claim that one network is best because it is faster, more popular, or has a higher-priced asset.
- Explain what criteria you would use to decide whether a layer label clarifies or oversimplifies a system.
- Connect the comparison process to the critical-thinking, communication, or self-directed-learning skills you are developing.

Your response should demonstrate your reasoning. You are not being asked to create an account, open a wallet, purchase an asset, connect to a network, use an application, or conduct a transaction.

SUBMISSION REMINDER

Write your response on separate paper or in an approved institutional messaging system. Include your name or approved Profile identifier, Lesson 8: Comparing Blockchain Networks and Understanding Layers, and the date you completed the entry.

Use one of the established Prison Professors Profile methods, subject to your facility's rules:

1. Send it by institutional email to Playbook@PrisonProfessors.org. Suggested subject: Web3 Lesson 8 — [date completed].
2. Send it by postal mail to: Prison Professors, 1205 BMC Drive, Suite 706, Cedar Park, TX 78613.
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