Blockchain Innovation Program Tutorial Framework

POWERED BY

Blockchain Innovation Program
Tutorial Framework

The Blockchain Innovation Program is a designed as an intensive 10-week programme which will provide students with educational and entrepreneurial support for them to develop a comprehensive understanding of what's involved in Bitcoin Application Development.
The programme will see the students complete the three bitcoin primitive courses Hash Functions, Merkle Trees, and Digital Signatures before they complete the newly refactored Introduction to Bitcoin Development.

Educators from the Bitcoin SV Academy team will prescribe weekly resource and question packs to stimulate the students to develop a deeper consideration for what is involved in creating a scalable Bitcoin application. The students will attend fortnightly tutorials where their answers to the question pack will be evaluated and discussed in greater detail.

Live session #1

Hash Functions	• Hash Functions and Hash Tables • Content Addressed Distributed Data Structures • Efficient Provable Data Possession for Hybrid Clouds

Course pre-requisite: Hash Functions (primitives)
Worksheet to complete prior to the live session: Week 1 – Hash Functions

Live session #2

Merkle Trees	• GitHub MerkleDAG • ForkBase: Immutable, Tamper-evident Storage • Substrate for Branchable Applications • Merkle-CRDTs - MerkleDAGs meet CRDTs • Merkle^2: A Low Latency Transparency Log System
Digital Signatures	• Digital Signatures • Legitimating Technologies: Digital Signatures Case Study. • Segwit, Mixing and Law • SigHash Flags

Course pre-requisite: Merkle Trees and Digital Signatures (Primitives)
Worksheet to complete prior to the live session: Week 2 Merkle Trees and Week 3 Digital Signatures.

Live session #3

Data and Databases	• What is DBaaS? • SQL vs NoSQL • What is Cloud Storage? • What is Object Storage? • Block vs File Storage • What is a Load Balancer? • Kubernetes vs Docker
API led Event-Driven & Microservices Architectures	• API vs SDK • What is API Management? • What is a REST API? • What is an API Gateway? • What is Event Driven Architecture? • What are Microservices? • Architecting a Cloud Native API Solution. • Blockchain Enabled Trustless API Marketplace • Unofficial API and Browser Extension Development for Augmenting Student Resources

Course pre-requisite: Bitcoin Development Chapter 1
Worksheet to complete prior to the live session: Week 4 Data and Databases and API led Event-Driven & Week 5 Microservices Architectures

Live session #4

Debunking the Blockchain Trilemma, CAP Theorem & Application Scalability	• Myths of Decentralisation • On Decentralisation • The Wizard of Blockchain • Cost Performance Trade-Off Evaluation in Microservices impacted by the CAP Theorem Limitations
Working Blockchain & Overlay Networks	• A Survey and Comparison of P2P Overlay Network Schemes. • Virtual Networking Explained • What is a Content Delivery Network • Mandala Network • SPV • Working Blockchain

Course pre-requisite: Bitcoin Development Chapter 2&3
Worksheet to complete prior to the live session: Week 6 Debunking the Blockchain Trilemma, CAP Theorem & Week 7 Application Scalability and Working Blockchain & Overlay Networks.

Live session #5

Intro to Git and Github	• Git and GitHub for Beginners • Getting Started With OpenSSH Key Management. • Setting up an Nx monorepo with Angular • Setting up CI/CD with Github Actions and Vercel
Constructing Transactions & Script	• Introduction to Bitcoin Transactions • MintBlue API, SDK and Integrations

Course pre-requisite: Bitcoin Development Chapter 4-5
Worksheet to complete prior to the live session: Week 8 Intro to Git and Github and Week 9 Constructing Transactions and Bitcoin Script.

Live session #6

Metanet	• Metanet Overlay • Dagda • The Birth of Ontology & the DAG • Tutorial on directed Acyclic Graphs • A.N.N.E preview.
End of programme	• Feedback on project completed by students • Wrap up of the programme

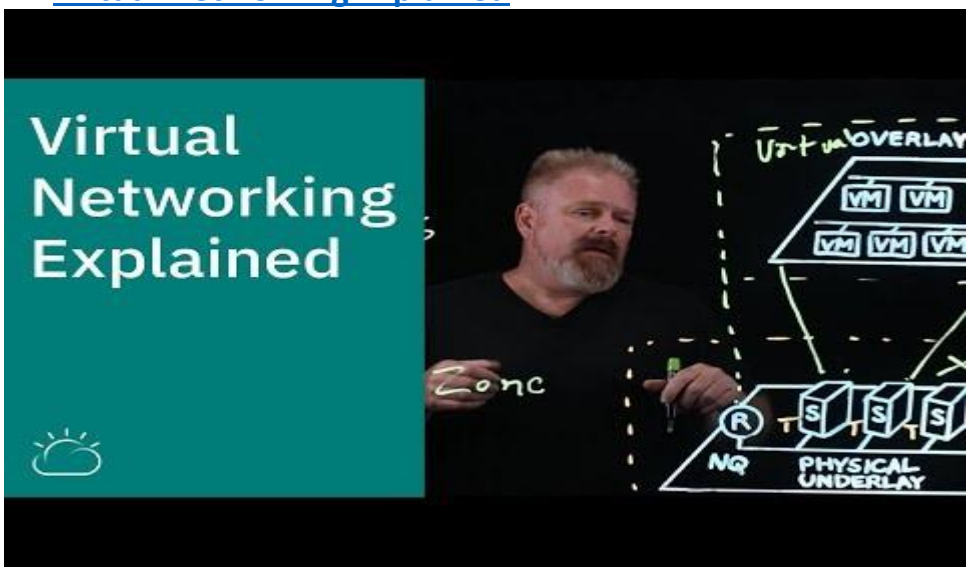
Course pre-requisite: Bitcoin Development Chapter 6
Worksheet to complete prior to the live session: Week 10 Metanet

Blockchain Innovation Program

Worksheets

Week 7: Working Blockchains & Overlay Networks

1. [Virtual Networking Explained]



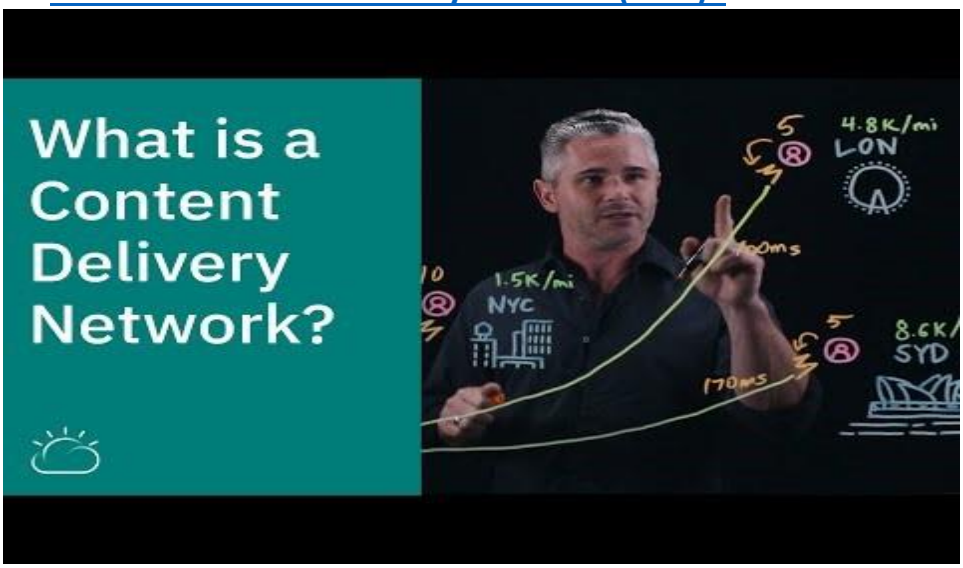
a. Since an overlay model can be thought of like a nested dolls analogy, and a fabric can exist at each level of the overlay networks, how can the bitcoin system be thought of as the fabric for a bitcoin application?
b. What would be a tunnelling end point for a bitcoin application using bitcoin as fabric?
c. What could be considered the routers in a bitcoin application overlay?
d. How could public private key pairs lend themselves to granting permissions or firewalling on a bitcoin based overlay network for an application?

2. A Survey and Comparison of Peer-to-Peer Overlay Network Schemes

https://snap.stanford.edu/class/cs224w-readings/lua04p2p.pdf (Introduction and II (whichever are interesting), III, IV (whichever are interesting), V & Concluding Remarks)

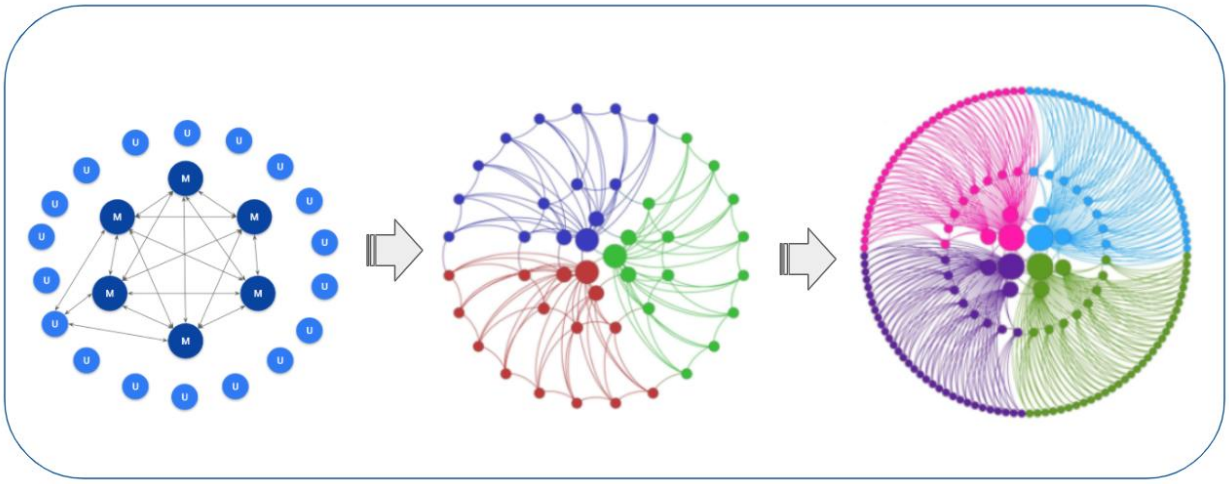
a. From Figure 1 (pg. 1) Which of the components listed in the figure could be replicated or supplemented by the bitcoin system? How?
b. What is the difference between structured and unstructured p2p overlay networks?
c. What data technique do structured p2p overlay networks rely upon and how does that impact scalability?
d. What data technique to unstructured p2p overlay networks rely upon, and how does that impact scalability?
e. How could bitcoin improve the latency issues of routing between nodes on the overlay network which are far apart on the physical network infrastructure?
f. How does having an incentive model prevent a tragedy of the commons in terms of free riding on network resources?

3. What is a Content Delivery Network (CDN)?



a. Why would a bitcoin application that performed read and write functions from the bitcoin blockchain suffer with speed performance?
b. In what respect can the CDN model be replicated for a Bitcoin Application to enhance the delivery of its services?
c. From last week's reading on microservices discuss the following:
Thirdly, infrastructure costs for all the systems were only evaluated in terms of the current BranchKey deployment, i.e., on AWS cloud platform. There are many cloud service providers in the market with competing prices. BranchKey could also deploy their own infrastructure over an in-house data center. This research could further be extended to compare the infrastructure cost of all such solutions.

4. **Small World Mandala Network**



a. The Bitcoin network consists of a p2p mining network of tightly connected devices which hold the full blockchain and resembles a near complete graph. Users sit at the periphery and only need to host the block headers and Merkle proofs for their specific transactions. The middle ring of the above network is the SPV layer where large merchants who process transactions from users and reconcile accounts with other large merchants persist their larger subsets of the bitcoin blockchain. How can this view of different working blockchains be related to an overlay or CDN type model for enhancing the performance of a bitcoin application?