Blockchain Introduction: cryptographic primitives, no third parties, consensus and trust.
The network required has gotten little attention. It can become the bottleneck and root-cause of problems/challenges. The propagation of transactions and blocks require unicast and multicast communication services. Network layer is critical for scalability, security, and privacy, and an efficient network layer enables higher transaction throughput and stronger resilience against malicious actors.

Network functionality: node discovery, data routing, encoding and transmission of data, error correction, measurements of the network performance. There may be differences between traditional networks and crypto-blockchain-networks: different requirements and use cases for security, traffic mixes, routing mechanisms. Need an incentive of participation as no one can be trusted.

Blockchain networks in perspective:
Blockchains are typically managed by a P2P network of nodes that collectively create and validate new blocks. There are two roles a node can assume: peer or miner. Peers can create and send transactions. Peers verify the correctness of received transactions and blocks and relay them if valid. Miners do anything a peer does, but they also generate blocks.
Discovery protocol: to establish connection with other nodes.
Flooding/Gossip protocol: to propagate transactions and blocks.

To improve scalability, additional payment channel networks may be implemented off-chain, offloading the blockchain. These additional payment channel networks rely on the “parent blockchain” for security.

To prevent Denial of Service attacks (DoS) from flooding the network, nodes can use a store-and-forward propagation model, where each node downloads the full block and verifies it prior to propagating it to peers.

For Bitcoin: The block propagation time to reach the majority of the network does not depend solely on a receiving node’s bandwidth but also on the network topology, the bandwidth of all nodes, and the manner in which blocks propagate.
For Off-chain: to protect user privacy, only the total capacity of a channel is disclosed, but not how the funds are distributed among the channel participants. Channel transactions might therefore fail and the routing algorithms attempt different execution paths until one succeeds, which can introduce delays.

Block Propagation.
Pipeline and Chunking.
Pipelining the block’s delivery, i.e., start to transmit the blocks before they have been fully validated, can prevent delays. Churns can cause delays.

Keywords: Throughput and latency. Compressed block encoding. Xtreme Thinblocks. Stratum Mining Protocol (industry standard mining communication protocol used by blockchain-based cryptocurrency systems). Weak Blocks. Relay Networks. State Synchronization.

Transaction Propagation.
0-confirmation policies and Information Eclipsing.

Topology. Distributed Hashtable. Eclipsing.DDoS. MiTM.