

Blockchain for IoT

Challenges and opportunities

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Does it really make sense to mix IoT and
blockchain?

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Or we are just merging to buzzwords?

Blockchain e IoT



- Security of data produced by IoT sensors
- IoT actuators reacting to an event on the blockchain
- Machine-to-machine micro-payments

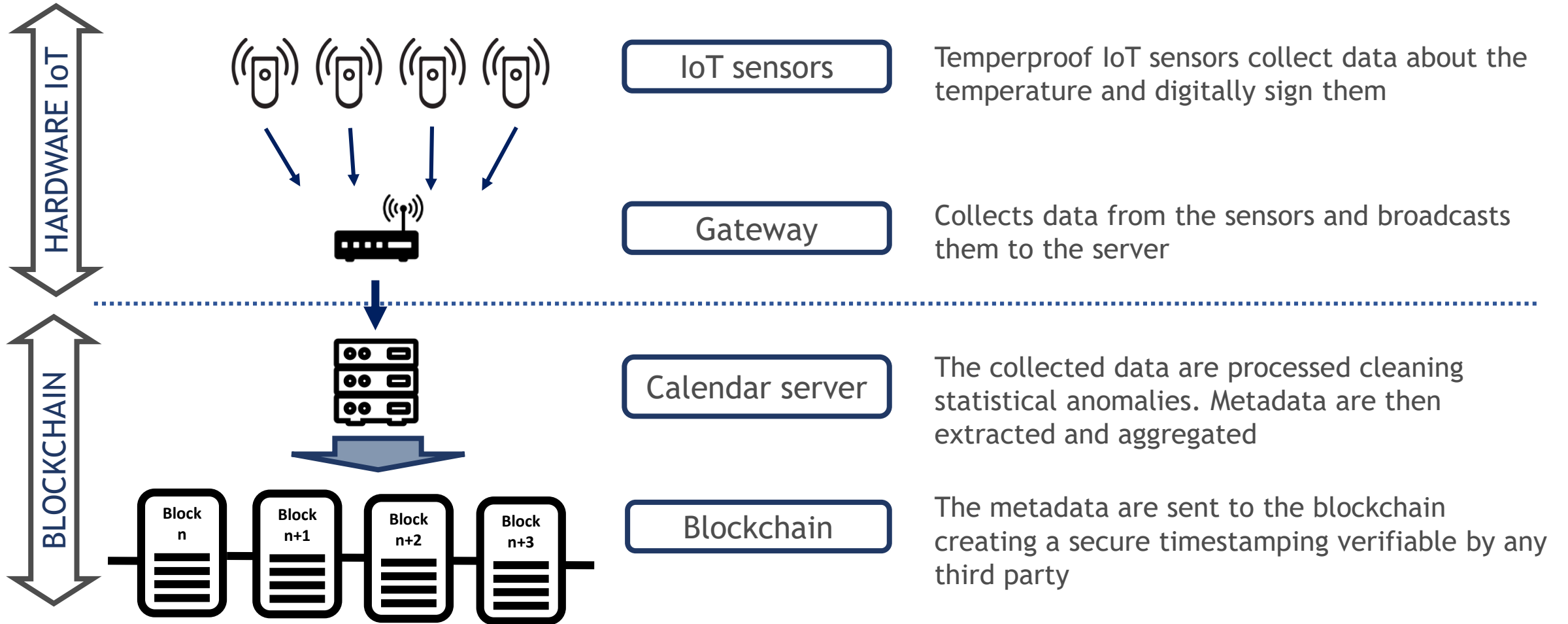
Security of data produced by IoT sensors



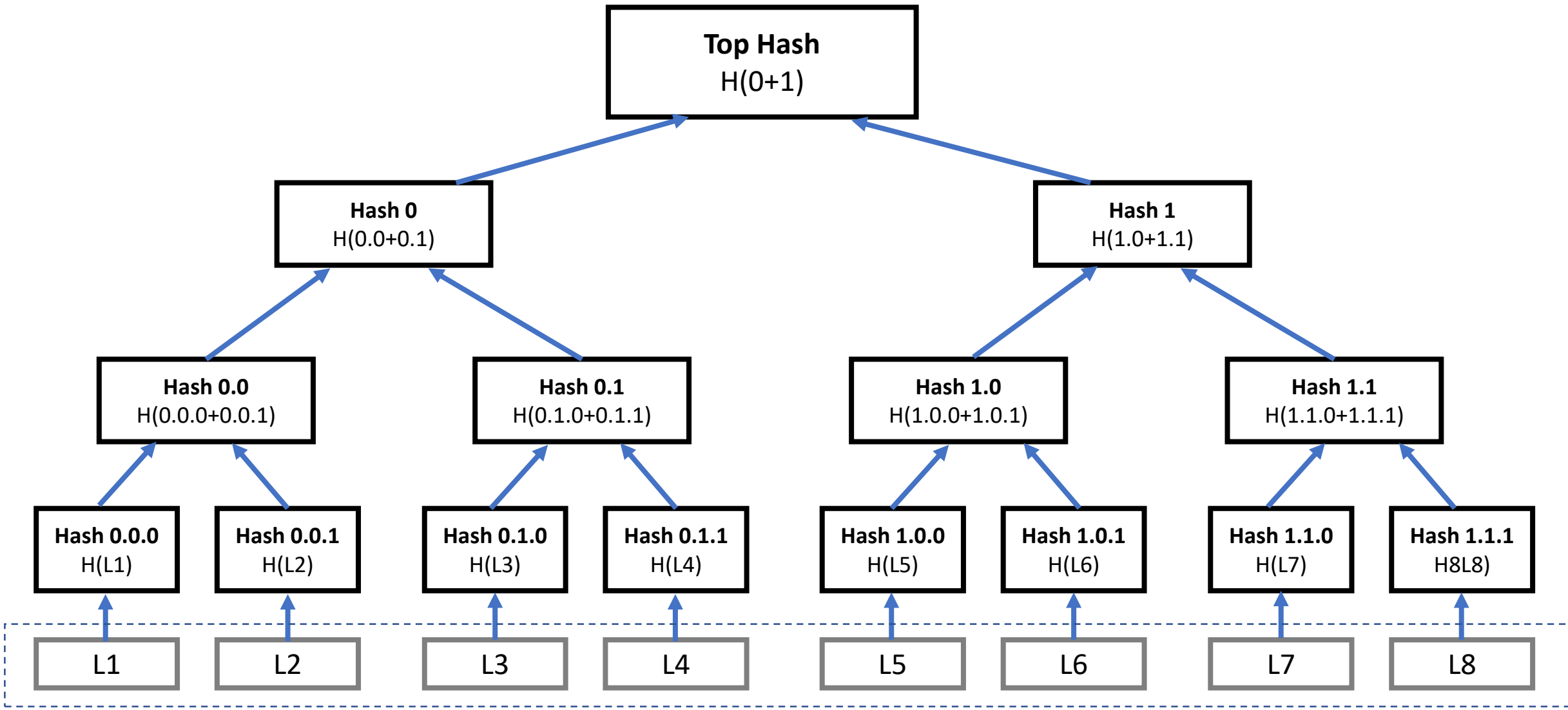
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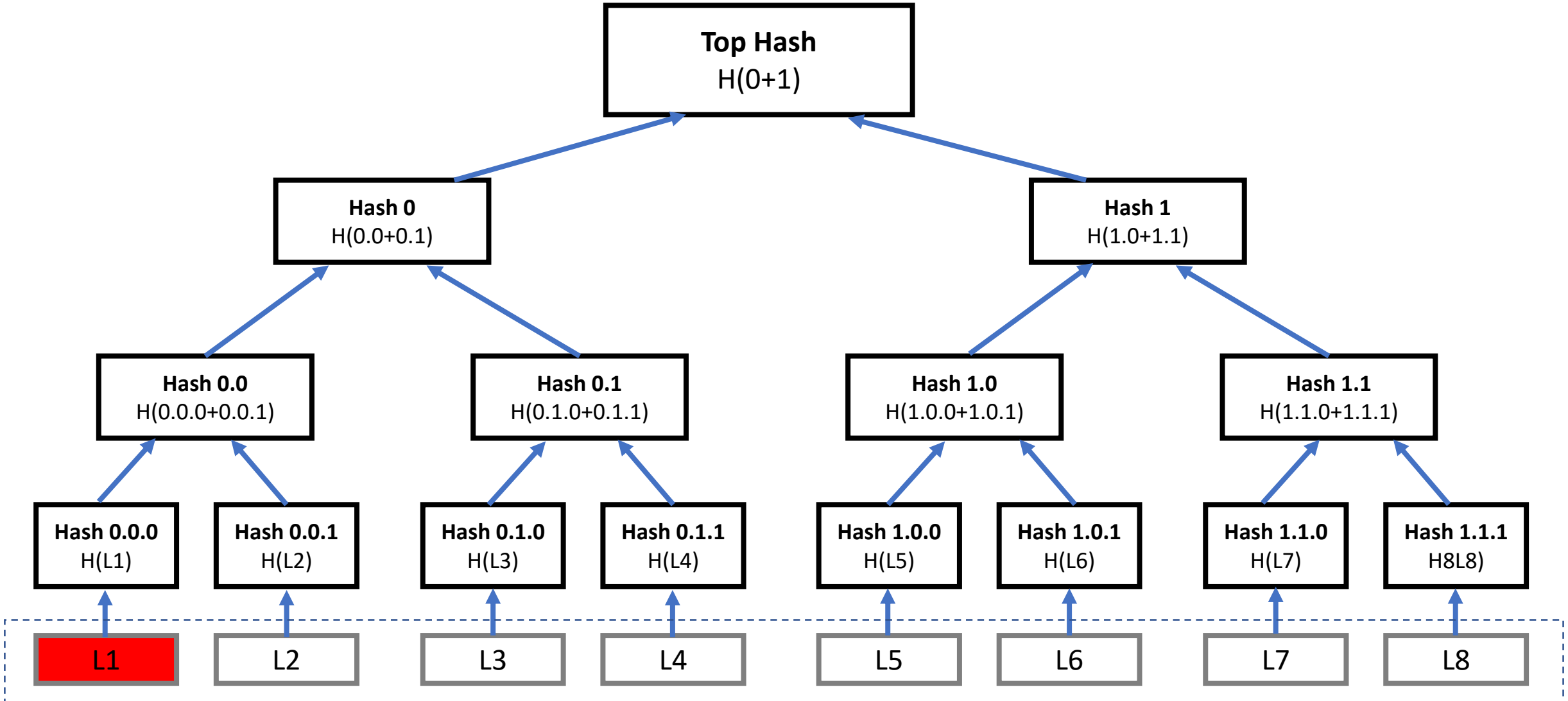
IoT data blockchain notarization



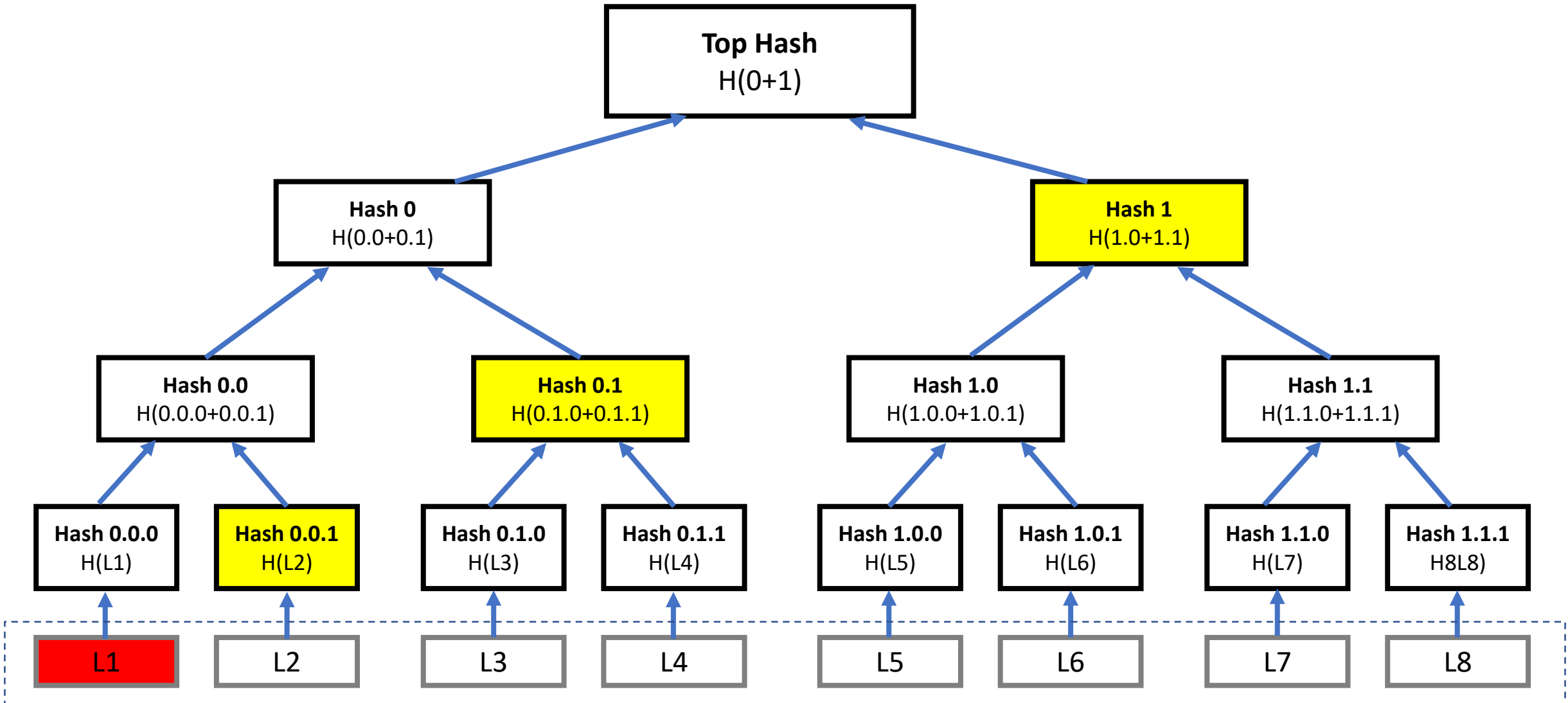
Merkle trees



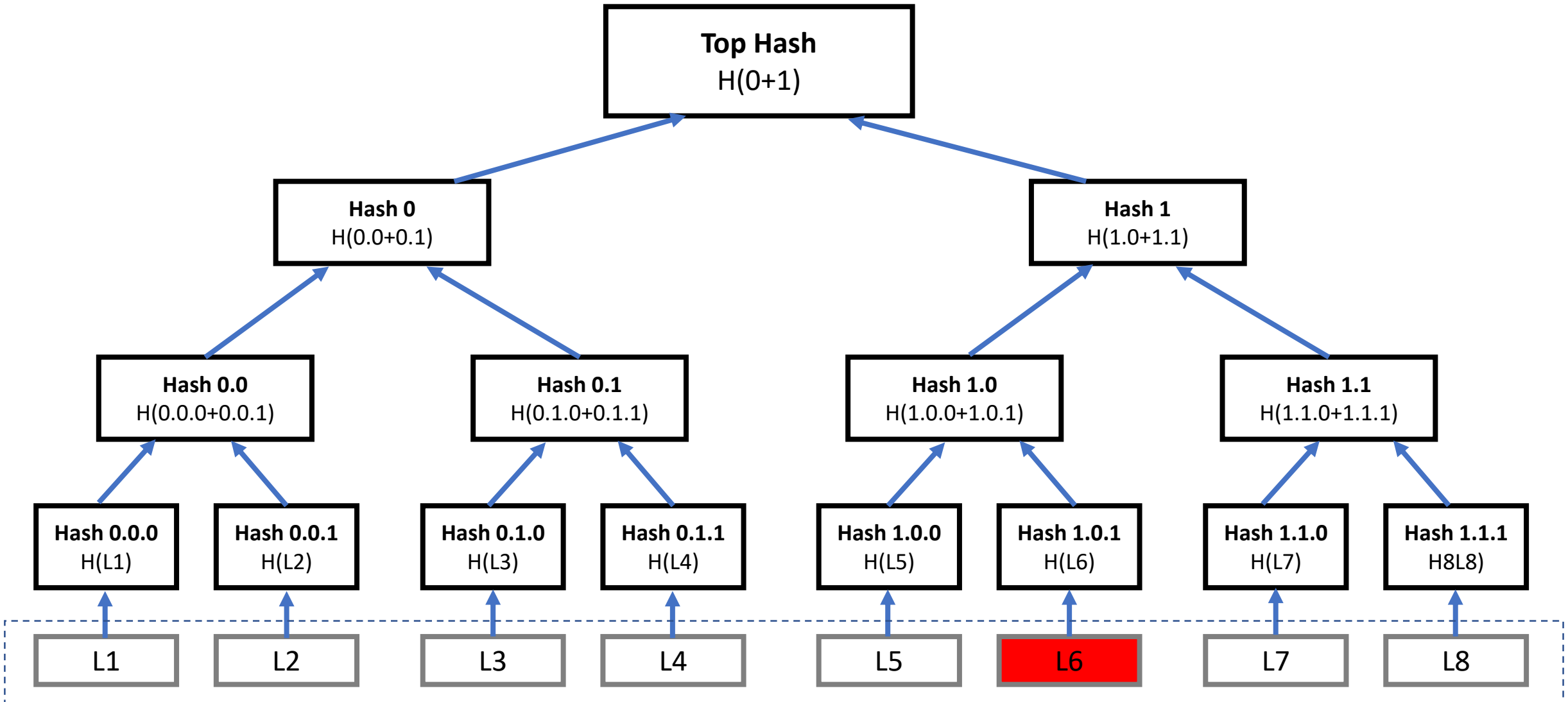
Merkle trees



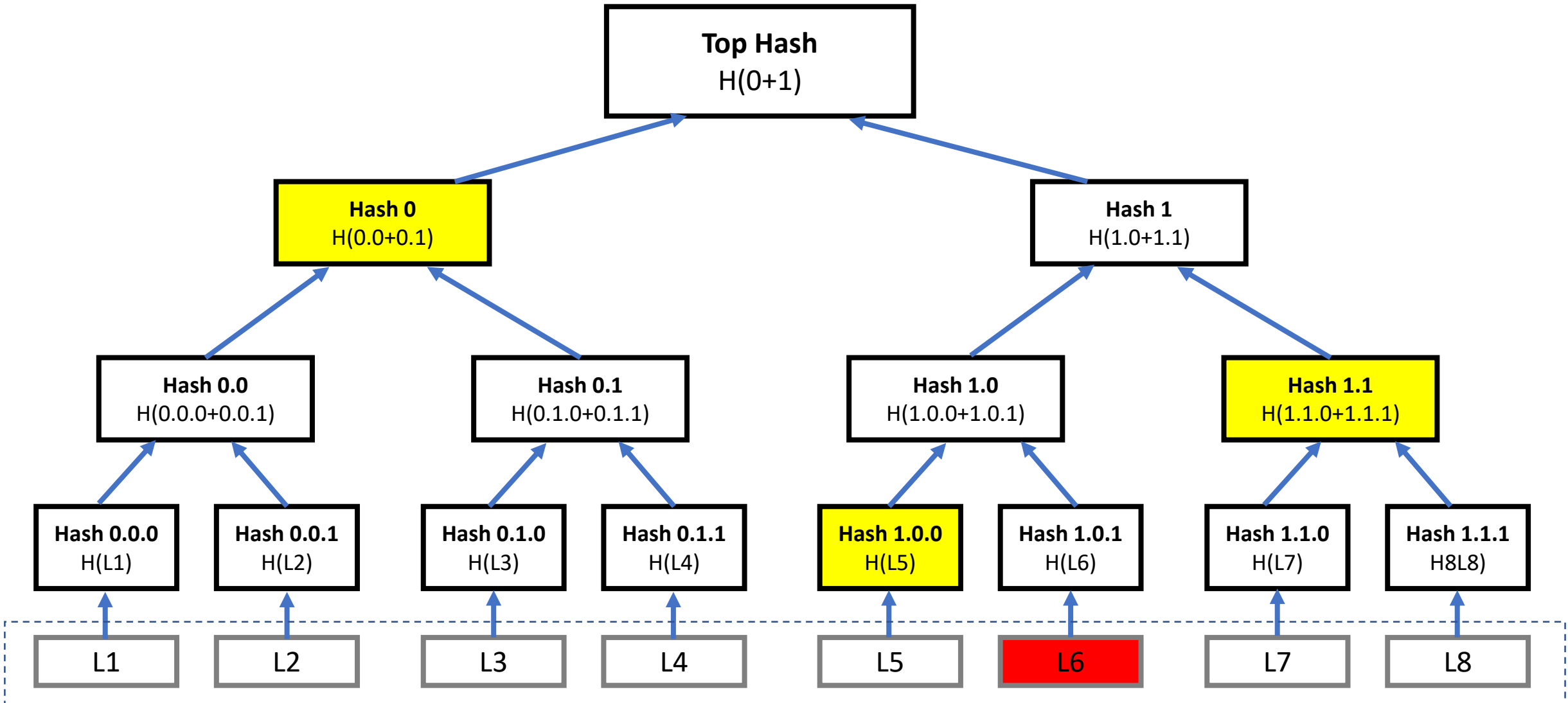
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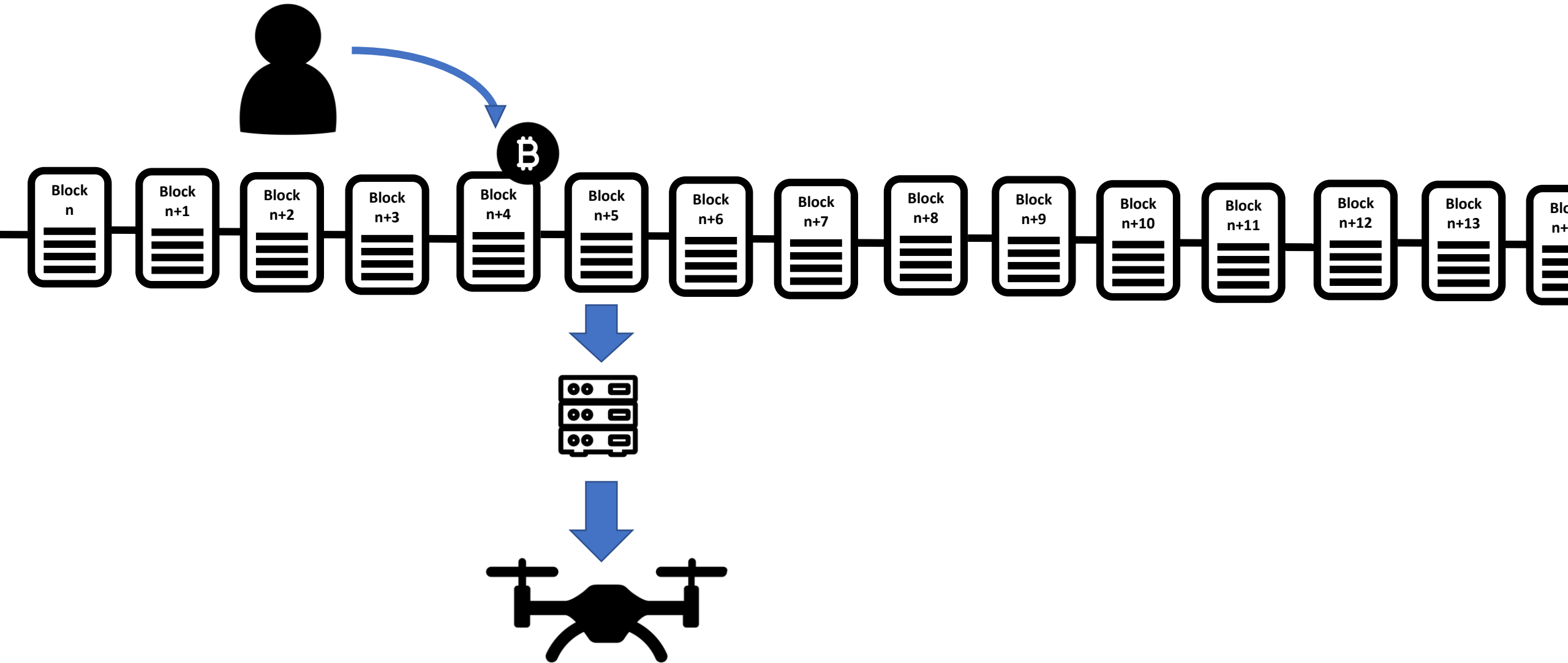
Blockchain for IoT actuators



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IoT actuator reacting to a blockchain event



Blockchain m2m micro-payments



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Problems with blockchain micro-payments

- In a blockchain the whole transaction history has to be shared among all participants, so the usage has to be limited



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Problems with blockchain micro-payments

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- If the usage is limited to few tx/s, the competition to get a transaction included in a block increases driving up the transaction cost
- If the transaction cost is high the blockchain is not suitable for micro-transactions



Solution

- Changing the architecture of the base blockchain layer is not a solution (e.g. exotic altcoins), you still have to deal with the same trade-offs

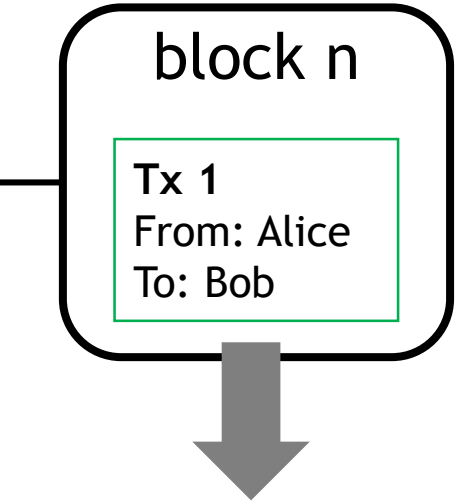


Solution

- Changing the architecture of the base blockchain layer is not a solution (e.g. exotic altcoins), you still have to deal with the same trade-offs
- Building a second transaction layer let you do secure transaction off-chain using the blockchain only as a settlement layer

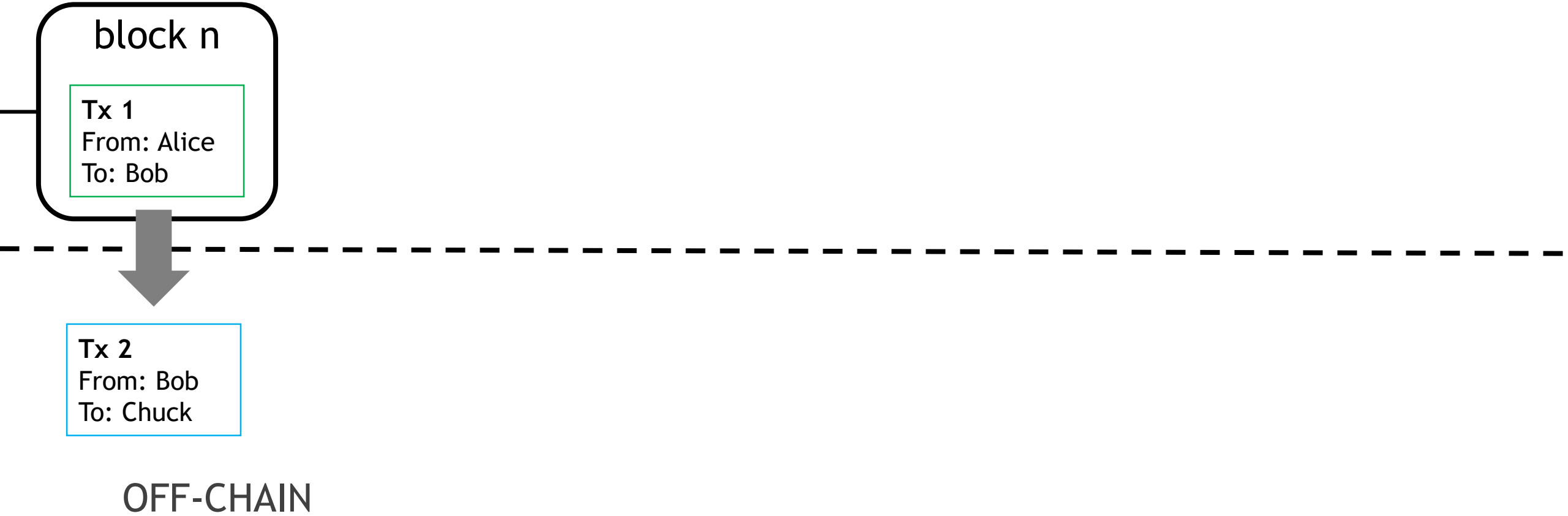


Off-Chain transactions



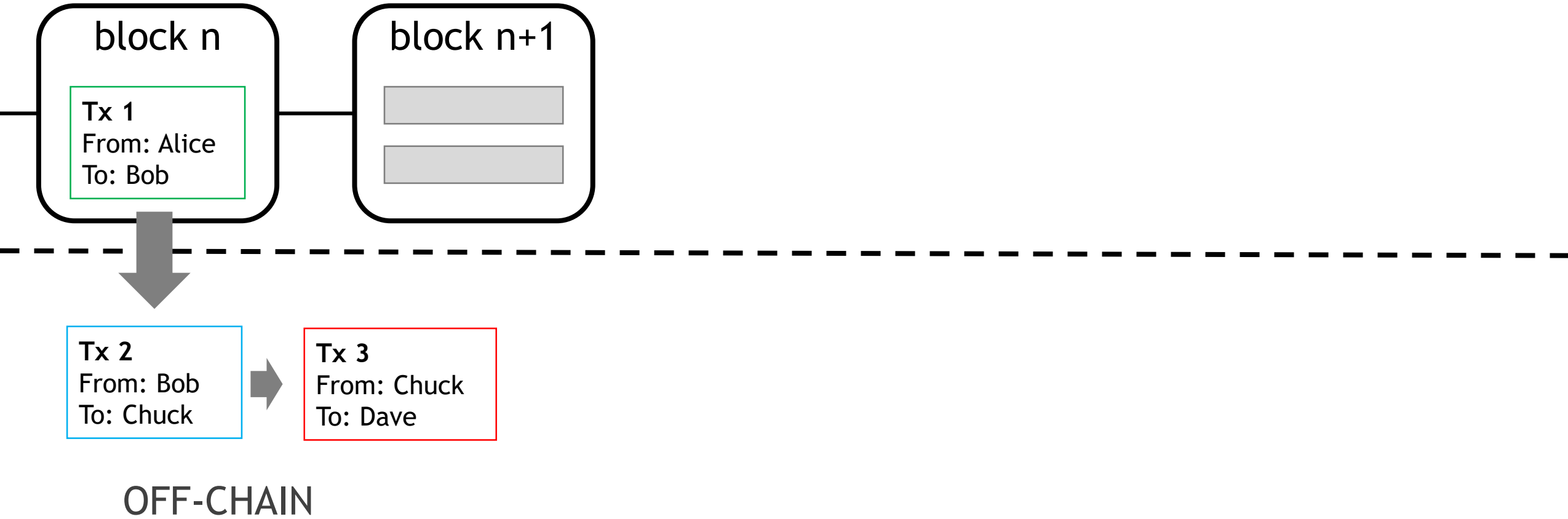


Off-Chain transactions



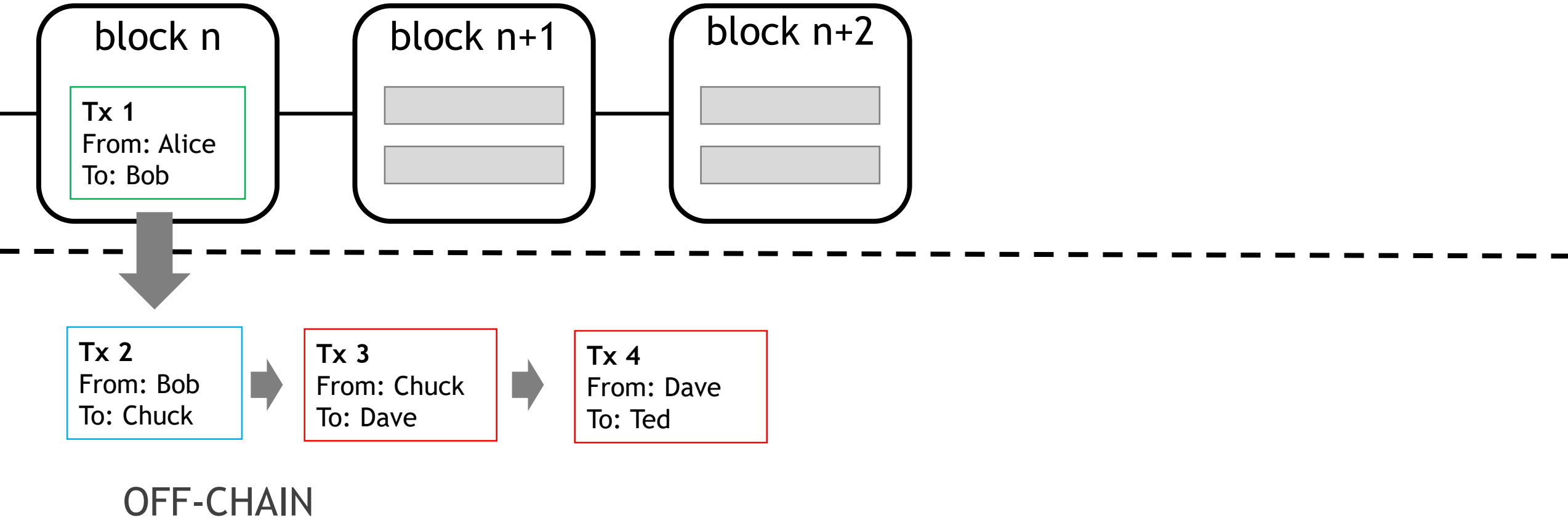


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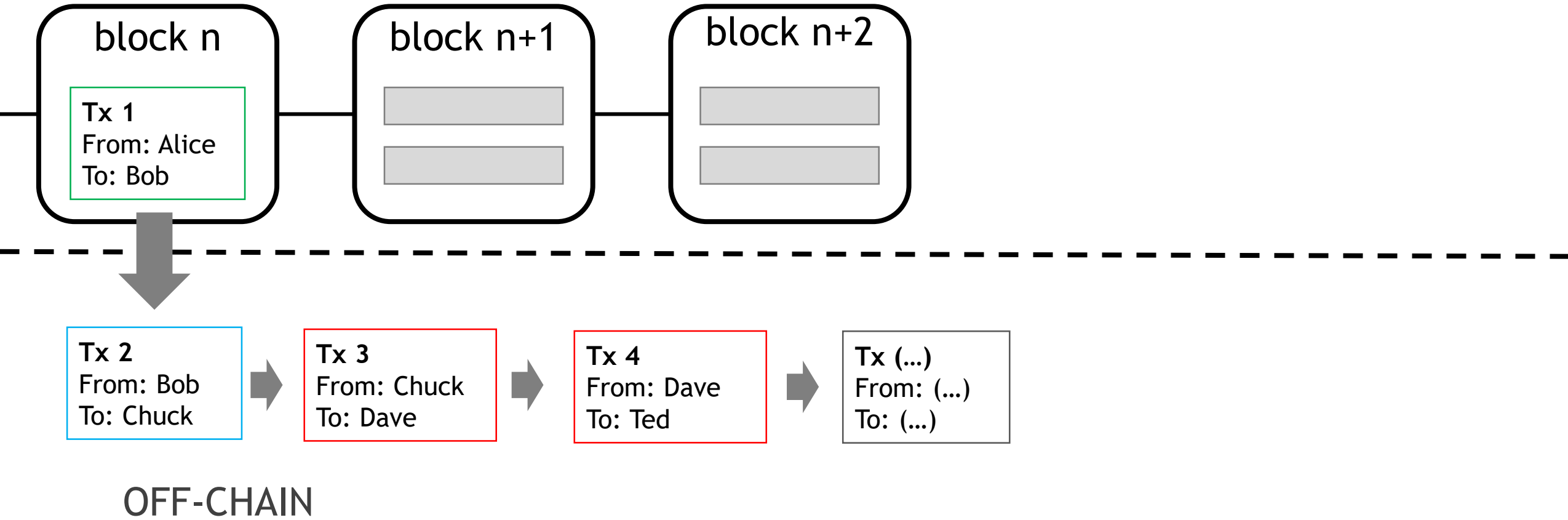


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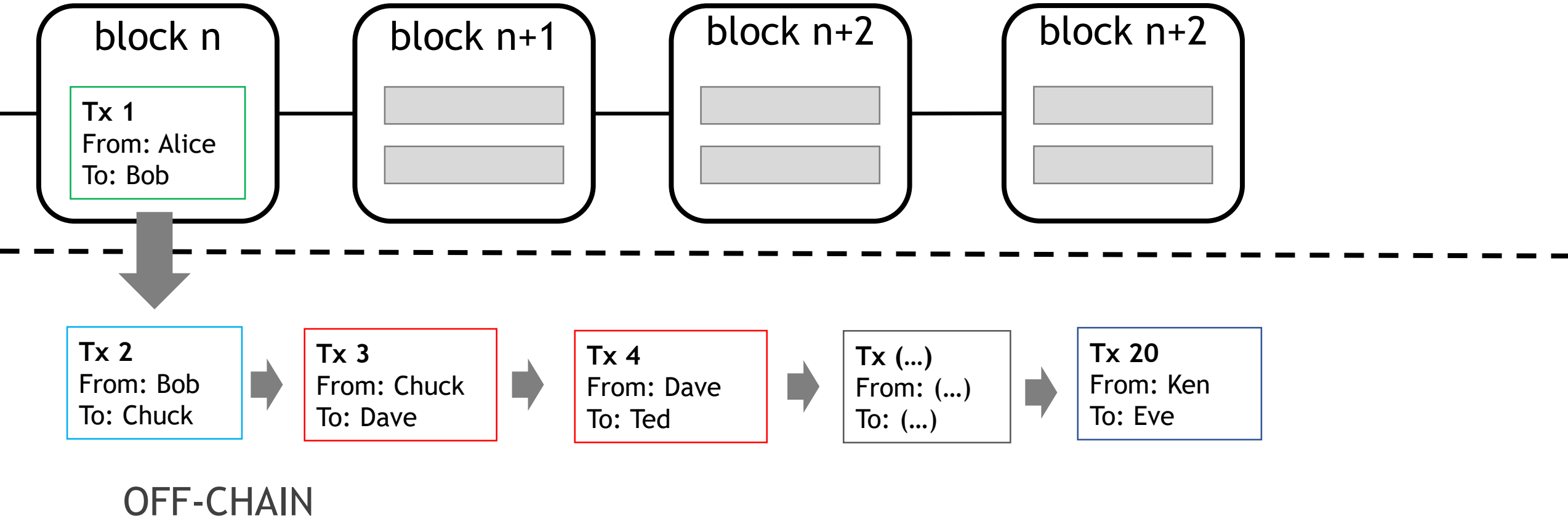


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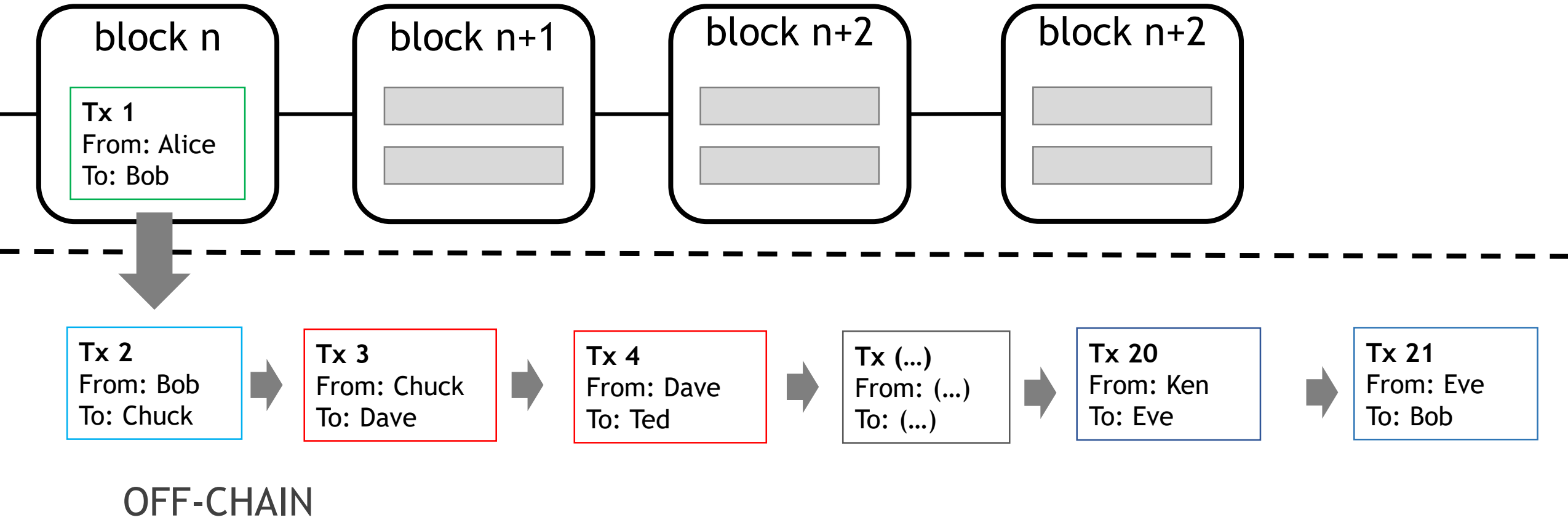


Off-Chain transactions



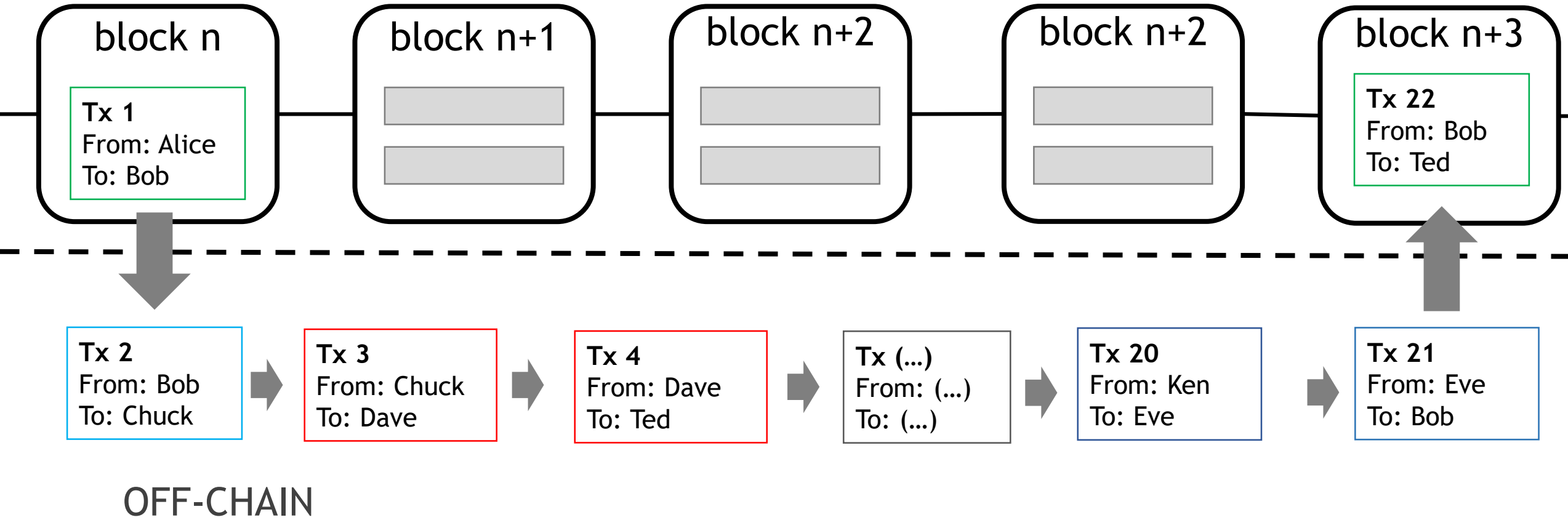


Off-Chain transactions



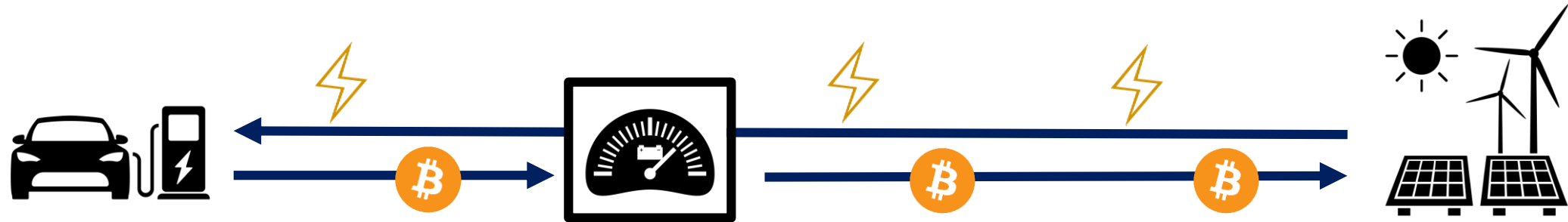


Off-Chain transactions





Micro payment applications



The energy buyer puts money on a **secure meter** allowing it to make transactions

The energy provider sends electricity to the buyer through the secure meter

The secure meter measures the energy transfer, and release small quantity of bitcoins every few seconds

Thanks to **the lightning network** and to payment channels, transactions are instant, costless and secure



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- Using the blockchain is it possible to have true machine-to-machine payments without the interference of humans



Conclusions

- Mixing IoT and blockchain can actually make sense and there are some scenarios where these two technologies work well together
- Data notarization from IoT sensor protects from some manipulation attempts (no all!) and is a very scalable application
- Using the blockchain is it possible to have true machine-to-machine payments without the interference of humans
- You can add complex smart contracts and build all sort of things



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