Block propagation and the *Z*-parameter

June 24, 2016

Peter R. Rizun
Bitcoin Unlimited

Block propagation and the Z-parameter

Related to market price for block space & network's ability to scale

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The Z-parameter

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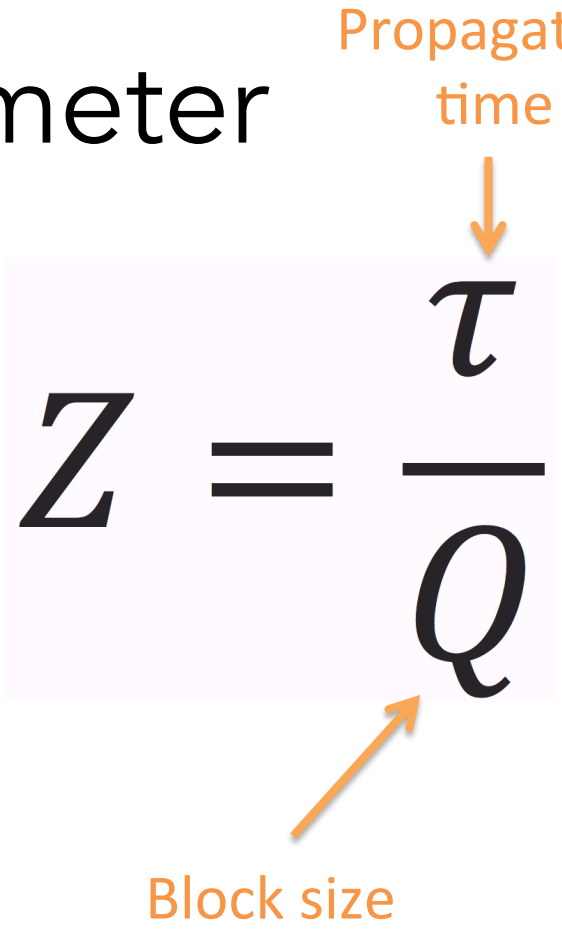
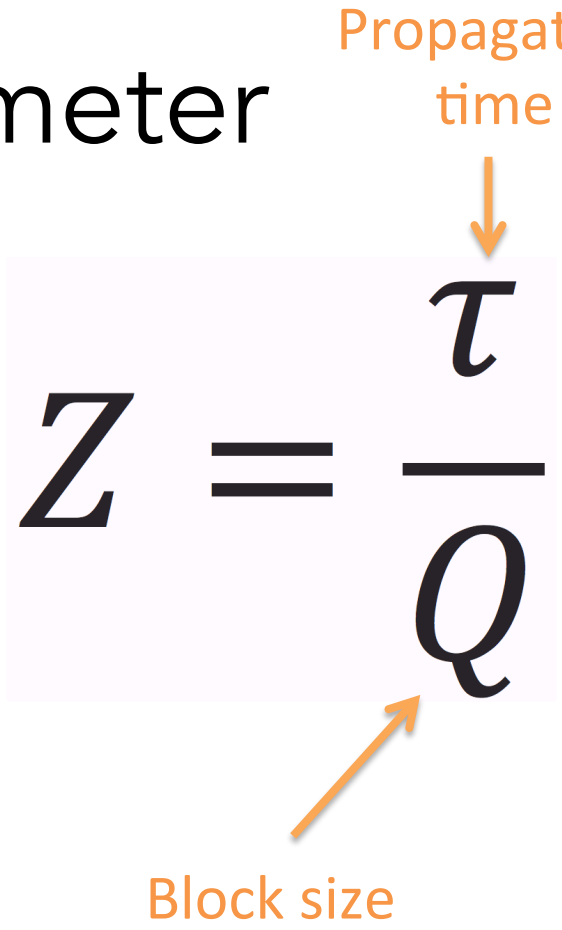


The Z-parameter

- A measure of the network's impedance to the propagation of blocks
- Units of seconds per megabyte
- The Z parameter is not constant over the network



Xtreme Thin Blocks (Xthin)

- New block propagation technology that reduces Z

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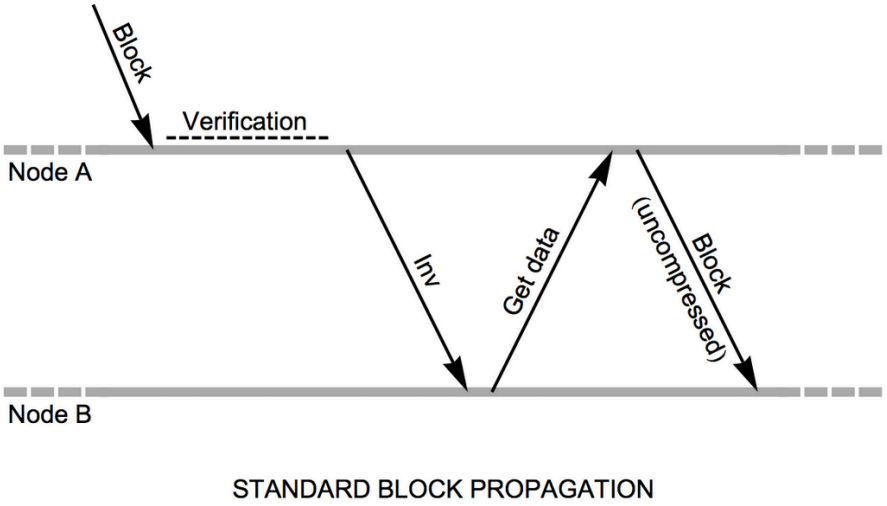

STANDARD BLOCK PROPAGATION

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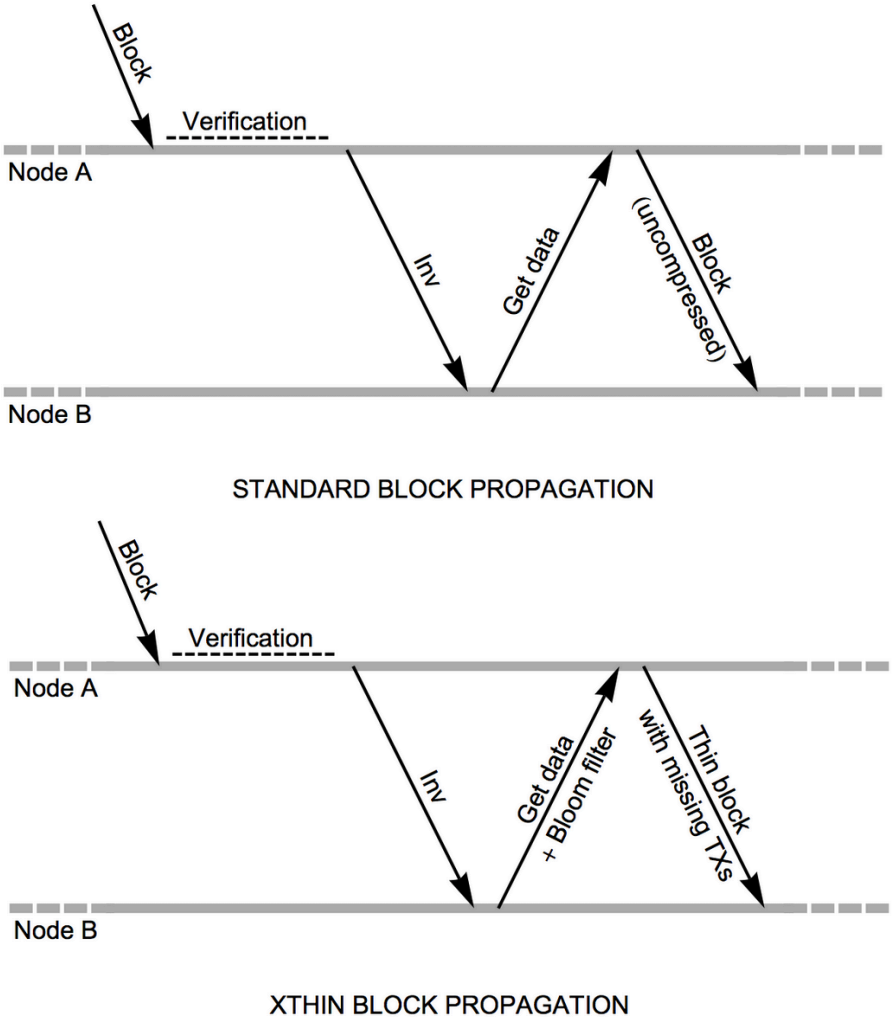

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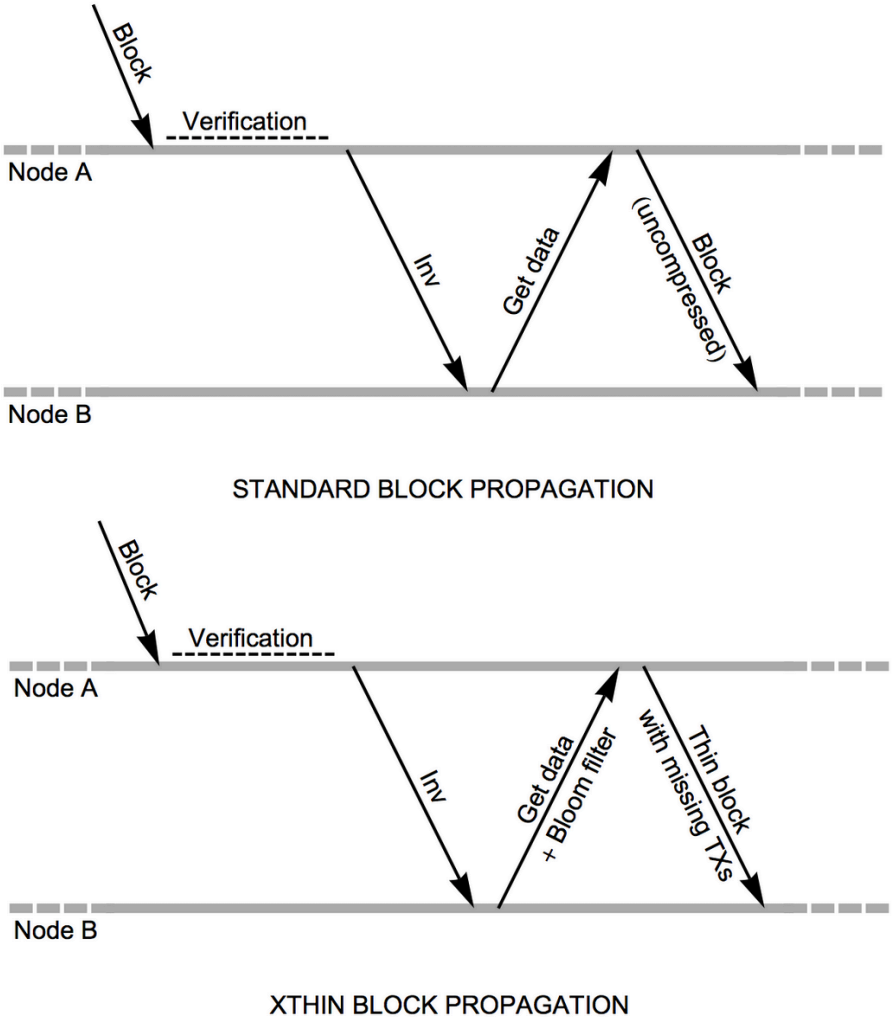

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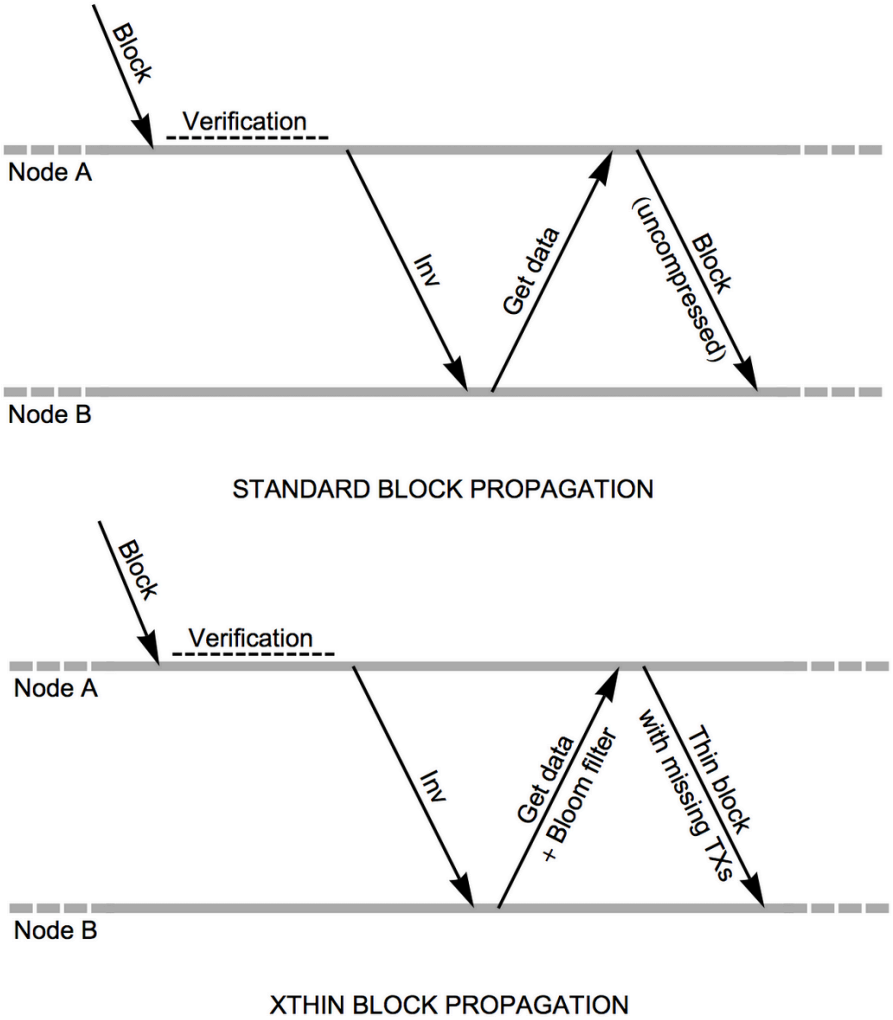
- Invented by Peter Tschipper (builds of work done by Mike Hearn)
- Implemented since March 2016 in Bitcoin Unlimited



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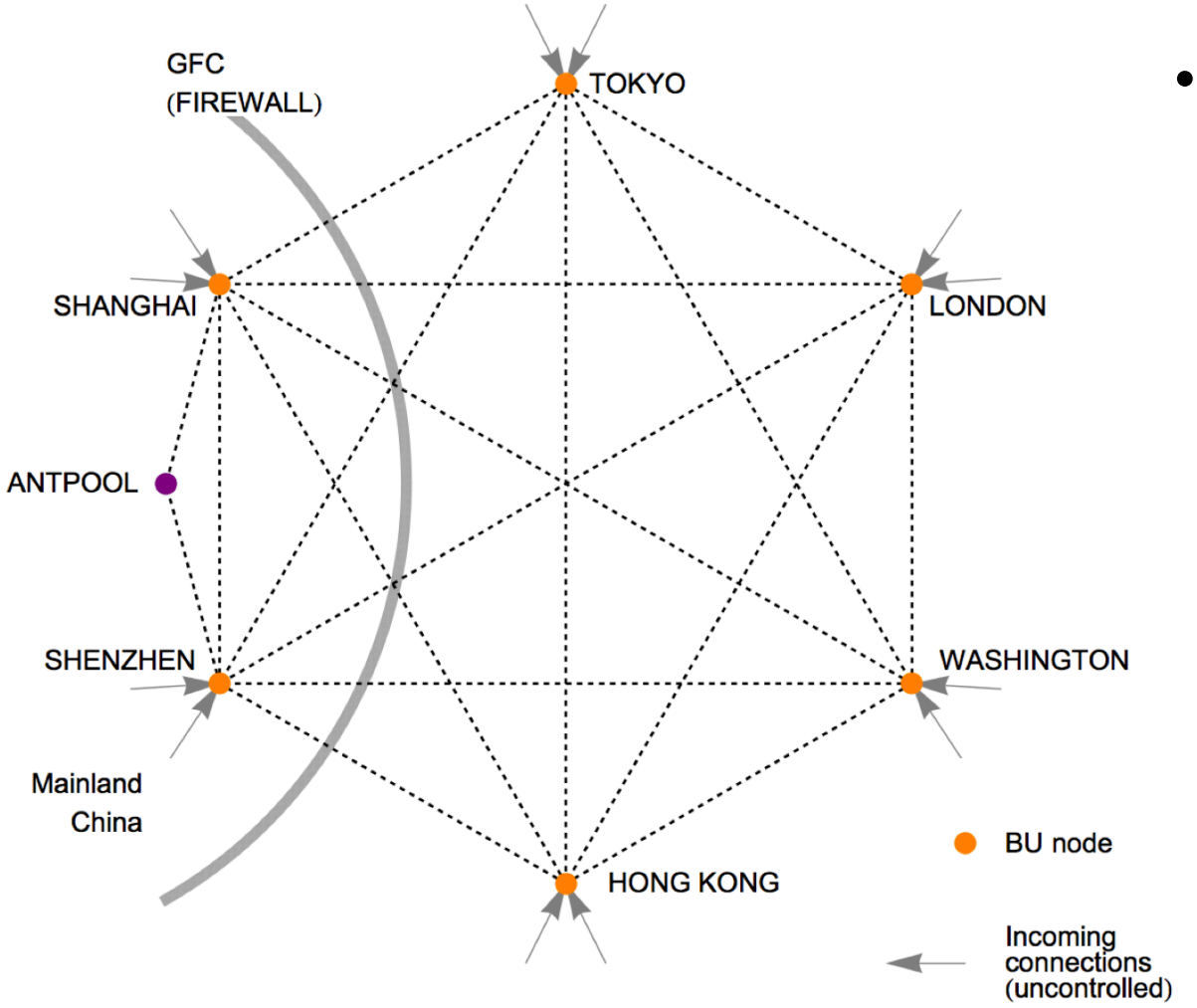

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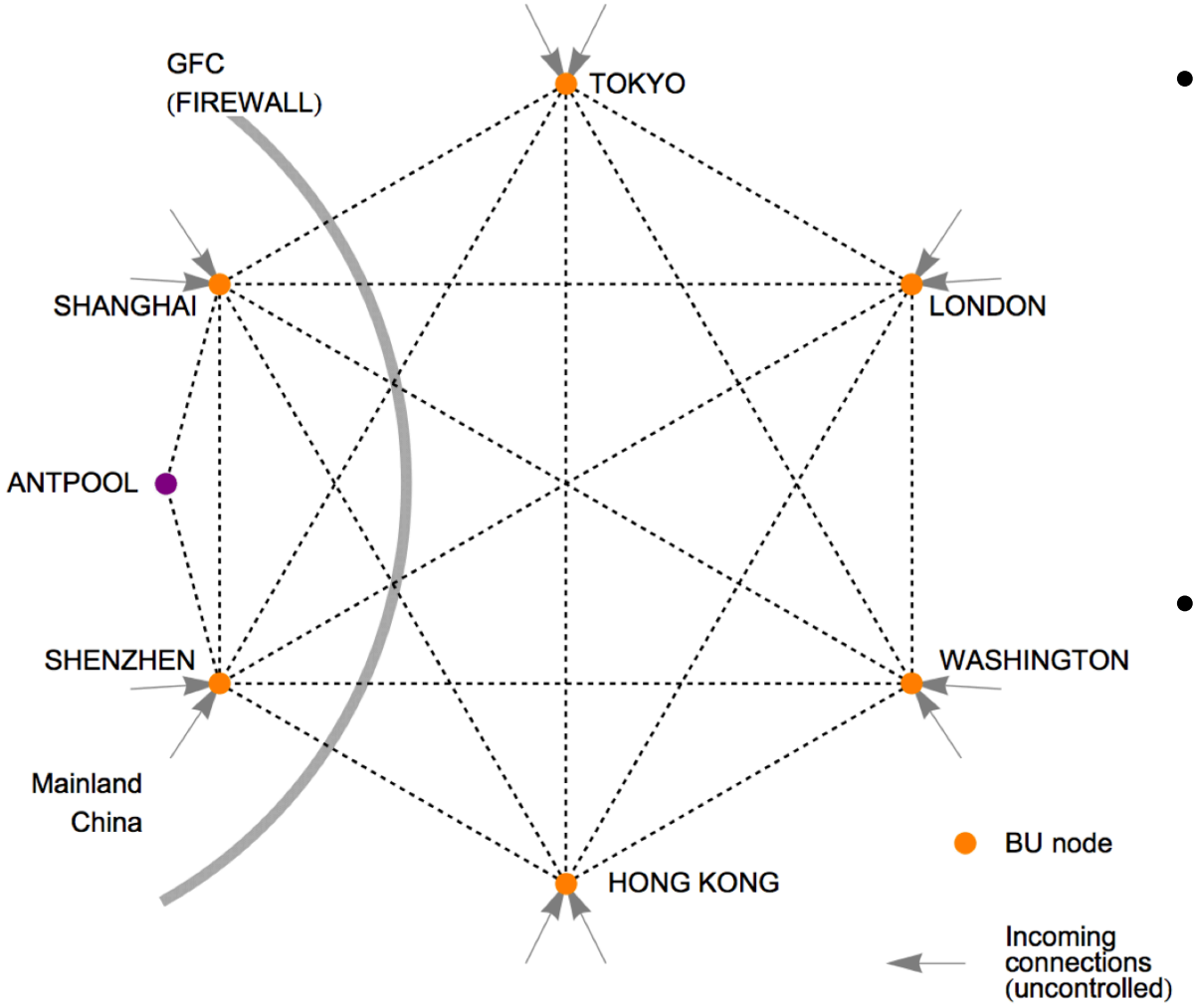

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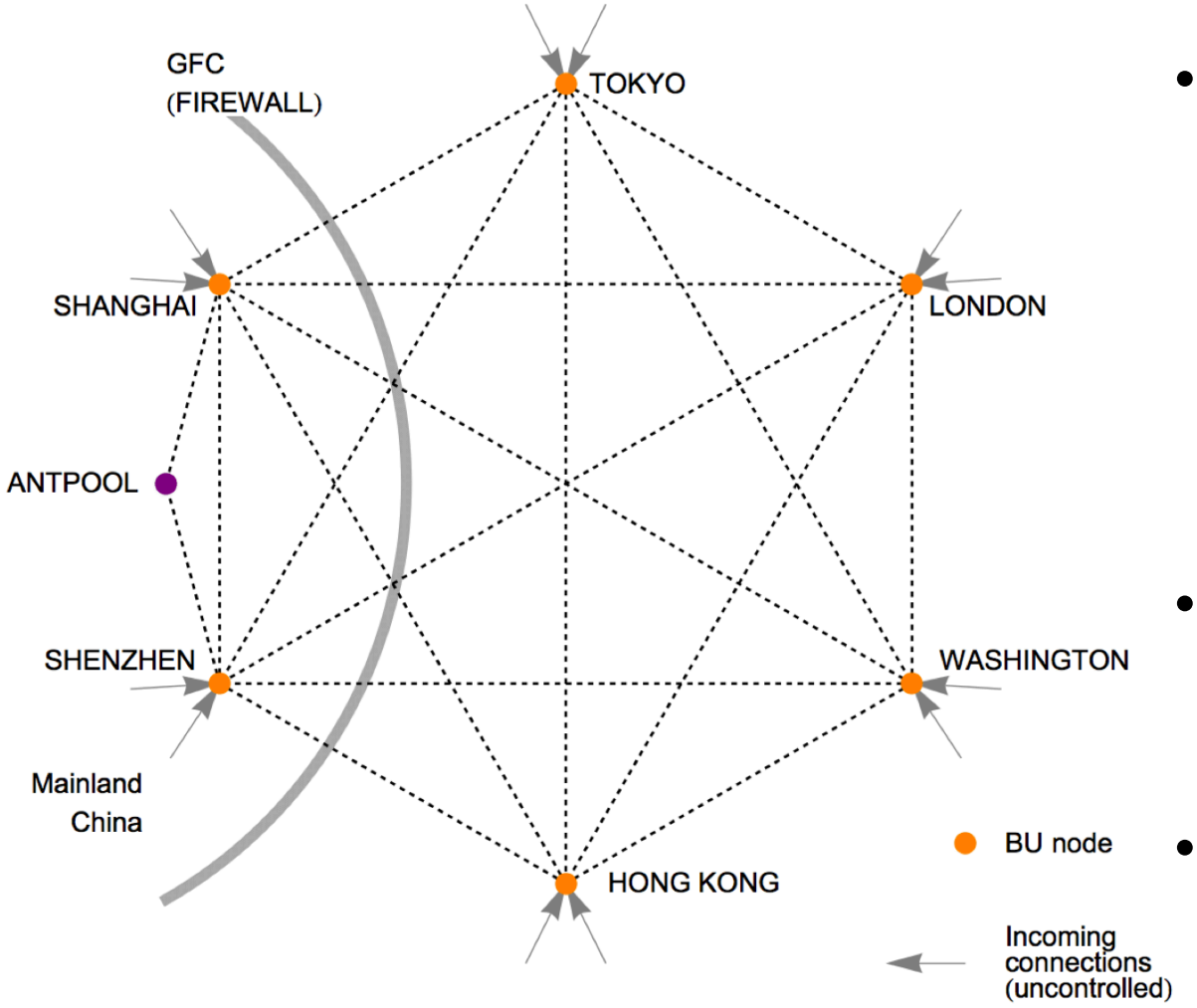

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- The results were impressive!

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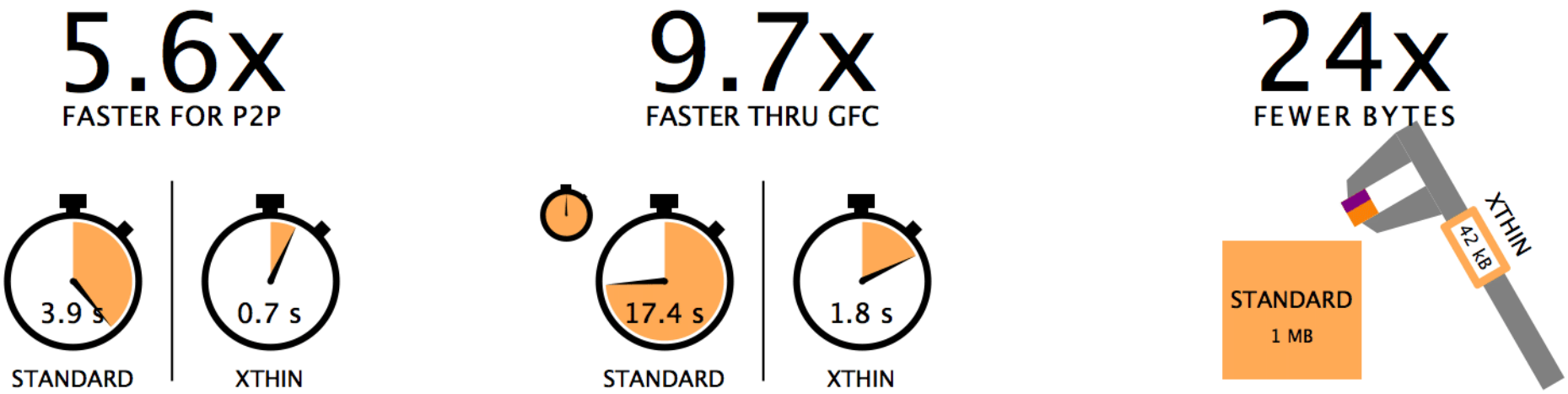

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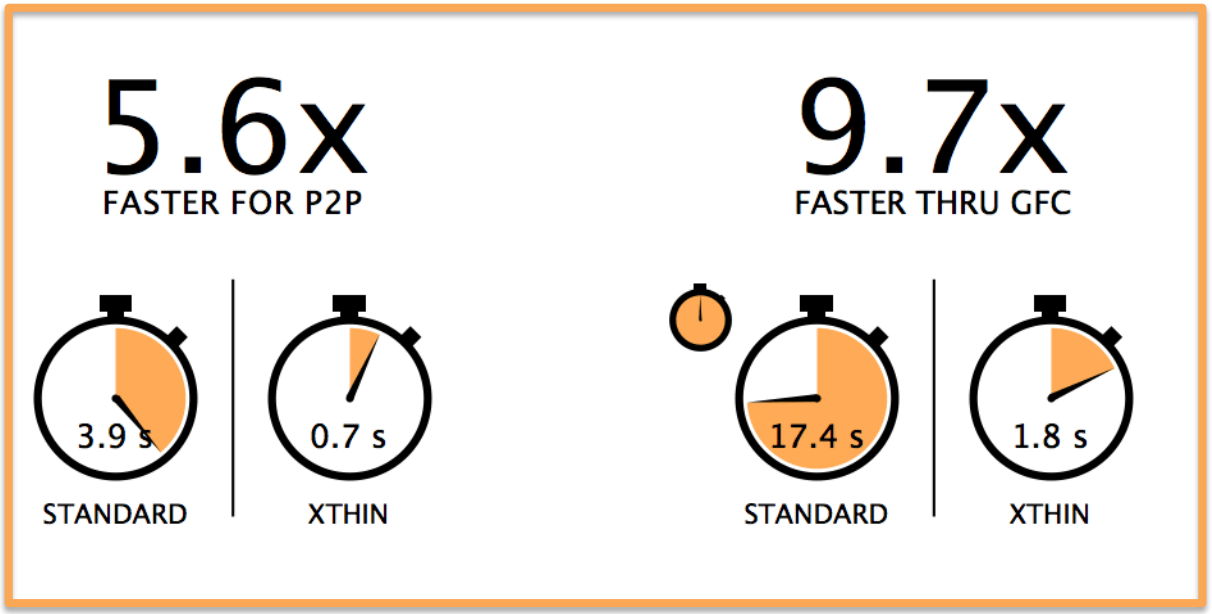

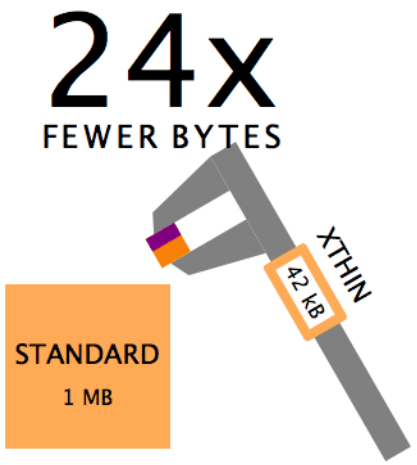

Xthin significantly reduces the *Z*-parameter

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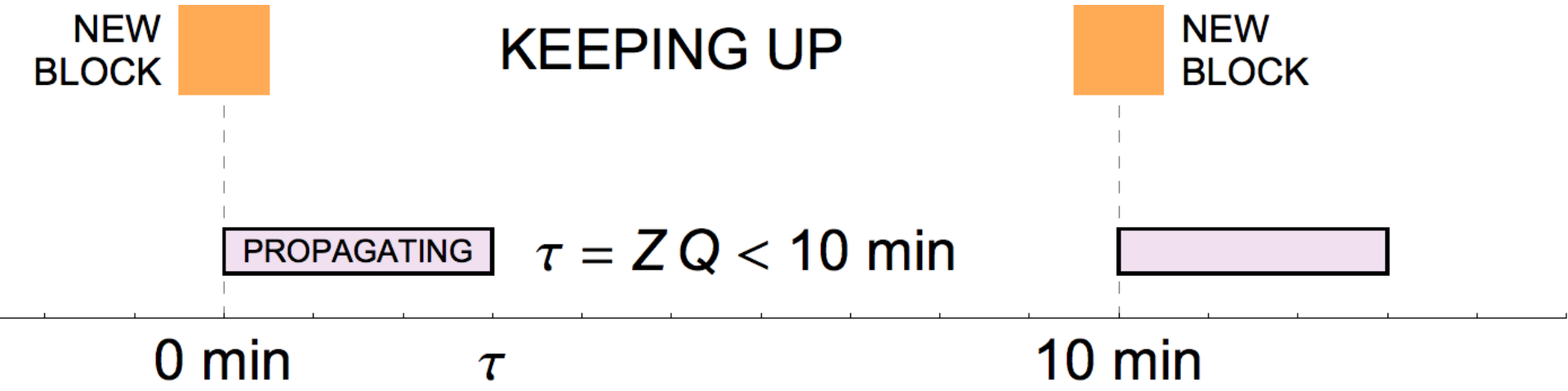

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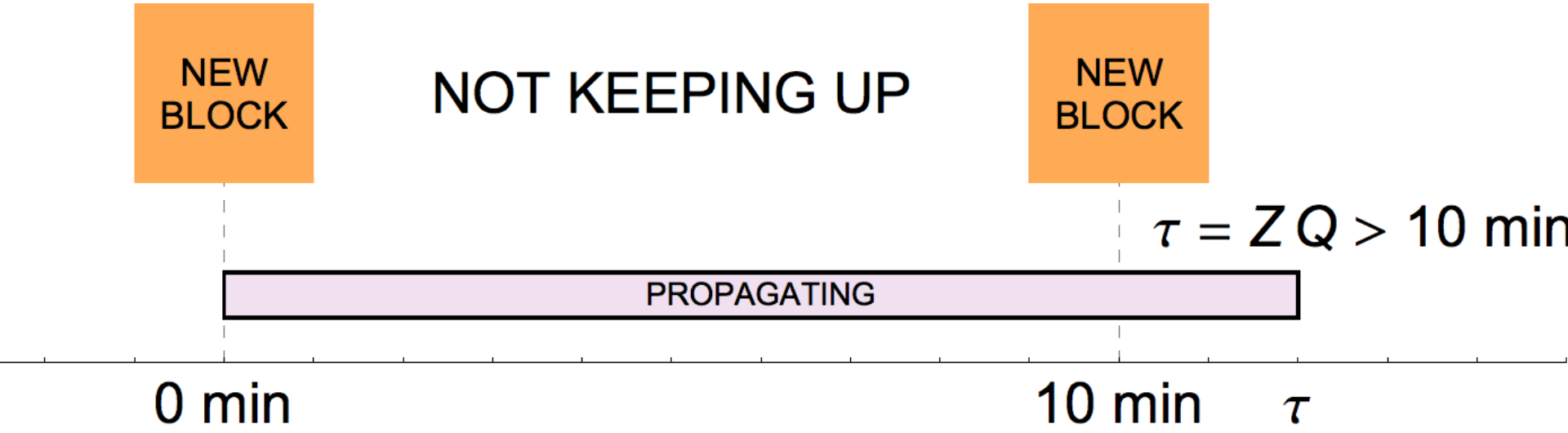

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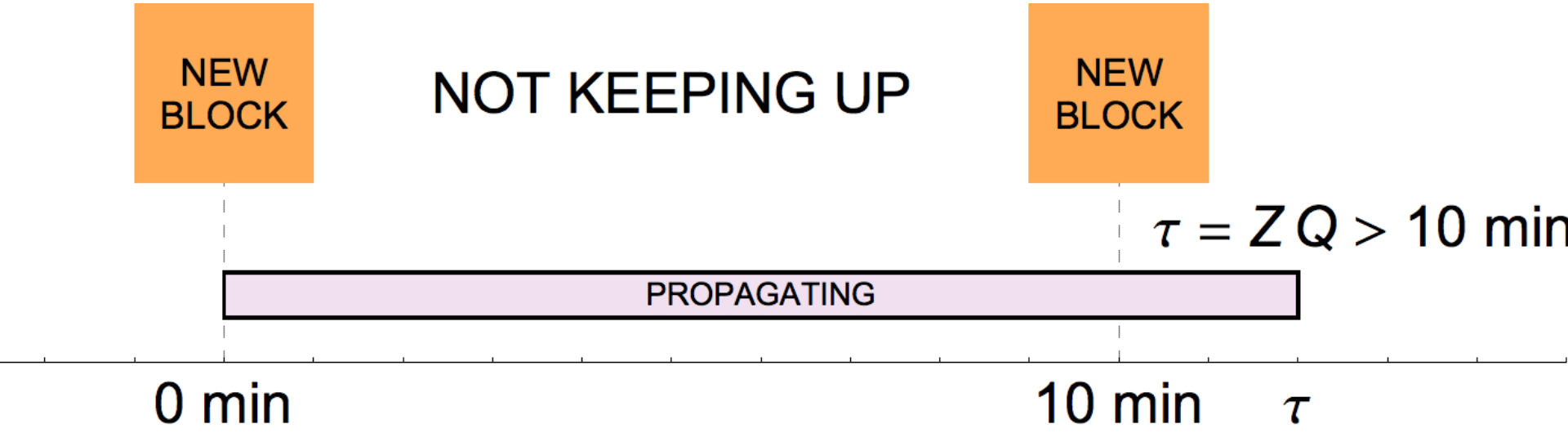

The smaller the *Z*-parameter, the bigger the block size a node can "keep up" with.

Block propagation to nodes is the bottleneck

Cornell Position Paper (2016)

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$$Z_{50\%} = \quad 16 \text{ sec / MB}$$

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- Calculated max block size using τ =10 min

$$Z = \frac{\tau}{Q} \quad \rightarrow \quad Q_{\max} = \frac{10 \text{ min}}{Z}$$

$$= 38 \text{ MB } (50\%)$$

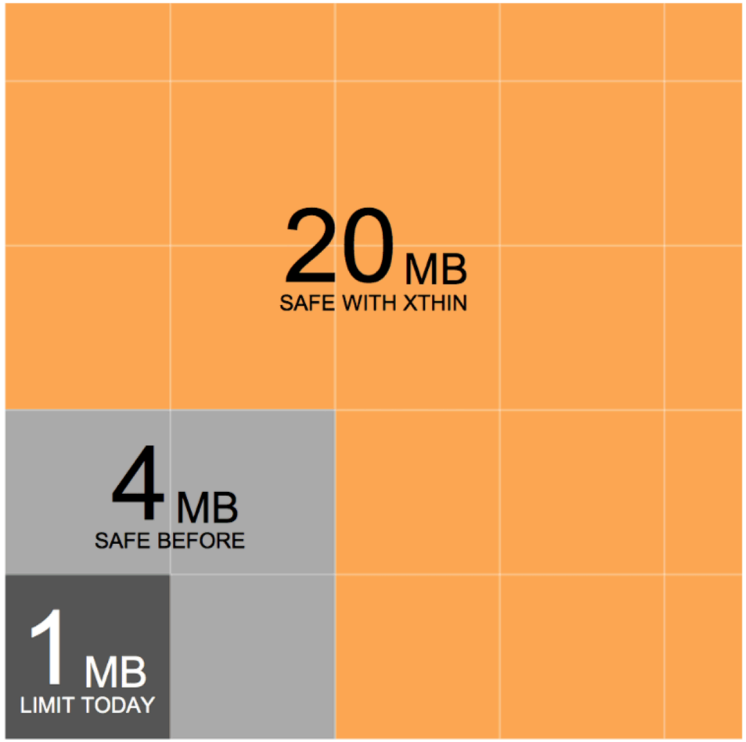
$$= \quad 4 \text{ MB } (90\%)$$

Propagation to nodes is the bottleneck
J. Toomim 'Block Size Olympics' (2015)

- Measured block propagation times
  - On TestNet, up to 10 MB
  - 20 nodes, hundreds of blocks
  - Considered effect of GFC
- Suggested 4 MB max size due largely to slow propagation through the GFC

Xthin fixes the bottleneck

- Blocks now propagate faster
  - By 9.7x thru GFC
  - By 5.6x normal P2P



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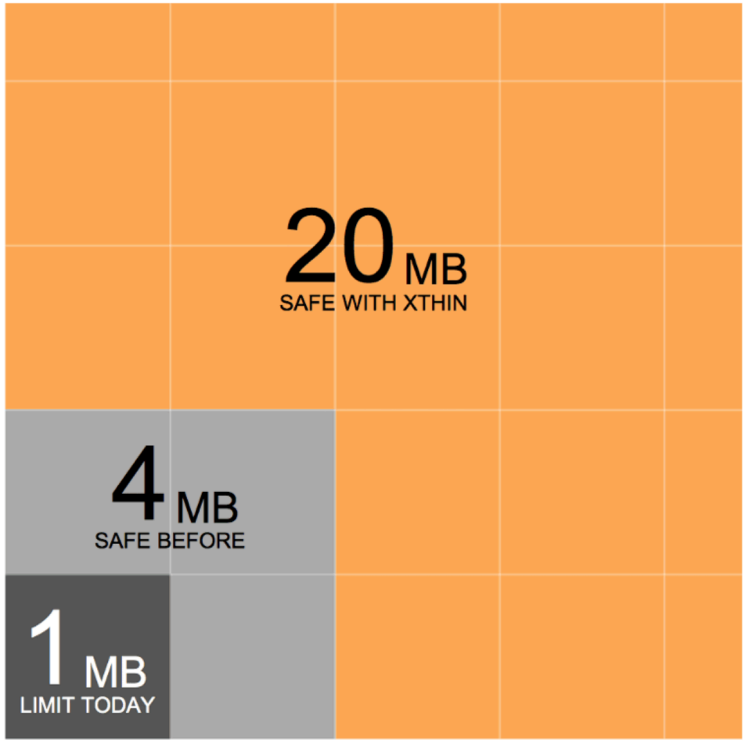

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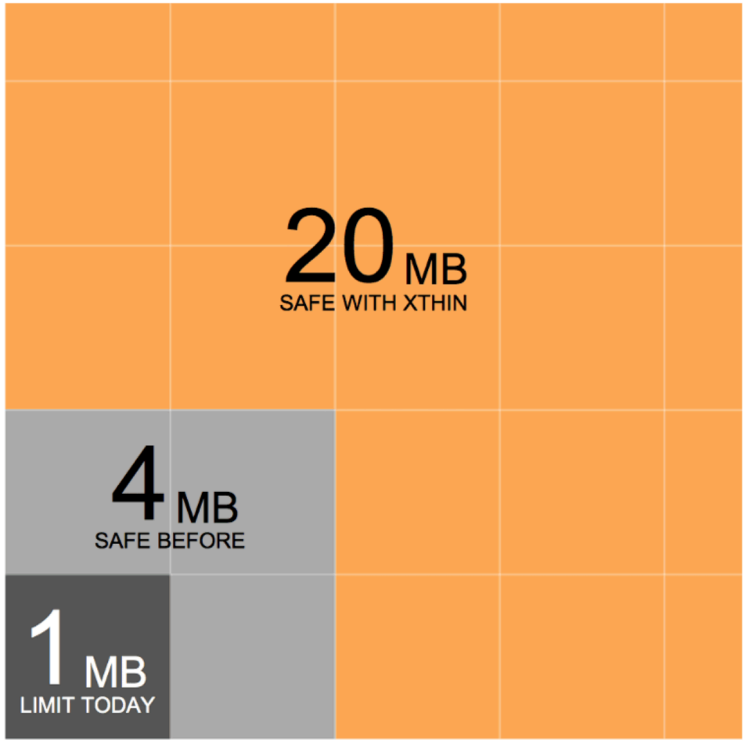
  $Q_{max} = \tau / Z = 4$ MB



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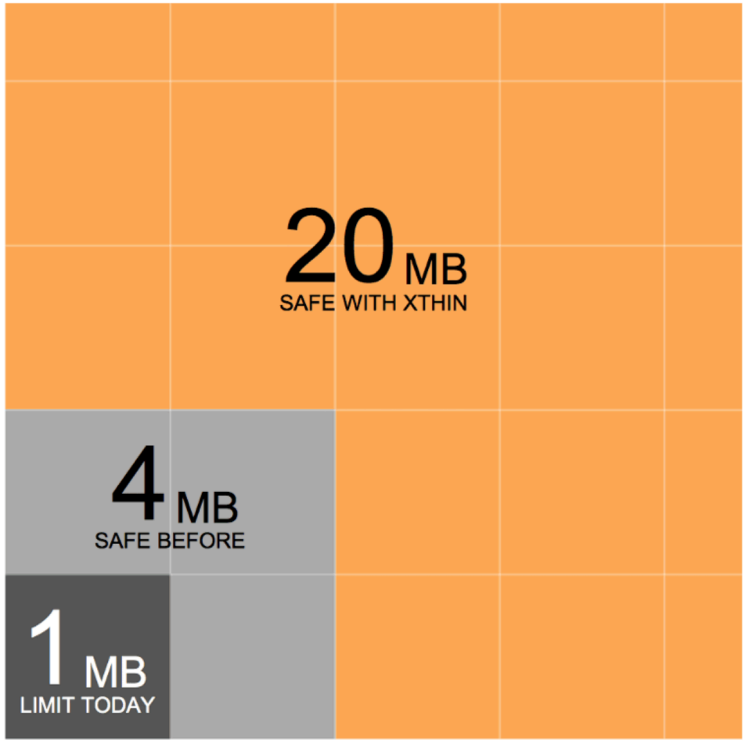
  $Q_{max} = \tau / (Z / 5) = 20$ MB



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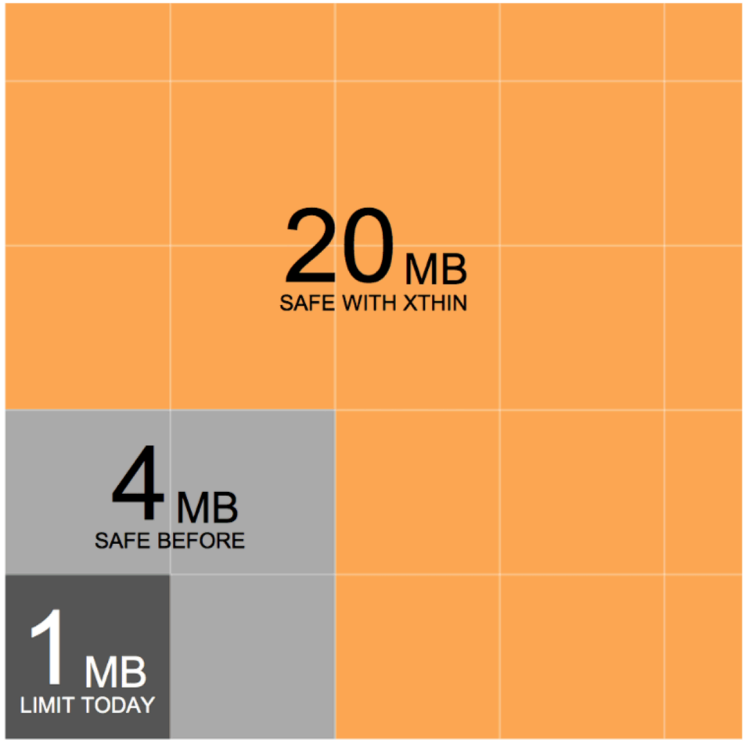
- This is an example of using the Z-parameter for nodes



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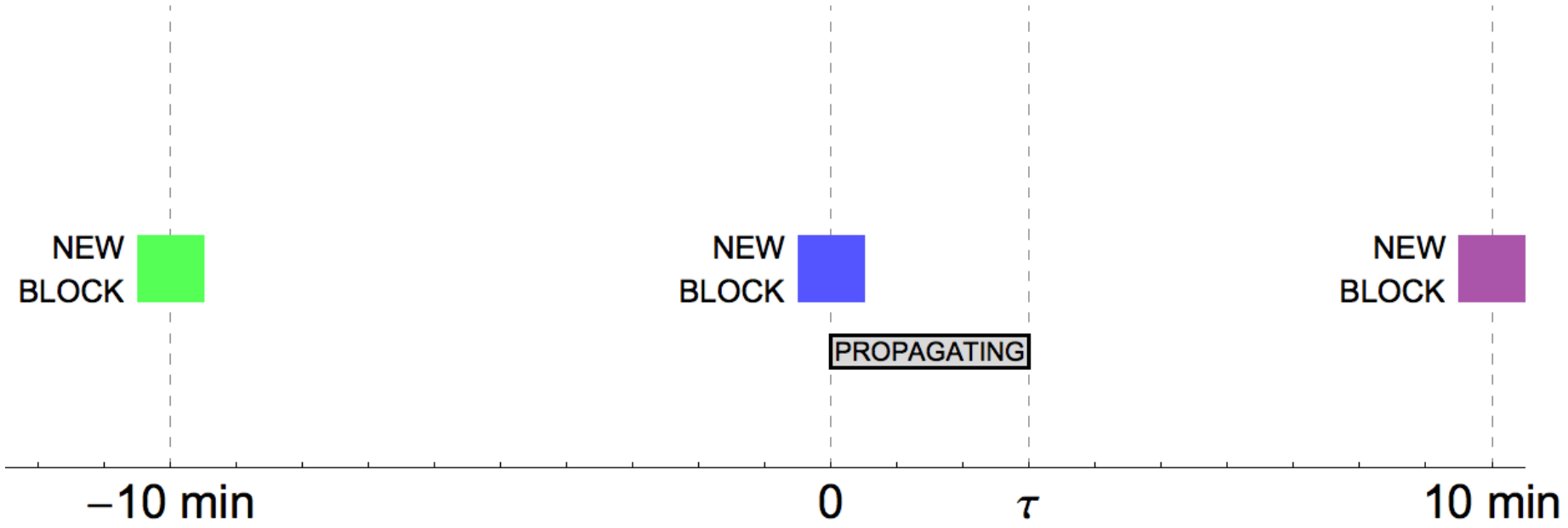

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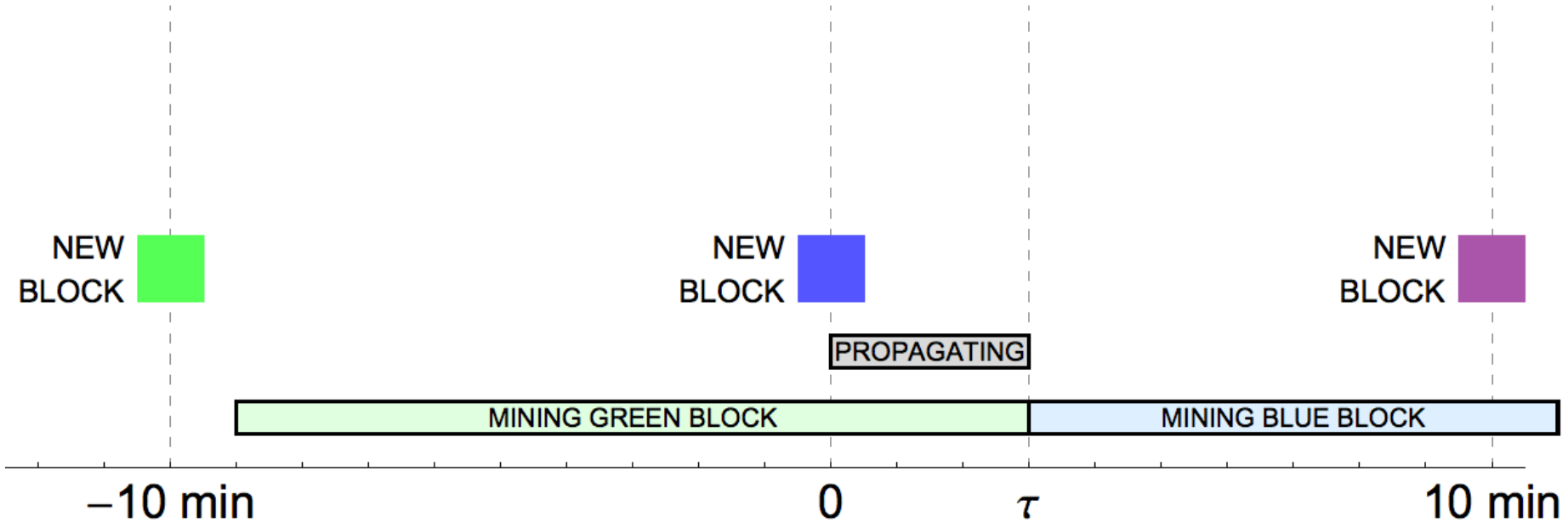

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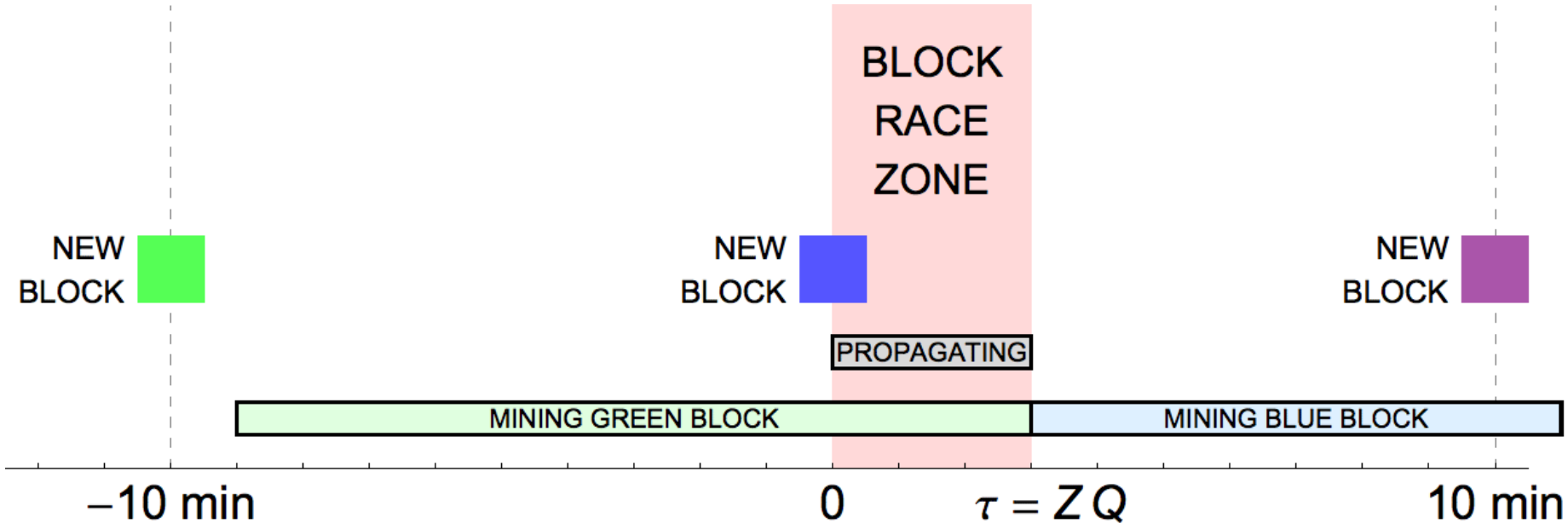

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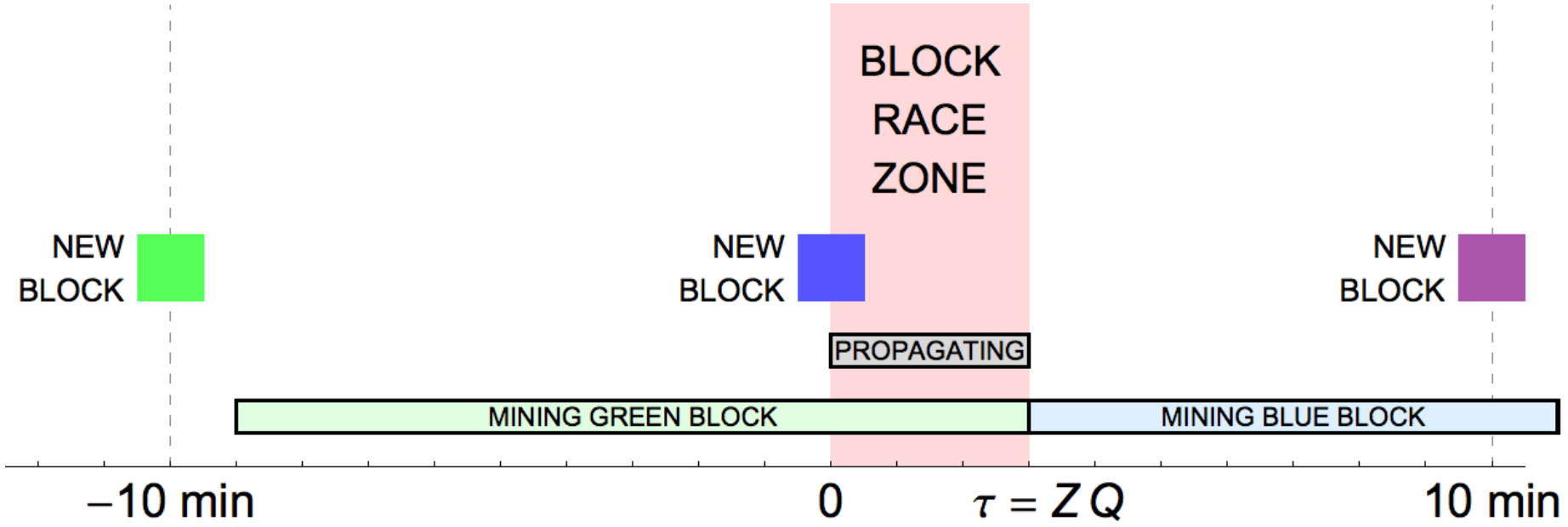
$$\frac{ZQ}{10\ \text{min}}$$



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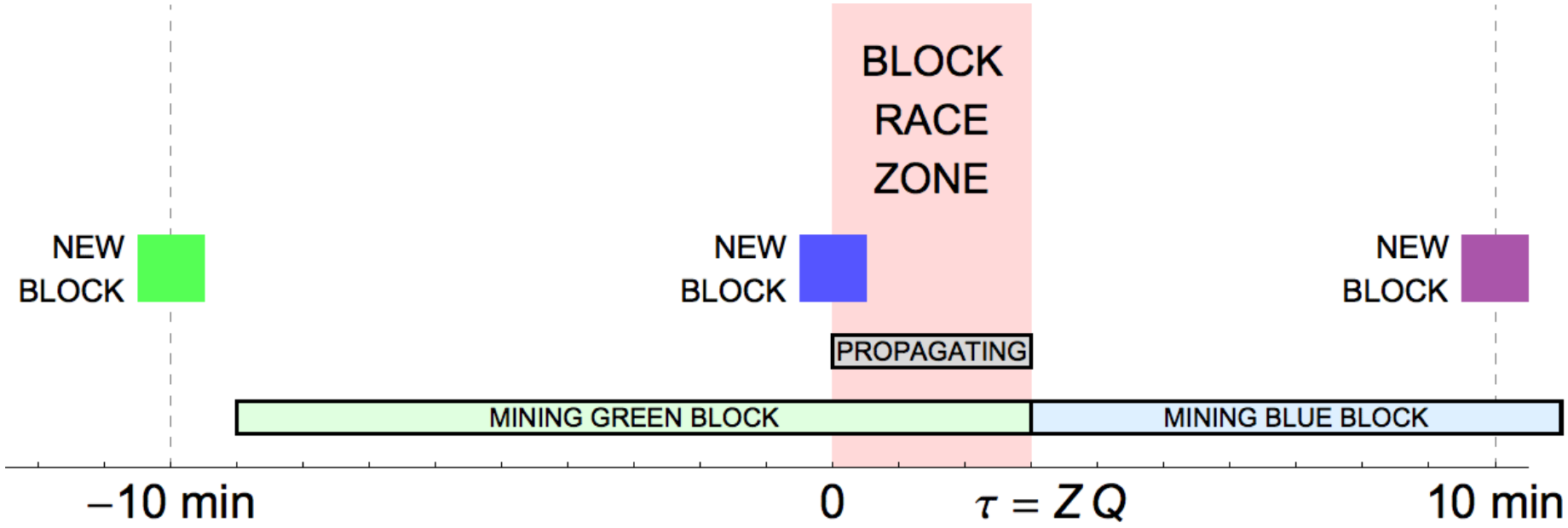

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Less risk with smaller *Z* → ← More risk with bigger blocks

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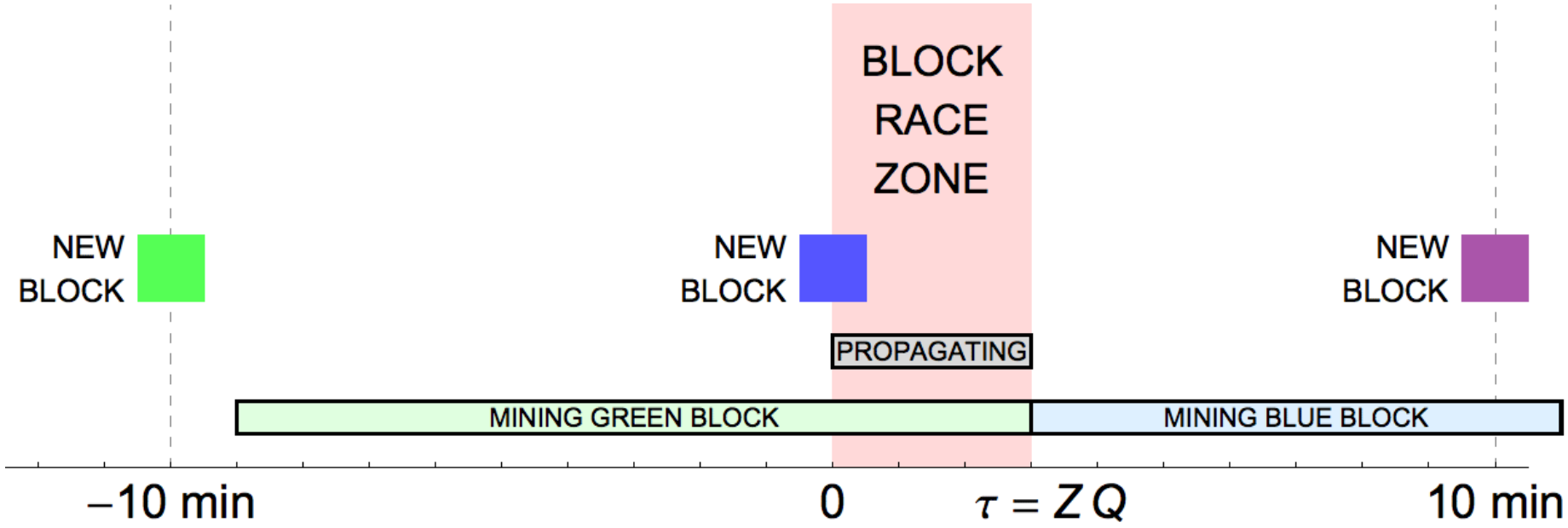
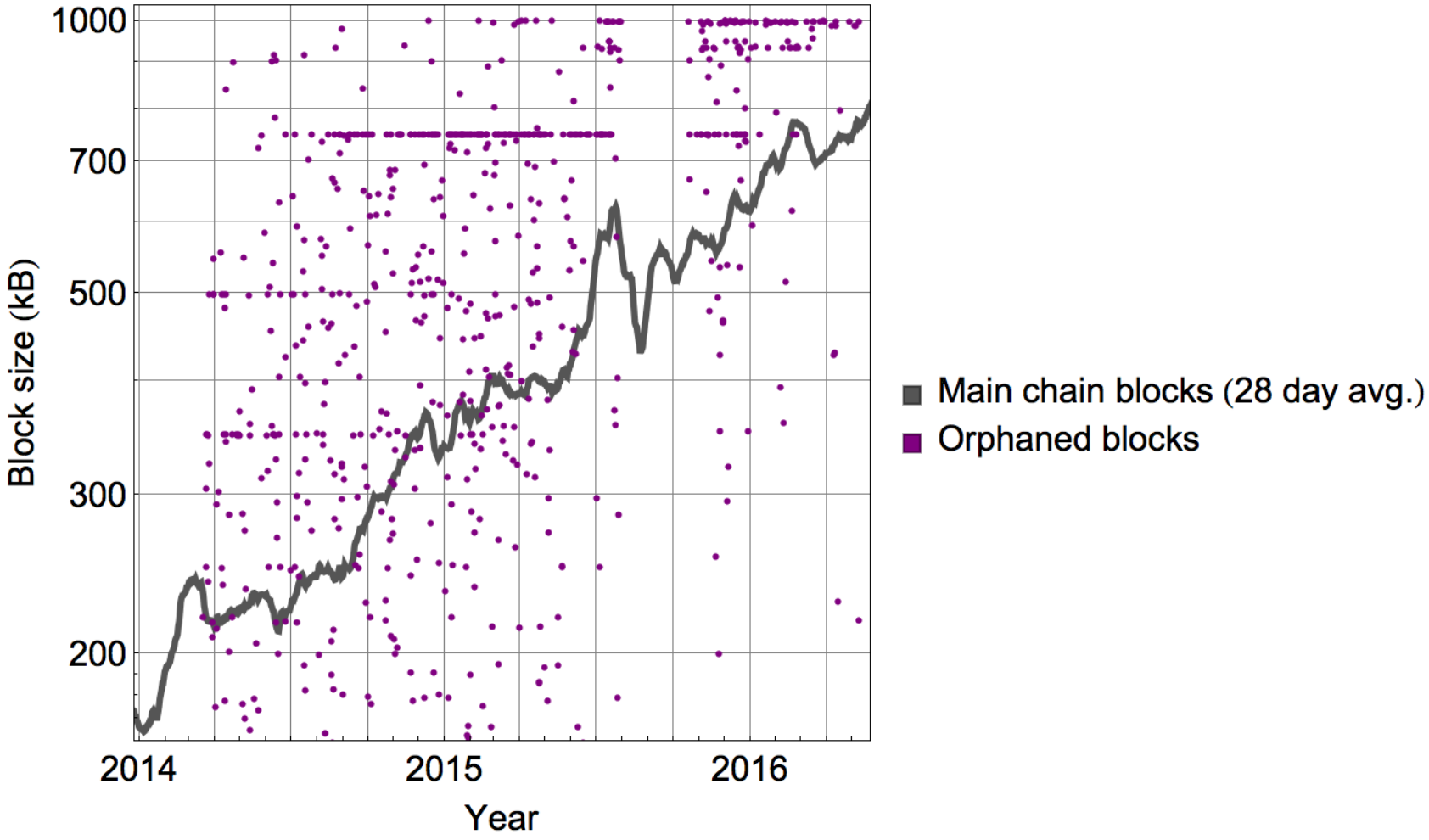


Bigger blocks are *empirically* risky



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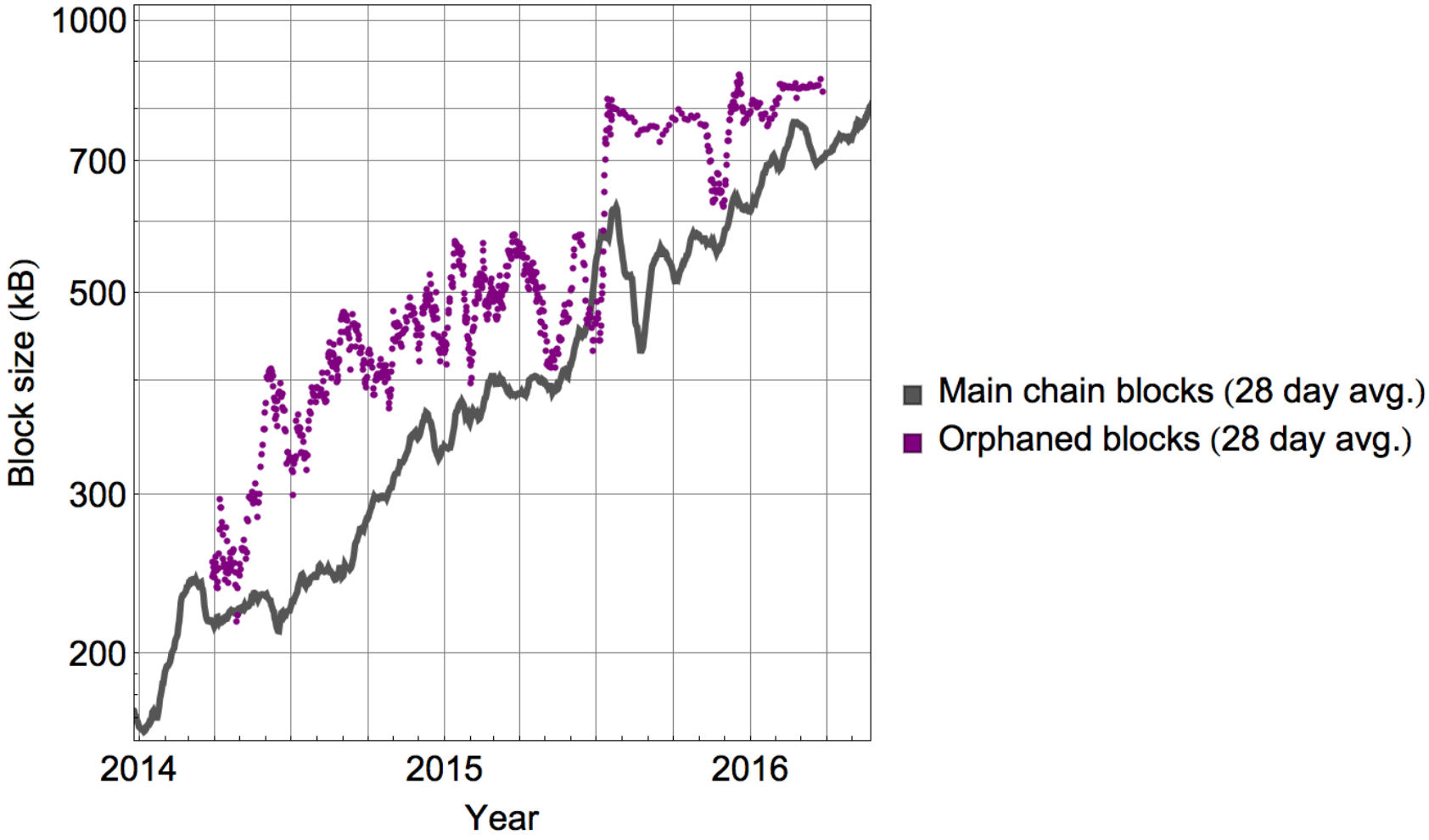
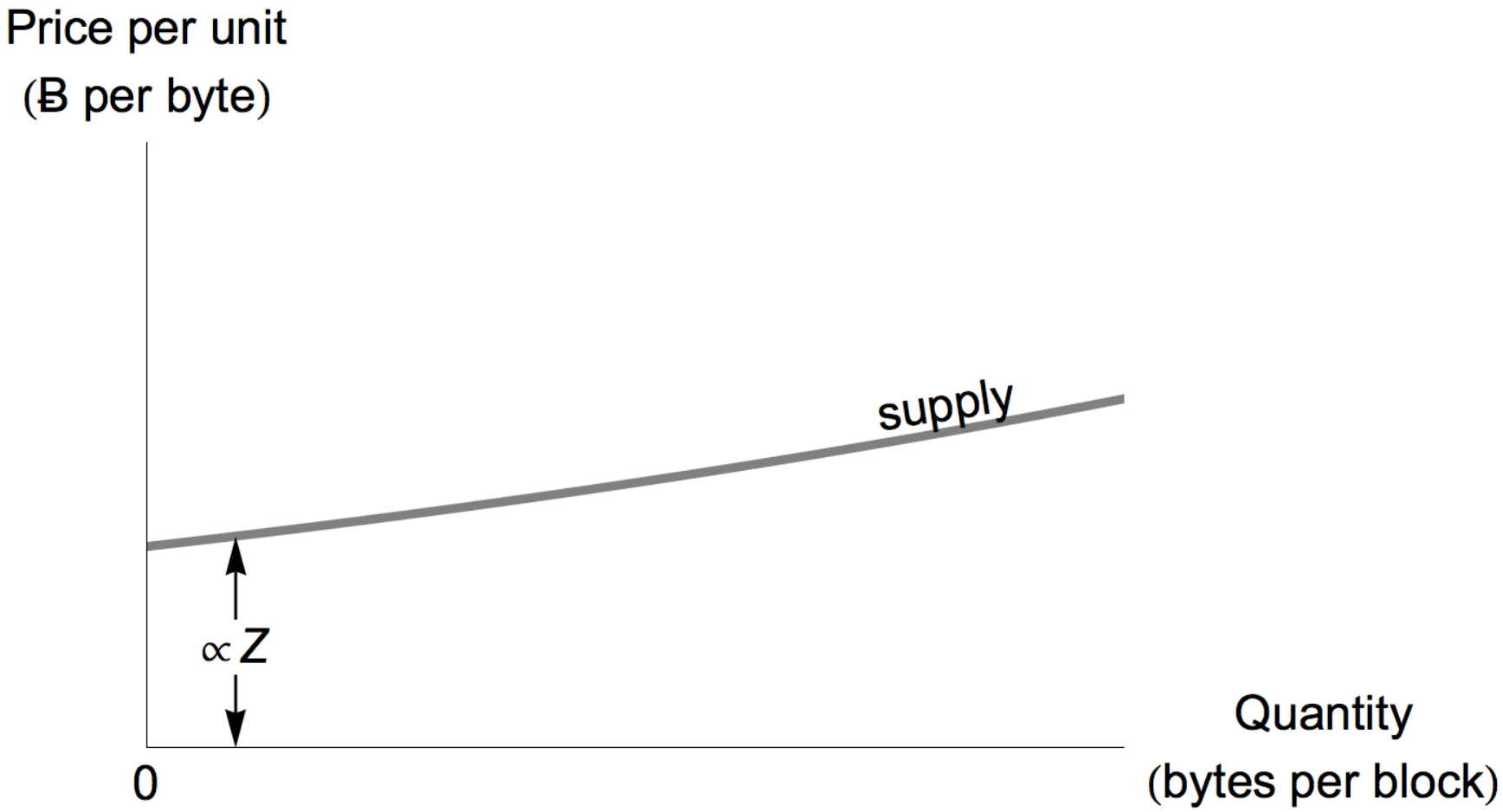
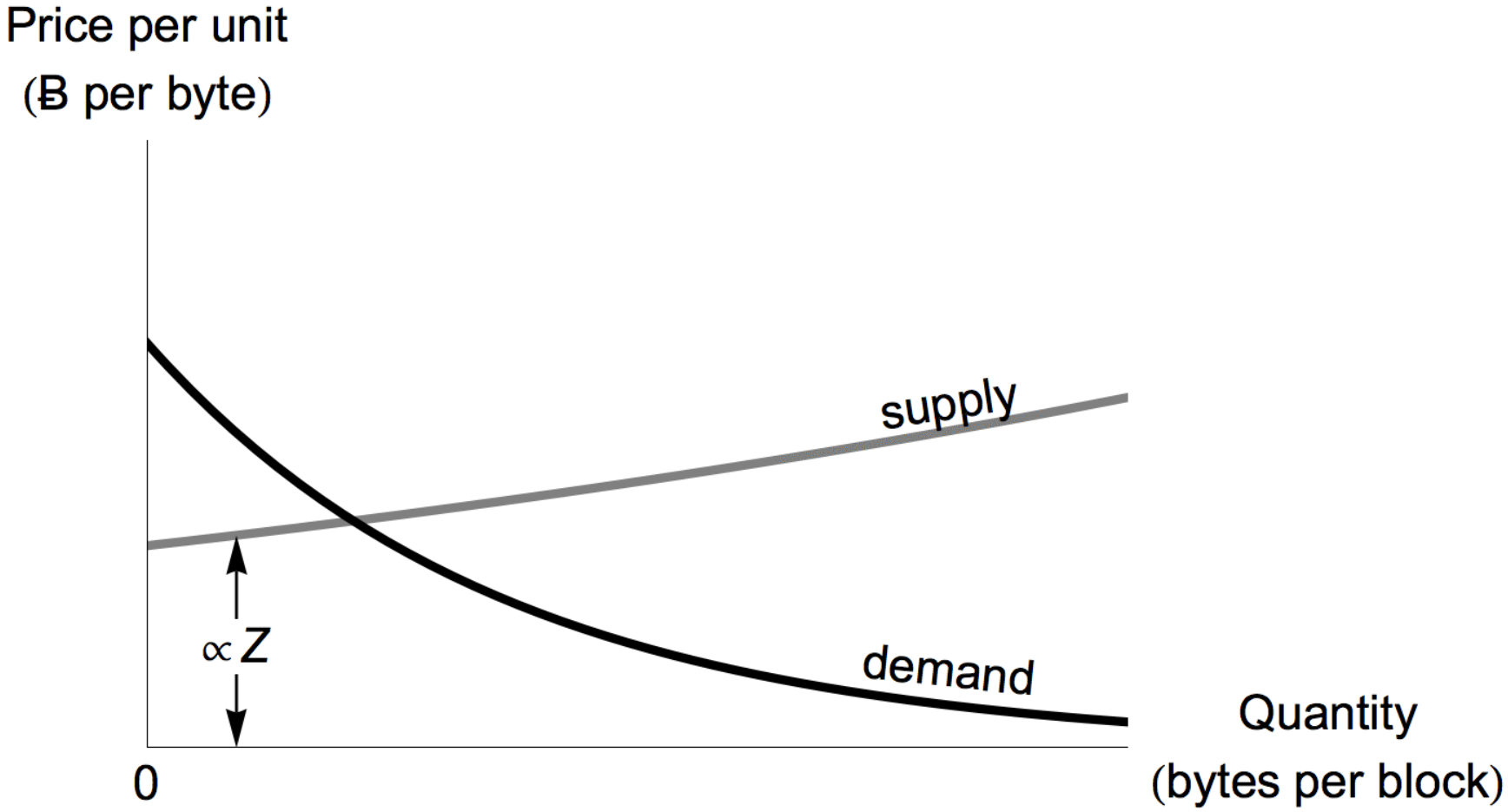


The block space supply curve



Fallacy #1:
Infinite demand = infinite blocks



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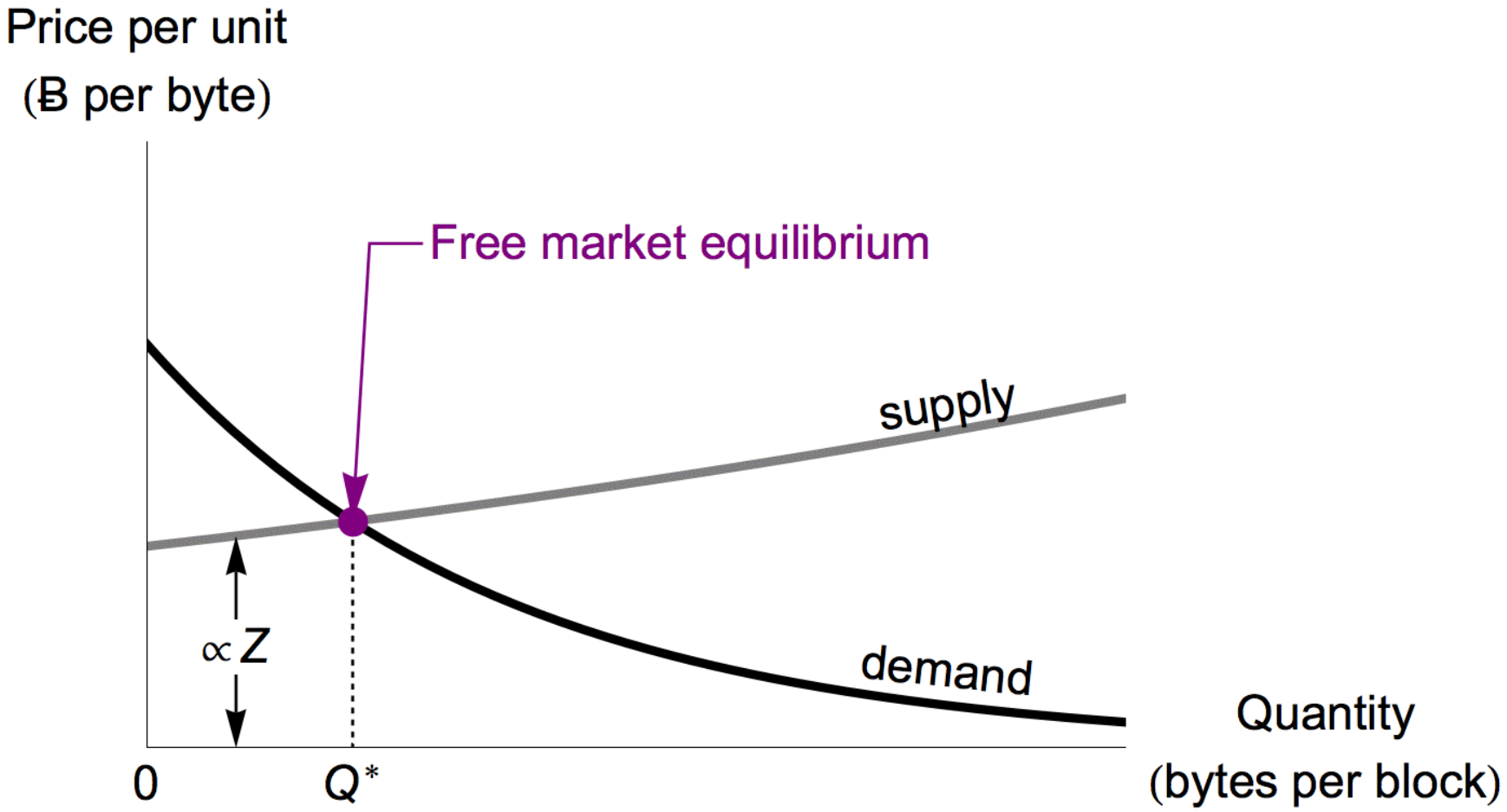

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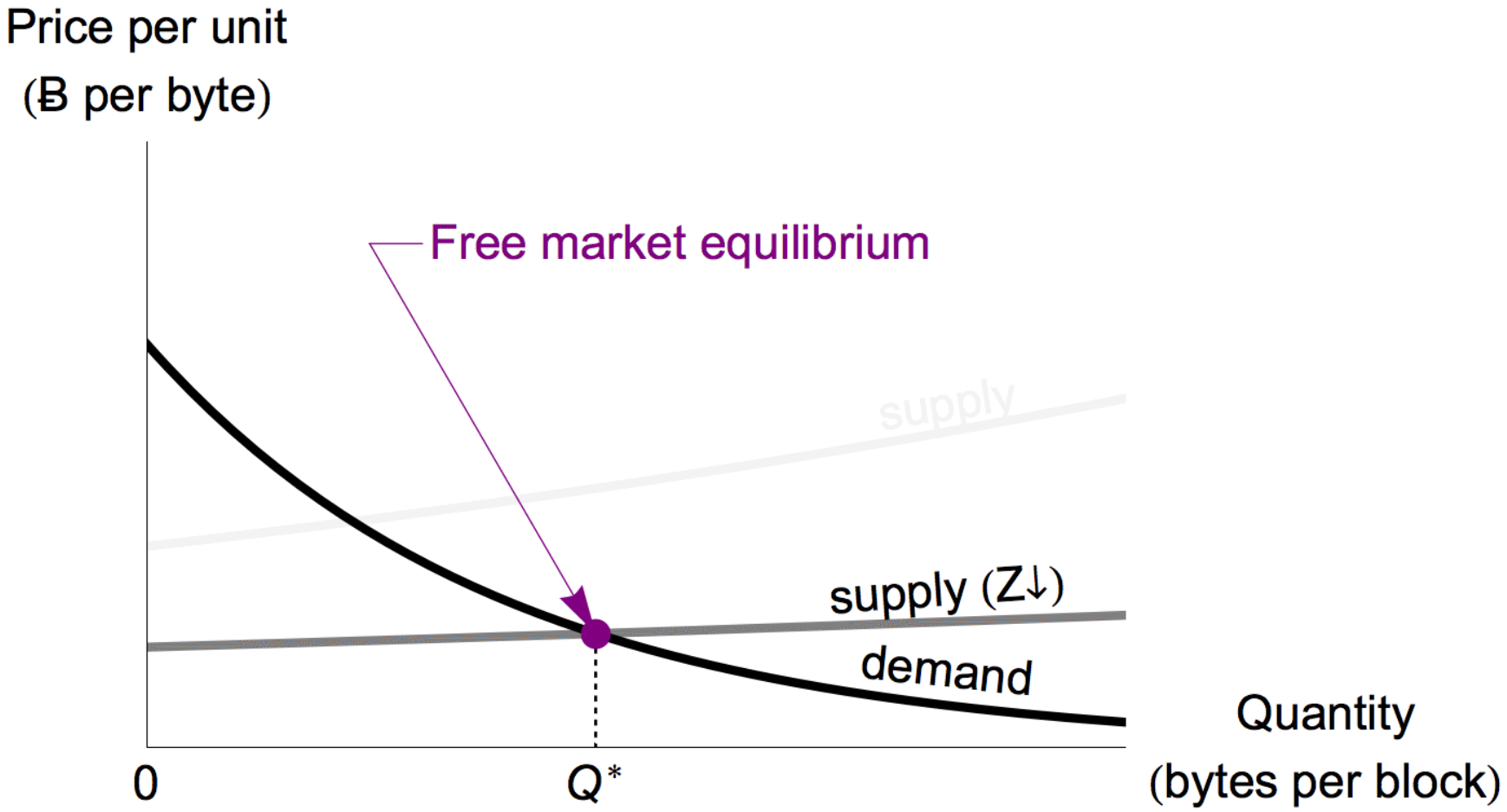

Fallacy #2:
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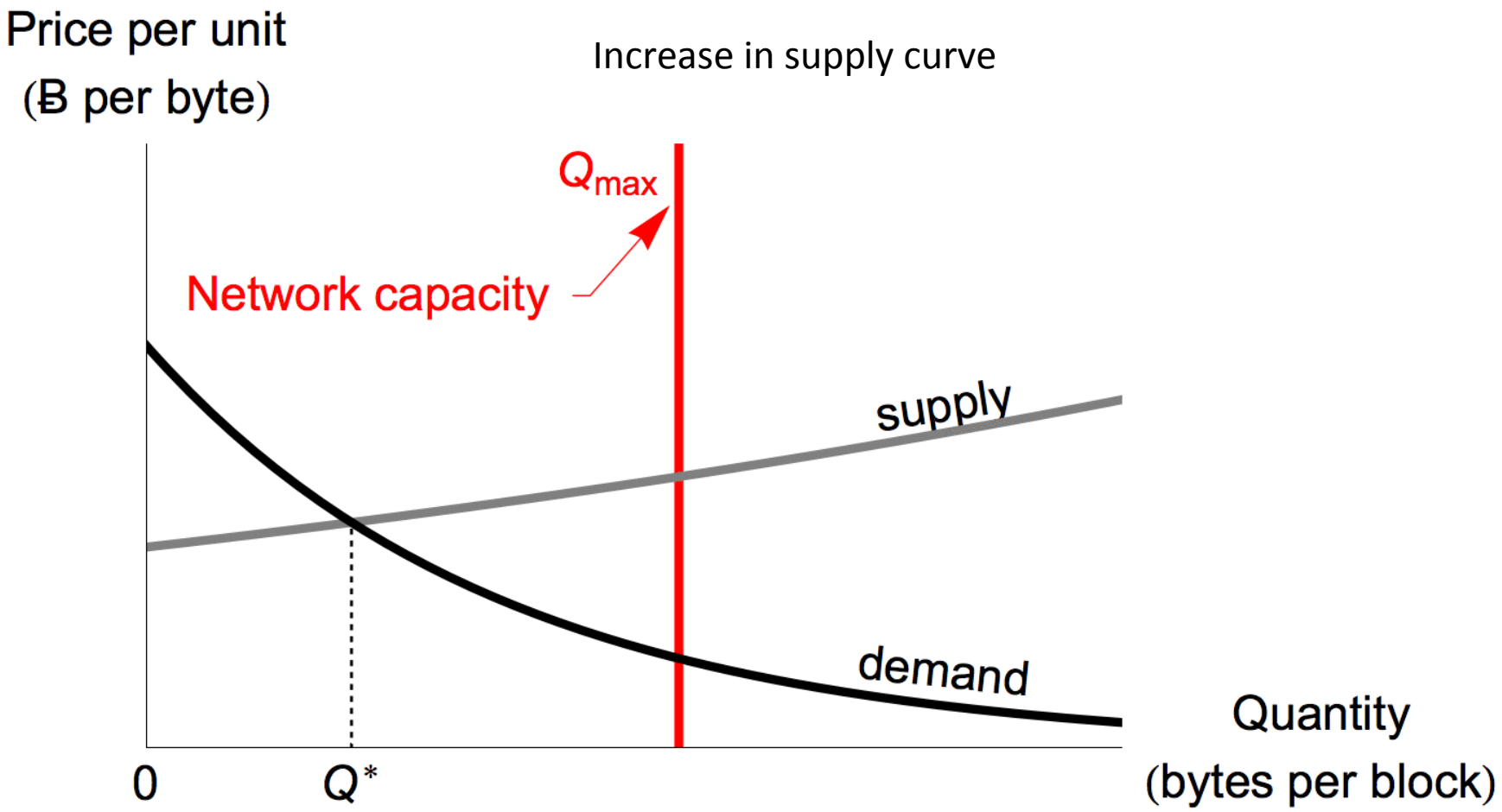

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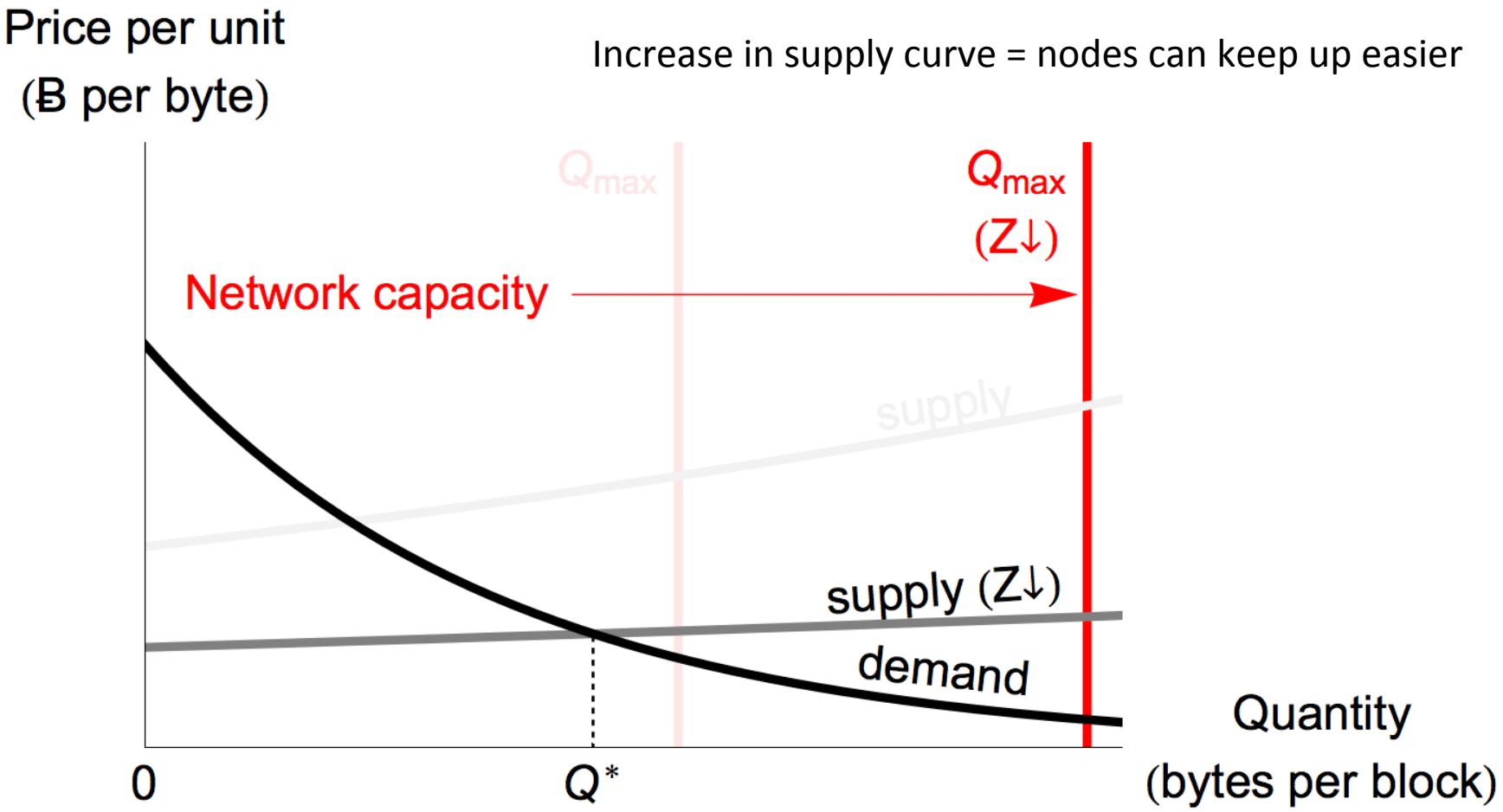
Increase in supply curve = nodes can keep up easier



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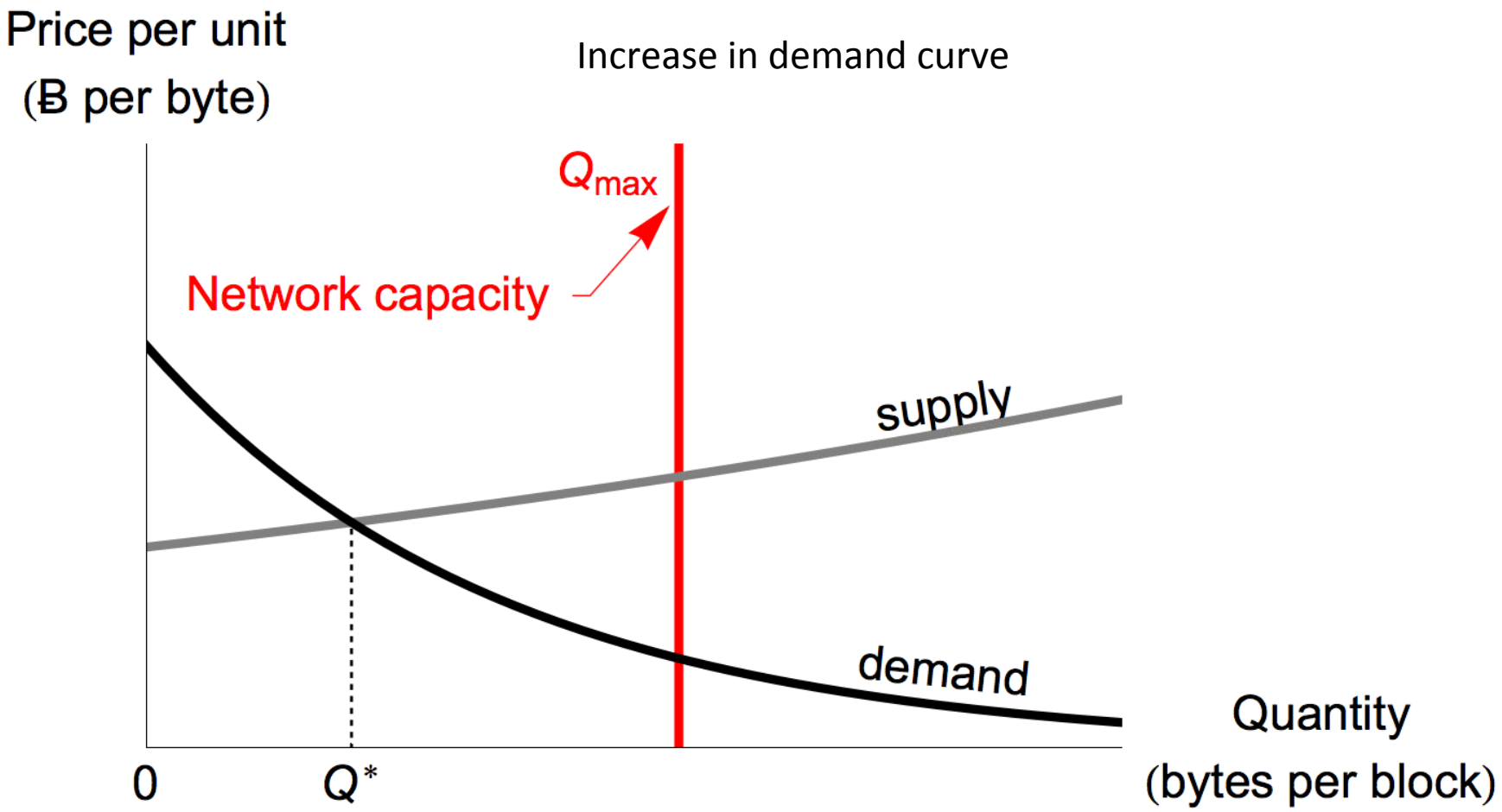

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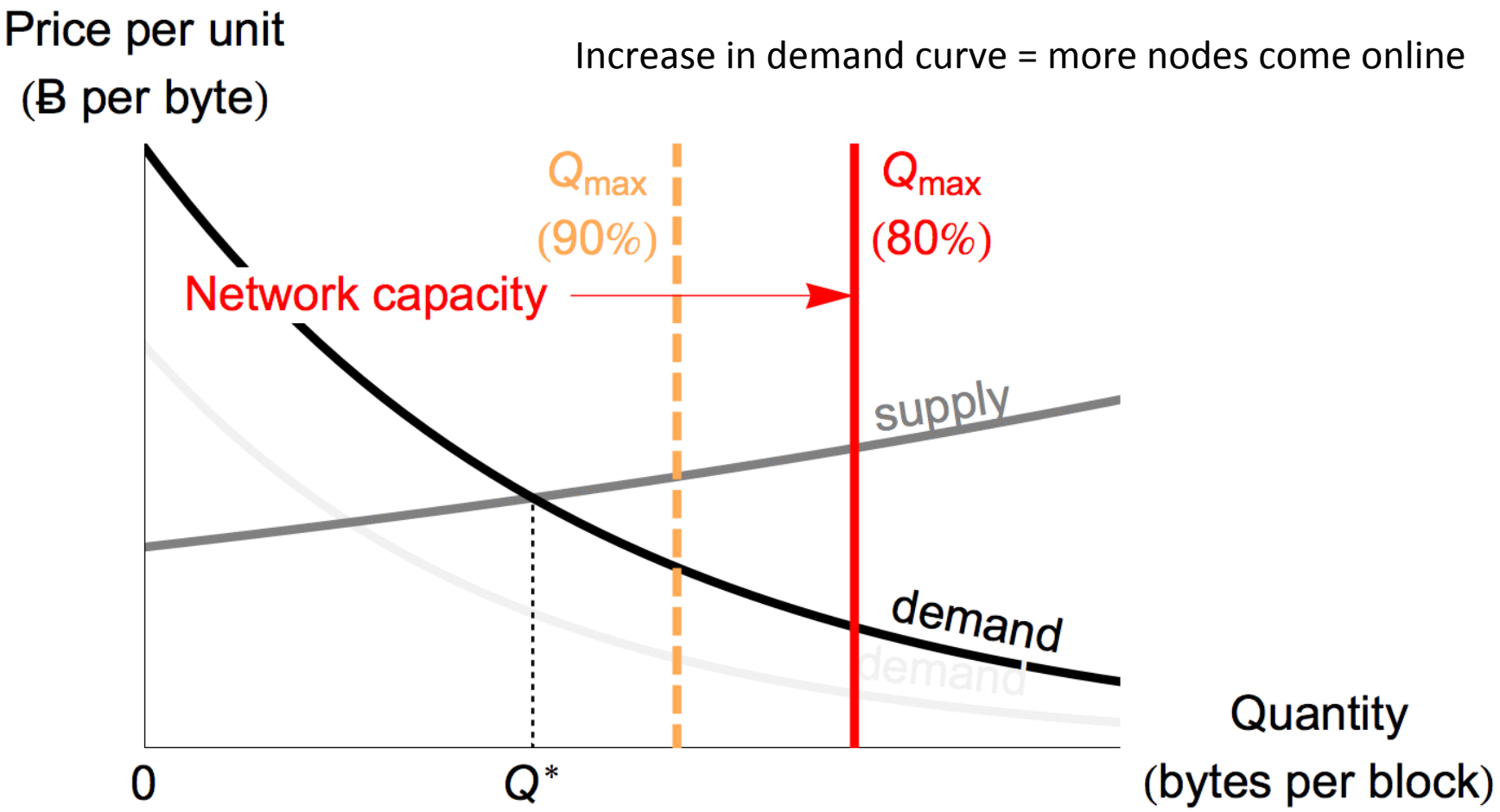

Conclusion

- Unclear whether these effects will favor decentralization or centralization
- Centralizing factors are balanced by decentralizing factors
- In my opinion, the network can grow organically without the need for top-down interventions by developers.

Questions?