Blockchain code development pitfalls

Stories from TrustChain development

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2019

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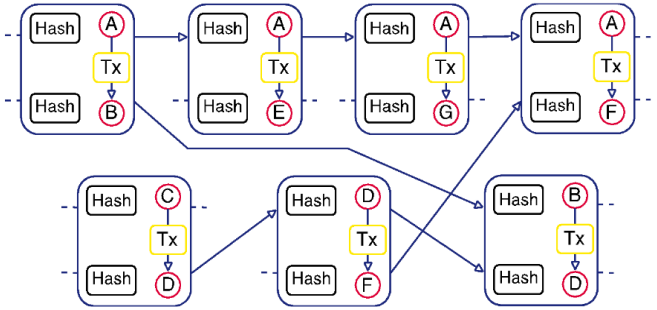
#1 unexpected blocks diagram

Theory

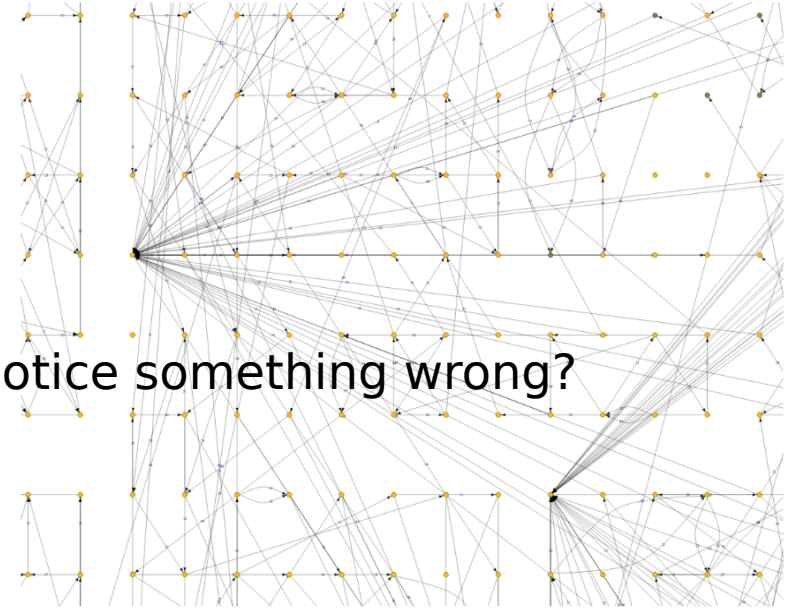
Diagram from the original TrustChain paper



Each block has exactly 2 parents and 2 children

Practice

Block diagram from an early version of TrustChain



Notice something wrong?

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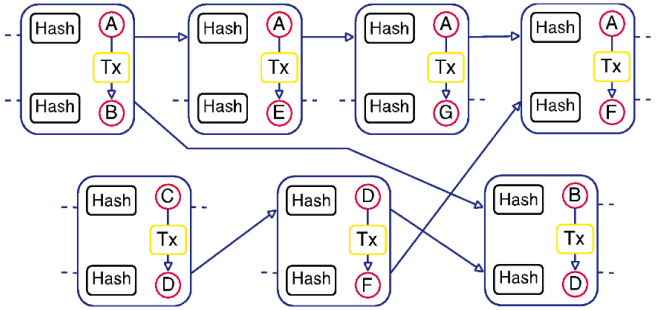
Diagram from the original TrustChain paper



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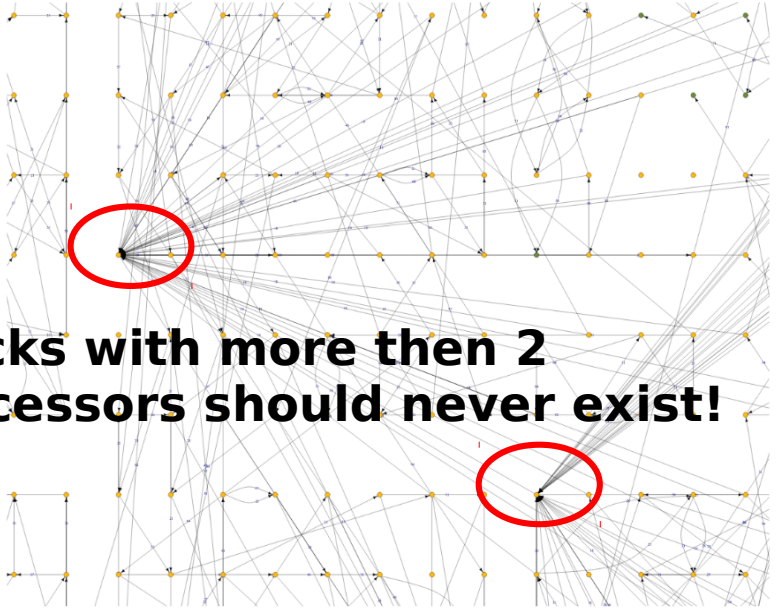

Blocks with more then 2 successors should never exist!

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#1 take-home message

- Humans think in visual images, not lines of code. Make proper use of your visual cortex.

Visualize everything **from the beginning.**

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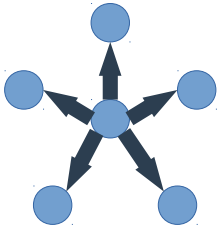
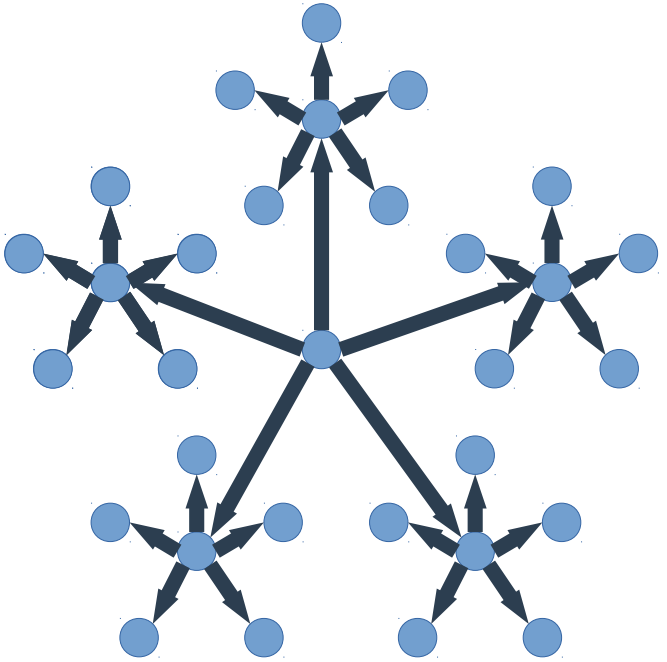
#2 excessive block broadcasts

Expected
(**and** unit tested!)



Packet time to live **1**.
Broadcast to **25** peers.

Reality



Packet time to live **2**.
Broadcast to **1110** peers.

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#2 take-home message

- There were 2 errors: in the main code **and** in the test.
- The risk of a double error is higher in a complex system. Double-check everything.

Tests can have errors too.
Cross-check your tests.

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#3 contagious crash

- One day, **all** app instances begin to crash 1 minute after connecting to the network.
- The crash spreads **like a disease** among peers.
- Who could have created this devious «message of death»? **Is this an attack?**

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#3 take-home message

- A broken block was put on the TrustChain. Peers trying to re-send it **could not handle the value**.
- You guessed it: no attack, just a student playing around ;-)

Sanitize incoming values
thoroughly.

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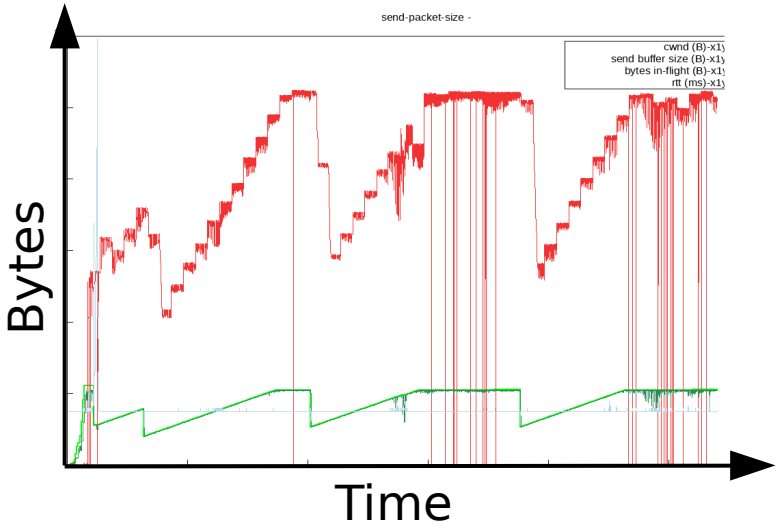
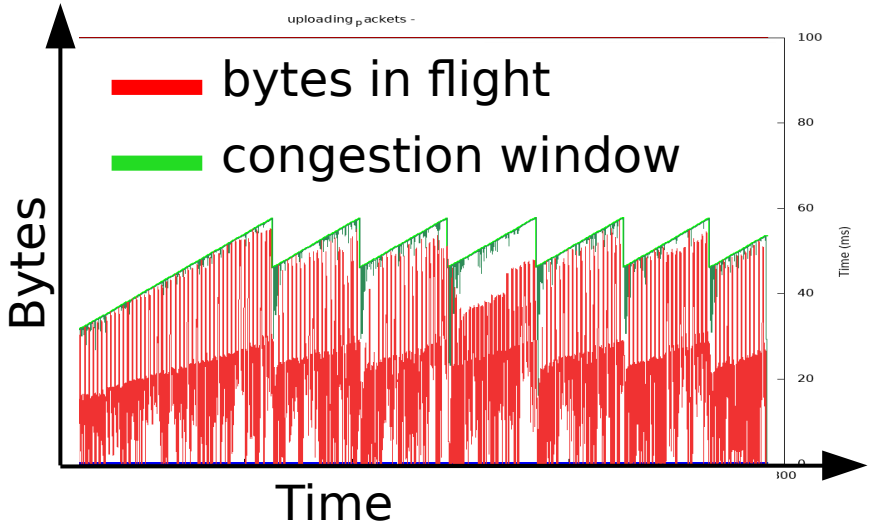
#4 confirmation bias

Wrong



Libtorrent developers were using using this chart to detect anomalies in network packet flow **for 5 years.**

Correct



Same chart, after a certain single-line bug was fixed. **The bug was there from the beginning.**

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#4 take-home message

- Never take anything for granted.

Use scientific thinking:

try to **falsify** your basic assumptions.

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Recap

1. Visualize everything from the beginning.
2. Cross-check your tests.
3. Thoroughly sanitize incoming data.
4. Always try to prove yourself wrong first.

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