Resilience: Links in path-based payments as “conduits” for tax redistribution, to guarantee basic income

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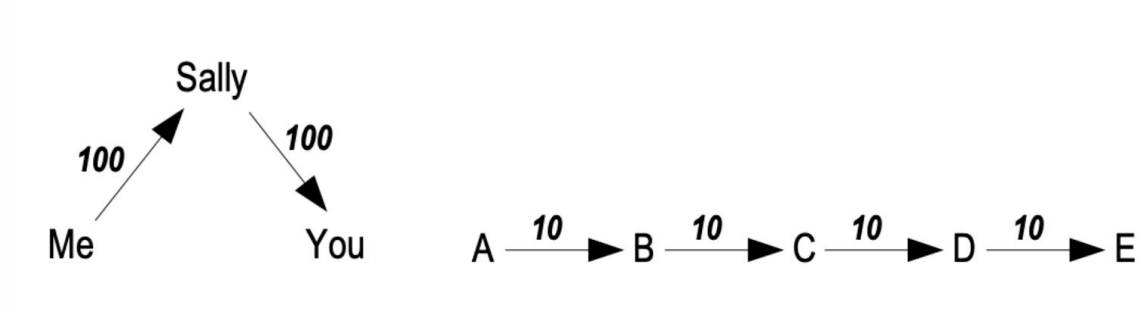
REVOLUTION: Ripple, the multi-hop mutual credit system invented by Ryan Fugger in 2003, is an ideal topology for a new type of mass-scale redistribution of wealth. The credit lines in Ripple can be used as conduits for reallocation of transaction taxes, achieving scalability by “multi-hop routing”, the same design philosophy that governs data transmission on the internet. Tax is reallocated by “hopping” from person-to-person along credit lines, analogous to packages of data in TCP/IP, propagating until it finds a person without an “income”. This new mechanism for redistribution of wealth is fault tolerant, has no central points of control, and scales to infinite size.

Path-based payments

Ryan Fugger improved on mutual credit by adding payment routing via multiple hops, similar to how traffic routing works on the internet. Ripple takes money to down the smallest possible scale. You are the bank. You issue money, and can only do so to people who trust you. In Ripple when you make a payment, you have to find a path of people that trust one another, going from you to the person you send the payment to.



In Ripple, your balance is between you and another person only. If you receive an IOU from someone else, it will not affect your balance with the other person. The way your balance is cleared is instead via credit clearing, when a circle of IOUs has formed.

The credit lines that record IOUs (I-Owe-You) in Ripple are what create the “web” that Resilience is built on top of, similar to how email built on top of the internet.

Horizontal wealth redistribution

The credit lines in Ripple have some properties that make them ideal for reallocation of taxes, they are one-directional, never loop because they are cleared when they do, and since credit lines clear continuously, the amount of credit lines per person should, roughly, approximate an equal distribution.

The assumption is made that there will at any time be enough credit lines between people so that tax can propagate.

Resilience is a single building block added to Ripple, that credit lines have “conductance” from the tax-rate used in a payment. From that, people compete to be altruistic. Taxes are enforced by the imperative to care for people around you, altruism. Incentive is that paying tax makes your transaction links “conductive”, and you compete to divert tax flow to your community.

Those who do not pay tax, are not a problem to the protocol, they are simple bypassed.

The Resilience protocol, a simple social norm

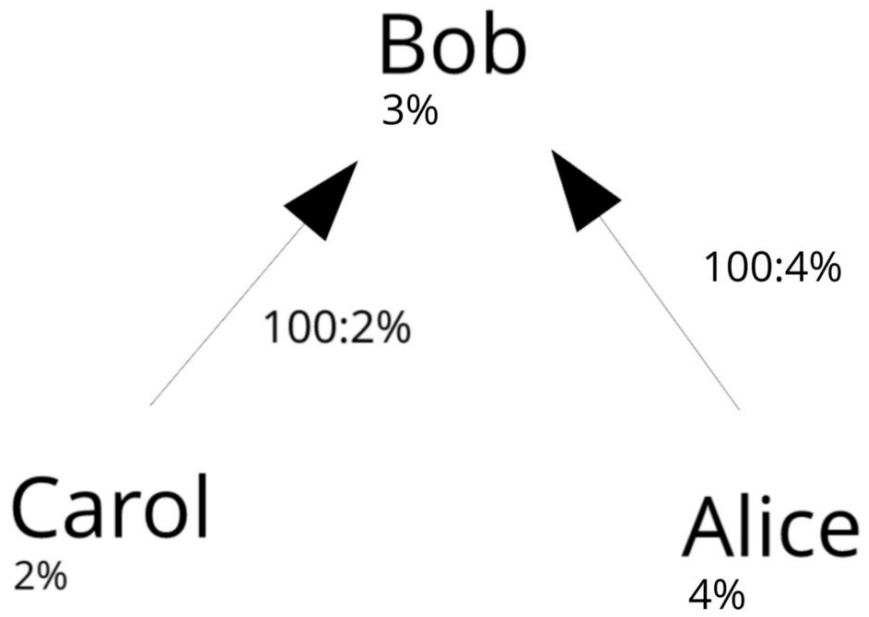
Resilience is the **social norm** that credit lines (invented by Ryan Fugger in 2003) have "conductivity" in proportion to the tax-rates people use when they make payments. That is all, very simple invention. Scales organically.

Mechanisms

You set your own tax-rate, and your credit lines to other people have a “conductance” in proportion to the tax-rate you used when making the payment. This “conductance” is a selection mechanism, people compete to propagate tax based on the tax-rates they use.

The propagation at any “hop” is the ratio of the “width” of credit lines to the relayer. This rule means that people compete to relay “tax”. The propagation is also the ratio between the “width” of the ingoing credit line to outgoing credit lines. This second rule means that people compete also with the person relaying the tax.

These two rules are analogous to flow of water through a pipe system, or electricity through wires.



In the example above, Alice will divert 4/6th of all tax flowing through Bob, and Carol 2/6th, Alice propagates twice as much tax as Carol. Tax is redistributed at a mass-scale by “hopping” from person to person, scales with *branchingFactor^hops*. When a person lacks an “income”, has no incoming credit lines, they only receive, the system provides them with guaranteed basic income.

If a person has credit lines with different tax-rates to another person, the “conductance” is cumulative. Two credit links, one with 50 XYZ at 2% and another with 100 XYZ at 3%, add up to 1/3*0.02 + 2/3*0.03, 150 XYZ with “conductance” of 2.6.

Social security as a commons

The transaction tax “pulses” decrease with the number of credit lines they split into, assuming an average number of credit lines per person the pulses decrease with *1/creditLines^hops*. The number of people reached increases with the same factor, *creditLines^hops*. This means that that how often pulses reach you increases with same factor as the amount you receive decreases. The resulting field is homogeneous, and can be mathematically defined with the equation *1/creditLines^hops * creditLines^hops = 1*.

Computation-wise, the protocol has an infinite capacity. All processes are only ever over a single hop, and tax “packages” can converge at any hop, minimizes computation.

Path-based redistribution, does it scale?

The scale of redistribution in Resilience is fundamentally limited by degrees of separation of credit lines, the total "hops" the tax "packages" can make. With 3 credit lines per person on average, after 5 hops a "package" of tax has reached 200 people, after 10 hops 60000 people, after 15 hops 14 million people, and after 20 hops 3 billion people (diminishing in quantity along way, while total "pulses" in network increase in quantity with same factor, producing a field.) The credit clearing in Ripple could give an indication to what the network topology for credit lines looks like.

Implementation

Ripple can be implemented with query routing, that people broadcast their search query to those who they have credit with, who in turn forward the query, until a path is found. Since both the start and the end of the path are known, bi-directional search can be used, decreasing the number of people involved with the square root. One-directional query flooding tends to be inherently unscalable (see Gnutella network), but bi-directional search decreases peers involved with *sqrt(unidirectionalQueryFlooding)*.

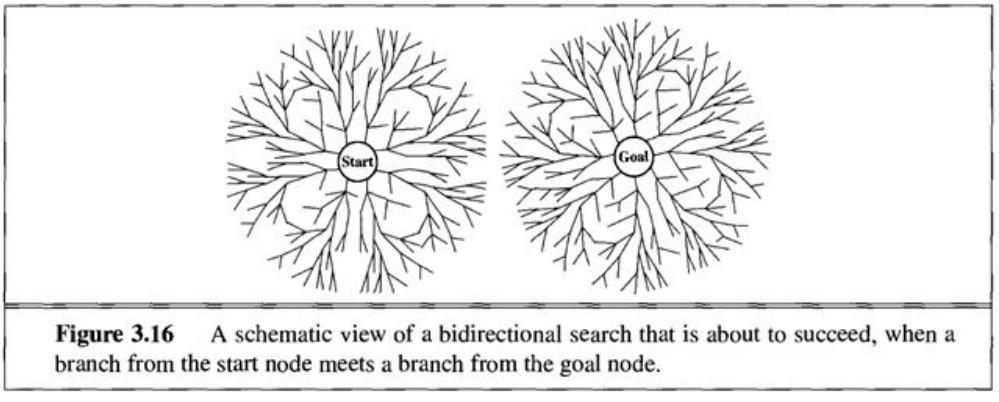


Figure 3.16 A schematic view of a bidirectional search that is about to succeed, when a branch from the start node meets a branch from the goal node.

Authentication between peers can be done with simple message authentication codes (MACs), used as a digital signature.

Since all interaction is only ever between people who know and trust one another, always just a single hop, one-time pad cryptography can be applied, for perfect secrecy, unconditional security, i.e., unbreakable even with infinite computational resources and time.

References

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