Resilience: multi-hop tax reallocation in Ripple for guaranteed basic income

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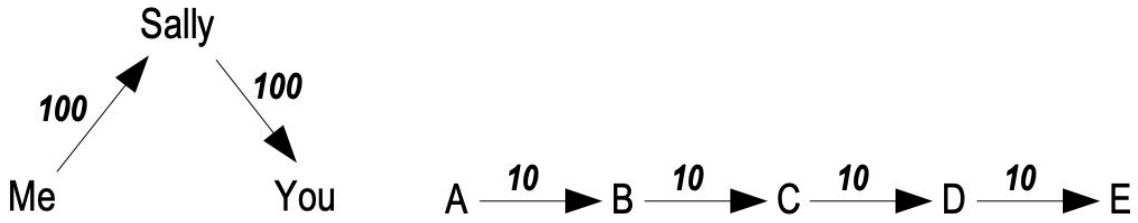
ABSTRACT: Ripple, the multi-hop mutual credit system invented by Ryan Fugger in 2003, is an ideal topology for a new type of mass-scale redistribution of wealth. The credit lines in Ripple can be used as conduits for reallocation of transaction taxes, achieving scalability by "multi-hop routing", the 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.

Introduction

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.

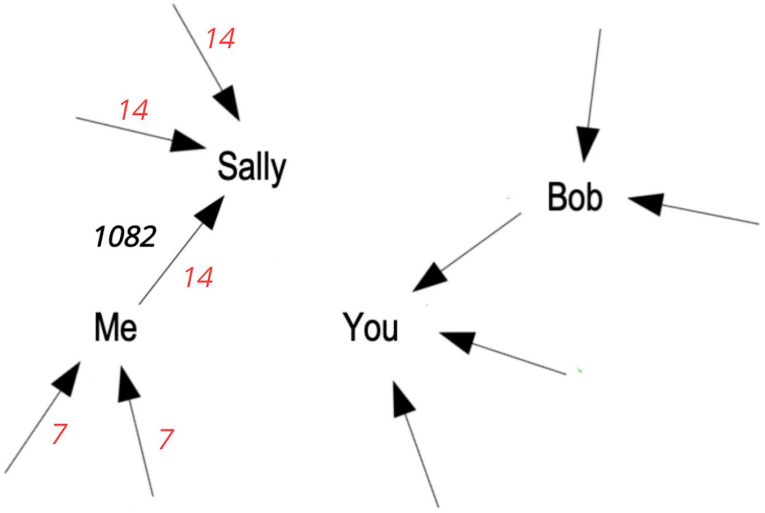
Resilience

Resilience provides a social safety net in a way similar to traditional wealth redistribution, that is, from the rich to the poor, with the difference that the reallocation is in debt being forgiven, debt reduction. The safety net is paid for with transaction taxes, applied to every IOU, at each intermediary in payment routing.

The taxes are allocated to the “credit line web” by multi-hop debt reduction, propagating along credit lines, person-to-person. Each person reduces the debt others have to them with an amount equal to the amount their debt was reduced. When a person lacks an "income", has no incoming credit lines, they only receive, the system provides them with guaranteed basic income.

In other words, the tax "hops" from person to person until it finds a person without an income. That way of scaling mass-reallocation of wealth, is similar to how the internet scales data transmission, or how Ripple scales payments by hopping between people who trust one another.

The example below shows payment routing of 1000 XYZ with one hop, from Me via Sally to You, with a 4% transaction tax, and multi-hop debt reduction. The credit line for the payment also propagates tax. (animation)



These “pulses” decrease with the number of credit lines they split into, assuming an average number of credit lines per person the pulses decrease with $\frac{1}{creditLines^{hops}}$. 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:

$$\frac{1}{creditLines^{hops}} \times creditLines^{hops} = 1$$

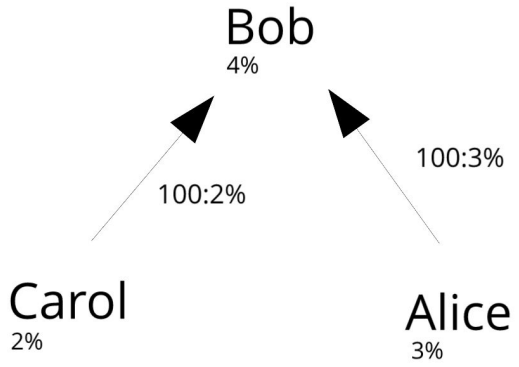
Tax as “packages” can converge, small amounts can aggregate into larger amounts, similar to water filling up a dam, meaning people do not have to propagate near infinitely many "packages".

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.

Trust index

The regulation of tax-rates in Resilience is very simple. To be able to select tax-rates as trends that spread via relationships of trust, in the context of rules defined in the code of the protocol, each person has their own “trust index”, a value for their preferred tax-rate. The "trust index" can be adjusted at any time. The lowest trust index of two people is always selected for.

The tax propagation is in proportion to the tax-rate that was used when issuing an IOU, encoded as a “width” of the credit line. The “width” shapes their “conductance”, a 2% credit line has twice the conductance of a 1% credit line. This is analogous to propagation of electricity in copper wires or water in a pipe system, where rate of flow is proportional to area.



People compete at any “hop” to propagate tax based on the tax-rates they select for, and the highest “conductance” is achieved with a “trust index” greater than or equal to that of the other person.

In the event a person has credit lines to another person with multiple tax-rates (“trust index” has been adjusted between transactions), the “width” is the product of the credit lines, e.g. 100:2% + 100:4% = 200:3%.

References

Fugger, Ryan. (2004). Money as IOUs in Social Trust Networks and a Proposal for a Decentralized Currency Network Protocol.

Feige, Edgar L., Taxation for the 21ST Century: The Automated Payment Transaction (APT) Tax (June 1, 1998). Economic Policy, October 2000. Available at SSRN: https://ssrn.com/abstract=2486665