

# Appeal fees specifications

## 0.0.1 Structure of proposed insurance mechanism

Suppose that we are in the  $i$ th appeal round. Suppose that Bob lost the previous appeal round and Alice won. Cases where the previous round was not decisive (due to a tie, etc) are considered below.

In order to appeal, Bob must pay  $x_i + s_{B,i}$ , where  $x_i$  is the cost of arbitration in this appeal round and  $s_{B,i}$  is some additional stake. Similarly, Alice must pay  $x_i + s_{A,i}$  to not forfeit the appeal, where  $s_{A,i}$  is also an amount of stake. These stakes paid by the winner of the previous round and the loser of the previous round should each be thought of as scaling with the size of arbitration costs. Hence one can take  $s_{A,i} = yx_i$  and  $s_{B,i} = wx_i$  for  $y, w \in [0, 1]$ .

We detail a sort of crowd-sourced insurance mechanism that can cover these fees:

- Bob, i.e. the losing party from the previous round, should have some time period to pay his fees.
  - Bob might be given the opportunity to pay these fees directly/himself; if he refuses to do so and/or a fixed period of time elapses where he hasn't, then the fees can be “adopted/crowd-funded” as described below.
  - Any user  $\mathcal{USR}_r$  can pay some percentage of the required fees  $x_i + s_{B,i}$ .
  - If less than  $x_i + s_{B,i}$  is raised, everyone is refunded any contributions they made towards Bob's fees in the  $i$ th round. The dispute is not appealed and Alice wins.
  - Once  $x_i + s_{B,i}$  is raised, the contract stops accepting additional contributions (see the discussion on pre-funding fees below).
- If Bob's side of the dispute is funded, Alice should be required to pay arbitration fees as well.
  - Alice might be given the opportunity to pay these fees directly/herself; if she refuses to do so and/or a fixed period of time elapses where she hasn't, then the fees can be “adopted/crowd-funded” as described below.
  - Any user  $\mathcal{USR}_r$  can pay some percentage of the required fees  $x_i + s_{A,i}$ .

- If less than  $x_i + s_{A,i}$  is raised, everyone is refunded any contributions they made towards Alice’s fees in the  $i$ th round. Bob wins the dispute.
- Once  $x + s_{A,i}$  is raised, the contract stops accepting additional contributions (see the discussion on pre-funding fees below).
- If both sides pay their fees, a call to Kleros is made, that can potentially be further appealed.
- Suppose Alice ultimately wins. (potentially after some number of additional appeals).
  - Adopters/crowdfunders lose any contributions they made towards financing Bob (potentially across various appeal rounds).
  - Calculate

$$s_r = \frac{\sum_j \text{contribution of } \mathcal{USR}_r \text{ in round } j \text{ to Alice}}{\sum_j (x_j + s_{A,j})}.$$

Namely,  $s_r$  is the percentage of what is paid on Alice’s behalf, across all appeal rounds, by  $\mathcal{USR}_r$ . Then contributor  $\mathcal{USR}_r$  receives back the contribution(s) she paid towards Alice’s fees (potentially across several rounds) and a corresponding portion of the losing party’s stake given by  $(\sum_j s_B) \cdot s_r$ .

- Suppose Bob ultimately wins. (potentially after some number of additional appeals).
  - Adopters/crowdfunders lose any contributions they made towards financing Alice (potentially across various appeal rounds).
  - Calculate

$$s_r = \frac{\sum_j \text{contribution of } \mathcal{USR}_r \text{ in round } j \text{ to Bob}}{\sum_j (x_j + s_{B,j})}.$$

Namely,  $s_r$  is the percentage of what is paid on the Bob’s behalf, across all appeal rounds, by  $\mathcal{USR}_r$ . Then contributor  $\mathcal{USR}_r$  receives back the contribution(s) she paid towards Bob’s fees (potentially across several rounds) and a corresponding portion of the losing party’s stake given by  $(\sum_j s_A) \cdot s_r$ .

## 0.1 Pre-funding fees

To simplify user experience, one can allow users to pre-fund fees for a given side in a future round of arbitration. Note that, typically if one or more insurers pay fees that overpay what is currently necessary, the first payment received should be used, and whatever difference should be refunded to the party that paid it. Hence, essentially, a distinction should be made between two types of fee payment transactions

- refundable overpay - for insurers that only want to pay the current round fees (and would potentially want to evaluate the result of the current round before paying fees in a future round)
- non-refundable overpay - for insurers (and potentially the parties themselves) that want to pre-pay funds for the following rounds that may be required.

## 0.2 Mid-appeal fee increases

Due to a governance decision, an arbitrator contract may change the required juror fees for a type of case while there is some ongoing dispute of that type.

Depending on when this decision is made relative to a given appeal round, and whether the change in fees is an increase or a decrease, this could have different effects.

If the fee change is made before either party has paid their fees for a subsequent appeal, both of their required contributions can adjust accordingly.

If the governance process has decreased the fees required, then at worst one or both parties to the dispute will have contributed too much in fees and/or stake. Hence, this amount can simply be refunded.

However, imagine the case where a change is made increasing the arbitration costs after the previous round loser has already paid their fees, but before the previous round winner has. In this case, it is possible that, unless the fees for the previous round winner are adjusted, inadequate fees will be paid to cover the arbitration.

There are a range of ways of handling the eventuality based on how the cost of the increase is spread between the two parties.

The previous round winner can be made to pay

1.

$$\text{newAppealCost} + \text{oldStake}$$

- This concentrates all of the hit from the fee increase on the previous round winner, but guarantees that people that crowdsourced funding for the fees of the previous round loser are no worse off than they would have been had there been no fee increase.

2.

$$\max(\text{oldAppealCost} + \text{oldStake}, \text{newAppealCost} - (\text{oldAppealCost} + \text{oldAdversaryStake}))$$

- This discourages people from trying to game fee increases by having both sides be worse off after a fee increase and minimizes the additional cost to the party that won the previous round. However, there is the risk that people who honestly funded the fees of the party that lost the previous round have their contribution eaten up by the fee increase, even if they wind up on the winning side.

3. (Recommended)

$$\max(\text{oldAppealCost} + \text{oldStake}, \text{newAppealCost})$$

- Here one minimizes the fee increase required of the previous round winner subject to the constraint that if the previous round loser wins, she is at least guaranteed to get back what she put in but not necessarily win any stake.

Ideally, if a governance change is made very near the time limit of a given fee payment period, that should extend the limit. Otherwise, fee changes that occur very near cut-offs will inevitably cause problems.

### 0.3 Ties, refusals to arbitrate, and non-decisive outcomes

Due to one or more jurors failing to vote, there is the possibility that an appeal round will end in a tie. Moreover, due to jurors voting “refuse to arbitrate,” there is the possibility that there will be a non-decisive outcome, hence there will be a future round in which there is not a “losing party” and a “winning party.”

In this case, the parties should be required to pay the arbitration fees plus the same stake, namely we are in a symmetrical case. A reasonable choice would be for both sides to be asked to pay,  $x_i(1 + y)$ , i.e. what the winning side would have had to pay had the previous round been decisive. Alternatively, a separate parameter  $l$  can be set such that in cases such as these, where there is not a previous round winner, both sides pay  $x_i(1 + l)$ .

Furthermore, due to the symmetry of this situation, both sides should pay their fees in the same payment period. While there is still the potential that a governance change will raise fees during the (common) payment period, this removes the possibility of a change after one party has paid its fees but before the other has, as in Section 0.2.

If the dispute ends in a non-decisive outcome (tie or refuse to arbitrate), then each insurer that contributed fees receives back what they paid in, minus a portion of the arbitration costs that corresponds to the proportion of the total fees that that insurer contributed (for the two sides combined).

## References