TiiQu – Full Trust Quotient

STEM Expert Example

weight (fixed or dynamically computed)
sample (fixed)
child node normalization
range (fixed)
value (variable)
set in child node, computed in node

TQ
(1-1000)
V = (1000 + 142.85 + 0 + 66.21)/4
V = 302.26

NODES

IDENTITY
(2, 1-1000)
Binary
wr = 1, wv = 1.1
V = 1000

VERIFICATION
(42, 1-1000)
Binary
wr = 1, wv = 1
V = 142.85

PERFORMANCE
(30, 1-1000)
Range
wr = ?, wv = ?
V = 0

REPUTATION
(10, 1-1000)
Limitless
wr = 0.3, wv = 1
V = 66.21

** 10*

** 10*

** 10*

CHILD NODES
categories:
1. no weight
2. fixed weight
3. dynamically computed weight

CREDIT AGENCY
(85, *1*, 0-1)
ru = 1
P = *1*/1
WP = 85/1.1

UNIVERSITY
(20, *1*, 0-1)
ru = 1
P = *1*/1
WP = 20/1.1

STACK OVERFLOW
(5, *1*, 0-1)
ru = 1
P = *1*/1
WP = 5/1.1

norm. sum(WP) = 100
= 110/1.1
(= sum(weights)/wv)

CREDIT AGENCY
(100/42, *1*, 0-1)
ru = 1, P = *1*/1
WP = 1*1*100/42

UNIVERSITY
(100/42, *1*, 0-1)
ru = 1, P = *1*/1
WP = 1*1*100/42

TIIQU RATING
(100/42, *1*, 0-1)
ru = 1, P = *1*/1
WP = 1*1*100/42

STACK OVERFLOW
(2*100/42, *1*, 0-1)
ru = 1, P = *2*/1
WP = 1*1*2*100/42

GOOGLE REVIEW
(100/42, *1*, 0-1)
ru = 1, P = *1*/1
WP = 1*1*100/42

norm. sum(WP)
=(600/42)/1 = 14.285

TO BE DESINGED

TIIQU RATING
(20, *4*, 1-5)
ru = 5
P = *4*/5
WP = 4/5*20*0.3
= 4.8

STACK OVERFLOW
(5, *1596*, 0-2600)
ru = 2600
P = *1596*/2600
WP = P*5*0.3
= 0.921

GOOGLE REVIEW
(5, *3*, 0-5)
ru = 5
P = *3*/5
WP = 3/5*5*0.3
= 0.9

norm. sum(WP) = 6.621
= 6.621/1

Analysis and Propositions

1) **Nodes N**

The value of 66.2 is very small compared to the impact of the value 1000 of the identity node, even though the values on the reputation node are not as bad (4 from 5 and 1596 from 260. The idea behind it is that an identity can be verified more easily than a reputation. The four nodes play the following roles in the algorithm:

- **Identity Node**

  "Are you who you say you are?"

  The identity node delivers a 100% contribution if at least two verifiers with a weight sum of at least 100 are confirmed. For example if the university and the credit agency confirmed the identity, TiiQu accepts the member's identity as confirmed.

- **Verification Node**

  "Is what you say about yourself true?"

  The verification node counts the verifications from all other child nodes and adds them to the trust quotient. It does not distinguish between the kinds of sources. Each verification has the same impact. It should take a lot of sources to reach a full contribution from the verification node, because a 100% contribution from this node should hardly be reached. Weights only count multiple kinds of verifications from the same source, like Stack Overflow in the above example.

- **Performance Node**

  "What do other's think of you?"

  The trust sources of this node and the way the performance node operates will be defined by work in progress. We may need to monitor this one more closely because although matching performance against proposal is interesting it may unfairly penalise people if done incorrectly.

- **Reputation Node**

  "How well do you do what you say you do?"

  We expect more reputation sources than identity sources but less than verification sources to reach a full contribution from the reputation node. In fact, a 100% contribution from the reputation node can hardly be reached.

2) **Child Nodes CHN**

Child nodes represent sources of trust verifications or ratings. TiiQu will examine all possible trust sources according to their professional context. No private behaviour shall have an impact on any trust source accepted by TiiQu.
The trust sources can be assigned to the following categories:

- **Identity Confirmation Sources**

  These sources only deliver a value representing confirmed or not confirmed. The identity node sources are all of this kind, because to the question about a specifies identity there is only a "yes or no" answer.

- **TQ Confirmation Sources**
  These sources are maps of all added trust sources. They give a TiiQu member the possibility to raise their trust quotient equally, no matter to which other node the trust source mace a contribution.

- **Open Professional Communities**
  Communities delivering ratings from other members of that community as well as from the community supervisors and automatically gathered points.

- **Private Professional Societies**
  Communities delivering ratings from other members of that community as well as from the community supervisors and automatically gathered points. These societies have to considered in a different way than open communities because their ratings might be more subjective.

- **Companies / Ordering Parties**
  These sources are subject to different considerations than all other sources. The ratings of these sources will depend not only on the quality of the completed work but also on the quality of the pre-agreement as well as on disturbing or unexpected factors during the execution of the mission. An interdependent rating of the ordering party and the contractor might be a sensible approach.

Some trust sources can belong to several categories, depending on what kind of information they deliver. E.g. a source can deliver a confirmation of an identity as well as a measurement for reliability or honesty.

3) **Sample (→ N)**
A fixed value representing with how many child nodes a TiiQu member can achieve full trust from a node.

- **Identity Node**
  Sample: 2

Proposition 1

- **Verification Node**
  Proposed sample value: sum of the samples of other three nodes

  For the integrity of the system the verification node should reach full contribution if the other three nodes have reached full contribution too. This will only happen for a person who has the highest possible rating from each source with at least sample sources in each node. So a trust quotient of 1000 is almost impossible to reach.

Proposition 2

- **Performance Node**
  Proposed sample value: 30 or higher

  The performance node sources might be companies and individuals rather than open communities. The rules according to which values from those sources will be delivered have yet to be evaluated and will require results from work in progress.

Proposition 2

A high sample value for this node is necessary because a TiiQu member might get a lot of assignments through the TiiQu platform and therefore a lot of performance ratings.

- **Reputation Node**
  Sample: 10

  The reputation node sources will be open professional communities mostly. Getting full reputation ratings from 10 such sources to get full contribution to this node is an unlikely but realistic scenario.

4) **Weights (→ CHN)**

Weights have an impact on the contribution of the child node's value to the value of the node. They represent how much impact a source is allowed to have on the trust quotient.

- Node weights are fixed.
- Child node weights are fixed if their values are within a likewise fixed range.
- Child node weights are dynamically computed if their value range is limitless.

- **Identity Node**
  The identity child node's weights are fixed. Their values are either 1 for confirmed or 0 for not confirmed.

Proposition 3

- **Verification Node**
  The verification child node's are considered weightless. In fact weights are only there to count the verifications coming from a source. To stay constant in the algorithm's computations we set a neutral weight to *100/sample = 100/sum of other three node's samples*. In the above example this would be *100/42*. Stack Overflow contributes to the identity and the reputation node, therefore its value is *2*100/42*.

Proposition 4

- **Performance Node**
  The handling of the performance node's source's weights has yet to be defined with work in progress. I propose a correlation between weights and the time it took to fulfill a mission which is rated in a source.

- **Reputation Node**
  Reputation source's weights can be fixed if the source delivers limited ratings or dynamically computed if the source delivers limitless values.

Some child node weights will become smaller if their ratings become older. This rule will apply to both dynamically computed and fixed weights.

5) **Range and range unit (→ CHN)**

The range is delivered by a trust source and can be binary, limited or limitless.

Definition:
Range unit ru = max(range) – min(range) (+1 if min(range)>0)

6) **Child node value (→ CHN)**

The child node value is the rating value delivered by the trust source. There are various kinds of values:

- Binary values
- Values within limited ranges
- Limitless values

Limitless values have to be handled in special ways because neither a range unit or a percentage (described in next section) can be computed.

7) **Percentage (→ CHN)**

The percentage P expresses how much of the highest possible rating a TiiQu member has achieved in a trust source. For the identity and the verification node P is naturally 1 for confirmed verifications.

Definition:
Percentage P = child node value/range unit

8) **Weighting Ratio (→ N)**

The weighting ratio ***wr*** does have a normalizing impact according to the number of child nodes. If the number of child nodes exceeds the nodes's fixed sample value, more child nodes won't have an additional impact on the node's value anymore.

Definition:
wr = 1 if # child nodes >= sample or sample == 0
else wr = # child nodes / sample

9) **Weight Value (→ N)**

The weight value ***wv*** expresses the percental contribution of weighed child nodes with values in relation to all weighed child nodes, if the sum of all weights exceed 100. In the case of the sum of weights being smaller than or equal 100 it has no influence.

Definition 1:
wv = 1 if sum(weights) < 100 else wv =sum(weights/100)

$$sum(WP) = ((P_0 * weight_0 * (wr/wv)) + \ldots + (P_n * weight_n * (wr/wv))$$
$$\Leftrightarrow\ sum(WP) = ((P_0 * weight_0 + \ldots + P_n * weight_n) * wr / wv)$$
$$\Leftrightarrow\ \mathbf{sum(WP) = ((P_0 * weight_0 + \ldots + P_n * weight_n) * wr) / wv}$$

For the identity node, where all percentages P and the weighting ratio wr equal 1 we get

$$sum(WP) = ((P_0 * weight_0 + \ldots + P_n * weight_n) * wr / wv$$
$$\Leftrightarrow\ sum(WP) = ((1 * weight_0 + \ldots + 1 * weight_n) * 1) / wv$$
$$\Leftrightarrow\ sum(WP) = (weight_0 + \ldots + weight_n) / wv$$
$$\Leftrightarrow\ \mathbf{sum(WP) = (sum\ of\ weights) / (sum\ of\ weights/100) = 1 / (1/100) = 100}$$

If the sum of the weights increase and not all child node's values are confirmed, the value to delivered parent node will become smaller. Consider the identity node in the above example:

sum(weights) = 110 ⇔ wv = 1.1 then
*identity node value = 110/1.1*10 = 1000 if all child nodes confirmed*
*identity node value = 105/1.1*10 = 954.54 if credit agency and university confirmed*

Now let us change the weight of the Stackoverflow from 5 to 15:

sum(weights) = 120 ⇔ wv = 1.2 then
*identity node value = 120/1.2*10 = 1000 if all child nodes confirmed*
*identity node value = 105/1.2*10 = 875 if credit agency and university confirmed*

Proposition 5

So if the sum of the weights increase, the delivered parent node's value will diminish due the diminished contribution of the confirmed nodes. To avoid such a behaviour, only child nodes with ratings should be considered. In the above example we would get would get a maximal identity node value of 1000 for both cases in which only the credit agency and university confirmed. That is appropriate because more that 100% of confirmation has been achieved anyway.

Considering the same case with child nodes having ranges of values, an additional child node will lower the node's value, if the percentage ***P*** of this child node is lower than the average of all other percentages in the same node.

So we will have to think about a mechanism that prevents TiiQu members with more child nodes from getting lower values than TiiQu members with less child nodes in the case of dynamically added child nodes and the sum of all child node's weights over 100.

A way to handle this weakness would be to give TiiQu members the possibility to activate and deactivate trust sources and chose an optimal trust quotient as soon as they have exceeded a weight sum of 100 in a node. They could decide themselves when they want to publish rust source contributions to the TiiQu community. Like this they could not cheat, but configure their own verified ratings in a desired way. This approach might also be a good base for GDPR compliance in the context of the TQ algorithm.

Another TiiQu controlled way to handle this weakness would be to only accept the contribution of an additional child node, if it does not lower the value ogf the node.

10) Weighted Percentage (→ CHN)

WP on a child node has the following impact:

- More child nodes have a positive effect on the ***WP*** of a single child node because of

  *WP = P * weight * (wr / wv)*
  ⇔ *WP = P * weight * (# child nodes / sample / wv)*

  E.g. the reputation node delivered

  - a value of 38.14 with 2 child nodes
  - a value of 66.21 with 3 child nodes (+ 73 %)

even though the third child node's contribution to the sum of WP is only

(((4.8 + 0.921 + 0.9) / (4.8 + 0.921)) - 1)% = 15,7 %

If the number of child nodes has reached the sample value, this effect stays constant.

- If the sum of the weights is smaller or equal 100, the weighted percentage expresses the value percentage scaled by the weight and the share of minimally expected child nodes for a full contribution.

  $WP = P * weight * (wr / wv)$
  $\Leftrightarrow\ WP = P * weight * (wr / 1)$
  $\Leftrightarrow\ WP = P * weight * (wr)$

- If the sum of the weights exceeds 100, the impact of the weighted percentage gets mitigated.

  $WP = P * weight * (wr / wv)$
  $\Leftrightarrow\ WP = P * weight * (wr / sum(weights)/100)$
  $\Leftrightarrow\ WP < P * weight * (wr)$

Proposition 6

11) **Limitless Child Node Values (→ CHN)**

Child nodes with limitless ranges will get dynamically computed weights as suggested in the section "Handling Extremely High Deviation From Median" in the Trust Quotient description.

Another approach would be to find a way to compute a range unit without a *max(range)* or a percentage without a range unit to stay conform with the contributions of the other values. For example we can start with a ***convergent geometric sequence***:

The limitless sum of q^n for $n = \{0, 1, 2, ...\}$ and $q < 1$ converges to $1/(1-q)$

set $q = 1/2$:

limitless sum of $(1/2)^{n}$ for $n = \{0, 1, 2, ...\}$

$1/1 + 1/2 + 1/4 + ... = 1/(1-1/2) = 2$

set $q = 999/1000$:

limitless sum of $(999/1000)^{n}$ for $n = \{0, 1, 2, ...\}$

$1/1 + 999/1000 + 999^2/1000^2 + ... = 1/(1-999/1000) = 1/(1/1000) = 1000$

With this approach we can generate a limited range from limitless ratings. The child node value would then be defined by the partial sum with the delivered value n.

Proposition 6

Proposed Definition:
The limited value ***LV*** *of a limitless child node source is the limited partial sum of q^{n} for n = {0, 1, 2, ..., n} and q < 1.* ***LV*** *can be computed with the fomula*

$$LV = 1-q^{n+1}/(1-q)$$

So with the choice of ***q*** we can define the range and the delivered value from the limitless child node source sets a child node value ***LV*** within this range.

12) **Node Value (→ N)**

Node values are the values computed from the child node values, ranges and weights.

The usage of median averages make no sense in the current design of the TQ algorithm because we only build the average of all node values to get the final trust quotient. The node values are already weighted and normalized, so no deviant behaviour has to be expected here.