October 16, 2013

OpenStack Board Briefing - STV

Context

The OpenStack Board of Directors wishes to consider a resolution to call a special meeting of members to amend the bylaws of the OpenStack Foundation to remove the "cumulative voting" defined process for election of the 8 individual member Directors, and provide for an "order of preference" voting system using either the Condorcet method or the Single Transferable Vote (STV) method of voting.
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This briefing paper is intended to brief the Board on the STV voting system, to support the consideration and discussion of the Board resolution when made.

Single Transferable Vote

STV is an "order of preference" or "ranked-choice" voting system that is used in certain US and international government, non-profit, and association elections.

Wikipedia has a very good detailed summary of STV here: http://en.wikipedia.org/wiki/Single_transferable_vote, with this overall description:

> "*Under STV, an elector has a single vote that is initially allocated to his or her most preferred candidate, and as the count proceeds and candidates are either elected or eliminated, is transferred to other candidates according to the voter's stated preferences, in proportion to any surplus or discarded votes. The exact method of reapportioning votes can vary…*
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> *The system provides approximately proportional representation, enables votes to be cast for individual candidates rather than for closed party lists, and minimizes "wasted" votes by transferring votes to other candidates that would otherwise be wasted on sure losers or sure winners.*"

In STV, each voter ranks the list of candidates in order of preference. In the most common ballot design, they place a '1' beside their most preferred candidate, a '2' beside their second most preferred, and so on. The completed ballot paper therefore contains an ordinal list of candidates.

However in the STV system proposed for consideration by the Board, the voter is not required to rank all candidates – the voter can choose how many to rank from 1 to the number ranked. In this way, STV provides for an "order of preference" vote without requiring the voter to know or form an opinion on all candidates for

election. This is particularly useful in the case of the OpenStack Foundation, where the number of individual member Director candidates was greater than 20 in the last election.

STV Voting System in Detail

Structure

The basic structure of an STV method is relatively simple, and can be expressed with a few steps:

1. Establish the winning threshold ("quota").
2. Count the first place votes.
3. Declare as winners all those who at least receive the quota.
4. Transfer votes from one candidate to other candidates:
    - If one or more candidates have surplus votes (votes in excess of the quota), then transfer votes from the candidate with the largest surplus.
    - Otherwise, eliminate the last place candidate and transfer those votes.
5. If not all seats have been filled, then go to step (3).

The above is not a comprehensive description in that it does not define the threshold and does not describe precisely how votes are to be transferred. Specific implementations of STV define both the threshold (quota) and how votes are to be transferred, and these are discussed with specific recommendations below.

The Quota or "Winning Threshold"

As outlined above, an important part of STV is the setting of a votes quota or threshold, which if met or exceeded, means a candidate has successfully been elected to the position.

Droop Quota

The most commonly used threshold today is the Droop quota, which is defined as:

$$\text{threshold} = \frac{\text{number of votes}}{\text{number of seats} + 1} + 1$$

and then either dropping any fraction, or allowing the threshold to be a fraction. This is the smallest threshold such that any candidate receiving this number of votes is guaranteed to be elected.

In addition, the threshold can be either static or dynamic. Static means it stays the same throughout each round of candidate calculations. Dynamic means the threshold reduces each round, because the number of votes is reduced each round.

It is recommended that the Foundation adopt the Droop Quota with a dynamic threshold calculation, and allow the threshold to be a fraction (not requiring a whole number).

The original threshold calculation developed by Thomas Hare (Hare quota) in the 1800's is a simpler formula:

$$\text{threshold} = \frac{\text{votes cast}}{\text{number of seats}}$$

However the Hare quota is less popular today because of the unlikely (but possible) event that each successful candidate receives the same amount of votes. Under the Hare quota, this situation would result in not enough candidates meeting the quota and filling the available seats in one count.

Further reading on quotas can be found at
http://en.wikipedia.org/wiki/Droop_quota
http://www.openstv.org/single-transferable-vote

Transfer of Votes

Methods for transferring *surplus* votes can be classified into two main groups: random transfer of votes and fractional transfer of votes. Methods for transferring votes from *eliminated* candidates do not vary greatly.

Once a candidate has reached the quota, their surplus votes are reallocated to the remaining candidates according to their preferences in a series of "rounds" of calculations. Voter preferences for eliminated candidates (the candidate with the fewest votes in a round where no candidate reaches the quota) are also reallocated to the remaining candidates in the next round.

The two methods of transfer of surplus votes are categorized as "random transfer" and "fractional transfer".

Random Transfer

With random transfer of surplus votes, a number of ballots corresponding to the candidate's surplus are transferred to their next choices. One could choose the last ballots the candidate received, the first ballots the candidate received, or choose some other method. It is important to note that changing the order of the ballots can change the outcome of the election. In reality, this will only happen in a close election.

Examples of random transfer methods are *Cincinnati* and *Hare*, with the popular variant *Hare-Clark* that minimizes the "order of ballots" issue.

Fractional Transfer

Fractional transfer methods are designed so that the result of the election remains the same when the order of the ballots is changed. The basic idea is that, when transferring a candidate's surplus votes, all of the ballots are transferred but at a fractional value. The fraction is set so that the total value of all the transferred ballots equals the candidate's surplus.

With fractional transfers of votes, secondary surpluses must be allowed. Since the point of fractional transfers is to ensure that the method is independent of the order of the ballots, all the ballots transferred in a given round must be treated identically.

Examples of methods for the fractional transfer of votes are *Gregory* and *Meeks*.

Recommendation on Transfer Method

The committee does not yet have a firm recommendation on the transfer method. The Meeks Method is preferred at this stage, but urther research and discussion with electoral experts is required to recommend which exact method of transfer will be recommended to the Board meeting on November 4th.

Note that STV with the Meeks transfer method is used by the Apache Software Foundation to elect their Board of Directors, and has therefore been proven to a degree in the Open Source Software community.

More detail on the STV counting algorithm and variants can be found at http://en.wikipedia.org/wiki/Meek%27s_method#Meek.

Use by other Foundations and Governments

As noted, the Apache Software Foundation uses STV (Meek's Method) for Board elections (http://wiki.apache.org/general/BoardVoting), and the Eclipse Foundation uses STV as well for Board elections (British Columbia Method, see http://en.wikipedia.org/wiki/BC-STV). The League of Professional System Administrators (LOPSA) also uses STV (Meeks) to elect Directors.

In addition, STV is in broad use in parliamentary and local government elections around the world, including Ireland and India, Senate elections in India, Pakistan and Australia, and local government/city elections in the UK, Australia, US (Cambridge, Massachusetts) and New Zealand.

Implementation of STV

STV is used broadly in elections, and there is software that can be used to administer an STV vote using the Droop Quota and Meeks or other method for counting transferred votes available at www.OpenSTV.org.
OpenSTV software enables full transparency of voting results and calculations.

Legal Considerations

There is nothing in Delaware law that specifically prohibits STV as a voting system for the Board of Directors. There is no known case law that would invalidate STV as a voting system.

The legal advice of counsel to the Foundation is that STV can be used for the individual member Director vote, provided that the system is sufficiently clearly defined in the bylaws.

Benefits of STV

A Well Understood System

The STV system of ranking candidates from 1 to N is generally well understood in concept by people voting in associations or parliamentary elections. STV provides for a clear "ranked-choice" of candidates by each member/voter. The fact that STV is in use by ASF and Eclipse for Board elections also strengthens the likelihood that the members of the OpenStack Foundation would consider and adopt it as an alternative to cumulative voting.

Can be Clearly Defined in the Bylaws

STV has been clearly defined in the bylaws of associations and for parliamentary elections, and once the method is selected, can be clearly laid out in the resolution and OpenStack Foundation bylaws.

Proportional Representation

One of the benefits of STV is to provide for proportional representation of voters. Through a voter presenting their ranked preferences on their ballot, and the use of a calculated quota for determining which candidates achieve the quota, STV ensures that both consensus candidates are elected (by quickly exceeding the quota), and also ensuring that minority or distinct groups of voters are not disenfranchised by the majority.

STV also overcomes to a fair degree the perceived and real problems of the current cumulative voting system, which can leads to "extreme" block voting with 8 votes from each voter being able to be given to a single candidate.

Transparency

The data and results from an STV election can be published in full to members, enabling verification and analysis by members of where voter preferences were allocated in the end result.

Drawbacks of STV

Like Condorcet, there are choices in implementation of STV - and math to calculate results - that can lead to confusion and uncertainty among members.

Given that one of the goals of an STV vote is proportional representation, smaller or discrete groups of individuals voting in the same way can result in one of their preferred candidates being elected. This can be positive in terms of enabling minority representation (e.g. geographic), or a potential negative in terms of undesired blocks of voting (e.g. company-directed voting).

Conclusions

STV is a broadly implemented preference or ranked voting system that is in use by other similar Open Source Software Foundations for Board elections. The requirement to rank candidates in order of preference, and the counting system in applying those preferences, results in a voting system that provides a a balanced combination of consensus voting and proportional representation than other voting systems. It is also not easily gamed. The voting process is easy to explain to voters, but as with Condorcet, the counting algorithm is more complex to describe (but not insurmountable).

STV is a viable alternative to the current cumulative voting system for individual member Directors, to strengthen the diversity of individual member Directors and reduce the perception and reality of block voting by company affiliation.

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