Submission to Victorian Electoral Matters Committee Electronic Voting Inquiry

Table of Contents

Appendices

A – Comparative Risk Analysis

B – Option Analysis

Disclaimer

This submission is made in a personal capacity. The information contained in this submission has been prepared by the author and only reflects the views of the author.

Although the submission has been prepared with care the author is aware there may be errors and would be grateful for any comments and/or clarifications from reviewers.

Submission by: Ian Brightwell

1 Executive Summary

This submission provides the author's assessment of electronic voting options for Victoria based on his recent experience managing the NSW iVote project and the current state of internet voting in Australia.

The submission initially examines electronic voting for both attendance voting and voting over the internet. The submission identifies the factors driving the proposed limited used of electronic voting in Australia. In brief they are:

- Demise of Postal Voting as a viable voting channel
- Dramatic increase in Pre-poll voting and difficulties managing the timely counting of these votes
- Difficulties of managing absent voting
- Difficulties managing interstate and overseas voting
- Difficulties faced by voters living in remote locations
- Inability of blind voters to vote independently with current paper ballots
- Difficulties of disabled votes to get to polling places
- Improved electoral integrity confidence through having multiple voting channels to validate the electoral outcome.

The report then identifies the requirements for an electronic voting system which will satisfy Victoria's ongoing electoral needs and is able to scale cost effectively. The following is a list of these requirements.

- Security & Risk
- Integrity & Scrutiny
- Elector Vote Verification
- End to End Verifiable
- Cost Effective
- Scalable
- Comprehensible
- Attendance & Remote Voting
- Supportable
- Coercion Resistance
- Remote Voting

Victoria in practical terms only has a limited number of options. One is to retain the current vVote system, alternatively the VEC could adopt iVote from NSW and work with NSW or they could develop a new system or do nothing.

An options analysis was performed which used criteria to determine the most appropriate option. The outcome of the analysis against criteria suggested that iVote is the preferable system to vVote and other options readily available to Victoria currently. See appendix B for more detailed assessment.

Finally, the report outlines the features of the proposed new evoting system and the support and governance environment required to ensure ongoing viability of iVote in Victoria.

2 Recommendations

The author commends the following recommendations for the Committee's consideration.

1. Amend legislation to make minimum electronic voter eligibility align with the current NSW eligibility categories of blind low vision and disabled.

2. Add eligibility criteria of outside Victoria or remote from a polling place on election day should the committee wish to remove the need for interstate and overseas voting centres and significantly expand the franchise for electronic voting.

3. Amend legislation to extend electronic voter eligibility to attendance voting at both pre-polls and polling places to capture a portion of absent votes. This would allow out of district voting for all pre-polls and selected polling places on election day. These votes would be verified using paper receipts.

4. VEC should adopt NSW's iVote electronic voting system to support its next Victorian Parliamentary election. Modifications should include the attendance vote verification using printed dockets and enhancements to allow for upper house regions and a fully preferenced lower house.

5. The VEC develop a collaborative support arrangement with NSW and any other jurisdictions using iVote. This arrangement should share the support resources and costs for iVote and use a shared governance structure.

6. The VEC consult with other Australian Commissions to determine the viability of creating a single entity with shared governance to provide ongoing support of all internet voting technology in Australia to elections for parliaments and local governments.

7. Amend Victorian legislation to create an Internet Election Committee to provide independent scrutiny for all electronic aspects of elections and the related manual operations supporting electronic voting.

8. The VEC should investigate the use of scanning or data entry of all ballots for the Legislative Assembly. This will provide a data file of preferences for all paper ballots which can be merged with electronic vote preference data. This approach avoids the need to print electronic votes as paper ballots to support a manual distribution of preferences.

3   Introduction

This submission responds to the following terms of reference provided to the Electoral Matters Committee.

- the forms of electronic voting currently utilised in Victoria and other jurisdictions and their effectiveness; and
- alternatives that are available that if implemented would ensure the continued integrity and security of the electronic voting system.

The submission also proposes an approach which the VEC could take to implement electronic voting and provides reasons for the author's recommendation of the proposed approach. Additionally, the author has made recommendations identifying the steps the VEC could take to implement electronic voting.

4   Background

The author of this submission was the CIO and manager at the NSW Electoral Commission and was responsible for the implementation of "iVote" at the 2011 and 2015 elections. iVote is NSW's electronic voting system. This system was recognised by the federal government for Excellence in eGovernment - Service Delivery at the Government ICT Award[1] in May 2016.

The author also has some 17 years' experience in the management of technology in the election process and has worked in the information technology area for over 30 years, with a particular emphasis on provision of technology within government agencies.

5   Why Electronic Voting?

Before considering if or what type of electronic voting should be adopted in Victoria it is important to understand why the current voting processes needs to change or at least change in part. The following sections outline the electoral process in Victoria's drivers for change.

5.1   Postal Voting

The postal service is dying[2] and along with it is the ability for the VEC to use post as a channel for voting. Unless Victoria is willing to stop using remote voting then an alternative has to be found to postal voting within the next two election cycles. The obvious and only alternative is the internet.

It should also be noted that internet voting has a lower failure rate than postal voting. Analysis of recent election returns show that internet voting using iVote had only 1.8% of voters who registered

---

[1] Winner of the 2016 11th Australian Government ICT Awards, Excellence in eGovernment - Service Delivery Category.
https://www.finance.gov.au/collaboration-services-skills/australian-government-ict-awards-program/
[2] Australia Post delivers $222 million loss as letter posting in 'terminal decline'
http://www.smh.com.au/business/australia-post-posts-222m-loss-letter-posting-in-terminal-decline-20150925-gjup78
Four graphs that show why Australia Post is in so much trouble
http://www.smh.com.au/business/four-graphs-that-show-why-australia-post-is-in-so-much-trouble-20150626-ghyvbe

not vote at all, while NSW Postal voting had 11.4% not voting and Victoria over 5%. Also worth noting in NSW that overseas postal votes are very problematic. At the last state election over 5,800 postal votes were sent overseas with only 129 entering the count[3].

5.2 Pre-poll Counting

There has been a phenomenal growth of pre-poll voting since in-district pre-poll voting was offered as an ordinary vote.

There are three problems with the large number of ordinary votes being taken as pre-poll.

1. at the end of pre-poll voting there is a large number of ordinary votes from a diverse set of districts which need to be initially counted and then sent to the correct district. Typically, the initial count has to be done in the pre-poll without the local scrutineers to ensure ballots for each district and region have been identified correctly (often ballots are placed in the wrong box).

2. there is a lack of scrutiny of pre-poll votes when counted, because typically they are counted in a sites post-election night and at a time when scrutineers (particularly for minor parties and independent candidates) are not available.

3. there is a difficulty counting pre-poll votes on election night. Pre-poll votes are becoming a larger percentage of the election and as such it is increasingly likely that on election night the results will not be sufficient to determine a close election for some close seats.

Electronic voting can address these issues as evotes cast in pre-polls should be available on election night with very little extra labour needed. It is proposed that these votes are cast using a verified paper trial which is the most trusted approach for most electors and does not need to be considered on election night.

It is also possible that evoting can work as a hybrid system; paper ballots for several local high volume districts and evoting for less used remote districts. This will limit the demands on the computers for evoting in pre-polls but vastly reduce the issues outlined in the above points.

5.3 Absent Voting

Absent voting has always been challenging for Election Management Bodies (EMB) because they required a large number of votes to be transferred between districts in a very short period of time. This is both a logistical challenge and handling/security risk. The full reconciliation of absent votes is not always possible prior to the final distribution of preferences (DoP), this means it is possible for absent votes to arrive at an RO's office after elections have been declared. It is then a matter for Commissioners deciding if the missing absent votes are electorally significant to determine whether a recount is required. Similar issues occur for overseas votes returned from consulates.

Electronic voting can reduce the number of paper based absent votes therefore allowing the votes to be available for the Distribution of Preferences (DoP) with no risk of logistical loss of votes.

---

[3] Postal vote data for the NSW state election 2015
http://data.nsw.gov.au/data/dataset/sge-2015-postal-vote-election-transaction-data

5.4 Interstate and Overseas Voting

The use of interstate and overseas voting centres to issue votes is problematic. The underlying assumption is that electors will be willing to travel to such centres to vote and do so at some inconvenience. iVote demonstrated that there were many more NSW electors outside of NSW on election day who would in all likelihood not have voted because voting would have been too difficult without iVote i.e. postal was too late and the delivery address unknown, interstate of overseas voting centre was too difficult to attend.

5.5 Remote Voters

Many voters live in regions which are not well serviced by polling places. These voters often have to make special trips to vote which is not a good use of their time and resources. Internet voting is one option to reduce that situation by providing a more efficient voting option.

5.6 Independent Voting

The Blind Low Vision (BLV) community have for many years been concerned they could not vote independently. They typically had to rely on friends, family or strangers to complete their ballot and vote. This meant they could not have a truly secret ballot. iVote overcomes this and allows blind low vision voters to independently vote either by DTMF phone voting or using an internet device.

5.7 Disabled Voting

Only a limited number of voting centres fully cater for disabled voters. iVote offers these voters the opportunity to vote from home using a phone or computer. A popular derivative of iVote is the use of electronic voting using a human operator as a proxy for the elector. This is particularly useful for those voters who have difficulty using computers but are able to speak on a phone such as elderly.

5.8 Improve Electoral Confidence

One of the interesting by-products of implementing evoting partially in an electorate is that it provides a second completely independent voting channel to which the paper vote channel can be compared. This comparison will not prevent electoral fraud but it will assist in the potential for the existence of electoral fraud or significant error to be detected.

6 Electronic Voting Requirements

6.1 Security & Risk

The only meaningful approach to risk assessment is to use a comparative risk approach. Appendix A provides an assessment of risks for the internet channel verse the current paper channel. It is not possible to entirely remove risk from internet voting. However, it is possible to implement a system where when the poll is declared there is a high level of certainty that the result is sufficiently accurate for stakeholders to be confident that the correct candidate/s has/have been elected. This is currently all that is able to be done for paper voting given errors in handling and counting of ballot papers and the ever present potential for vote tampering.

Internet voting systems are not the same as general office networks. They face many of the same threats but by their nature they are much less functionally rich and have well defined patterns of normal operation. This means that it is possible to monitor the operation of these systems and

detect anomalies with a higher level of certainty than more complex online systems. This means it is possible to identify more readily illegitimate activity on these systems.

It should be noted that even with the best intentions current paper voting systems have an expected failure rate. There is failure in electors multi voting, failure in postal votes being lost in the mail or not received in time by electors, failure in absent and other declaration votes envelopes not being completed correctly, failure in counting and handling of votes, etc. In general terms these failures represent a small percentage of the votes cast but they can be significant in terms of electoral outcome. In general terms the failure associated with internet voting systems is lower in normal operation but it is arguable that if a failure did occur it could be very significant, however if internet voting is done with paper voting a major failure in either channel is unlikely to occur without detection.

There will always be a chance that an attacker will breach an internet voting system and corrupt votes. The author believes the probability of this happening is low and happening without detection is very low. A significant amount of monitoring is present in internet voting systems used for parliamentary elections, there is also the verification system used by electors and the end to end verification done by auditors. Finally, if a breach did occur and votes were tampered with it would be expected that the ratio of internet votes for given candidate would differ from the paper votes for the same candidate. The author does not believe, as has been suggested by some computer science academics, the wrong person will be elected undetected, it is more likely the worst case scenario is that a re-run election will be required, as happened in WA.

6.2   Integrity & Scrutiny

The key issue with any electoral system is they must be trusted. Experience in NSW at the 2015 election has shown that iVote was trusted despite some negative media coverage. An independent post-election survey identified 98% of people that used the system would recommend it to others.

The current scrutiny processes used in NSW for technology assisted voting relies on the traditional scrutiny process, where scrutineers are nominated by either parties or candidates. Although this process is suitable for paper voting it needs augmentation for electronic voting. Effective electronic voting scrutiny requires a level of technical knowledge which is not commonly found in traditional scrutineers. In particular, with iVote the audit of the decrypted votes with the verified votes must be done by independent persons who need to be appointed by the Commission. The technical skill required for this process is not consistent with the normal skills of scrutineers.

This type of issue was addressed in Norway by introducing an electronic voting election board. This board was appointed by the equivalent of the electoral matters committee and comprised non-political persons with specific technical skills in electronic voting. It is a recommendation of this submission that a similar approach is taken in Victoria.

Finally, the introduction of electronic voting provides a second independent voting channel. The level of independence of the electronic voting channel allows it to be used as a benchmark for other voting channels. That means if the paper and electronic channels align the election outcome is almost certainly tamper free. This improves elector's trust in the electoral outcome.

Absolute security is often put forward by computer security experts as a minimum standard for internet voting but the post-election survey results for iVote that it is not needed for electoral trust. The current paper based electoral system bares testament to the fact imperfect systems are still trusted by the public.

6.3 Elector Vote Verification

Verifiability of votes by electors is an essential part of an acceptable electronic voting system. The following sections outline the verification approach considered suitable for Australian elections.

6.3.1 Attendance Voting

It is recommended that attendance voting at pre-polls and polling places use a paper docket for verification. The docket would be printed at the time of voting and then inspected by the voter, if they were satisfied with the vote it would be placed in the ballot box to allow a verification audit of the electronic count post close of poll. This approach is widely accepted by most electronic voting sceptics as the most acceptable verification practice and is easy for the elector to understand. Note in event of as dispute the paper docket vote would be taken as the vote.

6.3.2 Remote Voting

Verification of remote votes should be done using a separate communications channel to the voting channel. iVote uses a separately managed phone server over the public switch phone network (PSTN). This approach provides a means by which voters can verify their internet vote over a standard phone connection which is typically a different communications channel to that which they voted.

6.4 End to End Verifiable

In addition to verification of votes by the elector the electronic voting systems also needs to be able to be verified from end to end. Academics have a somewhat strict definition on what this means but in layman terms it means that a votes provenance can be traced from casting to the declaration of the results.

The current paper voting system does not have full end to end verification. All current practices with paper votes assume that the last count is correct and also assumes good chain of custody. iVote has various techniques which gives a high level of certainty that a vote both transverses the internet system unchanged and is decrypted as captured.

vVote claimed end to end verification is intrinsic in its design. This may be theoretically correct but at the last general election this was not achieved, as it was found that various aspects of the verification process were too unwieldy to implement[4] and as such were not used. Hence end to end verification was not achieved due to the complexity of verification techniques. See report by Wen and Buckland[6] section 2.1.

Additional verification is provided by an independent audit of votes as decrypted with votes held on the verification server – see section 6.4. This approach ensures the verification of votes from end to

---

[4] blank ballot verification audits were not conducted

end, albeit that some of this verification is not done by the elector. NSW considered that this audit process was sufficient to identify tampering of an elector's vote.

6.5 Cost Effective

The author has assessed marginal cost per vote for internet voting as about half that of the cost of a paper vote issued at a general election if the internet voting involves more than 200,000 votes. This would potentially mean that the total cost of elections could be reduced by 5% to 10% if internet voting was used introduced in Victoria for about 10% to 20% of the votes issued. This figure assumes a shared cost of maintenance and support for the internet voting system and a reduction in election officials, venues, paper ballots and rolls.

6.6 Scalable

The system needs to be able to scale to handle some 20% of the votes taken at a general election. This would mean in Victoria a system which could take some 800,000 votes reliably and cost effectively. iVote is able to scale to this level while vVote and other pure attendance voting systems would not.

6.7 Comprehensible

It is very important that an evoting system must be comprehensible. It is important that electors can quickly understand how the system works and the controls in place to ensure the systems integrity. The important point is that security controls are meaningful to the elector not just academically desirable.

The report by Wen and Buckland[6] section 2.1 said "The vVote system is the most complex e-voting system ever developed and implemented". The author would agree with this statement. Although iVote is technically complex it is relatively easy to explain its voting protocol and associated security features.

6.8 Attendance & Remote Voting

An evoting system for Victoria should be able to cater for both remote and attendance voting and offer various voting interfaces. Many blind low vision voters want to use DTMF voting options while others want to talk to a computer operator. Also the system must be able to be deployed in voting centres using standard computer end points.

6.9 Supportable

One of the key issues facing agencies beginning to use electronic voting is whether they can afford to maintain the technology over the long term. The skill and knowledge required to support iVote on an ongoing basis is more than any one Australian Commission can easily afford or reasonably expect funding over the longer term. The high cost is driven by the need to maintain the specific knowledge and skills required to operate the system in the Commissions, they cannot just rely on specialist contractors to provide this input periodically.

6.10 Coercion Resistance

Voter coercion is in some countries a significant issue, however in Australia it generally not considered to be an issue which will affect the outcome of elections. Coercion resistance is considered a desirable property for any election system but in Australia the main property required

is for the voter to be able to cast a new vote if they have been coerced. See paper by Associate Professor Rodney Smith [5]

6.11 Remote Voting

Postal voting is dying[3] and as such evoting is the only viable replacement. Intrinsically a replacement for postal voting has to be able to be accessed remotely. Remote voting is also essential to address problems with travellers both interstate and overseas which cannot easily be serviced by postal voting or consular offices.

7 System Options

7.1 Possible Options

The following are the most relevant evoting options available at this point in time.

7.1.1 NSW iVote

NSW iVote system was developed for about $6M and is a currently supported and operational system used for parliamentary elections in NSW. iVote is capable of operating as both an attendance and remote voting system and is able to be used by human operators to take votes on behalf of electors or allow electors to vote directly using a browser over the internet on a mobile or desktop device or a phone using DTMF touch tone dialling. It also offers elector verification and is end to end auditable.

7.1.2 Victorian vVote

The vVote system was developed by the VEC as a new end-to-end verifiable attendance electronic voting system. The development was done at a significant cost and effort to the state of Victoria. Various claims have been made about its electoral effectiveness for parliamentary elections which I am sure the committee is familiar and as such I will not pursue further. vVote is a novel evoting system which appears to have been developed primarily from a researcher perspective, not a voter or electoral authority's perspective. It is the author's view that vVote will not scale either easily or cost effectively. vVote is not amenable for remote electronic voting, it is not comprehensible by even the most technically sophisticated voters or indeed many electoral officials.

It has become apparent to the author over the past few years that many people who have supported vVote do not appear to fully understand its voting protocol, nor do they understand why these features are necessary for the system's electoral integrity and security. It is not surprising therefore that many voters do not appear to understand how the system works.

A lot has been written on the vVote system and a lot of claims have been published in academic journals. I believe the committee should take careful note of the points made in the submission

---

[5] Internet Voting and Voter Interference, A report prepared for the NSWEC, Associate Professor Rodney Smith, Sydney University, Department of Government and International Relations, 2013.
http://www.elections.nsw.gov.au/__data/assets/pdf_file/0003/118380/NSWEC_2013_Report_V2.0.pdf

made by Wen and Buckland in the inquiry into the 2014 state election[6]. I believe this report gives a fair assessment of the operation of vVote at the election and identifies issues which raise questions about vVote's longer term suitability for large scale operation in Victorian elections.

7.1.3   New System

A new system could be developed by the VEC. This would be the third system the VEC has developed and could reasonably be expected to cost in excess of the amount spent by NSW should a system of similar functionality be required. Given there is not definitive voting protocol agreed by "experts" it is unlikely that voting system developed by the VEC would be any better accepted than iVote.

7.1.4   Do Nothing

This is an option which needs to be stated but the author believes it is not viable, given the reasons stated in section 5. If it is accepted that evoting will be needed in the medium term in Victoria, then the VEC needs to develop and <u>maintain a capability in evoting</u> now. The development of this capability takes time and requires the VEC to have ongoing position/s in the organisation with this responsibility. These positions will require a mixture of technical and business skills which are not readily available in the general employment market so they will have to be developed internally by the VEC and other election bodies around Australia.

7.2   Selection Criteria

This section outlines the selection criteria for an evoting system for Victorian parliamentary and local government elections.

1   Integrity – the system must be able to reasonably ensure that an electors vote is counted as cast and the electors voting intentions can reasonably be only verified by the elector. The system integrity must be comparable to that of postal voting.

2   Security – the system must be able to reasonably ensure that an electors vote is counted as cast and the elector has reasonable grounds to believe their vote has not been tampered with or deleted or another vote added to the system. The system security must be comparable to that of postal voting.

3   Accessible – the system must be able to address the needs of disabled voters.

4   Scalability – system must be able to scale to be able to take about 10% to 20% of the electorates votes and offer cost savings on the comparable paper voting system.

5   Experience – The system must have been used successfully in other jurisdictions in Australia

6   Lower comparable risk – the risk of the system must be acceptable with respect to the voting process it is replacing.

---

[6] Submission to the Inquiry into the Conduct of the 2014 Victorian State Election, Problems with E-Voting in the 2014 Victorian State Election and Recommendations for Future Elections, Roland Wen1 Richard Buckland, July 2015.
http://www.parliament.vic.gov.au/images/stories/committees/emc/2014_Election/Submissions/No_12_Dr_Roland_Wen_and_Associate_Professor_Richard_Buckland.pdf

7   Development costs – The cost of developing a system for the local electoral environment is significant. There is not a comparable environment overseas and the size of many Australian ballots coupled with the complexity of the voting methods means any existing overseas system used in Australia must be customised.

8   Support costs – the support arrangements for the system should be manageable and ideally shared with other jurisdictions.

9   Coercion Resistance – elector can vote the way they want to not as others want them to.

10   Remote voting – ability to vote away from a polling place using a personally controlled phone or computer device.

7.3   Option Analysis

Appendix B is an assessment of the options outlined in section 7.1 against the criteria in section 7.2. The analysis shows that iVote is the most viable solution at this point in time for the VEC.

8   Proposed eVoting Solution

The options analysis identified the iVote system is the most appropriate choice for Victorian electronic voting. The following sections identify the proposed evoting solution for Victoria taking into consideration the reasons for evoting outlined in section 6 and drivers for evoting identified in section 5.

8.1   Verifiable

iVote offers electors an ability to personally verify their vote and the confidence of an independent audit process that their vote has been counted as cast. This will be for:

- Remote voters[7] will verify their vote by using the DTMF phone based verification system which speaks the elector's preferences back to them.
- Attendance voters at pre-polls and polling places by a printed docket which creates a verifiable paper trail for their vote.

8.2   Security

Security of iVote is greater than the security of most computer systems connected to the internet. Most computer breaches occur on large general purpose networks which are very hard to secure by virtue of their size and diversity of usage. iVote is a small dedicated system that only has a limited functionality and low transactional complexity which is closely monitored for anomalies and unexpected behaviour. This type of system is easier to secure than a general purpose network hence a comparison to breaches on general purpose networks is not directly relevant.

It will always be possible to identify a potential vulnerability in any computer system. There are many vulnerabilities identified every year[8] and not all are patched. It will always be the case that

---

[7] Includes voters using personal devices remotely and interstate attendance voters at election body designated venues using supplied devices.
[8] Common Vulnerabilities and Exposures, The Standard for Information Security Vulnerability Names, Total CVE-IDs: 76555

iVote will have allegations of vulnerability made against it and threats of attacks and breaches. Even at the 2015 election when the system was identified as vulnerable to a FREAK attack, this was a very recently identified attack which reasonably would have been detected should it have occurred on mass. It should also be noted that this attack required a significant technical resource to execute so unlikely to have been implemented and as such real threat. The relevant question to ask is what is the likelihood of a given viable attack strategy occurring and can it be detected if it occurs.

The basic concept of iVote security uses traditional people, process and technology approach with segregation of communications channels, data and people to reduce the possibility of attack.

8.3   Eligible electors

It is recommended that the Victoria considers a minimal implementation which includes the following elector groups;

- Blind low vision voters
- Unable due to disability to attend a polling place on election day
- Absent voter at any venue voting early or on election day
- Voting at a remote venue under the control of the VEC at either an interstate or overseas location

It is anticipated that the first two categories could result in some 10,000 to 20,000 voters at the next parliamentary election, while the last category could be as much as 50,000 to 100,000 depending on the number of pre-poll and polling place venues the system was installed.

It is also recommended that the Victoria considers an adding, in addition to the above categories, electors who will be interstate and overseas on election day and use their own device to vote. This could result in an additional 200,000 voters.

8.4   Operational Features

The following tables identify the features of the iVote system proposed for use in Victoria.

	Voting device		
Voting Type	**Std. Phone**	**Smart phone**	**Laptop/ Desktop**
Remote voting^ - interstate attendance, remote phone with human operator and remote internet voting using browser on mobile or desktop, DTMF phone voting. Using phone voice verification.	√	√^^	√
Attendance voting – pre-poll and polling place. Using paper docket verification.			√*

^   voter uses remote verification system to verify their vote

^^ voter should use a normal "dumb" to vote but could use smartphone as a telephone to vote over the PSTN. Use of a smartphone to phone vote is not recommended for security reasons.

*   the voter uses computer provided by the VEC and receives a paper docket to verify their vote which is placed in a ballot box before they leave the polling place.

---

https://cve.mitre.org/

The following table shows the different type of voting with voting protocol vs device that should be available with the proposed system.

Voting protocol for each voting type	Voting device		
	Std. Phone	Smart phone	Desktop/ Laptop
Remote voting over Internet using browser & receiving iVote number by SMS or email and verification using remote verification system over PSTN	Verify	Vote & Verify^	Vote
Attendance voting at interstate Venue over Internet using browser on computer provided by the VEC. iVote number provided in the system and verification using remote verification system over PSTN	Verify	Verify	Vote
Attendance voting at pre-poll or polling place over Internet using browser on computer provided by the VEC. iVote number provided in the system and verification by paper docket			Vote Commission Supplied
Remote over PSTN using DMF phone iVote number provided by SMS or email or operator calling and verification using remote verification system	Vote & Verify	Vote & Verify^	Vote^^
Remote over PSTN talking to an operator receive iVote number by SMS or email and verification using remote verification system	Vote** & Verify	Vote** & Verify	Operator*

^   voter could use smartphone as a telephone to vote over the PSTN but this is not recommended for security reasons

^^ voter could use skype or similar VOIP service vote over the PSTN but this is not recommended for security reasons

*   the operator enters the vote into a computer using same system as remote internet voters

** the voter uses a phone to talk to an operator

8.5   Management of Preference Data

At the 2015 NSW state election, the NSW Electoral Commission (NSWEC) data entered all the Optional Preferential Legislative Assembly ballot preferences[9]. This allowed the iVote preference data to be merged with data from paper votes for the DoP. The alternative would have been to print iVote ballots to allow a manual distribution of preferences. It is recommended that the VEC consider either data entry or scanning of the Victorian full Preferential Legislative Assembly ballot preferences to remove the need for printing of electronic ballots and a manual DoP. The NSWEC also found that having all preferences as data allowed the creation of a variety of reports[10] which were able to show preference flows. The raw preference data and reports proved very popular with the

---

[9] VTR Legislative Assembly preference file for Albury
http://pastvtr.elections.nsw.gov.au/SGE2015/la/albury/preferences/index.htm

[10] NSW STATE ELECTION RESULTS 2015, State Electoral District of Albury, Two Candidate Preferred
http://pastvtr.elections.nsw.gov.au/SGE2015/la/albury/tcp/tool/index.htm
Contribution of Preferences from First Preference Candidate
http://pastvtr.elections.nsw.gov.au/SGE2015/la/albury/dop/cont_pref/index.htm

public and psephologists. A number of analysts publish data after the election based on the raw preference data provided[11]. The publication of the data also allowed the distribution of preferences to be validated.

The Legislative Council paper ballots are currently entered into a computer hence the merging of iVote ballot preference data would continue to be merged into the other preference data in lieu of paper ballots being created and then data entered.

8.6 iVote Support Collaboration

The roll of technology in elections is challenging the ability and budget of many Australian election bodies. Given that the election processes in Australia follow a common pattern it is reasonable to believe that a common supplier will be able to provide a set of technology solutions which will meet the needs of most election bodies. The strategy questions which Australian electoral bodies collectively need to address is whether they want to individually work with 3rd party suppliers to obtain their own customised technology solution, or work jointly with a commonly owned and governed organisation which will provide technology for jurisdictions in Australia.

In addition to internet voting the activities of a commonly owned and customer focused organisation could involve the provision of other voting technologies including but not limited to electronic mark-off, election management systems and enrolment management. These could be added over time as demand and interest dictated.

This entity should have a shared governance by all participating election management bodies involved and may follow the structure used by PSMA[12]. The initial focus of such a body should be the management of iVote as a common platform for the delivery of electronic voting for subscribing Australian jurisdictions.

8.7 Internet Election Committee

Scrutiny of electronic voting is quite different to the scrutiny of other election processes. Effective scrutiny of electronic election processes requires some knowledge of the underlying technology.

In keeping with the current legislation related to electronic voting in Victoria[13] integrity in the process must not only be maintained but also be perceived to be maintained which is best achieved by independent overview. To achieve this level of integrity it is recommended an independent Electronic Election Board be established to provide effective scrutiny for all aspects of elections, where the votes are returned electronically and without a paper record.

---

[11] The Impact of How-to-votes on who Voters Preference Last, Antony Green Election Blog.
http://blogs.abc.net.au/antonygreen/2015/09/the-impact-of-how-to-votes-on-who-voters-preference-last.html

[12] PSMA Australia Limited is a company owned by state, territory and Australian governments, established to coordinate the collection of fundamental national geospatial datasets and to facilitate access to this data.
https://www.psma.com.au/our-history

[13] Electoral Act 2002, No. 23 of 2002, 110F Security arrangements
The Commission must ensure that arrangements are in place to ensure that - (b) the integrity of voting is maintained while electronic voting is being used.

The current approach of ensuring election integrity through the use of partisan scrutineers does not, in the view of the author, provide effective oversight for complex electronic systems, because scrutineers typically do not have the knowledge needed to effectively audit complex computer systems.

The use of specialist boards to deal with technology issues in election process has been implemented in other jurisdictions. In particular Norway implemented an Internet Election Committee (IEC) for their internet voting election trials in 2013 which had oversight of the trials with a particular focus on security. More information about the committee's work can be found in The Carter Centre's report[14].

Members of a board for Victoria should have both experience in and/or knowledge of electoral process and also have expertise in the management and use of information technology in mission critical business environment. Members of the committee should also collectively have expertise in cryptography and cyber security and security audit processes.

The board should provide reports to the VEC during the election period of any issues identified and post-election provide the Electoral Matters Committee a full report on the integrity of all aspects of the election process which only have voting records held electronically.

The board members should be selected by the electoral matters committee on a bi partisan basis prior to each electoral event or be appointed for a period to cover events in that period. The board could be constituted using normal Victorian board guidelines[15]. The board should be remunerated for time spent in session and conducting audits. The board should be able to engage specialists to report on specific issues. The board should hold a part of the election decryption key in conjunction with the Victorian Electoral Commissioner.

9   Conclusion

The increased use of technology in society is forcing many election bodies to evaluate their relationship with the community they serve. In many ways elections have been late in using technology for a range of reasons. Some of the reasons are prudent while others seem to reflect more of an ideological opposition to the use of computers in elections. There are certainly traps for electoral authorities related to the inappropriate use of technology and the committee must guard against these traps. Fundamentally any new technology should not increase unacceptably the risk of failure of an election compared to the current system.

The decisions made by the committee about not only the use of internet voting but also the way technology is to be managed will be critical to the successful expansion and acceptance of

---

[14] The Carter Center, Expert Study Mission Report, Internet Voting Pilot: Norway's 2013 Parliamentary Elections, 19 March 2014
http://www.cartercenter.org/resources/pdfs/peace/democracy/carter-center-norway-2013-study-mission-report2.pdf
[15] The Department of Premier and Cabinet (DPC), Victorian Appointment and Remuneration Guidelines for Boards, 1 July 2016
http://www.dpc.vic.gov.au/images/documents/dpc_resources/legal/2015/Appointment_and_Remuneration_Guidelines_-_Effective_from_1_July_2016.PDF

technology in elections. Factors like electoral integrity and security must be preserved with the increased use of technology in the election process with the drivers for change being the maintenance of participation and relevance of the electoral processes in a modern technology immersed society.

Appendix A – Comparative Risk Analysis

The table below compares risks between electronic voting and paper voting supporting section 6.1.

	Mitigation	
Risk	**Paper Ballots**	**Electronic Voting**
Impersonation	Using the current paper ballot approach potential voters only require a verbal declaration identifying themselves. The declaration requires them to know a name, DoB and address on the roll.	Similar to current paper ballot approach requirement but with option to provide additional information such as drivers licence or passport number or be sent a registration acknowledgement to their enrolled address.
Cast as intended	Elector can vote incorrectly causing their vote to be informal. General informality for paper ballots between 3% to 6%	Guided to ensure vote complies with formality rules. Must make active decision to cast informal vote. Informality typically about 1%.
Captured* as Cast	Once the ballot paper is placed in the ballot box the voter must trust the Commission. Independent scrutiny is sporadic and mainly focused on polling place votes. The 30% of declaration votes are typically counted without independent scrutiny.	Voter can verify their vote has been decrypted by personally checking the vote appears on receipt website. Also independent auditor will confirm the votes decrypted match the votes available for verification.
Counted as Captured*	Trust the Commission staff manually counts the ballot papers correctly.	Published preference data which is validated by auditors and electors can be counted by anyone to check the count is correct. Compare to paper ballot results.
* Captured - is for paper ballots when the ballot box is emptied or declaration envelope is opened or for iVote is when the ballots are decrypted.		

	Mitigation	
Risk	**Paper Ballots**	**Electronic Voting**
Tampering	It is difficult to identify evidence of vote tampering with paper ballots.	Vote encrypted by voter's computer and not accessible by the Commission or others until decrypted. Decrypted votes matched to separately stored votes used for verification. Also compare iVote results to paper ballots results to ensure consistency in voting patterns.
Ballot Box "Stuffing"	It is difficult to identify evidence of ballot papers which may resulted from ballot box "stuffing".	Ongoing monitoring of registrations against votes would identify stuffing at time it occurs and potentially allow added papers to be identified and removed. Compare to paper ballots results.
Integrity	Integrity of paper based elections relies on Commission staff following procedures and being trusted.	Combination of technology and procedures give the ability to be confident votes are counted as cast. Compare to paper ballots results.
Ballot Secrecy	Ballot secrecy is persevered in ordinary polling place voting but secrecy could be breached for declaration votes as the voter's details are available to Commission staff at the time of opening the declaration envelope.	Voter identity is held separately from the actual preferences voted by a given voter. Voters can not be associated with their vote without very significant breaches of multiple systems security.

Appendix B – Option Analysis

The following table analyses the options outlined in section 7.1.

Criteria (see section 7.2)	Options (see section 7.1)			
	iVote	**vVote**	**New System**	**Do Nothing (Current paper voting process)**
Integrity	Comparable to current electoral processes	Purported to be of high integrity but not well understood by community	No new systems on the horizon that will offer significant improvements in integrity. Block chain may be a viable technology in the future.	Accepted by the community but not effectively tested or provable.
Security	Relies on careful configuration and management. Breaches should be detectable.	Similar to iVote but claims that all breaches can be detected. However full security features have not been implemented to date.		Vote tampering and other electoral fraud techniques are possible and have occurred in the past. Generally, it is considered that errors are more likely to be a problem than fraud.
Accessible	Accessibility is a key feature with range of voting interfaces available.	Is considered to have an accessible user interface but it is doubtful that a BLV elector could perform all the verification techniques required to ensure integrity.	Accessibility should be a key feature of any new system developed.	Paper voting has several accessibility issues which cannot readily be overcome.
Scalability	iVote in its current form would be able to capture at least 1M votes which is well in excess of the proposed vote demands for Victoria. Infrastructure is the main constraint	Unknown scalability but currently has only been used for very small number of votes.	Should not be an issue if engineered correctly.	Access to human and venue resources are the main constraints in the scale of the current system's operation. Also the demise of the postal system could create problems for postal votes particularly for LG elections.

Criteria (see section 7.2)	Options (see section 7.1)			
	iVote	vVote	New System	Do Nothing (Current paper voting process)
Experience	iVote has been used for a parliamentary election in NSW and captured a significant number of votes.	Very limited usage	Unknown	Long known history
Lower comparable risk	See Appendix A	It is asserted that vVote is secure	Unknown	See Appendix A
Development costs	The development cost of iVote and vVote are sunk costs and not expected to be recovered.		A new system would have a significant development cost. Potentially in excess of $5M.	No cost.
Support costs	The support costs for iVote can be shared between several electoral authorities	Unlikely vVote will be used by any other electoral authority in Australia hence VEC would have cover all support costs.	The support costs of a new system would have to be covered by the VEC with the risk they will be the only users.	Current costs of creating an election.
Operating costs	Marginal cost of a vote would be about $7	Unknown but potentially comparable to paper voting	Unknown	Marginal cost of a vote would be about $14
Coercion Resistance	Non but not considered an issue in Australian elections as long as other voting options are available and the elector can revote.	Claimed to be coercion resistant but does not prevent family influence in the polling place.	There are no definitive anti coercion evoting systems in operation	Postal voting which is the main vote type being replaced by internet voting and it has a high potential for coercion.
Remote Voting	Able to vote on the voter's personal phone or computer at a remote location or at a venue managed by the Commission.	Only suitable for attendance voting.	Would need to be able to take remote votes.	Postal is remote vote and normal pre-poll and polling place voting is attendance voting.