

Inquiry concerning NSW iVote Internet and Telephone Voting System

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Date: 28 December 2017

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Executive Summary

The submission advocates the limited use of iVote for attendance voting and remote electronic voting. The following are the factors driving its proposed continued use in NSW:

- Demise of Postal Voting as a viable voting channel
- Dramatic increase in Pre-poll voting and difficulties managing the timely and accurate counting of these votes
- Difficulties of managing absent voting
- Current paper system inadequacies, which iVote could manage more reliably e.g. interstate and overseas voting, postal and absent
- Difficulties faced by voters living in remote locations
- Inability of blind voters to vote independently with current paper ballots
- Difficulties of disabled voters to attend 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 NSW's ongoing electoral needs and is able to scale cost effectively. The following is a list of these requirements in no specific order.

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

NSW only has two main options for iVote at SGE 2019. One is to retain the current iVote system (or an enhanced version of it), the other is to cease using electronic voting. The latter requires voters to revert to prior inadequate and demonstrably flawed paper voting procedures for the votes now taken by iVote eg interstate and overseas. A third but unacceptable option is to completely redevelop iVote for SGE 2019. This option is unacceptable because of the risk of not completing it on time and the lack of time to communicate the benefits of this change to stakeholders.

This submission recommends the limited use of an enhanced iVote for SGE 2019.

The submission also outlines new features for the proposed enhanced iVote system. It also recommends a new support and governance environment which will ensure stakeholder trust of iVote will be improved and also will improve trust in other electronic systems which NSWEC currently uses to capture and count votes in NSW.

Recommendations

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

1. Use enhanced iVote for the coming State General Election in March 2019 with at least the current eligibility criteria and improved transparency.
2. Amend legislation to extend electronic voter eligibility to attendance voting at both pre-polls and polling places and use it to capture a portion of absent votes. This would in particular allow iVote to be used for out of district attendance iVoting for all pre-polls and selected polling places on election day. These votes would be verified using paper receipts.
3. Modify iVote to include the attendance vote verification using printed docketts.
4. NSWEC develop a collaborative support arrangement with other jurisdictions interested in using iVote. This arrangement should share the support resources and costs for iVote and should be independent using a shared governance structure.
5. Amend NSW legislation to create a Technology Election Committee to provide independent scrutiny for all electronic aspects of elections and the related manual operations supporting electronic voting.
6. The NSWEC should continue the use of data entry of all ballots for the Legislative Assembly and Council. This will provide a data file of preferences for all paper ballots which can be readily 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 which is a major cost saving and reduces counting and handling errors.
7. Amend NSW legislation to allow iVote preference data to be merged with the electronically captured preferences of paper ballots without the need for iVotes to be printed as paper ballots. iVote preference data should only need to be available as an electronic rendition of the paper ballot in a pdf form.

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1 Introduction

This document is a response to the NSWEC call for submissions in support of an inquiry of the iVote system for the 2019 State General Election (SGE) by Mr Roger Wilkins. The terms of reference of the report are:

1. Whether the security of the iVote system is appropriate and sufficient.
2. Whether the transparency and provisions for auditing the iVote system are appropriate.
3. Whether adequate opportunity for scrutineering of the iVote system is provided to candidates and political parties.
4. What improvements to the iVote system would be appropriate before its use at the 2019 State General Election.

2 Author Background

The author of this submission was the CIO at the NSW Electoral Commission and as part of that role 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 Award¹ 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.

He is currently consultant and adjunct academic at the UNSW Faculty of Engineering school of Computer Science and Engineering with a practice and research focus in the area of cybersecurity and governance.

3 Why Electronic Voting?

Before considering if we should use iVote or what type of electronic voting should be adopted in NSW for the 2019 State General Election (SGE) it is important to understand the benefits iVote provides over current paper voting processes. The following sections outlines why we should continue to use iVote.

3.1 Postal Voting

The postal service is dying². Australia Post identified that letter services dropped by 11.8% in their FY 2017 annual report. Currently the voting period allowed for postal votes is only 2 weeks. This is not

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'

adequate for many voters as the cycle time for a vote is 11 days. The ability for the NSWEC to use post as a channel for voting is reducing as the postal service reduces. Unless NSW is willing to stop using remote voting as an option for electors 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 SGE 2015 election returns show that internet voting using iVote had only 1.8% of voters who registered and did not vote at all, while NSW Postal voting had 11.4%. Also, worth noting is that NSW overseas postal votes is very problematic, at the last state election over 5,800 postal votes were sent overseas with only 129 entering the count³.

3.2 Pre-poll Counting

There has been a phenomenal growth of pre-poll voting since in-district pre-poll voting was offered as an ordinary issued vote as opposed to being a vote requiring a declaration envelope.

There are three problems with the new approach of taking ordinary issued votes in pre-polls.

1. at the end of pre-poll voting there is a large number of ordinary votes potentially from a diverse set of districts which need to be initially counted and in some cases 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 at the pre-poll site post-election night which is 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 (evoting / evotes) can address these issues as evotes cast in pre-polls should be available on election night with very little extra labour needed. If these votes are cast using a verified paper trail, which even the most ardent anti internet voting activist approves, the significant pre-poll vote result can be known on election night along with the all the absent pre-poll. Verification of this results can then be done post election night with a risk limiting audit⁴.

<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>

³ Postal vote data for the NSW state election 2015

<http://data.nsw.gov.au/data/dataset/sge-2015-postal-vote-election-transaction-data>

⁴ Colorado leads the way with risk limiting audits, First-ever RLA shows accuracy of elections in The Centennial State, By M. Mindy Moretti, Nov 2017, Electionline.org

<http://www.electionline.org/index.php/electionline-weekly>

It is also possible that evoting can work as a hybrid system; some paper ballots for in-district votes during high volume periods at pre-polls and evoting only for absent pre-polls. This will limit the demands on the computers for evoting in pre-polls but vastly reduce the number of ordinary issue paper votes as the peak pre-poll usage is only in the last few days before election day.

3.3 Absent Voting

Absent voting has always been challenging for the NSWEC and other Commissions in Australia, because they require a large number of votes to be transferred from polling places and pre-polls to 93 separate district returning offices in a very short period of time post-election day. This is both a logistical challenge and a very significant handling/security risk.

It should be noted that the full reconciliation of absent votes⁵ against issuing documentation is not done prior to the final distribution of preferences (DoP) being completed and results declared, in fact it generally is not done at all in any jurisdiction in Australia. Full reconciliation would involve each issuing point's documents being examined and compared with data captured in preliminary scrutiny, a very expensive and tedious task.

The standard procedure is to assume all absent votes which to arrive at a Returning Officer (RO)'s office for preliminary scrutiny, at the designated cut off time, are all the votes taken for that district. Unfortunately, this sometimes is not a valid assumption. At the State General Election (SGE) in 2015 there were over 1,500 absent declarations NOT available prior to the declaration of all candidates for the Legislative Assembly (LA). Human error in two RO offices was the reason for this omission⁶. Every general election the author has been involved a similar problem to that identified above has occurred. Also, issues have always occurred with declaration overseas votes returned late from consulates. These votes regularly do not arrive back on time to be included in the count.

Pre-poll and polling place attendance electronic voting could reduce the risks associated with mishandling of paper-based absent votes and would also allow the initial count for these votes to be published on election night along with other in-district polling place results.

3.4 Mishandled and Lost Ballots

There is a misconception by the public, evoting security experts and some election officials, that votes cast using paper ballots are a "gold standard" in terms of electoral security and transparency. This argument has some truth where in-district votes are cast in a polling place which is well scrutinised. The main advantage of polling place scrutiny is that scrutineers are typically present during the initial count and witness the count process and attest to the reliability of the result sent to the NSWEC website on election night.

⁵ Reconciling absent votes which undertake preliminary scrutiny vs votes issued documentation from each issuing polling place or pre-poll.

⁶ Bags of absent votes were mistakenly left in Dubbo and Broken Hill RO offices and only discovered after the Legislative Assembly (LA) count was completed and results declared. These votes were then forwarded to Sydney and the Commissioner determined their inclusion in the count would not change the electoral outcome for the LA. The declarations were scrutinised and then then included in the Legislative Council (LC) count.

However, it does not hold that all other vote types which are not counted on election night with effective scrutiny satisfy the “gold standard” concept set out above. Typically, when these other votes from pre-polls and absent votes are counted they have limited scrutiny as they are counted after election night and in venues not convenient to scrutineers and in a large “factory” environment which is difficult for independent scrutineers to effectively operate. These ballots can make up in some elections more than 30% of the votes taken.

The author’s experience is that votes which are not counted on election night with effective scrutiny are not as reliable as polling place in district results. This observation is based on the author’s analysis results for NSW general elections from 2004 to 2015. He observed many discrepancies in the results for votes counted in central locations. The most worrying discrepancies were typically due to mishandling of votes, not miscounting.

A common problem is ballots being simply misplaced in an RO’s office or lost in transit, from the Polling Place to the Returning Office. Ballots were regularly misplaced when they were accidentally mixed with unused ballots which were bundled separately for storage and disposal post-election. In the SGE 2011 2,800 LC ballots were accidentally merged with unused ballots which were stored in the Riverstone RO office ready for disposal. These ballots were only identified as missing at the end of the LC data entry when this large discrepancy became apparent. A NSWEC officer and her husband went to the Riverstone RO office on a Sunday morning (because the RO was disaffected and refused to help) to try and find the missing ballots. They found them mixed with the unused ballots, this was just prior to the garbage trucks arriving on Monday and the count being done early the following week.

There are always a large number of smaller discrepancies in election results which are simply not followed up as it would take too long and require too many resources and generally is considered unlikely to have any electoral impact. The decision not to resolve these discrepancies is also justified on the premise that the apparently missing ballots “must have be here somewhere”. It is interesting to note that comparing votes from recounts with previous count shows that about 20% of the errors found in a recount it can be shown that the election night count was correct and the final count (done before the recount) was in error, this is obviously not an issue with iVote.

Also, there is general agreement within electoral circles that the ability of temporary staff to manage manual processes is actually decreasing with time. At the SGE 2015, five of the 93 returning officers “walked out” prior to election day. Similar losses were experienced in 2011 and indeed by other electoral authorities. Interestingly, Tom Rogers the AEC Commissioner, said in his introduction to the AEC’s submission to the current federal electoral matters committee⁷ “*I believe the temporary staffing model [is] at the end of their useful life*”. The AEC made further comments on the viability of the current temporary work force staffing and training models in their supplementary submission⁸. They said “it presents significant risk for the AEC”.

⁷ AEC Submission to the Joint Standing Committee on Electoral Matters

<https://www.aph.gov.au/DocumentStore.ashx?id=03788bba-c5aa-462d-9e05-0c8a67cad7ac&subId=459579>

⁸ Inquiry into and report on all aspects of the conduct of the 2016 Federal Election and matters related thereto Submission 66 - Supplementary Submission 18.

<https://www.aph.gov.au/DocumentStore.ashx?id=e14466fd-9ea1-495e-b8ee-1d4852a65ce0&subId=459579>

3.5 Interstate and Overseas Voting

The use of interstate and overseas voting centres to take paper ballots is problematic. The underlying assumption is that electors will be willing to travel to such centres to vote notwithstanding the inconvenience. Generally, there is only one voting centre in a state (electoral office of the state) or country (embassy office) which means the voter may have to travel long distances to vote. 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 had they been required to use a voting centre i.e. postal was too late and their delivery address unknown, the interstate or overseas voting centre was too difficult to attend.

Note postal voting is only available for 2 weeks during a state election and the average time taken for a postal vote to be returned is 11 days. This means that a postal vote issued after the Wednesday after close of nominations is unlikely to be counted.

3.6 Remote Voters

Many voters live in regions which are not well serviced by polling places or the post. These voters often need 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 problem by providing a more efficient voting option.

3.7 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.

3.8 Catering to disabled voters

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 voting option offered by iVote is the use of electronic voting with 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. This is particularly popular with the elderly.

3.9 Improve Electoral Confidence

One of the interesting by-products of implementing e-voting partially in an electorate is that it provides a second completely independent voting channel to which the paper vote channel can be compared. Having the ability to do this comparison does not prevent electoral fraud, but it does assist in identifying if electoral fraud or a significant error has occurred.

4 iVote Security

This section deals with whether the security of the iVote system is appropriate and sufficient.

Security of iVote is greater than the security of general-purpose transactional computer systems connected to the internet. Most computer breaches occur on large general-purpose networks which are very very hard to secure by virtue of the size of their infrastructure and functional diversity.

iVote is a relatively small dedicated system that only operates for 12 days and has a limited end user functionality and low transactional complexity.

It will always be possible to identify a potential vulnerability in any computer system. There are many vulnerabilities identified in commonly used systems every year⁹. Hence it will always be the case that iVote will have allegations that it is vulnerable to attack. Even at the 2015 election when the system was identified as vulnerable to a FREAK attack¹⁰, this was a very recently identified attack vector which reasonably would have been detected should it have been exploited on mass. It should also be noted that this attack required significant technical resource to execute, so unlikely to have been implemented and as such not a real threat. Alternative, it should also be noted that this attack required significant technical resource to execute, and so unlikely to be used in the manner described (a coffee shop) and so not a realistic threat as described)

The NSWEC was aware of the vulnerability which had been patched on the core system but due to operational issues did not check it on a supporting system which was used as a last minute change of design. The iVote Manager decided the benefit offered by this change was worth the low risk it offered, the system was quickly remediated. The relevant question always is what is the likelihood of a vulnerability being exploited with a viable attack strategy and could this attack be detected.

It should be noted that even with the best intentions and efforts the current paper voting systems is prone to failure. 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 and lost, failure in counting and handling of votes, etc. These failures represent a small percentage of the votes cast but they can be significant in terms of electoral outcome. Conversely, the operational failure associated with internet voting systems is by its nature lower because computer processing has lower failure rates than humans undertaking repetitive manual tasks. Currently there is no elector verification available for paper voting which would identify errors in handling and counting of ballot papers.

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 a successful attack being undetected. Additionally, iVote internal operations are closely monitored for anomalies and unexpected behaviour.

Given both iVote and paper voting can fail, the only meaningful approach to assessing security failures 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 either channel. However, it is possible to implement a system so that 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.

⁹ Common Vulnerabilities and Exposures, The Standard for Information Security Vulnerability Names, Total CVE-IDs: 76555

<https://cve.mitre.org/>

¹⁰ Response from the NSW Electoral Commission to iVote Security Allegations, NSWEC website.

http://www.elections.nsw.gov.au/about_us/plans_and_reports/ivote_reports/response_from_the_nsw_electoral_commission_to_ivote_security_allegations

The main criticism against iVote is that an attacker could breach it and corrupt votes without detection. The author believes the probability of this happening is low and happening without detection is extremely low. Conversely mishandling of ballots when counting manually is a certainty and has a probably of effecting the election as seen in the 2013 WA Senate rerun.

Notwithstanding the low chance of a successful attack and the high potential for identifying an attack the author advocates internet voting should be limited in usage to only take votes which currently are considered to be of commensurate high cost such as postal and absent votes and votes which could not otherwise be taken.

5 Audit and Transparency

This section deals with whether the transparency and provisions for auditing the iVote system are appropriate.

The iVote system utilises a voting protocol which relies on segregation of duties, communications channels and data to achieve an auditable transparent process. The audit of iVote is achieved by verifying that the votes cast are the same as those counted. This is done using a two-stage process. The first stage is vote verification by the elector that their vote had been captured accurately. The second stage is to allow independent verification that their vote has been counted as captured.

5.1 Vote Captured as Cast

Verifiability of votes by electors is an essential part of iVote and indeed any electronic voting system. The following sections outline the verification approach currently used for remote voting and that proposed for attendance voting if it were to be implemented.

5.1.1 Remote Voting

Verification of remote votes is done by the elector hearing their vote spoken back to them by a computer via a phone over the public switch phone telephony (PSTN) network preferably using a different device to that which they voted. The reason the PSTN was chosen is because it not the same channel used by the majority of iVoters to vote. The only way a vote could be tampered with successfully using this approach is if both the core voting system and the independently managed verification system were tampered with without detection. This would be very difficult to achieve. Cryptography is used on both systems to ensure that the votes cannot be seen in the clear and be tampered with and prevents attribution of the vote to a given elector.

Note only 1.7% of electors used the verification process at the 2015 SGE. The NSWEC needs to promote the verification system to ensure that this figure is increased for the SGE in 2019. This will have the effect of improving the statistical proof that iVote worked as intended.

5.1.2 Attendance Voting

It is recommended that attendance voting be used at pre-polls and polling places with a paper docket used for elector verification of their vote. 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. The use of a paper verification process will allow a risk limiting verification audit of some of the electronic counted votes after close of poll to ensure the electronic vote aligned with the paper verified vote.

The use of paper dockets to verify votes is widely accepted by most who oppose electronic voting in public elections. It is the most acceptable verification practice for attendance votes and is easy for the elector to understand. Note in the event of a dispute the paper docket vote should be taken as the vote.

5.2 Votes Counted as Captured

In addition to verification of votes by the elector iVote verification procedures also verifies that the votes captured in both the verification system core voting system are those used to determine the election result.

To ensure iVotes are being counted as captured additional verification is provided by an independent audit of votes as decrypted from the core voting system with votes held on the verification server. This is done without revealing the voter's credentials. This process is witnessed by scrutineers who are able to question the independent technical auditors performing the audit and the NSWEC appointed auditor.

In addition to the above you can also obtain evidence your vote has been passed on for counting by using the unique 12-character receipt code provided at the time of voting to lookup your vote at close of polls. You can do this by returning to the election website and entering your receipt code. The website will advise if a vote was successfully passed on to be counted. Note this information is not available for current paper voting channels.

5.3 End-to-End Verification

Academics have a strict definition on what End-to-End Verification means¹¹, however this definition is not so important for most voters as they will trust an evoting system if they can see a reasonable effort by the electoral authority to provide verification. They also know this is much more than they will get from current paper voting. In layman terms end-to-end verification occurs when a vote's provenance can be traced from casting to the declaration of the results with reasonable confidence and the voting process can withstand scrutiny of a court.

The elector's verification of their vote as defined in section 5.1 plus the audit of votes counted as captured defined in section 5.2 ensures the verification of votes is done from end to end, albeit that some of this verification is not done by the elector but by auditors. The author believes that this audit process was sufficient to identify tampering of an elector's vote and provide confidence in the process at least equivalent to the current paper process. It is however suggested the NSWEC appointed auditor be replaced by a new technology election committee for SGE 2019 – see section 6.3.

5.4 Results Comparison

An interesting side effect of having a separate electronic voting channel is that its electoral results can be compared with other voting channels to identify if gross electoral fraud has occurred. This means if the paper and electronic channels preference patterns align electorally within reasonable

¹¹ End-to-End Verifiable Elections in the Standard Model, Aggelos Kiayias, Thomas Zacharias and Bingsheng Zhang, Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens, Greece, 2015.

<https://eprint.iacr.org/2015/346.pdf>

tolerance then the election outcome is almost certainly tamper-free. This type of verification can be done by anyone with access to the results on the internet, hence the addition of a separate electronic voting channel can have the effect of improving elector's trust in the overall electoral outcome when voting patterns align.

6 Scrutiny

This section addresses the question of whether adequate opportunity for scrutineering of the iVote system is provided to candidates and political parties in the 2015 election.

6.1 Current iVote Scrutiny

The key issue with all electoral systems is that they must be trusted by the electorate. Experience in NSW at the SGE 2015 has shown that iVote was trusted even despite negative media coverage by a US based academic who specialises in discrediting internet elections¹⁰. An independent post-election survey¹² identified 98% of people that used the system would recommend it to others.

The partisan scrutiny process is the main way trust is maintained for elections in NSW. Currently, technology assisted voting has adapted the traditional partisan scrutiny approach, where scrutineers are nominated by parties or candidates and they observe key processes. Normally these people have no technology audit experience and in some cases, they do not have much electoral knowledge. The current processes do not require them to have detailed technical knowledge rather their role is to witness key processes and have an opportunity to interrogate independent experts who will confirm that key processes were completed adequately. Unfortunately, they for the most part do not understand the significance of these processes and simply trust the Commission is doing the right thing!

There are three key processes which scrutineers are currently asked to review for iVote. The first is the encryption process which is comparable to when the ballot box is sealed in a polling place. The second is the entry of decryption keys to allow the ballot box to be decrypted. The third is the validation of the votes decrypted in the Core voting system against the votes held in the verification system.

The technical knowledge and skill needed to perform the final verification of votes is not commonly found in traditional scrutineers. This process requires an expert to audit of the decrypted votes against the verification system's votes by running a program they have written to a specification provided by the NSWEC. The specification is mathematically provable and can be reviewed by any interested person with appropriate mathematical skills. Therefore, this verification audit is done by one or preferably more independent cryptographic expert/s who volunteer their services to write a complex program which provides proof that the votes held in the two systems match. The matching of these votes is strong proof that no iVote was tampered with or lost, or the iVote ballot box was stuffed with extra votes.

¹² IPSOS Report on the 2015 SGE

https://www.elections.nsw.gov.au/_data/assets/pdf_file/0003/205689/14-036279_ipsos_Report_-_NSWEC_General_Election_Research_FINAL_updated_110116.pdf

The cryptographic expert/s is/are not typically nominated by the party or candidate (but could be) and is/are unpaid and independent of the electoral process. Clearly this type of process is not suitable for traditional scrutineers to undertake but these scrutineers can witness this process and interrogate the expert/s who undertake/s the audit to satisfy themselves of the process outcome and the independence and integrity of the experts involved.

The scrutineers can also question the Commission appointed auditor who is overseeing the process and the person responsible for the management of the verification system. The verification system manager is responsible for the provision of the encrypted verified vote data used in the process and is available to scrutineers to be questioned about the verification data provenance. Note the voice response verification system is both managed independently to the NSWEC and operates completely separately from the core voting system and the registration system for both vote secrecy and election integrity purposes.

6.2 Current Paper Vote Scrutiny

The current partisan scrutiny system was developed with the concept that most votes would be initially counted on election night in polling places. In this situation the current partisan scrutiny system works well, as the scrutineers do not need much specialist knowledge, can see the ballot box being opened and can witness the counting can easily check the result against the witnessed process. The author fully supports the continuation of polling place paper voting for in district votes and the use of the current scrutiny process for these votes.

It is interesting to note that the process tends to fail even in polling places for the upper house count because the scrutineers have typically left the polling place before this count is commenced. This is largely due to then scrutineers being appointed by lower house candidates and as such, are not that interested in the upper house result and want to go home. Also scrutineers do not in any way scrutinise declaration votes taken in polling places or check reconciliations of votes against unused ballot papers this means the scrutiny of these votes has to be done in the RO office or a central count centre.

Our current scrutiny system was developed when all votes were taken in polling places and is now being adapted to deal with the large percentage of votes (33%) are taken either prior to election day or by declaration vote in polling places and pre-polls. The increased use of these large counting centres make it almost impossible for traditional scrutineers to determine if the final result relates to the votes they scrutinised. This is because the processes are so segmented the scrutineer is unable to easily compare the result for a given step being observed with the results published. This situation is exacerbated when ballots are entered into a computer system for computer counting which was the process followed in the 2015 NSW SGE for lower and upper house.

In short the current traditional partisan scrutiny system is ineffective for anything other than election night in polling place counting. It is failing due to the incremental changes which have been made to the electoral system over the past 100 years.

6.3 Technology Election Committee

The challenge of scrutinising election technology is not a new problem, every jurisdiction around the world is faced with this problem. This section explores the idea of creating an election technology

committee to not only assist with the scrutiny of iVote but also other election technologies such as electronic ballot capture and the computerised preference distribution process.

The current legislation related to electronic voting in NSW contemplates that scrutiny is achieved by independent overview using traditional scrutineers, volunteer experts and paid auditors. This approach works within the constraints of the current legislation but is cumbersome and does not give a fully independent assessment of the system for stakeholders and the public to trust. To ensure that the scrutiny of the iVote system and other election technology is both visible and adequate it is recommended an independent Technology Election Committee (TEC) be established to provide effective scrutiny for electoral processes impacted by technology currently used in elections.

The skills needed to scrutinise electronic voting systems are different to those for other election processes. Effective scrutiny of electronic election processes requires some knowledge of the underlying technology. Although the concepts of iVote integrity simply rely on the segregation of data, duties and communications channels, it can be difficult for a person not familiar with the way computer systems work and the electoral processes they support to fully comprehend these features and audit against them.

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 current scrutineers typically do not have the knowledge needed to effectively audit complex computer systems.

The 2013 Norway election is considered by many as a gold standard for evoting transparency. The author had an opportunity to be an official observer for their 2013 internet voting decryption process. The Norwegians used an electronic voting election board to deal with internet voting scrutiny. This board was appointed by the equivalent of the electoral matters committee and comprised non-political persons with specific skills in technology and elections. It is a recommendation of this submission that a similar approach is taken in NSW. This will need legislative change. More information about the Norway committee's work can be found in The Carter Centre's report¹³.

Members of a committee for NSW elections 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. The committee should also have members who have expertise in at least one of the following: election management, cryptography, cyber security and security audit processes.

The board should provide reports to the NSWEC 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 use votes held electronically to determine the election result.

¹³ 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>

The board members should be selected by the electoral matters committee on a bipartisan 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 NSW board guidelines¹⁴. The board should be remunerated for their time and expenses when conducting the 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 NSW Electoral Commissioner.

7 iVote SGE 2019

This section addresses the question of what improvements to the iVote system would be appropriate before its use at the 2019 State General Election.

7.1 Options Assessment

Before improvements can be considered for SGE 2019, the author believes the scope of the program of works achievable for the election must be considered. The following are the most relevant business options available to the NSWEC regarding the use of iVote for SGE 2019.

7.1.1 Current 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 Enhanced iVote

An enhanced version of iVote will do all the things in the current system plus items in section 7.2. This system would be suitable for operations for the SGE 2019 and potentially for other jurisdictions.

7.1.3 New System

A new system could be developed by the NSWEC. This would be the third iVote system the NSWEC has developed in as many election cycles. The cost could reasonably be expected to be in excess of the amount spent by NSW for SGE 2015, should a system of similar functionality be required and it be integrated with the current registration system.

Given there is no uniformly acceptable remote voting protocol agreed by “experts” it is unlikely that a new voting system developed by the NSWEC would be more readily accepted than the current iVote system.

The current tender for a new system is requesting the market provide a solution which can address all the broad requirements of the NSWEC and other Commissions in Australia for evoting. This approach would be acceptable for most systems other than an evoting system when the underlying voting protocol is fundamental to the systems acceptance by the public and stakeholders.

¹⁴ About the NSW Boards and Committees Register

<https://www.nsw.gov.au/your-government/nsw-government-boards-and-committees-register/about-the-nsw-boards-and-committees-register/>

Therefore, the key information the NSWEC must provide when tendering for a new voting system is a preferred voting protocol, this should be agreed with key stakeholders prior to going to market. If the NSWEC does not define the voting protocol prior to going to tender, then the NSWEC will be forced to do this when considering offers, which means given the nature of the evaluation process it will not be possible to garner stakeholder support for the protocol before selecting the preferred tenderer.

Given the time available now between the tender closing and the election the author would consider the implementation of a new system a high-risk strategy.

7.1.4 No iVote

This is an option which needs to be stated but the author believes it would be a significant retrograde step for NSW, given the reasons stated in section 3.

7.2 Proposed iVote Enhancements

Appendix B provides an assessment of the options outlined in section 7.1 against key criteria in Appendix C. The analysis shows that an “Enhanced iVote” is the most viable solution for NSW for the coming 2019 SGE.

The following sections identify the proposed new features of the enhanced iVote solution for NSW taking into consideration the drivers for evoting identified in section 3 and additional issues identified in section 8.

7.2.1 Multiple Elections

A number of enhancements have been requested already for iVote to allow it to operate in a production environment rather than for one off elections. Being able to run multiple elections is one of the most critical features. This feature will also assist with supportability as it allows the one code base to be used rather than multiple instances – one for each election event.

7.2.2 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 voters¹⁵ will continue to verify their vote by using the DTMF phone based verification system which speaks the elector’s preferences back to them.
- Attendance voters will be able at pre-polls and polling places to verify their vote by a printed docket which creates a verifiable paper trail for their vote.
- All electors using iVote can continue to verify that their vote has been entered in the count or not post-election using the website currently provided.

¹⁵ Includes voters using personal devices remotely and interstate attendance voters at election body designated venues using supplied devices.

7.2.3 Eligible electors

It is recommended that the NSWEC considers an implementation which includes the following electors which the Commission has difficulties obtaining votes from at general elections;

- Blind low vision voters
- Unable due to disability to attend a polling place on election day
- Outside NSW on election day
- More than 20 km from a polling place on election day
- Registered general iVoters
- Silent voters
- Voters at any venue voting early or on election day (start with only absent voters)
- Voting at an interstate or overseas location under the control of the NSWEC
- Outside of the elector's own district for by elections

It is anticipated that the above categories could result in at least 500,000 votes at the SGE 2019 election. These are votes which would have been expensive or problematic taking using any other approach.

7.2.4 Operational Features

The following tables identify the features of the iVote system proposed for use in NSW at 2019 SGE and potentially for other Australian jurisdictions. The highlighted areas are the features proposed for iVote.

Voting Type	Voting device		
	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” phone to vote but could also 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 NSWEC and receives a paper docket to verify their vote which is placed in a ballot box before they leave the polling place.

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 NSWEC. 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			NSWEC

Voting protocol for each voting type	Voting device		
	Std. Phone	Smart phone	Desktop/ Laptop
computer provided by the NSWEC. iVote number provided in the system and verification by paper docket			Supplied Device+
Remote over PSTN using DTMF 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

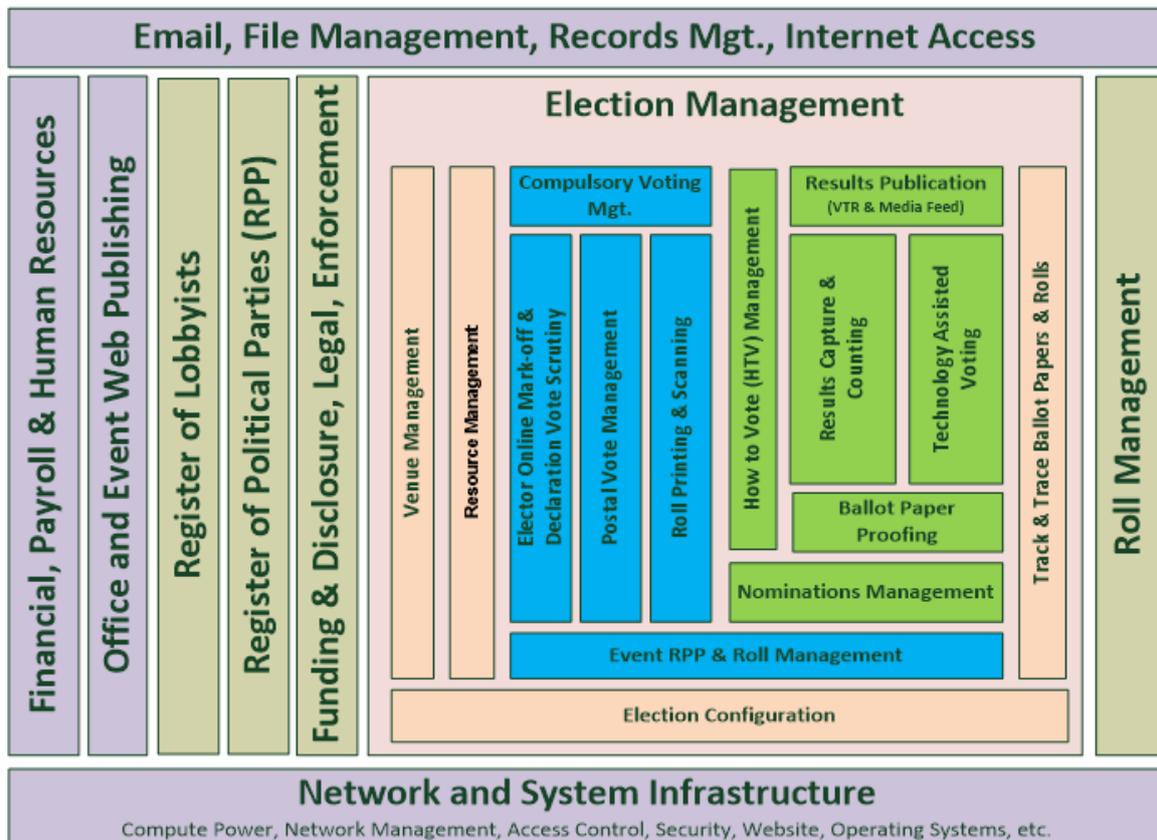
+ Voter can verify their vote entered the count after close of poll by entering receipt number in voting website using web browser.

8 Additional Issues

The following are additional issues that impact on the ongoing use of iVote. Although they are not directly relevant to the inquiry terms of reference these issues are material when considering the use of iVote in the future.

8.1 Technology in Elections

There is now a lot of technology used in elections, most of which is invisible to but expected by the public. Below is a diagram which identifies all the different systems used by the NSWEC and most other Australian Election Management Bodies (EMBs).



The growth in the use of this technology has largely gone unnoticed over the course of the past few years. However, the more recent interest in internet voting and the issues faced in the US election, “*technology in elections*” is now a hot topic.

An example of how difficult the issue of technology in elections has become for policy makers is illustrated by the recent Dutch elections¹⁶. During the Dutch elections of 2017, the role of supporting software in the election process threatened to be reduced to a minimum. This placed pressure on the process and on the determination of the outcome of the election. Election officials were asked at very short notice to change long standing practices which not surprisingly revealed errors in the manual systems which they were forced to use. The main point which came from this fiasco is that last minute decisions by policy makers responding to emerging events will not always give the expected outcome when dealing with large general elections. Also, policy makers need to understand that blanket edicts which seem clear to them may not be easy to interpret on the ground i.e. does the edict to not use technology to count votes allow the use of spreadsheets and calculators?

The expanded use of technology in elections is inevitable. The question which needs to be addressed by policy makers is the required security and integrity of the technology and how it will be effectively audited.

¹⁶ The use of 'supporting software' in elections, The peculiar case of the Netherlands 2017, Peter Castenmiller and Kees Uijl, E-VOTE-ID 2017, 24–27 October 2017, Lochau/Bregenz, Austria

8.2 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 reasonably expect funding for 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 also need to maintain a cohort of contract experts who can provide input and services periodically.

Frequency of use of the system is one of the key determinants which make evoting systems cost effective and reliable. No one jurisdiction has the amount of usage necessary to maintain a competent event ready staff of people able to run the system reliably at a reasonable cost. This means the only way a reliable and cost-effective have an evoting system in Australia is for all jurisdictions to use the one system.

Election processes in Australia are fairly similar in nature from jurisdiction to jurisdiction therefore it is reasonable to believe that a common supplier would be able to provide a set of technology solutions which will meet the needs of most election bodies. The strategic question 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 all jurisdictions in Australia and engage where appropriate 3rd party suppliers.

This entity should have governance shared by all participating election management bodies involved and could follow the structure used by [PSMA](#)¹⁷. 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.

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 dictate.

8.3 Scalable

The system needs to be able to scale to handle some 20% of the votes taken at a general election. This would mean iVote would need to be capable of processing some 1,000,000 votes reliably and cost effectively. The current iVote system should be able to scale to this level with minimal costs.

8.4 Processing of Preference Data

At the SGE 2015 , the NSW Electoral Commission (NSWEC) data entered all the Optional Preferential Legislative Assembly ballot preferences¹⁸. This had the advantage of being quick, accurate, provided

¹⁷ 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.psama.com.au/our-history>

¹⁸ VTR Legislative Assembly preference file for Albury <http://pastvtr.elections.nsw.gov.au/SGE2015/la/albury/preferences/index.htm>

addition data about preferences and allowed the electronic iVote preference data to be simply merged with data from paper votes to perform the Distribution of Preferences (DoP). The alternative, which was done in SGE 2011, was to print iVote ballots and manually distribute their preferences with other paper ballots.

The NSWEC also found that having all preferences in data files allowed the creation of a variety of reports¹⁹ which were able to show preference flows. The raw preference data also was popular with the public and psephologists. A number of psephologists published reports after the election based on the raw preference data provided²⁰. The publication of this data also allowed the distribution of preferences to be validated by independent researchers which is a powerful trust building mechanism.

It is recommended that the NSWEC continue either data entry or scanning of the Legislative Assembly ballot preferences to allow electronic DoP, provision of more data to the public and remove the need for iVotes to be printed.

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

Legislation should be created to ensure the merging of iVote data with other paper vote data can occur without the need to print ballots. The electronic rendition of this data should be publicly available and additional scrutiny of these non-paper ballots should be part of the work of the Technology Boards audit of the system and its operation.

8.5 Defensible

The iVote voting protocol was designed to ensure the election result from iVote could be defended in court. Most other voting systems use complex cryptography to perform all the security and integrity functions in one module. iVote uses segregation of data and system functions coupled with segregation of duties to ensure the system has worked as expected and has integrity.

The iVote voting protocol divides the system into two main components (the core voting and verification module) which are each independently managed and also interdependent on each other. This ensures that each component operates as expected which confirms the system's overall integrity. This integrity of the system overall therefore can be tested in court by cross-examining the responsible person for each module.

¹⁹ 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

²⁰ 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>

8.6 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 vVote system used in Victoria and now discontinued was described by Wen and Buckland in their report²¹ to the Victorian Electoral Matters Committee as “the most complex e-voting system ever developed and implemented”. vVote is a system which used a complex voting protocol and extensive cryptography to achieve the required outcomes, it failed the comprehensibility test. Although iVote is technically complex it is relatively easy to explain its voting protocol and associated security features, which was a conscious design decision of the NSWEC.

8.7 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 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.

8.8 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 Smith²². Re-voting is also a recommended approach by the Council of Europe in there recently published implementation guidelines to reduce the impact of coercion²³.

9 Conclusion

This inquiry’s recommendations will be pivotal to the use of internet technologies in elections, not only in NSW and Australia but also around the world. The inquiry will hear from various internet voting “experts” on the peril of internet voting and indeed any return of ballot using a computer.

²¹ 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 Wen & Richard Buckland, July 2015.

https://www.parliament.vic.gov.au/images/stories/committees/emc/2014_Election/Submissions/No_12_Dr_Roland_Wen_and_Associate_Professor_Richard_Buckland.pdf

²² 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

²³ Ad hoc Committee of Experts on Legal, Operational and Technical Standards for e-voting (CAHVE), 2017, page 6

<https://rm.coe.int/1680726c0b>

Most of the arguments against iVote will come from people with very impressive academic qualifications who specialise in cryptography and have great deal of expertise in internet security, particularly in the securing of internet's secure pipes. Because of this they sometimes are referred to as the plumbers of the internet. The expertise of these highly skilled "plumbers" and the standards they measure success by is very different to those of people that build and manage real world business systems like iVote. People who build these systems understand and manage risks in a very different way to the internet plumbers who will only sign off on a solution if it can be cryptographically proved.

These 'experts' will often say that return of ballots over the internet should not be used until they can formally prove the system used is secure. My view is that there will never be a proof that a system returning ballots over the internet is secure, to their standards. However, it has to be remembered that no other business system can satisfy this type of cryptographic proof, hence it should be unreasonable to expect that iVote would be able to meet this standard of proof. The standards and security attributes of the iVote system should be comparable to the system it is replacing.

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 technology.

There are certainly traps for electoral authorities related to the inappropriate use and management of technology and the inquiry must guard against these traps. Fundamentally any new technology should not increase unacceptably the risk of failure of an election compared to the current systems. Also, the technology used must be electorally comprehensible and rationally trustworthy and be implemented for good business reasons. The inquiry needs to closely consider the current methods of scrutiny and examine how this can be improved when technology is involved.

The author does not envy the inquiry's task as any recommendation will bring criticism. A recommendation to continue with iVote would be unprecedented, as it has been the norm around the world that reviews of this nature to result in the termination of the use of computers in public elections. Conversely, a decision to discontinue iVote will bring a lot of bewildered commentary from the NSW and Australian public who for the most part want it and do not understand why internet voting on scale is not here now.

It is the author's view that there are sound arguments to retain the limited use of iVote for hard to capture votes, where the business risk of iVote is comparable to the alternative voting method. The inquiry's challenge is to identify, address and balance, in public view, risks of both iVote and manual methods without undermining the public's trust in the current manual systems.

Appendix A – Comparative Risk Analysis

The table below compares risks between electronic voting and paper voting supporting section 4.

	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 cannot 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	Options (see section 7.1)			
	Current iVote	Enhanced iVote	New iVote	Revert to paper voting process
Integrity	Comparable to current electoral processes. Offers verification which is not available for paper voting but opens up additional risks intrinsic to the use of the internet.		No new systems on the horizon that will offer significant improvements that would improve public's perception of remote voting. 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.			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.
Implementation Timeline for SGE 2019	Could be easily and reliably implemented in the available time	Could be reliably implemented in the available time	Could only be implemented at high risk in the available time	Would be challenging as unable to provide the same level of accessibility to electoral process.
Accessible	Accessibility is a key feature with range of voting interfaces available.		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		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 at future elections.

Criteria	Options (see section 7.1)			Revert to paper voting process
	Current iVote	Enhanced iVote	New iVote	
Experience	iVote has been used for a parliamentary election in NSW and captured a significant number of votes.		Unknown	Long known history
Lower comparable risk	See Appendix A		Unknown	See Appendix A
Development costs	The operating cost of iVote and development enhanced iVote are relatively predictable and adequate the funds are available.		A new system would have a significant development cost. Potentially in excess of available funds.	Limited development cost but marginal cost of operation could be higher per vote.
Support costs	The support costs for iVote can be shared between several electoral authorities		The support costs of a new system would have to be covered by the NSWEC 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	Marginal cost of a vote would be about \$14
Coercion Resistance	Ability to revote is considered a strong coercion resistance mechanism.		Alternate anti coercion protocols unlikely to be an improvement as they generally involve an unacceptable increase in complexity for the voter or a reduction in vote secrecy.	Postal voting which is the main vote type being replaced by internet voting and it has a high potential for coercion.
Attendance Voting				
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.			Postal remote vote does not work well for the 2 week voting period and problems with returning votes from overseas venues.

Appendix C – iVote Selection Criteria

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

- 1 Integrity – the system must be able to provide reasonable proof that electors' votes were counted as cast.
- 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.
- 3 Comprehensible – the system must be able to be comprehended by both lay and experts alike.
- 4 Scrutinisable – the system must be able to be scrutinised checked by experts to ensure vote verification and lay persons need to be able interrogate the experts to gain confidence in the outcome.
- 5 Defensible - the system needs to be amenable to being examined in a court of law.
- 6 Accessible – the system must be able to address the needs of disabled voters.
- 7 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.
- 8 Experience – The system must have been used successfully in other jurisdictions.
- 9 Lower comparative risk – the risk of the system must be acceptable compared to the voting process it is replacing.
- 10 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.
- 11 Support costs – the support arrangements for the system should be manageable and ideally shared with other jurisdictions.
- 12 Secrecy - the electors voting intentions should only be known by the elector.
- 13 Coercion Resistance – the system assists electors vote in the way they want and allows them to change their vote if they have experienced coercion.
- 14 Remote voting – ability to vote away from a polling place using a personally controlled phone or computer device.
- 15 Attendance voting – ability to produce a paper docket to verify the electors vote in event of a dispute.