Online Voting in New Zealand

Feasibility and options for local elections

Report from the Online Voting Working Party

Contents

Introduction

The working party

The Online Voting Working Party (the working party) was established on 4 September 2013 to consider the feasibility of online voting.

Our Chair is **Danny Mollan.** Danny is the Consulting Practice Manager and a founding partner at NZYM, a technology consulting company, and an experienced ICT strategist.

The remaining members of the working party (in alphabetical order) are:

Anne Shaw

Anne is the Government Relations Manager, Service and System Transformation at the Department of Internal Affairs. In this role she has managed the Government Chief Information Officer's Review into Publicly Accessible Systems and the ongoing privacy and security review programme for the GCIO. Anne is an experienced policy manager and public servant with experience in both ICT and local government portfolios.

David Farrar

David is a blogger and supporter of online voting. His blog, Kiwiblog, is one of the most widely read and commented on blogs in New Zealand. David is a frequent commentator in the media on Internet issues, has been the Vice President of Internet NZ and is a former Director of the New Zealand Domain Name Registry Ltd. He is currently the Board Chair at the Domain Name Commission and Chair of InternetNZ's Policy Advisory Group. David manages his own market research company (Curia) and is a member of the Market Research Society of New Zealand.

David Pannett

David is the Manager of the Governance & Crown Entities team at the Ministry of Health. He has a background in law and information technology, and has worked in health governance for the last 12 years. During that time, David has been involved in a number of strategic projects, including establishing the Health Sector Forum and supporting the development of shared administrative and support services for district health boards. He has been involved with district health board elections since 2004 and previously worked with the Department of Internal Affairs on the project to develop the STV Calculator.

Darryl Griffin

Darryl is the chair of the Society of Local Government Managers (SoLGM)'s Electoral Working Party and is a former President of SoLGM. Darryl is the Governance and Civil Services Manager at Christchurch City Council and has previously held a number of senior local government management positions including Democracy Services Manager at Auckland Council and Chief Executive for both Buller District and Selwyn District Councils.

Jan Ziegler-Peri

Jan is a local government community development expert and has significant experience in local government and community development. In 2013, she led Auckland Council's *Kids Voting* – a programme run by the Auckland Council to allow school children to take part in online voting for the Auckland Council.

Jordan Carter

Jordan Carter is the Chief Executive of InternetNZ, a non-profit open membership organisation dedicated to protecting and promoting the Internet in New Zealand and fostering a coordinated, cooperative approach to its ongoing development. Jordan is an expert on policy, regulation and social impact issues raised by the Internet, and the connections of these issues with wider political economy, economic development and globalisation concerns and trends.

Karaitiana Taiuru

Karaitiana has been a leading figure in the online Māori renaissance of the Internet since 1997. His focus is on social, cultural and economic benefits of the Internet while still continuing to support Internet access to all. Karaitiana is the author of the successful 2002 Māori.NZ proposal which led the world's first Indigenous language domain name; proposer for macrons in .nz domain names and .Māori.NZ (2010), and .iwi.nz moderator since 2000. He also brings with him over a decade of experience in tribal, Māori organisations and online and offline voting issues. Karaitiana represents the Māori Internet Society on the working party.

Lorraine Vincent

Lorraine Vincent is the Chief Executive of the Manawatu District Council. Lorraine entered local government in 1996 as the Manawatu District Council's Community Services Group Manager. Before joining the local government sector, Lorraine was Sport Manawatu's Chief Executive from 1991 to 1996.

Maea Petherick

Maea is a Project Co-ordinator for Auckland Council within the Democracy Services team, and has vast experience in the delivery of local government Elections, including resource planning and implementation for Candidate Information Evenings, upskilling and training staff about process, issuing of nominations, special votes and the collection of voting documents for the Auckland region. Maea was also a key player in the delivery of the Kids Voting Online Pilot 2013, which ran alongside the Auckland Local Government Elections in 2013.

Mayor Nick Leggett

Nick is the Mayor of Porirua City Council and has been a local body politician since the age of 19. Nick has been a champion for online voting for a number of years and has led Porirua City Council since 2010.

Paul Matthews

Paul Matthews is the Chief Executive of the Institute of IT Professionals New Zealand (IITP), the professional body of the IT industry in New Zealand. As Chief Executive of the IITP Paul has overseen the implementation of sector-changing projects such as *IT Certified Professional*, which accredits IT Professionals, chaired the Steering Groups for the ICT Qualifications Review (reviewing and replacing all IT qualifications at NZQF Levels 1-6) and the Cloud Computing Code of Practice.

Our role

As the Internet becomes a part of everyday life, online voting is a natural progression – as systems adapt to technology, democratic processes can also be expected to change. The Government needs to make sure that the New Zealand voting system is relevant for voters in the 21st Century. This includes both designing a voting system that can be used by voters to cast their vote online and identifying areas where modern technology and the Internet can be used to help voters engage more fully in the democratic process.

Our task has been to determine the feasibility of online voting for local elections in New Zealand and to identify practical options for trialling and then implementing online voting in local elections.

Our terms of reference are attached to this report (**Appendix One**) and are available on the Department's website (www.dia.govt.nz/online-voting).

Our process

We met regularly in early 2014 to discuss and consider the issues associated with online voting. This was supported by a secretariat provided by the Department of Internal Affairs (the Department). We also heard from external experts either about their area of expertise or their experiences in taking government services online.

This report does not provide a single, definitive solution for successfully implementing online voting for New Zealand's local elections. What we have set out is our view on whether New Zealand should consider online voting in local elections, what issues ought to be considered by policy makers, and how online voting could work in practice.

Acknowledgements

A range of individuals and organisations have supported this project. We would like to acknowledge their assistance:

- Nick von Dadelszen, Lateral Security (IT) Services

- Mark Scanbury and Craig Lange, Statistics NZ

- The Ministry of Justice

- Matthew Lord, New Zealand Internet Task Force[1]

- Independent Election Services

- Electionz.com

- The Electoral Commission

- The Office of the Privacy Commissioner

- Local Government New Zealand

- Society of Local Government Managers

- Our Secretariat: Ben Creet, Andrei Zubkov, and Kate MacDonald from the Department, for providing excellent support throughout the process.

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[1] Matthew works as Head of Technology Governance and Risk at Kiwibank. He engaged with us in his capacity as an information security and risk professional, not as an official representative of Kiwibank

Executive summary and recommendations

Executive summary

We have been asked to consider the feasibility of online voting for New Zealand's local elections and, in particular, how online voting could be implemented in the 2016 local elections, subject to a significant and successful trial.

It is our view that online voting represents an opportunity to modernise and enhance the operation of local democracy in New Zealand. We think that online voting should not replace postal voting, but instead should create options for voters, better enabling New Zealanders to vote how, when and where they want. By adding to the current postal voting system, we think that online voting has the potential to enrich voters' experience of their local democracy, allowing them to engage in different ways and make it easier for people to act on their intention to vote in local elections.

International experiences with online voting are limited and we were only able to find information from 11 countries where online voting has either been considered, trialled or implemented. These experiences have been both good and bad. We think it is important to acknowledge that the New Zealand experience will be different. We are a small, multicultural nation with different electoral systems and New Zealand has been using postal voting in local elections for over 20 years.

We have identified four principles that have guided our thinking as we have prepared this report – *Access*, *Participation*, *Integrity* and *Security*. These principles are particularly important for online voting, but do not diminish or overturn broader electoral principles. The Department should use these principles to guide further work on online voting.

Online voting is feasible

Having considered international experiences, the local government electoral system and technological and security challenges associated with enabling voting online, we consider that **online voting is feasible and desirable**. It could make the voting process easier and faster, increase the speed and accuracy of obtaining results and could reduce costs of local elections over time.

Trialling in 2016

We consider that the most feasible approach is to trial online voting, in politically binding trials, in the 2016 local elections. We think that while testing and smaller scale trials before this date will be important, there are no trials that would be significant enough to adequately test an online voting system's capability to cope with the complexity of local elections outside of the triennial local elections. We recognise that the local government sector wants to move faster and we share the sector's enthusiasm. However, working towards a trial of online voting in 2016 creates the best chance of success and will still require significant commitments from both central government and local government.

We believe that through a phased approach to trialling in 2016 - with testing, non-binding trials and running smaller politically binding trials (if possible) - continued progression towards the end goal of New Zealanders voting online in local elections can be established.

As a part of preparing for the trial, further judgements would be required to identify the best mix of communities to trial online voting and to ensure that findings from the various trial phases can inform further trials and, ultimately, the broad implementation of online voting.

Taking a partnership approach

As a group, particularly those of us without previous experience in the local government sector, we were struck by the complexity of the local electoral system. There is a range of organisations involved in local government and many parties will be affected by introducing online voting. All of these parties need to be able to play their part. Therefore, a clear partnership approach to trialling and implementing online voting will be a critical factor for success. The Department will need to collaborate and partner with Local Government New Zealand (LGNZ), the Society of Local Government Managers (SOLGM), the Ministry of Health[2], the Electoral Commission and other key stakeholder organisations (strategic partners) to make online voting a success.

Additionally, many of the experts needed to ensure the success of online voting are not in government. Security experts, usability experts, representatives of disability communities and ethnic communities all need to be involved from the outset to maximise the benefits of online voting.

Equally important is New Zealanders' trust in their electoral systems. Because the Internet is new (compared to physical voting methods), we need to ensure that the public has the opportunity to understand how online voting is being tested, trialled and ultimately implemented. Taking an approach to online voting that is as transparent as possible will help maintain New Zealanders' trust in our electoral systems.

This report shows that the best way for online voting to be successful is to take a phased approach to trialling and implementing online voting. We hope that the Department find it useful and that it guides the Department, its strategic partners and New Zealanders on the benefits that online voting can bring to New Zealand's local elections and how we, as a nation, should go about trialling and implementing online voting for local elections.

Findings

As a working party we have come to some significant findings that we wish to highlight. These seven findings are set out below.

Finding One – online voting is feasible…
Online voting for local elections is feasible, and should be viewed as a natural continuation of existing voting options that will enhance and modernise voting in local elections.

Finding Two – …but broad implementation is not feasible in 2016
We do not think that broad implementation of an online voting option in the 2016 local elections is feasible. Our analysis indicates that a staged approach allows all parties and stakeholders to become familiar with the opportunities and

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[2] The Ministry of Health funds and administers elections for District Health Boards

challenges presented by online voting, whilst also supporting the effective management of delivery risks in line with experience.

Finding Three – online voting should be trialled in 2016 as part of local elections

To maximise success, politically binding trials of an online voting option should be run as part of the 2016 local elections. Our view is that the broad availability of online voting in 2016 is not feasible. We would like to go faster, but we consider that trialling in 2016 best balances the benefits with the risks.

Finding Four – online voting can improve and enhance the voting experience

Online voting recognises and responds to the needs of those New Zealanders for whom postal voting presents some practical limitations and challenges.

Finding Five – public trust and confidence must be maintained

It is vitally important to trial and implement online voting in a manner that reinforces and maintains New Zealanders' trust and confidence in our electoral systems.

Finding Six – implementing online voting will require a partnership approach

Trialling and implementing online voting will require the Department to work with strategic partners such as local authorities, Local Government New Zealand, the Society of Local Government Managers, the Electoral Commission and the Ministries of Health and Justice.

Finding Seven – securing online voting is critical, but not easy

No ICT system is perfect, and absolute security on the Internet is not achievable. Online voting systems should be "secure enough" to support their use and that this judgement should be supported by a detailed threat analysis which is developed and maintained throughout the delivery process.

Recommendations

This section summarises the Working Party's recommendations, which are set out throughout the report. While these recommendations are numbered and grouped below, they are not necessarily sequenced in this order throughout the document.

We recommend that:

Recommendation One

The Department should take the lead to establish a partnership approach with local government and other important strategic partners to further work on online voting.

Recommendation Two

The Department should adopt the following four principles to inform all further work on online voting:

- **Access**: online voting should be available to all, easy to use for voters who want to use it, and the system should allow for increased accessibility where possible
- **Participation**: all qualified persons should have a reasonable and equal opportunity to cast an informed vote either online or by post

- **Integrity**: voters must be confident at all points that their vote is being held, transmitted, kept and counted in a way that protects it and produces a result that is a true reflection of the choices made
- **Security**: online voting needs to be highly reliable and secure enough to uphold the integrity of local elections.

Recommendation Three

For participation and access reasons online voting should be considered complementary to postal or booth voting and not as a replacement to existing voting methods.

Recommendation Four

Councils and their communities should choose whether online voting is available as a voting method.

Security and Integrity

In our view, getting the security and integrity aspects right will be the most significant challenge for online voting. The Internet provides for many unique threats to online voting, and these threats must be identified, mitigated and prepared for.

Recommendation Five

The Department and its strategic partners should involve security experts throughout the process, including at the very early specification and design stages, to ensure that online voting systems are appropriately secure.

Recommendation Six

The Department should undertake a detailed threat analysis to inform security decisions made as a part of protecting online voting systems.

Recommendation Seven

In order to ensure that online voting systems are secure enough, the Department should harness the expertise of the wider security community through a 'bug bounty' or similar process to attract constructive analysis of proposed systems for vulnerabilities.

Recommendation Eight

The Department should ensure that any online voting solutions are highly auditable.

Trialling online voting

In our view, before online voting is used in a politically binding contest it must first be trialled in a non-binding context so that voters can familiarise themselves with online voting and the performance of the system can be tested and evaluated. If the non-binding trials are successful, it is our view that online voting should then be used in politically binding contests on a trial basis, and then robustly evaluated.

Recommendation Nine

The Department should work with its strategic partners to trial online voting in the 2016 local elections using a suitable system made available for this purpose.

Recommendation Ten

The Department and it strategic partners should proceed in measured, incremental steps, including robust evaluation processes to establish and use learnings at each stage to inform future stages.

Recommendation Eleven

Testing and non-politically binding trials should be undertaken prior to the 2016 local elections to ensure that online voting systems are ready for use in a political contest.

Recommendation Twelve

Smaller scale, politically binding trials such as local polls or by-elections should be considered as opportunities to further test and improve online voting systems in preparation for the 2016 trial.

Recommendation Thirteen

The Department should ensure that any findings, audits, and reviews in relation to the delivery of online voting are publicly available in an appropriate form to foster understanding and trust in the transparency and rigour of the delivery process

Getting to a trial

The Department should play a leadership role in trialling online voting. Trials should be sufficient in scale to be meaningful, but small enough to be manageable. The Department would be responsible for progressing most of the legislative changes that would be required to trial online voting. The Department should also play a wider leadership role and work with stakeholders in local and central government to ensure a successful trial of online voting. The public should be engaged early and often in the development of online voting trials to ensure that voters have some input into the online voting system.

Recommendation Fourteen

The Department should begin work as soon as possible on the necessary policy, legislative and implementation workstreams to ensure that online voting can be trialled at the 2016 local elections.

Recommendation Fifteen

The Department should work with its strategic partners to undertake a robust cost analysis on how much it will cost to trial and implement online voting.

Recommendation Sixteen

The Department should work with its strategic partners to identify councils and communities that want to trial online voting and to identify and agree the appropriate scope and timelines for meaningful trials.

Recommendation Seventeen

The Department and its strategic partners should engage New Zealanders throughout the process of enabling online voting, in order to ensure that they are familiar with the proposed nature of online voting and have input into it.

Recommendation Eighteen

For the 2016 trials, online voting should:

a.   use the existing postal ballot issue to communicate login details to users
b.   only allow one-time access to the online voting system
c.   use two factor authentication if possible – our preferred option is for the voter to use their date of birth (acquired from the electoral roll) as a 'shared secret'
d.   enable a voter to vote online for all local electoral contests that they are entitled to vote in.

Recommendation Nineteen

Online Voting systems must be, at a minimum, fully accessible and available for use in both English and te reo Māori and the Department should work with its strategic partners to ensure that online voting can also be translated into other languages used by many New Zealanders.

Voting online after trials

These recommendations set out how we believe online voting should operate after it has been trialled successfully. We believe that the Department should run an accreditation process that would allow for local authorities to choose from potentially multiple online voting systems, rather than a centrally developed or procured online voting system.

Recommendation Nineteen

In order to realise the additional benefits that pre-registration will offer in the long term, post-trial online voting systems should include an option to allow voters to pre-register.

Recommendation Twenty

When implementing online voting (after the 2016 local elections), the Department's role should be to establish and administer a mandatory accreditation process for online voting solutions for communities and councils to use.

Part One – Goal and rationale

This part sets out what we were seeking to achieve with this report and why we think online voting is an important next step for New Zealand's local democracy

Purpose

The purpose of this report is to investigate whether online voting is feasible in New Zealand local elections. In this report we propose some options for how online voting could be trialled and implemented. We also set out a preferred approach for successfully implementing online voting, which has been informed by international and domestic experiences with both online voting and online government services.

Our goal

Our goal is for New Zealanders to be able to vote online in local elections.

We want New Zealand to have smoothly run, trusted online voting systems that support all eligible voters to engage in the democratic process. Local democracies are important and, as we move further into the 21st Century, our local electoral systems need to maintain their relevance.

In our view, it is vital that any future online voting system maintains and reinforces the trust and confidence that people have in local elections and New Zealand's electoral systems.

Rationale

Online voting has great potential to benefit and improve New Zealand's local elections. By adding to the current postal voting system, we think that online voting would enrich voters' experience of their local democracy, allowing them to engage in different ways and make it easier for people to act on their intention to vote in local elections.

Online voting has the potential to enhance participation in local elections and meaningfully engage New Zealanders in the way they want, when they want and where they want.

- Online voting has the potential to **increase the accessibility** of voting for some parts of the population. Postal voting does not cater well to New Zealanders with disabilities, it can be difficult for overseas voters to have their vote counted due to international mail timeframes and the lack of translation of postal voting documents into other languages means that some New Zealanders may struggle to understand voting papers.

- Online voting is a tool of **convenience** for individuals who have already decided to vote, or intend to vote. New Zealanders already undertake a large number of activities online, including shopping, banking, socialising and running businesses. Online voting can be seen as an extension of the democratic and voting process, allowing new technologies to be used to engage voters.

- Voter turnout has been dropping in both national and local elections in New Zealand. Overseas experience suggests that New Zealand cannot rely on online voting to boost voter turnout. However, we believe that easy-to-use online voting tools together with other initiatives could **educate and engage** New Zealanders, make local elections more accessible, and help boost voter turn-out in the medium or long term.

- Online voting may also improve the **speed and accuracy** of results, although this benefit, along with **cost savings**, may take time to be realised as the online voting option will sit alongside the existing options for some time to come.

- Online voting offers the potential to **reduce voter errors.** Technology can help by preventing a voter from accidentally spoiling their ballot or submitting an incorrect or invalid vote. It can also empower New Zealanders to more clearly articulate the deliberate spoiling of their vote as an act of no-confidence.

Objectives

This report makes recommendations on the feasibility of adopting online voting in local elections by 2016 and provides practical advice on implementation issues.

The objective for this report is to provide the Department, stakeholders and the public with:

- information about the benefits that online voting can bring (the value proposition of online voting)

- a feasible way to trial and implement online voting in local elections

- an appreciation of the risks associated with using the Internet for voting.

Part Two – Context

This part provides background information about Internet access in New Zealand, local elections, international and domestic experiences with online voting.

Summary

Not all New Zealanders have easy access to the Internet.

The local government electoral system is complex, with most New Zealanders voting in a number of different contests using two different voting methods (first past the post or FPP and single transferable voting or STV).

International and domestic experience of online voting is limited. While there are some important lessons to be learned, ultimately trials will be crucial to inform the New Zealand electoral context.

Internet in New Zealand

An important part of the context for online voting is New Zealanders' ability to access the Internet. If online voting is to be viable, let alone successful, then New Zealanders will need to have access to the Internet.

The World Internet Project New Zealand 2013[3] (World Internet Project NZ) puts New Zealand's Internet usage at 92 per cent (see below).

Figure one: 2013 Internet usage in New Zealand
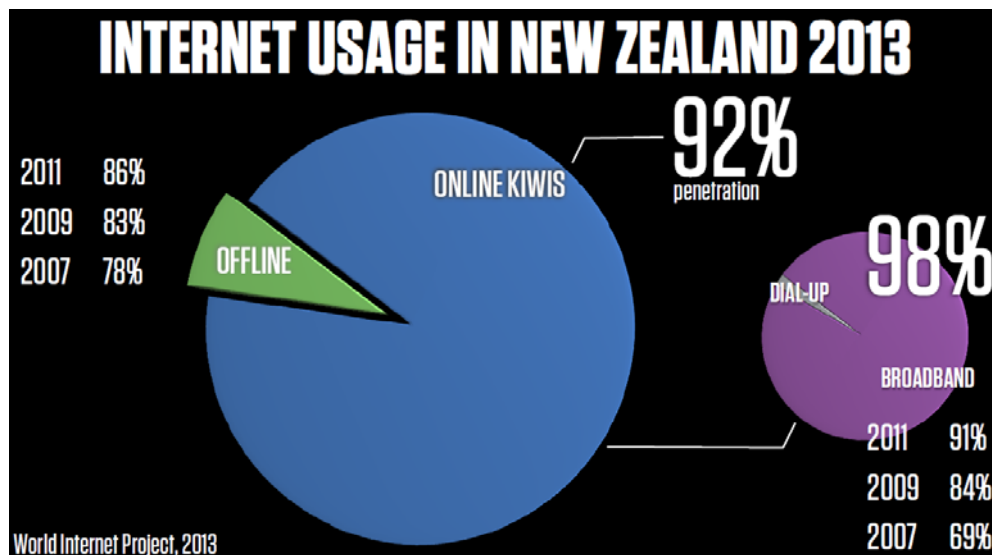
New Zealanders now have access to a wider array of Internet capable devices than they did in the past. The World Internet Project NZ also contains information about what types of devices New Zealanders have access to.

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[3] More information on the World Internet Project New Zealand is available here: www.wipnz.aut.ac.nz

While desktops and laptops are still the most common devices used, a significant proportion of New Zealanders are using smartphones and tablets to access the Internet. It is worth noting that almost half of New Zealanders surveyed were accessing the Internet through tablets and just over two thirds (67 per cent) of households had Internet availability through a smartphone. Together, these numbers show that the development of online voting should include mobile devices as a core component of how people can cast an online vote.

A total of 92 per cent of New Zealanders are online, or put another way, nine in10 New Zealanders have broadband Internet access which they use. This is encouraging for online voting as it means that the majority of New Zealanders have the ability to access online voting systems. However, 92 per cent still means that a sizable minority of New Zealanders do not have access to the Internet. We are aware that while people may have Internet access, they may not want to use the Internet to cast a vote. It will be important to ensure that those New Zealanders who either do not have Internet access, or do not want to cast a vote online, still retain their democratic rights.

Local government electoral process

Local elections are used to elect representatives for local government councils, DHBs and other local community-based democratic entities. Local elections are held every three years and when a vacancy arises on these bodies (e.g. when a member resigns, dies or is disqualified), a by-election may be triggered for the vacant position.

Because of the number of different local government entities, local elections are arguably more complex than general elections. Voters are often asked to vote in a number of contests (e.g. mayoral, council, regional council and DHB) and will often have to use two different voting methods – First Past the Post (FPP) and Single Transferable Voting (STV). We note that because STV is used in all DHB elections, all local elections have some STV component. Figure two, below, provides a high level overview of the number of different local government entities that hold elections and the spread of FPP and STV in these elections.

Figure two: overview of the local government electoral system
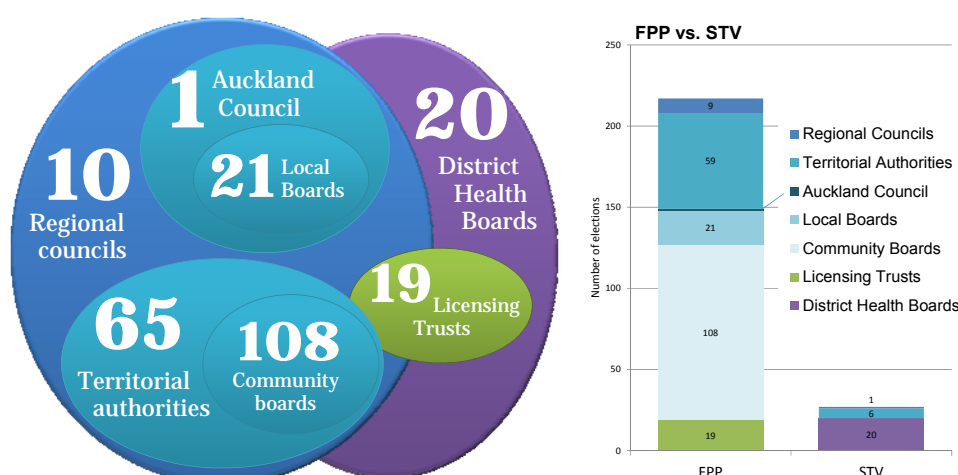
Local elections are largely decentralised. Councils are responsible for the conduct of local elections, while the Department of Internal Affairs retains oversight and is responsible for regulating the local electoral process. Local elections and polls are conducted under the Local Electoral Act 2001 (the Act) and the Local Electoral Regulations 2001 (the Regulations).

The law around who is eligible to vote in a local election is a little different to the law for parliamentary elections. Everyone on the electoral roll used for parliamentary elections is eligible to vote in the local elections in the area where they live. This is known as the *residential franchise.*

In addition, non-resident ratepayers have some voting rights. One person per non-resident ratepaying property has the right to enrol on what is known as the *ratepayer franchise*. For example, if a couple has a rental property in a different region from where they live, one of them will be able to register to vote in that area. However, individuals cannot be enrolled as a residential elector and a ratepayer elector in the same local authority.

How are local elections administered?

The Act sets out the fundamental rules, basic outcomes, principles and expectations of the local electoral system.

Other matters that are subject to more frequent change are provided for by the Regulations. These add to, but cannot overwrite, matters in the Act.

Other Central Government agencies with responsibilities include:

- the Electoral Commission, which provides information from the electoral roll to each local authority and confirms that special voters are on the electoral roll

- the New Zealand Police, who investigate potential breaches of the Act that may be offences and decide whether to prosecute

- the Ministry of Health, which administers the New Zealand Public Health and Disability Act 2000, which governs the conduct of elections to district health boards

- the Ministry of Justice, which administers the Sale and Supply of Alcohol Act 2012 which governs the conduct of elections to licensing trusts, and

- the District Court, which conducts any recount of votes, or other inquiries into local elections.

The Regulations permit councils to use either booth or postal voting. However, postal voting is well established and local authorities have used postal voting since 1992.

Postal voting: an overview

Voting papers are posted to all voters who are enrolled about a month before voting starts. Anyone who is correctly enrolled can vote in the local elections where they live.

Overseas voters can vote, but must ensure that they are correctly enrolled with an overseas postal address in order to receive their voting papers. Voting papers for local elections cannot be downloaded electronically.

Postal voting has a number of weaknesses, including:

- a stolen postal ballot may be used fraudulently

- the privacy of voting cannot be controlled – a voter may be coerced into voting a particular way

- it is non-voter verifiable as the voter has no way of knowing if their posted ballot has been received

- postal votes need to be opened and processed, resulting in possible delays and high overheads

- voting documents may be lost.

We are aware that concerns are sometimes raised about postal voting in New Zealand including lost documents or people filling out other people's forms. We are aware of a recent case from Auckland of a small group attempting to fraudulently change the enrolment addresses of approximately 30 voters. However, we understand that this incident was detected, did not lead to any illegitimate votes being cast, and resulted in the successful prosecution of the perpetrators.

Overall, the postal system appears to operate effectively. We are not aware of any substantive proof that New Zealand's postal voting systems have been undermined. Further, the manuals produced by SOLGM for the running of elections include good practice guidelines to minimise any corrupt or illegal behaviour. The Report of the Justice and Electoral Committee Inquiry into the 2010 Local Authority Elections acknowledged that, while there are concerns with postal voting, it believes the risks are well managed by the relevant authorities.

Elected members of territorial authorities and regional councils are required to make some decisions concerning the election. For example, they agree the representation arrangements for the local authority and determine which voting system will be used.

However, the day-to-day conduct of each local election is largely the responsibility of the electoral officer. The electoral officer is responsible for the entire process including:

- compiling and certifying the electoral roll

- appointing a deputy electoral officer and other officials

- accepting nominations

- preparing, issuing and processing voting papers

- early counts of votes.

Electoral officers and other officials do not need to be local authority employees and many local authorities contract some responsibilities to private sector providers. It is also not uncommon that the private provider is appointed by the local authority as its electoral officer. The electoral officer for DHBs and licensing trusts must be appointed as an electoral officer for a local authority.

Additionally, to assist electoral officers, SOLGM prepares the *Code of Good Practice for Local Elections and Polls* (the Code of Practice). SOLGM reviews the Code of Practice once every three years.

Voting systems

Local authorities have the choice of one of two voting systems: FPP or STV.

The FPP system is identical to that used in elections for *electorate* seats in Parliament; votes are counted and the candidate with the highest number of votes is elected.

Under the STV system voters rank the candidates in order of preference. Then a quota for election is calculated based on the number of votes and number of seats available, votes are counted and any candidate who reaches the quota is declared elected[4].

The rationale of STV is that votes are not wasted, but instead are available to help other candidates become elected, based on the second or subsequent preferences of voters. If there are seats vacant, the candidate with the lowest number of first preferences is excluded, and the voters' second preferences are tabulated. This process continues until all seats have been filled.

All DHB elections must be conducted using the STV system. In 2013, 90 per cent of local authorities used FPP in their own elections. As shown in figure two, above, seven local authorities conducted their elections using STV.[5]

Calls for online voting

We are not the first group to have looked at or thought about online voting in New Zealand. Both local government and central government organisations have considered online or "e-voting"[6] over the last decade. Advocates of online voting have cited a number of benefits:

- ease of use for those who otherwise have difficulty voting

- improving the overall rates of participation

- maintaining and enhancing trust and confidence in the local electoral system

- engaging younger voters

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[4] Vote counting under STV is too complex to be carried out manually, and is therefore carried out using computers. To do this, councils have their own software which inputs voters' preferences into an STV 'calculator' computer programme provided by the Department. The STV 'calculator' is independently certified and is the only counting software permissible for STV elections under the Act. For more information about how STV works, please see www.stv.govt.nz.

[5] The local authorities that used STV to conduct their 2013 elections were: Dunedin City Council, Kapiti Coast District Council, Marlborough District Council, Palmerston North City Council, Porirua City Council, Wellington City Council and the Greater Wellington Regional Council.

[6] "E-voting" is sometimes used interchangeably with "online voting". In our view e-voting lacks sufficient clarity as it may refer to other electronic voting services, such as voting machines. For internal consistency and clarity in this report we refer to "online voting" as a means of voting remotely, using the Internet, on the voter's own device.

- overcoming the challenges of the postal system (e.g frequency of delivery).

Below is a short summary of these different efforts.

Electoral Commission

In 2007 the Electoral Commission released its draft long-term strategy for voting technology which canvassed, among other electoral technology, online voting. The strategy considered the risks and benefits of Internet-based voting and the approach of moving from small scale piloting to wider use of online voting focused on overseas, meeting the needs of vision impaired and disabled voters. The Electoral Commission has not trialled or piloted online voting to date.

Justice and Electoral Committee report

In its report on the inquiry into the 2010 local elections, Parliament's Justice and Electoral Committee recommended that a trial of Internet voting be considered for the 2013 local elections.

It considered that online voting could alleviate the problems faced by overseas voters who did not receive their documents in time to vote. The Committee also observed that the Internet is becoming a regular part of modern society, with an increasing number of services and functions online. The report noted that the launch of the igovt system[7] could facilitate online voting and allay concerns about the security of personal information.

New Zealand Society of Local Government Managers (SOLGM)

SOLGM produced a report in September 2011, calling for the introduction of online voting to address what it saw as a growing public demand for the option. The paper was intended to start a dialogue between local government bodies, central government and the Electoral Commission.

The SOLGM Electoral Working Party developed a model online voting system using the relevant principles in Section 4 of the Act and the internationally accepted democratic principles of universal, free, equal, and secret suffrage as a guide.

The online voting vision developed by the Electoral Working Party was "an electronic voting system for local government elections capable of delivering user-friendly and convenient voting services of high integrity to those voters who choose to use it". To achieve this vision, the goals of improving access to voting in local elections and maintaining or enhancing the trust and confidence of voters, candidates and politicians in the system must be met.

The key issues identified by the Electoral Working Party that need to be addressed included:

- verification of voter identity
- the possibility of the user's device being compromised
- vulnerabilities in the online voting transmission channel or network
- attacks on the online voting infrastructure
- trustworthy verification of the counted results.

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[7] Igovt is a common login service and has since become part of RealMe, which is run by the Department, in partnership with New Zealand Post. For more information visit: https://www.realme.govt.nz/

Advocacy from Local Councils

We are aware that Auckland, Porirua City, Manawatu District and other councils have all advocated online voting. This advocacy has taken the form of media interviews, submissions to the Justice and Electoral Committee, Ministerial correspondence and meetings.

These councils have all indicated a willingness to undertake a trial in their territories.

Current examples of online voting

Online voting is relatively new compared to established voting processes, and only a few countries have managed to implement it successfully for use in politically binding elections. This section explores international examples of online voting and the lessons learned. This section also touches on New Zealand examples of online elections and online services that are relevant to our consideration of using online voting for local elections.

International experiences of online voting

Online voting is a relatively new technology, which has really only been viewed as a viable voting option within the last decade. The number of countries that have used politically binding online voting is small. Each of these countries has a unique local context which shaped its experience with online voting. This means that while we can look at these examples, we need to be careful in drawing conclusions from them.

At least 11 countries have now used online voting for politically binding elections or referenda. However, online voting systems have had a mixed record of success. Australia, Estonia, and Switzerland have successfully used online voting for binding elections or referenda and are set to continue to use online voting systems. Additionally, Norway has successfully piloted an online voting systems which is modelled on Estonia's, and will likely use it in future elections.

The Netherlands, United Kingdom, United States, and Spain have used, then discontinued use of online voting systems. Online voting in these countries was discontinued for a range of reasons including poor system design and unrealised benefits.

The main lessons we have taken from these international examples are:

- maintaining trust in the voting process is critical to success

- ensuring secrecy of the vote is both very important and not always easy

- online voting systems need to be accessible for voters to use

- a staggered rollout helps build trust and identify problems

- awareness and information is important to help users understand the system

- adverse publicity has a big impact on trust in the system

- impact on voter turnout is inconclusive.

The table below provides a short summary of findings from international jurisdictions that have trialled online voting.

Country	Scope	Status
Australia (NSW)	State government elections for remote voters and voters with disabilities.	Successful trial. New version of software to be used in the 2015 state government elections.
Canada (British Columbia, Halifax, Peterborough and Markham)	Local government elections and local government polls.	Successful trials in Markham, Peterborough and Halifax. British Columbia investigated online voting and decided not to implement at the time due to risks involved. Exploring use of online voting in federal elections beyond 2015, but this may be subject to security concerns, budgetary and political pressures.
Estonia	Local government, parliamentary and European parliament.	Successful nationwide implementation. Used in six elections from 2005. Online voting in Estonia is now well established and they are considered to be a world leader in online voting.
France	An assembly that selects representatives of French expatriates to the Upper House. Limited to expatriate voters.	Used successfully in the election of representatives to the Assembly of French Citizens Abroad. Some security and technical issues identified.
Netherlands	Water board councils and national parliament.	Successful trial, but due to lobbying based on security concerns the Netherlands passed a law banning online voting.

Country	Scope	Status
Norway	Local government and parliamentary elections.	Successful trials. Online voting system has many similarities with Estonia's. A view to implement nationwide by 2017.
Portugal	Experiment to test the feasibility of allowing overseas citizens to vote in the Parliamentary elections.	Successful non-binding trials but discontinued due to concerns about voter coercion and high costs.
Spain (Barcelona)	Citizens' referendum. Pre-registration was not required but voters could use a range of authentication mechanisms to vote.	Discontinued. Negative perceptions, controversy and technological problems undermined public trust.
Switzerland (Geneva)	Municipal, cantonal and federal referenda and elections for university councils and libraries.	Successful trial. Other cantons developing online voting based on the Geneva model.
United Kingdom	Local government elections.	Pilot successful, but electoral commission recommended to discontinue due to lack of evidence of benefit realisation and high costs.
USA (Washington DC)	Local government elections. Limited to military and overseas voters.	Discontinued. Total compromise of online voting system as part of a public pre-launch security exercise, caused the system to be discontinued weeks before the election.
USA (West Virginia)	Presidential, federal, state and county elections. Trial limited to military and overseas voters.	Successful, but in review due to the Washington DC experience. Unclear if it is to be used in 2014.

We have compiled short digests on each of these international experiences to illustrate the lessons New Zealand could learn from international experience. These have been built from information available on the Internet and are attached in **Appendix B**:

New Zealand has not implemented online voting for government organisations or services, but online elections already take place for other purposes. We have met with two New Zealand companies that provide existing election services to local authorities.

Non-government online voting

The two companies that provide existing elections services to local authorities also offer online voting systems in a range of contexts. These companies currently provide online election services to a mix of private sector, not-for-profit and other organisations such as energy trusts, Fonterra, iwi, the Teachers Council and political parties. In 2013, one of the providers was involved in Auckland Council's Kids Voting (see the case study below).

These online voting systems leverage existing postal voting systems for their non-government clients. Postal ballots are sent to voters with their online voting credentials. Voters are able to vote by post or use a provided login and password to vote online. Online voter turnout (that is, the proportion of respondents voting online) varies between the type of elections but usually range between 10 and 30 per cent, with up to 50 or 60 per cent for some elections.

Case study: Kids Voting 2013

Just before each local election, Auckland Council undertakes a Kids Voting exercise. Kids Voting is a political awareness tool which teaches young people aged 11 to 15 years (school years 7 to 10) about democratic participation. As part of Kids Voting, students are given the opportunity to experience an election and vote for real candidates on real issues

In 2013, Auckland Council used online voting for Kids Voting. This gave the Auckland Council the opportunity to pilot online voting within a non-binding environment. In 2013, 44 schools, with approximately 8319 students registered to take part in Kids Voting.

Auckland's disabled communities also played a part with the Kids Voting Online Pilot 2013. Students from the Campus Transition Programme voted online, along with sight impaired adults who were given the opportunity to view information and provide feedback on the pilot.

Case study: Online Census

While not an example of online voting per se, the option to complete a census form online presents a good New Zealand case study of the successful introduction of a comparable online service that met the requirements for confidentiality, integrity of data, ease of access and availability.

Statistics New Zealand conducts a census of population and dwellings every five years. An online option was first introduced as part of the 2006 Census following growing public demand for government services to be delivered online. The online option was a success. There were almost no implementation problems and over seven per cent of all census dwelling and individual forms - almost 400,000 forms - were received through the online channel. In the 2013 Census, 35 per cent of forms were completed online. A more detailed report of the Online Census experience is included as **Appendix C**.

Statistics New Zealand has always had a high trust reputation within New Zealand. It chose to implement the online option slowly, gaining people's confidence and giving itself the opportunity to fix any mistakes that might occur while the uptake numbers were still small.

An expanded online model was trialled in Oamaru in 2013. Internet codes were mailed to 5,000 addresses in Oamaru using a trial address list compiled from administrative sources, and paper forms were provided only on request. The purpose of this trial was to explore a new collection model less reliant on hand delivery and collection of paper forms to each household. Statistics New Zealand mailed out the required log-on codes, along with a letter with simple instructions, and this approach got a very high participation rate with 65 per cent of forms completed online.

The success of the online census holds several valuable lessons for online voting:

- **Extensive usability testing is vital** so that problems can be identified and fixed early in the process. Statistics New Zealand told us that the log-in process was the biggest hurdle for respondents. In 2013, the access code was reduced from 12 characters to nine, and information pages that were a precursor to the actual forms were cut out.

- **Having a trusted brand is important** as people begin from a position of trust in the organisation and what it is delivering. Statistics New Zealand already had a trusted reputation with the public. The delivery of a small, but trouble free, 2006 Census online option helped to cement this reputation as a safe organisation that protected people's information.

- **Start with a small target** and don't promote it too widely, then slowly build on this small initial success.

- **Take the time to do it right.** It pays to put the time and effort into getting the right vendors and systems and testing the final version properly.

- **Carefully consider what changes are needed** to any existing processes and develop ways to ensure the new process is fully integrated.

- **Keep internal staff well informed** about the online option and how it affects their work and make sure they have the tools and information to understand and communicate the new system to the public.

- **Build the system to cope with a higher than expected load** so it can deal with more traffic over a time period. This is to ensure the availability of the system.

- **Work collaboratively with different organisations.** As the Internet-based census project used multiple suppliers, Statistics New Zealand needed to ensure there was excellent communication between all parties and clear allocation of responsibilities.

- **The public is willing to use new technology**. The Oamaru experience shows that a single, well-designed letter with simple instructions is enough to get people to take part in an online trial. For the next census, Statistics New Zealand is considering mailing out an Internet code to most New Zealand addresses - which is linked to the dwelling.

Part Three – Principles of online voting

This part explains the existing electoral principles and the principles that have guided our thinking about how online voting could work in New Zealand's local elections.

Summary

Democracy in New Zealand is governed by a number of electoral principles, including universal suffrage and secrecy of the vote.

We have identified a further four principles which we feel are the cornerstone of an online voting system.

- **Access**: Online voting should be available to all, easy to use for voters who want to use it, and the system should allow for increased accessibility where possible
- **Participation**: all qualified persons should have a reasonable and equal opportunity to cast an informed vote either online or by post
- **Integrity**: voters must be confident at all points that their vote is being held, transmitted, kept and counted in a way that protects it and produces a result that is a true reflection of the choices made
- **Security**: Online voting needs to be highly reliable and secure enough to uphold the integrity of local elections.

These principles do not replace broader, electoral principles but are of particular importance to online voting.

The system that is eventually built, procured and accredited will incorporate the traditional principles and the four online voting principles. These are discussed below

Electoral principles

The most fundamental concept of democracy is that people consent to being governed. An essential part of this consent is that voters have the ability to choose their leaders in free, fair and regular elections.

In New Zealand **free elections** provide citizens and residents the right to express their will and the opportunity to change leaders, address wrongs and protect the limitation of their rights. Elections establish the political rights of citizens and residents (collectively referred to as citizens).

There is no precise definition of what a regular, free and fair election is, or how to conduct one. International human rights conventions have established a basic consensus, most importantly Article 21 of the Universal Declaration of Human Rights. It states:

> *"Everyone has the right to take part in the government of his country, directly or through freely chosen representatives... The will of the people shall be the basis of the authority of government; this shall be expressed in periodic and genuine elections which shall be by universal and equal suffrage and shall be held by secret vote or by equivalent free voting procedures."*

Universal suffrage means that there all adult citizens have the right to vote and that there can be no burdensome impediments to registering to vote. The aim is to encourage participation, so that the maximum number of eligible voters will exercise their right to choose their government.

Another important principal is **one person, one vote**, meaning all people are equal and have a vote, and no person's vote can be counted twice.

Equally important is the principle of a **secret vote**, where no one but the voter knows how he or she has voted. If a voter's choice is seen by others, voters may be subject to intimidation and reprisals by the party in power or by a party seeking power, and elections would lose their integrity.

Central government electoral principles

In New Zealand, the Royal Commission on the Electoral System (set up in 1985) established 10 criteria for choosing an electoral system. These criteria have guided New Zealand's electoral system for almost 30 years. The criteria are not of equal weight and the balance of objectives that provide the best mix for a particular system will differ from case to case.

The criteria are:

- Fairness between political parties. Effective representation of minority and special interest groups
- Effective Māori representation
- Political Integration
- Effective representation of constituents
- Effective voter participation
- Effective government
- Effective Parliament
- Effective parties
- Legitimacy.

Explanations of these principles are included in **Appendix D**.

Principles of local elections

The Local Electoral Act governs the way in which local elections are undertaken, managed and audited. The Act, as a recent replacement to previous local electoral statute, seeks to modernise the law governing local elections and allow diversity in the voting methods and electoral systems used for local decision making while adopting uniform rules for the administration and timing of local elections.

As the law governing local elections, the principles of the Act are critical benchmarks in our consideration of online voting. These principles are set out below:

- Fair and effective representation for individuals and communities. All qualified persons have a reasonable and equal opportunity to cast an informed vote, nominate one or more candidates and accept nomination as a candidate.

- Public confidence in, and understanding of, local electoral processes through:

    - the provision of a regular election cycle
    - the provision of elections that are managed independently from the elected body
    - protection of the freedom of choice of voters and the secrecy of the vote
    - the provision of transparent electoral systems and voting methods and the adoption of procedures that produce certainty in electoral outcomes, and
    - the provision of impartial mechanisms for resolving disputed elections and polls.

Any new voting system adopted by the New Zealand government must meet the test of being free, fair and regular, and provide for universal, equal and secret suffrage.

Principles for online voting

We have identified four principles that we consider should be used to guide the design and build, procurement or accreditation of any online voting system. These principles have also been informed by the work of other jurisdictions that have successfully implemented online voting solutions.

Access

Online voting should be available to all, easy to use for voters who want to use it, and the system should allow for increased accessibility where possible. We consider that:

- Online voting should not disadvantage anyone and should be accessible for voters who have particular needs or disabilities

- There will be fair and effective representation for individuals and communities when designing online voting tools to ensure that the benefits of online voting are realised

- Online voting should enable voters to access the same or a higher degree of information about candidates as postal voting

- Online voting should be no more difficult to do than postal voting

- New Zealanders should be able to vote online at any point during the election period, which should be the same election period as all other voting channels.

Security

Online voting needs to be secure enough to uphold the integrity of local elections and be highly reliable. We consider that:

- Voting over the Internet involves risks that can be mitigated but not eliminated

- User's devices cannot be relied upon to be secure and up to date. Online voting systems have to assume the devices voters use cannot be trusted and be designed to mitigate this as much as possible.

Participation

Participation means that all qualified persons should have a reasonable and equal opportunity to cast an informed vote either online or by post. Online voting should not disadvantage voters and it should provide effective participation opportunities.

We consider that:

- Online voting has the potential to increase voters' access to information about candidates

- An online voting system needs to be easy to use and designed for the voter and their voting experience

- Online voting should seek to improve a voter's ability to engage in local democracy, if they wish to use it

- As a voting option, online voting should not be forced on those who prefer to vote by postal voting.

Integrity

The principle of integrity means that voters must be confident at all points that their vote is being held, transmitted, kept and counted in a way that protects it and produces a result that is a true reflection of the choices made.

Elections must be reliable and produce results that accurately reflect the votes cast. As a method of voting, online voting will maintain and enhance the integrity of, and level of trust in, our local elections.

We consider that:

- Online voting must keep the identity of the voter secret to the same extent as postal voting

- The concept of equal suffrage must be maintained

- The public needs to have confidence that the system can be monitored and that their vote will be cast correctly

- Online voting needs to be accepted by the public and political candidates.

- Online voting systems must be demonstrably accurate and able to be audited.

- The online voting implementation process should involve the public in a way that maintains or improves New Zealanders' confidence in our electoral systems.

Balancing these principles

While well designed systems can be acceptably secure and easy to use, elements of ease of use and security sometimes counter each other. For example, higher security will mean more checkpoints or barriers before people can get into the system. It is also the case that maintaining the secrecy of the vote will impact on the verifiability and transparency of the system. All the principles matter. However, design and implementation choices will need to strike a balance that preserves the opportunities of online voting while adhering to the principles as much as possible.

We recommend that the Department should adopt the following principles to inform all further work on online voting:

    a. Access: online voting should be available to all, easy to use for voters who want to use it, and the system should allow for increased accessibility where possible

    b. Participation: all qualified persons should have a reasonable and equal opportunity to cast an informed vote either online or by post

    c. Integrity: voters must be confident at all points that their vote is being held, transmitted, kept and counted in a way that protects it and produces a result that is a true reflection of the choices made

    d. Security: online voting needs to be highly reliable and secure enough to uphold the integrity of local elections.

WHAT ABOUT ONLINE-ONLY VOTING?

We have discarded any online-only options for both trial and broad implementation as it is not consistent with New Zealand's general electoral principles or our principles of **Participation** and **Access**.

According to the 2013 Census 76.8 per cent of New Zealand households have access to the Internet. The World Internet Project's 2013 data showed that while a higher 92 per cent of people use the Internet, there are still some New Zealanders who either choose not to use the Internet, or do not have access to the Internet.

Our collective view is that while New Zealand is approaching Internet saturation, our country and society is not yet ready to move our local elections entirely online. Online voting should add to our existing local democratic processes, expanding the ways in which New Zealanders can engage in local democracy. Those New Zealanders who do not use the Internet should still be able to vote in local elections according to their preferences, be it postal ballot or physically handing in their ballot.

We recognise that, in the future, online voting use and Internet access will both reach a tipping point when decision makers could consider a move to replacing postal voting with online voting in local elections. However, we do not consider that time is now.

We recommend that for participation and access reasons, online voting should be considered complementary to postal or booth voting and not a replacement to existing voting methods.

Part Four – Key issues

In this part we discuss some key issues for online voting and make recommendations. Technical and security issues are discussed in the following chapter.

Summary

One of the most important issues facing the implementation of an online voting system is trust. Delivering public trust and confidence in the new system is vital. A number of the issues below stem from, or are related to, the need for an open, transparent system that gives the voter confidence in the new system. Aligned to trust is the need to include audit and evaluation are key components of the process.

We also discuss the issue of access, which we consider to be of such importance that we have included it as one of the principles (see above). Online voting offers the opportunity for enhanced access for many, but not all, voters. Below we discuss some of the access benefits, and issues, in an online voting option.

Public engagement and awareness is closely aligned to our principle of participation and we consider that engaging people is one of the advantages online voting can bring to the electoral process. Along with this, we have made some recommendations on public awareness and education programmes, recognising that trust is built through confidence in, and knowledge of, the system, and that one of the issues in introducing online voting is having a confident, informed group who feel comfortable taking up the opportunities provided by new technology.

Trust and transparency

The implementation of online voting will not be possible without the support of voters. Building trust and gaining support is one of the most critical parts of the process. Without trust, the system will be unusable and the integrity of the whole electoral system could be called into question. The level of transparency will also be critical to building trust.

Trust

New Zealanders have a strong trust in the electoral system and in the bodies who administer our elections. This confidence may be transferred to an online voting system. However, online voting takes away a great deal of responsibility from the electoral officials, putting it in the hands of an electronic system that is, as yet, untested in the eyes of the voters. People will take time to trust this system.

Electoral systems need to deliver a system that reflects the will of voters, and that convinces stakeholders that the election has delivered the will of the voters. This means that it is not enough for the results to be accurate – people need to have trust in the system itself to believe the results presented are correct.

To achieve a credible and trusted online voting system, a number of factors need to be in place. Firstly, the operational and technical components need to be well designed and suitable. There needs to be a clearly seen and articulated foundation for doing the work. The design and build needs to be transparent at all steps of the process. There need to be mechanisms for keeping the system secure and free from manipulation. Any certification processes need to be open and credible. Standards and the certification process need to be internationally acceptable.

Trust in the system will be helped by the socio-political context. Trust in the existing institutions will help, as will consultation with the public and acceptance of the system by trusted experts and public figures. Time is also good for increasing familiarity and acceptance.

Transparency

Transparency of online voting will be important. We recognise that not everyone in New Zealand will be optimistic about online voting, while others may be scared or sceptical of the motivations for implementing online voting. This is why transparency is important.

To gain public confidence, all systems should be designed to be as transparent, simple and open as possible. The design, testing and implementation also needs to be made available for public review where possible, keeping security considerations in mind.

Audits done on the system and any documentation from the certification process should also be made public. This level of openness will allow public confidence and trust in the system to grow.

Testing, trialling, evaluating and auditing online voting systems should be done in a transparent manner. The level of openness that surrounds online voting will be critical to ensuring public confidence and trust in the system.

If the system is transparent, voters and other stakeholders can gather information and make a rational decision about whether to trust the system. Voters who may not understand the system can be reassured by the trust experts have in it.

There are two aspects to the transparency of information: access to the information itself, and disclosing the findings of any analysis conducted on the system. Both are important in making the system transparent and building trust in it.

If voters cannot ensure the systems are working as intended, they must rely on independent experts to do this for them. Online voting scrutineers will require specialised knowledge to be able to be effective, and to give the public confidence that the system is working as it should be.

Access

One of the most compelling arguments for online voting is making it easier to vote for New Zealanders who find voting under the current postal voting system difficult, or cannot vote secretly and personally. For these voters, online voting is far more than another option: it is a game changer, allowing them to participate fully in a democratic system.

The principle of accessibility requires that voting opportunities are accessible to all eligible voters, regardless of their location, social status, abilities or personal circumstances. Online voting has the potential to allow some groups access, but we must also make sure that it does not exclude others. Whether or not online voting will increase accessibility will depend on New Zealanders' access to the Internet and their ability or desire to use this channel to vote.

Recent data released by Statistics New Zealand shows that three-quarters (76.8 per cent) of New Zealand homes had Internet access in 2013. Cell phone access has also increased with 83.7 per cent of homes having access to a mobile phone.

Currently, there is low voter turnout for local elections (but is greater than other countries). Across New Zealand as a whole, the 2013 elections saw a turnout of 41.3 per cent. The lowest turnout was in urban areas, where 40 per cent voted. Online voting may have the potential to engage some of these voters and encourage them to participate in elections – especially if it is

supported by marketing and awareness programmes that encourage people to engage with democracy.

Online voting also presents opportunities for New Zealanders to vote in different languages. In line with current practice, online voting must recognise te reo Māori as the Taonga that it is. Online voting should, at a minimum, be fully available in both English and Māori.

There are other opportunities for translating online voting ballots into other languages. New Zealand is a multicultural nation and, in line with our principle of **Access**, the Department should be seeking to provide online voting in a number of other languages so that New Zealanders can engage in local elections in the language of their choosing.

We recommend that online Voting systems must be, at a minimum, fully accessible and available for use in both English and te reo Māori and the Department should work with its strategic partners to ensure that online voting can also be translated into other languages used by many New Zealanders.

Public engagement and voter turnout

Voter turnout has been declining for a number of years. This has been a recent trend across all elections, but is particularly marked in local elections, which reached a low turnout of 40 per cent in 2013.

Online voting is often seen as a solution to declining voter turnout, but research into jurisdictions that have implemented online voting have not drawn robust conclusions about the connection between online voting and voter turnout. There have been some online elections where voter turnout has increased, but often this turnout cannot be solely attributed to an online option.

The general consensus is that introducing an online voting option does not cause non-voters to vote; it is usually used as tool of convenience by those who have already decided to vote.

Where there is an increase in voting, it is often a one-time only spike, suggesting that the novelty value of online voting wears off after the first time. In Markham,, Canada, there was a 300 per cent increase in advance voting in 2003 after online voting was introduced, but overall voting remained constant. The increased turnout for advanced voting did not translate into more people actually voting online on election day.

Estonia is one country that has seen positive movement in online voting, with the number using the online voting increasing each election. However, evaluations of online voting in both Estonia and Norway concluded that there is no overall increase in voting and the votes being cast would have been cast anyway, whether electronically or not.

Young voters are one of the groups often cited as being the least likely to vote. As they are also one of the most digitally literate groups, online voting is seen as a key way of encouraging these voters to engage with the electoral system.

However, there is mixed evidence that online voting actually attracts younger voters. Most jurisdictions report that the group most likely to vote online are baby boomers. It is likely that young people will choose an online voting option if they decide to vote – but getting them to decide to vote is the challenge. Offering an online option may not be enough alone to entice them.

There would seem to be much deeper issues involved in public turnout than the ability to vote online. These issues, and finding ways to address them, are outside the scope of the online voting project. In our view online voting is a means of future-proofing the electoral system. It has the potential to increase engagement in the democratic process which, when partnered with other initiatives, may result in increased turnout.

Figure three: Factors necessary for public confidence in an online voting system

- a trusted online voting system
- operational and technical issues are seen to be secure
- the socio political context
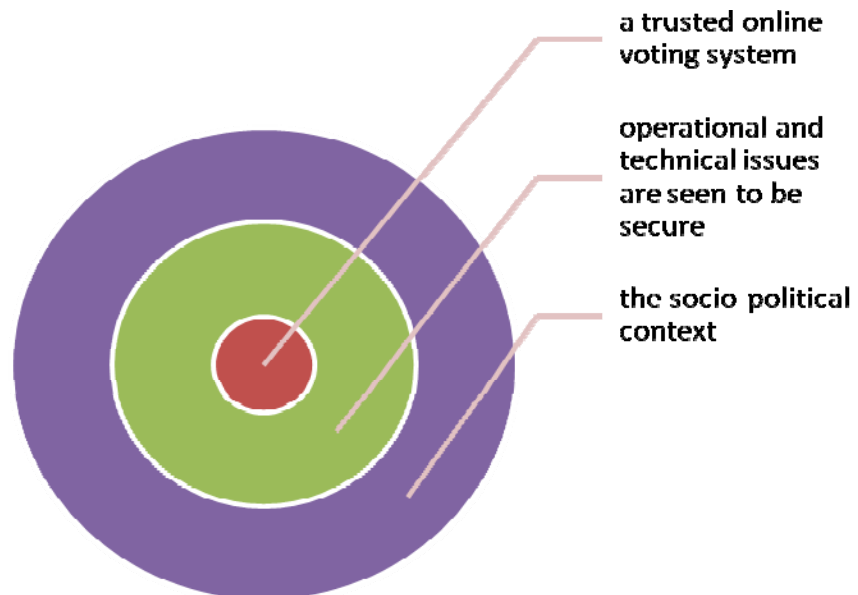
Understanding online voting systems in sufficient detail to form an opinion about their qualities requires significant technical expertise. This creates a significant challenge for the general public, whose trust and confidence we must gain if the implementation of online voting is to be a success.

We recommend that the Department should ensure that any findings, audits and reviews related to the delivery activities are available in an appropriate form to foster understanding, trust in the transparency and rigour of the delivery process.

Training

Training modules and sessions should be developed for council electoral staff. The SOLGM Electoral Working party, for example, may be responsible for developing the training modules. All electoral officials need to be comfortable with how the new system works so they can answer questions and provide advice.

Public engagement

Prior to introducing online voting, it is advisable to engage in meaningful public consultation both on the concept of online voting and the sort of system envisaged. Public engagement can help create confidence in the system and gives transparency to the decision-making process. People should also be encouraged to test the process during the build phase.

We recommend that the Department and its strategic partners should engage New Zealanders throughout the process of enabling online voting, in order to ensure that they are familiar with the proposed nature of online voting and have input into it.

Education and engagement

Another way to build trust is to educate and inform people about the system and how it works. The more comfortable people are with the system, the more likely they are to trust it.

It is also important to make sure people are engaged and consulted early in the process. The level of understanding about Internet processes is low, and this lack of knowledge has the potential to create distrust. Understanding and confidence is built through involving people in the process and providing them with material to educate them and answer their questions.

Audits and evaluation

Audit

Auditing elections is an important part of verifying and recounting votes and voting procedures to confirm the result of an election. The process should be independent and documented.

Any online voting system will need to be audited at the vital parts of the system by appropriate agencies. This will allow for people to see the system is functioning properly and nothing is being hidden. An audit will allow for any changes and decisions to be defined and explained.

A similar process currently occurs with the STV calculator, where the Department sought independent certification of the calculator by KPMG.

All parts of online voting systems and processes should be reviewed, from voting, counting and archiving, through to the destruction of votes.

Evaluation

Once the system is built or procured, it will need to be evaluated through the trial, testing and implementation phases. This is an ongoing process that involves constantly checking and adjusting the system. The evaluation should broadly answer two questions:

- Did online voting achieve the objectives it set out to achieve? For example, did it improve access to voting or increase participation?

- How did the online voting system perform technically? For example, in terms of casting a vote and calculating the result.

To answer these questions, policy makers need to be clear with the system architects about what online voting seeks to achieve and how it is expected to perform.

The evaluation process should be outlined at the start of the voting process, including being clear about what information will need to be identified and evaluated. Requirements or standards need to be very clear as the evaluation will check against these to see how well the system is performing. As part of this evaluation, tests and trials need to gauge the public view of voters and non-voters through means such as polls and surveys.

It is important that the companies or agencies that provide equipment or services for online voting are trusted, competent, open, transparent and independent. This is because public scrutiny of the democratic process is a fundamental principle of a free and fair election system.

Legal framework

The legal framework should lay the foundation for online voting and make it clear the role that online voting plays in the electoral process. Online voting should not compromise the general principles that already exist in relation to elections and voting.

We have been advised by the Department's secretariat that there will need to be some manner of legislative changes to facilitate online voting. These changes include:

- **changes to the Act**: while the Act is permissive of online voting, a small number of changes may need to be made to better facilitate a voter using a non-physical ballot paper

- **changes to the Regulations**: a new part in the Regulations will be needed to manage online voting. This is comparable to the components of the Regulations that cover postal and booth voting.

We think these changes to local electoral law should not be complex, and should be able to be achieved easily, subject to appropriate prioritisation within the government's legislative programme.

It may also be necessary to make minor amendments to other acts such as the Electoral Act 1993 or other relevant law. While we have not identified any other legislative changes, we think that the Department should engage with its strategic partners to ensure that any necessary legislative changes are identified early to meet the necessary timeframes for trials in 2016.

Part Five – Technical and security challenges

This part sets out online voting's technical and security challenges. We believe these challenges are not insurmountable, but nor are they trivial. Online voting presents excellent opportunities so the Department will need to carefully work through these challenges and engage with the various parties who may be impacted by these challenges.

For online voting to be a success in New Zealand there are some technical and security challenges that need to be overcome. These are set out below.

Summary

For online voting to be a success in New Zealand there are some technical and security challenges that need to be overcome:

- online voting systems will need to have extremely high confidentiality settings and uphold the secrecy of the vote

- online voting systems need near perfect accuracy, integrity and should be available for the entire voting period in order to support voter **Participation** and **Access**

- online voting systems need to have a high security capability. However, while they can be made 'secure enough', some security risks will always be present. Security considerations will also need to be carefully balanced against the principles of access and participation.

The technical challenges

Online identity verification

Being certain that the person casting the vote is, in fact, the person whose vote is being cast is not an easy task. We consider this crucial to the wider principles of democracy. Online voting, and the democratic process in general, could be seriously undermined if certain individuals are able to impersonate other individuals and vote on their behalf. In order to succeed in New Zealand, online voting will need to reconcile the tension between authentication requirements (which must be linked to the electoral roll) and ease of access for voters.

One such possibility is using RealMe, the Department's online identify verification tool. Although the RealMe logon currently does not have enough users linked to the electoral roll.

We consider that RealMe is a promising tool for the future of online voting. However, our main principles of **Participation** and **Access** have led us to conclude that voters should not be required to use RealMe to cast a vote online. The current postal system does not have any additional checks or balances (outside of mailing the ballot to the registered address of that voter) to ensure that the person who votes is the person who the ballot belongs to. The strong public trust in the postal system ensures that this is an appropriate mechanism to effectively "authenticate" the voter and provide them with their voting documents.

Given this, we believe that online voting should not involve any significant, additional steps such as a registered online account. Online voting should include the option of using RealMe for pre-

registration, but we consider that requiring pre-registration through RealMe would be counter productive.

Confidentiality, Integrity & Availability

One common ICT methodology when thinking about technical priorities is to use the Confidentiality, Integrity and Availability triad (the CIA triad). These three concepts represent different high level technical aspects that architects and designers can use to understand what is most important to an ICT build.

Confidentiality

Figure four: The CIA Triad

The principle of confidentiality refers to securely keeping information within the information system. In particular, only allowing the information to be accessed by authorised users and preventing unauthorised users from accessing that information.

In the context of online voting this information would include the voter's details and their vote. A person's vote should only be available to the person who is casting it and the relevant Electoral Officer (and their staff) who oversee the electoral process.
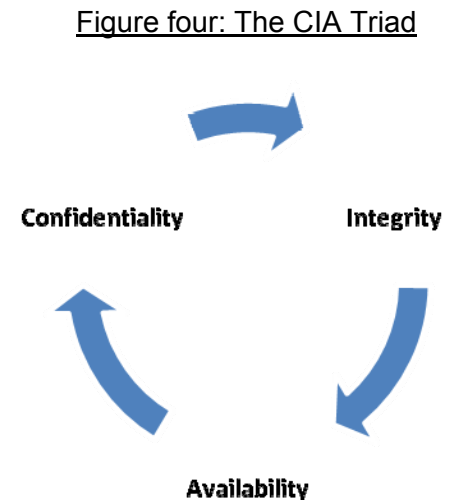
Integrity

The principle of integrity refers to the secure storage of data within the information system. Data integrity means that information has not been altered (either through malicious means, data corruption or system faults) from when it has been received until it is used. Further, if a fault or an intrusion occurs there must be a means to identify any changes made to the information as well as a means to restore the information to its original state (such as a backup).

In the context of online voting, this would include means to ensure that the voter's preferences have been received accurately and have not been altered while the vote is in storage.

Availability

The principle of availability refers to the information being readily available both to authorised users and administrators of the information system. This means having the necessary resources available to provide a service to users and system access for administrators even if there are disruptions or, at the very least, to have plans in place to manage disruptions when they occur. In the context of online voting, availability means that the online voting system is available for the use of voters and election officials throughout the voting process.

The Confidentiality, Security & Availability challenge for online voting

Typically in an ICT project, one of the principles of confidentiality, integrity and availability is prioritised over the other two principles. This prioritisation enables architects to design a system that reflects the priorities of the owners.

However, for online voting, all three of these should be of high importance. New Zealanders need to have the secrecy of their vote maintained (secret suffrage). In addition, online voting

needs to be conducted in a way that both correctly counts each online vote and maintains robust audit of electoral systems. Finally, any online voting software would need to be available during the whole three week voting period.

This means that online voting must have very high confidentiality, excellent integrity and constant availability. Confidentiality of 99.99 per cent is too low, and even one or two incorrectly cast or 'lost' votes could call into question the rest of the system and affect the perceived legitimacy of the election. In line with our principles of **Participation** and **Access**, online voting systems should be available for the entire voting period.

Likewise, 99.99 per cent integrity would not be good enough – online voting systems need to provide voters with the correct contests that they are entitled to vote in and will need to record voters choices correctly. Online voting systems need to be able to recall individual votes correctly for the purposes of auditability and judicial review.

Current expectations from users about being able to access websites 24/7 means that websites must be reliable enough to meet these expectations. In line with our principles of **Participation** and **Access**, online voting systems will need to be available for the entire voting period.

We recognise that this will be a challenge. But in order to realise the benefits of online voting, this technical challenge must be met.

The security challenge: can online voting be secure enough?

Online voting takes place over the Internet - an environment that is not transparent or easily monitored by election officials and is accessible globally, so it can be tampered with on a wider scale than traditional types of voting. Poor security, or a security incident, would be likely to set back online voting in New Zealand by years if not decades. This is why we have adopted **security** as one of our key principles.

As a group, we have been asked to consider principles and other high level matters relating to online voting. Information security is an area we found both complex and detail specific. Providing high level guidance and comment on how to do information security well is not a simple task. However, through ongoing assistance with security experts, we have arrived at a set of core concepts and recommendations for the Department to consider when thinking about the security of online voting.

There is no such thing as 'secure'

Simply put, the Internet is not secure and the concept of '100 per cent secure' does not exist. This means that no system can ever be secure – it can only be secure enough. Security efforts should seek to understand and then mitigate the risks to the point that the risks can be accepted.

For online voting this means that the Department should be clear that neither it, nor a software vendor, can make online voting 'totally secure'. For online voting to be successful, the Department will need to carefully engage with decision makers and the public to communicate the message that all care will be taken to make online voting secure enough, but that there will always be residual risks that something could go wrong, as is currently the case with postal voting.

Security decreases over time

The security of an ICT system decreases over time. New security techniques are constantly being developed as are architecture concepts. Because the security landscape is constantly evolving, systems that are not patched and updated will be less secure over time.

One example from New Zealand is the online census. Statistics New Zealand first developed its online system in 2004, for use in the 2006 Census. Because of the changes in security practices, system architecture and new knowledge, Statistics New Zealand has told us they will no longer be using their existing system and instead will be developing a new tool with more modern architecture.

This can be a challenge for online voting systems, which are used infrequently, usually once every three years. The Department will need to plan regular reviews between election cycles to ensure that security remains appropriate.

Security is best when done early

We have heard that systems are usually more secure when security is considered as a part of design and architecture, as opposed to when systems security is considered at the end of the development. Use of a modern software development lifecycle would help ensure that security concerns are set out from the beginning.

We consider that any online voting system used in New Zealand should adopt a modern software development lifecycle to ensure that security is considered at an early stage and continually considered as a part of definition, design, development, integration, testing, deployment, maintenance and evaluation.

Good security takes time

Achieving a high level of security is not a simple or short task. Good security takes time. Ensuring the requirements are correct, designing securely, developing securely, and undertaking testing and the relevant points are critically important. Security testing and review is important whether online voting systems are built or procured. Given the importance of getting the security settings correct, we would encourage the Department to ensure there is enough time to address security testing and concerns.

The need for comprehensive risk and threat modelling

These security principles are useful, high level concepts to consider when launching an online voting project. It will also be important for the Department to undertake comprehensive risk and threat modelling. At this early stage, actually undertaking risk or threat modelling would not be productive, nor do we think that we are the right people to engage in such modelling. However, we have heard and discussed how threats to online voting systems can come from a wide range of individuals and organisations with quite distinct motivations, and that the risks are broad and real. Below is a short, visual summary of the different potential threats to online voting systems.

Actor Type	Automated Attacks	Targets of opportunity	Publicity seekers	Security motivated	Political manipulation
Objective	Automatic malware systems that scan the internet for vulnerable hosts to infect.	Searching for vulnerable systems to compromise for personal gain.	Compromising a system to gain publicity for political or personal motivations.	Specifically targeting the online voting system to prove online voting should not be progressed.	Targeting the online voting system to manipulate the results of a political election.
Targeted	✗	☑	☑	☑	☑
Character	Automated	Opportunistic	Opportunistic	Divergent	Political

Given this broad range of potential threats, we recommend that the Department engage in robust threat modelling to ensure that the threats are understood and appropriately mitigated.

An online voting 'bug bounty'

One process that we believe the Department should consider during the testing and non-binding trial phase is a 'bug bounty'. We have heard from security professionals that security vulnerabilities are a fact of life for ICT systems and that in any process, some vulnerabilities will remain.

Bug bounties involve paying third parties for any bugs they find in your ICT system. They can be fixed term events or standing bounties such as those run by Google, Facebook and Microsoft. Internationally, 'bug bounties' are becoming more common tools for owners of ICT systems to help them discover serious vulnerabilities and incentivise a process where these vulnerabilities are disclosed and fixed securely.

A bug bounty for an online voting system would be useful in that it would help flush out any remaining bugs and vulnerabilities prior to the 2016 trials. A bug bounty would enable New Zealanders who are interested in the security of online voting to be able to contribute to improving the system before it is used in a real political contest.

We are of the opinion that, given the types of threats that online voting systems face, a bug bounty would be an excellent opportunity to harness the wider expertise of New Zealand's security community. A bug bounty would also help decision makers to gain awareness of the bugs that exist in online voting software in a controlled manner, early in the process. One less attractive alternative is that some of the same bugs could be made public during the voting period of a live trial.

We are not aware of any bug bounties that have been undertaken by New Zealand State Sector agencies. However, we think the Department should give careful consideration to the benefits of offering a bug bounty on the online voting system trial. Undertaken in the right way, at the right time, a bug bounty represents a way to obtain enough information to make an informed, risk-aware decision about whether to trial online voting in a politically binding trial.

Rising to the technical and security challenge

We are of the view that online voting needs to have both a very high security standard and high security expectations. The integrity of our local democracy is a critical component to ensuring that New Zealanders are engaged in local decision making and ensuring that their voices are heard. Overcoming these security and technical challenges to achieve successful online voting may not be easy, and meeting them will rely on decision makers' willingness to accept some level of residual risk.

Working to manage and mitigate the risks, to create a highly secure system that can withstand public and technical scrutiny and earn the trust of both voters and political candidates are critical steps in both making online voting secure enough and ensuring that everyone understands the risks that are involved and are willing to accept those risks.

Overcoming these risks and challenges presents an exciting opportunity. Rather than being scared or turned away from online voting by these challenges we should try to overcome them, as other jurisdictions have already done.

We recommend that the Department and its strategic partners should involve security experts throughout the process, including the very early specification and design stages, to ensure that online voting systems are appropriately secure.

We recommend that the Department should undertake a detailed threat analysis to inform security decisions made as a part of protecting online voting systems.

We recommend that the Department should ensure that any online voting solutions are highly auditable.

We recommend that the Department should harness the expertise of the wider security community through a 'bug bounty' or similar process to attract constructive analysis of proposed systems for vulnerabilities

Part Six – Preferred approach to online voting

This part outlines our preferred approach to the design of online voting for local elections. When reflecting on international experience we found a number of critical points where certain decisions or tradeoffs were made, for example whether to allow an online vote to be "trumped" by a paper vote. This section describes our reasoning for favouring one approach over another in the New Zealand context.

Summary

The Department should take a partnership approach to trialling and implementing online voting by working with strategic partners on planning, governance and funding.

The online voting process should:

- use postal ballots to communicate login details to users

- only allow one-time access to the online voting system

- use two-factor authentication – our preferred option is for the voter to use their date of birth (acquired from the Electoral Roll) as a shared secret

- not require pre-registration due to **Participation** and **Access** considerations, but recognise the long-term potential of pre-registration

- enable a voter to vote online for all local electoral contests they are entitled to vote in.

International examples have shown that online voting, when implemented successfully, can deliver significant benefits and efficiencies to voters. However, we have also seen a number of cautionary examples where online voting has not worked well. It is, therefore, clear to us that the development of online voting for local elections in New Zealand must proceed steadily, engage and involve the public and clearly identify and mitigate risks in a staged way.

Taking a partnership approach

The operation of local elections is complex. It involves a complex array of organisations and stakeholders in central and local government. The Department cannot trial and implement online voting in isolation. A partnership approach to the planning and governance of online voting is required. There are a number of what we call 'strategic partners' that the Department should work with to progress online voting. These strategic partners include LGNZ, SOLGM, the Electoral Commission, the Ministry of Health and the Ministry of Justice. The successful trial and introduction of online voting will require shared governance arrangements that reflect key stakeholder interests.

We recommend that the Department should take the lead to establish a partnership approach with local government and other important strategic partners to further work on online voting.
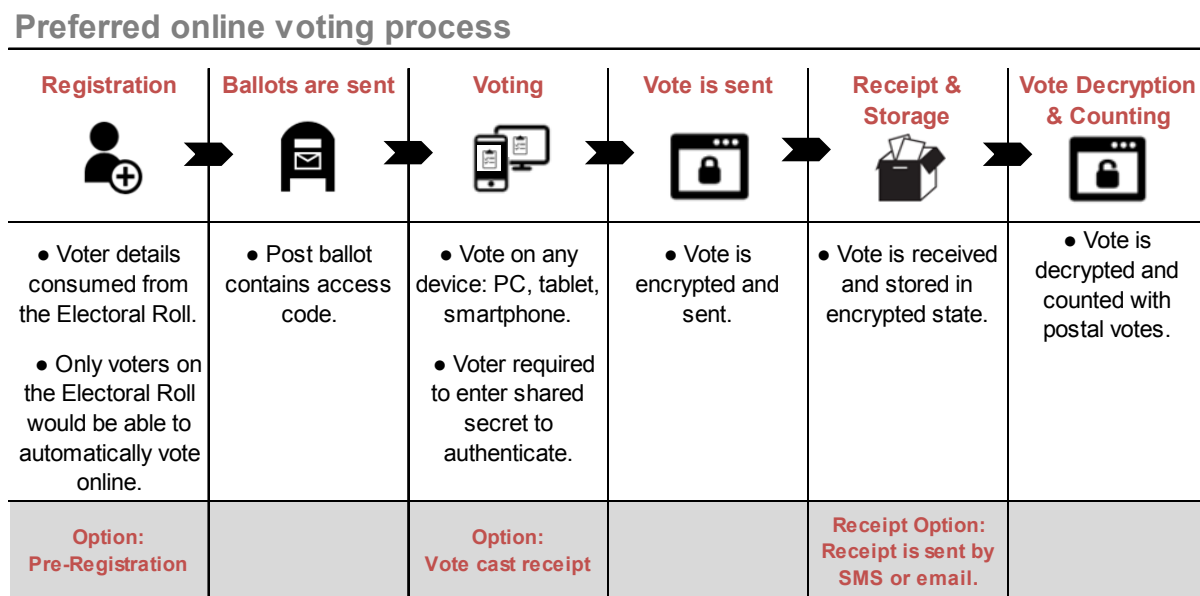
Design for users (user experience)

Ensuring good user experience is crucial for the success of the online voting system. A well designed online voting system will feel intuitive for the end user. If the public finds the online voting system is not user friendly and is not free from bugs and errors there is a high chance they will simply continue to vote on paper or not vote at all.

Domestic and overseas experience suggests that users must be involved in building of the system, and extensive usability testing must be undertaken before the system is released to the public. This testing should involve as many different groups of the community as possible, to ensure that access to online voting remains as wide as possible.

The voting process

As part of considering whether online voting is feasible, we have looked at how the voting process could be adapted for online voting. An overview of our preferred online voting process is set out below in figure six.

Figure six: preferred online voting process

Preferred online voting process

Registration	Ballots are sent	Voting	Vote is sent	Receipt & Storage	Vote Decryption & Counting
● Voter details consumed from the Electoral Roll. ● Only voters on the Electoral Roll would be able to automatically vote online.	● Post ballot contains access code.	● Vote on any device: PC, tablet, smartphone. ● Voter required to enter shared secret to authenticate.	● Vote is encrypted and sent.	● Vote is received and stored in encrypted state.	● Vote is decrypted and counted with postal votes.
Option: Pre-Registration		**Option: Vote cast receipt**		**Receipt Option: Receipt is sent by SMS or email.**	

Our thinking is explained further below.

Enrolment

To closely replicate paper voting, enrolment for online voting should occur through the electoral roll process for local elections. Voters would have the opportunity to update their electoral details ahead of the elections, as per the normal process. We consider that if there were to be a non-binding trial of online voting, that it be limited to voters on the electoral roll, in order to properly test the authentication mechanisms.

Pre-registration for online voting

Overseas experiences with online voting show that successful online voting systems have some measure of pre-registration. Pre-registration has the advantage of enabling more secure authentication of the voter and signalling the likely demand for online voting. Furthermore, pre-registration can result in cost savings for local authorities if they do not have to mail voting

documents to pre-registered voters. However, in our view, pre-registration represents a significant barrier to online voting and may prevent some people from participating. We believe that while pre-registration may deliver some benefits, it should initially be considered a voluntary additional step. We also think that providing for optional pre-registration leaves open the opportunity for councils to encourage pre-registration as a part of seeking potential cost savings.

Authentication

In a broad sense, authentication is a means of verifying that the person casting the vote is in fact the person to whom the voting document was issued to. The current postal method has no additional means of authentication, but rather relies on the possession of the ballot paper, people behaving ethically and lawfully and the trustworthiness of the postal system.

Online voting is fundamentally different from postal voting – it can be disrupted more easily, and therefore requires some means of additional authentication. While RealMe is becoming an essential part of the online service delivery machinery of both government and, increasingly, other organisations outside of government, its use is not necessary.

We consider the most straightforward way to add an additional level of security without compromising access is to use a "shared secret", something that is only known to the voter and the online voting system. Date of Birth offers a potential shared secret. Currently the birth dates of voters are not published on the electoral roll, but are gathered as part of the electoral enrolment process. It would be possible to require a voter to logon with a unique code and then confirm their date of birth. The unique code may be additionally protected, for example by using a scratch-off panel. This approach would make it significantly harder to compromise online votes and help provide assurance that the online voting system was secure without introducing a significant process hurdle for voters.

There may be practical difficulties (e.g. whether the date of birth can be obtained from the electoral roll) but we believe that this would be the easiest and most straightforward way to operationalise the shared secret approach. However, this approach is not without risk as there is a possibility a person's date of birth can be obtained, for example through social media or if the person is a high profile New Zealander. The ability to obtain the date of birth from the electoral roll for the purposes of online voting will also require additional legislative change.

Casting a vote

The process for casting a vote online has several components to it. The user experience should be streamlined and feel intuitive. More importantly, the voter should not be able to cast an incorrect or an informal vote by accident. However, we are aware that on occasion people spoil their ballots on purpose as a form of political statement. Spoiling a ballot means filling a ballot in such a way that makes it invalid, such as not voting for any candidate, or voting for more than the required number of candidates in an FPP election, or giving multiple candidates the same ranking in an STV election. We think that there should be consideration given to enabling voters to purposefully spoil their online ballots, just as they can their postal ballots.

Consideration should also be given to whether the voter's unique online voting code could be used to log in just once (single use) or whether it could be used multiple times until the ballot is submitted (multiple use). A single use code will improve security, as a voter's interim preferences would not be saved locally or remotely. However, this could inadvertently "lock out" some users if they have technical issues or if they take too long to vote.

Voting for multiple local contests can also be time consuming, which is why some voters prefer to fill in their postal ballot over multiple sittings. If a single use code was adopted this would alter a fundamental equivalency between postal and online voting.

In our view, multiple use voting represents an unacceptable risk to security and integrity of the online voting system. It introduces an element of risk which is more difficult to mitigate and rectify. For this reason we recommend the use of a single use code for online voting.

We do not recommend the approach adopted by some European states such as Estonia and Norway, which allows for multiple online votes to be cast with the last vote being the decisive vote, or being "trumped" by a paper vote. This will introduce an additional element of complexity in an online voting system. The current approach where a voter can request a special vote at the discretion of the electoral officer after casting a vote is an existing process which is working well. A decision of the electoral officer to provide a special vote is also subject to judicial review.

Counting the votes

Due to the nature of the STV voting system all votes must be counted together to ensure accurate distribution of preferences. Reconciling electronic and paper votes therefore represents a fundamental challenge. International experience shows there are a number of ways of doing this, but there are a number of important steps or considerations that must be taken before votes are counted.

Decryption – once or on the fly?

Under the postal system, votes are processed as they arrive to the electoral office. Processing votes involves inputting a voter's preferences into a collated electronic record so they can be calculated to determine the election result. It is not possible to determine a result until all the votes have been processed and the appropriate vote counting software has been "opened" by the principal Justice of the Peace and the Electoral Officer.

A decision needs to be made as to whether votes are decrypted and processed as they arrive (on the fly), or whether to wait until the end of the electoral period and then decrypt the votes. On one hand, decryption on the fly represents some equivalency with the current method of processing votes, i.e. votes are processed as they arrive at the electoral office, and while a voter's preferences are known for the purposes of processing there is no way to tell the overall result. Decryption on the fly also reduces the workload of the electoral office and allows for the timely tabulation of votes and preliminary results. However, each time the votes are decrypted introduces more interaction between the secure vote storage server and an outside agent which has the potential to compromise security and the integrity of the electronically stored votes.

Method of reconciling votes

We consider that there are two practical ways to reconcile electronic and paper votes:

- Votes may be printed out and processed alongside postal votes
- Votes may be reconciled electronically with paper votes.

The advantage of printing out electronic votes is that existing processes and infrastructure can be used to process online votes alongside paper votes. The principal disadvantage is that some potential efficiencies offered by online voting would be lost. Printing large numbers of electronic votes and manually processing them can be time consuming, particularly if the electronic ballot box is decrypted only once, after polls close.

Electronically adding votes will help realise some of the efficiency gains of online voting. Because of the electronic STV calculator, all votes must be added electronically before the calculator is able to determine a result. This provides a natural linkage where electronic votes can be added to the digitised paper votes. The most crucial consideration with this method is that the process of adding the two groups must not compromise the security or integrity of data. Additionally, this method should also have the functionality to print out individual votes for the purposes of a judicial review or audit.

We recommend that for the 2016 trials online voting should:

      a) Use the existing postal ballot to communicate login details to users

      b) only allow one-time access to the online voting system

      c) use two-factor authentication if possible – our preferred option is for the voter to use their Date of Birth (acquired from the electoral roll) as a shared secret

      d) enable a voter to vote online for all local electoral contests that they are entitled to vote in.

We recommend that in order to realise the additional benefits that pre-registration will offer in the long term, post-trial online voting systems should include an option to allow voters to pre-register.

Part Seven – Timing, scope and method for trialling online voting

This part of our report describes the timing and scope issues that are involved in binding and non-binding trials of online voting and sets out our preferred approach to politically binding trials of online voting at the 2016 local authority elections.

Summary

Completing successful and significant trials of online voting before 2016 is not feasible. We recommend that the Department work towards politically binding trials of online voting at the 2016 local elections.

In line with best practice, testing and non-binding trials should take place prior to 2016.

Trialling online voting in a number of volunteer councils across New Zealand presents the best opportunity for success.

International experience has shown us that attempts to use online voting do not always succeed. There are some significant technical and security challenges associated with online voting and the potential for risk is high. The risks and impacts are not always easy to measure and cannot necessarily be mitigated as easily as other online services. For example, in online banking if a fraudulent transaction occurs and you as a customer are not at fault, you would expect your bank to refund any money stolen from you. The financial sector can implement a financial response to its issues of incorrect transaction and wrong-doing. However, voting does not have this fallback position.

This is why it is crucial to trial online voting before implementing it as an option. Trialling new technology or new uses of technology, and the testing that this involves, enables users to become familiar with its use and gives assurance to owners and managers of the technology or process that it will work the way it is supposed to. In this way, online voting is exactly like online banking or any other online service. Before it is available for all users, a smaller group will be involved in testing and trialling the new technology or product to ensure it is successful when rolled out for general use.

When announcing appointments to the working party, the previous Minister of Local Government stated that online voting would be implemented in local elections subject to a significant and successful trial.

What is a significant trial?

A significant trial of online voting would need to test the usability, security, accuracy and integrity of the ICT system. International best practice suggests that an online voting system is first trialled in non-binding "test" elections to demonstrate capability, test the user interface, increase public awareness of online voting and build credibility prior to a politically binding trial.

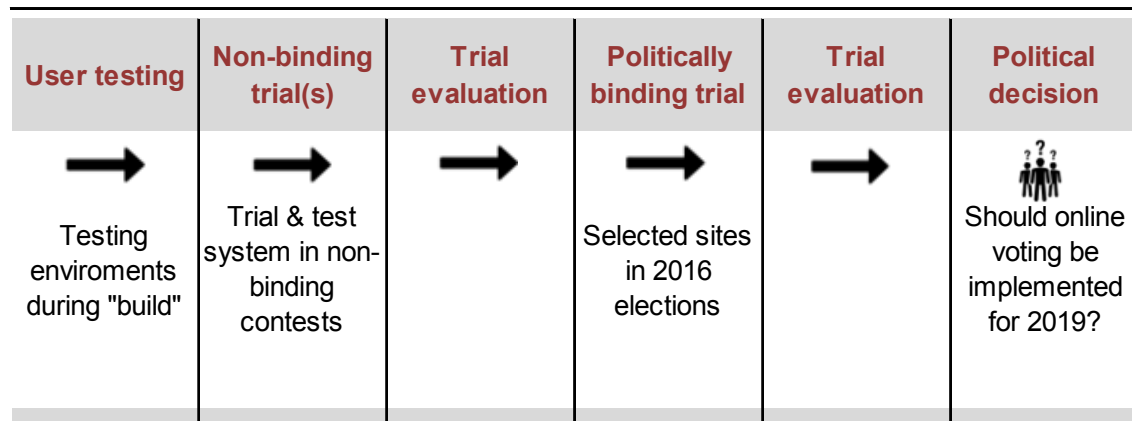## How to trial online voting

Successful examples of online voting, and other types of online services, suggest that trials should start slowly, be gradually adapted, and that user experience is very important. In the

context of online voting, this would mean that the user interface would be extensively tested to ensure a positive user experience. This would be followed by trialling of the voting system itself.

We think that the best approach, which is supported by international best practice, is to take a staged approach to testing and trialling online voting (as set out in figure seven below).

Figure seven: staged approach to trialling online voting

Staged approach to trialing online voting

User testing	Non-binding trial(s)	Trial evaluation	Politically binding trial	Trial evaluation	Political decision
Testing enviroments during "build"	Trial & test system in non-binding contests		Selected sites in 2016 elections		Should online voting be implemented for 2019?

As a group, we have discussed at length the need for decision makers to have enough evidence to make an informed decision about whether to use online voting in real political contests. The above approach of user testing and multiple trials appears to be the best way to provide both enough information to make a decision and a robust process to acquire it.

We recommend that the Department and its strategic partners should proceed in measured, incremental steps, including robust evaluation processes to establish and use learnings at an early stage to inform future stages.

User experience and building credibility as a key first step

The need for a voter-friendly system cannot be over-emphasised.

We think that New Zealanders' voting experience should be at the centre of any online voting system. Online voting should be easy to do, capture users' interest and attention, feel intuitive and make it easy to complete a vote. If there are significant hurdles to voting online there is a high likelihood that voters will abandon online voting either in favour of postal voting or not vote at all.

It is important to consider the journey that voters will need to go on to become familiar with, and trust, online voting systems. International and domestic experience, such as the online census, found that extensive usability testing is vital so that problems can be identified and fixed early in the process.

Usability testing should be built in at the start of the testing and implementation processes and must include representation from key stakeholder groups such as visually impaired New

Zealanders, those with disabilities, communities for whom English is a second language, young voters and older voters.

Non-binding and binding trials

Non-binding trial(s) of the system

A non-binding, but meaningful, trial would test the online voting system in a live environment, but the vote would not determine the outcome of a political contest. The focus would be on testing the usability and security of the system and whether the system performs as intended in terms of access, confidentiality, integrity and availability.

International best practice – such as the Council of Europe recommendations - suggests that an online voting system be first used in "test" elections. This allows the voting public to familiarise themselves with the voting system and builds trust in the voting system. This approach also has the advantage of localising some of the risk with an online voting system – if there are significant disruptions in this phase they will not interfere with local democracy.

A non-binding trial on its own would not necessarily be a significant indicator of how successful an online voting system is, but it would serve as a valuable "proof of concept" of an online voting system, and prepare it for a future politically binding trial.

More serious issues such as the security of system architecture may also emerge during this phase and would need to be remedied before the system is available for a binding trial.

There are a number of opportunities for non-binding trials leading up to the 2016 local elections. Non-binding trials could include an individual council's non-binding referenda and other non-binding polls at a town or community level.

We encourage the Department, or whoever is ultimately responsible for trialling online voting technology, to think broadly about how non-binding trials could be used to help test the elements of any online voting system. If there is only one non-binding trial then it would need to test all aspects of the system including user authentication. This means that it would need to be able to use information from the electoral roll.

We think that it would be risky to proceed to a politically binding trial without testing the online voting system in a non-binding trial first, as the system would be untested in a live environment and disruptions could significantly affect the outcome of elections. Additionally, a successful non-binding trial builds credibility and confidence in the online voting system.

What a politically binding trial could look like

Without a politically binding trial, we do not think that a trial of online voting could be objectively described as "significant". Any measure of success would be balanced against the non-binding non-political nature of such a trial.

Options for politically binding trials include:

- by-elections

- local government amalgamation polls[8]

- local elections in 2016.

A politically binding trial of online voting must test the voter's experience when presented with the entire ballot online, which includes voting for multiple local authorities and can include both STV and FPP voting. We do not consider that politically binding trials using by-elections prior to the 2016 elections would be significant enough on their own. By-elections are held shortly after a vacancy requires one, are non-complex contests (involving one decision or contest without the use of both FPP and STV) and, apart from larger wards in some cities, are unlikely to involve enough scale to adequately test online voting systems' ability cope with a large number of users.

We think that amalgamation polls have many of the same drawbacks as by-elections when considering their utility as a politically binding trial. Amalgamation polls are quite rare and can happen relatively quickly after a petition has been submitted. Like by-elections, amalgamation polls would also be a relatively simple poll which would not test all aspects of the online voting system.

The most comprehensive politically binding trial of online voting would be as part of local elections in 2016, where specific local authorities could be selected to trial online voting. This is similar to Norway, which has trialled online voting in only 10-12 of its 429 municipalities. Selected authorities, districts, or wards could participate in the trial of online voting. To be a complete trial, the entire ballot would be available online (for example, city council, regional council, DHB and other applicable authorities). This would provide a meaningful option of voting online, and reduce any potential voter confusion issues if voters are required to fill out a paper ballot in addition to an online ballot. The voters determined to be in scope of the trial would have a choice whether to participate in the trial and vote online or whether to vote using their paper ballot.

A diverse, representative sample as part of binding trials would greatly assist the evaluation, which would ultimately improve the online voting system when it is rolled out nationwide.

For the trial, it would be most practical for one online voting system to be made available by central government in collaboration with local authorities. Having multiple online voting systems introduces more risk and could undermine the evaluation of the trial if there are disruptions or performance issues.

What does a successful trial look like?

It is crucial that following each phase of a trial, a robust evaluation takes place. The evaluation would measure a range of criteria of the trial, to determine which areas performed well and which areas need improvement before the system became fully operational. This would not only be limited to the performance of the system (from a security, integrity and availability point of view) but also user experience and interface.

It may also be useful to engage an independent consultant to review the system and release their report publicly. This would not only test the thinking of government, but also increase transparency and help build public trust in the online voting system.

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[8] Amalgamation polls take place when, following a Local Government Commission proposal for local authority amalgamation, a petition (from voters in the region) for a binding poll is submitted to the Local Government Commission. An amalgamation poll is then held and should the majority of voters in the area reject amalgamation the proposal is defeated.

Evaluation should address fundamental questions such as:

- Did the online voting system fulfil the basic parameters of confidentiality, integrity and availability?

- Was the online voting system objectively secure, trusted and auditable?

- Was the user experience positive and intuitive?

- How did the online voting system handle the issue of access and were there significant access issues that prevented people from using the system?

- Can the demographic data of online voting tell us anything useful about the types of people who did/did not vote online?

To successfully test the online voting system there needs to be enough people using it to confirm the design of the user experience criteria. If there are enough people trialling the system, the results may be statistically significant, from a quantitative point of view, thereby improving the evaluation of the system.

Additionally, complexity testing needs to be carried out so that the user interface of the online voting system is able to allow someone to easily cast votes on the different issues they will be asked to vote on. Testing the complexity of the voting system also helps ensure that it assigns votes correctly and there are no flaws (e.g. people being asked to vote for things they are not normally able to).

Lessons from New Zealand and overseas suggest that it is best to involve users at the beginning of the building phase in order to obtain the best possible usability data and feedback, and then growing a system slowly and incrementally from there. Ignoring or not meaningfully capturing users' feedback could result in a system that is not user friendly and is ignored by the public. Similarly, growing a system too big too soon could either raise issues of scalability, resulting in availability and access problems, or introduce vulnerabilities in the system that could seriously undermine the security, trust and integrity of the system.

Awareness raising and information campaign

It is important that before each trial of online voting there is an awareness raising and information campaign that seeks to inform and educate the voting public of the online voting option. There are already widespread information campaigns for national and local elections – for example to explain different voting methods. Because online voting will be a new experience for voters, it will be important to have a significant information campaign, particularly for politically binding trials at the local elections.

Timing and options

For a non-binding trial there are fewer time pressures as a trial can take place any time after the system has been built.

However, a politically binding trial will have defined milestones that will place additional time pressure on building, testing and evaluating an online voting system.

For politically binding trials, we believe there are three possible options:

- broad implementation of online voting for the 2016 local elections

- graduated trials not specifically tied to the local elections

- online voting trialled at the 2016 local elections (preferred option).

Online voting available for all local authorities for the 2016 local elections

This option involves online voting being available for all local authorities to use during the 2016 local elections. The trial itself will likely use online voting providers, which would have been accredited by central government.

This option would deliver on local government sector expectations of having online voting sooner. However, it would be the first time online voting would be used in large scale, complex, politically binding elections in New Zealand. This option therefore presents risks if online voting is disrupted or the system fails. While there may be means to mitigate this, such as taking out insurance to cover the cost if elections have to be run again, any disruptions or failures would likely damage the public trust and delay the adoption of online voting for the foreseeable future.

The implementation timeframe would also be particularly ambitious, as an online voting system would have to be built, procured, accredited and tested in less than two years. This can pose additional risks if system testing is inadequate or if the system has poor user experience due to the compressed timeframe.

While this option has merit and delivers on the local government sector's expectation in our view, the risks involved are too great to proceed with online voting for all authorities in the 2016 local elections. We do not consider that widespread online voting is feasible for the 2016 local elections.

Graduated trials not specifically tied to the local elections

This option involves testing the online voting system very gradually, and would likely involve one or more non-binding trials before undertaking a suite of politically binding trials. The online voting system would gradually be tested and improved until it is sufficiently ready to be used nationwide.

This option best manages the risk associated with online voting by ensuring the online voting system is rigorously tested before being used by the entire electorate. A staged approach also allows for greater consultation and stakeholder engagement as there are no significant time pressures associated with the election cycle. Furthermore, each trial represents an opportunity to inform the public and educate them on online voting.

However, this option does not deliver on the expectation of some local authorities, some of which are very keen to trial online voting in the near future. We believe that an online voting system could be acquired, tested, and trialled within the initially proposed timeframe and be ready for a politically binding trial at the 2016 local elections.

Online voting trialled at the 2016 local elections   [preferred option]

This option provides sufficient time to develop, or procure, a system that can be used in a limited politically binding trial at the 2016 local elections. The evaluation of this trial would go a long way to help to decide whether or not online voting will be used nationwide at the 2019 local elections.

This approach would not be without risks, and may be similarly affected by risks of disruptions or outright failure of the online voting system. However, these risks would be somewhat mitigated through the trial period.

We believe that, consistent with best overseas practice, the online voting system be used in a non-binding election or poll before it is trialled in the 2016 local elections. In addition, it is our view that the Department should take an opportunistic approach to smaller scale politically binding trials pre-2016. If there are by-elections or amalgamation polls taking place in late 2015, if the Department has enough confidence in the system, and if the groups holding the contests want to trial online voting, then those opportunities should be taken up.

We consider that trialling online voting during the 2016 local elections offers the most feasible approach to successfully trialling and implementing online voting in New Zealand.

We believe that given public expectations, and the statement of the former Minister of Internal Affairs supporting movement to online voting sooner rather than later, it is reasonable to recommend that there should be a trial of online voting at the 2016 local elections. Overall, we believe that the public and local communities are ready for online voting and it would be unreasonable to delay a trial of online voting beyond 2016.

However, to achieve a politically binding trial in 2016, work will need to begin immediately. Setting up, funding, testing technology and implementing an online voting trial by October 2016 is an ambitious timeframe.

We recommend that the Department should work with its strategic partners to trial online voting in the 2016 local elections using a suitable system made available for this purpose.

We recommend that the Department should ensure that the principles are also used to continually inform the development or acquisition of any solutions used for online voting in local elections.

We recommend that the Department should begin work as soon as possible on the necessary policy, legislative and implementation workstreams to ensure that online voting can be trialled at the 2016 local elections.

We recommend that testing and non-politically binding trials should be undertaken prior to the 2016 local elections to ensure that online voting systems are ready for use in a political contest.

We recommend that smaller scale politically binding trials such as local polls or by-elections should be considered as opportunities to further test and improve online voting systems in preparation for the 2016 trial.

We recommend that the Department should work with its strategic partners to identify councils and communities that want to trial online voting and to identify and agree the appropriate scope and timelines for meaningful trials.

Part Eight – Key implementation decisions

Broad implementation of online voting for local elections will be a challenge. Central and local government must work together and with external providers to deliver a successful online voting system. This part of our report explores the possible options for the implementation of online voting and our preferred approach going forward.

Summary

Our preferred approach to implementing online voting is to allow communities and their councils to choose whether online voting should be available as a voting method in their elections, and for councils to select an online voting solution from a pool of accredited providers.

This approach would maintain the Local Electoral Act's flexibility allowing local authorities and their communities responsibility for how their elections are run. We also consider that, given there are existing international and domestic online voting software providers, an opt-in accreditation system would be the best way to proceed with implementing online voting.

The difference between trialling and implementing online voting

The Department, and anyone else involved in trialling and implementing online voting, should ensure that they do not confuse the two different steps unnecessarily.

How online voting is trialled is likely to be different from how online voting is fully implemented. We have covered above how we think online voting could work, and what we consider is the best approach for trialling online voting.

Following a trial and comprehensive evaluation of that trial there is a decision to be made about how online voting should be broadly implemented. This decision will impact on costs, implementation timeframes, project governance and the scope of regulatory change that is required.

Our view is that the approach as to how online voting is broadly implemented turns on the preferred answer to the following two questions:

- Should communities choose whether optional voting is available, or should it be available as an option for all New Zealanders?

- How should online voting systems be selected?

Should communities be able to choose whether online voting is available, or should it be an option for voters in all local elections?

Our goal is for *New Zealanders to vote online in local elections*. However, there is a question of whether the decision to have online voting available should be made centrally – i.e. by the Government after seeking the views of the local government sector and the public, or whether it should be left to councils and their communities to make the choice.

Making online voting a core component of local democracy that is available in the future as a part of every local government election would, on the face of it, be most in line with our goal, as well as our electoral principles of **Participation** and **Access**.

However, the Local Electoral Act sets up a regime which offers communities flexibility in the methods and electoral systems that they use to determine their local political governance. Our principles of **Participation** and **Access** are important for realising the benefits of online voting. However, we cannot escape from the fact that the Local Electoral Act is designed from a perspective of flexibility and local choice in electoral methods.

The option of online voting being an opt-in component of local elections raises an important question: who decides to use online voting?

The local government sector is complex and there is a minimum of two organisations (a unitary authority and a district health board) that New Zealanders will cast a vote for their representatives on those organisations. Practically speaking, this means that whether to use online voting is not a decision for individual councils, territorial authorities or district health boards to make.

For online voting to be a success, a voter needs to be able to vote in all of the local electoral contests they have a right to vote in. It would be counter-productive for a City Council to have online voting while the relevant Regional Council and District Health Board required postal voting. It will be more time consuming for a voter to vote both online and by post, thereby negating the efficiency gains of online voting and could lead to voter confusion or accidental double-voting.

We consider that use of online voting is a decision that should be jointly made by the relevant organisations and the people that they serve. This is important for a number of reasons:

- Local authorities are responsible for the running of their own elections: the costs of online voting, once implemented, would need to be met by the local government sector

- Online voting will not be without risk: councils and the communities they serve should be able to make informed decisions about whether they want to accept the residual risks that come with online democracy

- Improved voter experience: by having a single online ballot for all applicable electoral contests the experience of voters is vastly improved, as it replicates the postal ballot as closely as possible. Having some portion of electoral contests in an online ballot and others in a postal ballot will increase voter confusion and risks preventing some voters from voting altogether in some contests.

We consider that, should opt-in online voting be selected, the Department, along with LGNZ and SOLGM should work with councils and district health boards to facilitate community discussions about whether online voting is something that communities want, and to facilitate cost sharing arrangements between the relevant organisations.

How should an online voting system be selected?

We understand that software selection is a complex, and requirement-based process. Our role is to examine feasibility and high level options rather than solution an online voting system.

As a part of our thinking we have discussed the comparisons between a procurement approach and an accreditation approach.

Procurement approach

One option would be for the Department, or some other entity given collective responsibility for the local government sector, to procure or build an online voting system. We do not think that the Department should have to build a new online voting system for New Zealand. There are a number of systems provided by both domestic and international vendors that could potentially be used to support online voting in New Zealand.

In line with the Government's ICT Strategy and Action Plan to 2017, the Department should be looking to purchase an online voting system, or systems, for use in New Zealand, rather than setting out on a journey to develop a bespoke solution. We are aware of both international and domestic companies that online voting systems could be procured from, should they meet the relevant requirements. If none of the existing online voting systems are found to be suitable, only then should the Department or some other entity consider building an online voting system for the purpose of local elections in New Zealand.

We consider that New Zealand should seek to use the existing market before attempting to build its own online voting software, subject to a detailed market analysis to assess the depth and capability of the market to deliver a viable online voting system.

An accreditation approach

An alternative approach would be for a central organisation such as the Department to accredit a system, or multiple online voting systems, for use in local elections. Under this system, decisions about which vendor to go with would be left to councils or Territorial Authorities, after consultation with the other relevant local government organisations that their Electoral Officer administers elections for.

An accreditation approach would better enable competition between software vendors and retain capacity within the system for more than one provider to deliver competitive online voting services.

Options for implementing online voting

After considering these two main questions and choices, there are four main options for implementing online voting. These are set out below in figure eight.

Figure eight: high level options for implementing online voting

Whether to use online voting

	Choose	**Use**
Collectively procured or built	**①** **A single online voting option** [Option One] A collective/central organisation offers a single online voting system to local authorities that choose to have online voting available.	**②** **A centralised, single system** [Option Two] There is one system that anyone can use. Owned & controlled by a central / collective entity.
Local choice	**③** **Total local choice** [Option Three] Online voting system(s) are accredited for use. Local authorities, communities or electoral officers make decisions about whether to use online voting and which system to use (if choice)	**④** **System/Provider choice** [Option Four] Online voting is used everywhere. Electoral Officers choose which accredited system to use.

Choice of system

For any of these options, software that successfully navigates the procurement, testing and trialling regimes that are required to get to politically binding trials in 2016 would be well placed to achieve broad implementation, procurement or accreditation.

A single, opt-in online voting system   [option one]

Option one would allow councils to decide whether to use a collectively provided and maintained online voting system. A single system would be procured and any local council wishing to use online voting could use this system.

Benefits	**Drawbacks**	**Risks**
• reinforces local decision making: local communities choose a preferred system • offers a uniform user experience for all online voters: because there is only one system, voters across New Zealand who vote online would have consistent user experiences • resources could be focused on one system: potentially increasing security, user interface and testing capabilities.	• slower timeframe: the procurement process may take more time; • lack of provider choice: there would not be any choice of provider for local authorities – they would have to accept and use the system that is procured.	• incentive problems: the costs of opting in to online voting could potentially create perverse incentives, discouraging local authorities from using online voting, slowing the uptake of online voting. We think that this risk could be mitigated through investment by the Central Government to cover procurement and inter-electoral cycle management; • potential single point of failure: because there is only one system, failure would mean failure for all online voting.

Option one is similar to the way the Department regulates STV – any community can choose to use the STV voting method, but if it does so, it has to use a single approved STV calculator that is managed by the Department.

A single, collective online voting system   [option two]

Option two reflects a collective agreement or desire for online voting to be available for all local government voters and the use of a single system (either procured or built).

Benefits	Drawbacks	Risks
• <u>a uniform user experience for all voters</u>: because there is only one system, voters across New Zealand would have consistent user experiences; • <u>resources could be focused on one system</u>: potentially increasing security, user interface and testing capabilities; • <u>a guaranteed user base could lower costs</u>: because all elections would use online voting, a selected vendor would have a better understanding of the potential user base for their product.	• <u>slower timeframe</u>: the procurement process may take more time; • <u>lack of provider choice</u>: there would not be any choice of provider for local authorities – they would have to accept and use the system that is procured.	• <u>incentive problems</u>: the costs of opting in to online voting could potentially create perverse incentives, discouraging local authorities from using online voting, slowing the uptake of online voting. We think that this risk could be mitigated through investment by the Central Government to cover procurement and inter-electoral cycle management; • <u>potential single point of failure</u>: because there is only one system, failure would mean failure for all online voting.

Local choice   [option three]

Rather than procuring, or maintaining an online voting system, the Department could instead seek to accredit online voting system(s). Decisions about whether to use online voting would be down to local authorities, and the costs of using and maintaining the system would be theirs to bear.

Accreditation would generally involve the Department setting out the specifications, including user interface, of an online voting system. Providers would then build the system and give it to the Department for testing and, if successful, accreditation.

Practically speaking this option would mean that a range of accredited systems from different providers would be available for use in local elections. Local councils could choose the provider that suits them and the communities they support.

An accreditation approach would support populations opting in to online voting.

Benefits	Drawbacks	Risks
• <u>Local authorities have more choice to choose the online voting system/provider that is right for them</u>: New Zealand's local communities are diverse, have different complexities around their local governance	• <u>Accreditation process may be time consuming or difficult to judge</u>: Accreditation of software, especially when it comes to security, is complex. Accreditation could include a number of testing phases to	• <u>Failure of one system could undermine trust</u>: while this option may spread the risks to local democracy across a number of solutions, a failure of one could result in more widespread distrust in the other

Benefits	Drawbacks	Risks
arrangements • Majority of costs fall on councils that want to use online voting: an accreditation system means that while councils do not have to directly meet the costs of developing online voting software, they are able to access online voting systems. • Risk spread across several online voting systems: no single system would be responsible for all online voting.	cover off different technical and security requirements. There is also a balance to be struck between the accreditation process and individual council's responsibilities to conduct due diligence. • Limited budgets could discourage uptake: smaller local authorities may not have the budget to fund use of an online voting system on top of their postal voting systems.	systems.

Service provider choice   [option four]

The final option for broad implementation would be to mandate that all local authorities provide online voting, while enabling them to choose the online system they want to choose from a range of accredited systems. This option assumes that more than one provider would achieve accreditation.

Benefits	Drawbacks	Risks
• Local authorities can choose the online voting system/provider that is right for them: New Zealand's local communities are diverse, have different populations, language needs and Internet access profiles; • Mostly user pays: under this option local councils maintain their responsibility for meeting the costs of their elections. An accreditation system means that while councils do not have to directly meet the costs of developing online voting software, they are able to access online voting systems. The non-user pays component would likely be the accreditation component; • Risk spread across several online voting systems: no single system would be responsible for all online voting.	• Accreditation process may be time consuming or difficult to judge: accreditation of software, especially when it comes to security is complex. Accreditation could include a number of testing phases; • Smaller local authorities may not have the budget to fund use of an online voting system.	• Lack of vendor choice: if only one provider was to achieve accreditation, that would, in practice, make using their system compulsory; • Failure of one system could undermine trust: while this option may spread the risks to local democracy across a number of solutions, a failure of one could result in more widespread distrust in the other systems.

We consider that communities and their councils should retain choice and decision making over whether to have online voting available. Our preferred broad implementation option, therefore, is option three.

We recommend that councils and their communities should choose whether online voting is available as a voting method.

We recommend that, when implementing online voting (after the 2016 local elections), the Department's role should be to establish and administer an accreditation process for online voting solutions for communities and councils to use.

Part Nine – Risks and priorities

This part provides a high level look at the risks and perceived risks associated with online voting and the comparative priorities that we think are most important for successfully implementing online voting.

Summary

In order to successfully implement online voting the Department and its strategic partners will need to carefully manage and mitigate a host of risks – both real and perceived.

Online voting must not only be reliable and safe, it must be trusted by the public.

Successfully implementing online voting in New Zealand will require a careful and considered approach to engaging and educating the public, as well as local and central government decision makers about the risks that come with online voting. The perceptions that people have of online voting will also be crucially important. Online voting must be seen to be reliable and trustworthy if it is to be used by the public.

We consider that it is important that some of these risks are highlighted in this report. This is so that policy makers, members of the public and other interested parties are aware of the risks and also the measures that could be taken to mitigate them.

No clear conceptual framework or vision for the designers

Policy makers will need to ensure that the brief for implementing online voting is clear about the purpose and objectives of the project, along with the qualities that the system needs.

Mitigation:

This report will provide some direction about the general objectives of online voting to inform policy makers in developing and implementing online voting.

Planning for online voting has not been fully explored

The Department, with its strategic partners, will need to complete more detailed planning before progressing with online voting. This planning should include an evaluation and analysis of the potential project, taking into account our recommendations, project timing and any further challenges identified.

Mitigation:

In this report, we have analysed the strengths and weaknesses of online voting, considered various case studies (including international best practice), considered a range of issues relating to online voting and made recommendations on how an online voting system may be trialled and implemented broadly. It is important that policy makers take our recommendations on board and develop plans to manage the trial and implementation of online voting from business case to broad implementation. Robust project governance will also be required to resolve a range of practical issues that may arise in the implementation phase.

Voter turnout is not increased

The low turnout in the 2013 local elections had prompted some calls for online voting to be introduced as a measure to lift voter turnout. While lifting voter turnout for local elections is important, it must be noted that online voting in and of itself will not necessarily lift voter turnout. International evidence shows that there is no clear link between voter turnout and online voting. However, online voting can make voting more convenient for those who were intending to vote. Online voting represents a more efficient, convenient, method of voting and an opportunity to better engage and inform the voting public.

Mitigation:

We believe that online voting will modernise voting and make it more convenient, but meaningful steps must be taken by central government, local government and by the candidates themselves in order to better inform and engage with the voting public in order to lift voter turnout.

The system is not embraced or used by the public

Gaining the public trust is key to the success of the online voting system. As part of the development of the online voting system there needs to be wide consultation with a number of different groups and communities to ensure their access needs are met and the system is user friendly.

Mitigation:

Awareness and education campaigns will also help the public get more comfortable with online voting. A non-binding trial will help voters familiarise themselves with the online voting system before it is used in binding elections. Usability testing will ensure that the online voting system is fit for purpose and feels intuitive.

Online voting systems are perceived as having a bias

Some groups may perceive online voting as an attempt to enable a particular group of voters or enable participation of voters with particular political views. This could impact on the integrity and trust of the system.

Mitigation:

The awareness raising campaign must be clear that online voting represents an opportunity for everyone. Meaningful consultation with sector groups would also ensure they have a positive experience of the online voting system. The Department also needs to make it clear that traditional methods of voting are not going away – online voting is simply another option for voters to use. To some extent there is an inherent bias already in the postal system with regard to people who move or change addresses frequently.

Disagreement on funding issues delays the implementation of online voting

Agreement on a funding approach for online voting could become an obstacle for trialling online voting in 2016. On one hand there are several local authorities who want to use online voting, while on the other hand, setting up, procuring, or seeking accreditation of an online voting system is likely to be costly. Local authorities would have to fund existing postal voting in addition to online voting. We consider that if local authorities want to use online voting, they should be prepared to pay for it. We consider it sensible that there be some cost sharing between local and central government – given that DHB elections are currently funded by central

government through baseline funding to DHBs, and that costs are also shared between local authorities themselves on a pro-rata basis.

Mitigation:

Having a strong business case and strong collective governance arrangements of online voting will be an important mitigation in securing sector support and funding.

The online voting system is unavailable

Some international jurisdictions only provide online voting in an advance voting period which usually ends before polling day. We consider that online voting must be available for the entire three week voting period, just like paper voting. Practically this means that the online voting system must be resilient to threats such as a denial of service attack and to large number of voters trying to access the system at once (for example right up until voting closes at noon on polling day). We consider that even one hour of unplanned down time in a three week voting period is unacceptable and would likely undermine the trust in an online voting system.

Mitigation:

We suggest that in the development of an online voting system, extra resources and server capacity is made available just in case there is overloading and robust security evaluation is carried out so that threats are able to be identified and neutralised quickly.

We also note that postal ballots will still be available during the entire voting period and that if there are disruptions to the online voting system, people will be able to vote using paper ballots. While this should ensure that there is little to no impact on democracy, this would likely be damaging to the prospects of online voting in New Zealand in the future.

The vote is not secret

Secrecy of the vote is vital to exercising democracy. A person has the right to know that nobody but them will know what vote they cast.   This is necessary so that voters are not subject to intimidation or pressure and are able to exercise their free will. There is a possibility of voter coercion with online voting, as there is currently with postal voting.

However, it is important to note that invariably the person's voting preferences are currently known to electoral office personnel as the votes are processed.   Also, due to auditability requirements, a person's preferences must be able to be linked back to an individual voter – for example to identify instances of multiple voting. This auditing occurs in a secure environment and under the supervision of a Justice of the Peace.

Mitigation:

Meaningful steps must be taken to ensure that online votes remain secret until they are processed. For example this could be achieved by having the votes encrypted, stored securely, and then decrypted on a separate, "air-gapped" machine that is not connected to the Internet.

We consider the current process for requesting a special vote mitigates voter coercion to a large degree. We also note that influencing or interfering with how a person votes is an offence under the Act.

Votes are incorrectly recorded, altered or lost

This risk would seriously undermine the integrity of the online voting system. The voter must be certain that their voting preferences have been received accurately and have not been altered while the vote is in storage. Similarly, if false votes are added, this could skew the election result. This may be done for political, publicity or malicious reasons either to hijack an election or to discredit online voting.

Mitigation:

We consider that meaningful security testing must be carried out to ensure that a system cannot be compromised to the point where the integrity of votes is at risk. Further, if a fault or an intrusion occurs there must be a means to identify any changes made to the information as well as a means to restore the information to its original state (such as a backup)

Vote is intercepted

If not properly secured, votes could be intercepted and changed between the voter's device and the secure vote storage. The vote could be changed, deleted or recorded undermining both the secrecy and integrity of online voting.

Mitigation:

In our principle of Security we have identified that we have to assume the voter's device cannot be trusted. Systems can be built with certain security considerations in mind e.g. encryption techniques or using perfect forward secrecy.

Scams

False website could be set up and people directed to them through email or social media in order to obtain personal voting credentials to vote on behalf of other persons or to harvest the information for illegitimate purposes.

Mitigation:

As with any "phishing" type attack, local authorities and central government should take proactive steps to ensure that voters are directed to the legitimate online voting website through education and awareness raising. Additionally, there needs to be a mechanism where such attacks are reported and, if necessary, taken down as they pose a major threat to the democratic process and the safety of the users.

Priorities

As we have seen, the benefits of online voting are great, including better access for some groups of people, potentially greater engagement and participation, and a more convenient system to use.

Against this, the weaknesses are the potential for a system that is poorly designed and insecure, creating a high profile failure. The costs involved in building a system could also be a disadvantage.

Some of the important points we have considered through this process in relation to our final prioritisation of values have included:

- The voters need to have trust in the system and be confident that it is reflecting their electoral choices.

- This trust must be built on a robust and well communicated process, not on voter ignorance.

- The system needs to be fully auditable.

- An online voting system needs to be of service to the voters and not make it harder for them to cast a vote.

- The benefits of online voting should at least equal, if not outweigh, the current system.

- The drawbacks of online voting should not be greater than the benefits.

- The costs for implementing the system should be justified by the benefits it will give voters.

We have also looked at situations where there are potential conflicts, such as between security and access, or verification and secrecy of the vote.

In these cases, we believe a system can be built or procured that earns the confidence of voters and ensures the electoral principles that govern us are met. But, we also believe that we can achieve these aims by having a system that works for the voters, giving them a system that is easy to use and has more benefits than the current system.

Our view is that the advantages that access and ease give outweigh any disadvantages. We believe that with careful management, the risks can be managed. We also feel that the time to move forward has come and we ought to be looking at ways to bring voting into line with other functions that we already carry out electronically.

The principles we have chosen give voice to the priorities we have for online voting: participation, integrity, access and security. If we ensure we have a system that is as secure as it can be, and is trusted by voters because it can be seen to be safe and reliable, we will find that people want to use it, feel safe using it, and eventually, will use it to increase their participation in democracy.

Part Ten – Estimated costs

This part of the report provides an initial, high level discussion of the estimated costs of online voting.

Summary

We are not in a position to provide a detailed or robust costing of online voting. We think that, due to our recommendation to offer online voting alongside postal voting, online voting will add to the cost of running local elections.

We estimate that trialling and implementing online voting is likely to cost between $8 million and $10 million. However, a more detailed and robust costing analysis should be undertaken by the Department.

It is clear to us that online voting, in conjunction with existing postal voting, will involve additional costs, and that costs will have to somehow be shared between central and local government and between local authorities themselves.

The costs of online voting will also depend on the method of implementation – using an accredited system will be cheaper than developing and building one from scratch.

Costs for trialling and implementing online voting will also be different, but are likely to have initial high start-up costs but lower scalability costs due to economies of scale. For the purposes of this section we are interested in estimating the costs of implementing online voting across the whole country, rather than a limited trial. This is because a trial is likely to be quite limited and would give an accurate reflection of the costs of an online voting option.

It is difficult for us to accurately estimate the costs of online voting, given no specialist costing has been carried out, so the following should be considered as "ballpark" estimates of the additional cost of online voting.

Costs of implementing online voting

In New Zealand we are able to draw on two examples which would give us some indication of the likely cost of introducing an online voting option. The online component of the New Zealand census cost approximately $12.7m and was used by 7 per cent of respondents in 2006 and 35% in 2012. This was a system that was purpose-built and rigorously tested, and represents a real-world domestic scenario.

In 2012, the Electoral Commission undertook some preliminary estimation of the cost of online voting in the general election for overseas voters. The Electoral Commission estimated this would involve between 25,000 and 75,000 voters and cost between $5-7m. The online voting system would be procured "off the shelf" using a provider of online election services. This however represents only a cost of $1.2m, with other significant costs including external audit and testing ($750k), awareness and promotion ($650k), and project management ($550k).

If the turnout of the last local elections is taken into account, and assuming that 10 per cent of the electorate votes online, and assuming no increase in the overall election turnout, the number

of voters who may cast an online vote is approximately 125,000 voters. This is more than the estimates of the Electoral Commission pilot but within the overall ballpark.

We therefore estimate the likely total additional costs of online voting nationwide to be between $8m and $10m, almost doubling the cost of local elections. However, this is a high level estimate and the Department should undertake a more rigorous costing analysis once it knows how it will trial and implement online voting. In addition, there will be an ongoing cost required to continuously update the online voting system due to security or usability requirements.

We recommend that the Department should work with its strategic partners to undertake a robust costing analysis on how much it will cost to trial and implement online voting

Sharing costs

Regardless which implementation approach is taken, there will be some element of cost sharing between central and local government. If there is a single centrally developed system, then central government will be expected to contribute more than if their role was limited to accreditation of an online voting system. Nevertheless we consider that if local authorities want to use online voting, they should be prepared to pay for it. However, the precise nature of any cost sharing is an implementation decision that is beyond the scope of this report.

Measuring value

It is unclear to us how to measure the value of online voting. Is it as simple as "cost-per-vote"? If online voting, and the increased awareness raising and information campaign, leads to an increase in turnout then this would provide more value as the overall cost-per-vote would decrease. However, bearing in mind that the likely costs of online voting could be double the costs of existing postal voting, this means a substantial increase in turnout will be needed to decrease the overall cost-per-vote compared to postal voting. There is likely to be a decrease in the postal costs of local elections, but this would be offset against a substantial outlay required to implement online voting.

Overseas experience suggests that online voting does not necessarily lead to a higher voter turnout, and it takes several election cycles for the public to embrace the idea of online voting. Even in Estonia, a world leader of online voting, after five election cycles only 25 per cent of those who voted, did so online.

However, online voting also provides benefits for those who were already intending to vote. International experience suggests that this is the real tangible benefit of online voting. Online voting can substantially improve the voting experience of voters, making it easier to vote when they want and offers potential for greater information and engagement. This benefit is difficult to quantify and measure, but is nevertheless significant. Interestingly, Estonia has attempted to quantify the efficiency gain for using online voting as opposed to booth voting and calculated that in the Estonian parliamentary elections of 2011 the cumulative time savings in online voting were 11,000 working days or €504,000 in average wages.

There are also intangible benefits, such as improving access to and participation in democracy, which cannot be readily quantified, particularly with a monetary value.

Appendix A – Terms of reference for the online voting working party

Purpose

The online voting working party (the working party) is appointed to consider and recommend:

a)   the feasibility of having online voting in local government elections by 2016;

b)   any other opportunities to provide for local electoral processes through the Internet; and

c)   practical options for achieving online voting in the 2016 local authority elections, subject to a successful trial having been conducted before 2016.

The aim of this work will be to enable a trial of the voting method and then implementation of online voting at the 2016 elections, subject to due diligence and affordability considerations.

Context

Currently, New Zealanders can vote in local authority and district health board elections by postal vote or by casting a ballot in person.

Enabling online voting for local authority and district health board elections may be an opportunity to enhance and modernise the operation of local democracy and enhance the ease and overall experience of voting for New Zealanders.

Role and establishment

The Minister of Local Government has directed the Department of Internal Affairs (the Department) to establish a working party to "consider and recommend options for introducing online voting for local authority elections".

The working party is appointed by the Department to fulfil this role.

The working party reports to the Chief Executive of the Department, through his representative the General Manager Policy.

Scope of work

The working party will look at:

•   the opportunities and risks that online voting represents, including access;

•   high level options for introducing online voting and the service design approaches that could be taken; and

•   analysis of costs, benefits and risks of the options.

Options for online voting presented by the working party will need to be consistent with the principles of the Local Electoral Act 2004 (attached).

The following matters are out of scope:

•   online voting for Parliamentary elections; and

- aspects of local elections not related to voting (e.g. matters relating to the use of the single transferrable voting method) or end-to-end online electoral service delivery.

Outcome

The working party will provide advice that will form the basis for implementing online voting as a modern, safe, secure, accessible and engaging method for conducting local authority elections.

Deliverables and process

The working party will have three main deliverables:

- 28 February 2014: the Chair will provide a progress report to the General Manager Policy;

- 11 April 2014: the working party will provide a draft report to the Department; and

- 28 April 2014: the working party will produce its final report to the Department.

The working party will report back to the Department no later than 30 April 2014.

In order to deliver these items, the working party will meet at least every 3 weeks, excluding 22 December 2013 – 31 January 2014.

If further time is required, the Chair will talk to the General Manager Policy to seek her agreement.

The report will need to consider and set out recommendations on a number of technological, practical, access, integrity, security and process matters as well as identifying opportunities to run a trial.

The working party may, during its considerations of these issues, identify new issues outside of the existing scope. Should the working party raise new matters outside of this scope, these will need to be taken to the Department for agreement.

The working party is expected to work collaboratively and cooperatively to produce an agreed position in its report.

In parallel with the work of the working party, the Department will be reviewing the legislative and regulatory impacts of online voting. This work will include engaging with population agencies (e.g. the Office of Disability Issues, Office of Ethnic Affairs) to ensure that online voting benefits as many New Zealanders as possible.

The Department will provide secretariat support to the working party and in consultation with the Chair, will prepare working papers for the working party as reference material.

The working party's report will be provided to the Minister of Local Government for consideration and used by the Department to inform the next steps.

Expectations

The working party is expected to work with the Department to:

- raise issues with the Department's local electoral programme internal governance group in the first instance;

- keep the Department informed of the work of the Working Party. The Department will expect "no surprises" in order to fulfil its duties as an adviser to the Minister of Local Government. It will be important to inform the Department as fully and as early as possible of any issues that may be contentious; and

- provide impartial, comprehensive and frank advice.

The Department also expects members to keep the work of the Working Party confidential until its report has been made public. The Department will be responsible for all public communications, interactions with the media, and the release of information related to the Working Party.

Working party members are expected to declare any actual or potential conflicts of interest as soon as they are aware of the conflict. Once declared, conflicts must be well managed by the Chair and the working party.

Proceedings

The Department will, after consulting with Local Government New Zealand & Society of Local Government Managers, invite members to join the working party.

The Department retains the ability to review membership to ensure that the working party maintains the skill and experience mix needed to complete its task and to operate in a collaborative and cooperative manner.

The Department may bring in subject matter experts in particular areas to provide advice to the working party on an as needs basis.

Confidentiality and external advice

The working party is expected to undertake whatever external engagement is needed to complete its task. However, as stated above all communications and media contact will be handled by the Department

Members of the working party must not provide public comments or comment to the media in a way that can be seen to represent either the working party, the Department or the Minister of Local Government.

Communications will be provided for through the Department and the Chair.

Principles of the Local Electoral Act 2004

The principles of the Local Electoral Act are set out in section 4 of the Act and are set out below.

4   Principles

(1)   The principles that this Act is designed to implement are the following:

     (a)   fair and effective representation for individuals and communities:

     (b)   all qualified persons have a reasonable and equal opportunity to—

         (i)   cast an informed vote:

         (ii)   nominate 1 or more candidates:

         (iii)   accept nomination as a candidate:

     (c)   public confidence in, and public understanding of, local electoral processes through—

         (i)   the provision of a regular election cycle:

         (ii)   the provision of elections that are managed independently from the elected body:

         (iii)   protection of the freedom of choice of voters and the secrecy of the vote:

         (iv)   the provision of transparent electoral systems and voting methods and the adoption of procedures that produce certainty in electoral outcomes:

         (v)   the provision of impartial mechanisms for resolving disputed elections and polls.

(2)   Local authorities, electoral officers, and other electoral officials must, in making decisions under this Act or any other enactment, take into account those principles specified in subsection (1) that are applicable (if any), so far as is practicable in the circumstances.

(3)   This section does not override any other provision in this Act or any other enactment.

Appendix B – International online voting digests

International Digest: New South Wales (Australia)

Context

Australia has been using electronic voting technology in to assist in elections since the early 2000s and had previously provided online voting services to members of the armed forces serving overseas. The 2011 New South Wales (NSW) elections however, were the first time that a fully online voting system was used (iVote). This was designed primarily for blind and low vision voters and "remote" voters who live outside of NSW. iVote also provides telephone support for voters who are not able to use the online component.

What they did

The elector applies to use iVote, the elector can apply on the Internet; or by calling a dedicated iVote call-centre. When an elector applies they provide a 6 digit PIN number of their own choosing. The elector is then sent a confirmation letter and the NSW Electoral Commission also provides them with a unique iVote number. The iVote number can also be provided via email, text message, or phone call. To use iVote the elector needs to use both their PIN number and the iVote number.

An elector can use the Internet, or use the phone where they will be connected to a dedicate iVote call centre and speak to a live operator (rather than a recording or an automated system). If using the online system the elector is presented with an electronic ballot that they can complete at their own pace, and they are able to take a break and return to complete their ballot for 12 hours. The elector can review their ballot before submitting it, if they are using the phone their preferences will be read back to them by the operator.

The iVote electronic ballot box is "opened" after the close of polls and all votes are securely printed in one batch. A certain number of election officials with electronic keys are required to be present to open the electronic ballot box. Scrutineers can be present to observe the opening of the electronic ballot box and printing of votes. The printed votes are sorted by district, cross checked to see whether an elector had already voted by other means, and then are couriered to electorate district and counted with the rest of the regular votes.

Challenges they faced

The election process had run relatively smoothly but there were some noted areas for improvement.

The evaluation found that around 30 per cent of eligible voters preferred to use traditional voting methods, or found that they did not need to use an online voting system. Out of those eligible voters who had registered 20 per cent did not use iVote because they did not know how to use it, and 16% because they had experienced a glitch in the system. The post-election evaluation survey found that 10 per cent of respondents had some technical problem with the iVote system.

Voters also noted that the authorisation process in order to use iVote can be relatively time consuming.

Result

The iVote system was used by 46,000 voters. This was five times as many votes as was originally anticipated. This was largely due to the increased uptake of iVote by electors who lived outside of NSW.

Out of those who had used to cast a vote with iVote, 96 per cent of users surveyed were either satisfied or very satisfied with the way iVote performed.

Lessons we can learn

iVote overall has been successful. It is best if used in conjunction with other voting methods such as postal or telephone voting. Postal voting gives an elector an opportunity to participate if they encounter technical difficulties with online voting, while telephone voting was particularly useful for voters with disabilities.

Staggered rollout – iVote (at least for now) is limited to certain categories of electors (disabled, remote etc) rather than the entire electorate. This provides for a much smaller proportion of the electorate for an initial trial of online voting, with contingencies in place (telephone or postal ballot) if there are large scale technological disruptions of the online voting system. Lessons learned can also be implemented in time for a large scale roll-out making the overall online voting system more effective and thereby giving it a greater degree of trust and certainty among the electorate.

There are plans for a more extensive roll-out of iVote, at a cost of approximately – $AUD 3.6m (estimated). Although this was considered expensive in the context of the work already done, the cost per vote represents good value compared to other voting methods. There are also additional time savings and convenience for voters over other voting methods, with 92 per cent of respondents to the post-election evaluation survey noting that they found iVote to reduce the time it takes for them to vote.

Context

Barcelona has an established practice of engaging its citizenry in local decision making. When a decision needed to be made on the modernisation of the city's main streets, the local authorities decided that this was a good opportunity to trial an online voting system. In 2010, Barcelona held an online referendum asking its residents to decide between two possible layouts for the streets.

What they did

A supervisory board was appointed by the City Council with external and independent members. The Board legally monitored the whole online voting process.

Online voting was the only channel available and it could be done either from a personal computer or in a supervised environment (kiosks). Electors were given a period of five days to cast their vote.

Electors were not required to pre-register and were allowed to use one of three authentication mechanisms to vote. These mechanisms were: digital official certificates already accepted in other e-procedures with the Barcelona City Council; a one-time password sent to a cellular phone; and websites of designated organisations (e.g. universities, banks) with their own authentication logins (the e-voting system was embedded in partner websites so citizens did not need new logins and passwords).

The system provided no means for electors to verify either that their vote was cast as intended or counted as cast.

The online referendum was audited by the Polytechnic University of Catalonia.

Challenges they faced

The system was not sufficiently secure and it allowed impersonations via someone getting the password with some else's personal data. This problem was highlighted when a prominent voter found that someone had already logged on with his authentication details and cast a ballot for him. The media and other stakeholders proved that this fraud was also possible with other votes.

The online voting project was controversial and there was no consensus on the two options provided in the referendum or if the process was the appropriate way to make a decision. The technical problems discovered during the implementation of the project polarised stakeholders even more.

To build confidence in the online voting system, the Mayor of Barcelona declared he had cast his vote online. However, the e-voting application was not properly running when this vote was cast. Once a newspaper discovered the situation, the Mayor was forced to acknowledge that it was not certain his vote had been successfully cast. It was soon established the vote had not been received by the server and the Mayor needed to vote again.

Result

Given the failure of the online referendum in Barcelona, it is unlikely that Spain will trial or use online voting again for official polls or elections in the near future.

Lessons we can learn

The Spanish experience of online voting demonstrates the importance of having robust identity verification processes. More broadly, the failure of Barcelona's online referendum shows that countries need to very careful when conducting online voting pilots. A poor first experience with new technology can turn electoral stakeholders against the technology in a way that is difficult to repair.

International Digest: British Columbia (Canada)

Context

Municipal governments have been at the forefront of electronic and online voting in Canada as their ballots are less complex and have fewer candidates than local and provincial government elections.

In 2009, Canada's Chief Electoral Officers began a formal dialogue on e-voting at federal and provincial level, creating a shared definition and set of guiding principles. Elections Canada has undertaken extensive research on online voting but has not yet instituted online voting.

In 2012 in British Columbia, officials were invited to look into online voting with a view to seeing whether online elections could be helped in local government and/or provincial elections in British Columbia by 2014.

What they did

In August 2011, Elections BC submitted a discussion paper on Internet voting to the Legislative Assembly to try and further public debate on the issue of online voting. Three months later, in November 2011, the Chief Electoral Office submitted recommendations for legislative change to the Legislative Assembly, one of which was trialling new technologies, including Internet voting.

On August 2012, the Minister of Justice and Attorney-General invited the Chief Electoral Officer to convene a Panel to review best practices in Internet voting in other jurisdictions, and look at the issues that would be associated with implementing online voting in British Columbia.

A Panel was subsequently appointed, consisting of people with expertise and experience in online voting. It invited experts on particular topics to address it, reviewed the literature on online voting and debated the issues. In October 2013, the Panel released its preliminary report, which looked at:

- Internet voting – definition and scope
- Perceived and actual benefits of Internet voting
- Perceived and actual challenges to implementing Internet voting
- Other jurisdictions' experiences.

Challenges they faced

The issues the Panel identified were:

- security
- compromised election results
- accessibility, usability and availability
- authentication and ballot anonymity
- secrecy of the ballot
- transparency and auditability
- trust

- stakeholder management
- cost

Result

The Panel concluded that online voting has the potential to provide some benefits for local government and provincial elections, including increased accessibility and convenience. However, it felt that other presumed benefits, such as increased voter turnout and lower cost, were not typically realised in other jurisdictions.

There were some significant risks identified too. These included the fact that security issues were increased with people having a range of security settings on their home computers, and the possibility of large scale fraud was greater in an online environment; reduced transparency and auditability in an online system; and no clear evidence that costs would be reduced. Authentication, secrecy and ballot anonymity were also more complex in an online system. These issues made it likely that the public would have a low level of trust in the system.

The Panel concluded that online voting has the potential to be an additional voting channel for voters with specific accessibility issues, provided a number of issues were resolved and set of principles were complied with. It did not feel this could be done by 2014, and it made the point that while online voting had been investigated by a number of other countries and jurisdictions, it is still not widely implemented, being used in only a few places and on a limited basis.

The Panel's recommendations were:

1. Do not implement universal online voting at this time. If, however, it is decided to implement it, online voting should be limited to those with specific accessibility challenges, and jurisdictions need to be aware that the risks to accuracy of the voting results remain substantial.

2. Take a province wide coordinated approach to Internet voting.

3. Establish a technical committee to evaluate Internet voting systems and support the jurisdictions that implement approved systems.

4. Evaluate any future voting system against a set of principles:
   - Accessibility
   - Ballot anonymity
   - Individual and independent verifiability
   - Non-reliance on the trustworthiness of the voters' devices
   - One vote per voter
   - Only count votes from eligible voters
   - Process validation and transparency
   - Service availability
   - Voter authentication and authorisation

Lessons we can learn

It is important to have a set of principles that are considered to be important. Any voting system option can be evaluated against these.

Security vulnerabilities are significant: the three biggest vulnerabilities are at the voter's device; in transit and at the election server, and an election is an attractive target for hackers.

Context

Markham introduced Internet voting in 2003, the first municipality in Canada to do so. It aimed to increase participation in elections by making voting more convenient for residents. In addition to the Internet voting option, vote tabulators were introduced as part of the engagement strategy to help incorporate electors with disabilities and allow them to cast a secret ballot.

Internet voting was introduced in Peterborough in 2006. The rationale for this was to make elections more accessible by creating more voting options for electors. Peterborough is demographically different from Markham, in that it is less urban, and has a smaller electorate. It has a very large senior population (the second largest in Canada) and a large percentage of its electors have home computers with access to the Internet.

Halifax Regional Municipality (HRM) first introduced remote Internet voting in its municipal and school board elections in 2008 as part of a pilot project that sought to establish the viability and reliability of electronic voting. The municipality decided to offer remote Internet and telephone voting, given that voting over the phone appealed to a wider demographic; especially older electors who might have greater difficulty using the Internet. HRM contains both an urban core and suburban areas, so while some areas are highly connected to the Internet, other parts were not. By implementing both remote Internet and telephone voting Halifax offered those residents who have limited or no Internet access the possibility of voting electronically.

What they did

Markham

Prior to introducing electronic voting, Markham conducted considerable research. The electronic model used by Markham included the option of remote Internet voting in advance polls during the 2003 and 2006 municipal elections as well as the use of optic scan vote tabulators in every polling station on election day.

On-line voting was only offered during the advance polls, and electors wishing to vote in this manner were required to pre-register. In 2003, electors were able to vote on-line during a five-day period and in 2006 the advance polling period lasted for six days.

Every elector received an on-line registration package by mail as part of the voter notification process. The rationale behind pre-registration was that it would serve as an additional security precaution and would give the town a better sense of which electors opted to use electronic voting. When electors registered they were prompted to create a unique security question whose response was required before casting their ballots. Registration also removed elector names from the manual voter list and they no longer had the option of voting at a traditional polling station. Upon registering, electors were also mailed a unique PIN. Use of the PIN and the response to the unique security question allowed electors to vote on the Town of Markham Web site.

The Town of Markham also took a unique outreach approach to inform its electors of the electronic voting service by creating an interactive Web site that not only encouraged

electors to register to vote on-line and informed them of how the process worked, but also educated them on the importance of voting. The Web site also included links to the various candidates' Web pages in case electors wanted to learn more about them or their mandates. The town advertised both the Web site and on-line voting through mailings, fridge magnets, print ads, in malls and by e-mail and telephone. This aggressive marketing approach is very likely one of the keystones to the success of Internet voting in Markham, and the notable increases in voter turnout. The same services were used in both election years.

Peterborough

Peterborough did not gauge electors' reactions towards online voting but they did implement an intensive promotional campaign to inform electors of the service, part of which involved visiting seniors' residences and community centres to convince to older electors to use the online option.

Like Markham, Peterborough chose to use remote Internet voting for a five-day period in its advance polls and introduced vote tabulators into all polling stations on election day.

All electors on the voters list were mailed a notice of registration card or letter with, among other information, a unique elector identifier (EID). To access the on-line election services electors were required to login to the system prior to registering using their EID as well as retyping a security code called a CAPTCHA challenge. To register, electors were required to provide their address (as shown on their notice card) and their year of birth. They also had the option of choosing whether they preferred to have their PIN mailed (as in the Markham trials) or e-mailed to them. Registered electors were then either mailed or e-mailed another card with a PIN. Both the PIN and the login information (EID number and CAPTCHA challenge entry) were required prior to casting a ballot on the City of Peterborough Web site.

The trial included a potential 276,000 voters and was contracted to a locally established company. Remote Internet and telephone voting were incorporated as a component of the advance polls. The remote Internet and phone portion of the election took place during a three-day period two weeks prior to election day.

Halifax

The Halifax experience differs slightly from the Markham and Peterborough projects given that electors were not required to register prior to using remote Internet or telephone voting – residents were instead able to choose to use the service at any time. Whereas in the other two trials electors who expressed a willingness to use remote Internet voting (by registering on-line) were taken off the manual voting lists, the technology used in the Halifax trials enabled voters to select their preferred method of voting when they wanted to cast a ballot and not before.

The Halifax approach is also exceptional in that electors were able to spoil a ballot by having a "decline to vote" button which was presented along with the candidate names so that electors could exercise this right. Another important feature of the model used in Halifax is that voters were able to switch voting channels if they wished. For instance, an elector could start voting on his or her cell phone on the way home from work (e.g. vote for mayor) and then continue voting for the remaining positions (e.g. councillors and school board members) from his or her home computer.

To ensure security and anonymity, a specific set of steps was undertaken. Every resident of HRM on the voters' list was mailed a letter explaining how to vote electronically and providing a PIN. At any point during the three-day period electors were able to log on to a secure Web site or call a phone number and cast their ballot electronically. The on-line process required electors to complete a CAPTCHA challenge, and then use their PIN and date of birth to confirm their identity. Once these security steps were complete a menu prompted electors on how to vote for mayor, councillor and school board representatives.

In terms of security more specifically, the system used in HRM used four levels of security checks. The first, a "penetration test", involved a contracted IT firm trying to break through the system to evaluate whether existing security mechanisms were capable of adequately preventing another person or group from tampering with the system. The second check involved analysing the encryption system used in the communication between computer servers. The third was an external audit of the entire voting process undertaken by an auditing firm. Finally, the fourth check analysed the network's overall security to ensure prevention of attacks and problems.

Challenges they faced

Peterborough

Initially negative media coverage was an obstacle, but this was overcome by providing media sources with additional resources and educating them about the Internet process and the security of the system.

Halifax

In 2012, security issues were raised in the Halifax election, with suggestions being made that online voting would enable groups such as fraternities, churches and other groups to vote together for one candidate, putting undue influence on some electors; and, secondly, that the loss of a vote through unsafe systems meant the vote was gone forever. These views did not gain much traction with the wider community.

Result

Markham

While turnout overall remained unchanged in the 2003 election (28 percent), turnout in the advance polls increased by 300 percent. To put this in perspective, voter turnout in most other Ontario municipalities declined during the 2003 election. Markham electors had the option of voting from home, their workplace, a library or public place where Internet was available as well as touch-screen kiosks that were set up in city hall. In 2003, 12,000 out of 150,000 electors pre-registered to vote on-line and slightly over 7,000 voted on-line.

In 2006, advance voting on-line increased by 48 percent, as 10,639 voters chose to use the service to cast their ballots. Eighteen percent of all votes cast in 2006 were electronic ballots, a one-percent increase from 2003, and a 38-percent increase in turnout overall. Public attitude data that was collected highlights use of and satisfaction with on-line voting in Markham.

In terms of remote location, 82 percent of electors who voted on-line did so from home and 88 percent of on-line voters cited convenience as the primary reason for doing so. These percentages indicate that there is strong public support for remote Internet voting in the Town of Markham, at least among those who use the service. In addition, a portion of previous non-voters (25 percent in 2003 and 21 percent in 2006) declared that they had decided to cast a ballot because of the convenience of Internet voting. One hundred percent of the voters who voted on-line in 2003 reported they would vote on-line again in the future and 91 percent in the 2006 survey indicated they would be "very likely" to do so.

Following the 2010 election, nearly two thirds of voters who registered to vote online did so. 99 percent of online voters expressed satisfaction with the process and said they would continue to vote online. The rate of Internet voting is declining among the young, but is increasing in the older voting groups and the evidence from the Markham suggests that modest increases can be expected from the use of online voting.

Peterborough

Overall, the introduction of electronic voting in Peterborough was considered a success. Public reaction to the introduction of Internet voting was positive despite the initial negative media, and no security issues or risks required attention. The only drawback of the process cited by city officials was that Internet voting was limited to advance polls only and this is something they would like to see expanded in future elections.

There was no noticeable effect on turnout overall (it remained unchanged from 2003 at a rate of 48 percent), but turnout in the advance polls was moderately higher than the figures for 2003. The increase in advance turnout may be a consequence of the fact that aside from the on-line polls, only one traditional advance polling station was open to the public. In all, 14 percent of electors who voted cast their ballots over the Internet (3,473 of 25,036).

The largest group of on-line voters was baby boomers; specifically, 70 percent of on-line voters were 45 and older, and the highest rate of use was among electors aged 55 to 64. Only 14 percent of those aged 18 to 34 voted on-line. The higher rate of use among baby boomers is interesting because most survey data indicates that young people are more inclined to report using, or saying they would make use of, Internet voting than other cohorts of electors. If seniors, or older cohorts of electors, are interested in making use of on-line voting, its implementation is more likely.

Halifax

Public acceptance and support of electronic voting in Halifax was relatively strong. As early as 2004, HRM began conducting polls in which more than 70 percent of respondents said they would be in favour of HRM implementing an electronic voting option. While 44 percent reported that voting at the polls was their preferred method, 35 percent indicated that they would prefer Internet voting if it were available. No objections were raised at council meetings and there was no public protest.

Though voter turnout did not increase overall (from 2004 to 2008 it dropped from 48 percent or 125,035 voters to 38 percent or 100,708 voters), turnout on advance voting days (where remote Internet and telephone voting were offered as options)

increased by more than 50 percent (from 14,000 electors in 2004 to 29,000 electors in 2008) despite it only being offered for a three-day period.

Another remote Internet and telephone voting trial was conducted in September 2009 where the option to vote using the Internet or telephone from remote locations was continuous (from the first voting day up until and including election day). Voter turnout was 35 percent, a 12 to 25 percent increase from turnout in the three previous by-elections (21, 10 and 23 percent respectively) and 75 percent of all votes cast were electronic.

In 2012, voters again had the option to vote online with the polls opening 13 days before election day for telephone and online voting. The turnout for the election was 45 percent, and 22 percent of voters – just over a fifth of all eligible voters - chose to vote online.

Lessons we can learn

- Public acceptance is vital to online voting being accepted and used. If the public both trust and are interested in the new method, all sections of the community will try it, giving wide accessibility.

- Intense marketing, awareness packages and training are important in winning people over and giving them the confidence to try the new methods.

- Having a combination of features in the system helps reduce barriers to voting and increase accessibility. This was seen in the Halifax case because it did not require electors to pre-register to vote on-line, offered a "decline to vote" button enabling electors to refuse a ballot, offered telephone and Internet voting simultaneously, allowed voting for the whole election period, and implemented a candidate module that allowed for the maintenance of candidates' representatives for electronic ballots.

- Accessibility can also be maximised by allowing different methods of voting. While a majority of households in a given jurisdiction may have access to the Internet, many rural areas may experience limited connectivity and those with lower incomes may not be able to afford access.

- Instituting Internet kiosks in public places such as libraries and community centres is one method of making remote online voting more widely accessible to these groups of citizens.

Context

Estonia has used online voting for a total of six elections, starting with the 2005 local government elections, and then progressively rolled out to parliamentary and European parliament elections. Due to the high uptake, public confidence, and security of its online voting system, Estonia is seen as a world leader in online voting.

Estonia's online voting systems are one component of broader online government infrastructure which includes information management systems and online identity verification tools. Tallinn, Estonia's capital, is also home to NATO's Cooperative Cyber Defence Centre of Excellence.

What they did

Estonia, like many other European Union member states, has a national identification card (ID card). This ID card has a microchip with digital signature and encryption technology which allows Estonian residents to authenticate their identity and access e-government services, as well as all major banking services in Estonia and provides freedom of travel through the Euro zone.

This ID card provides an existing secure platform to authenticate voters for the purposes of online voting. Voters can obtain a smart card reader that connects to their computer (most are given one free of charge for the purposes of Internet banking but they are also available from retailers for a small fee) and using purpose built online voting software can cast their ballots online.

Other authentication platforms for online voting have been subsequently rolled out such as digital and mobile authentication, but both build on the ID card.

The vote information is then encrypted using two unique PIN numbers and sent to the Vote Forwarding Server, which is the only component of the online voting system that is directly accessible from the Internet. The dual encryption of votes and their digital "voting envelopes" ensures that voters retain their anonymity when voting.

Valid votes are then transferred via a firewall protected connection to the Vote Storage Server. Votes from the Vote Storage Server are transferred via an external storage medium (such as a CD) for counting. The counting of votes takes place using a Vote Counting Application which is totally separate from the network and has local databases of voter lists and candidate lists. Votes are then decrypted by election officials and are sorted by constituency.

Online voting is only possible between ten and four days before polling day in order to eliminate double voting. A key feature is that voters have the ability to vote and re-vote multiple times (including booth voting on polling day itself), with their last vote overwriting their previous vote. The rationale for this is so that the voter can exercise their free will when voting and be free from influence.

Challenges they faced

Providing an online voting option, naturally raises issues of access. With regard to access to the Internet, Estonia is one of the few countries in the world to have legislated Internet access as a social right.

The online voting portal is only available in Estonian, the official language, however other minority groups, including a sizeable Russian minority (approximately 25%) may struggle to use online voting in Estonian. Research into the 2005-2011 elections found that at first, fluency in Estonian was statistically significant in terms of whether or not a voter would use online voting. However, Estonia has provided resources in Russian and advertisements for online voting in Russian. Results from the 2011 election suggest that language is no longer a statistical factor in the usage of online voting.

Result

The online turnout for election has steadily increased since inception:

- 1.9 per cent - Local Elections 2005

- 5.5 per cent - Parliamentary Elections 2007

- 14.7 per cent - European Parliament Elections 2009

- 15.8 per cent - Local Elections 2009

- 24.3 per cent - Parliamentary Elections 2011

Total turnout has also increased with the advent of online voting. From 47.4 per cent in 2005 to 60.6 per cent in 2009 for local government elections, and from 61.9 per cent in 2007 to 63.5 per cent in 2011 for national elections.

Interestingly, the Estonian government estimated that in the case of i-voting, the cumulative time savings for using online voting in the Estonian parliamentary elections of 2011 were 11,000 working days, which would amount to around 504,000 euros in average wages.

Lessons we can learn

A well supported e-government infrastructure can greatly improve the efficiency and effectiveness of online voting. Strong public trust in e-government services will also translate to online voting leading to greater trust of an online voting system and a greater uptake of online voting as an alternative voting method.

Estonia had already developed a strong regulatory framework for the management of e-government services, such as digital signatures and ID cards, and online voting was able to fit well within that framework. Furthermore, the investment approach that Estonia took with regard to ICT infrastructure and e-government services allowed the public to naturally adopt new Internet based technologies. Estonians are able to access a wide range of e-government services and the private sector also adopted these technologies for their use (such as ID card verification for online banking). This in turn led to a natural and gradual evolution and adoption of new technologies, where online voting is seen as one more e-government service that is provided to the public, rather than a completely new service.

One other factor owing to the success of online voting in Estonia, that cannot be overlooked, is Estonia's small (approx 1.3m) highly centralised and technologically savvy population, which was able to quickly adopt new technologies such as e-government and online voting.

Context

France has experimented with online voting since the early 2000s. Online voting has been used most extensively for election of its Assembly of French Citizens Abroad, a body that advises the French Government about issues involving French nationals living outside France. During May and June 2012, French expatriates were able to vote online for the first time in parliamentary elections. This digest provides information about the 2012 election.

What they did

The online voting process was overseen by the Electronic Vote Board (EVB). The EVB is a board of seven individuals, mainly from groups that represent expat French citizens, and is regulated by the French Electoral Code. One of the Board's main responsibilities was to hold on to the cryptographic keys used for encrypting and decrypting online votes.

Eligible electors enrolled by submitting their e-mail addresses and mobile phone numbers to French consulates. They then received instructions on how to vote online via the Internet and the login to use by regular mail two weeks before the first round of voting. Additionally, each of them received two different passwords via e-mail, one for each round of voting.

To vote online the elector established a secure connection to a voting portal and then downloaded a Java-based Internet voting application onto their computer. Electors were allowed six days to cast their vote for each round in case they encountered significant problem voting online and needed to vote in person. Once the elector cast his or her vote, it could not be changed.

The elector was able to confirm their vote had been correctly cast by checking a receipt containing a validation code, which was displayed on their computer screen in a printable format. However, this level of confirmation was not sufficient to provide proof that the vote was cast as intended, recorded as cast, and counted as recorded.

While there was no official certification process for the online part of the election, the system did have to comply with guidelines and regulations issued by official agencies. General guidelines about minimal privacy, secrecy and security requirements were provided by the Commission on Information Technologies and Liberties, the independent French administrative body responsible for data privacy, with input from an independent third-party audit company. The voting system also had to comply with the requirements for electronic certificates, encryption levels, and authentication mechanisms provided in a regulatory framework established by the French Network and Information Security Agency.

Challenges they faced

Shortly before the 2012 election, the Pirate Party (a party committed to Internet freedom and opposed to copyright restrictions) and a civil society organisation, *"ordinateur du vote",* raised concerns about the transparency and security of the online voting system.

They claimed the system was vulnerable to 'man-in-the-middle' type attacks where communication between two systems is intercepted by a malicious actor. Concerns were also raised about the lack of public information on the process of adopting online voting, particularly about the tender for the system.

The Java-based operating environment was updated around the time online voting was available for the first round of voting. The system then became incompatible with the voting application, which resulted in several electors being unable to cast their vote. Once this problem with detected, a technical solution was published on the online voting website. Another technical glitch corrupted the digital certificate of one vote and resulted in it not being counted.

Result

Despite the above challenges, the online voting system was successfully used to directly elect 11 members of the national parliament. A total of 126,947 online votes were cast during the first round and 117,676 in the second round, with 55 percent of expat electors choosing online voting over conventional voting channels.

Lessons we can learn

The Office for Democratic Institutions and Human Rights, an institution of the intergovernmental Organization for Security and Co-operation in Europe, assessed the conduct of the 2012 French parliamentary election. Its report made a number of recommendations relating to online voting, including that:

- online voting security requirements, audit protocols and the source code be made available to the general public to enhance confidence in the online voting process;
- a document containing all command-level procedural and operational details be published in good time before elections to enhance the accountability of the online voting process;
- the procurement process for online voting systems be conducted in the most transparent way possible, including for tender documentation;
- a voter education project be launched to enhance and promote citizen knowledge and involvement with new voting technologies; and
- consideration be given to permitting electors to recast their votes in case of error and to limit possibilities of voter intimidation.

International Digest: Geneva (Switzerland)

Context

In 2000, the Swiss federal government decided to conduct a trial of online voting as a national survey showed that two-thirds of Internet users wanted to be able to vote online. Geneva was chosen as the site of the trial as it was the only canton to allow electronic voting trials and it had a centralised and computerised voters' register already set up.

The pilot phase came to an end in 2007, and in 2008, federal law was amended to allow for electronic voting across Switzerland.

Currently, the Internet voting project is managed at the federal level for federal ballots, while cantons are autonomous for cantonal or municipal ballots. The ultimate aim is to have all citizens voting online in the future (there is no official timetable) but security comes first and cannot be compromised.

Internet voting currently represents some 20 per cent of votes cast in any referenda.

What they did

The Geneva Internet voting project chose a simple system as a starting point – basically an electronic translation of postal voting. They did not want a system that would require preliminary registration of the voters.

The project had four phases, offering:
- Citizens the possibility of voting for initiatives and referendum and the other to deal with elections (In Switzerland, citizens not only vote in elections, but also take a direct role in policy issues of the day through frequent referendums on issues. On average, Swiss citizens vote between four and six times a year.);
- Citizens the ability to elect representatives online;
- Citizens the possibility of digitally signing referendum and initiative forms;
- Giving political parties the possibility to digitally sign candidate's lists.

By concentrating on initiatives and referendum first, the group could test the validity of the basic concept, the components and the architecture of the system without taking big political risks. By the end of 2011, Switzerland was moving into phase 2. There is no official timetable for each phase.

The Geneva system relies on a simple architecture, use of a quantum generator to produce the various cryptographic keys and voters' identifying features. It uses symmetrical and asymmetrical keys and encrypted ballots. A mixing process is applied to the ballots before being counted.

The system implements a combination of several security techniques: mutual SSL protocol, double encryption of the data and authentication of messages. As current web browsers do not offer the functions required to implement these features, the Geneva project uses a java applet that is downloaded to the voter's computer. An integrity meter ensures that no vote is added or subtracted without these being seen. The electronic ballot box is then sealed with a key owned by the Central Electoral Commission.

For each voting operation, the voter is posted a single-use voting card containing a unique voting card number enabling them to be identified in the voting management system (irrespective of what channel – postal, booth or online – they use). This information is not exchanged online, but an imprint is sent out. The imprint is obtained by applying a cryptographic hash function to the voting card number. For the online vote, the voter number and a password are completed by the voter inserting two shared secrets into the system; their birth date and their municipality of origin.

There is no vote verification for the voter, but the system has a special part where Internet votes are recorded on a paper form. Before the electronic votes are counted, they are checked against the paper form to make sure the system has not somehow biased the outcome.

Challenges they faced

Legal changes

Existing law on the counting of votes and a citizen's right to view the counting had to be rewritten to allow for online voting. It took the State Parliament from 2006 to 2008 to debate a law generalising Internet voting. During this period, online ballots were suspended.

Technology

The Geneva application has been steadily upgraded, but because applications such as java are not normalised among platforms, the voting application ran on a smaller number of platforms and browser combinations. Many voters found that they could not use online voting as they had Apple computers at home.

Participation

In Geneva, Internet voting is currently available for all Geneva-registered voters living abroad and a small percentage living in Geneva. Overseas voters can only vote if they live in an EU country, or a country that has ratified the Wassenaar agreement.

For federal ballots, the government has put a limit on online voting to 20 percent of the population of any canton. This cap was calculated on the question: should a problem occur, what share of votes can be lost without affecting the final result. In Geneva, the selection of the 20 per cent able to vote online is done by choosing 10 to 12 municipalities whose registered voters together add up to 20 per cent of all Geneva voters.

Maintaining trust in the system

A number of tests are performed on the system to check it is working properly before it is sealed. It also has a number of controls activated during the ballot opening period, including allowing an automatic paper record which can be compared with the electronic record, and an automatic casting of a vote every five minutes to check the system is not down. At the end of each ballot, forensic statistical checks are performed to see whether they are coherent with the voting history of the constituency.

Geneva law also mandates a triennial audit, which must be made public.

One mistake that the project does recognise was that it did not include stakeholders such as civil society or political parties in the initial pilot programme. This gave rise to suspicion and meant no independent bodies could support the system in the media and with activists. Despite this, the public have great trust in the system, due to the length of time it has been going, and the lack of any major problem with it.

Result

Switzerland in general has a lower than average voter turnout in elections: at the time the online voting project started, it ranged between 25 and 30 percent.

Between 2003 and 2008, Geneva held ten ballots, where voters had the choice of Internet, postal or polling station voting. The initial ballot saw a 44 percent turnout (attributed to intense marketing of the new option), but the turnout rate after that ranged from 22 percent to 25 percent.

Lessons we can learn

- Having a limit on online voting would allow trust to be built slowly in the system – and would minimise the damage from any initial problems as only a small percentage of votes would be lost and those votes could easily be recast as the voting group whose votes were lost would be known.

- Disgruntled people, or people with agendas will try and denounce the system and the media will not always support their stories with facts. The risk is not the flaws in the system, but the fact that people will believe the unsupported stories and lose trust.

International Digest: The Netherlands

Context

In December 2003, the Dutch Government adopted its 'Modernising Government's programme', a wide ranging commitment to implementing e-government and in 2004 the Government approved plans for the creation of a unique identification number for Dutch residents by 2006. In 2005, the Dutch Digital Identity service was launched, providing citizens with a centralised online authentication solution for accessing e-government services, based on a user ID, and in 2008, the Ministry for Internal Affairs launched a website enabling citizens to interact with local and national politicians.

What they did

The Dutch have conducted several experiments with online voting. In 2004, Dutch citizens living abroad were able to vote online for the first time in the European elections. Later that year, the elections for two water boards combined postal voting with online voting. Problems with the security in the water board elections meant that Internet voting development stopped in the Netherlands.

The Dutch have developed a set of principles for their elections which include:

- transparency
- verifiability
- fairness
- eligibility to vote
- free suffrage
- secret suffrage
- equal suffrage and
- accessibility

The principles are the criteria by which existing and future methods of voting should be judged. In practice, the election process cannot provide 100 per cent safeguards so it is necessary to strike a balance between them.

Challenges they faced

In essence, the big questions in the Dutch elections were:

- what are the essential requirements in e-voting and what do they mean?
- what are the threats?
- which techniques should be used to counter these threats?

In Internet voting, transparency, verifiability and access are in conflict with security and a reliable system.

Interestingly, the Dutch report names high cost as a factor in Internet voting, saying the online voting experiments conducted in the Netherlands had "run into millions of euros". It said it was hard to compare the cost to a paper-based election, but believed the "cost

of online voting was likely to be much higher than that of voting with paper ballots at polling stations".

Result

The Dutch concluded that voting at polling stations was the only voting method that provided enough safeguards for all the principles.

However, they concluded that for some citizens, including Dutch citizens abroad or people with physical impairments, other methods of voting were necessary. Many of these people have requested Internet voting and the Panel recommended that Internet voting should become the regular method of voting for them - but that postal voting should also remain for those who do not have Internet access or who do not wish to vote online.

The Panel recommended that Internet voting should be the regular method of voting only for voters living abroad, with postal voting retained for those who are unable or unwilling to use the Internet.

In 2008, due to successful lobbying based on security concerns the Netherlands passed a law banning online voting.

Lessons we can learn

The Dutch developed a clear set of principles that they felt were important, and used these as a set of criteria to measure the different voting systems against. Developing our own set of principles might be a very good starting point when evaluating the options.

Context

Norway has trialled online voting in selected municipalities for the 2011 local elections and the 2013 parliamentary elections. Originally 10 out of 429 municipalities were selected for the online voting trial in 2011 and 12 municipalities in 2013, with online voting being available during the advance voting period only.

The primary objectives behind the Internet voting project were to provide better accessibility to voters, to ensure rapid implementation of elections and the efficient use of resources in municipalities, as well as facilitating direct democracy.

What they did

Norway's online voting model is very similar to that of Estonia, however instead of an identification card based verification, Norway uses a combination of existing digital identity verification services and an SMS (text message) based system that allows voters to verify that their vote has been received and recorded correctly.

Similar to Estonia, voters in Norway can re-vote as many times as they wish online, with their most recent vote being the one that is counted. If voters vote in person on polling day, their paper vote supersedes their online vote.

A key feature to improve openness, security and transparency is that the source code for online voting has been made public. This allows members of the public to review the source code and draw attention to any issues.

To improve accessibility the online voting portal was available in Bokmål, Nynorsk, Sami and English languages, and font size could be adjusted.

Challenges they faced

The nature of the SMS based verification system has posed some security issues, with security experts claiming that if a voter's smartphone was compromised, the vote could be changed and the SMS verification could be hijacked to deceive the voter.

Additionally the client-side vote encryption has drawn some criticism as the random number generator used to encrypt the vote was described as very predictable by a security company.

Result

The post-trial evaluation in 2011 found that online voting had no effect on election turnout (in fact the trial municipalities had a lower election turnout than the national average - 62.3 per cent vs 63.8 per cent).

Further, the evaluation found that people in the trial municipalities who do not vote are as likely to say that they abstained from voting because of time-constraints, as those in the rest of the country. Thus the evaluation concludes that Internet voting did not impact on voters' decision to take part in the election.

Nevertheless the evaluation found that, people who voted online are very happy with Internet voting, and report that it was easy to cast a ballot in this manner. The authors of

the evaluation therefore argued that Internet voting did increase access to the election for people who actually voted.

Lessons we can learn

- A phased roll-out of online voting could help manage risks of online voting and continuously improve the online voting service until it is rolled-out to the entire population. However, even a phased roll-out carries the risk of damaging voters' perceptions of online voting if there are significant or widespread problems.

- Having the online voting portal in multiple languages that reflect the population will improve the accessibility of online voting.

- Making the source code available in advance for scrutiny by interested experts, will lead to greater public trust of the online voting system as a whole. Furthermore, if significant issues are discovered in the source code it will allow them to be fixed before the online voting system goes live.

Context

Portugal has experimented with electronic voting, including online voting in the mid 2000s. The online voting initiative in Portugal was also run in conjunction with more general "electronic voting", which included electronic voting machines and additional assistance for voters with particular needs.

What they did

Portugal investigated online voting in order to enable citizens to vote in situations where they either cannot get to their local polling place or when to do so may be difficult for them, which officials refer to as the "mobile vote". Portugal's assessment of online voting notes that it is this factor alone that is the main driving force behind their online voting initiatives. Online voting was piloted in the 2005 Parliamentary elections in five selected wards.

The online voting experiment used the following procedure:

- The voter received a posted card with a random user code

- After using the code to access the voting system, the voter once more identified themselves using their electoral number as an additional security step as well as a "personal random item".

- The voter would cast their non-binding vote, and when confirming their choice, they were presented with a message asking them to vote in the normal manner, and re-stating that this was a non-binding voting experiment.

- The vote was stored in a digitally verified database which could only be opened by five authorised people, nominated by each one of the parties in Parliament.

Challenges they faced

Portugal considered their current paper ballot system to be quite efficient, and adding an online voting option would increase costs, logistical complexity and computer security risks for example secrecy of the vote.

Result

The Ministry of Education and Science commissioned academics from the University of Porto to evaluate the online voting trial.

The evaluation found that:

- Online voting compares favourably with postal voting and contributes positively to voter participation.

- The online voting system would need to be significantly strengthened to improve security, integrity and secrecy.

- Technical aspects of how different components of the online voting system work together must be improved.

- The way in which voting credentials and voters are authenticated must be revised.

- Overall the online voting system has many weaknesses compared to other types of voting and it should not be adopted in its current form.

Portugal subsequently decided not to progress the online voting system, citing high costs and risks of voter coercion.

Lessons we can learn

- Small scale non-binding trials can manage and identify risks associated with an online voting system.

- Having a robust, authoritative evaluation is necessary to make informed choices on the future of an online voting system.

Context

Since the Representation of the People Act 2000 allowed local authorities in England and Wales to submit proposals to pilot new electoral arrangements, a number of local authority elections have held piloting schemes. In 2007, six different types of pilot schemes across twelve different local authority areas were trialled. The pilot schemes were varied, covering advance voting, Internet voting, electronic counting and signature checking, but five areas trialled an Internet voting scheme.

What they did

The five pilot areas used different methods, some, such as Swindon, allowing advance electronic voting in some locations prior to polling day, and having a large number of electronic polling stations across the borough to allow a vote anywhere on polling day.

In order to be able to vote online, voters had to pre-register to be issued with a log-in and password. Once registered, voters could switch back to polling booth voting if they wished, or use the online or postal option. The registration form required electors to provide two personal identifiers (date of birth and a unique personal identification number to be used during the authentication process when they logged on to vote. Electors also had to sign and date the pre-registration form and return it to the Council offices by a certain date. Once the forms were returned and checked, each elector was entered into a database and sent an acknowledgement letter by the Councils. Each elector was notified of their unique 10-digit ballot code in a secure mailer that also served as the poll card. To remote vote, pre-registered electors had to input their date of birth, self-generated PIN and ballot code.

Challenges they faced

People were concerned about the lack of transparency in the system and how secure it was. The lack of transparency was also a big concern for candidates and agents, who were dismayed at their inability to check the authenticity of the figures or scrutinise the outcome.

Tight timeframes meant there was a lack of testing. This resulted in the system being delayed in going live as security concerns were identified and needed to be fixed.

Human error from electors resulted in a number of Internet votes being cast incorrectly. Helpline staff or the Council were able to resolve these issues. Other problems arose from incorrect entering of elector's names or problems with the boot disks, meaning electors could not be found in the registration lists.

Results

The pilot was considered to be successful, but the Electoral Commission recommended to government that further piloting of electronic voting be stopped until an electoral modernisation strategy was developed, which incorporated a clear process for the development, testing and approval of e-voting solutions. This strategy would include a realistic timetable to allow for effective and robust planning and implementation.

Lessons we can learn

Awareness of the pilot and what it meant was patchy across the councils taking part. Some areas, such as Swindon conducted awareness programmes prior to the pilot to highlight the scheme and promote the online voting options.

Training was also considered to be important so that voting station and polling booth staff could provide technical help and advice to voters who wished to vote online at the polling stations. This training needed to be done at least two weeks in advance, giving staff time to become familiar with the system and gain confidence in using it.

There needed to be adequate time available to test the system before it went live so that problems did not have to be fixed on the polling day.

The pre-registering step seemed to be one of the areas that raised problems – people felt that the point of online voting was to make voting easier and having to do the extra step of pre-registering was making it more complicated rather than simpler.

There was a high cost to the trials with the costs of the technical, programme and project management elements and, while a percentage of the population found online voting to be convenient, there was negligible impact on turnout with a limited uptake of the facilities. This, alongside the cost of fixing the technical problems, meant there is a big question mark over whether the plot scheme represented good value for money.

International Digest: Washington D.C. (United States of America)

Context

In 2010 the D.C. Board of Elections and Ethics (the D.C. Board) trialled online voting technology through what can best be described as a digital vote by post system. This online voting system was designed to allow military and other overseas voters to take part in local elections.

What they did

Rather than a strict online system, the D.C. Board designed a "digital-postal-vote" system where voters downloaded a PDF form, filled out the form, then saved and uploaded their ballot to the online voting system. To design and build the software the D.C. Board entered into a partnership with the Open Source Digital Voting Foundation. The technology was all open source software[9].

Prior to actually using the system in their 2010 election, the D.C. Board allowed public access over one week for people to become familiar with the system, take part in a mock election and test the system's security.

How the system worked

Ballots that were uploaded were encrypted using a public key and stored on a server until after the election. Decryption required a private key that was stored on a non-networked computer which decrypted and then printed the ballots for physical counting along with regular postal votes.

The D.C. Board put in place an intrusion detection system (software designed to monitor traffic and detect attempted and successful intrusion), but it was not configured appropriately and overlooked some parts of the system.

Challenges they faced

The security of the system was significantly compromised to the point where within a few days a team of computer scientists from the University of Michigan had gained near total access including, but not limited to:

- stealing the public encryption key from the system and using it to change all of the previous votes;
- modifying the system to change any future incoming votes;
- added a 'calling card' by playing a University of Michigan song whenever anyone completed their vote;
  - o identifying the names and details of voters and who they voted for;
  - o modify logs to remove record of their activities, effectively hiding their actions; and
  - o the systems infrastructure was attacked by multiple people, most likely including automated malware and offshore groups from Iran, India & China.

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[9] Ruby on Rails, Apache web server with MySQL database.

Result

The D.C. Board made the decision to take down their online voting system for further development and security work. The Board did not publicly state that it was no longer continuing with online voting.

However, the D.C. Board's website does not contain any information about online voting for the 2014 elections.

Lessons we can learn

Detecting intrusions is difficult. Technology such as intrusion detection systems are only useful to a point and need to be carefully configured.

Comprehensive security testing should be conducted, including a security review of the architecture.

Small coding mistakes will happen. They will be detected and used by attackers.

Context

The West Virginia Internet pilots were designed to comply with the electronic transmission elements of the Military and Overseas Voter Empowerment Act – an Act designed to allow military members serving overseas to vote in federal elections regardless of where they were stationed.

What they did

Eligible voters (military and overseas voters covered by the Military and Overseas Voter Empowerment Act) first submitted a Federal Post Card Application, and then received an email from the county clerk or the voting system vendor. This email contained a username and a URL to a secure website. The voter could then cast a ballot with this information. Upon completion, they received a receipt code that verifies that the vote was processed correctly.

After the ballot was cast, it was stored in an encrypted form on a host server until election night, when it was transferred to a stand-alone, non-networked computer to be decrypted. The decryption process disassociated ballots from any voter-identifying information. Key holders, using unique passwords, did this decryption. Decrypted ballots were then printed and included in the central count of all absentee ballots.

The system ran on redundant servers, located locally and remotely. This allowed the system to continue operating even if one server went down.

Challenges they faced

Awareness-raising

The success of the project hinged on letting eligible voters know that this option existed. As the military voters were scattered across the globe, it was a challenge to reach them all. The Secretary of State's office used a three-pronged approach:

- Targeted broad media outlets;
- Targeted small group out-reach; and
- Individual contact through communications from the county clerks to voters.

Publicity

The West Virginia pilot ran without any problems or difficulties, but it found itself being pulled into the furore around the Washington DC case. When the DC pilot was hacked by University of Michigan students, the West Virginia pilot was inundated with press enquiries about the safety of their system and how easy it would be for hackers to attack it. This adverse publicity undercut the positive stories that the trial had been generating.

Result

The first pilot was held in 2010 in the state's primary election. The return rate for votes was 76 percent, which is far higher than the average 58 percent return rate from standard mail reruns. Voter satisfaction with the system appeared to be high, with 100

percent of those polled (a very small sample of 34 respondents) saying it was easy to use.

The project experienced no problems, but drew criticism from security experts who voiced concerns over Internet voting in general. These concerns were reinforced when the Washington DC mock election was hijacked by the University of Michigan hackers. Following this, West Virginia's Secretary of State said in 2011 that she wished to convene a committee to look into the concerns and recommend future actions before continuing to use the online option.

Lessons we can learn

- Security concerns will haunt even successful trials. Even continuously monitoring and updating systems will not stop determined hackers.

- People's trust in the system will be coloured by other high profile online events – or even Internet stories in general.

Appendix C – Online Census: New Zealand case study

Statistics New Zealand conducts a census of population and dwellings every five years. New Zealand censuses are conducted along the lines of collector drop-off and collect. Support for the census is high, but Statistics New Zealand knows it cannot take this level of support for granted.

The public are increasingly demanding more choice and convenience when interacting with government, including when filling out their census form. In order to keep the high level of public support it enjoys and to meet this public demand, Statistics New Zealand introduced an online option for the 2006 Census. The online option had 6 per cent of the population filling out their census forms on the Internet in 2006.

Statistics New Zealand retained this channel for the 2013 Census, but aimed to increase use of the online option to 35 per cent of all forms. This required just under two million forms to be completed online. This target was met.

The online option was successfully introduced as part of the 2006 Census. There were almost no problems and over seven per cent of all census dwelling and individual forms - almost 400,000 forms - were received through the online channel.

In 2013, 35 per cent of forms were completed online in the 2013 Census. This level of uptake was Statistics New Zealand's target for use of online forms.

Testing of the form

Statistics New Zealand started to develop a prototype system of the online option in September 2002. This early testing was concentrated on the usability of the online form. The first testing of the online form was simple, with a basic field test in March 2003. There was a more detailed test in November that year with 65 people completing the online form.

Statistics New Zealand did further testing to ensure the online forms allowed the majority of users to follow instructions and correctly fill in the form. In 2004, 60 tests were conducted between February and July with users from a wide range of backgrounds who had various levels of computer literacy.

As a result of user feedback from extensive testing, Statistics New Zealand was able to confirm what aspects of the forms worked and what changes were required.

A pilot was held in March 2005. It highlighted the benefits of this testing and tailoring of the forms with 94 per cent of respondents stating they found the online form easy to use.

Promotion

Statistics New Zealand made the decision to promote the online option on the household doorstep and through selected high use Internet sites only. The strategy in the 2006 Census was to promote the new technology, while positioning Statistics New Zealand to manage a significantly higher Internet participation rate in the future.

Despite the low take up numbers of 6 per cent, the online option was successful as it was almost a completely trouble-free operation and over 74 per cent of people were aware of the online option – although chose not to use it at that time.

Log-in and authentication

In 2006, field staff delivered an envelope containing a 12 digit Internet Personal Identity Number and information to all households along with the census forms.

A two-step log-in process allowed a secure log-in and authentication process. To log in, users needed to enter firstly, an 11 digit ID number from their hard copy census form and secondly, the 12 digit Internet Personal identification Number from the sealed envelope accompanying the census forms. Few users had trouble with this process.

The form was designed to mirror the hard copy form as closely as possible and was available in both English and Māori.

Cloud services

The main change in 2013 was the use of Government Infrastructure as a Service, the government's cloud system. The cloud system was used to support the existing content management system to so it could meet the additional resource requirements needed during the census period. This approach also allowed Statistics New Zealand to decouple the high profile, high usage census environment from its other websites. This was to reduce the impact of the census on these sites.

The 2013 Census used three levels of cloud services. The first level was Software as a Service, which is the level accessed by the end user and was the web browser for the census. The second level is Platform as a Service, which provided and managed the underlying systems in the census. The third level, which underpinned the rest, was Infrastructure as a Service, which was used to host and provide the physical and virtual infrastructure, including all auxiliary services, like networking, storage and power.

Expanded online based model

The other main change was the trial of an expanded online census for Oamaru. The purpose of this trial was to explore a new collection model that was less reliant on hand delivery and collection of paper forms to each household.

Internet codes were mailed to 5,000 addresses in Oamaru and paper forms were provided only on request.

Incorporating the online option

The online response needed to be integrated into the whole 2006 Census process from development to the final evaluation. The most important part was integration into the data collection phase.

Statistics New Zealand dealt with this challenge by examining the business model used for data collection, identifying areas that would be affected by the introduction of the online response option, and investigating solutions. Each activity identified as needing changes was individually examined and a process established to incorporate the required changes into the existing methods. Where integration was not possible, a parallel process was developed.

The development and operation of the online option was the responsibility of a separate dedicated team. However, integration of the paper and online version was also helped by making some teams, such as the field management team, responsible for areas that encompassed both the online and paper parts of the census.

Awareness and training

Statistics New Zealand put a significant effort into informing staff about how the online option worked. This included the development of an extensive training programme and an online training facility that staff could use to familiarise themselves with the option before it went live. This training was very important in ensuring staff were informed and confident about promoting the online option. Frequently asked questions and scripted responses were also developed to inform staff and the public about the online option.

Interestingly, the 2006 Census was promoted very little. While an online option was offered to all households when the collector made contact, no materials were left about the online option when no personal contact was made. Households that wanted information were required to obtain it through a call centre. This was done deliberately as Statistics New Zealand did not want to create too large an expectation and demand.

Timeframes

Statistics New Zealand had a short time frame of eight months in 2002/03 to design, develop, test and deploy the online option. The option needed to integrate with Statistic New Zealand's existing systems. Testing began as soon as possible, the first test taking place only a few months after the idea of an online option was raised.

Capacity

The solution developed had to have the capacity to handle a very large amount of data. During the peak hour on census night, Statistics New Zealand received approximately 130,000 online forms, more than 2000 per minute.

The solution also needed to be scalable in case the uptake exceeded the projections. There was almost no room for error as Statistics New Zealand required the online channel to have 99.9 per cent availability over the three day peak period before census night.

Security

In addition to capacity and availability requirements, the system also had to be secure. Statistics New Zealand needed a system with a restricted rating, as per the New Zealand Information Security Manual published by the Government Communications Security Bureau. Under this rating access to material needs to be limited to the appropriate people.

Appendix D – Central government electoral principles

In New Zealand, the Royal Commission on the Electoral System (set up in 1985) established ten criteria for choosing an electoral system. These criteria have guided New Zealand's electoral system for almost 30 years. The criteria are not of equal weight and it is up to the people choosing to decide which balance of the objectives provides the best mix for their system.

The criteria are:

- Fairness between political parties. When they vote at elections, voters are primarily choosing between alternative party governments. In the interests of fairness and equality the number of seats gained by a political party should be proportional to the number of voters who support that party.

- Effective representation of minority and special interest groups. The voting system should ensure that parties, candidates and MPs are responsive to significant groups and interests. To facilitate this, membership of the House should not only be proportional to the level of party support but should also reflect other significant characteristics of the electorate, such as gender, ethnicity, socioeconomic class, locality and age.

- Effective Māori representation. In view of their particular historical, Treaty and socioeconomic status, Māori and the Māori point of view should be fairly and effectively represented in Parliament.

- Political Integration. While the electoral system should ensure that the opinions of diverse groups and interests are represented, it should at the same time encourage all groups to respect other points of view and to take into account the good of the community as a whole.

- Effective representation of constituents. An important function of individual MPs is to act on behalf of constituents who need help in their dealings with the Government or its agencies. The voting system should therefore encourage close links and accountability between individual MPs and their constituents.

- Effective voter participation. If individual citizens are to play a full and active part in the electoral process, the voting system should provide them with mechanisms and procedures which they can readily understand. At the same time, the power to make and unmake governments should be in the hands of people at all election and the votes of all electors should be of equal weight in influencing election results.

- Effective government. The electoral system should allow Governments in New Zealand to meet their responsibilities. Governments should have the ability to act decisively when it is appropriate and there should be reasonable continuity and stability both within and between governments.

- Effective Parliament. As well as providing a Government, members of the House have a number of other important Parliamentary functions. These include providing a forum for the promotion of alternative governments and policies, enacting legislation, authorising the raising of taxes and the expenditure of public money, scrutinising the actions and policies for the executive and supplying a focus for individual and group aspirations and grievances. The voting system should provide a House which is capable of exercising these functions as effectively as possible.

- Effective parties. The voting system should recognise and facilitate the essential role political parties play in modern representative democracies in, for example, formulating and articulating policies and providing representatives for the people.

- Legitimacy. Members of the community should be able to endorse the voting system and its procedures as fair and reasonable and to accept its decisions, even when they themselves prefer other alternatives.