



INTERNET VOTING

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INTERNET VOTING

INTRODUCTION

Many democracies around the world are trying to find ways to re-engage citizens in the democratic process. This effort is in response to a steady decline in voter turnout at the polls over recent years, and diminishing voter confidence in institutions of representative democracy. Some analysts have suggested that new information and communications technologies, in particular the Internet, could be a panacea for ailing democracies.

The Internet could be used in a number of ways to strengthen citizens' participation in the democratic process. For example, it can be employed as another mode of personal communication between citizens and their elected officials; as a means to share information with citizens; as a method to allow consultation with citizens on the development of government policy; as a means to allow citizens to participate actively in policy making; and as a voting tool. This paper examines the technological feasibility of Internet voting (Internet voting, along with machine counting and computerized voting, are referred to collectively as electronic voting, or "e-voting"), and considers whether there is any evidence that it would lead to increased voter participation rates in elections.

TRENDS IN VOTER TURNOUT

In many democracies, public interest and/or confidence in institutions of representative democracy have been declining over the last few decades. The most visible manifestation of citizens' disaffection is the low voter participation rates in national elections, particularly in North America. For example, the turnout of registered voters in Canadian federal elections has declined steadily from 80.6% in 1958 to an all-time low of 61.2% in the last federal election in 2000.⁽¹⁾ As a proportion of the voting age population, only 54.6% of the population

(1) International Institute for Democracy and Electoral Assistance, *Voter Turnout From 1945 to Date*, http://www.idea.int/vt/country_view.cfm. See Appendix 1 of this paper for a graphical representation of voter turnout in Canadian federal elections between 1980 and 2000.

voted in the 2000 federal election. In the United States, turnout of the voting age population⁽²⁾ for presidential elections dropped gradually from 95.8% in 1964 to 51.2% in 2000. Voter turnout for congressional elections in the United States is amongst the lowest in the world; the average turnout since 1945 has been 10-15% below the turnout for parliamentary elections in Western Europe.⁽³⁾ Turnout has also been declining, however, in Western Europe. In the United Kingdom, for example, voter turnout for general elections has fallen from a high of 83.6% in 1950 to 59.4% in 2001,⁽⁴⁾ the lowest turnout since 1918.⁽⁵⁾

There are some exceptions, however, to this downward trend in voter turnout. In Australia, for example, where voting is compulsory, turnout of registered voters for parliamentary elections has hovered close to 95% since 1945.⁽⁶⁾

INTERNET VOTING: TECHNOLOGIES AND TRIALS

E-voting employs such technologies as the Internet, telephone, or text messaging to record votes. Some analysts have suggested that e-voting, by offering a more convenient and flexible way of voting, may increase voter participation rates in elections. Other advocates for e-voting suggest that its use would better reflect current lifestyles, or that its introduction would lead to efficiencies and increased accuracy in voting operations. With the worldwide explosion in Internet access and use in recent years, the idea of using the Internet as a means to vote has received the most attention of the various e-voting technologies.

In Internet voting, encryption technologies ensure that the ballot is secure, and a separation of the voter's choice from his or her identity by the e-voting system ensures that the ballot is secret. Internet voting can be conducted at a polling station (in which case election officials can verify the identity of voters), or from a remote location. The latter is technically more difficult, since appropriate electronic voter authentication tools (e.g., digital signatures, smart cards or biometrics) must be in place, as well as security technology to prevent hacker

(2) In the United States, since a large proportion of eligible voters are not registered, voter turnout is calculated by dividing the number of ballots cast by an estimate of the voting age population.

(3) International Institute for Democracy and Electoral Assistance, *Voter Turnout – A Global Survey*, http://www.idea.int/vt/survey/voter_turnout3.cfm. Note that, while some European countries have compulsory voting, sanctions for not voting are strictly enforced only in Belgium and Luxembourg.

(4) *Ibid.*

(5) Office of the e-Envoy, *In the Service of Democracy: A Consultation Paper for a Policy on Electronic Democracy*, HM Government, London, July 2002, p. 9.

(6) International Institute for Democracy and Electoral Assistance, *Voter Turnout – A Global Survey*.

access to all computer systems involved in the voting process. Remote Internet voting is the more attractive option if the goal of e-voting is to increase voter participation by making voting more accessible and convenient for the citizen. However, even Internet (or other electronic) voting at a polling station may be beneficial if voters can vote at polling stations other than those at which they are registered, or if it replaces archaic voting systems that are prone to error. Some jurisdictions are already moving to e-voting systems. For example, the *Help America Vote Act of 2002*,⁽⁷⁾ which was introduced in response to vote-counting problems during the 2000 presidential elections, requires a number of reforms to the administration of elections in the United States. One of the law's provisions allows for payments to states for election administration improvements, including the replacement of punch card and lever voting machines with other systems that meet minimum standards described in the legislation. In response to the law, many states are replacing their outdated voting machines with electronic touch-screen or optical-scanning technology.⁽⁸⁾

Although certain forms of e-voting (e.g., touch-screen computers in polling stations) have been used in some areas over the last decade, experiments with Internet voting are relatively recent. In the late 1990s, several small trials of Internet voting, generally for local governments or private organizations, were conducted across Europe and the United States. The first large-scale experiment in political Internet voting (both remotely and at polling stations) was for the Arizona Democratic Party's Presidential Primary in the United States in March 2000. The company that ran the elections, *election.com*, proclaimed the event an overwhelming success since voter participation more than tripled in comparison to the number of votes cast during the 1996 Democratic Primary. Approximately 42% of the election's 85,970 voters chose to cast their ballot from a remote location via the Internet.⁽⁹⁾ There were, however, problems with the on-line voting system and associated procedures: the system went down for a short period on the

(7) http://www.fec.gov/hava/law_ext.txt.

(8) These machines generally record and store votes internally, and are referred to as direct recording electronic voting machines. They may send their vote counts electronically to a central site either through a direct dial-up connection or via a network.

(9) See *election.com*, press release, "Arizonans Register Overwhelming Support for Online Voting," March 2000, <http://election.com/us/pressroom/pr2000/0312.htm>.

first day of voting, some voters lost their personal identification numbers, and the telephone help line could not handle the volume of calls from voters experiencing problems.⁽¹⁰⁾

Other noteworthy trials of e-voting since then have included Web-based voting for the 2000 Democratic National Convention candidate in the United States, and e-voting (via telephone, the Internet and mobile text messaging), in addition to other voting methods, in the 2002 and 2003 local government elections in certain areas of the United Kingdom. In the latter pilots, the e-voting process generally worked well with few technical hitches, but it did not have a significant impact on voter turnout. Other pilot electoral schemes tested during the same elections included all-postal voting; in that case, voter turnout was significantly higher than it had been in previous elections.⁽¹¹⁾⁽¹²⁾ The ultimate goal of the e-voting pilot schemes in the United Kingdom is to have an “e-enabled” general election sometime after 2006.

Elsewhere in Europe, three successful trials of a prototype Internet voting system were held in 2002 and 2003 in France (legally binding results for a district council election), Germany (a test election for the Councils of the University of Public Administration in Bremen), and Sweden (a test referendum in Kista). The trials were the last stage of a 31-month-long project known as “CyberVote,” funded by the European Commission and companies and organizations undertaking the work. The goal of CyberVote was to develop and demonstrate the world’s first highly secure cyber-voting prototype using mobile and fixed Internet technologies.⁽¹³⁾

Although a few small-scale experiments with Internet voting have been carried out in Canada (e.g., at the municipal level and in universities), Canada lags behind other countries in terms of researching and testing its feasibility. A large-scale Internet voting experiment was conducted in Canada in January 2003 when the New Democratic Party employed an e-voting system (provided by *election.com*) to elect a new leader. Party members could vote via mail, over the Internet or in person at the convention. Although the voting process went largely as planned, Internet voting was disrupted and the election results were

(10) “A Survey of Government and the Internet,” *The Economist*, 24 June 2000, p. 31.

(11) The Electoral Commission, *Modernising Elections: A Strategic Evaluation of the 2002 Electoral Pilot Schemes*, London, August 2002.

(12) Electoral Reform Society, *Piloting Alternative Voting Methods in the 2003 Local Elections in England*, June 2003,
<http://www.electoral-reform.org.uk/publications/briefings/pilotingalternativevotingmethods.htm>.

(13) See CyberVote’s Web site for further details of the project: <http://www.eucybervote.org>.

delayed on convention day. According to news reports and an official at *election.com*,⁽¹⁴⁾⁽¹⁵⁾ the disruption was caused, in part, by a “denial-of-service” attack: a hacker flooded the network with data, which temporarily prevented access to the servers. The official provided assurances that security measures prevented the hacker from breaching the computer’s defensive perimeter and altering election results, and that the integrity of the election was never compromised.

INTERNET VOTING: CRITICISMS AND POTENTIAL PROBLEMS

A. Security Concerns

Most of the main criticisms of e-voting, and Internet voting in particular, are technical in nature and relate to issues of authentication, security and privacy. Any voting system has to ensure that i) each voter casts only one vote, and that the voter is eligible to vote; ii) measures are in place to protect the security and integrity of the process; iii) the vote is secret, in that no vote can be linked to the voter that cast the ballot, either at the time of the vote or in the future; and iv) the vote count is accurate.

Computer-based systems and networks are subject to attacks from viruses, worms and Trojan Horses, and “denial-of-service” attacks in which a security intrusion prevents users from accessing network resources (e.g., by flooding a system with e-mail messages to slow or halt network traffic). Internet-based voting systems are vulnerable to attack at three main points: the server, the client, and the communications path.⁽¹⁶⁾ Given the importance of the electoral process, an Internet-based voting system is an obvious target for computer hackers. Although various technologies (e.g., firewalls, anti-virus programs and intrusion detection systems) are available to protect computer-based systems, and encryption technologies and digital signatures can be used to protect privacy and to authenticate voter identity, the technologies are not foolproof. Furthermore, setting up Internet voting systems is relatively expensive and would deliver efficiencies only over the longer term.

(14) Personal communication with Earl Hurd of *election.com*.

(15) CBC News, “Computer vandal delays leadership vote,” 25 January 2003, http://www.cbc.ca/stories/2003/01/25/ndp_delay030125.

(16) See Appendix 2 for a schematic representation of a generic Internet voting system.

An analysis of Internet voting sponsored by the National Science Foundation in the United States suggested that current technologies are not adequate to address the security risks associated with remote Internet voting. The report did suggest, though, that poll-site Internet voting could be beneficial and should be explored for use in the near future.⁽¹⁷⁾ Similar concerns about Internet voting have been raised by other recent studies. For example, a study conducted for the Electoral Commission in the United Kingdom concluded that “at present there is no effective defence against such disruption [of the Internet]. Until and unless such defences are introduced, the Internet cannot be relied upon as a substantial transmission route for electronic voting.”⁽¹⁸⁾

Even poll-site computerized voting machines that record and store votes internally (and which may or may not be connected to the Internet) are not immune to serious security breaches. A team of U.S. researchers recently analyzed every line of code purportedly used to control a type of voting machine that has been used in state elections in the United States.⁽¹⁹⁾ The study exposed serious bugs in the code that could allow one person to cast multiple votes electronically. The researchers contended that counterfeit cards could be used in place of the smart cards required to cast votes. The study concluded that there are serious risks associated with e-voting, and that source code used for these systems should be open to evaluation by independent auditors. The researchers further suggested that additional security features, such as a “voter-verifiable audit trail,” whereby a paper ballot is produced and verified by the voter following the casting of each electronic vote, might be necessary to improve the security of e-voting.⁽²⁰⁾ The company that made the machines, Diebold Election Systems, contested the findings of the report, suggesting that such problems could not occur within a real election process because of “the checks and balances within the actual equipment and those found in accepted election procedures.” The company argued, among other things, that the section of the code that the researchers reviewed represented a very small percentage of the entire code needed

(17) Internet Policy Institute, *Report of the National Workshop on Internet Voting: Issues and Research Agenda*, March 2001.

(18) Lawrence Pratchett, *The Implementation of Electronic Voting in the UK*, LGA Publications, London, May 2002, p. 54.

(19) The code was downloaded from a non-public but unsecured part of the Web site of Diebold, the manufacturer of the voting machines.

(20) Tadayoshi Kohno, Adam Stubblefield, Aviel D. Rubin and Dan S. Wallach, “Analysis of an Electronic Voting System,” July 2003, <http://avirubin.com/vote.pdf>.

to conduct an election. It also stated that the software was analyzed using a device (a personal computer) on which it was not designed to work and using an operating system under which the software was not designed to run.⁽²¹⁾

Even if the security of Internet and other e-voting systems equals or exceeds that of traditional voting methods, voters must still be convinced of that fact. Voters will be reluctant to vote if they believe that the systems are not secure, even if, in reality, they are.

B. Social Issues

Other criticisms of Internet voting are social in nature and centre around the so-called “digital divide,” the gap between individuals, households, businesses and geographic areas with regard both to their opportunities to access information and communications technologies and to their use of the Internet for a wide variety of activities.⁽²²⁾ Although Internet penetration rates have increased around the world, most citizens, even in advanced economies, do not have access to the Internet from home. Even in Canada, which has one of the highest Internet penetration rates in the world, only 51% of all households had at least one member who regularly used the Internet from home in 2001.⁽²³⁾ Furthermore, in Canada and other countries surveyed, certain socio-economic or demographic groups (e.g., older people, individuals with relatively low levels of education, women, people living in rural areas, and individuals from lower-income households) use the Internet less than the rest of the population.⁽²⁴⁾ Some commentators suggest that Internet voting might limit the electoral strength of groups that have limited access to the Internet. If voters from these groups have to go to a polling station to cast their vote and, in some cases, are unfamiliar with the technology, voting will be no more convenient or accessible to them than by traditional means.

In the Arizona Democratic Party’s Presidential Primary of 2000, the Voting Integrity Project (VIP), a not-for-profit organization, filed a lawsuit against the Arizona Democrats before the elections. The lawsuit contended that the use of Internet voting would discriminate against low-income and non-white voters, who were less likely than other voters to

(21) See Diebold Election Systems, press release, “Diebold Election Systems exposes flaws found in recent voting system report,” July 2003, <http://www.diebold.com/followupstatement.pdf>.

(22) OECD, *Understanding the Digital Divide*, OECD, 2001, p. 5.

(23) Statistics Canada, *Household Internet Survey 2002*, September 2003. In 2002, a total of 62% of all households had at least one member who regularly used the Internet from home, work, school, public library or another location.

(24) Statistics Canada, *Overview: Access to and Use of Information Communication Technology*, March 2001.

have access to the Internet, and that this would weaken the influence on the final election outcome of individuals belonging to one or both of those groups. Although the party was allowed to proceed with the on-line voting, one analyst has suggested that the VIP's concerns were at least partially founded; data collected following the election suggest that more Internet votes were cast from remote locations than from polling stations, and that significantly more remote location Internet votes were cast by affluent voters than by lower-income voters.⁽²⁵⁾

Recent surveys of the extent and nature of the digital divide suggest that, at least in advanced economies, the divide between some demographic groups is narrowing, albeit gradually.⁽²⁶⁾ In many democracies, therefore, the digital divide will probably cease to be a major obstacle to Internet voting in the near future. North America and Europe, with their relatively high Internet penetration rates, will likely be the first regions of the world where this barrier to Internet voting falls.

INTERNET VOTING AND VOTER PARTICIPATION RATES

Since Internet voting is in its infancy, it is difficult to say with certainty whether such an addition to the suite of voting methods already available in various jurisdictions would increase voter turnout at the polls. A few studies have suggested, however, that if issues of authentication, security and privacy can be resolved, Internet voting *might* boost voting rates. A 1998 study for Elections Canada indicated that three technologies – the telephone, the electronic kiosk and the Internet – could improve the accessibility and efficiency of the electoral process in Canada, but that none of the voting technologies had “been adequately tested in a way that would satisfy the requirements of electoral democracy in Canada.” The report suggested, among other things, that Parliament could make the necessary legislative changes to allow Elections Canada to test some of the promising technologies in controlled, pilot situations.⁽²⁷⁾ When the new *Canada Elections Act* received Royal Assent in 2000, it gave the Chief Electoral Officer the

(25) Rachel Gibson, “Elections Online: Assessing Internet Voting in Light of the Arizona Democratic Primary,” *Political Science Quarterly*, Vol. 116, No. 4, Winter 2001-2002.

(26) See, for example, U.S. Department of Commerce, *A Nation Online: How Americans Are Expanding Their Use of the Internet*, February 2002.

(27) KPMG/Sussex Circle, *Technology and the Voting Process*, Report prepared for Elections Canada, June 1998.

authority to carry out studies on alternative voting means, and to devise and test an e-voting process for future use in a general election or a by-election.⁽²⁸⁾ A recent study on on-line voter registration commissioned by Elections Canada concluded that Internet registration is technologically feasible and “the technology to ensure that Internet-based transactions are secure and efficient is available.” The study’s authors did note that some legislative issues – particularly with regard to the authentication of on-line registrants – remain to be resolved before on-line voter registration can be fully implemented.⁽²⁹⁾ The study did not address the issue of Internet voting.

A 2002 survey of Canadian voters and non-voters examined potential reasons for the decline in voter turnout in Canadian federal elections. Reasons cited by non-voters for not going to the polls included lack of interest in the election, negative attitudes toward politics, and personal/administrative factors. The survey’s authors concluded that voter turnout is likely to continue to decline in Canada, in part because the voting rates of generations entering the electorate in the last two decades, and particularly since 1993, are substantially lower than those of previous generations. They suggested, however, that an improvement in the voting rate might be produced through education and administrative changes such as the use of the Internet for adding to and updating the National Register of Electors, and/or for voting itself.⁽³⁰⁾

Another Canadian study demonstrated that “ease of voting” has an impact on voter turnout. The study revealed that in countries where, all other things being equal, it is possible to vote by mail, in advance or by proxy, turnout is about 10% higher than in countries where none of these options is available.⁽³¹⁾ Although the study’s authors did not address the issue of Internet voting, it is possible that it, too, could lead to higher voting rates since it increases the ease of voting.

In terms of increasing voter participation rates, results from the few Internet voting trials that have actually been conducted are mixed. In the Arizona Democratic Party’s

(28) Elections Canada, *Modernizing the Electoral Process – Recommendations from the Chief Electoral Officer of Canada*, November 2001.

(29) Elections Canada, *On-line Voter Registration Feasibility Study – Executive Summary*, March 2003.

(30) Jon H. Pammett and Lawrence LeDuc, *Explaining the Turnout Decline in Canadian Federal Elections: A New Survey of Non-voters*, Elections Canada, March 2003.

(31) André Blais, Agnieszka Dobrzynska, and Louis Massicotte, *Why is Turnout Higher in Some Countries than in Others?*, Elections Canada, March 2003.

Presidential Primary in 2000, where voting via the Internet was available, voter participation more than tripled in comparison to the number of votes cast during the 1996 Primary. However, in local government elections held in the United Kingdom in 2002 and 2003, where citizens in some local authorities could vote via the Internet and other electronic routes – telephone, digital television and text message voting – voter turnout was not significantly different from that of previous elections. In fact, turnout in 2003 fell in most pilot areas despite no change, on average, in the levels of participation in those councils that were not running any pilots. An analysis of the 2003 local elections in the United Kingdom concluded that “[i]t remains the case that e-voting increases convenience but does not increase the number of people who feel it is worthwhile voting. For this reason, it is our conclusion that electronic remote voting fails the Government’s test of increasing turnout.”⁽³²⁾

Many analysts suggest that since the main causes of low voter turnout are social in nature and have little to do with how easy it is to vote, it is unlikely that voting rates will change dramatically as a result of the introduction of new voting technologies.

CONCLUSION

The Internet has the potential to make the act of voting more convenient. Some analysts suggest that by making it easier to vote, the Internet could increase voter participation rates in elections, which have been slumping in recent years in many democracies around the world. Other arguments in support of Internet voting, and other forms of e-voting, focus on efficiencies and increased accuracy in vote counting. Some commentators argue, however, that because of deficiencies in computer security technologies and the presence of the digital divide, the Internet is not an appropriate method for casting votes at this time.

The digital divide, at least in advanced economies, is narrowing. Canada, with one of the highest Internet penetration rates in the world, is a good candidate country for testing Internet voting technologies. Improved Internet security measures are being introduced, but these measures are not tamper-proof. Several major studies have exposed security flaws in various e-voting technologies, and have suggested that the Internet is too vulnerable to security breaches at the present time to allow remote Internet voting. An acceptable interim alternative

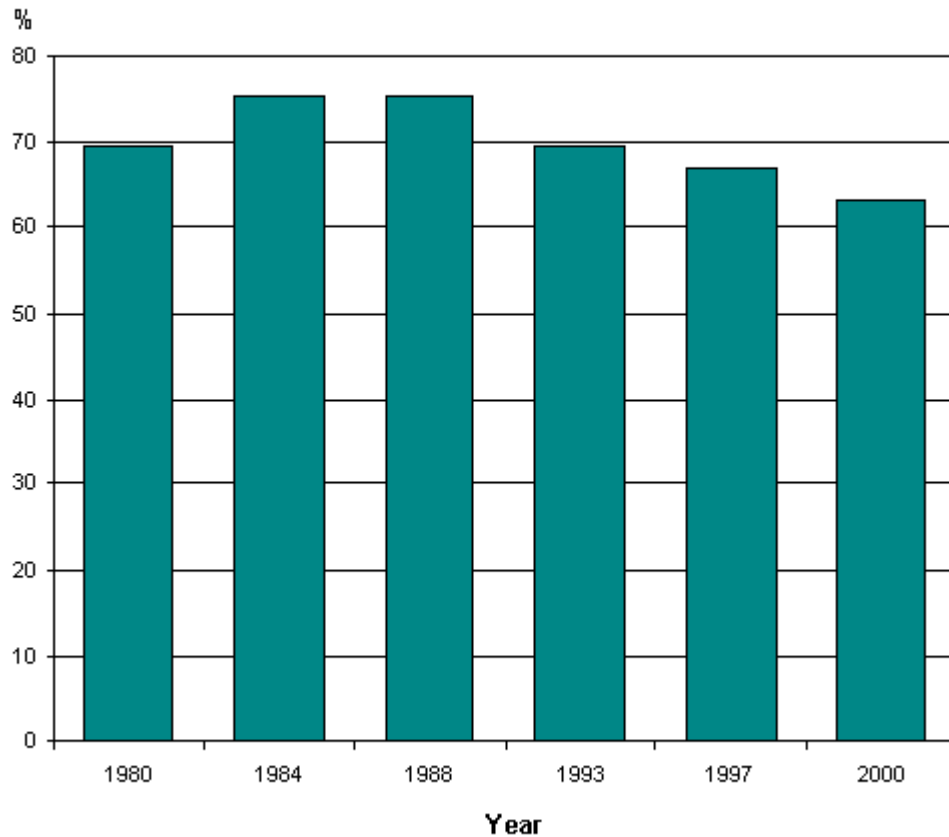
(32) Electoral Reform Society (2003).

may be to install poll-site Internet-based voting machines that generate a paper ballot that is verified by each voter and retained for recounts or audits in the future (a “voter-verifiable audit trail”). The adoption of such a system would increase the complexity and expense of e-voting. On a more permanent basis, an electronic audit trail could be created, but developing such a system will take some time. The current security and access problems associated with Internet voting do not prevent jurisdictions from researching and experimenting with the technology. Jurisdictions that have experimented with various forms of Internet voting will be able to make full use of the Internet in the voting process (at polling stations and/or remotely) as soon as security and access barriers fall.

In terms of increasing voter turnout rates, trials of Internet voting have produced mixed results. In one of the largest trials, in the United Kingdom, Internet voting (and other modes of remote e-voting) did not affect voter participation rates in local elections. This result may reflect the fact that the main reasons why citizens do not vote are social in nature, and have little to do with “ease of voting.” Although Internet voting and voting via other electronic methods are likely to increase as the technology becomes even more widely available and security problems are resolved, it is questionable whether the availability of e-voting will lead to increased voter participation rates. It is improbable that a high proportion of those citizens who have little or no interest or confidence in representative institutions will start, or return to, voting because of the availability of Internet voting. Other more fundamental changes to these institutions are likely necessary to reinvigorate citizens’ confidence and involvement in the democratic process.

APPENDIX 1

Percentage of Registered Voters Who Voted in Canadian Federal Elections, 1980-2000⁽¹⁾



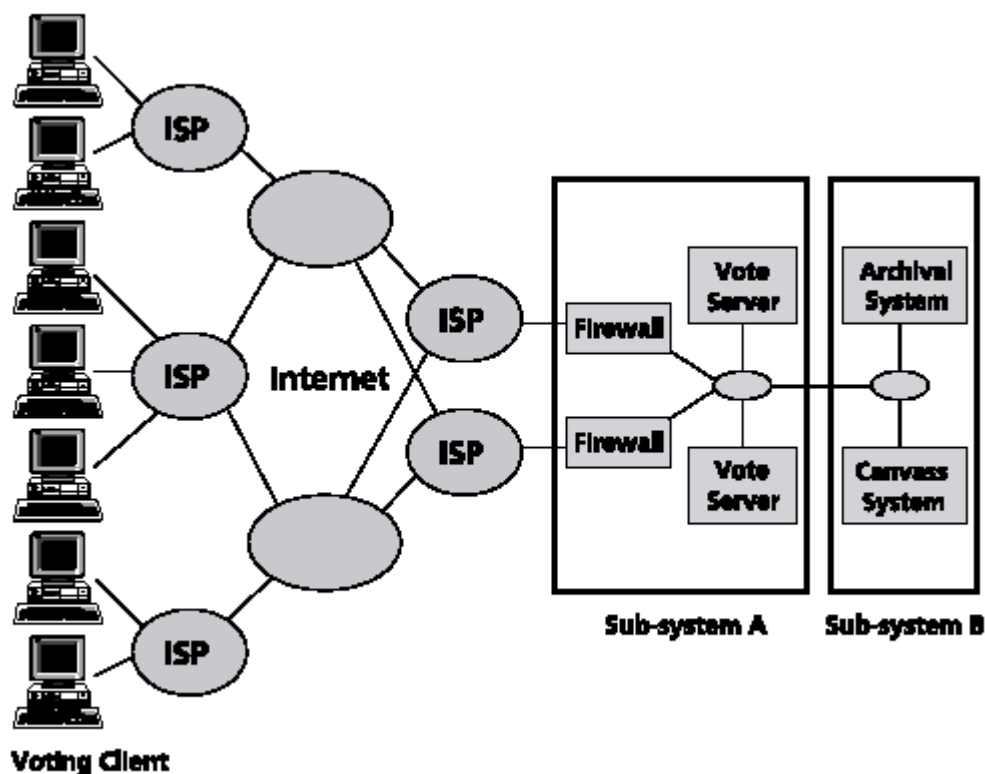
Source: Elections Canada.

(1) Statistics Canada, *Societal Indicators: More Information on Voting*, January 2001, <http://www.statcan.ca/english/freepub/89F0123XIE/00002/32.htm>.

APPENDIX 2

Schematic Representation of a Generic Internet Voting System

The voters (either at a polling station or at a remote location) are connected to one or more Internet service providers (ISPs) and to the ISPs on the server side of the system through the Internet. The server side is divided into two parts: sub-system A, which collects encrypted votes; and sub-system B, which decrypts ballots, tallies and archives votes, and produces reports.⁽¹⁾



(1) Internet Policy Institute, *Report of the National Workshop on Internet Voting: Issues and Research Agenda*, March 2001.