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This draft report was prepared by NIST staff at the request of the Technical Guidelines Development Committee (TGDC) to serve as a point of discussion at the Dec. 4-5 meeting of the TGDC. Prepared in conjunction with members of a TGDC subcommittee, the report is a discussion draft and does not represent a consensus view or recommendation from either NIST or the TGDC. It reflects the conclusions of NIST research staff for purposes of discussion. The TGDC is an advisory group to the Election Assistance Commission, which produces voluntary voting system guidelines and was established by the Help America Vote Act. NIST serves as a technical advisor to the TGDC.

The NIST research and the draft report's conclusions are based on interviews and discussions with election officials, voting system vendors, computer scientists, and other experts in the field, as well as a literature search and the technical expertise of its authors. It is intended to help in developing guidelines for the next generation of electronic voting machine to ensure that these systems are as reliable, accurate, and secure as possible. Issues of certification or decertification of voting systems currently in place are outside the scope of this document and of the TGDC's deliberations.

“End to End” Accessibility

A discussion paper for the TGDC Whitney Quesenbery, HFP Subcommittee

This paper examines the accessibility issues raised by the concepts of software independence in voting systems (as presented by the Security and Transparency (STS) subcommittee).

To date, the focus of the requirements drafted by the Human Factors and Privacy (HFP) subcommittee has been on individual pieces of equipment in a voting system. In the accessibility requirements (Chapter 3.2 in the VVSG 2005), the goal has been to provide intrinsic accessibility for a self-contained system, not requiring the voter to provide personal assistive technology.

Many of the systems described as software independent (or allowing for “independent verification”) include more than one piece of equipment in the voting system. For example, a Ballot Marking Device (BMD) is used with an optical scanner that reads and counts the ballots (whether marked by the BMD or by hand).

To ensure that we meet the goals of HAVA to provide “the same opportunity for access and participation (including privacy and independence) as for other voters,” the goal must be an accessible *voting system*, not just a collection of accessible pieces of *voting equipment*.

This paper proposes that any *voting system* presented for certification as an Accessible Voting System (AccVS) must show that the entire system is *accessible* (the highest standard), or show how *reasonable accommodation* can fill gaps in full accessibility.

Accessibility and Accommodation

These two concepts come from the Access Board, where the goal is to ensure participation by people with disabilities first through accessibility, and secondarily through accommodation, when there are no readily available solutions to meet the primary goal. Three paired statements¹ illustrate the difference:

- Accessibility is technology-centered
Accommodations are person-centered
- Accessibility occurs before the fact
Accommodations happen after the fact
- Accessibility focuses on mainstream technologies
Accommodations primarily focus on assistive technologies/services

Consider this architectural example:

- A polling place is accessible if a person in a wheelchair can enter, complete voting, and leave with a clear path of travel, and appropriate equipment (for example, a table at a proper height).

In this case, the technology (the polling place) is accessible, this made possible before any person with disabilities arrives to vote, and those voters use the same (mainstream) polling place as other voters.

- A polling place might provide curb-side voting as an accommodation when the physical building is not fully accessible

In this case, the focus is on specific voters with mobility disabilities, the accommodation is made at the time the voter arrives, and special processes are created to assist the voter.

In both of these cases, voters are able to mark and cast their ballot independently and privately. But in one, their mobility disability is accommodated with a different process for signing in and receiving their ballot than that used by other voters.

Although accessibility is the goal, accommodation provides us with a means to ensure that voters with disabilities can vote privately and mark their ballot independently, even when full accessibility is not possible.

Accommodation should not be made lightly, and must be *reasonable*. In a voting system:

- It must not put undue burden on the voter.
- It must be based on a substantiated gap in readily available assistive technology suitable for use in elections.
- It must not require the voter to supply personal assistive technology or a trusted personal assistant for the accommodation (though it may use them).
- Accommodation that violates ballot privacy or which compromises voters' ability to mark their ballots independently is not acceptable. For example:
 - a) Using an audio system to read a marked ballot to the voter is acceptable.
 - b) Requiring a person to read a marked ballot to the voter is not.

¹ Source: Access Board

We should also be particularly interested in accommodations that are likely to be replaced with full accessibility in the near future as technology improves. For example, there are some products already on the market that can read plain text; their accuracy, general availability and cost will only improve over time.

End-to-End Accessibility

A system that has “end-to-end” accessibility is one that not only meets all of the detailed requirements for each component in the system, but can also show that it is accessible throughout the entire voting process, from obtaining or initiating a ballot to casting a vote.

There are few (if any) current systems that can meet this high standard. Even DRE (electronic) voting systems, for example, often require initiation, using procedures such as inserting a card that may be impossible for people with some disabilities. To solve this problem, a system that cannot show full “end-to-end” accessibility, should be allowed to demonstrate that with reasonable accommodation to fill gaps in accessibility, the overall system can meet the requirements for voting systems.

Accommodation for a voting system requires that all voters be able to perform equivalent steps in the voting process. It is not acceptable that some voters (especially based on type of disability) skip normal parts of the voting procedure.

For example, if a system includes a voter verification step as part of its security features, that step must be made available, in an equivalent way, to all voters. It is not acceptable to simply say that the system leaves a gap, forcing some voters to skip a step deemed critical for others.

Example of End-to-End Accessibility Analysis

As an example of an analysis of “end-to-end” accessibility, let’s consider a voting system that uses a ballot marker and an optical scanner/counter, and includes a scanner/reader for voter verification.

This example is intended only to illustrate the analysis process. It is not based on a specific product but on a general class of systems that has been discussed in other TGDC white papers.

Step in voting process	Accessibility	Accommodations
1. Receive ballot and insert into ballot marker	For visual disabilities: Tactile notches are used to orient the ballot for insertion into device	For dexterity disabilities: a poll worker* can insert the blank ballot into the device
2. Mark the ballot using the ballot marker	Fully accessible, with audio and tactile controls.	
3. Read ballot to review ballot marking	For visual disabilities: a scanner/reader device with audio output reads the ballot	
4. Transport ballot to	For visual disabilities:	For dexterity disabilities: a poll worker

scanner/counter and cast ballot	Tactile notches are used to orient the ballot for insertion into device	can assist with transport and insertion into scanner/counter, using the privacy sleeve to maintain ballot secrecy
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* Poll worker or personal assistant

The fictional system in this example is not completely accessible, although the ballot marker, scanner/reader and scanner/counter are all individually accessible. However, it includes a separate accessible solution for people with visual disabilities in step 3 and dexterity disabilities in steps 1 and 4. Most importantly, the critical step 2, in which the ballot is marked, is full accessible, preserving ballot secrecy.

Equivalent Facilitation

In the STS discussions of software independence (SI) and “independent verification” (IV) concepts, one of the goals is to ensure that the VVSG does not cut off innovative development of new systems that may better meet the complex challenges of a voting system. There is a similar concept in accessibility regulation, called “equivalent facilitation”. In Section 508:

§ 1194.5 Equivalent facilitation.

Nothing in this part is intended to prevent the use of designs or technologies as alternatives to those prescribed in this part provided they result in substantially equivalent or greater access to and use of a product for people with disabilities.

This concept is applied not only to electronic and information technology, but to architectural guidelines. From the Access Board's ADA Architectural Guidelines (ADAAG) checklist: “Departures from the ADAAG technical and scoping provisions are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the facility.²”

As the ITTATC (Industry Technology Technical Assistance and Training Center) accessibility training course puts it, “The Section 508 regulations are intended to foster innovation in accessibility, not prohibit it by specifying exactly how your software must operate. You are free to innovate as long as you make sure that the software is accessible.³”

This concept is similar to the “innovation class” proposed by the STS white paper on software independence. The TGDC, NIST and the EAC might benefit from discussions with the Access Board and innovative accessible technology companies on how equivalent facilitation is managed in the scope of the Section 508 regulations.

² <http://www.access-board.gov/adaag/checklist/a16.html>

³ http://www.ittatc.org/training/webcourse/software/funcperf_equivfacil.php

Next steps

This paper proposes that any voting system presented for certification must show that the entire system is accessible (the highest standard), or show how reasonable accommodation can fill gaps in full accessibility.

To meet this goal the TGDC will have to create requirements in the VVSG that require an end-to-end accessibility analysis, and how end-to-end accessibility will be tested.