The TrustTheVote™ Project
Ballot Design Studio—Garnet

Status of this RFC

This Request-for-Comment (RFC.204) provides capabilities design requirements for the TrustTheVote Project community. This RFC does not specify, but intends to be the basis for proposing an election technology standard with regard to an open source Ballot Design Studio. Distribution of this memo is intended to be unlimited but is initially being provided to the TrustTheVote Project Stakeholder community and other OSET Institute Advisers from who early comment on this preliminary draft is sought.

Table of Contents

Section I – Introduction
1. Purpose of this Request for Comment
2. Scope of this Request for Comment
3. ADA Compliance
4. Related Documents
5. Basic Concepts
6. Terminology
7. Sample Artifacts

Section 2 – Concept of Operation
1. Basic Data Set
2. Initial Steps
3. Preparatory Steps
4. Template Selection
5. Style Sheet Customization
6. Ballot Content
7. Localization and Language Support
8. Ballot Generation
9. Printed and Ballot Metadata
10. Digital Ballot Support
11. Final Steps

Section 3 – Profiles

Section 4 – Product Requirements Document Elements
1. Bill of Materials
2. User Categories and Profiles
3. Supported Operational Models and “Business” Models
4. Summary of Feature Sets and Software Modules
5. Committed For Garnet

Section 5 – Summary

Section 6 – Appendices

A. Sample Ballot Specification .....
B. Sample Ballot Generated by Prototype .....
C. Partial View of Ballot Configuration Proofing Tool .....

Section I
Introduction

1.1 Purpose of This Request for Comment

The purpose of this Request for Comment (RFC.204) is to solicit advice, comments, and proposed revisions that will inform the TrustTheVote Project (TTV) Core Team (hereafter "Core Team") final design and specification decisions for the Ballot Design Studio ("BDS") architecture and reference implementation. BDS is an open source technology to implement a digital ballot design service with more capabilities and increased usability than available from proprietary vendor solutions.

The TTV open source Election Technology Framework ("ETF") is composed of several distinct components that have been designed to both: [1] interoperate via standards-based common data formats; and [2] collectively provide all the core capabilities for U.S. election administration and the conduct of elections. The BDS is a key component of the ETF, providing the capabilities that local election officials (LEOs) need to design ballots based on a prior election definition. Like all ETF components, the BDS's standards-based interoperability enables it to be adopted for use without the requirement that other ETF components be used as well.

The purpose of this RFC is to provide a understanding of the planned BDS Version 1.0 ("Garnet") design requirements. The system as designed is intended to support open and common data formats. The BDS will fully interoperate with the TTV Election Management System (EMS) subsystem of the open source Election Technology Framework ("ETF") and be able to integrate with current legacy commercial election management systems.

The objective is to produce an open source design specification and reference implementation for a BDS suitable for adoption by any State of the Union pursuant to the final version of this RFC. The goal is to produce an open source result that has the approval and endorsement of the TTV Stakeholder Community.

Note that "approval and endorsement" is for the design and specification of the BDS and not necessarily a recommendation for adoption of the implementation in any jurisdiction.

1.2 Scope of This Request for Comment

Pursuant to RFC.001, the scope of RFC.204 covers business functional requirements for the BDS only. Any references to government codes and regulations should be verified. RFC.204 has been originated roughly on requirements as communicated by several advisers to the TrustTheVote Project who, themselves, are elections officials, although it is intended that the Stakeholder Community will guide a final specification in concert with rapid prototyping that represents a hybrid system framework capable of implementation in any jurisdiction albeit with localization requirements.

Generally, an RFC drives two types of design specifications: the External Design Specification (EDS) and optionally an Internal Design Specification (IDS). The EDS is intended to define two of the three "faces" of an interactive system[1]: the "outer-face" or user experience, and the "interface" or the components and services that provide the interoperability between back-end services and data sets and the actions of users. Some systems are sufficiently complex or represent information technology innovations that require specifications of the back-end layer or "inner-face." The IDS document is used for this purpose.

Importantly, in the TrustTheVote Project, an RFC is not a design specification, regardless of type (EDS, IDS), nor can it be a replacement for the same.

This specification document provides: the basics of the BDS "Concept of Operations;" high level architecture; functional requirements for the BDS initial release; and some aspects of a product concept definition in an MRD in typical software product development methodology

Also included is background information on those elements of BDS that have been developed as early proof-of-concept (POC). Also included is definitional information on "Garnet", which will be the publicly available BDS v1.0 system. In addition to source code distribution and documentation, Garnet will also be available for interactive exploration, via a BDS system deployed for the fictional state of "Farallon" as a method of demonstrating BDS concepts and capabilities.

Section 1.5 provides an overview of the basic concepts. Section 2 provides the concept of operation for BDS usage based on these basic concepts. Section 3 describes the BDS feature set for Profiles that enable streamlining of this process based on per-State requirements[2].

1.3 ADA Compliance

To meet and carry out compliance with the nondiscrimination requirements of Title II of the Americans with Disabilities Act (ADA), it is the policy of the OSET Foundation and TrustTheVote Project to make every effort to ensure that its designs, specifications, and reference implementations are guided by the needs of persons with disabilities.

1.4 Related Documents

- The **TTV ETF System Blueprint** document, which lays out all the components, workflows, dataflow, data formats, and interoperability features of the ETF.
- The **IEEE 1622.2** standard for Election Definitions and Election Results Reporting, which is used by the BDS for election definition data interoperability.
- The Voting Information Project's **VIP v5** data format, also used for election definition data interoperability.
- AIGA standard for ballot layout and usability

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1 See generally, Dr. Aaron Marcus http://www.amanda.com/people/staff/staff_f.html

2 NOTE: Importantly, this RFC does not attempt to present any user interface attribute requirements, user experience elements, or any discussion of the presentation layer beyond is capabilities (functionally). User interaction design is addressed separately.

1.5 Basic Concepts

The BDS consumes an externally created election definition dataset, and offers a user interface (UI) for LEOs to specify various elements of ballot layout, as needed to create concrete presentations of each ballot style in a given election. The election definition dataset can be created by any standards-based election management system (EMS), including but not limited to the TTV Election Manager, another component in the TTV ETF.

At the end of an election preparation cycle, a user of the BDS will have created not only PDF files for creating pre-printed blank paper ballots, but also similar artifacts for digitally presented ballots (*e.g. in a ballot marking device*), and other data artifacts described below.

Section 2 of this specification provides the concept of operation for BDS usage based on these basic concepts. **Section 3** describes the BDS feature set for Profiles that enable streamlining of this process based on per-state requirements.

1.6 Terminology

The details of this specification depend on some terms defined below.

- **Locality**: a geo-political unit—most often a county, parish, or township—that conducts elections for electoral districts that fall entirely or partly within its geographic boundaries.
- **Jurisdiction,** or **Electoral Jurisdiction,** or **Electoral Authority**: a government body charged with administering elections within a Locality.
- **District,** or **Electoral District**: a geo-political unit that participates in an election by holding one or more contests for elected office and/or one or more ballot questions that serve as a referendum.
- **Precinct,** or **Ward,** or **Vote Tallying District (VTD**): a geo-political unit to which some voters are assigned in a Jurisdiction, because these voters are entitled to vote on ballot items from the same set of electoral districts. Usually the lowest level of vote tally information as part of election results. Sometimes subdivided into precinct splits for cases where an infrequently active district subdivides the precinct.
- **Jurisdiction Definition**: a body of information that describes all the precincts in a Locality, all the districts in it, and the precincts that comprise each.
- **Election Definition**: a jurisdiction definition (often limited to the subset of districts involved in a given election), coupled with a list of all the ballot items that will be voted on in a given election by the voters of that jurisdiction.
- **Ballot choice items**: contests and questions that appear on a ballot in an election
- **Ballot items**: ballot choice items, together with other visual or textual artifacts for a ballot, that must be part of ballot contents, design, and layout, such as: header items, footer items, general instructions, instructions for specific ballot choice items (e.g., “Vote for One”), headers or separators for groups of contests (e.g., “Federal”).

- **Ballot configuration**: a list of ballot items that will be on a specific ballot for a specific precinct; that is, the subset of an election definition that applies to a single precinct in that election. Note that one precinct may have multiple ballots, each with a different configuration, in primary elections.
- **Ballot style**: an ambiguous term used in several different contexts in U.S. election practice. We try to avoid this word with usage of other terms, for example: one ballot configuration, coupled with one among several formatting options (including but not limited to choice of language(s)) can result in multiple concrete ballots (*paper or digital*) that present the same ballot items in a different way.
- **Ballot choice method,** or **alternative voting method**: for a particular contest or referendum, a combination of instructions to a voter for what choices they may indicate, together with an algorithm for counting choices as votes, for example: vote for one, the top vote getter wins; first-past-the-post with possible run-off; "instant runoff", ranked choice, referendum majority, referendum plurality, and many more.

1.7 Sample Artifacts

Appendices provide some concrete examples of some of the key concepts described in this specification.

Appendix A provides examples of the base data set described in **Section 2.1** below. One example is of a detailed ballot specification for a precinct in a local election in the town of Moultonborough, expressed in a YML data format[3] used in POC. The new IEEE 1622.2 standard data format to be used in Garnet is illustrated in **Appendix A** by an XML fragment of much larger dataset.

Appendix B provides example sections of generated ballots:

- The Moultonborough ballot corresponding to the example in **Appendix A**;
- One of a set of more than 2700 ballots generated by the POC BDS for a Virginia statewide election, used for online ballot distribution to UOCAVA voters;
- A fragment of a sample ballot using the AIGA standard, which will be the basis for most of Garnet's ballot templates.

Appendix C provides a fragment of the POC BDS's ballot proofing tool interface described below in **Section 2.2**.

[3] For a definition of YML, see Footnote 5 infra.

Section II
Concept of Operation

The BDS is TTV ETF component that LEOs use to create authentic ballots in two forms: [1] digital files used for printing paper ballots and [2] digital files that define ballot layout for a ballot presented by a digital device (*e.g., a ballot marking device*). To create these artifacts, LEOs[4] start with a base data set, and make choices among style sheets and options, for the BDS to create ballots for the LEO to review.

The remainder of this Section provides an overview of the starting point and steps in the basic workflow. Note that basic workflow is augmented (*see below*) with the use of profiles and "configurators" that reduce both the number of options and the level of effort required of a BDS user.

2.1 Base Dataset

The base data set can take either of two forms depending on the capabilities of the EMS that produces the data. One form is an election definition; it doesn't specify individual ballots, but the complete set of ballot configurations can be computed from the precinct/district relations and the district/contest and district/question relations. The other form is a complete list of already completed ballot specifications. Both the TTV Election Management System ("EMS") and the TTV BDS share the ability to create ballot specifications from election definitions. In the Proof-of-Concept ("POC") BDS, the base data set was a Pew Voter Information Project ("VIP") feed, and the ballot specifications were computed from the VIP data. For Garnet, VIP will still be supported, as will the new standard IEEE 1622.2. Also, bindings of these formats in either XML or YML[5] are supported; one road map item not committed for Garnet is a CSV file format version of either of these formats.

Development of Garnet will proceed in parallel with continuations of existing IEEE 1622 standards work, such as extending the 1622.2 standard to specify ballot choice methods, partisan/non-partisan contents, and write-in/no-write-in contests.

2.2 Initial Steps

The first step is for one user in a workgroup to create a new election "workspace" for design of ballots for that election. This creates a workspace for stored shared data among the workgroup of people responsible for ballot design. The initial contents of the workspace are the base data

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4 Actually the LEO designates this effort to a ballot layout specialist. Typically, a graphic designer who specializes in ballot layout and production is retained by a jurisdiction to perform ballot design services. The American Institute of Graphic Artists ("AIGA") actually maintains a directory of ballot design specialists through the nation.

5 For those unfamiliar, YML is the file extension label and shorthand used herein for YAML is a human-readable data serialization format that takes concepts from programming languages such as C, Perl, and Python, and ideas from XML and the data format of electronic mail. YAML is often meant as an acronym for "*YAML 'aint another markup language*" to distinguish its purpose as data-oriented, rather than document markup oriented.

set uploaded by the creator of the workspace. If the base data set does *not* include a complete set of ballot specifications, then the BDS instantiates such a set, and enables the user to utilize a BDS module for "*ballot specification proofing;*" that is, examining each individual ballot specification to find potential mistakes, misspellings, etc.

In the POC BDS, ballot proofing was limited to viewing an exported CSV file. (*See Appendix C for an example*). In the Garnet BDS, ballot proofing will be presented via the BDS web interface as well.

2.3 Preparatory Steps

Among the first tasks for a BDS user is performing a number of possible transformations on the ballot specifications, to comply with relevant state laws. Among these are:

- Candidate rotation for those contests, if any, for which rotation is required. The result is a modified set of ballot specifications in which each particular precinct's ballot configuration(s) have a specific ordering of candidates.
- Other candidate ordering methods, based on partly affiliation.
- Inclusion or suppression of candidate party affiliations depending on whether a contest is to be presented as non-partisan.

Each of these transformations is from a complete ballot specification to another complete ballot specification set. As a result, BDS is extensible to accommodate each transformation as a separate software module, where additional modules can be added over time, in order to meet individual states' specific requirements.

Appendix A provides a YML representation of one specific ballot specification read for later steps.

2.4 Template Selection

After the ballot specifications have been completed, the BDS user chooses a paper ballot layout template, or makes a new one that is a modifiable copy of an existing one. In the POC, templates were purely internal constructs. For Garnet templates will be a first-class objects with the set viewable within the Studio user interface[6]. The extent of allowable customization of a copy is to be determined, as are capabilities to support creation of new templates that are not derived from previous ones.

There are several types of existing ballot layout practices to be supported by built-in templates:

- office block layout
- office block layout with straight-party option
- party-column layout
- party-row layout

And there will be support for variants of these to accommodate the following factors:

[6] See Footnote 2

- multiple-language formats
- mixed primary/special election formats
- different types of mark zones (bubble, square, arrow, etc.)
- different types of timing mark layout used by various types of optical scanner.

Office block layouts were supported in the POC. Appendix B shows the result of applying one such template to the ballot specified in Appendix A.

The full set of built-in templates for Garnet will include all ballot layouts for which the American Institute of Graphic Artists ("AIGA") ballot usability standards provided a model. All of the style options conform the AIGA standards for usable ballot design. Specific options will be for commonly used layout factors, such as page size, single-language or dual language, home print sample ballots, home print UOCAVA absentee ballots, and variations in placement of scanner artifacts such as timing marks and OCR labels.

Other templates, if any, are to be determined by Stakeholder input regarding desirable ballot layouts that are not accommodated by the AIGA standards, but are required to meet the ballot design needs of the wide variety of U.S. State election laws, and of jurisdictional norms and preferences.

Another aspect of a template is how, within that template, each of various ballot choice methods are handled. In BDS POC, only vote-for-one and vote-for-N-of-M were supported. In Garnet, additional methods will be supported, including both typical and Minnesota variants of referendum choice methods, both versions of straight-party emphasis voting, and some of the many variants of ranked choice voting, including the variant in which only a fixed number of candidates (*e.g. top 3) are ranked (one of several methods that are sometimes called by the same name, "instant runoff"*).

2.5 Style Sheet Customization

Each template includes basics like page size and large scale layout geometry, as well as a variety of style sheet items for characteristics like text color, size, font, and spacing between blocks in the layout geometry, spacing and indentation within blocks, etc.

After selecting a template, the user can customize the use of the template by viewing the modifiable style sheet elements, selecting from available modifications, and observing the effect on any or all of the specific ballots. In the POC, stylesheets were internal data modified manually. In Garnet, stylesheets will be viewable and modifiable via the Studio user interface.

Note: For those jurisdictions that have their needs met by AIGA-based templates, style sheet modifications may be the bulk of the visual layout activity in the BDS.

2.6 Ballot Content

Complete legally compliant ballots contain content that is not necessarily part of an election definition, and BDS users may have to specify additional content.

One type of additional content is specific to an election (*e.g. the official name of the election for headers and/or footers, identification of each ballot by precinct name, and other header or footer items that may be required by state election law*.) Generic across elections, but specific to a jurisdiction are content items such as instructional text and/or images, directions for individual contests (e.g. "*Vote for one*" vs. "*Vote for no more than one*"). Most of these additional content items need to be specified only once, and applied to all ballots in an election. Some may also be specified as part of a template for one election, and reused for later elections in the same jurisdiction.

Also included in this category of content are ballot layout items that are not ballot items per-se. For example, this would include separators or sub-headings that group together contest by type: Federal, State, etc. While the contest ordering defined in the election definition provides the layout order of ballot items, the precise text, style, and ordering of these additional ballot layout items often is not; the ballot designer needs to specify if and how these are to be added to comply with state law.

In the POC BDS, each of these items was customized at the level of template or style sheet. In Garnet, these additional content types will be accessible via the UI as a separate from the layout and styling functions of template and style sheet.

2.7 Localization and Language Support

After the variety of ballots' content has been defined, it may be required by some jurisdictions to provide ballots in alternative languages. The BDS Localization module enables users to view all and only the ballot presentation elements that may require translation (*e.g. instruction text but not candidate names*.) The user can specify one or more languages to be supported; for each, the user can provide a set of translations for each presentation element.

In BDS POC, ballot configurations were defined in English, and single-language ballots in other languages were created using automated translation tools. In the BDS Garnet release, true localization will be supported, with BDS users providing translations that have passed appropriate internal review procedures.

Also, the Garnet template feature set will support templates for both multiple single language versions of a ballot, and single multi-language ballots (e.g. *EN/ES/ZH*.) Later extensions will support new templates for various different methods of multi-language support.

2.8 Ballot Generation

The actual PDF files for paper ballots can be generated and reviewed at any point in the process of selecting among templates, stylesheets, stylesheet modifications, custom content, etc. Regeneration is also important in cases where the base dataset has changed (*for example, late withdrawal of a candidate*) and previous choices of template and styling need to be re-applied to a new set of ballot specifications. When such changes occur, the designer-

user must follow each step of the process (*i.e., ballot content review/modification, localization, etc*.) before re-generating the ballots.

However, at some point during the election preparation cycle, a BDS user will be in the situation where the ballot information is complete, and the generated PDFs are candidates for final review. After the review process and and any changes, the ballot PDFs are final, and are the basis for other parts of BDS output (*see below*).

2.9 Printed Ballot Meta-data

PDF for pre-printed ballots, intended for count by opscan, are one of the key outputs of BDS. Support for e-ballots is another, described below. But in addition to PDFs for pre-printed ballots, BDS also generates meta-data for each individual ballot style.

This meta-data is needed for ballot counting devices that are based on opscan and digital image processing to detect voter marks on paper ballots. A paper ballot has, for each ballot selection item (*e.g. candidate*) a print mark zone (e.g. bubble) that has a location in a page geometry that is a fixed grid with an x/y coordinate system. Each mark zone has a unique place in this grid. BDS meta-data output includes data that associates each mark zone with a ballot choice. Scanners use this data to interpret a found mark on a marked ballot with a specific candidate or referendum answer.

Also included in the output ballot specifications is an aspect of each distinct ballot that includes a ballot-specific identifier, which is also present in the printable ballot image. Scanners capture the ballot identifier in order to know which meta-data to use to interpret marks on ballots.

Not committed for Garnet, but on the capabilities road map, the BDS will also generate meta-data for OPSCAN ballot counting devices that are based on other counting methods, including optical character recognition (OCR) interpretation of "*voter selections only*" format ballots from digital marking devices.

2.10 Digital Ballot Support

Another required representation of ballots is presentation as a series of screens on an assistive ballot-marking device ("BMD"). Each screen roughly corresponds to a part of a paper ballot (*e.g. header, main instructions, straight-party option, and presentation of each ballot item and other ballot layout items*) in a single screen.

2.10.1 Basic Support

BDS supports digital ballots by using common data format elements to annotate a ballot specification (*either in or derived from the base data set*) with extensions that provide every presentation element to be included on a screen subject to a stylesheet. It is the responsibility of each standards-compliant BMD device to render each screen in a manner appropriate for its operational environment, and to provide navigation, help, etc. The BDS output—the annotated ballot specifications, contain the full set of information that a BMD should render for each screen.

2.10.2 Accessibility

The BDS annotated ballot specifications are not limited to simply recasting each full ballot's presentation elements into a common data format. For accessibility of ballot presentation in a BMD, a variety of other data is required. The Accessibility module of BDS enables users to specify the additional information required. One type of additional information is localization of ballot text to alternative languages (*see above*); the translations need to be part of the annotated ballot specifications. Voice rendering in each language is also required. Voice recordings of each screen element, in each language, are also part of the annotated ballot specification. Garnet will provide basic features for associating imported audio files with ballot elements and languages.

2.10.3 Proofing

Ballot proofing for paper ballots is performed by inspection of PDF files generated by the BDS. For digital ballots, however, inspection of output XML files and audio files is not effective. Ultimately, the approval of BDS generated digital ballot data must be performed using a BMD that voters will actually use. Yet ballot design is an iterative process, and it may be burdensome to shuttle data back and forth between BDS and a test BMD. Although not committed for Garnet, a subsequent release of the BDS will incorporate parts of another TTV ETF component, the Interactive Sample Ballot (ISB). The ISB serves a similar function to a BMD, in terms of consuming digital ballot data and rendering it for an end-user; but in the case of the ISB, the rendering is done within a web browser. When the BDS digital ballot data sets are made available to a test ISB linked with the BDS, then ballot proofing can be performed using the ISB.

2.11 Final Steps

After all proofing, reviews, and corrections, a BDS user re-generates a final version of the output documents and data sets, and saves them for later use in the election preparation cycle: pre-printing blank ballots, creating per-election configurations for ballot marking devices, ballot counting devices, etc. The output data sets are described above: ballot PDFs, ballot meta-data, and digital ballot support data sets.

Section III
Profiles

The BDS will need to eventually meet the ballot design requirements of the wide variety of U.S. State's election laws, and of jurisdictional norms and preferences. In theory, Garnet may be able to cover a large portion of the varied design space, because of the flexibility of the BDS workflow and feature set. However, in practice, streamlining will be required to *avoid* the expectation that "*all users are power users*."

Such power users will be able to handle ballot design processes that touch on several variable elements: templates, stylesheets, particular modifications of them, and inclusion of presentation data not present in the base data set.

While a BDS power user may wish to have full control over each element, a great many BDS users will prefer to start with a situation in which their State's requirements from election law and practice are already represented in one template, one stylesheet with state specific settings, and sample data for every part of the presentation data that may be required but not present in base data, plus translations and audio for election-independent elements.

Such a collection of "pre-sets" for BDS elements constitutes a "Profile." A critical feature of the BDS for State-specification adaptation is the module for Profile Management, where Profile developers can do much of the "heavy lifting" of the BDS usage, and save the work as a Profile to be applied to a particular election. Also, part of the Profile subsystem is the Profile Selection module, which serves as a sort of "configurator" for a non-power user, presenting them with Profiles that have been developed for their State, characteristics of each, and enabling selection of the most appropriate profile.

The additional of BDS module for Profile usage is perhaps the most significant addition of functionality from the POC to Garnet. A great deal of user-centered experience design remains to be done before this part of the requirements (and specifications) can be complete for feature sets related to Profile developers' workflow and interface, and ordinary Profile users' workflow and interface.

Section IV
Product Requirements Document Elements

This Section provides some of the elements of a traditional product requirements document.

4.1 Bill of Materials (BOM)

The following BOM lists all the elements required for a complete high-level definition of the Ballot Design Studio (BDS), how it is used, and how it interacts with other systems.

1. Election Management Systems: complementary external products or systems that perform election back-office data management, and produce Election Definition datasets.
2. Election Definition datasets to be used as base data by the BDS.
3. Election Definition data standards: VIP and IEEE 1622.2 (see Section 1.2).
4. Shared open source application level software incorporated with BDS software:
   4.1. Libraries for import and export of datasets in common data formats.
   4.2. The TrustTheVote Project "TENET" application services framework that implements functions for application administration, user management, strong authentication, and access control.
5. A web-based application deployment platform for the BDS, that provides the required software stack as documented in deployment documentation. (*Hopefully by this point it is clear the intended deployment strategy for the BDS is as a "cloud-based"—private or public—service using properly configured standard web security protocols*.)
6. Publicly accessible demonstration instance of the BDS.
7. Deployment automation and deployment documentation.
8. A deployed, configured, operational instance of the BDS.
9. Deployment artifacts including SSL server certificate, and visual assets to customize the appearance of a BDS instance.
10. Network infrastructure to connect the BDS instance to the network(s) on which BDS users' workstations are deployed (*typically in LEO offices*).
11. BDS user workstation, including the latest compliant web browser and software to read PDF document types.
12. User documentation, and user-assistive static content linked to/from a BDS instance.
13. External storage and/or network transport to carry BDS generated PDFs to a printing facility.

14. External storage and/or network transport to carry BDS generated data sets—both ballot meta-data and digital ballot support data sets—to the administrative component of a voting system product or solution.
15. A voting system product or solution, with an administrative component to import BDS generated data sets and use them to configure voting system components such as ballot marking devices, ballot counters, and a tabulation system to combine tallies from ballot counters.
16. Data standards that extend current IEEE 1622.2 standards with fields necessary for extended ballot specifications, meta-data for paper ballot counting devices, and meta-data for e-ballot presentation on ballot marking devices.

4.2 User Categories and User Profiles

To be developed in the next version of this RFC.

4.3 Supported Operational Models and "Business" Models

To be developed in the next version of this RFC.

4.3 Summary of BDS Features Sets and Software Modules

4.3.1 Committed for Garnet

The following is a list feature sets or functional modules that are committed for Garnet. Elements already present in the Proof-Of-Concept ("POC") are noted in parentheses.

1. User management, application administration and access control (TENET).
2. Standards-based data import and export (POC).
3. User interface for proofing imported data (POC).
4. Creation ballot configurations (POC).
5. User interface for proofing ballot configurations (POC).
6. Printed ballot template usage core (POC).
7. Stylesheet usage core (POC).
8. Interactive web interface to tailor templates and their stylesheets.
9. Profile management core.
10. Profile development user interface.
11. Profile usage user interface.
12. Ballot PDF file generation (POC).
13. Ballot meta-data generation (POC).
14. Language localization features and user interface.
15. Audio data management and user interface.
16. Digital ballot meta-data generation.

4.3.2 Extended Feature Roadmap

To be incorporated.

Section V
Summary

The BDS is used by Local Elections Officials (LEOs) (*or more precisely their ballot designer designate*) to start with a basic definition of data to presented on ballots; add additional data and information; make selections among various presentation options for ballots; and produce a full set of ballots and supporting meta-data for use in a voting systems.

The TrustTheVote Project open source Ballot Design Studio will offer these capabilities as a web-delivered application that creates and supports shared workgroup environments. These workgroup environments, securely partitioned, is how and where ballot-related data and design choices are to be maintained over the entire pre-election life cycle for a given workgroup of LEOs—typically working together in one electoral jurisdiction.

Using this web application, LEO users can work through a comprehensive ballot design workflow that is designed to accommodate per-State and locality-specific requirements and preferences. BDS will enable such in a manner that is durable from election to election, and also flexible enough to accommodate re-starts of the workflow as a result of external events in the pre-election time frame.

This RFC presents the concept of operation, the customization features around Profiles, elements of typical Product Requirements Document, and Appendices with illustrative examples. With settlement of this RFC, detailed specifications together with user experience design will comprise the final reference document(s) from which the production ready facility will be developed and produced.

Appendix A

```
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precinct_list:
- voting_places:
  - ballot_counters: 2
    ident: vplace-xxx
  ident: prec-1
  display_name: Moultonborough
  district_list:
  - ident: prec-1
    display_name: Moultonborough
type: jurisdiction_slate
jurisdiction_display_name: middleworld
display_name: General Election
contest_list:
- ident: cont-xx
  display_name: President and Vice-President of the United States
  candidates:
  - party_ident: party-4
    ident: cand-91
    display_name: John McCain and Sarah Palin
  - party_ident: party-4
    ident: cand-91
    display_name: Barack Obama and "Joe" Biden
  - party_ident: party-4
    ident: cand-91
    display_name: Ralph Nader and "Matt" Gonzalez
  - party_ident: party-4
    ident: cand-91
    display_name: George Phillies and Christopher Bennett
```

Figure A-1: A sample ballot specification “Moultenborough” created by the BDS POC system


```
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date="2014-11-04" type="general" absenteeCountStatus="in-process" earlyCountStatus="in-process"
electionDayCountStatus="in-process" provisionalCountStatus="not-processed" writeInCountStatus="not-processed"
URL="http://vote.ohio.gov/">
<CandidateCollection>
    <Candidate object_id="_D0B4BE98FA9B4F9B8439403ACA1A83B4" ballotName="Peter Abele" status="qualified">
        <Party>_4078798702EA49A79B56B96D97AFB761</Party>
        <Person>_62529E70C40243C5B4DE60C29FC59832</Person>
    </Candidate>
    <Candidate object_id="_484FF73AF31745538E683A34EDC40795" ballotName="John Adams" status="qualified">
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        <Person>_969D349099574986815FBB271E4C0F39</Person>
    </Candidate>
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        <Person>_A2E27811F3FF4C7883396D35C0826FC6</Person>
    </Candidate>
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        <Party>_3756BCE1F95642B48AF39744B9AB0493</Party>
        <Person>_E0C40474697C4FC68537EDBE567C13F4</Person>
    </Candidate>
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        <Person>_BBEF254F69954F3FA216A2B085A9CF23</Person>
    </Candidate>
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    </Candidate>
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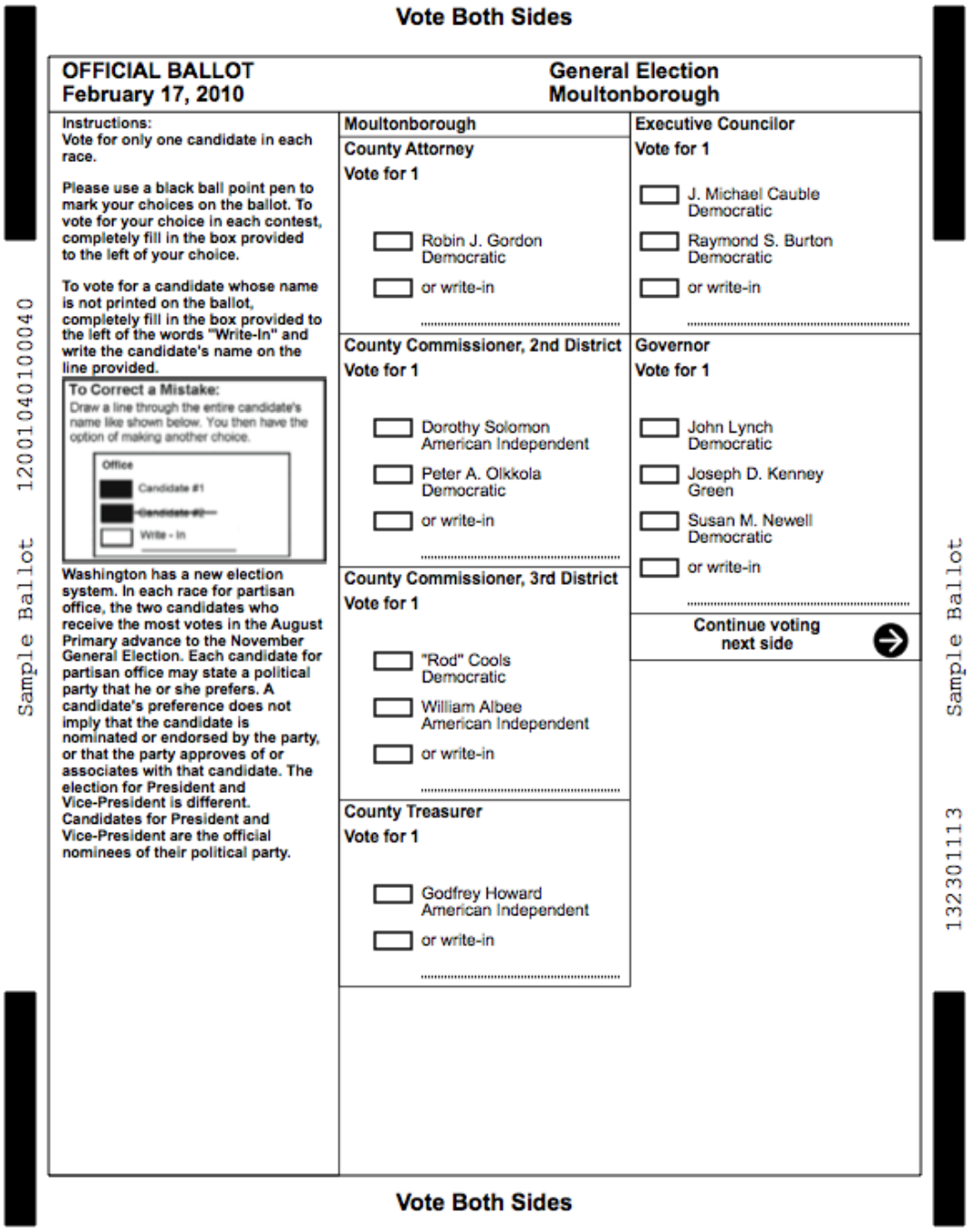
Figure A-2: A fragment of a ballot specification in the new data standard to be supported in BDS release "Garnet."

Appendix B



Vote Both Sides

OFFICIAL BALLOT
February 17, 2010

General Election
Moultonborough

Instructions:
Vote for only one candidate in each race.

Please use a black ball point pen to mark your choices on the ballot. To vote for your choice in each contest, completely fill in the box provided to the left of your choice.

To vote for a candidate whose name is not printed on the ballot, completely fill in the box provided to the left of the words "Write-In" and write the candidate's name on the line provided.

To Correct a Mistake:
Draw a line through the entire candidate's name like shown below. You then have the option of making another choice.

Office
Candidate #1
~~Candidate #2~~
Write - In

Washington has a new election system. In each race for partisan office, the two candidates who receive the most votes in the August Primary advance to the November General Election. Each candidate for partisan office may state a political party that he or she prefers. A candidate's preference does not imply that the candidate is nominated or endorsed by the party, or that the party approves of or associates with that candidate. The election for President and Vice-President is different. Candidates for President and Vice-President are the official nominees of their political party.

Moultonborough

County Attorney
Vote for 1
- Robin J. Gordon Democratic
- or write-in

County Commissioner, 2nd District
Vote for 1
- Dorothy Solomon American Independent
- Peter A. Olkkola Democratic
- or write-in

County Commissioner, 3rd District
Vote for 1
- "Rod" Cools Democratic
- William Albee American Independent
- or write-in

County Treasurer
Vote for 1
- Godfrey Howard American Independent
- or write-in

Executive Councilor
Vote for 1
- J. Michael Cauble Democratic
- Raymond S. Burton Democratic
- or write-in

Governor
Vote for 1
- John Lynch Democratic
- Joseph D. Kenney Green
- Susan M. Newell Democratic
- or write-in

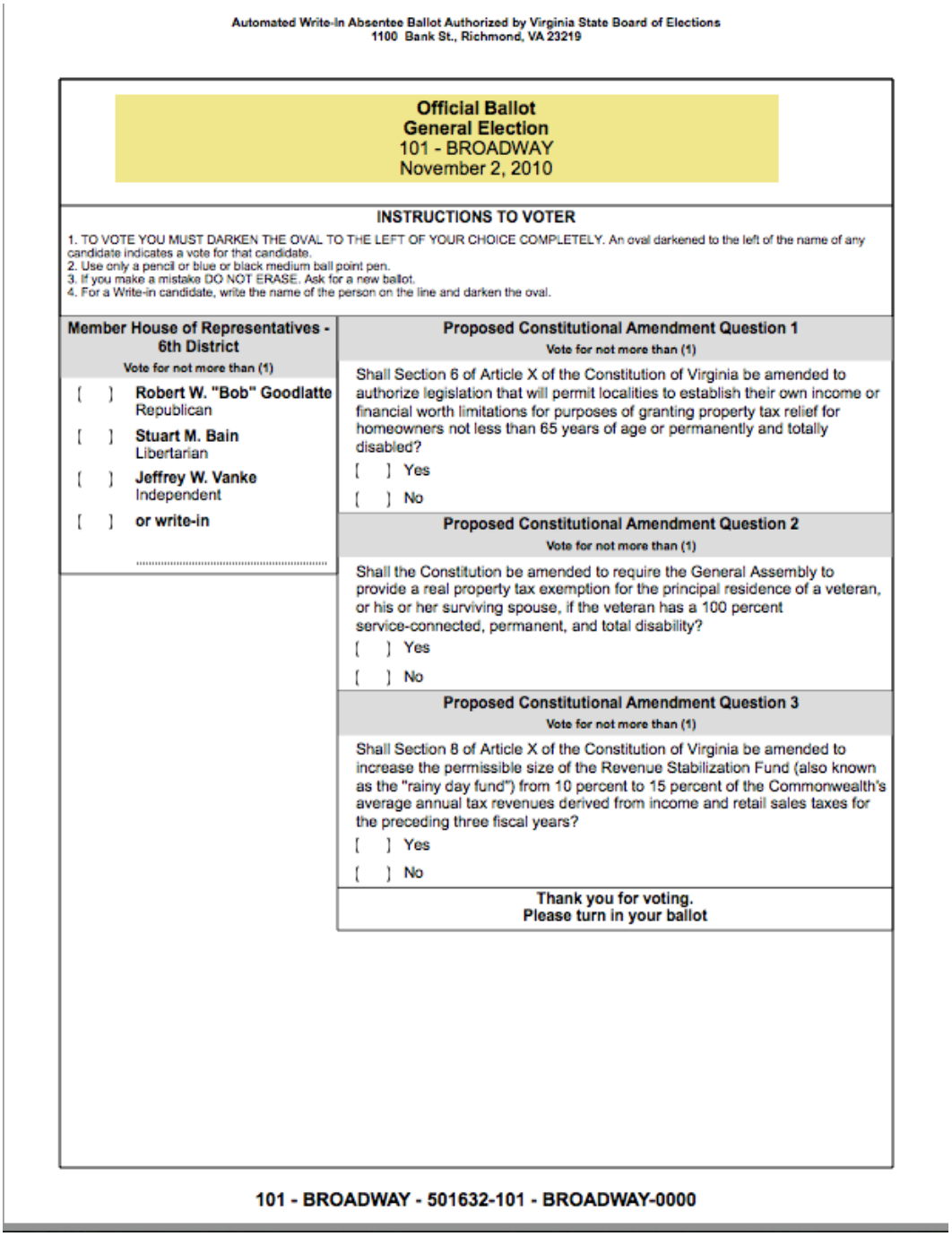
Continue voting next side

Sample Ballot 12001040100040

Sample Ballot 132301113

Vote Both Sides

Figure B-1: A sample ballot "Moultenborough" created by BDS POC system



Automated Write-In Absentee Ballot Authorized by Virginia State Board of Elections
1100 Bank St., Richmond, VA 23219

Official Ballot
General Election
101 - BROADWAY
November 2, 2010

INSTRUCTIONS TO VOTER

1. TO VOTE YOU MUST DARKEN THE OVAL TO THE LEFT OF YOUR CHOICE COMPLETELY. An oval darkened to the left of the name of any candidate indicates a vote for that candidate.
2. Use only a pencil or blue or black medium ball point pen.
3. If you make a mistake DO NOT ERASE. Ask for a new ballot.
4. For a Write-in candidate, write the name of the person on the line and darken the oval.

Member House of Representatives - 6th District
Vote for not more than (1)

[ ] **Robert W. "Bob" Goodlatte** Republican
[ ] **Stuart M. Bain** Libertarian
[ ] **Jeffrey W. Vanke** Independent
[ ] **or write-in** .....

Proposed Constitutional Amendment Question 1
Vote for not more than (1)

Shall Section 6 of Article X of the Constitution of Virginia be amended to authorize legislation that will permit localities to establish their own income or financial worth limitations for purposes of granting property tax relief for homeowners not less than 65 years of age or permanently and totally disabled?

[ ] Yes
[ ] No

Proposed Constitutional Amendment Question 2
Vote for not more than (1)

Shall the Constitution be amended to require the General Assembly to provide a real property tax exemption for the principal residence of a veteran, or his or her surviving spouse, if the veteran has a 100 percent service-connected, permanent, and total disability?

[ ] Yes
[ ] No

Proposed Constitutional Amendment Question 3
Vote for not more than (1)

Shall Section 8 of Article X of the Constitution of Virginia be amended to increase the permissible size of the Revenue Stabilization Fund (also known as the "rainy day fund") from 10 percent to 15 percent of the Commonwealth's average annual tax revenues derived from income and retail sales taxes for the preceding three fiscal years?

[ ] Yes
[ ] No

Thank you for voting.
Please turn in your ballot

101 - BROADWAY - 501632-101 - BROADWAY-0000

Figure B-2: One of 2,700+ ballots created by BDS POC system digital blank ballot distribution to UOCAVA voters, used in 2010 election.

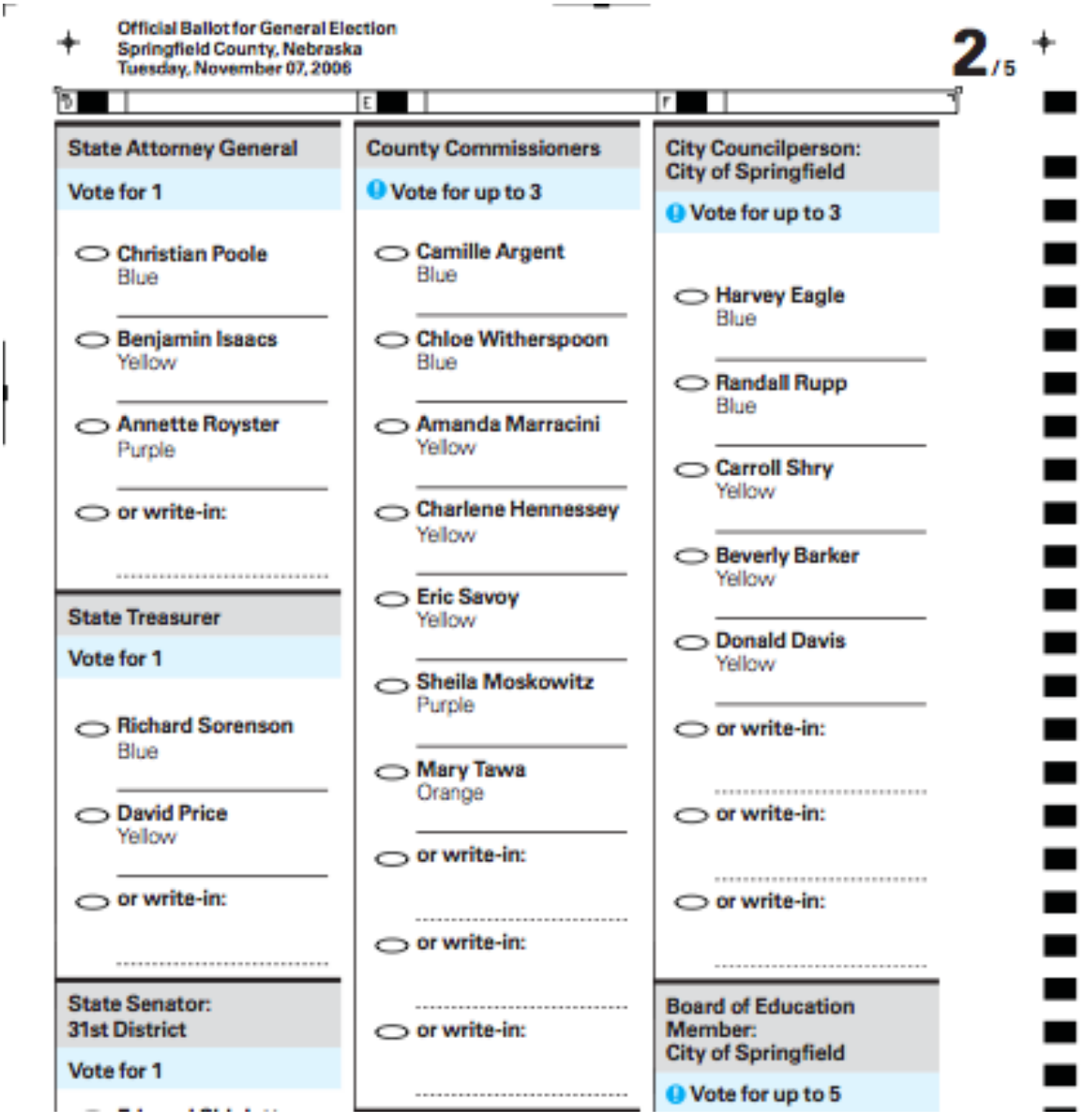


Figure B-3: View of AIGA-standard ballot to be used for Garnet templates

Appendix C

Sheets | Charts | SmartArt Graphics | WordArt

<>	A	B	C	D	E	F	G	H	I	J
1	pre	precinct	n cont	n que	contest names	question_names				
2	50:	101 - BROADWAY	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
3	50:	102 - TIMBERVILLE	3	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
4	50:	103 - FULKS RUN	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
5	50:	104 - BERGTON	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
6	50:	105 - LACEY SPRING	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
7	50:	106 - TENTH LEGION	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
8	50:	107 - PLAINS	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
9	50:	201 - SINGERS GLEN	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
10	50:	202 - EDOM	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
11	50:	203 - MELROSE	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
12	50:	204 - MT CLINTON	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
13	50:	207 - OTTOBINE	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
14	50:	301 - KEEZLETOWN	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
15	50:	302 - PORT REPUBLIC	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
16	50:	303 - NORTH RIVER	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
17	50:	304 - GROTTOES	3	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
18	50:	305 - MASSANETTA SPRINGS	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
19	50:	306 - CROSS KEYS	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
20	50:	401 - BRIDGEWATER	3	3	CONTEST Mayor - Bridgewater|CONTEST M	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
21	50:	402 - MONTEZUMA	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
22	50:	403 - MT CRAWFORD	3	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
23	50:	404 - DAYTON	3	3	CONTEST Mayor - Dayton|CONTEST Memb	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
24	50:	405 - SILVER LAKE	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
25	50:	501 - ELKTON	3	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
26	50:	501 - ELKTON	3	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
27	50:	502 - SWIFT RUN	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
28	50:	503 - MCGAHEYSVILLE	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
29	50:	504 - SOUTH FORK	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
30	50:	505 - STONY RUN	1	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
31	50:	101 - MERRIMANS	2	3	CONTEST Member City Council|CONTEST M	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
32	50:	102 - OLD TOWN	2	3	CONTEST Member City Council|CONTEST M	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
33	50:	201 - VIRGINIA AVENUE	2	3	CONTEST Member House of Representative	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
34	50:	301 - WAR MEMORIAL	2	3	CONTEST Member City Council|CONTEST M	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
35	50:	401 - FREDERICK DOUGLASS	2	3	CONTEST Member City Council|CONTEST M	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
36	50:	101 - WASHINGTON	2	3	CONTEST Clerk of Court|CONTEST Membe	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
37	50:	101 - WASHINGTON	2	3	CONTEST Clerk of Court|CONTEST Membe	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
38	50:	201 - AMISSVILLE	2	3	CONTEST Clerk of Court|CONTEST Membe	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				
39	50:	301 - SPERRYVILLE	2	3	CONTEST Clerk of Court|CONTEST Membe	QUESTION: Question 1|QUESTION: Question 2|QUESTION: Question 3				

Figure C-1: Partial view of the ballot configuration proofing tool used in the BDS POC system