Common Data Language

Overview

The need for a common data language is analogous to the use of a common language for people and economies to share the best of ideas, products, and services. A language used exclusively by a few isolates people from the rest of what the world has to offer.

As the demand and use of technology increases in elections, a variety of new products are being used by election officials which must be able to talk intimately with each other (i.e. share data) or talk with a common host in order to integrate them into the entire election administration process.

Since the 'data language' used by these products tends to be proprietary and doesn't communicate with products from another vendor, election officials usually find themselves limited to the voting systems product line available through a single vendor.

In the elections marketplace, this reality has several disadvantages:

- Election officials are frequently locked into a single vendor's product line by decisions made years and decades ago in their jurisdiction when the needs were different. The cost of converting the jurisdiction's entire product line to another vendor and the top to bottom change in procedures often required is prohibitive.
- Election officials don't have an opportunity to shop for the best product to meet their needs. Jurisdictions only use products offered by its vendor … when its vendor develops the product and not before.
- Existing elections vendors develop, integrate, market, and/or support devices outside of their historical area of expertise and competence.
- Smaller companies that might focus on a single product – build the best mouse trap so to speak – are locked out because they are required by this marketplace to develop the entire line of products needed by election officials.

In addition to these suites of products that need to be tightly integrated, there are needs for families of products to talk with each other. Finding a way to promote voter registration systems talking with ballot tabulation systems, as an example, might be the 'low hanging' fruit where a common data language can be implemented in a way that helps election officials in the relatively near future

For example, a jurisdiction's voter registration system and a jurisdiction's candidate filing system contain information needed by its ballot layout system when it comes time to create a new election. Many jurisdictions duplicate data entry and opportunities for error by creating that information in the ballot layout system more or less manually. Due to a lack of a common data language between the two systems, jurisdictions that import/export information between the systems have commonly had to expend its own resources to create a sort of 'translation service' between the two that is unique to that jurisdiction's situation.

A common array of electronic products used in a single election jurisdiction

In many parts of the country, a jurisdiction with polling places will use the following voting systems technology:

- **Direct Recording Electronic Devices (DRE).** Also frequently known as touch-screen devices. These devices support adaptive technologies that allow voters with certain disabilities vote privately and independently. In some parts of the country these are also the exclusive means provided for voting in the polling places. However, the number of jurisdictions relying solely on the DRE is in severe decline.
- **Precinct Optical Scanners (POS).** A voter will mark an optical scan ballot and run the ballot through a scanner located at the polling place. The scanner records the choices made and deposits the ballot in a sealed bin.
- **Ballot on Demand (BOD) printers.** Especially valuable where jurisdictions use optical scan ballots at early polling sites. Rather than maintain an inventory of every possible pre-printed ballot style at the polling site, the election official prints the necessary ballot for each voter as the voter signs in.
- **Electronic Poll Books.** An electronic device that assists the poll worker in determining the eligibility of the person who has presented herself to vote. After determining that she is a registered voter and hasn't voted previously, the device can print a token that will bring up the ballot style she is eligible to vote on the DRE or print the correct ballot at the BOD.

In addition to these electronic devices at the polling places, many jurisdictions also use 'high speed' **central count optical scanners (CCOS)** to count the paper ballots returned by vote-by-mail voters (often referred to as absentee voters).

During an election, the DRE, POS, and CCOS communicate the data (votes) they gather with a common host where the data is tabulated and reported in a variety of formats (yes, almost always unique to that vendor). Prior to use in the election, a common host communicates a complex set of ballot configurations to these devices that define the ballot styles of each vote the device will be used to gather. Typically the host that creates the ballot styles and communicates the ballot styles to the devices is the same system that receives the data gathered by the devices.

Without a common data language and given that the communication protocol, data structure, and data elements are unique to each vendor, the DRE, POS, and CCOS in a jurisdiction will almost always be products developed, marketed, and/or integrated by the same vendor who created the jurisdiction's host system. If a jurisdiction wants to use a different DRE, or POS, or CCOS than the one provided by its vendor, it will typically be necessary or most expedient to change the entire product line.

Outside of the scope of this paper but worth mentioning here, larger jurisdictions with high volumes of vote-by-mail ballots are deploying sophisticated **mail sorting equipment.** The equipment is used to capture the signature image from the front of the envelope, and sort the ballots into manageable units using a variety of criteria. These systems require interaction with the jurisdiction's voter registration system.

Obstacles to a Common Data Language

A strong argument can be made that the reason a common data language doesn't exist in voting systems is because a compelling need hasn't arisen that overcomes the prevailing (often dysfunctional) elections marketplace dynamics. This is a classic chicken and egg scenario, where creating a meaningful common data language format must coincide in some way with a changed regulatory and marketplace environment.

Vendor Interests

The prevailing business model in the elections industry doesn't support a common data language when applied to tightly-integrated voting systems products. The expectation under the current model is that once a vendor has a foothold in a jurisdiction, the jurisdiction will purchase upgrades and new devices from the same vendor. Supporting a common data language would make it easier for a competitor with a nifty mouse trap to 'poach' on a vendor's jurisdiction.

There might be other technical difficulties as well. For example, the products used in the elections space are often somewhat esoteric and may be specifically engineered to maximize the efficiency of interacting with the vendor's product line.

Election Official Concerns

Election officials do not want to deal with multiple vendors – especially in an environment where the systems must be as tightly integrated as voting systems are. We are fearful of situations where vendors point fingers at each other and the problem doesn't get solved.

In an ideal world, election jurisdictions would deal with a single voting systems integrator, independent enough to pick & choose "best of breed" voting systems products that best meet the jurisdictions needs. In that world, a common data language is a necessary and key component of the production environment.

Can the elections marketplace be transformed? Open Source Digital Voting Foundation seems to think so.

Its vision is that with adequate financial backing, it can develop (in conjunction with election officials and technical experts) specifications for voting and voter registration system components. In this vision, systems integrators would be able to put together a complete election management system from these components. Entrepreneurs might have an incentive to develop single products – the best mousetraps – since the specifications would allow them to develop their product component to interact correctly with the other components required in a comprehensive election management system.

The regulatory environment (EAC/NIST) would change as well. Rather than only certifying systems that demonstrably prove all the components work together, the EAC/NIST certification testing program would also be required to certify individual system components that are proven to interact with voting systems according to established specifications for that type of component.

Low hanging fruit

Given the market difficulties to overcome in creating a common data language that would allow mix and match of current vendor voting systems product lines, the best approach probably lies in the areas where voting systems must be able to communicate with other types of systems.

Voting Systems and Voter Registration Systems (A common election definition language)

As noted earlier, *voter registration* systems *and candidate filing* systems contain information necessary to building an election and its ballot styles in a *voting system* (ballot layout). Once the election has been defined and the ballot styles determined by the voting system, the *voter registration* system will need which ballot style each voter in the jurisdiction is eligible to use from the *voting system*.

The overwhelming majority of jurisdictions use one vendor's voter registration system with another vendor's voting system. In some cases, vendors/jurisdictions have collaborated on good interfaces between the two systems, some interfaces are inadequate, and many don't exist at all.

In Washington State, we have four different voting systems with one statewide voter registration system (VRDB). In addition, our state system offers a candidate filing system integrated with the state VRDB that supports online candidate filing (candidates use credit cards for the filing fees), automatically sends an email to each candidate when another candidate files, posts online reports of contests and candidates filed, allows candidates to submit voter pamphlet statements and photos online, and provides customized online voter guides for voters.

Washington collaborated with Hart, one of the voting system vendors (used by 21 of Washington's 39 counties), to use the XML data schema Hart defined as a means of communicating election definition information including the candidate information from the state VRDB to Hart's voting system. We found Hart's schema for the most part robust and well thought out.

The response of county election officials (in Washington, counties are responsible for conducting elections held within its jurisdiction) was overwhelmingly positive to this project. See Appendix ??A?? for a sample communication from a county official. See Appendix B for a sample of the XML file. There is a substantial opportunity here to reduce errors made by an election jurisdiction in the process of laying out its ballots.

As the market currently stands, in order to provide the same service to all counties, Washington will either develop a different data schema for each vendor (most likely) or convince the other vendors to support the schema that we have developed (very unlikely).

A common election definition data language would define the way voting systems and voter registration systems communicate election definition information with each other to the eventual benefit of vendors and election officials.

In an ideal market where the state voter registration systems all supported a common election definition data language, voting systems vendors would find it in their interest to support the common language.

Voting Systems and Election Results Reporting (A common election result data language)

Many states, Washington included, collect election results information from its jurisdictions in order to publish statewide results. With four different voting systems, Washington's statewide election results system was developed to process four different sets of data elements and structures.

Because some of the voting systems election file exports didn't provide data we needed, Washington developed a hybrid system where some of the data was manually entered while the rest of the data was contained in the upload file.

A common election results data language would facilitate the process of rolling up election result totals from the local to the state to the national levels for all stakeholders involved in the process of reporting election results, including media.

See Appendix C for samples of election result data currently provided by voting systems.

Voting Systems and Online Ballot Delivery (A common ballot definition data language)

As noted previously, a method for updating the voter registration system with the ballot styles created by a voting system (ballot layout) is a necessary component of a functional election management system. Basically, the set of jurisdictions that define a unique ballot style in the voting system also defines the set of voters in the voter registration system who receive that ballot style.

Ideally, all voting systems would create the same data file format and data elements that at a minimum provides the set of jurisdictions associated with each ballot style so that all voter registration systems, now existing or in the future, could be developed to consume it.

A new market just beginning to open up is delivering ballots online. These products occupy a position in the voting system in some respects similar to the DRE, POS, and CCOS in that they need a ballot definition for the ballots that voters will use on the ballot delivery system. Ideally the ballot definition would come from the voting (ballot layout) system. At this time, unlike the DRE, POS, and CCOS, the products are primarily being offered through vendors other than the voting system vendors.

The vendors of voting systems might not view supporting a common data language as desirable from a business standpoint. However, the good news in that event, is that a common data language could help the vendors of the online ballot delivery systems if a relatively few states that offer candidate filing with the statewide VRDB agreed on a common data language. The ballot styles produced by the voting system can be mapped to ballot styles created by the state system.

This product provides an opportunity to test the theory that a common data language will help the elections marketplace. The use of a common ballot definition language should help bring these products to the market faster and more efficiently than if the ballot delivery vendors are forced to develop unique interfaces to each different voting and voter registration systems.

See Appendix D for a list of data elements that belong to a ballot definition.

Conclusions

The elections market place has been isolated from the best the product world has to offer by the use of exclusive proprietary languages spoken by a few. However, the obstacles to overcome in implementing a meaningful common data language that integrates existing voting system components across vendor product lines looks formidable.

The best near term project for a common data language lies in responding to the developing needs in an emerging market for products that facilitate electronic delivery of ballots. An opportunity exists for companies with significant experience in overseas markets delivering electronic ballots to provide services/products to states looking for ways to integrate these products with existing voter registration and voting systems.

Ideally, the electronic ballot products would be integrated at the vendor voting system level.

The ballot style definitions would be provided in a common data language from the vendor so that the electronic ballot provider would be able to match the set of jurisdictions/contests/candidates of the ballot styles with the set of jurisdictions/contests a voter is eligible to vote.

On the back end, with the delivery of the ballot to the elections jurisdiction after being voted by the voter, the ideal solution would be a common data format that allows the electronic ballot vendor to export the choices made by the voter to the vendor voting system so that the voting systems can print a ballot that conforms with the way all the other ballots scanned through its processes. (A more direct route would have the voting system accept the votes as it does DRE results. At this time, I believe a paper audit trail at this step is preferable for several reasons)

The principal disadvantage of having the voting system print the ballot is that such a change requires the voting systems vendor to re-certify its system with the EAC.

An alternate approach to the back end being discussed by the election ballot providers has the provider printing the scan-able ballot from the returned ballot. This approach maps to what is currently being done with electronic ballot delivery and paper return. The elections jurisdiction manually duplicates the returned ballot to a paper ballot scan-able by its voting system.

The elections jurisdiction saves the personnel time and potential for error in the duplication process by having either the electronic ballot provider or the voting system print a scan-able ballot from the ballot returned by the voter.

Alternately, the electronic ballot products could be integrated at the state voter registration system level.

> All the data elements needed to present the electronic ballot to the voter are also available in most state voter registration systems. However, this is a less desirable access point from a functional standpoint because the information needed to create a scan-able ballot when the ballot is returned is not available to the voter registration system. Since election jurisdictions currently manually duplicate the returned ballot to a scan-able ballot, this approach would not burden the jurisdiction with additional work at the current level of activity.
>
> The advantage of using the state voter registration system as the access point is that states have more control over those systems and is a single source in states where the ideal access point - voting systems - reside in many election jurisdictions. Not only do the voting systems reside at the local level but in many states there are several different voting systems vendors. A common data language that supports electronic ballot delivery might be easier to implement at the state registration database access point.

What is compelling about the development of a common data language for electronic ballot providers is that the work done on these data definitions is also a necessary first step toward establishing a common data language to interface other voting system components with host voting systems. The application for the definitions developed in this elections space is not exclusive to the electronic ballot component.

This work also would provide important support for the work currently being done to develop UOCAVA.

Appendix B: ELECTION Definition – Hart Export EDX as implemented by Washington


```
<?xml version="1.0" encoding="utf-8"?>
<EDX creationDateTime="2009-09-09T11:53:51.970">
  <StateDefinedCodes state="WA">
    <VotingDefinitions>
      <VotingMethodCode code="P" name="Polling Place-Election Day" voteCategory="ED" />
      <VotingMethodCode code="M" name="Mail Ballot (Absentee)" voteCategory="AB" />
      <VotingMethodCode code="E" name="Early by Personal Appearance" voteCategory="EV" />
    </VotingDefinitions>
  </StateDefinedCodes>
  <County id="PA" name="Pacific" state="WA">
    <DistrictTypeList>
      <DistrictType name="County" id="4" code="CNTY" />
      <DistrictType name="Fire" id="13" code="FIRE" />
    </DistrictTypeList>
    <Election name="General" id="32" date="11/03/2009" isFinalized="true" type="GE">
      <Title>
        <DisplayText lang="en-us">General</DisplayText>
      </Title>
      <ElectionDate>
        <DisplayText lang="en-us">11/03/2009</DisplayText>
      </ElectionDate>
      <Parties>
        <party name="Nonpartisan" id="3" code="NP" displayOrder="3" isUnaffiliated="true" />
      </Parties>
      <Contests>
        <Contest name="State Initiative Measure 1033" id="57" displayOrder="1" type="MS" isCumlative="false" maxVotes="1">
          <MeasureText lang="en-us">Initiative Measure No. 1033 concerns state, county and city revenue. | |This measure would limit growth of certain state, county and city revenue to annual inflation and population growth, not including voter-approved revenue increases. Revenue collected above the limit would reduce property tax levies.  | |Should this measure be enacted into law? Yes [ ] No [ ]</MeasureText>
          <Choice name="Yes" displayOrder="1" id="71" type="OP" />
          <Choice name="No" displayOrder="2" id="72" type="OP" />
        </Contest>
        <Contest name="Fire District #8 FIRE COMMISSIONER #1" id="32" displayOrder="493" type="OF" isCumlative="false" maxVotes="1" maxWriteIns="1">
          <Choice name="Gregory F. Blevins" displayOrder="1" id="40" type="CD" />
        </Contest>
      </Contests>
      <Precincts>
        <Precinct name="Eklund Park" id="4" displayOrder="4">
          <DistrictPrecinctSplits>
            <DistrictPrecinctSplit district="1" />
            <DistrictPrecinctSplit district="13" />
          </DistrictPrecinctSplits>
        </Precinct>
        <Precinct name="South Bend 1 R" id="28" displayOrder="28">
          <Splits>
            <Split name="1" id="1" displayOrder="1">
              <DistrictPrecinctSplits>
                <DistrictPrecinctSplit district="1" />
              </DistrictPrecinctSplits>
            </Split>
            <Split name="2" id="2" displayOrder="2">
              <DistrictPrecinctSplits>
                <DistrictPrecinctSplit district="1" />
                <DistrictPrecinctSplit district="13" />
              </DistrictPrecinctSplits>
            </Split>
```

```
          <Split name="3" id="3" displayOrder="3">
            <DistrictPrecinctSplits>
              <DistrictPrecinctSplit district="1" />
            </DistrictPrecinctSplits>
          </Split>
        </Splits>
      </Precinct>
      <Precinct name="South Bend 2 R" id="30" displayOrder="30">
        <Splits>
          <Split name="1" id="1" displayOrder="1">
            <DistrictPrecinctSplits>
              <DistrictPrecinctSplit district="1" />
            </DistrictPrecinctSplits>
          </Split>
          <Split name="2" id="2" displayOrder="2">
            <DistrictPrecinctSplits>
              <DistrictPrecinctSplit district="1" />
            </DistrictPrecinctSplits>
          </Split>
          <Split name="3" id="3" displayOrder="3">
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              <DistrictPrecinctSplit district="1" />
              <DistrictPrecinctSplit district="13" />
            </DistrictPrecinctSplits>
          </Split>
          <Split name="4" id="4" displayOrder="4">
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              <DistrictPrecinctSplit district="1" />
            </DistrictPrecinctSplits>
          </Split>
        </Splits>
      </Precinct>
    </Precincts>
    <Districts>
      <District id="1" name="Pacific County" districtType="4" />
      <District id="13" name="Fire District #8" districtType="13" />
    </Districts>
    <DistrictContests>
      <DistrictContest contest="32" district="13" />
      <DistrictContest contest="57" district="1" />
    </DistrictContests>
  </Election>
 </County>
</EDX>
```

Appendix C: ELECTION RESULTS – Upload files by Vendor as used in Washington State

Notes: The voting system vendors usually have multiple election result reporting formats. The attached were considered to be the vendor formats most useful in Washington State for communicating election results from the county systems to the statewide election results publishing system.

Most systems are capable of reporting results both at the precinct level and cumulative at the election jurisdiction level. Where readily accessible, Washington chose to use precinct level results.

The vendor was not asked to provide specific formats to accommodate Washington needs. These data formats are reporting options available to the election jurisdiction as standard options at the time of creating a report.

King County is the only county in Washington that uses the Premier (now ES&S) GEMS tabulation system. This appendix does not provide the GEMS export format because King County converts the GEMS output to the Sequoia Cumulative format before uploading to the state.

ES&S Unity Systems - Election Results Upload

Reporting level: Precinct
Data format: single ASCII flat file, fixed format
File Layout:
The file is conceptually broken into two sections: the 'Counter' area and the 'Contest' area.

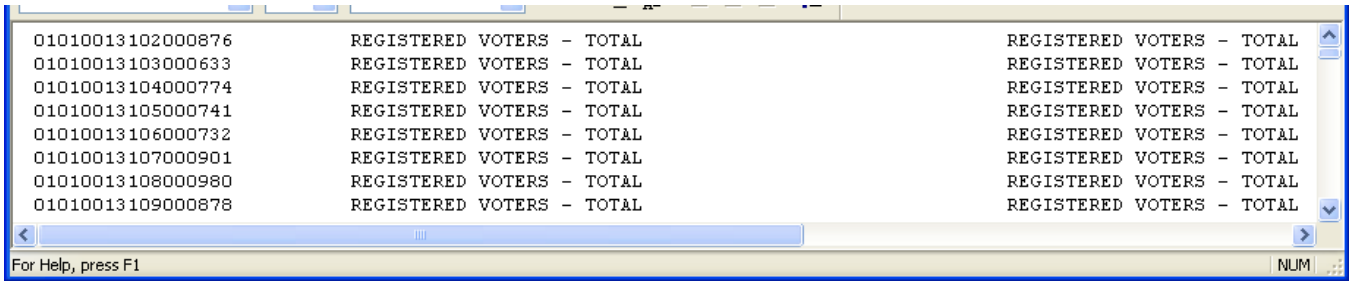
The first records are considered the 'Counter' area, and the counter for each record is stored at fixed position 12-17 (see the fixed field format for each record below). The counter area contains 1 to n records (where n=number precincts in the election jurisdiction) for each of the following:

REGISTERED VOTERS – TOTAL (contest title and candidate name)
BALLOTS CAST - TOTAL (contest title and candidate name)
BALLOTS CAST – D, R and NONPARTISAN (in Washington, only applicable in a presidential primary)
BALLOTS CAST - BLANK (If any blank ballots were included)

The rest of the records are 'Contest' records, and the votes for each candidate in each precinct are stored at fixed position 12-17. The number of records for each contest/candidate is determined by the number of precincts with that contest within the election jurisdiction.

Record Pos.	Field	Field Definition	Notes
1 – 4	Contest Number	4 Position Numeric	
5 – 7	Candidate Number	3 Position Numeric	
8 – 11	Precinct Code	4 Position Numeric	
12 - 17	# Registered Voters	5 Position Numeric	Prints in the counter area only
12 - 17	Number of Votes	5 Position Numeric	Prints in the contest area only
18 - 20	Party Code	3 Position Numeric	
21 - 23	District Type ID	3 Position Alphanumeric	
24 - 27	District Code	4 Position Numeric	
28 - 83	Contest Title	56 Position Alphanumeric	
84 - 121	Candidate Name	38 Position Alphanumeric	
122-151	Precinct Name	30 Position Alphanumeric	
152-176	District Name	25 Position Alphanumeric	
	Votes Allowed	2 Position Numeric	
	Referendum Flag	1 Position Numeric	
	CR Code (0D)		
	LF Code (0A)		

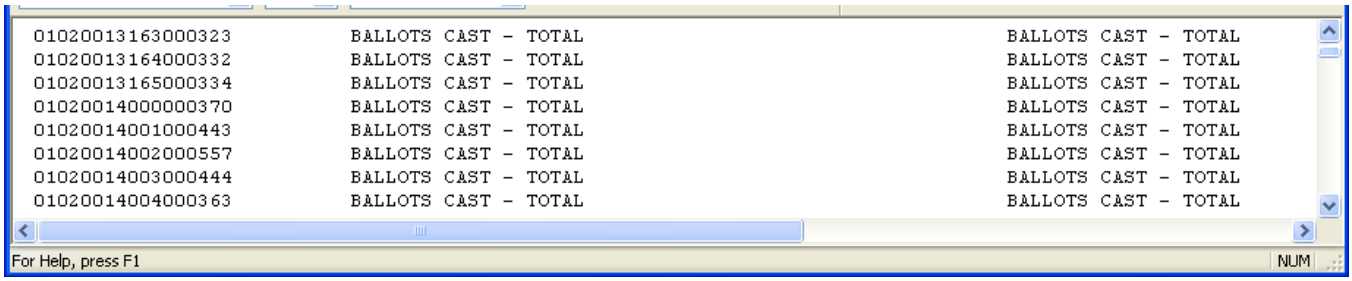
SAMPLE – 'Counter Area' and 'Registered Voters – Total'



01010013102000876	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013103000633	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013104000774	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013105000741	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013106000732	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013107000901	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013108000980	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL
01010013109000878	REGISTERED VOTERS - TOTAL	REGISTERED VOTERS - TOTAL

For Help, press F1 NUM

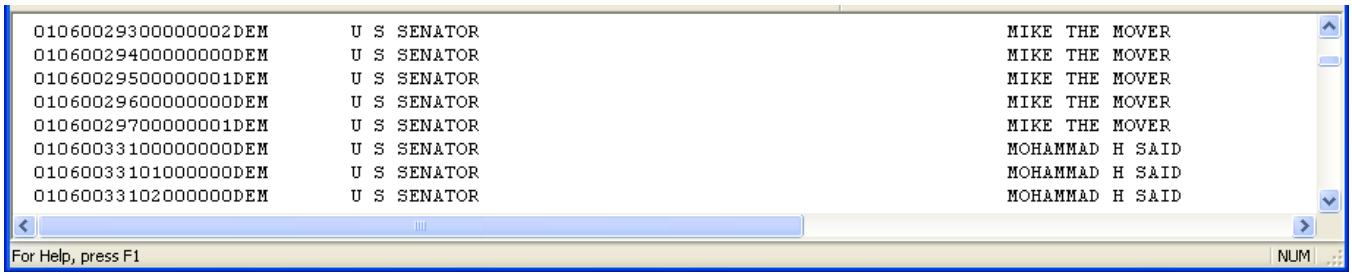
SAMPLE – 'Counter Area' and 'Ballots Cast – Total'



01020013163000323	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020013164000332	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020013165000334	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020014000000370	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020014001000443	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020014002000557	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020014003000444	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL
01020014004000363	BALLOTS CAST - TOTAL	BALLOTS CAST - TOTAL

For Help, press F1 NUM

SAMPLE – 'Contest Area' and Contest/Candidate



0106002930000000 2DEM	U S SENATOR	MIKE THE MOVER
0106002940000000 0DEM	U S SENATOR	MIKE THE MOVER
0106002950000000 1DEM	U S SENATOR	MIKE THE MOVER
0106002960000000 0DEM	U S SENATOR	MIKE THE MOVER
0106002970000000 1DEM	U S SENATOR	MIKE THE MOVER
0106003310000000 0DEM	U S SENATOR	MOHAMMAD H SAID
0106003310100000 0DEM	U S SENATOR	MOHAMMAD H SAID
0106003310200000 0DEM	U S SENATOR	MOHAMMAD H SAID

For Help, press F1 NUM

Sequoia Election Results Upload

Reporting level: Cumulative, Precinct
Data format: single ASCII flat file, comma delimited
File Layout:

Note: Sequoia provides two different ASCII, delimited, flat file formats to WA with different strengths.

The *precinct detail format* can be summarized at the election jurisdiction level but of course, is a much larger file than the *cumulative file* and requires more processing of the file to obtain cumulative totals.

The precinct detail also does not provide the undervotes, and overvotes that are in the cumulative file.

Sequoia counties in Washington chose which format to export to the state election results.

PRECINCT DETAIL

Field Name	Type	Notes:
PRECINCT_NAME	Alphanumeric	
CANDIDATE_FULL_NAME	Alphanumeric	
contest_party_id	Numeric	
candidate_party_id	Numeric	
CONTEST_TYPE	Numeric	-2 = Registration and Turnout (within/Precinct) 0 = Regular Contest 4 = Measure/Initiative
contest_id	Numeric	
CONTEST_ORDER	Numeric	Order of the contest within the election jurisdiction
CANDIDATE_ORDER	Numeric	Order of the candidate within the contest
CONTEST_FULL_NAME	Alphanumeric	
TOTAL	Numeric	Votes Cast for candidate
PRECINCT_ID	Numeric	
precinct_order	Numeric	Order of the precinct within the election jurisdiction
contest_vote_for	Numeric	Limit on number of votes a voter can cast in contest
PROCESSED_DONE	Numeric	
PROCESSED_STARTED	Numeric	
CONTEST_TOTAL	Numeric	Total Votes cast in contest
IS_WRITEIN	True/False	0=Regular Candidate 1=Write-In

CUMULATIVE

Field Name	Type	Notes:
CONTEST_ID	Numeric	
CONTEST_ORDER	Numeric	Order of the contest within the election jurisdiction
CANDIDATE_ORDER	Numeric	Order of the candidate within the contest
TOTAL	Numeric	Votes Cast for Candidate
CANDIDATE_PARTY_ID	Numeric	
CANDIDATE_ID	Numeric	
VOTE_FOR	Numeric	Limit on number of votes a voter can cast in contest
CONTEST_TYPE	Numeric	-2 = Registration and Turnout (within/Election Jurisdiction) 0 = Regular Contest 4 = Measure/Initiative
CANDIDATE_TYPE	Numeric	0 = Regular Contest 4 = Measure/Initiative
TOTAL_PRECINCTS	Numeric	Number of precincts/Contest
PROCESSED_DONE	Numeric	Number of precincts/Contest
PROCESSED_STARTED	Numeric	Number of precincts/Contest
IS_WRITEIN_CANDIDATE	True/False	0=Regular Candidate 1=Write-In
CONTEST_FULL_NAME	Alphanumeric	If Contest_Type=2 'Registration and Turnout'
CANDIDATE_FULL_NAME	Alphanumeric	If Contest_Type=2 Either 'Poll Turnout' or 'Electronic Vote Turnout'
CONTEST_TOTAL	Numeric	Votes Cast in Contest
Undervote	Numeric	
Overvote	Numeric	
IS_WINNER	True/False	0=RunnerUp 1=Winner
cf_cand_class	Alphanumeric	Candidate or Winner
IS_PRECINCT_LEVEL	True/False	0=False 1=True
PRECINCT_NAME	Alphanumeric	Blank if Is_Precinct_Level = 0
is_visible	True/False	

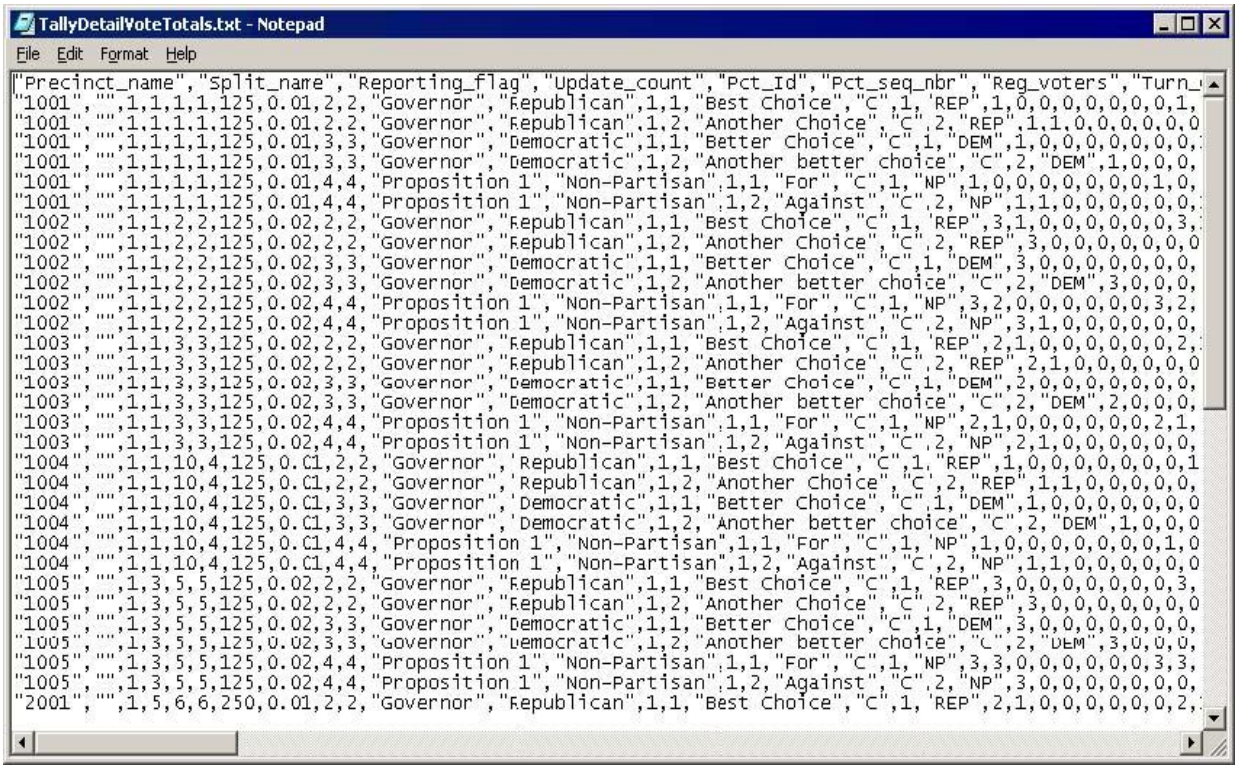
Note: While this file can break results down to a precinct level report, it provides less precinct detail information than the precinct detail format. Missing is the precinct ID, and the precinct order. As a cumulative file, its advantage is that it is a smaller file and requires less processing to get election jurisdiction level contest totals.

Hart Tally – Election Results Upload

Reporting level: Cumulative, Precinct
Data format: single ASCII flat file, comma delimited, first row is column headings
File Layout:

Field Name	Type	Notes:
Precinct_Name	Char(100)	Name of the precinct.
Split_Name	Char(100)	Name of the split precinct. Null if consolidate results.
Reporting Flag	Integer	Flag set to 1 if the precinct is reporting for election day.
Update Count	Integer	Counter updated when data in the precinct changes.
Pct_id	Integer	BOSS precinct ID. Null if consolidated.
Pct_seq_nbr	Integer	BOSS precinct sequence number used to order precincts on reports.
Reg_voters	Integer	Registered voters.
Turn_out	Float	Total percentage turn-out for the precinct.
Contest_id	Integer	BOSS contest ID.
Contest_seq_nbr	Integer	Order of the contests on the ballot.
Contest_title	Char(100)	Contest Title.
Contest_party_name	Char(50)	Party name associated with the contest.
Selectable Options	Integer	The number of options that can be selected in the contest.
candidate_id	Integer	Candidate BOSS Choice ID.
Candidate_name	Char(100)	Candidate name.
Candidate_Type	Char(1)	Candidate Type: ◆C- Normal Candidate ◆W-Write-in Candidate (Certified)
Cand_seq_nbr	Integer	Used to order the candidates by BOSS.
PartyCode	Char(10)	Party code for the candidate.
Total_Ballots	Integer	Total ballots cast in precinct.
Total_votes	Integer	Total votes for the candidate in precinct.
Total_Under_Votes	Integer	Total undervotes for a contest in precinct.
Total_Over_votes	Integer	Total overvotes for a contest in precinct.
Absentee_Ballots	Integer	Ballots cast absentee.
Absentee_votes	Integer	Absentee Votes for candidate.
Absentee_under_votes	Integer	Absentee undervotes for contest.
Absentee_over_votes	Integer	Absentee overvotes for contest
Early_Ballots	Integer	Ballots cast early.
Early_votes	Integer	Early votes for candidate.
Early_under_votes	Integer	Early undervotes for contests.
Early_over_votes	Integer	Early overvotes for contests.
Election_Ballots	Integer	Ballots cast on election day for precinct.
Election_votes	Integer	Votes cast election day for candidate.
Election_under_votes	Integer	Election undervotes for contest.
Election_over_votes	Integer	Election overvotes for contest.

Sample File


TallyDetailVoteTotals.txt - Notepad

File Edit Format Help

```
"Precinct_name","Split_name","Reporting_flag","Update_count","Pct_Id","Pct_seq_nbr","Reg_voters","Turn_
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"1001","",1,1,1,1,125,0.01,2,2,"Governor","Republican",1,2,"Another Choice","C",2,"REP",1,1,0,0,0,0,0,0
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"1001","",1,1,1,1,125,0.01,3,3,"Governor","Democratic",1,2,"Another better choice","C",2,"DEM",1,0,0,0,
"1001","",1,1,1,1,125,0.01,4,4,"Proposition 1","Non-Partisan",1,1,"For","C",1,"NP",1,0,0,0,0,0,0,0,1,0,
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"1002","",1,1,2,2,125,0.02,2,2,"Governor","Republican",1,1,"Best Choice","C",1,"REP",3,1,0,0,0,0,0,0,3,
"1002","",1,1,2,2,125,0.02,2,2,"Governor","Republican",1,2,"Another Choice","C",2,"REP",3,0,0,0,0,0,0,0,0
"1002","",1,1,2,2,125,0.02,3,3,"Governor","Democratic",1,1,"Better Choice","C",1,"DEM",3,0,0,0,0,0,0,0,0,
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"1003","",1,1,3,3,125,0.02,2,2,"Governor","Republican",1,1,"Best Choice","C",1,"REP",2,1,0,0,0,0,0,0,2,
"1003","",1,1,3,3,125,0.02,2,2,"Governor","Republican",1,2,"Another Choice","C",2,"REP",2,1,0,0,0,0,0,0,0
"1003","",1,1,3,3,125,0.02,3,3,"Governor","Democratic",1,1,"Better Choice","C",1,"DEM",2,0,0,0,0,0,0,0,
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"1005","",1,3,5,5,125,0.02,3,3,"Governor","Democratic",1,1,"Better Choice","C",1,"DEM",3,0,0,0,0,0,0,0,0,
"1005","",1,3,5,5,125,0.02,3,3,"Governor","Democratic",1,2,"Another better choice","C",2,"DEM",3,0,0,0,
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"2001","",1,5,6,6,250,0.01,2,2,"Governor","Republican",1,1,"Best Choice","C",1,"REP",2,1,0,0,0,0,0,0,2,
```

Note: The Precinct ID in the HART file is an assigned # by Hart. Therefore, many counties put the precinct code into the Precinct_Name field.

Appendix D: Election Data Structures

Notes:

The following is an exercise by the author to think through what a comprehensive data language with major data elements would need to look like to provide a flexible and extensible data language that supports the needs of the developing electronic ballot delivery elections area in two areas: Election Result Reporting and Ballot Style Definition.

This is a starting place. This work was done without re-referencing significant efforts like the Election Markup Language (EML) put forth by the IEEE. The author intends to follow up by reviewing these other approaches to see how they approach this elections space.

This note should make clear to the reader that the deficiencies in the following are the sole responsibility of this author.

A Conceptual Data Structure for Elections:

Election data can be structured in many different ways. For example, although Appendix B is an implementation of Hart's XML election definition schema, it clearly suggests an alternate structure to the one below that could be implemented for election result reporting. A review of Appendix C will show how a few of the major voting systems vendors have implemented election result reporting in existing systems.

The author believes a structure like the **Election Result** data structure below has the flexibility to be used in a variety of circumstances, ranging from:

- Reporting a single electronic ballot to the host tabulation system (from a UOCAVA voter, for example)
- Reporting results from DRE, POS, and CCOS systems to the host tabulation system.
- Reporting results from an election jurisdiction voting system to the state reporting system (both cumulative and at a precinct level)
- Reporting results from the state reporting system to media (both cumulative and at a precinct level)

The author believes a structure like the **Ballot Style** data structure below has the flexibility to be used in following situations:

- Updating a voter registration system with the ballot styles created by the voting system (ballot layout)
- Creating a single ballot for electronic delivery (if combined with something like a Cascading Style Sheet (CSS)))
- Defining ballot styles for use by a online UACAVA voting systems (if combined with something like a Cascading Style Sheet (CSS))

The attached Ballot Style data structure is a subset of all the data elements necessary to communicate ballot style definitions to POS, CCOS, and DRE equipment.

Election Result Data Structure:

<Election (ElectionName, ElectionType)>
<ElectionJurisdiction (ID, Code (in WA, this is the CountyCode), Name (county name), StateCode, StateName)
< Political Parties>
<Party (PartyID, Code, Name)/>
</ Political Parties>
< VotingTypes>
< VotingType (ID, Code, Name)/>
{<ComponentType (ID=1, Code='EV', Name='Early Voting'/>
<ComponentType (ID=2, Code='AB', Name='Absentee'/>
<VotingType (ID=3, Code='PV', Name='Poll Voting'/>
<VotingType (ID=4, Code='OS', Name='UOCAVA''/>
<VotingType (ID=5, Code='ALL', Name='All''/>
}
</ VotingTypes>
< ComponentTypes>
< ComponentType (ID, Code, Name)/>
{<ComponentType (ID=1, Code='POS', Name='Precinct Optical Scan'/>
<ComponentType (ID=2, Code='DRE', Name='Direct Recording Electronics'/>
<ComponentType (ID=3, Code='CCOS', Name='Central Count Optical Scan'/>
<ComponentType (ID=4, Code='ONL', Name='Online Internet'/>
<ComponentType (ID=5, Code='ALL', Name='All'/>
}
</ ComponentTypes>

<ElectionJurisdiction-Results>
<VoterGroups>
<VoterGroup (VotingTypeID, ComponentTypeID>
<Jurisdictions>
[Jurisdiction] (JurisdictionID, PrecinctsReported)
<Contests>
<Contest (JurisdictionID, ContestID) >
<PrecinctSplit BallotsCast, Undervotes, Overvotes, PrecinctSplitID, ContestID)
<Candidates>
<Candidate (Votes, PrecinctSplitID, CandidateID) />
</Candidates>
</PrecinctSplit>
</Contest>
</Contests>
</Jurisdictions>
</VoterGroup>
</VoterGroups>
</ElectionJurisdiction-Results>

<JurisdictionsInElection>
<JurisdictionTypes>
<JurisdictionType (ID. Code, Name, Rank, ElectionJurisdictionID) />
<Jurisdictions>
<Jurisdiction (ID, Code, Name, Rank, JurisdictionTypeID) />
</Jurisdictions>
</JurisdictionsInElection>

<Contests>
<Contest (ID, Rank, Name, Type{candidate, measure}, maxVotes, JurisdictionID) />
<Candidates>
<Candidate (ID, Name, Rank, Votes, IsWriteinCandidate, PartyID, ContestID) />
</Candidates>
</Contests>

< PrecinctSplits>
<PrecinctSplit (PrecinctSplitID,PrecinctCode, PrecinctName, PrecinctRank, RegisteredVoters)/>

```
    </ PrecinctSplits>

    <JurisdictionsInElection-PrecinctSplits>
        <Jurisdiction-PrecinctSplit] (JurisdictionID, PrecinctSplitID) />
    </JurisdictionsInElection-PrecinctSplits>

    </ElectionJurisdiction>
</Election>
```

Ballot Style Definition Data Structure:

<Election (ElectionName, ElectionType)>
<ElectionJurisdiction (ID, Code (in WA, this is the CountyCode), Name (county name), StateCode, StateName)
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<Party (PartyID, Code, Name)/>
</ Political Parties>
< VotingTypes>
< VotingType (ID, Code, Name)/>
</ VotingTypes>
< ComponentTypes>
< ComponentType (ID, Code, Name)/>
</ ComponentTypes>

<BallotStyles>
<BallotStyle (BallotStyleCode) />
<BallotStyle-Jurisdictions>
<BallotStyle-Jurisdiction (BallotStyleCode, JurisdictionID) />
</BallotStyle-Jurisdictions>
</BallotStyles>

<JurisdictionsInElection>
<JurisdictionTypes>
<JurisdictionType (ID. Code, Name, Rank, ElectionJurisdictionID) />
<Jurisdictions>
<Jurisdiction (ID, Code, Name, Rank, JurisdictionTypeID) />
</Jurisdictions>
</JurisdictionsInElection>

<Contests>
<Contest (ID, Rank, Name, Type{candidate, measure}, maxVotes, PartyID, JurisdictionID) >
<Candidates>
<Candidate (ID, Name, Rank, Votes, IsWriteinCandidate, PartyID, ContestID) />
</Candidates>
</Contests>

< PrecinctSplits>
<PrecinctSplit (PrecinctSplitID,PrecinctCode, PrecinctName, PrecinctRank, RegisteredVoters)/>
</ PrecinctSplits>

<JurisdictionsInElection-PrecinctSplits>
<Jurisdiction-PrecinctSplit] (JurisdictionID, PrecinctSplitID) />
</JurisdictionsInElection-PrecinctSplits>
</ElectionJurisdiction>
</Election>