ABSTRACT
This paper describes a joint university-government effort to develop software that helps journalists, voters, and watchdog organizations visualize campaign funding data in San Francisco. The paper also presents broader plans for constructing comprehensive electronic identities for politicians, and describes how emerging trends in online information systems can be leveraged. The newest version of the software is at http://www.whosfundingwhom.org.

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Design, Human Factors, Standardization

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1. INTRODUCTION
There has been little progress in campaign finance reform and public disclosure since Roosevelt spearheaded the Publicity Act of 1910 [8]. Computers have helped—San Francisco and New York initiated the first required online filing systems in 1993[4] and there are now megabytes of data existing in thousands of databases across the country. Unfortunately, there is a lack of sufficient software for viewing that data. Existing software leaves journalists and voters to perform the virtual equivalent of rummaging through file cabinets to discover the web of financial relationships that control our elections and country.

The inaccessibility leads to: 1) Voters being ill-informed concerning who is funding candidates, 2) Journalists and investigators spending weeks uncovering information that could be at their finger tips, 3) Campaign ethics commission administrators investigating only the most egregious of filing violations. The end-result is less transparent campaigns and more corporate influence handcuffing our leaders.

The lack of sufficient visualization software can be attributed to the shortage of funds for such projects in local and state governments, as well as the high cost of developing software. Most city information technology departments are overwhelmed with the challenge of making government services available online, and have thus far focused on implementing online forms and rudimentary viewing systems.

The Transparency in Government project at the University of San Francisco (USF) is an example of how universities can help fill this void. Working directly with the San Francisco City Ethics Commission directors and staff, USF students have created a software tool for viewing campaign finance data that is filed in San Francisco. The software periodically downloads the raw data from the Ethics Commission and builds graphs and web forms that make it easy for users to follow campaign funding trails.

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The current version of the software, found at http://www.whosfundingwhom.org (see Figure 1), is the first step in a larger goal of providing comprehensive electronic identities for our leaders and those running for office. In this paper, we describe the current status of the software and the issues involved, then discuss strategies for extending it based on the semantic web and social software.

2. PROJECT ORIGINS
Through its Ethics commission (www.sfgov.org/ethics), San Francisco is one of the leaders in online filing—they enacted the first mandatory electronic filing bill and built the world’s first online campaign finance database [1].

In terms of campaign finance data, San Francisco, like most municipalities, has henceforth focused on the input-side—replacing the old paper forms with online equivalents as required by newly enacted laws. Less attention has been given to output—allowing the public to easily visualize the data. Currently, a user can search the resulting database to retrieve forms and summaries. Though it is more than what most local municipalities provide, the site is not ideal for analyzing data—it does not allow a user to quickly view the key officers and candidates, navigate the money trails inherent to campaigns, or provide a graph view of multiple entities and funding relationships. As a simple example, when the user views the entities who have funded Mayor Newsom, the user cannot then click on them to see the entities that have funded the entities that fund Newsom.

Aware of the potential for this online data, as well as the lack of resources available to the Ethics Commission, Commissioner Joe

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Lynn approached representatives from the Leo. T. McCarthy Center for Public Service and the Common Good at USF (http://mccarthycenter.usfca.edu). Under the direction of Patrick Murphy, the center is a focal point of the university’s service learning initiative and the university’s mission of educating hearts and minds. Commissioner Lynn’s idea was met with enthusiasm from Murphy, the Center’s namesake, Leo McCarthy, as well as former mayor of San Francisco Art Agnos, who serves on the Center’s board.

The missing link was the connection to technology. Centers like the McCarthy Center, and public service efforts in general, have traditionally been concerned with humanities—sending students to work on political campaigns or inner-city soup-kitchens. Fortunately, USF has emphasized service learning in the sciences as well, perhaps most prominently in the computer science department. The McCarthy center had already helped fund the department’s Community Connections effort (www.usfca.edu/cc), which regularly sends students into inner city computer centers to provide information technology services and annually sends a group to Peru to build and maintain computer labs at needy schools.

Whereas the previous Community Connections projects focused on system administration tasks, this one would focus on software development, which is the primary focus of the computer science curriculum and more in-line with what most computer science students will end up doing for their careers. The department embraced the idea put forth by Lynn, Murphy, McCarthy and Agnos, and a collaborative effort was born.

Beginning in August of 2004, five USF students and one professor began development of the software. The key challenge was determining the specifications for the project, including gaining an understanding of the funding data and all of its complexities. This domain analysis was only possible through the efforts of the Ethics Commission directors and staff, most notably directors Mabel Ng and John St. Croix, as well as Oliver Luby, the staff member with the most expertise in actually using the funding data to uncover filing inconsistencies.

Through an iterative development cycle, analyzing top federal data sites like www.opensecrets.org and the Federal Elections Commission site (http://www.fec.gov/disclosure.shtml), and continual consulting with those at the Ethics commission, the
team completed a working version of the funding data visualization software, as well as the city’s first online lobbyist filing system. The campaign funding site, which is the focus of this paper, is publicly available at http://whosfundingwhom.org, while the lobbyist software is now undergoing pilot testing with a selected group of lobbyists. Nine different students have participated in the project over the year and half of its existence, funded in part by grants from the McCarthy Center and the City of San Francisco.

3. SYSTEM OVERVIEW

The campaign funding visualization software takes raw data supplied from the Ethics Commission, builds a relational database from it, then displays the data in forms that allows a user to easily view campaign activity and funding trails. The system shows only campaign funding data filed by political committees in San Francisco.

The key goal is to help users do what Deepthroat suggested to Woodward and Bernstein in the Watergate investigation: “follow the money”. The system provides two methods of navigating such trails: a table-based method that displays the data for a particular entity and allows quick navigation to the page for another entity (see Figure 2), and a graph view that provides a birds-eye view of multiple entities and chained relationships (see Figure 3).

3.1 Where do Users Start?

In the original Ethics Commission viewer, the landing page was a search page in which the user could enter a name and get a listing of the forms filed relating to that person or committee. Such a search page is necessary, but it assumes that the user is looking for a particular entity and has knowledge about the key players in the city’s government. For most users, it is not an ideal introduction to the system.

A key innovation in the whosfundingwhom.org software is the introduction of a landing page which is a list of the key offices in San Francisco, including the Mayor, the District Attorney, and the Board of Supervisors (see Figure 1). This page gives the user a birds-eye-view of the politicians in San Francisco and quick summaries of the funding records for the politicians and their key committees.
Figure 3. The Graph View of a Politician’s Funding Relationships

So that the page can be updated without the intervention of a web developer or programmer, administrative pages were created that allow a non-technical staff member to enter the current office holders and important information about them. These forms, and the underlying database holding this basic information, is necessary because this data is not part of the campaign funding data at the Ethics Commission (it stores only funding transactions without information about the office of the entities).

Besides allowing the administrator to specify that, for instance, “Gavin Newsom” is the “Mayor”, the software also allows for the specification of an image and a homepage for each person, along with a list of the committees associated with the person. Though it easy for a human to know that “Gavin Newsom for Mayor” is a committee for “Gavin Newsom”, software cannot make such an assumption, so such human intervention is necessary.

The data displayed in Figure 1 combines the additional information provided by the administration forms and underlying database with funding data directly from the Ethics Commission site. The columns labeled ‘committees’ show only those committees that the administrator has specified as being associated with the officer. The funding summary data, and the data that can be seen if the link is followed, all comes from the campaign funding database.

Without this additional data, a user would have to either know the committees of a particular officer, or use a search page to scout for the associated committees. Furthermore, without the politician-committee relations being set explicitly in the database, it wouldn’t be possible for software to summarize data amongst the associated committees (whosfundingwhom.org doesn’t perform these calculations currently, but the database is designed to allow it).

3.2 Table-Based Navigation

When the user selects one of the entities from the landing page or the search screen, data concerning that entity is displayed in a tabular format, as in Figure 2.

In this example, the funding data for “Aaron Peskin for Supervisor” is displayed. Four tables are displayed. For a politician’s committee, the first two—“Top Contributors” and “Top Expenditure Recipients”—are generally non-empty. When a donor, independent committee, or vendor is displayed, other tables are more important (e.g., vendors generally have non-empty expenditures received).
The tables show the top ten associations. Each row in the table displays a funding relationship, which is a summary of all transactions between two entities. Sometimes a relationship consists of just a single transaction, e.g., the first row shows a single transaction between “Aaron Peskin for Supervisor” and “Robert Dockendorff”. Sometimes two entities have shared more than one transaction. For instance, the second table in Figure 2 shows that there are 5 transactions between “Aaron Peskin for Supervisor” and “Stearns Consulting”. Unlike many current systems, including the one at the San Francisco Ethics site, the user can navigate a money trail by selecting one of the entities listed. For instance, if “Stearns Consulting” is selected in the table of Figure 2, the user sees a listing of Stearns Consulting’s funding data, which shows that the firm also received expenditures from the San Francisco Women’s Political Action Committee.

### 3.3 Graph-View

While a table provides detailed information concerning a funding relationship, it shows funding trails at only one degree of separation. whosfundingwhom.org also provides a graph view that shows entities and relationships with multiple degrees of separation (See Figure 3).

The graph shown in Figure 3 was invoked by selecting “Graph View” from the “Aaron Peskin for Supervisor” tabular view page. Both incoming and outgoing funding relationships are shown and color coded. The graph allows the user to view multiple-degree relationship chains, e.g., Peskin’s committee accepted a contribution from Robert Dockendorff who also contributed to Kamela Harris.

The graph view induces the biggest “aha!” reaction from those that have viewed it. At the unveiling of the software, Ethics commission staff and other interested parties immediately became engaged in discussions not about the software, but about the data. This slowed progress in terms of getting technical feedback but gave a great indication about how powerful data visualized in this way can be.

Eventually, such a graph could be designed so that relationships other than just money flow could be shown. For instance, the nodes for an individual could point to his or her associated committees, or the node for a committee might be connected to the lobbyists it has hired. The key to implementing such views lies in integrating data from various databases, as will be discussed in Section 5.1.

### 4. PLANNED REFINEMENTS

Plans for the next version of the “whosfundingwhom.com” software include the following refinements: 1) Eliminating unwanted aliases, 2) Providing ‘top ten’ lists and dynamic lists created by administrators.

#### 4.1 Eliminating Unwanted Aliases

Certainly electronic filing improves the state of campaign information compared to the days of paper forms. Consider this statement:

“The old paper system made it difficult to track the flow of campaign cash . . . The candidates often did their best to keep the public in the dark. Former Governor Mario Cuomo’s reports regularly included handwritten entries, some illegible. [Governor George] Pataki filed printed reports, but used extremely small print and alphabetized his list of contributors for a time by first name.[4]”

However, on-line filing and of itself does not eliminate the problems presented in the above quote. If input is based primarily on typing free text into unstructured text fields, the problems with paper filings will persist in the electronic world, as filers can wittingly or unwittingly refer to the same entity differently at different times.

For instance, in the raw data we download from the San Francisco Ethics Commission site, there are numerous examples whereby a single entity is referred to by various names. This is essentially an “input” problem caused by users typing entity names into unstructured text fields instead of choosing from data that is already in the database. With unstructured text, even an extra space or comma can lead to problems. For example, in San Francisco’s campaign finance data of 2004, “Haight Street Mortgage” appears as:

- Haight Street Mortgage
- Haight Street Mortgage Co Inc
- Haight Street Mortgage Co., Inc.
- Haight Street Mortgage, Inc.

A human can easily surmise that the text strings all refer to the same entity, but a computer program cannot make that assumption, so data will be displayed incorrectly.

It should not be assumed that such misinformation is due to wrong-doing. In this case, Haight Street Mortgage had no part in the problem-- various other entities filed “received payment” forms and typed in the mortgage company’s name in slightly different ways.

The root of the problem is that many on-line input forms are just paper forms directly transferred to the computer. With such PDF-like forms, the user can only enter text in boxes and cannot choose from existing entries. This is an example of a more general problem in human-computer interaction—programmers modeling the on-line world too closely to the paper world and not taking advantage of what is electronically possible.

Web applications, as opposed to PDF-forms, can connect directly to the live database and allow the user to choose from existing entities. Such applications can also notify the user, as her or she types, that an entity with a similar name exists. Such simple facilities can reduce the count of unwanted aliases significantly.

With no control over the input side of the equation, the plan for whosfundingwhom.org is to tackle the problem by performing alias processing on the raw data downloaded from the Ethics commission. Like the specification of associations between individuals and committees, such processing will be a joint effort between software and human—the computer can flag similar names and ask the administrator to make the final call on whether the similar names refer to the same entity. Our plan is to add this capability as part of the administration forms, so that Ethics Commission staff can continually monitor the data to remove unwanted aliases.
4.2 Additional Lists
Currently, the system allows a user to find a particular entity through the landing page of top officers, through a direct search, or through an association. The plan is to also add ‘top ten’ lists which will provide pages for 1) the top n contributors over a time period, 2) the top n receivers of contributions, 3) the top n spenders, and 4) the top receivers of expenditures.

Whereas these lists are pre-defined, the system will also allow an administrator to create additional lists on-the-fly, just as the top officers page is created now. Such form-based list creation adds great flexibility to a site as users, not just programmers, can specify the collections of data that are displayed. Amazon was an early proponent of user lists, allowing users to create lists of books within their Listmania framework, and integrating those lists within their searches. Jeteye (www.jeteye.com) has applied the idea more generally to the web, providing a site whereby users can create arbitrary lists of web pages, notes, and images.

For whosfundingwhom.org, the administrator will be given the ability to create lists of entities, e.g., a list of “current candidates”, a list of “republicans” in the city, or a list of “political consultants”. The underlying motivation is that politics is dynamic in nature, so the system needs to be flexible enough to allow the data shown on the site to change dynamically. And, because of the high cost of software and the lack of funds available to most government organizations, a key is that those changes can be made without a software/web developer.

5. FUTURE OF POLITICAL E-IDENTITY
Developing software for visualizing campaign funding data is the first step in USF’s Transparency in Government Project. The long-term goal is to provide comprehensive information about the public record of politicians.

With the current state of the web, there is a lot of information but little organization. Journalists and other interested citizens can now forage for information at sites put out by the politicians themselves, at non-partisan sites that attempt to provide objective information politicians, and finally to blogs and other participatory sites that provide a forum for public discourse.

Key data points of a politician’s public record include campaign finance information, information about the lobbyists or consultants hired by the politician, the politician’s voting record and stand on issues, the politician’s appointees and appointors, the organizations the politician has awarded government contracts to, and the politician’s employment records.

Much of this information exists on the web, but it is scattered. Compiling a politician’s public record takes a single investigator days, weeks, or even months to collect it from the various web pages on which it resides. And because most of the information is not structured—it is free text—software cannot perform such a task in an automated manner.

There are two strategies for tackling the problem: one is to induce organizations to publish information in a standardized XML format. If data were published in this manner, instead of as free text “reports” on web pages, then automated software could collect, process, and display it in various ways. Specifically, a site like whosfundingwhom.org could access data from various services to provide a more comprehensive view of a politician’s identity. The site might access, for example, voting records from the city elections commission, appointee records from the mayor’s office, and directors information from the Chamber of Commerce, in standardized XML forms, then display the data in graphs such as Figure 3. Such a strategy, based on standardized web services, is an example of a general movement in information systems to a more semantic web [2].

The second strategy involves collaborative tools that can harness the time and effort of the many politically interested individuals now roaming the web. The idea here is that, until the day when all information sources publish data in a standardized XML format, there will be a need for humans to read web pages and extract the data that is pertinent to a politician’s public record. Whereas such a task is too enormous for a single individual or group, it could be possible with the combined efforts of the collective.

With this strategy, a site like whosfundingwhom.org would provide publicly accessible input forms for entering information about politicians and political organizations into the comprehensive system. Some of these forms now exist—forms for specifying who the current officers are, forms for specifying the committees of each politician, and forms for data like a politician’s home page and image. These forms could be opened to the public, and could be extended to allow for the entry of various types of data and relationships.

Such public collaboration has gained wide acclaim with the success of such efforts as wikipedia.org, an on-line encyclopedia that allows anyone to create and edit content. But can a collaborative strategy be used to collect and organize political information? And is it possible to harness the power of the many while also staying objective?

5.1 Semantic Web
Tim Berners-Lee, one of the founders of the web of today, is the leader in the movement towards the creation of a semantic web [2], one that consists of structured data and not just web pages. The semantic web is based on information systems providing web service access to their data, and providing input forms that enable the creation of structured data.

5.1.1 Web Services
Web services are distributed programs that allow client software to query another computer for particular data. Unlike normal web page requests, which return HTML, web service requests return data in a machine-readable XML format. In essence, web services provide the data without all the presentation formatting of HTML, from which software has a difficult time in extracting desired data.

There has been little progress towards providing web service access to campaign finance data. At the federal level, the FEC site (http://www.fec.gov/disclosure.shtml) does publish data in a structured format that can be read by computers, but it is in the form of a single downloadable file, not a web service, so the only way to use it is to download it in its entirety.

If the FEC site provided web service access to its information, a client program could request, for example, all the contributors of a particular politician. The results would be returned in a structured manner, without presentation formatting, so that the client program could process it, combine it with other data, and display it in any way it wants.
Such web services are the key to the interoperability problems involving databases “owned” by various sources and in various formats. If interested parties can agree on a standard XML format for queries like “return all contributors of politician X”, then client programs can query different web services, e.g., the federal campaign finance service, the local campaign finance service, the lobbyist service, and a board of director service. Programs can then process the various data and display it in a comprehensive way. A user could then go to one site, enter a politician’s name to view all information about the politician, and be able to follow associative trails, e.g., view information about the politician’s lobbyists.

5.1.2 URI-based Input
Allowing a user to choose from existing entities, as discussed in section 4.1, can provide significant improvement in an information system, but that in and of itself does not eliminate the potential for ambiguity. Semantic web proponents also consider issues of identity through the use of Uniform Resource Identifiers (URI). URIs are like URLs in that they are globally unique identifiers, but unlike URLs they do not necessarily map to a file on some server.

What URIs can provide is help in uniquely identifying real world objects like people. Instead of referring to “David Wolber” in a web page to refer to the author of this paper, one could refer to “cs.usfca.edu/wolber” which is the unique uri for David Wolber, the USF professor.

Of course filers cannot be expected to know the URIs of individuals. What is needed is a global name service which client software can access, and which provides a mapping between basic information (last name, first name, etc.) and a URI. When a filer enters a name, this service would be queried to return a list of matching known individuals. The user would then be allowed to choose from the list. Beneath the surface, the software would identify the individual using the URI from the service.

5.2 Public Participation
The previous section discussed one strategy towards building comprehensive political information sites: inducing information sites to publish their data in web service form, which would allow other software to access data from various places in order to provide comprehensive views of a politician’s public record. But such an “automated” strategy is dependent on many organizations agreeing to publish data in this way, then agreeing on a standard, and finally actually implementing the changes. Such a process may take years and it is doubtful that all pertinent information will be made available in XML form.

The key problem is that most data is in web page report form, which is understandable by humans but not software. A human can read it and understand it, and if given the time could research thousands of pages on the web and come up with a cohesive collection of data. For instance, Josh On researched the web pages...
of hundreds of companies to compile a comprehensive list of the board of directors in corporate America[7] He then made this information publicly accessible at the website http://www.theyrule.org (See Figure 4).

Unfortunately, humans don’t have unlimited time to perform such work. theyrule.net, for instance, has only 2004 data and is not kept current. Can software perform such a task? Well, as discussed, software is best able to read structured data—data in pre-defined tables and fields. Natural language processing has progressed, but is not near the point in which a software program could crawl the web to discover the websites of all Fortune 500 websites and extract the board of directors information from them.

The semantic web solution, for theyrule.net would be to require corporations to file a list of their board of directors, and then have the government make that information available in a machine-readable XML format. Short of such automation, there is also the strategy of engaging the masses. There are thousands of intelligent people roaming the Internet along with emerging collaborative tools which can tap their enormous potential. Wikipedia (www.wikipedia.org), the on-line encyclopedia, is probably the most popular site that is edited by all that choose to contribute.

Another is www.de.li.co.us.com, an on-line bookmarking system that allows users to categorize web pages and together create a folksonomy of popular web pages. A third example is Slashdot (www.slashdot.com) which allows users to submit and rate technology “stories”. The basic idea in all of these systems is to tap the power of the “technorati” on the Internet by letting everyone become not just consumers of information but publishers of information (prosumers).

The power of such collaboration has barely been tapped in the political world. www.politicalfriendster.com is one of the earliest political sites allowing the public at large to enter data. It allows any user to add a new person or organization to the database and add associations between entities, e.g., George H. Bush is senior advisor to the Carlyle Group and a close friend of Prince Bandar Bin Abdul Aziz. Such relationships probably cannot be found in any existing database, only in news articles and documentaries. By entering such relationships into Political Friendster, a user brings them into the structured data world and potentially to any software that focuses on displaying political relationships (political friendster currently does not publish its data in XML format, however, so one can only view the associations through that website).

The key issue with participatory sites is integrity of data and the potential for erroneous information to be input. Wikipedia has recently had some high profile problems, including one involving a man being accused of involvement in the Kennedy assassination [9], and another involving staff members of Senator Diane Feinstein altering reports concerning her husband’s investments [5]. The stakes might even be higher for a site focused on politics.

But should public participation in data gathering be disallowed just because the data is so sensitive? Political blogs, after all, have even worse potential for erroneous information as users can enter any unstructured text.
The issue is to determine an appropriate level of site moderation and whether the moderation should be administered by a trained individual, the users themselves, or a combination thereof. Slashdot, the technical news site, takes the latter approach. A team of individuals from the organization chooses which stories to “publish” from all those input by the public. Users then comment on stories. Because a story can have hundreds or even thousands of comments, a reputation mechanism is provided whereby users rate each other’s comments. Those that have had highly rated comments in the past are given high reputations and their comments are listed more prominently. Because users themselves help moderate the site, a significant burden is removed from the site maintainers—Slashdot would have to hire thousands of employees to keep up with the work. As non-partisan political information sites are often maintained by non-profit organizations, it is likely that funding will be scarce and public moderation will be a necessity. The reader is referred to [6] for a discussion of reputation and moderation schemes.

5.3 Next Steps
We plan to explore both the semantic web and public participation directions within the Transparency in Government project. The idea of opening the site to public participation has received less than enthusiastic support from both the McCarthy Center board of directors and the Ethics Commission, who both have advocated for limiting the site to objective data only. One possible compromise is allowing human-input but restricting it to a password-protected user-base consisting of trained administrators. Of course this solution severely restricts the amount of data that can be included since it doesn’t harness the power of the masses. Other potential solutions include limiting the types of data that can be input (e.g., no free text comments, just associations) and providing extensive moderation to the site.

On the semantic web side, we are conducting a survey of existing XML-based initiatives in government, beginning with the list at XML.gov, and including inquiries into various local agencies. We also plan to implement a web service interface to our augmented campaign funding data, and explore the possibility of initiating the development of a standard protocol for such data.

6. SUMMARY
Early feedback of whosfundingwhom.org suggests that the software can significantly increase the ease of investigation. We see journalists and ethics commission staff as the key audience for the software, though those interested in identifying funding sources have also shown interest.

Besides the value of its end-product, the Transparency in Government Project at USF can also serve as a model in terms of university-city collaboration and service learning within the computer science curriculum. Many computer science students are well-skilled by the time they are in the upper classes. Instead of working on “academic” problems, they can apply their energies to real problems and help the community. The students who have participated in “whosfundingwho” have gained invaluable experience not often gained in a school setting—requirements gathering, working with people, giving presentations to groups including VIPs like Leo McCarthy and Art Agnos, human-computer interaction analysis, and exhaustive software testing. The students have also been exposed to the possibility of applying their craft in a public service setting, which is unfortunately all too uncommon in computer science education.

Though the project has practical goals, the potential for applied research is great given the relative infancy of both the semantic web and collaborative web sites. Semantic web research is in great need of problems that can really help someone: political data on the web can provide a great test bed for researching large-scale web service based data aggregation, as well as semantic analysis and inference techniques.

Collaborative tools like del.icio.us have just recently popularized the concept of mass annotation of the web, so the area is not yet well understood. Applying the idea to the political data on the web should present and amplify many of the interesting issues, including privacy, techniques for fair and useful moderation, and issues of automated reputation measurement.

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8. REFERENCES

