

AN ARCHITECTURE FOR A CERTIFIED SERVICE PROVIDER (CSP) TO
COLLECT SALES AND USE TAX FROM ONLINE COMMERCIAL
TRANSACTIONS

By

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For friends..

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Towards the latter half of the 21st century, states have shown an increasing reliance on sales and use taxes as sources of revenue. This is evidenced by a casual study of the increase in rates and the number of local jurisdictions that now levy such taxes (more than 7,500). Gravitation towards sales and use taxes has been attributed towards their general acceptability: they consistently score as being among the fairest taxes in surveys conducted since 1973. Efforts at collecting sales and use taxes from out-of-state businesses that do business in a state have been mired in constitutional, economic, and jurisdictional issues. The supreme court has consistently ruled in favor of the out-of-state businesses stating that it was far too great a burden for them to keep track of changes to tax rates, exempted items, exempted buyers, tax holidays, caps, and thresholds in each of the taxing jurisdictions. Confronted with a colossal erosion of their tax base from Internet based retailers, the states embarked on initiatives such as the Streamlined Sales Tax Project to explore, recommend, and institute changes to participating states' tax systems

so as to make it easier for out-of-state businesses to collect taxes. A technological solution that simplifies many aspects of tax collection and administration while preserving the status quo has percolated through the streamlining efforts as an agreeable alternative to otherwise lengthy and contentious efforts at real simplification.

The work in this thesis is based on the recommendations for a technological solution: a Certified Service Provider (CSP) that collects sales and use tax from online commercial transactions. Online retailers submit an XML document of their imminent transaction to the CSP, which calculates and sends the tax back in another XML document. The retailer remits the tax due on the transaction to the CSP and is absolved of filing tax returns to and audits from the states and jurisdictions. The implementation uses Java, XML, Sybase, and Java Servlets.

CHAPTER 1 INTRODUCTION

One of the reasons formulating fair tax laws for the Internet is complicated has to do with the location independence of entities on the net. Transactions are made possible on the Internet through web sites that have their physical servers, management establishment, and customers-all in different states. Online retail companies can be perceived as the natural extension to traditional mail order firms. The business model is nearly intact: a catalog, a customer, an order, and a shipment. The verdicts from court trials that mail order firms endured from their inception have set the foundation for the manner in which online commercial transactions have come to be considered for tax purposes. Mail order firms have gained significant decisions made in their favor by the Supreme Court in accordance with its interpretation of the commerce clause and the due process clause put forth in the constitution. In the landmark 1967 *National Bellas Hess v. State of Illinois* decision, the court ruled that out-of-state mail order firms could not be required to collect state and use taxes for states in which their only business presence consists of distributing catalogs and other advertising materials [ADV86, p.56]. This decision has subsequently been upheld in the 1992 *Quill v. North Dakota* case. The commerce clause safeguarded a national market by allowing the free flow of interstate commerce: it was far too great a burden to require an out-of-state firm to comply with sales and use tax laws in the states that it does business in, where it did not have *nexus* in. Nexus was clarified with help from the due process clauses as being the establishment of

sufficient minimum linkage between a state and the firm it seeks to tax as evidence of benefits received by the tax remitting firm from the taxing state [ADV86, p.56].

The festering nature of the conflicts inherent in implementing a fair and efficient sales and use tax system was noted by Robert Hawkins, chairman of the Advisory Commission on Intergovernmental Relations in a revelatory 1986 report on the State and Local Taxation of Out-Of-State Mail Order Sales: “Notwithstanding the philosophical and constitutional issues involved, the conflict is a classic one. That between the national interest in protecting the free flow of interstate commerce from unreasonable imposition of state and local taxes, and the rights of the individual states to protect the integrity of their taxing authority and their revenue system” [ADV86, p.iii].

The mail order industry in 1967 was based on a very traditional way of doing business that was predominantly oriented toward physical presence. Limited communication avenues and distribution channels required businesses to have local offices to conduct significant commercial activities in a state. In 1992, even with fast growing 1-800 number sales through newspapers, magazines, television, and computer terminals with catalogue linkup in work places, the court still upheld the Hess judgment. The furious growth of the Internet in the 90s has substantially changed the fundamental nature in the way commerce is conducted in some industries. Despite the dot com crumble of the late nineties, the simple truth is, commerce via the Internet is sensible for these industries, and as business models evolved, it has grown to be even critical for some.

It was in the boom years, however, that states became increasingly alarmed at the real and perceived notion of loss of sales revenue from online sales. Sales tax losses

owing to mail order companies never quite managed to have the critical mass to warrant a sales tax system overhaul but with the proliferation of online businesses, large numbers of transactions were slipping by the obligation to collect sales tax under the nexus requirement. In late 1999 and most of 2000 as e-commerce was making its biggest strides in terms of media hype, capital generation and IPO racketeering, concerns of tax revenue lost and unfairness to main street businesses (that had to collect tax), the states and other concerned parties undertook a search for feasible solutions to collect tax from online businesses. Among the proposals were those to simplify and standardize taxation rules and systems various jurisdictions employed so as to make collecting taxes easier for out-of-state businesses. Simplification is viewed by many as a wicked, unrelenting objective that has failed past attempts at its reckoning. Perhaps what it seeks to accomplish sets it up against forces destined to undermine it in their own efforts at self-preservation. Local jurisdictions have no interest in giving up their specially tailored tax system to one that is more standardized. Local rates, exempted items, exempted consumers, limits, ceilings, and holidays are the result of the community deciding what is best for itself. Any attempt at standardization should ideally allow the leeway for a jurisdiction to customize its tax system, which of course means little or no standardization is possible. Technological intervention, bemoaned by fans of simplification as a patch that sidesteps the real issue, surfaced as a pragmatic solution that preserved the status quo of customization while alleviating some of the real administrative and logistic annoyances that out-of-state businesses faced. The Streamlined Sales Tax Project's broad definition of a technological solution in terms of a certified service provider (CSP) that acts as a third-party conduit between online businesses and tax jurisdictions is the basis of this thesis.

The CSP implementation in this work takes into account most of the recommendations made by the SSTP for a streamlined tax system. Ideas not within the framework of, and at times contradicting the tenets of, the SSTP were also explored and implemented. This work contributes an XML DTD, termed TaxML (Appendix A) to interface between sellers and the CSP. TaxML defines entities and attributes that abstract this work's unique resolution of tax issues-either in accordance, in extension, or in contradiction to SSTP recommendations. Among other contributions, of particular interest to jurisdictions would be the slab based tax system for items in the tax base that require special handling. Different tax rates can be set for items depending on either the quantity in which they are sold or the price at which they are sold. Jurisdictions can encourage or discourage the economic destiny of items by adjusting the slab rates. This will be appreciated by jurisdictions but at the same time be seen as a step in the wrong direction by those who seek simplification-which in the extreme amounts to a single rate in all jurisdictions, across all items. Other significant contributions are in the areas concerning multiple use locations and exemptions. Buyers can have different quantities of the same item delivered and used in different locations. Tax is assessed based on the final use location and not the delivery location. Exemptions are handled using an elaborate mechanism. Exemptions are resolved by considering the buyer exemption period, the jurisdictions for which the buyer has valid exemption, the items that were approved for exemption for that buyer, and the percentage of exemption on the regular tax rate that was granted for that item, for that buyer, in that jurisdiction (details are provided in Chapter 4).

The SSTP is still evolving as it deals with more issues in hearings and meetings, but regardless of the version of the recommendations that are finally binding, the CSP in this work provides a working model that deals with the issues involved in a way that presumably gives all parties involved, despite concessions some may have to make, a system that is still worth the fairness and convenience it ultimately achieves.

A brief overview of the issues surrounding collecting taxes over state lines is presented in Chapter 2. The working mechanism and architecture of the CSP is introduced in Chapter 3. Issues involved in collecting tax are explored based on their relation to the CSP architecture in Chapter 4. Implementation details including information on various technologies used, the data structuring, data flow, and implementing objects interaction are dealt with in Chapters 5 and 6. Chapter 7 summarizes the contributions made by this thesis and discusses future work in this area.

From mid-2001 when the implementation was complete to the time this thesis was submitted, the economy has taken a few tough knocks. Corporate accounting scandals, copious layoffs, pre-emptive strikes, and stock market lows have contributed to a general weariness and a slippery slope to recovery. E-commerce today is more rational in its expectations and scope. It is hoped that the states will find the work in this thesis useful when the economy improves.

CHAPTER 2
OVERVIEW OF ONLINE SALES TAX COLLECTION ISSUES, LANDMARKS,
AND INITIATIVES.

The United States constitution mandates that states shall not enact laws that hamper the free flow of interstate commerce. Thereby Florida must not impose prohibitive tariffs on peaches coming into the state from Georgia and Georgia likewise for oranges. From the earliest cases in the 1930's, states have been grappling with issues of jurisdiction to tax out-of-state businesses that sold goods to in-state customers. Is it possible, the Advisory Commission on Intergovernmental Relations (ACIR) asked in its 1986 report on mail order taxation, to shield interstate commerce from undue tax burdens without causing revenue losses for state governments? This chapter starts with an illustration of the fundamental issues and introduces various efforts at their resolution over the past decades.

The Issue

Take for example three firms: firm A incorporated in Kansas; firm B also incorporated in Kansas but having offices and retail outlets in Florida; and firm C having a retail outlet in Florida.

Scenario 1

A Florida resident chooses to purchase a big-ticket item costing \$1000 from firm A. As firm A does not have nexus or any minimum presence in Florida, it is not required to collect the sales and use tax which at a 6% rate would amount to \$60.

The \$60 however is still due to the state of Florida as the use tax. This has always been the case but such is rarely ever remitted by customers owing to widespread ignorance on the subject, or as was studied, people generally tend towards non-compliance when they observe others doing the same. The inordinate administrative task of collecting use tax from a large number of buyers as opposed to a small number of sellers has resulted in non-enforcement.

Shipping and handling charges would ultimately reduce what seems to be a substantial saving but in general the savings depend on a unique relationship for that item derived from the kind of item it is, its price, and its shipping component. Based on this relationship is a more important and general concept of the price elasticity of demand for that item. Relative to income, the elasticity of demand for a product determines how people base their decisions on which of two or more closely related products to purchase. Price differences might effect either avoiding a purchase or a shift to a closely related product. For example, salt being cheap relative to most people's incomes, on a price increase for their brand, they might never the less continue to purchase their brand. Salt is then said to be inelastic. If on the other hand, people choose to shift between Delta and United Airlines based on a small fare difference, the demand is said to be price elastic. For such products, the tax may become the deciding factor that pushes customers online. But choosing an out-of-state online retailer over an in-state bricks and mortar retailer for closely related elastic products also comes down to the difference not in the products themselves but the sellers. Clothes can be tried out at the store but some guess work goes into purchasing them online. Other considerations such as the shopping and customer service experience that real stores offer (easy store returns, servicing, etc.) overcome

advantages that the tax break might portend to give online stores. However, over time certain categories of products are becoming more apparent in the advantages they possess in their purchase online.

Scenario 2

The Florida resident chooses to purchase from firm B. As firm B has offices and retail outlets (or nexus) in Florida it is required to collect the sales and use tax. This scenario would be no different from the one played out with an in-state or main street retailer.

Interestingly enough, when going online, some nation-wide retailers who had nexus in all states sidestepped the nexus issue by spinning off separate online companies, incorporating them presumably in the state that had the fewest customers. The online companies would then enter into a contract with the brick and mortar “parent” company to handle their deliveries, returns, etc. Such distortion of economic behavior is wryly noted by David Hardesty “The loophole becomes part of the economics of the industry. In order to perpetuate the industry, the loop hole must be perpetuated” [HAR01b].

Scenario 3

The Florida resident purchases from firm C which is a local bricks and mortar retailer. Sales and use tax is collected by the firm and remitted to the state.

The unfairness inherent in applying the same law differently was grudgingly tolerated until the cumulative effects of sales steadily shifting to “tax free” out-of-state retailers were beginning to seriously jeopardize local retail viability in certain segments.

Judicial and Legislative Background

The due process clause mandates linkage between the state and the business firm as defined by a minimum presence or nexus. The commerce clause safeguards a national market free from local entanglements.

The threshold of presence a firm has to exceed to qualify for nexus in a state has varied in quality and degree as evidenced by the court's stand in some landmark cases.

The earliest mail order sales related case of *Nelson v. Sears, Roebuck* established that sellers with retail outlets in a state were required to remit use tax even on mail order sales delivered through common carrier rather than through the retail outlet [ADV86, p.54]. The linkage issue was furthered in five subsequent cases: "1954 *Miller Brothers v. Maryland* where sporadic deliveries by company truck to another state were not considered an adequate business presence. In 1960 *Scripto, Inc. v. Carson*, the presence of ten independent jobbers in the taxing state (no offices, property, or full time employees) met the requirement" [ADV86, p.55]. In the landmark 1967 *National Bellas Hess v. State of Illinois* case, the court ruled that on account of the firm not having sufficient nexus in the state of Illinois, was not required to collect sales tax from its customers in the state. *National Bellas Hess'* business presence in Illinois was limited to the distribution of sales catalogs and flyers. This overturned the statutory provisions of twelve states that had specifically identified mail order sales and advertising to have sufficient nexus at that time. In 1977 *National Geographic Society v. California Board of Equalization*, the existence of two small offices which provided only advertising support was found to have an adequate nexus to collect use tax [ADV86, p.56]. The Internet Tax Freedom Act 1999 includes a provision that states the accessibility of a website in a state does not by itself constitute nexus. It is open to interpretation when the website is hosted

on an in-state computer [HAR98]. In Virginia, however, a ruling was issued that stated an out-of-state auto parts seller who's own web server was located at a hosting company's in-state facilities (that provided hookup and maintenance services) did not constitute nexus [HAR00a].

During the sixties and through the seventies various committees and bills such as the Willis committee bills, Mathias bill, and Mondale bills attempted to seek common ground between the taxing authorities and businesses by introducing ideas such as a registration mechanism for buyers that would remit tax independently, a de-minimis provision to exempt small out-of-state businesses from the burden of collecting tax and the Traigle plan to register a combined state and local tax rate. These attempts helped expand the avenues of resolutions and perhaps simplification. They appeared in several hearings to congress over the late seventies and eighties [ADV86, p.59].

States Arguments and Other Tax Issues

Erosion of Tax Base

The argument from the states point of view was principally that of the erosion of the tax base. States have the obligation to protect their revenue streams to provide for the services it renders to its citizens. Concerns from main street retailers grew over time as to the competitive disadvantage out-of-state businesses place them at by not having to collect sales tax. The arguments from the out-of-state businesses have evolved over the years to be almost insurmountable: The out-of-state business does not benefit from the services a state provides to in-state businesses (that are financed by the sales taxes collected) and, therefore, should be absolved of the obligation to collect tax. To this, the states, and Justice Fortas in his dissent in *National Bellas Hess*, put forth that they (the states) undertake in creating, developing, and sustaining the customer base, banking and

commercial institutions, and communication and transport infrastructure within the state, which by themselves are the services the state provides. A very serious issue out-of-state businesses raise though is one of the costs associated with having to collect tax. A local business has to deal with only one rate, the state rate, or at most two, the local jurisdiction rate that is just added to the state rate. It is a reasonable expectation that a local business can keep track of changes to the tax base. Items such as food, medicines, and clothing are exempt from taxes in some states or are taxed less. New items may be made exempt and currently exempt items may be made taxable. There are temporary changes to the tax rate (tax holiday) along with permanent rate changes. Then there are the exempted buyers such as orphanages, religious, and charitable institutions that get special exemption rates for certain categories of items [ADV86].

Cost of Collecting Taxes

Consider, the sale of a \$10 item for which a 6% Florida state sales tax and a 1% Alachua county sales tax is levied. Suppose a hypothetical 10% gross profit or 100 cents was made by the vendor, the cost associated with remitting tax collected on the sale through either monthly or quarterly returns to the state will factor in as an operating cost. This cost is defrayed in some states by allowing the sellers to keep a percentage of the tax collected. In other states, the costs are entirely borne by the seller. Clearly, the cost of collecting taxes has an impact on profit, and thus, prices [ADV86, p.43].

Incidence and Sourcing

The legal incidence of sales tax is on the buyer in some states (consumer taxes) and on the vendor in some (vendor taxes) and on both in some states (hybrid). The economic incidence however shifts between a higher price paid by the buyer and lower net revenues made by the seller. Regardless of incidence however, sales tax is most commonly

collected and remitted to the state on the buyer's behalf by the vendor as this is easier from an administrative and cost point of view. The sale is said to be sourced not at the sellers' location (origin) but at the location of the buyer (destination) and tax laws in the buyers' jurisdiction apply on that sale. As most of the incidence falls on the buyer, it is logical that his or her jurisdiction, that provides services to its residents, has a stronger claim on the tax. Also treating all out-of-state sellers alike creates a level playing field as opposed to distortions where a seller might be selected based solely on being based in a state, for instance that has low or no taxes [ADV86, p.45].

Acts and Initiatives Affecting Sales and Use Tax

Internet Tax Freedom Act 1998

The Internet Tax Freedom Act (ITFA) passed on October 21, 1998 imposed a 3-year moratorium on the following

- 1) Taxes on Internet access unless such taxes were imposed and enforced prior to October 1st, 1998 and
- 2) Multiple or discriminatory taxes on electronic commerce.

In essence, the ITFA defined a narrow, tax-exempt service (internet access) and a few guidelines to guard against choking e-commerce from zealous taxation. More information about the ITFA is presented in Appendix B.

Advisory Commission on Electronic Commerce (ACEC)

The advisory commission was to conduct a thorough study of federal, state, local, and international taxation and tariff treatment of transactions using the Internet. Its report and recommendations were to be submitted to congress in June 2000. The ACEC, chaired by Virginia governor James S. Gilmore, III, an anti-tax advocate, submitted its report and recommendations, well ahead of schedule in April 2000. On perusing the report, it might

be observed that the formal findings and recommendations dealt with safe and broad issues (privacy and the digital divide). The real, industry-changing issues (sales and use tax) on which congress would have needed guidance, rallied only a “majority vote.” Out of the 19 member committee, there were 7 abstentions for each of the majority vote proposals. The abstentions could probably be interpreted due to a lack of clear information on what is essentially an evolving, contentious issue (ACEC). More information about the ACEC can be found in Appendix C.

Streamlined Sales Tax Project (SSTP)

From its inception in March 2000, the SSTP has made significant strides in its objective to find a solution to simplifying and modernizing the complex tax systems that has been a hindrance to efficient tax collection and administration, both within states and across state lines. The general objectives of the SSTP closely follow the proposals set forth for a simplified tax system by the ACEC. It is one of the recommendations of the SSTP, namely a third party service provider for tax collection which forms the basis for this thesis. The SSTP will be cited continuously through the text of this report. Readers are urged to read the executive summary of the SSTP reproduced in Appendix D.

National Conference of State Legislatures (NCSL)

In the early months of 2001, the National Conference of State Legislatures had approved the SSTP’s final draft of recommendations albeit with some very crucial amendments. The NCSL’s version of the SSTP’s tax agreement omits several provisions that were considered to be controversial. The proposal for a uniform tax base was removed, and the provision on caps and thresholds were removed. The NCSL also voted to move the SSTP from a lead position to an advisory position. This was reported to have

been done to move the process from the tax administrators' realm to that of the politicians.

The NCSL's revised plan has generally found more acceptance among states as it is less threatening than the SSTP recommended changes. As more states enact legislation to participate in the SSTP, it remains to be seen if the states that have enacted legislation to explore the NCSL's amended version make progress in a direction that is more viable [HAR01a].

CHAPTER 3

ARCHITECTURE OF THE CERTIFIED SERVICE PROVIDER (CSP) TAX COLLECTION MECHANISM.

The CSP architecture developed in this thesis, is currently a single tax server established at the machine and port identified in the configuration information. Sellers registered with the CSP send requests in a TaxML (see Appendix A) query document to the CSP's tax server (the CSP's tax server is frequently identified in the text of this report simply as the CSP). The CSP calculates the tax due and sends a TaxML reply document back to the seller. The CSP's bank is credited the tax amount due on the transaction by the seller. Figure 3.1 illustrates the general relationship between the CSP, the sellers, and their customers.

The architecture of the CSP tax collection mechanism, shown in Figure 3.1, can be described in two functional sections: Seller site and Certified Service Provider site. The functionality of each section is described in detail in the following pages.

Seller Site

The level of intrusion of the CSP software at the seller's site is minimal consisting of a thin network protocol client henceforth described as the stand-alone network client module as shown in Figure 3.2. It requires certain networking services and information in the form of an XML document from the seller. Figure 3.2 is a birds-eye view of the data flow between the seller site and the CSP in the form of an XML document.

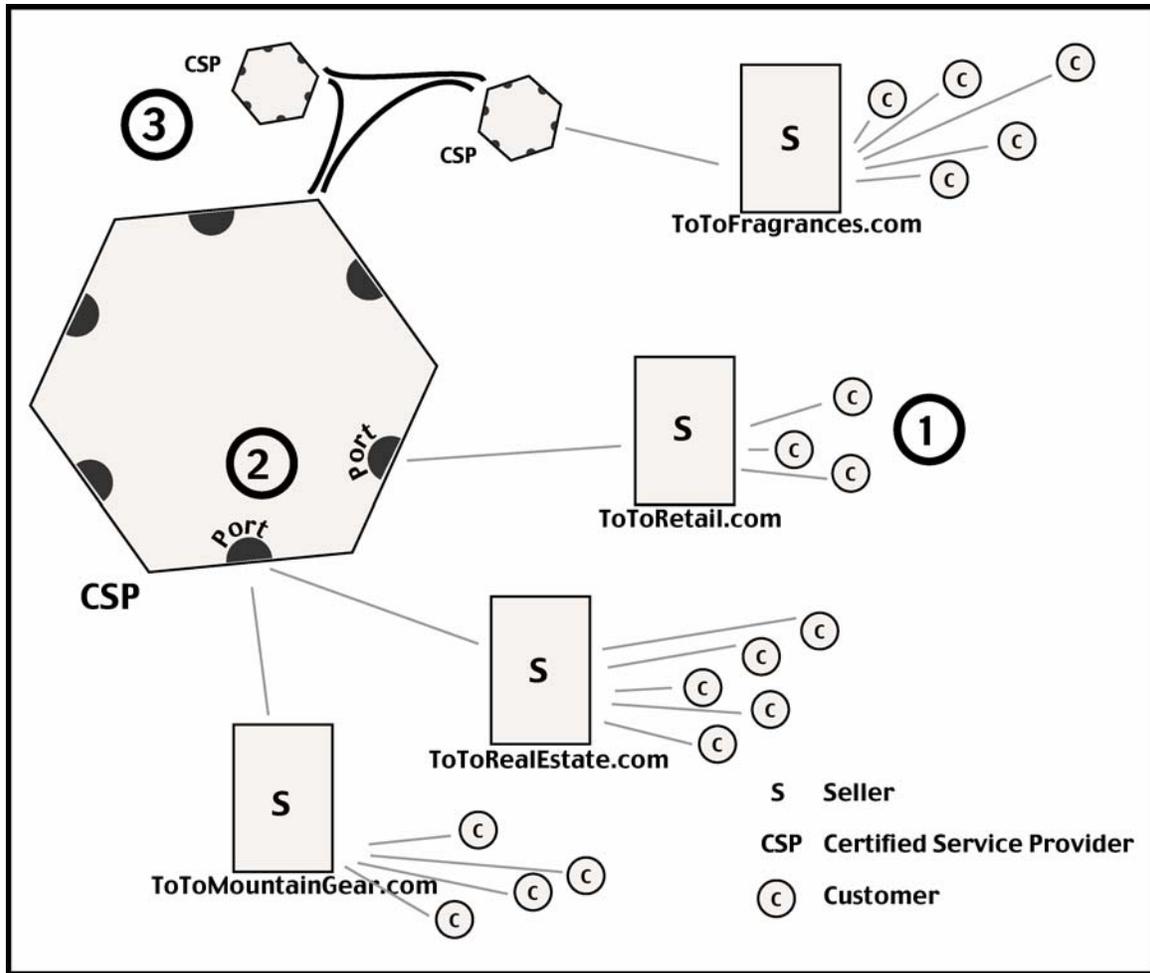


Figure 3.1 The CSP in relation to sellers and their customers. 1) Customers send information about purchasing items, quantities, locations of use, and other information to the seller. To provide for scalability, the following is proposed: 2) Several ports can be established for servicing requests, and for sending back replies. 3) A reliable service can be made available by replicating the CSP's tax server at several sites. Sellers can be given a choice of machines and ports from which to choose, which they prioritize through analysis of their experience with their various choices. A distributed CSP tax server system will need an application to maintain a protocol that ensures coherency and concurrency of distributed objects such as the tax base.

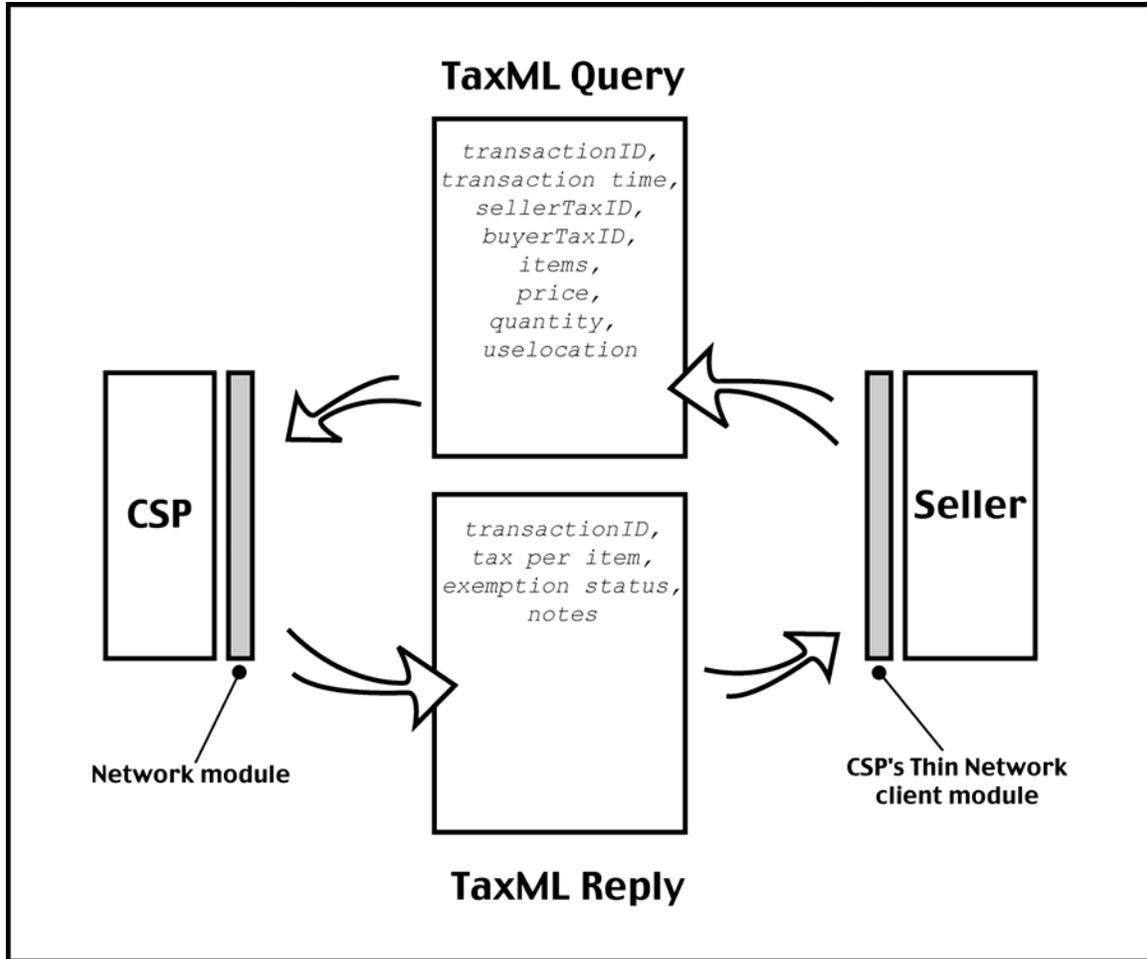


Figure 3.2 XML data flow

The description below expands on the role of each module while walking through the process from transaction initiation, tax retrieval to funds transfer. Figure 3.3 shows the overall transaction data flow. A user initiates a transaction by acknowledging intent to purchase merchandise (that is assumed to be in stock) by asserting a submit button on the seller's web site. The acknowledgement is handled by the seller's *transaction processor*. Information about the user is either retrieved from file or is submitted by the user prior to asserting the submit button.

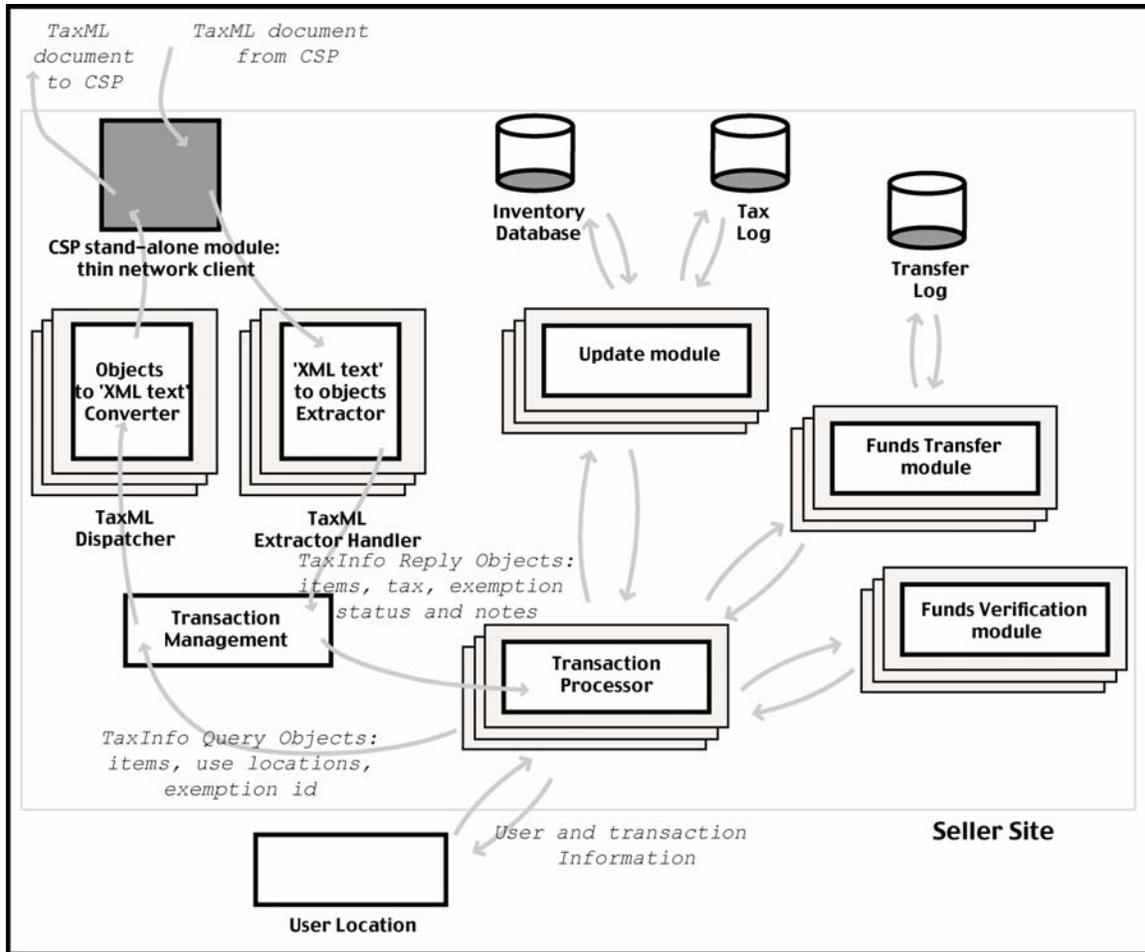


Figure 3.3 Functions, data flow and interaction at the seller site

The transaction processor creates a transaction ID and returns it along with user information to an *XML converter* that converts the received objects into a TaxML query document conforming to the TaxML DTD (Appendix A). The TaxML query document is submitted to the stand-alone network client module, which transmits the same to the CSP. The transaction processor meanwhile creates a transaction thread christened with the transaction ID, which blocks for activation from the stand-alone network client module upon arrival of tax information from the CSP. If a reply from CSP does not come in a specified timeout period, the current implementation sends a notice to the customer of

network problems and makes a suggestion to resume shopping after some appropriate time period.

The TaxML reply contains the tax calculated and the corresponding `transactionID`. Upon a TaxML reply's arrival, the stand-alone network client module wakes up the thread blocked at the transaction processor whose name corresponds to the received `transactionID`. The received TaxML document is extracted into objects and passed on to this awoken thread. The objects are processed and the final amount due is displayed to the customer. When the customer sends acknowledgement to the final amount due (price of merchandise plus the tax), the *update module* (not implemented) temporarily freezes or debits the *inventory database* for the number of items being processed in the transaction for a reasonable timeout period for transfer of funds (or presumably to select an alternate source of funds should one fail).¹

The *verification module* (not implemented) checks to see if the source of funds (SF) (credit card or bank) has sufficient funds for the transaction to go through and if so freezes or commits the amount due. If a negative response is returned from the SF due to an insufficient balance, the user is asked to use an alternate source or is led through whatever mechanism the seller has created to handle such a situation.

¹ A potential security hazard exists wherein a malicious customer might freeze large chunks, or even the entire inventory only to have the transaction intentionally fail due to insufficient funds. This temporary freeze would hurt legitimate customers who might get a 'not sufficient items in inventory' notice. Alternatively we can avoid freezing till the very last moment. Once the customer's source of funds are identified to be sufficient, one can perform an inventory check and freeze if sufficient items available, otherwise notify customer to reselect the items. As the customer's funds are not frozen there is no problem on the part of the credit card issuer or bank

On a positive response (with the amount due frozen at the SF for transfer to the seller) the transaction is said to have gone through. The customer is notified of the successful transaction along with shipment and tracking details.

Meanwhile, a *funds transfer module* (not implemented) initiates a transfer protocol with the source of funds, the seller's bank, the CSP, and the CSP's bank. The funds transfer module sends a request (tracked by a transaction ID) to the SF to transfer funds to its bank. Once it receives confirmation from its bank that the transfer has taken place, it retains the price of the merchandise and initiates transfer of the tax amount to the CSP's bank. When it receives confirmation from its bank that the tax has been remitted to the CSP's bank, it sends a transaction termination message to notify the CSP that the funds have been sent for the corresponding `transactionID`. The underlying protocol addresses the details of tracking messages through a `transactionID` and about lost transfers and messages.

Updates are committed to the inventory database, user information tables, and merchandise shipment tables. A *tax log* is also maintained for all the taxes that were paid.

CSP Site

The CSP site has its functionality divided in several modules as shown in Figure 3.4. The most important module, the *database controller* accesses the ZIP code indexed tax base, retrieves corresponding taxes, information on exempted items, and exempted buyers and tax holidays.

The network module at the CSP site receives the TaxML query document and initiates an *extractor*. It then goes back to listen for more TaxML documents. The

extractor parses the TaxML document into objects and sends them to the database controller.

The database is queried for the tax percentages values for the listed items, in their associated use locations. Items can have a quantity based tax or a price based tax (explained in Chapter 4).

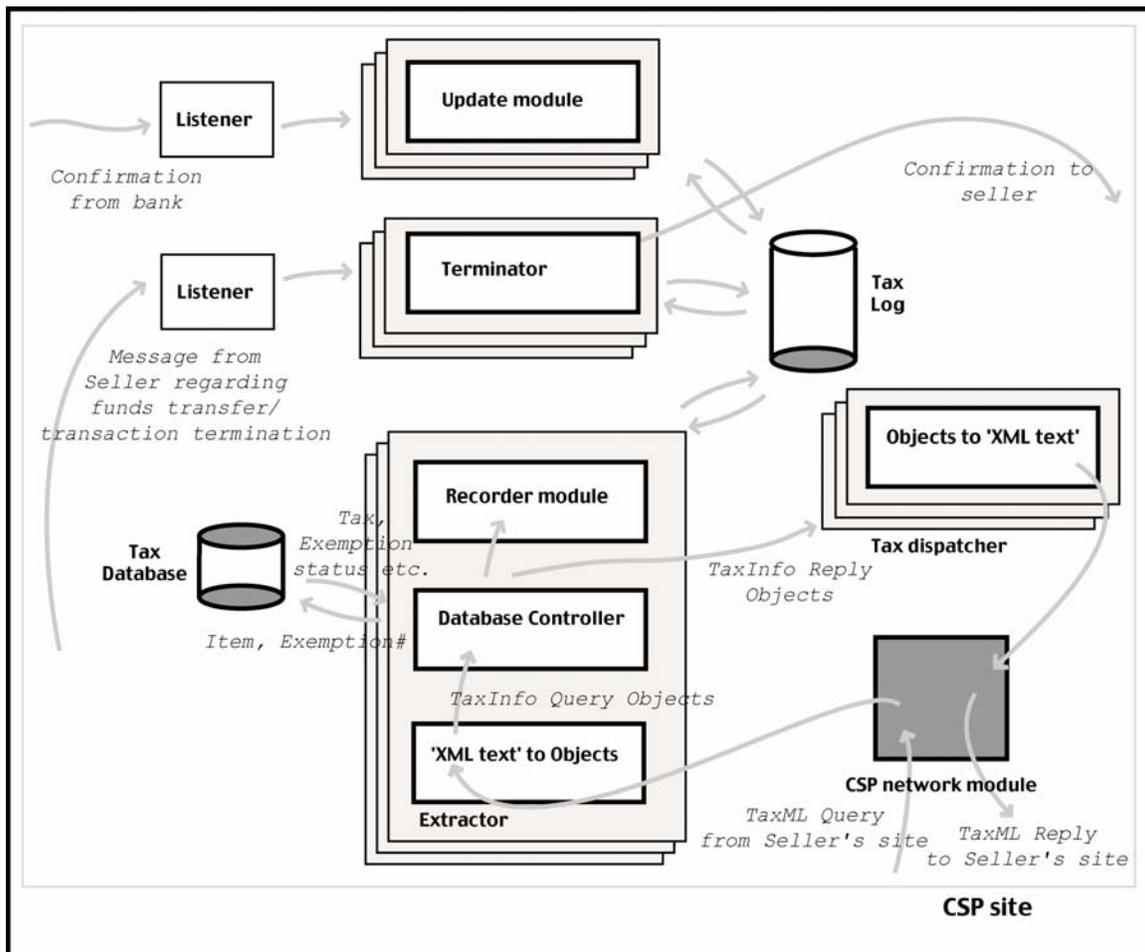


Figure 3.4 Functions, data flow, and interaction at the CSP site

If the item is tax exempt, that information is returned. If exemption is being sought (certain buyers have exemption privileges, as discussed in Chapter 4), the buyer's tax ID is checked to see if he/she is approved for exemption. If the buyer is exempt, the

exemption percentage for that buyer, for that item, in the use jurisdiction is retrieved. Otherwise notes detailing why the exemption is not valid anymore are returned.

Tax holidays are checked for the item, following which tax is calculated (taking into consideration exemption percentage or tax holidays) and recorded in objects maintained through the process.

The tax calculated for each item in the transaction and exemption status notes are returned to the seller's site. This is accomplished by converting the information accumulated in various objects (that were maintained in the tax extraction process) into a TaxML reply document, and dispatching it through the network module to the seller.

The transaction information is sent to a *recorder module* that logs each request. All the information relating to the transaction, including the time at which the tax quotation was sent to the seller's site is stored in the log and a receipt is flagged on the tax due for the transaction. A timeout period is initialized for the receipt. Logs are to be cleared periodically of transactions that have a receipt flagged on them after the timeout period. It is assumed that the transaction did not go through at the seller's end.

In the unforeseen case that the transfer of tax due from the seller's site is received after the timeout period, the seller's site is asked to send the transaction details once again. Transfer of funds confirmation from the CSP's bank initiates retrieval of the record with the corresponding `transactionID`. The receipt flag is removed. Upon receiving a transaction termination message from the seller, the CSP returns a transaction termination message.

CHAPTER 4
THE CSP ARCHITECTURE, MECHANISMS, AND ISSUES.

Using the SSTP recommendations as a model to address issues surrounding tax collection, other ideas and solutions were explored. This chapter introduces various issues and discusses how the proposed architecture and the implemented architecture differ from, extend upon, or conform to SSTP guidelines.

Table 4.1 SSTP recommendations. Proposed architecture and implementation information.

	Uniform definitions in Tax base	Collection cost allowance	Centralized exemption	Centralized seller registration	Tax rate database
SSTP guidelines	Present	Present	Identification numbers	Present	Publicly accessible databases
Architecture proposed	Present. Described in section below.	Described in section below.	Highly flexible system described below.	Present	Database replicated as distributed object at CSP mirror sites
Implemented	Database has standardized tax bases referenced by their version numbers. TaxML documents have version numbers tags on items.	Transfer of funds from credit card and banks are not implemented.	Database keeps track of exempted buyers, items exempted, percentage of exemption in relation to jurisdictions where such apply. Interface for registration provided.	Interface provided	Interface provided to jurisdictions to modify tax rate database. Distributed objects and mirror sites are not implemented.

Table 4.1 (continued)

	Multiple locations of use	Taxing jurisdiction resolution	Tax Holidays	Caps and thresholds	Confidentiality
SSTP guidelines	For digital products, sellers need not collect tax if customer applies for multiple points of use exemption	Delivery location is the taxing jurisdiction. Locations resolved by mapping ZIP code areas to jurisdictions.	Only for goods specifically defined in the agreement.	Member states must eliminate caps and thresholds.	Only information required for calculation of tax to be given to CSPs.
Architecture proposed	Provides for tracking and assessing taxes on quantities of an item being shipped to/used in different jurisdictions. Details in section below.	Use location is the taxing jurisdiction. Zip code areas map to jurisdictions. Described in section below.	Tax holidays for any goods the jurisdiction sees fit.	A slab based tax rate system is proposed and is explained in detail in section below. This gives jurisdictions exacting control over their tax base.	Only customers that request exemptions have their exemption certificate presented to the CSP for verification and resolution of exemption percentages.
Implemented	The TaxML document holds information on items, and their constituent individual quantities being shipped to/used in various jurisdictions.	Interface provided for modifying ZIP code area information.	Jurisdiction can log into its database and create tax holiday periods for any item.	Jurisdictions can log into their database and specify tax slabs for items in tax base.	Buyer tax id for buyers requesting exemptions. The seller tax id for keeping track of transaction-tax remittance, and audits in case of irregularities.

CSP Architecture and Implementation Issues

Resolution of Item Being Taxed

Items listed on a seller's website are identified differently at various levels in the tax extraction process. Take for instance a particular shoe on display for sale among hundreds of others that are also available. The seller in his database uniquely identifies this shoe by an item code. Associated with the item code is presumably an entry that spells out in a human-readable, perhaps non-unique language, a brief description of said item. In the seller site implementation of this work, the following colon delimited format is used: [Description of item:customer_site_item_code]. The description is permitted to have spaces while the item code is not. The shoe in the example above might have the following entry associated with it: [Operating room moccasins:med34554].

For taxation purposes, the shoe is determined as belonging to the category *Hospital Supplies*. Yet another shoe might belong to the category *Extreme Sports*. The collection of such categories is listed in a standardized tax base. All conceivable items, taxable or otherwise, presumably map to one of the categories in the tax base. The tax base technically should contain only the categories that are taxable but this architecture considers all items as belonging to the tax base. The actual determination of whether an item is taxable or not is a jurisdiction specific issue.²

² The standardized tax base was one of the items left out in the National Conference of State Legislatures' (NCSL) version of the SSTP agreement-the justification being that more states would be interested in signing up when not confronted with an undertaking that mandates relinquishing their tailored mapping system, built perhaps over several years consuming committee man hours and good intentions. And then there is the resistance from some states where industry lobbyists, as David Hardesty reports, complained about the potential negative impact of standard definitions (preceding categorization). "For example, confectioners fear that by creating a separate category within food for 'candy', some states might be encouraged to tax candy" [HAR 2001-a].

The standardized tax base is created once all the participating states in the SSTP formulate and agree upon the definitions and mapping. Once ratified, it is frozen. A version number assigned to it and transferred to each seller. The seller uses the frozen version to map the items in its inventory, manually, perhaps in consultation with an SSTP designated office for resolving difficult to map items. There will be items that belong to several categories either in a vertical or horizontal manner. Vertical relationships between categories are represented by a hierarchy with increasing specialization on the way down. For example three categories that are related vertically: Food, Recreational food and Candy. An item will belong to the category that represents it the closest. Horizontal relationships between categories can be represented by a Venn diagram. Two categories such as Jewelry and Industrial tools may lay claim to diamonds. An item will be classified in the category with which its use is most closely associated.

The tax base category name is user-friendly and may contain spaces, while the tax base code consists of an alpha-numeric sequence strictly meant for database interaction and storage. Item name resolution traces its path from the seller site code to tax base code and tax base version. The seller site name and tax base name are used for describing items to humans.

The Money Trail

When the extracted tax information is passed to the waiting transaction object, the customer is presented with the final amount due. The customer acknowledges the final amount and sends a confirmation. The current seller site implementation handles only

The standardized tax base is arguably one of the most critical components in the CSP architecture without which the automated mapping process would be dealing with 50 hashes from the states or infinitely more frightening, 7500 hashes that includes all the taxing jurisdictions.

credit cards and checks for sufficient funds in a dummy method, which always returns true. The architecture envisages a production version in which the seller site then commences a transfer of the amount due towards tax to the CSP's bank. The CSP is also sent a notice of the imminent transfer with a reference to the `transactionID`. Needless to say, all transfers of notices or messages over a network are acknowledged through some protocol. The seller site logs the transfer in its transaction files and terminates that thread. The CSP, upon receipt of the transfer information from its bank, logs the same information in its transaction logs.

An alternative that reduces the number of transactions, and is therefore more attractive is where the CSP maintains credit accounts or direct-debit information such as a bank routing number for each seller. Upon sending the tax information, the CSP awaits a *go ahead* from the seller confirming the sale. Then depending on the setup, either the seller's credit account is charged or a transfer of funds is commenced. If the *go ahead* is not received within a reasonable duration of time, it is safe to assume that the sale failed as a result of the customer canceling the transaction after being presented with the final amount or due to insufficient funds.

The CSP can choose to remit the tax due to jurisdictions in real time, or on a daily, weekly, or in some other suitable interval of time. The cost of services provided by the CSP is deducted by it as a percentage of the tax collected or through some other arrangement between it and the participating states. As is provided in the SSTP agreement, the seller is absolved of having to file returns, and from audits considering items that tax information was sought on were represented correctly.

Buyer Exemption Certificate Security

Buyers that qualify, apply once at the participating states portal (PSP) for exemptions on particular items and the ZIP codes in which they seek exemptions. The jurisdictions deal with exemption requests on a case-by-case basis and grant or deny exemption status. On receipt of at least one exemption status, the buyer is issued a buyer exemption certificate as represented by an alphanumeric code. This code is used by buyers when purchasing items. In the current implementation, the code is entered insecurely i.e. the seller interface does not implement a secure form for buyer information input. However, a secure form addresses only part of the security concern-that of the buyer exemption certificate being intercepted by an eavesdropper. The other security concerns or potential misuse scenarios include a) buyer exemption certificate deliberately given to friends or b) stolen through conventional non-electronic methods. There are several possible methods that address these concerns:

- 1) For each exempted buyer certificate, register the I.P. number of the computer that the buyer would be using to make purchases. This requirement will exclude those buyers that do not own computers and are opportunistic in their usage.
- 2) Register delivery addresses associated with the certificate. This, however, does not solve the case where in a buyer may register the address of the person to whom he is giving the certificate. Damage is limited when compared to a free for all type of development such as when a certificate is published online or distributed in news groups or group mails.
- 3) Public key cryptography: The buyer is issued a private key, the public key for which is stored along with his other account information at the CSP. When a transaction is commenced, the buyer, prior to asserting the purchase button that sets in motion the tax retrieval and exemption verification and calculation process, uses his private key to encode a challenge c sent by the seller site. The encoded message $e(c)$ and the actual message c are sent by the seller site to the CSP along with the transaction information. Verification is successful when the CSP extracts the encoded message $d(e(c))$ using the public key of the buyer and positively matches it to the actual message ($d(e(c)) = c$).

Privacy Safeguards

The name or any other form of identification of the buyer is not sent to the tax jurisdiction. The buyerTaxID is sent only in the case exemptions are sought so as to enable the CSP to approve the buyer. This would enable CSP's to store this information- which might be beneficial in analyzing exemption irregularities. Future analysis of log data at the tax jurisdiction can be made only by zip code. The credit card company or any of the banks involved are not informed of the items purchased by the buyer. Only the seller information is sent.

Message Passing Protocol

The CSP has a well-identified address and port to which the sellers connect. The machine used to host the CSP was *taproot* on the CISE network listening on the port 8277. Any seller wishing to communicate with the CSP sends the TaxML query to taproot on port 8277 using UDP. UDP was used as it is fast, but since it is unreliable, a protocol of acknowledgements between the CSP and the seller is required to ensure a measure of reliability. For sellers that have a volume of transactions beyond a certain threshold a connection oriented communication service is justified. Multiple transaction threads can use a single connection. An additional layer would interface with the shared connection to keep track of out-going packets, and pass in-coming packets to their rightful thread owners. Appendix E addresses a few scenarios that the UDP based protocol generates.

CSP Tax Resolution Issues

Sales or Use Tax

The distinction between sales tax and use tax is one of vendor collection obligation more than a meaningful economic one [ADV86, p.23]. Out-of-state businesses are not

obligated to collect and remit a use tax on behalf of its in-state customers. It is the customers that are required to conscientiously apply the local tax laws to their purchases and remit the same to the states' exchequer. This arrangement is plainly un-enforceable due to its cost in-effectiveness and the administrative drudgery involved in keeping track of a large number of customers and an exponentially larger number of transactions.

Solutions and agreements to aid in the collection of use tax are the basis for the SSTP.

The CSP is such a mechanism to collect the use tax due on an item in the location of its usage.³

Sourcing the Transaction: Origin or Destination

A transaction is legally said to have taken place or *sourced* at the point of delivery of goods or services. The SSTP recommends for a digital product (software, books, movies, music, news, information, and services) delivered electronically, the buyer's billing address be used as the taxing jurisdiction. If the buyer's address is not known then the sourcing is at the server used to deliver the service. To prevent servers from being relocated to tax free states, the agreement stipulates that a server alone without an administrative setting, is not acceptable [HAR00b]. This architecture sources the sale at the location of usage and not the location of delivery, i.e. the tax is determined from the usage jurisdiction's tax base and not the delivery jurisdiction's. Customers explicitly

³ "Most states that enacted sales taxes followed them shortly thereafter with a use tax, the main purpose of which was to tax purchases made in other jurisdictions by residents of the state. Typically, the use tax is a tax on 'the enjoyment of that which is purchased' when the purchase would, in the absence of vendor collection problems, be subject to the sales tax" [ADV 1986]. Significant differentiation was made between the sales tax and the use tax in a series of cases heard during the mid forties wherein the court indicated that the standards for collecting sales and use taxes from vendors were different. Out-of-state vendors were not to collect sales tax in most cases though a use tax might be acceptable in some cases. This legal distinction was supplemented by linkage issues in later cases [ADV 1986, p.54].

select a use location, if different from the delivery location, for each item in their shopping cart. This is an important addition that this work makes to SSTP recommendations as it is the *use tax* that is being collected. In most cases the delivery location and the use location are the same, but there are classes of transactions where they might differ. A company might have items delivered to its corporate head office from which consignments may be sent out to branch offices. People might use for delivery, the nearby address of a friend in a neighboring jurisdiction that has lesser taxes. Stretching further on that line of reasoning, rather thin perhaps, customers might purchase items while living temporarily out-of-state whereas the significant enjoyment of the item takes place on their return. In all cases cited, the actual usage of the item takes place in a different jurisdiction from the delivery jurisdiction and it is but logical to let the use location prevail.

Multiple Use Locations, Multiple Delivery Locations

The most common case would be that of a head office of a corporation that has a centralized purchasing system. Local branches' purchasing requests are channeled to the head office that approves and processes the orders. The same item can then have multiple delivery locations, which again engender multiple usage locations. Another significant class of transactions are gifts. A customer might order items to be shipped to various delivery locations. The CSP implementation handles transactions with multiple items, being delivered/used in varying quantities at multiple locations. The use location associated with the delivery location is always used to compute tax for the quantity of the item destined there.

Zip Code Area Aggregates Based Jurisdictions

“Currently, forty five states and the District of Columbia impose sales and use taxes on purchases of tangible goods. In addition, 4,696 cities, 1,602 counties, and 1,113 other tax jurisdictions also impose sales taxes” [SST02a]. The physical location of all customers map to these 7457 taxing jurisdictions in a hierarchical fashion. That is, as jurisdictions enclose other jurisdictions, an item’s tax is calculated cumulatively by adding the state tax, to the county tax if any, and to the city tax if any. The precise determination of a customer’s address to its enclosing jurisdictions has to be done on an address by address basis and can be automated with a database of address and their corresponding enclosing jurisdictions (perhaps MapQuest, Yahoo maps, MSN maps, or another company that has already charted a large number of US addresses can help in jurisdiction resolution). The current CSP implementation in this work uses a ZIP-code-based mapping system and aggregates individual ZIP code areas to form jurisdictions (the implementation does not however cumulatively apply taxes of enclosing jurisdictions). This aggregation of ZIP code areas to jurisdictions is not precise as jurisdiction boundaries are not defined by ZIP codes areas and there will be customers on border ZIP code areas that may map to a jurisdiction to which they do not belong. In a production version of the CSP, some optimization is possible by only having to map those customers living in border ZIP code areas. The current CSP implementation also does not calculate cumulative taxes from enclosing jurisdictions.

Recommended CSP future release work should include ZIP code areas that are aggregated to form enclosing jurisdictions. Cumulative taxes from such enclosing jurisdictions can then be calculated. Production version work should have the jurisdiction

of customers on border ZIP code areas resolved by using the services of a commercial mapping company or by using such a database if developed.

Caps, Thresholds, and Tax holidays

Some jurisdictions use a measure of caps to either exempt, or assess less tax. In New York, clothing sales up to \$100 are exempt from tax. In other places there are thresholds, or a volume of purchase beyond which tax exemptions or lesser rates apply. Tax holidays are used by various jurisdictions to give a temporary reprieve from taxes on certain goods. A popular tax holiday in some jurisdictions is the one before school starts. In the current CSP implementation, caps and thresholds are dealt with in terms of the concepts introduced in the next section. Jurisdictions can log into their account and set tax holidays for items in their tax base. Start dates and end dates are specified for each item. When an item with a tax holiday flag set, it is universally granted the reprieve from tax regardless of the type of buyer.

Study in Control Minutiae: Tax Based on Gross, Quantity and Price

The current CSP implementation gives jurisdictions intricate control over how items in its tax base might be taxed. At a broad level, items can be deemed to fall under two categories. Those that are quantity oriented and those that are quality-price oriented.

Quantity oriented goods are those that are usually purchased by weight (with an avoirdupois or quantitative measure): two metric tons of sugar, three hundred cases of oranges, 800 liters of sunflower oil etc.

Quality-price oriented goods are those that are usually purchased in singles: a house, car, computer etc.

Tax based on gross

Most items in the tax base do not require specific control as it is neither desired nor required. Tax based on gross is the most common type of tax across the item spectrum (both quantitative and qualitative). A percentage of the total transaction amount is assessed as the tax. A 6% tax on a \$100 transaction would yield \$6 in tax revenue.

Tax based on quantity

There are times when jurisdictions might want to base tax on the quantity of an item being sold. An overabundance of oranges in a particular season might merit from a lesser tax rate for purchases beyond a certain quantity. The current CSP architecture provides for 20 slab rates based on measure.

For example: A jurisdiction might change its rates to a 6% rate for oranges up to 600 cases, a 2% rate for oranges more than 600 cases-up to 1000 cases, and a 0% rate for above 1000 cases. On the other end, consumption of commodities may be controlled by adjusting the tax rates applicable at different quantities. Figure 4.1 charts out sample slabs to encourage or discourage purchase and consumption.

Item: Oranges	
<u>Quantity (in cases)</u>	<u>Tax Rate</u>
1 - 600	6%
601 - 1000	2%
1001 +	0%
Perhaps in a war-time economy, oil may be charged at 2% for purchases up to 20 liters and 10% for purchases above 20 liters.	
Item: Oil	
<u>Quantity (in liters)</u>	<u>Tax Rate</u>
1 - 20	2%
21+	10%

Figure 4.1 Illustration of the quantity based slab rate system

The architecture envisions that jurisdiction representatives log into their accounts and set up the hash table for items that need quantitative controls. Future implementation work includes the following

- 1) Users upon selection of an item that has a quantity based tax rate would be given details about the same to aid in decision making and
- 2) Provide a mechanism to track users so they do not make multiple purchases of an item just below the cap beyond which it is charged at a higher rate.

Tax Based on Price

For items such as cars and houses, a jurisdiction might have social goals that seek to rectify in some measure, inequalities. Taxes can be based on the price of an item. The current CSP architecture allows for 20 slab rates based on price.

For instance, a car that costs less than \$4,000 may be taxed at .5% (subsistence). A car that costs between \$4,000 and \$10,000 taxed at 2%. Cars costing between \$10,000 and 20,000 may be taxed at 4.5% and so forth. Figure 4.2 charts a sample price based slab.

<u>Price</u>	<u>Tax Rate</u>
Item: Car < \$4,000	.5%
4,001 - \$10,000	2%
\$10,001 - \$20,000	4.5%
\$20,001 - \$35,000	6%
\$35,001 - \$55,000	7%
\$55,001 - \$90,000	8%
\$90,000 - \$200,000	10%
\$200,001 +	14%

Figure 4.2 Illustration of the price based slab rate system

Such a micro controlled system can easily get out of hand if not handled with care. A worst-case scenario where every item in the tax base has a different slab is frightening.

Jurisdictions should exercise prudence and use slab-based rates for a very selective set of items. Inclusion of items in this selective list must be justifiable, and approved by a special panel set up for that purpose. Those items for which the slab rate has outlived its usefulness should revert to a gross rate.

Study in Exemption Minutiae: Exempted Entity-Jurisdiction-Item-Percentage of Exemption

A variety of users are exempt from paying taxes owing to concessions that society and the government makes to help in their livelihood, or maintenance and upkeep. Charitable institutions, religious institutions, senior citizens, disabled war veterans, persons with challenges, or unemployed citizens, might, among others, fall into this category. The implementation in this architecture gives each jurisdiction control over many aspects of exemptions. A user is exempt in a particular jurisdiction for a particular item at a particular percentage of exemption. For instance, a person identified as a disabled war veteran may be set in a particular jurisdiction to receive a 100% exemption of tax on food, a 95% exemption on clothing, a 80% exemption on appliances, and a 45% exemption on all other items in the tax base. The current CSP implementation employs this multi-variant exemption schedule and envisions jurisdictions to be able to log in and make changes to these tables. An exempted entity has the following data items associated with it:

- 1) Exemption period validity period (identified by a date).
- 2) Notes on exemption certificate usage. Irregularities or investigations currently in process or past will appear here.
- 3) For each item exempt in tax base, an exemption percentage.

Future work should include a mechanism for selecting groups of items-created especially for each exempt group. To enable more flexibility, a few general groups

should also be created. This would vastly simplify the exemption process enabling a scenario where a senior citizen might request and be approved for the *Senior Citizen Exemption Package* along with *General Exemption Packages No. 45A* and *No. 332B*.

Exemption Registration Procedure

The Participating States Portal (PSP) has a centralized form that users may fill out to request tax exemption. The user specifies the items and the jurisdictions in which exemptions are sought. This form is sent to each jurisdiction where they show up in a *request for exemptions* list. Jurisdictions manually inspect the credentials of the requesting user. Upon verification and approval, an exemption certificate ID is created and sent to the user. The format of the ID must be standardized. A central PSP mechanism that issues IDs is envisioned.

CHAPTER 5 IMPLEMENTATION DETAILS: HOW TO RUN THE APPLICATIONS

The implementation of the CSP is done in Java. It was developed and tested in the Java 2 platform version 1.3.1 on a Sun Microsystems Ultra5 (sparc) running Solaris version 5.8. The database used was Sybase. Java Servlets were used to create all interfaces. Though initially developed and tested using the TomCat 3.3 server, the servlets now run, on the TomCat 4.1 server.

Sellers communicate with the CSP at an established machine and port. The CSP identifies the machine on which it is running and the port it is using through a configuration file in the form of static objects in a public java class called `ConfigData.java`. The Seller implementation is started by the servlet that handles user transactions `ShoppingCartNew.java`. A text file or an XML configuration file are the desirable methods for configuring any application. The next release should have XML configuration files.

How to Start the CSP

To run the CSP on a particular machine and port, follow directions 1 through 4. If no configuration is desired, follow steps 3 and 4. The CSP machine by default is `taproot.cise.ufl.edu` and the port is `62974`.

- 1) Identify the machine and port on which to run the CSP.
- 2) Change `ConfigData.java` to reflect the machine and port. Compile it.
- 3) Login into any machine on the `cise.ufl.edu` sun machines network or network that has the machine identified in step 1. The network has to be configured such as to allow remote running of processes using the `rsh` command.

- 4) Run StartCSP.java using the command: `java StartCSP`
- 5) The CSP generates a log file `csplog` in the directory of execution.

How To Start the Seller

The seller is started automatically by the servlet `ShoppingCartNew.java`, which handles user interaction. The Interfaces are all hard coded to run on the machine `sun114-44` on the `cise.ufl.edu` network. A small script at the root of the servlets directory by the name of `start.sh` can be used to start all servlets as described in the next section. The default port for the seller is `8277` on the machine the servlets are running on: `sun114-44`. The default port can be changed in the `ConfigData.java`, which will need to be compiled for the change to take effect. The machine can be changed only as described in the next section.

How To Start The Interfaces

- 1) Login into `sun114-44` on the `cise.ufl.edu` network.
- 2) Run the `start.sh` script using the command: `./start`
- 3) If servlets are to run on another machine, each reference to the machine `sun114-44` in the servlet programs have to be changed to reflect the new machine. The servlets use static html pages currently hosted at <http://www.cise.ufl.edu/~mc1/thesis/SellerSiteShopping/> and <http://www.cise.ufl.edu/~mc1/thesis/Interface/>, and these files will become unavailable when the `mc1` account ceases to exist. They would need to be copied to a fresh location and references to them in the servlet programs have to be changed to reflect the new location.

CHAPTER 6 IMPLEMENTATION DETAILS: THE CLASSES

The implementation uses Java's net, sql, and swing packages, and programming features such as synchronized monitors. The following is a discussion of the classes that compose the various applications, how they relate to each other and what they accomplish.

TaxML Object Classes

The TaxML object classes hold the data parsed from the TaxML documents. Each object is designed so as to parallel an XML entity. The attributes of the XML entity become the corresponding object's primitive data fields. An XML entity that have other entities ensconced within them are represented as user defined object data fields. For instance, the object class `TaxInfo` is the big wrapper that parallels the outermost entity in the TaxML document-`taxinfo`.

`version`, `taxbaseversion` and `query` are attributes to the `taxinfo` entity which are reflected by primitive type attributes of the same names in the object class `TaxInfo`.

`Buyer`, `Seller`, and `JurisdictionTaxAggregate` are three user-defined objects that have their own primitive attributes and user defined objects within them paralleling the TaxML document structure. Figure 6.1 illustrates the parallel mapping schema.

```

<taxinfo version="1.0" taxbaseversion="2.0" type="query" >
<buyer ..>
.
.
</buyer>
<seller ..>
.
.
</seller>
</taxinfo>

```

This translates to an object called TaxInfo as defined below:

```

class TaxInfo
{
    String version;
    String taxBaseVersion;
    String type;
    Buyer buyer = new Buyer();
    Seller seller = new Seller();
    JurisdictionTaxAggregate jurisdictionTaxAggregate =
        new JurisdictionTaxAggregate();
.
.
.
}

```

Figure 6.1 XML entities map to respective Java objects

A TaxInfo object that bears query type information usually has a null JurisdictionTaxAggregate object. A TaxInfo object that bears reply type information usually has null Buyer and Seller objects.

The TaxML object classes laid out in Figure 6.2 illustrate their enclosing structure that parallels the TaxML query and reply type documents. The Buyer and Seller parts together parallel a TaxML query while the JurisdictionTaxAggregate part parallels a TaxML reply.

The query type `TaxInfo` object is initially assembled by the seller as the customer makes item choices including quantity, delivery, and use locations for portions thereof of the quantity. A complete query type `TaxInfo` object is then converted to a `TaxML`

```

TaxInfo
{
  Buyer
  {
    Item
    {
      DeliveryLocation
    }
  }
  Seller
  {
    Transaction
    {
      MyDate
      MyTime
    }
  }
  JurisdictionTaxAggregate
  {
    TaxItem
    {
      TaxAmt
      {
        Notes
      }
    }
  }
}

```

Figure 6.2 The `TaxML` DTD maps to the `TaxInfo` Java object

query type document and is sent across the network. The CSP receives the `TaxML` query type document, parses it, and forms the same query type `TaxInfo` object that initially existed at the seller's site. Tax is calculated and put together in a reply type `TaxInfo` object, which is converted into a `TaxML` reply type document and is sent across to the

seller. The seller parses the received document into the same reply type `TaxInfo` object that existed at the CSP. Information is extracted from the reply type `TaxInfo` object to the interface objects servicing the customer. The entire process is illustrated in Figure 6.3

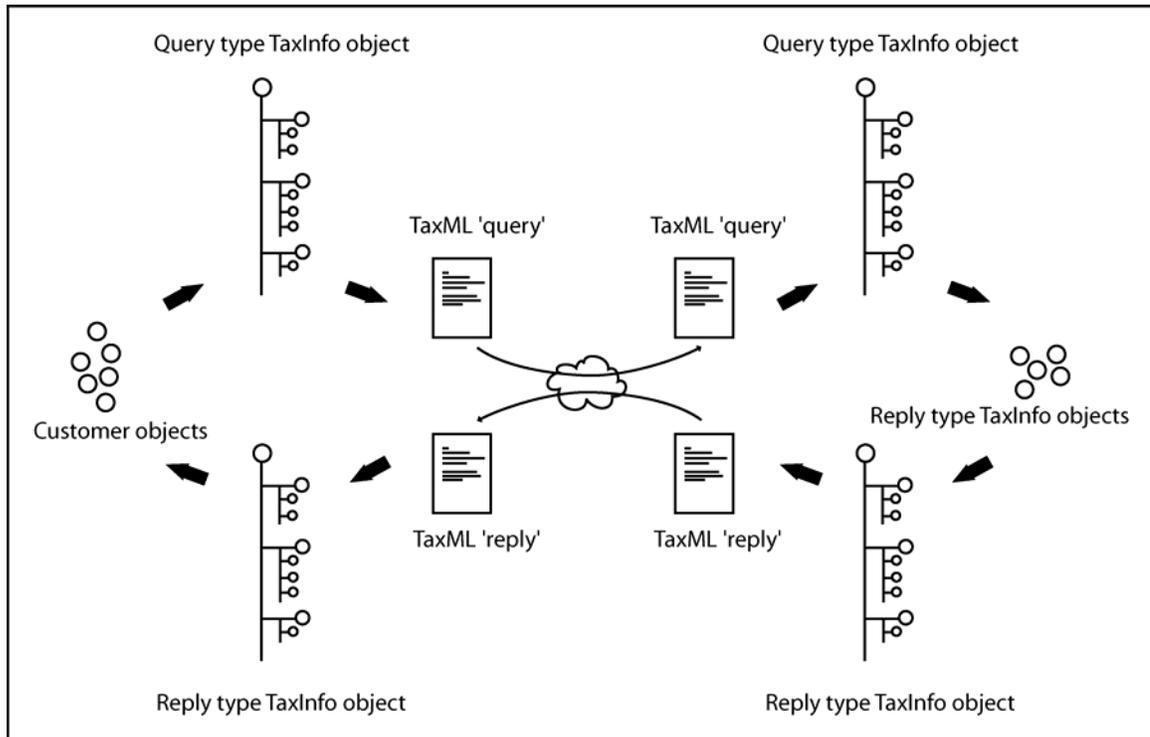


Figure 6.3 Information containers and paths

CSP Site Java Classes

The CSP site is comprised of a collection of classes that perform different functions. The CSP receives TaxML messages and spawns separate threads to handle them. Tax is calculated and put together in an out-going TaxML message. It is then sent to the requesting seller.

StartCSP.java

`StartCSP.java` is the class that starts the CSP on the machine identified in `ConfigData.java`. The `rsh` facility is used to start the CSP process remotely from

any computer on the CISE network. A log file called `csplog` holds progress messages from the CSP's startup process.

CSPListener

`CSPListener` initializes a socket listening to the port identified in `ConfigData.java`. It spawns a `CSPExtractorHandler` if it receives a TaxML query document. If it receives an acknowledgement it sets the same in the class `StationHash` that maintains a static hash of messages. The `CSPListener` also has static methods that send acknowledgements and TaxML documents using the socket established previously. This arrangement is not scalable. A socket pool from which a socket is selected based on some criteria (queue on gross load) for sending messages will scale well as traffic increases.

DataBaseController

The heart of the CSP, the `DataBaseController` class is given a `TaxInfo` object for which all the query type attributes are all filled with data parsed from the TaxML query document (the reply type attributes are null for the same `TaxInfo` object). `DataBaseController` proceeds to make database accesses collecting tax and exemption information for the items listed, calculating tax due and storing the same in objects that will eventually come together in another `TaxInfo` object as the reply type attributes. It creates a log of the final `TaxInfo` object created in the database.

TaxDispatcher

Part of the network protocol group of classes, `TaxDispatcher` receives a reply type `TaxInfo` object that it converts to a TaxML reply document and takes care of

sending it to the seller. It also accesses, updates hashtables that keep track of acknowledgements and information related to the `transactionID` being processed.

StationHash

`StationHash` is a data holder class that maintains static hashtables of `transactionID` related information.

CSPExtractorHandler

Activated by the `CSPListener` on receiving a TaxML query doc as a separate thread, `CSPExtractorHandler` proceeds to extract the same to a query type `TaxInfo` object, which it passes to a new `DataBaseController` thread.

Seller Site Java Classes

Station

`Station` parallels `CSPListener` from the CSP site. It starts a socket using the port specified for the seller in `ConfigData.java`. It is used to send TaxML query type docs to the CSP at the machine and port specified in `ConfigData.java`. On receiving an acknowledgment to the sent TaxML query doc, it sets the same in the class `Dispatcher` that handles message passing. On receiving a TaxML reply document, it spawns an `ExtractorHandler`.

ExtractorHandler

This class is given a `DatagramPacket` received by `Station`. It extracts the TaxML reply document into a reply type `TaxInfo` object, which it sends across to `TransactionManagement` that subsequently un-blocks the thread waiting for the reply.

Dispatcher

Spawned with a query type `TaxInfo` object, `Dispatcher` converts it to a TaxML query document and uses the socket at `Station` to send it to the CSP.

`Dispatcher` is part of the messaging protocol group of classes and among other things, maintains and updates hashtables that enable it to maintain the messaging protocol.

TimeBomb

Once a request is sent, a `TimeBomb` thread is spawned that ticks down to the timeout allowed for the round-trip, i.e. from the time of sending the TaxML query to the time of receiving the TaxML reply. If the TaxML reply is received before timeout, the `TimeBomb` thread is interrupted and it stops execution. If the timeout occurs first, then the thread sets a Boolean value `timeout` to true and executes another indefinite `wait()`. It will subsequently be interrupted by `TransactionManagement` upon noting the `timeout` value.

TransactionManagement

Two static hashtables are maintained by `TransactionManagement`. One is for holding received reply type `TaxInfo` objects set by the `ExtractorHandler`. One is for holding the `TimeBomb` objects mapped to `transactionID`'s, ticking down to their timeouts. A `TransactionManagement` thread is spawned by the servlet that processes user interaction: `ShoppingCartNew.java`. The servlet then proceeds to call, with a `transactionID`, a synchronized method that checks the `TaxInfo` hash and the `transactionID`'s corresponding `TimeBomb` thread's `timeout` variable for the `TimeBomb` thread belonging to the `transactionID`. The synchronized method blocks the thread with either of the checks returning a false. On either arrival of reply

type `TaxInfo` object it returns the same to the requesting servlet and interrupts the `TimeBomb` thread. On a timeout, it simply interrupts the `TimeBomb` thread. The corresponding entries in the `TimeBomb` has are removed and are automatically garbage collected.

General Utility Classes

The utility classes are used by many other classes common at both the CSP and the seller sites. They mainly comprise of the scanner, parser, and the reverse-parser.

Token.java

`Token.java` is a wrapper class representing an individual character of information in a document.

Scanner.java

`Scanner.java` decomposes a document fed to it into tokens.

Extractor.java

`Extractor.java` takes a vector of tokens and extracts `TaxInfo` object (query or reply) from it.

Converter.java

`Converter.java` takes a query or reply type `TaxInfo` object and creates a TaxML query or reply type document respectively.

Dgram.java

`Dgram.java` is a general datagram utility class that creates a `Datagram`, given required parameters.

Configuration Files and Classes

ConfigData.java

`ConfigData.java` holds various configuration data as static variables. These include durations for timeout periods, a back-up federal tax rate to use if a problem is encountered trying to assess tax on an item, CSP machine and port, seller machine and port, etc.

Interfaces

The interfaces are all java servlets. Originally written and tested in the TomCat 3.3 server, they now run on the Tomcat 4.1 server.

Seller Interface

SellerInterface.java

The Participating States Portal uses a central seller registration system. The `SellerInterface` collects information about the seller and makes database entries that are manually checked for approval.

Shop Interface

The shop interface is divided into two parts: the part that implements the functionality to handle user interaction and the shopping cart, and the part that implements the functionality to handle new users.

Shopping cart

ShoppingCartNew.java

The most important interface as far as demonstrating the seller side of the CSP architecture. It interacts with the user with login, catalog display and selection, and display of a final invoice with tax information.

New user**NewUser.java**

`NewUser` is used by new users wanting to register with the seller as a customer at their site.

Buyer Interface**BuyerInterface.java**

Used by the Participating States Portal, `BuyerInterface` handles interaction with buyers seeking exemptions.

Jurisdiction Interface**JurisdictionInterface.java**

Jurisdictions login into their respective accounts to view or update information about buyers exempt in their jurisdiction, requests for exemptions, tax base items, etc. As each jurisdiction has complete control over its tax base, changes made are immediately noticeable at the CSP. This solves the tedious problem of having a central body keep track of changes in each jurisdiction.

CSP Interface**CSPInterface.java**

The CSP uses this interface to keep track of the various transactions, jurisdictions, and sellers that interact with it.

Interface Objects

Interface objects hold information for servlets. The data fields are either set either by interaction with the user or through database access. Interface objects used by the servlet `ShoppingCartNew.java` (at the sellers site) are at the ends of the process of

sending for and receiving tax information. The `toPrint()` method present in each of these classes returns an HTML formatted string of the classes' data fields.

Info

This is the parent class of `UserInfo`, `TransactionInfo`, `BuyerInfo`, `SellerInfo`, `JurisdictionInfo`, and `CSP info`. `Info` has a large number of the common data items shared by all the inheriting classes.

UserInfo

Used by `ShoppingCartNew.java`, `UserInfo` holds all the information about a user including all his credit cards and delivery locations on file (in the database).

TransactionInfo

Used by the `CSP` interface, `TransactionInfo` object holds information about a transaction. The query date-time, the payment (from seller) date-time, and the payment remitted (to jurisdiction) date-time among other data items.

BuyerInfo

Used by the `BuyerInterface` at the Participating States Portal, `BuyerInfo` holds information on the exemption request being made by the buyer.

SellerInfo

Used by the `SellerInterface` at the Participating States Portal, `SellerInfo` holds information on the seller's industry, website address along with other information required to process a seller's registration with the PSP.

JurisdictionInfo

`JurisdictionInfo` is used by the `JurisdictionInterface` to handle and keep track of buyers approved for exemptions, requests for exemptions in its jurisdiction, items in its tax base, and the tax due to it from transactions.

CSPInfo

CSPInfo is used by the CSPInterface.

CreditCard

CreditCard abstracts a real world credit card.

Address

Address abstracts a real world address.

CustomerItem

CustomerItem abstracts an item listed for sale at the seller's site.

ItemInfo

ItemInfo abstracts an item listed for sale at the sellers site along with tax holiday information and hashtables to hold quantity based or price based tax slabs.

TaxDue

Roughly paralleling the TaxML class TaxAmt, TaxDue is an interface class used as a convenience class for holding and producing data for Interfaces that use it.

ExemptionItem

ExemptionItem holds exemption related data for a particular item.

CHAPTER 7 CONCLUSION AND FUTURE WORK

This work focuses on designing and implementing an architecture for a Certified Service Provider that can give taxing jurisdictions a flexibility that even the currently in use customized tax systems do not provide. Jurisdictions have intricate control over their tax base and can tailor it to fit their needs. Changes made are instantly and transparently visible to all sellers through the CSP. Exemptions are handled to give better control over how best to serve a particular community of buyers. Multiple locations for use are handled, so certain groups of buyers such as corporate offices making purchases for branch offices are not left out of the loop. Given the nature of the implementation, jurisdictions should find this architecture beneficial although they would have to give up customized definitions for items in their current tax base. It is likely that those preferring a simple, one-rate, or few rate type of tax system would find this architecture leaving far too much discretion in the hands of jurisdictions (elaborated on page 35). However, the simplification achieved in centralizing administration, registration, and automating tax collection should make for a balancing argument in favor of the proposed CSP.

TaxML provides for a smooth interface between the sellers and the CSP. All the seller's programming staff needs to consider is how to present the data from their transactions in the TaxML query format and how to extract information from a TaxML reply. As TaxML evolves, subsequent versions will include additional features and improvements.

References to future work have been identified within the text of the thesis where they had contextual significance. The major ideas that future work can accomplish would be in setting up mirror CSP sites that have local databases. A network file handling system or protocol must be used to maintain distributed file system goals for replicated resources (database). After issues in the message passing protocol are addressed, CSPs should be made capable of handing requests from a pool of available ports. The most pressing need is to expand upon TaxML to define an entity for conveying error messages (to the seller) encountered in the tax resolution process. Various procedures in the code currently catch exceptions which would need to be dealt with by higher routines that log such errors and convey the same, when relevant, to the seller.

APPENDIX A
TAXML DTD AND DOCUMENT TYPES

TaxML Document Type Definition (DTD) .

```
<!ELEMENT taxinfo ( (buyer, seller) | jurisdictiontaxaggregate)>
<!ELEMENT buyer (item+)>
<!ELEMENT item (deliverylocation+)>
<!ELEMENT deliverylocation EMPTY>
<!ELEMENT seller (transaction)>
<!ELEMENT transaction (date, time)>
<!ELEMENT date EMPTY>
<!ELEMENT time EMPTY>
<!ELEMENT jurisdictiontaxaggregate (taxitem+)>
<!ELEMENT taxitem (taxamt+)>
<!ELEMENT taxamt (notes)>
<!ELEMENT notes(#PCDATA)>

<! ATTLIST buyer
buyertaxid CDATA #REQUIRED
>

<!ATTLIST item
customersitecode CDATA #REQUIRED
taxbasecode CDATA #REQUIRED
taxbaseversion CDATA #REQUIRED
price CDATA #REQUIRED
>

<!ATTLIST deliverylocation
zip CDATA #REQUIRED
uselocation CDATA #REQUIRED
quantity CDATA #REQUIRED
>

<!ATTLIST seller
sellertaxid ID #REQUIRED
>

<!ATTLIST transaction
transactionid #REQUIRED
>
```

```
<!ATTLIST date
month CDATA #REQUIRED
day CDATA #REQUIRED
year CDATA #REQUIRED
>
```

```
<!ATTLIST time
hour CDATA #REQUIRED
minute CDATA #REQUIRED
second CDATA #REQUIRED
>
```

```
<!ATTLIST jurisdictiontaxaggregate
transactionid ID #REQUIRED
totaltaxamt CDATA #REQUIRED
>
```

```
<!ATTLIST taxitem
customersitecode CDATA #REQUIRED
taxbasecode CDATA #REQUIRED
taxbaseversion CDATA #REQUIRED
taxitemamount CDATA #REQUIRED
>
```

```
<!ATTLIST taxamt
deliverylocation CDATA #REQUIRED
uselocation CDATA #REQUIRED
taxamt CDATA #REQUIRED
emptionstatus (approved|notapproved) "notapproved" #IMPLIED
>
```

TaxML Query

TaxML documents are either queries or replies. A query is sent from the seller to the CSP requesting tax information on an assortment of items. The reply is the itemized list of taxes due. The sub-parts for Figures A.1 and A.2 are described below the respective figures.

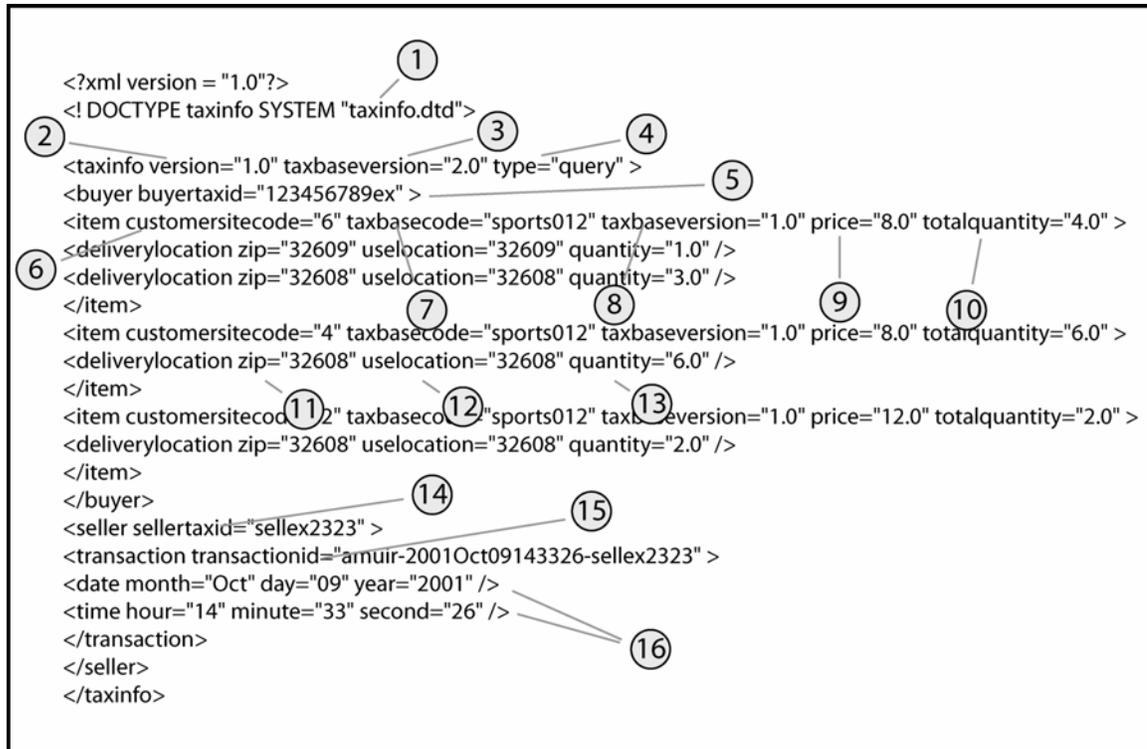


Figure A.1 TaxML Query.

- 1) All TaxML documents will conform to the Document Type Definition specified in `taxinfo.dtd`. As TaxML evolves, subsequent versions of the DTD released will bear the same name. The version number itself will be specified as an attribute (to the `taxinfo` entity) within the document itself.
- 2) `version` pertains to the version of the `taxinfo.dtd` being used for the document.
- 3) `taxbaseversion` pertains to the version of the standardized tax base (page. 25)
- 4) `type` pertains to whether the particular document is a ‘query’ or ‘reply.’
- 5) `buyertaxid` defaults to 12341234ex for all buyers that are not registered for exemptions, otherwise it is the id that is given to buyers registered at the

centralized exemption registration center maintained at the Participating States Portal (Appendix F)

- 6) `customersitecode` is the code used to identify the item at the sellers location (page. 25)
- 7) `taxbasecode` is the code that that item maps to from the standardized tax base (page. 25)
- 8) `taxbaseversion` is the version of the standardized tax base that was used for this particular item's mapping. A different version here overrides the global `taxbaseversion` being used in (3).
- 9) `price` is the price for the sale unit of the item. If the item is standardized in the tax base for sale in pounds, the price is the price per pound. If it is standardized to be sold in dozens, then the price is the price per dozen.
- 10) `totalquantity` is the number of units of sale.
- 11) `deliverylocation` is indexed by zip code as jurisdictions are zip code based (page. 31)
- 12) `uselocation` is the location used to assess taxes (page. 31)
- 13) `quantity` pertains to the quantity of the item destined to the delivery location specified in (11). The same item can be delivered to multiple locations in various quantities.
- 14) `sellertaxid` is an id sellers are given by the centralized registration system maintained at the Participating States Portal (Appendix F)
- 15) `transactionid` is an unique id generated by the seller for that transaction. It has a few standardized requirements that are meant to enforce uniqueness and enable tracking or retrieval, such as having the seller id included as the last fragment in the id.
- 16) Transaction time is tracked to the nearest second.

TaxML Reply

```

<?xml version = "1.0"?>
<! DOCTYPE taxinfo SYSTEM "taxinfo.dtd">
<taxinfo version="1.0" taxbaseversion="2.0" type="reply" >
<jurisdictiontaxaggregate transactionid="amuir-2001Oct09143326-sellex2323" totaltaxamt="3.6399999999999997" >
<taxitem customersitecode="6" taxbasecode="sports012" taxbaseversion="1.0" taxitemamount="1.12" >
<taxamt deliverylocation="32609" uselocation="32609" taxamt="0.28" exemption="notapplicable" >
<notes>
:)
</notes>
</taxamt>
</taxitem>
<taxitem customersitecode="4" taxbasecode="sports012" taxbaseversion="1.0" taxitemamount="1.68" >
<taxamt deliverylocation="32608" uselocation="32608" taxamt="1.68" exemption="notapplicable" >
<notes>
:)
</notes>
</taxamt>
</taxitem>
<taxitem customersitecode="2" taxbasecode="sports012" taxbaseversion="1.0" taxitemamount="0.84" >
<taxamt deliverylocation="32608" uselocation="32608" taxamt="0.84" exemption="notapplicable" >
<notes>
:)
</notes>
</taxamt>
</taxitem>
</jurisdictiontaxaggregate>
</taxinfo>

```

Figure A.2 TaxML Reply

- 1) The type attribute specifies that this particular TaxML document is of type reply sent from the CSP to the seller bearing tax information.
- 2) The total tax amount due on the transaction has to be rounded according to the rules specified in the agreement. At the time of the implementation, the rounding rules were yet to be decided. The next CSP release will have this Figure rounded appropriately.
- 3) The attribute totaltaxamount pertains to the total tax due on a particular item calculated by taking into account all the individual quantities of that item being delivered to individual jurisdictions.
- 4) taxamt is the tax due for a certain quantity of an item being delivered to a jurisdiction.
- 5) exemption holds the values approved to convey approval for exemptions for the buyer, for that particular item, for that jurisdiction. A value of not approved

coveys the opposite due to various reasons such as having a certificate that has expired, or cancelled or suspended due to irregularities (page. 35).

- 6) The entity notes holds details about the exemption status. If approved, it will have the period for which the certificate is valid, along with, in some cases, other notes pertaining to the certificate.

APPENDIX B INTERNET TAX FREEDOM ACT

The Internet Tax Freedom Act (ITFA) passed on October 21, 1998 imposed a 3-year moratorium on the following

- 1) Taxes on Internet access unless such taxes were imposed and enforced prior to October 1st, 1998 and
- 2) Multiple or discriminatory taxes on electronic commerce.

In essence, the ITFA defined a narrow, tax-exempt service (internet access) and a few guidelines to guard against choking e-commerce from zealous taxation. One of the interesting exceptions to the Internet access provision is that it does not cover entities that engage for commercial profit, in communication of material that can also be accessed by minors, and is harmful to them, unless safeguards are implemented to restrict access.

The exception does not apply to telecommunication providers such as AT&T; ISPs such as AOL; search engines such as Yahoo; or web hosting services such as Tripod to the extent that they are providing their core services. Those entities engaging by any means, in providing unrestricted access to materials harmful to minors would be partly taxable [HAR98]. David Hardesty, an adjunct professor of taxation at the Golden Gate University notes that this can be viewed as congress using the ITFA as a backhanded way of forcing self-regulation on the Internet community, which has resisted any form of formal or direct control.

The discriminatory provision prohibits taxes imposed on electronic commerce transactions that are not generally imposed on equivalent transactions accomplished by

other means. “For example, a state could not impose a tax on access to an online newspaper where the sale of newspaper from a street corner is free of tax” [HAR98]. It also prohibits imposition of a higher tax on electronic commerce than on the same transactions accomplished by other means. “For example, a state could not impose a 7 percent sales tax on sales of flowers via the Internet where it imposes a 5 percent tax on sales from a local flower shop” [HAR98].

The ITFA also provides provisions that clarify the sales and use tax liability of online entities. States cannot impose a remote seller to collect sales tax if “the sole ability to access a site on a remote seller’s out-of-state computer server is considered a factor in determining a remote seller’s tax collection obligation...” [HAR98]. For example, consider a Washington based sports equipment company *xsports.com* that has its online shopping web site hosted on its servers located in Washington. The fact that its website is accessible in Nevada or any other state cannot be used to determine if the company has nexus in these states. A similar rule applies to ISPs. This concept is central to the definition of e-commerce taxation. However, the ITFA does not explore the situation where *xsports.com*’s website is hosted on a server located in Nevada. Presumably, Nevada can interpret the ITFA to find that *xsports.com* does have sufficient nexus as a result of the server [HAR98].

However, one of the only instances that the ITFA’s ‘discriminatory tax’ guideline was interpreted was in a private ruling made by the Web friendly state of Virginia (home of AOL), which ruled that “a Web site, hosted on a server in Virginia does not by itself result in sales tax nexus in that state” [HAR00a].

The ITFA also prevents states from imposing an obligation to collect or pay the tax on a different person or entity than in the case of equivalent transactions of goods and services accomplished by other means. For example, owing to xsports.com servers and administration in the state of Washington, it is deemed that it has nexus in that state. Consider ysports an unrelated specialty company that xsports hosts and services on the same server that it uses. The company ysports does not have nexus in Washington. Though Washington can enforce xsports collection of sales and use tax on items xports sells to Washington residents, it cannot compel xsports to collect sales and use tax on behalf of ysports for the sales ysports makes to Washington customers.

Perhaps owing to the glamour inherent in its name (Tax Freedom), the ITFA has been a source of misunderstanding and hype since its inception. The belief that anything sold over the Internet is free of sales tax has been perpetuated either intentionally or unintentionally [HAR01b]. Online companies have always been responsible for “sales tax” in states that they have sufficient nexus in and therefore have always collected tax from their in-state customers. As for the states that the online companies did not have nexus in, the buyers were responsible for filing a ‘use tax’ to their state’s tax authority. Such a responsibility often imposes a burden on individuals that goes beyond a reasonable expectation of their diligence, organization, and effort. Most people that shop on the internet are unaware of this responsibility—partly due to online companies not stating as much so their products will appear cheaper, but mostly due to non-enforcement of this requirement.

The ITFA deserves much credit in the establishment of the Advisory Commission on Electronic Commerce [HAR98].

APPENDIX C
ADVISORY COMMISSION ON ELECTRIC COMMERCE (ACEC)

The advisory commission was to conduct a thorough study of federal, state, local, and international taxation and tariff treatment of transactions using the Internet. Its report and recommendations were to be submitted to congress in June 2000. The ACEC, chaired by Virginia governor James S. Gilmore, III, an anti-tax advocate, submitted its report and recommendations, well ahead of schedule in April 2000. On perusing the report, it might be observed that the formal findings and recommendations dealt with safe and broad issues (privacy, digital divide). The real, industry-changing issues (sales and use tax) that congress would have needed guidance on, rallied only a “majority vote.” Out of the 19 member committee, there were 7 abstentions for each of the majority vote proposals (listed below). The abstentions could probably be interpreted due to a lack of clear information on what is essentially an evolving, contentious issue [ADV00]. The following is a reproduction of the ACEC’s majority vote proposals.

The ACEC’s majority vote proposal on Sales and Use Taxes [ADV00]

- 1) For a period of five years, extend the current moratorium barring multiple and discriminatory taxation of e-commerce and prohibit taxation of sales of digitized goods and products and their non-digitized counterparts;
- 2) Clarify that the following factors would not, in and of themselves, establish a seller’s physical presence in a state for purposes of determining whether a seller has sufficient nexus with that state to impose collection obligations:
 - a. a seller’s use of an Internet service provider (ISP) that has physical presence in a state
 - b. the placement of a seller’s digital data on a server located in that particular state
 - c. a seller’s use of telecommunications services provided by a telecommunications provider that has physical presence in that state

- d. a seller's ownership of intangible property that is used or is present in that state
 - e. the presence of a seller's customers in a state
 - f. a seller's affiliation with another taxpayer that has physical presence in that state
 - g. the performance of repair or warranty services with respect to property sold by a seller that does not otherwise have physical presence in that state
 - h. a contractual relationship between a seller and another party located within that state that permits goods or products purchased through the seller's Web site or catalogue to be returned to the other party's physical location within that state; and
 - i. the advertisement of a seller's business location, telephone number, and Web site address.
- 3) Encourage state and local governments to work with and through NCCUSL in drafting a uniform sales and use tax act within three years after the expiration of the current Internet Tax Freedom Act moratorium (i.e., by October 21, 2004) that would simplify state and local sales and use taxation policies so as to create and maintain parity of collection costs (net of vendor discounts) between remote sellers and comparable single-jurisdiction vendors that do not offer remote sales, including providing the following
- a. uniform tax base definitions
 - b. uniform vendor discount
 - c. uniform and simple sourcing rules
 - d. one sales and use tax rate per state and uniform limitations on state rate changes
 - e. uniform audit procedures
 - f. uniform tax returns/forms
 - g. uniform electronic filing and remittance methods
 - h. uniform exemption administration rules (including a database of all exempt entities to determine exemption status)
 - i. a methodology for approving software that sellers may rely on to determine state sales tax rates

- j. a methodology for maintaining revenue neutrality in overall sales and use tax collections within each state (such as reducing the state-wide sales tax rate) to account for any increased revenues collected (on a voluntary basis or otherwise) from remote sales.
- 4) Formation of advisory commission and reports to congress:
- a. Establish a new advisory commission responsible for oversight of the progress of NCCUSL's efforts to create a uniform sales and use tax act.
 - b. Within six months after the completion of NCCUSL's work, the commission shall transmit to Congress for its consideration a report containing the following
 - (i) findings, for the period from 1999 through 2004, regarding the growth of e-commerce, the impact of e-commerce on traditional retailers, and the impact of remote sales on state tax revenues
 - (ii) an assessment of whether the uniform sales and use tax act meets the standards listed in (3)(a) through (j) above
 - (iii) an assessment of whether the adoption of the uniform sales and use tax act would result in equal tax collection burdens (net of vendor discounts) for remote sellers and comparable single-jurisdiction vendors that do not offer remote sales
 - (iv) an assessment of whether requiring all remote sellers to collect and remit sales and use taxes to those states that adopt the uniform sales and use tax act would impose any unreasonable burden on interstate commerce or would otherwise adversely impact economic growth and activity through remote electronic channels
 - (v) a recommendation as to whether states that adopt the uniform sales and use tax act should be permitted to collect sales and use taxes on all remote sales; and
 - (vi) any other recommendations as required to address the findings of the commission's report [ADV00].

Such an advisory commission was not instated by congress but the states and local governments moved to independently work on a streamlined sales tax project (SSTP).

APPENDIX D
STREAMLINED SALES TAX PROJECT (SSTP) EXECUTIVE SUMMARY.

The following document is reproduced from the executive summary of the SSTP available online at the SSTP website: www.strealinedsalestax.org [SST02b].

The Streamlined Sales Tax Project is an effort created by state governments, with input from local governments and the private sector, to simplify and modernize sales and use tax collection and administration. The Project's proposals include tax law simplifications, more efficient administrative procedures, and emerging technologies to substantially reduce the burden of tax collection. The Project's proposals are focused on improving sales and use tax administration systems for both Main Street and remote sellers for all types of commerce.

Thirty-nine states and the District of Columbia are involved in the Project. Thirty-four states and the District of Columbia are voting participants in the Project because their legislators have enacted enabling legislation or their governors have issued executive orders or similar authorizations. Five states are non-voting participants in the work of the Project because they do not have the formal commitment of the state executive or legislative branches, but are still participating. Forty-five states and the District of Columbia impose a sales and use tax.

The Project was organized in March 2000. The Project is conducting its work through a steering committee with co-chairs, four work groups, and a number of sub-groups. Project participants are generally state revenue department administrators but there are also representatives of state legislatures and local governments. Businesses

including national retailers, trade associations, manufacturers, direct marketers, technology companies, and others have actively participated in the project by offering expertise and input, reviewing proposals, suggesting language, and testifying at public hearings.

The goal of the Streamlined Sales Tax Project is to provide states with a Streamlined Sales Tax System that includes the following key features

- Uniform definitions within tax laws. Legislatures still choose what is taxable or exempt in their state. However, participating states will agree to use the common definitions for key items in the tax base and will not deviate from these definitions. As states move from their current definitions to the Project's definitions, a certain amount of impact on state revenues is inevitable. However, it is the intent of the Project to provide states with the ability to closely mirror their existing tax bases through common definitions.
- Rate simplification. States will be allowed one state rate. Local jurisdictions will be allowed one local rate. A state or local government may not choose to tax food at one rate and all other items of tangible personal property or taxable services at another rate. State and local governments will accept responsibility for notice of rate and boundary changes at restricted times.
- State tax administration of all state and local taxes. Businesses will no longer file tax returns with each local government within which it conducts business in a state. States will be responsible for the administration of all state and local taxes and the distribution of the local taxes to the local governments. A state and its local governments will use common tax bases.
- Uniform sourcing rules. The states will have uniform and simple rules as to how they will source transactions to state and local governments. The uniform rules will be destination/delivery based and uniform for tangible personal property, digital property, and services.
- Simplified exemption administration for use- and entity-based exemptions. Sellers are relieved of the "good faith" requirements that exist in current law and will not be liable for uncollected tax. Purchasers will be responsible for paying the tax, interest, and penalties for claiming incorrect exemptions. States will have a uniform exemption certificate in paper and electronic form.
- Uniform audit procedures. Sellers who participate in one of the certified Streamlined Sales Tax System technology models will either not be audited or will have limited scope audits, depending on the technology model used. The states may conduct joint audits of large multi-state businesses.

- State funding of the system. To reduce the financial burdens on sellers, states will assume responsibility for funding some of the technology models. The states are also participating in a joint business-government study of the costs of collection on sellers.

The Project proposes that states change their sales and use tax laws to conform with the simplifications as proposed by the project. Thus, the simplifications would apply to all sellers. Participation in the Streamlined Sales Tax System is voluntary for sellers who do not have a physical presence or “nexus” with a state unless Congress chooses to require collection from all sellers for all types of commerce. Also, registration by sellers to voluntarily collect sales and use taxes will not infer that the business must collect business activity taxes, such as the corporate franchise or income tax.

The Streamlined Sales Tax System will provide sellers the opportunity to use one of three technology models. A seller may use Model 1 where a Certified Service Provider, compensated by the states, will perform all of the seller’s sales tax functions. A seller may use Model 2, a Certified Automated System, to perform only the tax calculation function. A larger seller with nationwide sales that has developed its own proprietary sales tax software may use Model 3 and have its own system certified by the states collectively. However, some sellers may choose to continue to use their current systems and still enjoy the benefits of the Project’s simplifications.

The Streamlined Sales Tax Project envisions two components to the legislation necessary to accomplish the Project’s goals. First, states would adopt enabling legislation referred to as the Uniform Sales and Use Tax Administration Act (“Act”). The Act allows the state to enter into an agreement with one or more states to simplify and modernize sales and use tax administration in order to reduce the burden of tax compliance for all

sellers and all types of commerce. The Act does not require any amendments to a state's sales and use tax law.

Secondly, states would amend or modify their sales and use tax laws to achieve the simplifications and uniformity required by the participating states working together. The Project refers to this legislation as the Streamlined Sales and Use Tax Agreement ("Agreement"). Some states will require only minor changes to current law to implement the requirements of the Agreement. Other states with more complicated sales tax laws may require significant changes to current law to be in accord with the Agreement.

A certificate of compliance will document each state's compliance with the provisions of the Agreement and cite applicable statutes, regulations or other authorities supporting such compliance. Public notice and comment will be provided before a state becomes part of the interstate Agreement. A state is expected to be in compliance with the requirements of the Agreement and to never substantially deviate from the requirements of the Agreement. If a state does substantially deviate, it will not be accepted into the interstate Agreement or will be expelled by the other participating states. In a voluntary system, sellers who are voluntarily collecting sales taxes for participating states may decide to no longer collect for the expelled state. Also, that state would not have a vote on changes in the Agreement.

As of July 2002, thirty-five states and the District of Columbia have enacted the Act. These states are considered the "Implementing States" and will control the provisions of the initial Agreement. Adoption of the Agreement will require an affirmative vote of three-fifths of the Implementing States. On all other matters (e.g., amendments to the Agreement), action is final by majority vote. Matters involving

interpretation of the Agreement may be brought before the Implementing States acting jointly. The Implementing States acting jointly are empowered to issue an interpretation of the Agreement, subject to approval by a majority of the states. An advisory council, including representatives from business, will advise Implementing States.

It is anticipated that states that enact the provisions of the Agreement as approved by the Implementing States in the summer of 2002 will continue as the governing states of the interstate Agreement of the future.

The project website is www.streamlinedsalestax.org.

APPENDIX E NETWORK MESSAGE PASSING SCENARIOS

Figure F.1 illustrates some of the scenarios that the UDP based message protocol generates. The text below explains the implementation significance of each scenario and is provided for documentation purposes. Future work includes fixing the problems identified with a *caution* note, along with the functionality to report to higher modules that take alternate courses of action.

Figure E.1 Scenarios with passing Query and Query-Acknowledgement. A) Ideal world example: The Query is sent, received, and acknowledged without delays. The CSP processes the Query and sends across a Reply, which is received and acknowledged without delay. B) Query lost: Q is sent 5 times before Dispatcher gives up. Higher module to be notified. C) Q-Ack lost: Duplicate queries at CSP site area added to the `StationHash.sHash`, if one is present already, no harm done. D) Duplicate Q-ACK: Duplicate acks are inserted into `Dispatcher.ackHash` as long as `TransactionManagement` has the `transactionID` still active (no harm done). Caution: `ackHash` is not cleared. E) Delayed-duplicate Q-ACK: It is presumed `TransactionManagement` does not have the `transactionID` still alive, the ack is NOT inserted. Caution: `ackHash` is not cleared. F) Delayed-duplicate Q: The incoming duplicate Q is counted as a fresh Q: caution.

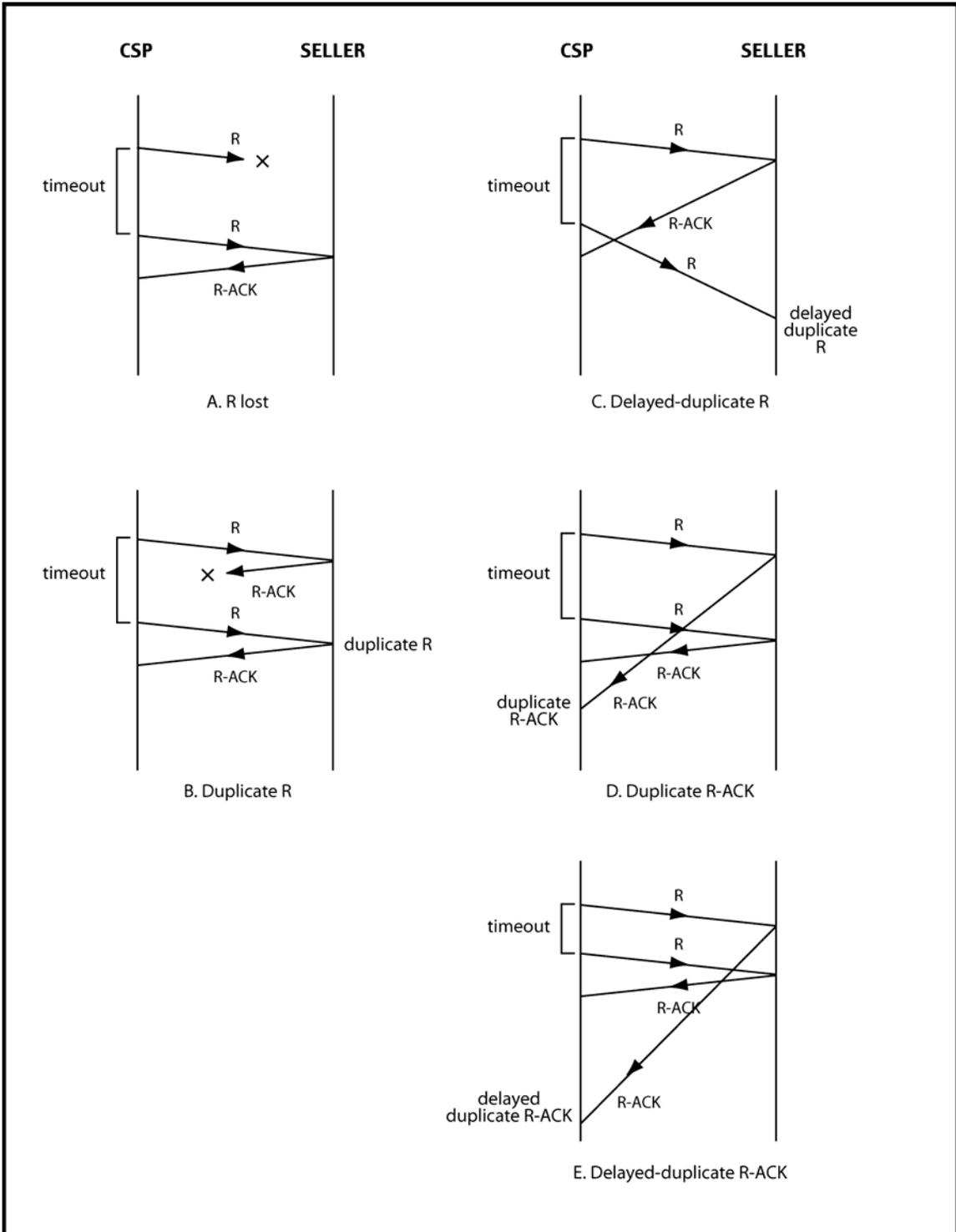
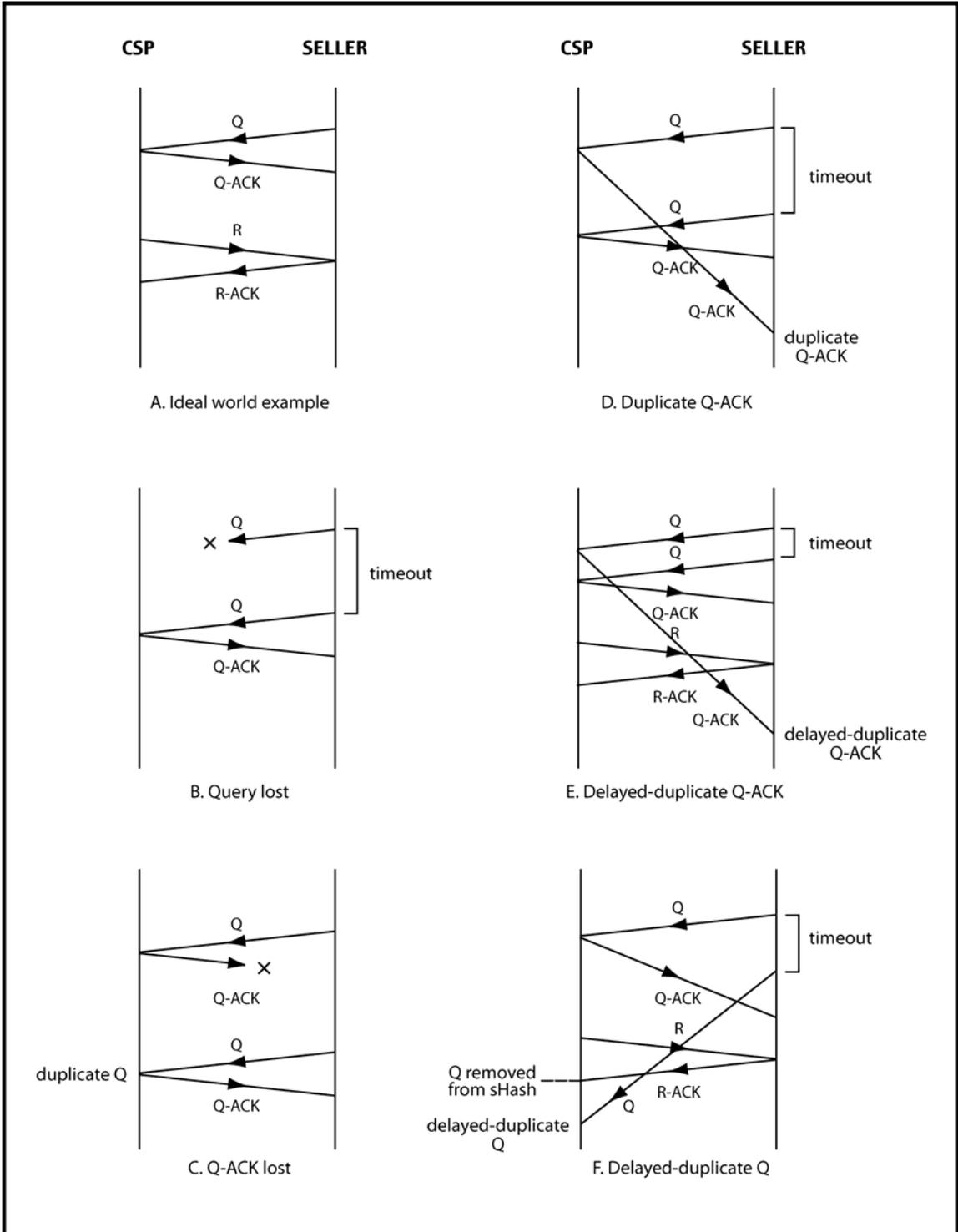


Figure E.2 Scenarios with passing Reply and Reply-Acknowledgement. A) R lost: Replies are sent by the `TaxDispatcher` 5 times before giving up. Higher module to be notified. B) Duplicate R: Duplicate replies are discarded if an entry with the same `transactionID` is already present. C) Delayed-duplicate R: Duplicate replies are discarded as the entry is still available in the `ExtractorHandler.receivedType2DocHash`. Caution: The hash table is not being cleared. D) Duplicate R-ACK: The duplicate ack is inserted into `TaxDispatcher.ackHash`: caution. E) Delayed-duplicate R-ACK: Delayed, duplicate acks are inserted into `TaxDispatcher.ackHash`



APPENDIX F DEFINITIONS OF TERMS

TaxML

XML is used to transfer information about transactions between the CSP and its clients, the sellers. A DTD defines a standard structure for the query that all sellers must conform to when requesting tax information from a CSP. The CSP returns information in another XML document (reply) that conforms to the same DTD. The prescribed DTD is called the TaxML DTD and documents that conform to it (query and reply) are called TaxML documents.

Certified Service Provider-CSP

The certified service provider is defined by the Streamlined Sales Tax Project as a certified third party firm that provides a technological mechanism to enable sellers to look up taxes for items they are selling, and for consequently transferring the tax calculated to the CSP's bank. The CSP's *tax server* that sellers connect to, and are returned tax information is frequently identified in the text of this report simply as the CSP. The SSTP agreement states that a CSP will file periodic returns to various jurisdictions. Tax is remitted after debiting a portion of the collected taxes as a servicing fee (cost of collection). The sellers are absolved of remitting taxes directly to the taxing jurisdictions and from audits as long as they have represented the goods they sought tax information on correctly.

Participating States Portal-PSP

States have come together to participate in the Streamlined Sales Tax Project either as direct participants or as observers. When five participant states have legislative approval of the tax simplifications and other mechanisms outlined in the SSTP agreement, the same goes into effect and is deemed to be binding in these five states. The agreement outlines a centralized mechanism for some administrative tasks such as having customers register for exemptions at a central location, or for sellers to register themselves using a single form etc. The central location where such forms can be found is at the Participating States Portal. The term PSP is not part of the SSTP terminology but the recommendation for a centralized mechanism is.

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BIOGRAPHICAL SKETCH

Manav Chimakurthi was born and raised in India. His schooling from 6th grade through 12th grade was at Bhavans Gandhi Vidyashram, a small school in the Annamalai mountain range in South India. He attended the College of Management Studies at GITAM, Vishakapatnam, where he received a bachelor's in business management in 1995. He received his second degree, a master's diploma in journalism and mass communication, from Symbiosis, Pune.

His first career as a copywriter in Pune and then in Hyderabad found him work at advertising agencies and design houses in these cities. While attending the University of Florida in August, 1997, his growing interest in computer science precipitated a career shift to the field. He commenced his studies towards a master's in computer science at Computer and Information Sciences and Engineering Department (CISE) in spring 1999. Nurturing an interest in technologies that can be applied to find feasible solutions to real world problems on the Internet, he pursued his current research work. His other interests lie in the field of delivering educational content over the Internet using interactive technologies.