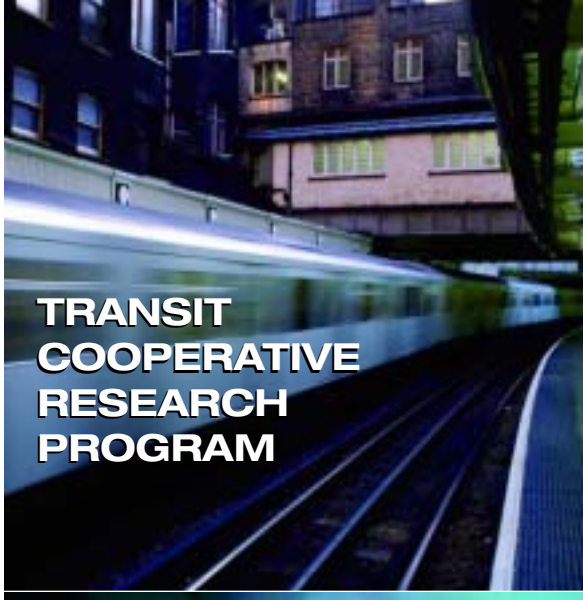

TCRP
REPORT 84

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e-Transit: Electronic Business Strategies for Public Transportation
Volume 2

Application Service Provider Implementation Guidelines

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TCRP REPORT 84

e-Transit: Electronic Business Strategies for Public Transportation Volume 2

Application Service Provider Implementation Guidelines

MITRETEK SYSTEMS
Washington, DC

SUBJECT AREAS
Public Transit

Research Sponsored by the Federal Transit Administration in Cooperation with the Transit Development Corporation

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2002
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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA; the National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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FOREWORD

By Gwen Chisholm
Staff Officer
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TCRP Report 84: e-Transit: Electronic Business Strategies for Public Transportation documents principles, techniques, and strategies that are used in electronic business strategies for public transportation. *TCRP Report 84* will be published as multiple volumes; *Volume 2: Application Service Provider Implementation Guidelines* presents the results of an investigation into the use of application service providers (ASPs) and thin client computing technologies by transit agencies. The characteristics and market position of ASPs were investigated, and the strengths and weaknesses of this computing service model were identified. A similar investigation of thin client computing was conducted and reported in this volume. This report may be used by senior managers, operations managers, maintenance managers, customer service managers, and schedulers.

The Internet and other new information and communication technologies are revolutionizing the way services are delivered and organizations are structured. Electronic business processes change the ways organizations operate and conduct business. Opportunities to lower transaction costs and improve efficiency have changed relationships between transit agencies and their suppliers and customers, and electronic business processes are likely to change industry structures in the longer term. Portals for transactions in government-to-government and business-to-government marketplaces are offered through diverse organizations. Numerous transit agencies are preparing to offer customized itinerary planning and fare media purchasing over the Internet.

The declining costs of communications, data storage, and data retrieval are accelerating the opportunities spawned by the Internet and other information and communications technologies. Choosing and sequencing investments in technologies, processes, and people to reduce costs and increase productivity present challenges to the transit manager, who must weigh the costs, benefits, and risks of changing the ways services are delivered. To assist in meeting such challenges, TCRP Project J-09 will produce a multiple-volume series under *TCRP Report 84.* The research program will identify, develop, and provide flexible, ongoing, quick-response research designed to bring electronic business strategies to public transportation and mobility management.

Volume 2: Application Service Provider Implementation Guidelines is the second volume in the *TCRP Report 84* series. Mitretek Systems prepared this report. The objectives of this task were to define a framework for evaluating ASP architectures in terms of the factors that an implementing organization would consider in its planning and to describe trends in the ASP industry. An ASP is an enterprise that provides network-based access to applications that it hosts, manages, upgrades, and operates in its own data center or in a partner's data center. A survey of transit agencies was conducted to assess the penetration of the ASP service delivery model and thin client computing into the transit industry and to identify operational and financial benefits that accrue to

agencies using ASPs and thin clients. Thin client computing is defined in the report as an application system software architecture that concentrates application business functionality and processing capability on a central server and limits the client-side portion of the application to user interface display. End users of such applications are referred to as thin clients. The findings of the study show a viable model for ASP computing service delivery that constitutes an alternative to be considered when seeking new or replacement computing services; however, the findings also show that the ASP alternative has significant associated risks, which must be mitigated through the exercise of due diligence when selecting an ASP and when contracting for ASP services. Guidelines for ASP selection and for managing an ongoing service relationship with an ASP are provided. The study found that thin client computing is a well-established, mainstream computing model that provides clear economic benefits when implemented in targeted, vertical applications.

Volumes issued under *TCRP Report 84* may be found on the TRB website at national academies.org/trb.

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The research described herein was performed under Transit Cooperative Research Program Project J-09 for fiscal year 2000 by the Intelligent Transportation Systems Division, Mitretek Systems. Robert J. Dunphy was the principal investigator. Other authors of this report are Gerard E. Hahn, Matthew H. Hardy, and Rex C. Klopfenstein. The work was performed under the overall direction of Donald Roberts.

e-Transit: Electronic Business Strategies for Public Transportation: Volume 2

APPLICATION SERVICE PROVIDER IMPLEMENTATION GUIDELINES

SUMMARY

The Application Service Provider (ASP) business model provides a viable alternative for transit agencies seeking to add new or replace existing computing services. ASPs first appeared in the late 1990s as part of the Internet boom and established operations funded by venture capital. When the level of investment interest in Internet companies dropped, many ASPs found that they had too few customers to sustain operations. The industry has been experiencing a shakeout and consolidation as inadequately funded ASPs and ASPs with flawed business plans exit the industry through bankruptcy, cessation of operations, merger, or acquisition.

Enterprises have been slow to adopt ASPs as a source of computing services. This reluctance is due to a variety of reasons that include unfamiliarity with the ASP business model, the general immaturity of the ASP industry as a whole, the high failure rate among ASPs as the industry undergoes consolidation, and the unavailability of the applications that enterprises wish to add to their computing capability portfolios. Those enterprises that have become customers of ASPs are extremely pleased with the service delivery model. Many who currently use ASPs are considering outsourcing additional applications to an ASP. Some who have had the experience of their selected ASP going out of business were sufficiently pleased with the ASP service delivery model that they subsequently subscribed to services from another ASP.

The current instability in the ASP industry demands that the prospective customer for ASP services exercise diligence in the selection of an ASP. The prospective customer must investigate the financial condition of the ASP and assess the ASP's prospect for survival. In addition, the customer must identify the ASP's partners in service delivery and assess the probability of survival of each of those as well. To determine whether the ASP is capable of delivering the services promised, it is recommended that the prospective customer conduct a thorough check of customer account references. The prospective ASP customer should also be willing to expend the effort necessary to craft and negotiate a service level agreement with the ASP that specifies the customer's expectations for service delivery, problem-resolution mechanisms, and penalties for non-performance up to and including termination of service. Finally, the prospective customer should be prepared to manage the ongoing relationship with the ASP by continually monitoring the

quality of service delivery and evaluating service-delivery metrics and by maintaining contact with the ASP throughout the duration of the service contract.

For those transit agencies with the necessary resources and the willingness to expend them in the performance of due diligence investigations of ASPs, in thorough customer reference checks, and in managing a business relationship on a continuing basis, the ASP business model provides an alternative to be considered, among others, for provisioning new or replacement computing services. The ultimate choice among available alternatives should be made only after weighing business objectives, costs, benefits, and risks, as would be done for any other business decision. Agencies that lack the resources or capability to engage in due diligence investigations and ongoing relationship management should refrain from considering the use of ASPs until the industry stabilizes and stable service providers emerge.

Thin client computing is a software architecture that concentrates processing and data storage on centralized servers and employs a minimal client-side software application to access applications hosted on the central servers. Thin client workstations can be personal computers, or they can be specialized network computers or thin client devices. Thin client devices and network computers are specialized computers that consist only of a central processor, monitor, keyboard, mouse, and memory while usually possessing minimal, if any, storage. These devices are designed to execute user-interface software residing or hosted on a central server or burned into read-only memory that allows access to centralized, enterprise thin client applications. The user-interface access software may be an Internet browser or some other minimal application.

Thin client applications and systems have been in use for several years and are accepted as standard alternatives for providing computing services. The economic benefits of thin client computing have been well established and are generally well understood. The emergence of the network computing model that calls for accessing applications over a network has accelerated the development and spread of thin client applications as each application designed to be accessed over a network or retrofitted to be web-enabled for access over a network is itself a thin client application. This style of application access is commonly accepted and is frequently provided by software vendors for client workstation access to their application systems in addition to, or instead of, client server access.

Transit agencies considering the use of thin client applications are not confronted with the risks of provider failure that must be mitigated if considering the use of an ASP. Rather, when considering thin client applications, the agency can limit its concerns to the specific applications to be implemented as thin client, costs, the anticipated benefits to the agency of thin client–application adoption, any infrastructure upgrades that might be prerequisite for thin client implementation, and with the agency's technical capability to implement and support thin client applications. If the applications under consideration for thin client implementation are structured, transaction-oriented, and repetitive, the thin client computing model is an appropriate alternative for providing the applications. If, on the other hand, the applications to be provided are compute-intensive, data-intensive, or if they support creative work processes, thin client may not be the optimum choice for application support. If an agency can satisfy itself that the end result of these considerations is positive, then the agency should not hesitate to proceed with the selection of a thin client solution for providing its computing needs.

CHAPTER **1**

INTRODUCTION AND RESEARCH METHODOLOGY

The 1990s witnessed the development of the Internet from an obscure network to a ubiquitous enabling technology for information delivery and commerce. Advances in network technology gave rise to network-centric computing in which instead of being directly attached to a local computer hosting software applications, end users connected to a network and accessed those applications over the network. With this advance, the computers hosting the applications could be located in the same facility with their end users or they could be located in a remote facility.

In the late 1990s, a new type of outsourcing emerged that allowed enterprises to access individual applications as a service over a network on a subscription basis. A vendor offering this subscription service was called an "application service provider" (ASP). The network could be the Internet, or it could be a private Internet Protocol (IP) wide area network (WAN). ASPs deliver access to software applications across a network and provide associated maintenance, operations, and support services. ASPs generally employ thin client technologies in provisioning their service offerings. The applications offered can be commercial software applications, or they could be applications custom-developed by the ASP. The applications offered either have been designed specifically for access over an IP network, or have been modified to allow network access. The most common means client-side access to the ASP application's user interface is through an Internet browser such as Microsoft Internet Explorer or Netscape Navigator.

Applications that employ thin client technology can also be implemented internally by an enterprise. The enterprise hosts those applications on servers housed within its own data center and provides end user access to those applications across its private network or intranet. For thin client applications, the enterprise provides all of the computing services, software support, operations, maintenance, and end-user support required to operate the application. An enterprise could consider obtaining access to the same application that it might host internally using thin client technology from an ASP. In this case, the ASP would host the application on servers residing in its own or in a partner's data center and would provide all of the computing and support services necessary to operate the application.

Both internal thin client computing and subscription access to outsourced applications hosted by an ASP are options available to transit agencies for provisioning their application software needs. The purpose of this report is to document guidelines to be used by transit agencies when considering subscribing to outsourced access to software applications hosted by an ASP or when considering operating thin client–software applications internally.

The research methodology used for this investigation consisted of two surveys. The first was a survey of the industry trade press for reports concerning the use of ASP services and internal thin client applications. This investigation was intended to assess industry usage of ASPs and thin client applications and to identify the general characteristics of those operating models and the risks and benefits associated with their use. The second survey was a survey of transit agencies to assess the level to which the transit industry has adopted the ASP and thin client operating models for provisioning computing services. The results of these separate lines of investigation were combined into guidelines for the implementation of the ASP and thin client computing service provisioning model in the transit industry.

CHAPTER 2

FINDINGS

ASP BACKGROUND

ASP Business Model

An ASP is an enterprise that provides network-based access to applications that it hosts, maintains, manages, upgrades, and operates in its own data center or in a partner's data center. ASPs rent access to their applications for a monthly fee; this fee usually depends upon the number of users accessing the application, the specific application modules accessed, and associated service and support options selected by the customer. The ASPs' products are its applications and associated support services. ASPs market the same applications to a broad range of customers with minimal levels of application customization and attempt to realize economies of scale by delivering the same application service to many customers; customers hope to share these economies of scale in the form of a total cost of operation that is less than the cost of hosting the same application internally.

There are a number of descriptions of the ASP business model in use, but there is no single formal definition of the model. ASPs self-identify so that any vendor who chooses to claim to be an ASP is classified as one regardless of the combination of services that vendor offers. As a result, it can be difficult to compare service offerings from different self-identified ASPs. Ashenhurst (*1*), Lavery (*2*), and Hayes (*3*) provide slightly varying descriptions of the ASP business model. There is, however, general agreement that the ASP business model contains four key elements:

- **Application hosting:** Software applications run on a host computer operated by the ASP or by a business partner.
- **Network access:** Applications are accessed across a network, either the Internet or a private WAN.
- **Thin client interface:** Software applications offered are server-centric and concentrate their processing on servers hosted by the ASP. The applications are generally accessed through an Internet browser or some other minimal client-side application running on the customer's desktop computers.
- **Subscription access:** Customers subscribe to software applications for an agreed-upon period of time rather than licensing the software directly and pay a monthly rental fee for that access.

The first ASPs appeared in the late 1990s. The term "application service provider" was first applied to these vendors in 1998. The appearance of ASPs coincided with the emergence of what came to be known as the "Internet economy." During this period, investors were willing to provide large amounts of investment capital to all manner of start-up enterprises with business plans loosely based on the Internet. The ready availability of investment capital lowered barriers to entry into the industry and allowed many ASPs to establish themselves. These ASPs began to invest in the infrastructure required for their service offerings: data centers, networks, computing hardware, software licenses, and software development. Initially, ASPs attracted few customers. Their business plans relied upon continued availability of venture capital funding until such time as they could expand their customer bases to generate positive cash flow.

When investors lost confidence in the Internet economy in mid-2000, venture capital became unavailable and ASPs, along with other companies who were part of the Internet economy, were forced to rely largely upon revenue derived from their customers for survival. The ASPs found themselves burdened with debts incurred while building infrastructure and with a customer base that generated a revenue stream too small to sustain operations. As ASPs exhausted their cash reserves, they began to exit the market through cessation of operations, bankruptcy, merger, acquisition, or by entering different businesses. The trade press contains numerous reports of ASPs exiting the market suddenly and leaving their customers to replace the ASP services with little or no notice. Bushaus (*4*), Songini (*5* and *6*), Mears (*7* and *8*), Hudson (*9*), Mitchell (*10*), and others document numerous cases of ASP failure. This shakeout in the ASP market was sufficiently severe to cause Gartner Group to predict that 60% of the ASPs in existence in mid-2000 would fail by the end of 2002, as reported by Sweeney (*11*).

In spite of these problems, many customers who had subscribed to ASP services received the levels of service they desired and achieved the business objectives that had initially led them to the ASP model. Muse (*12*) reports the results of an International Data Corporation (IDC) survey in which adopters of the ASP business model achieved significant return on their investments in ASP services. In several cases, customers who experienced an ASP failure responded by finding another ASP and transferring their processing to the

new ASP rather than licensing the software applications themselves and bringing the processing in-house.

Benefits of ASP Usage

The ASP industry claims a number of benefits result from subscribing to ASP services. These benefits include the following:

- **Application access:** ASPs make access to sophisticated applications available to small- and medium-size organizations—applications that those organizations could not afford to license and operate internally. ASPs also make a wide variety of applications available to organizations of all sizes.
- **Concentration on core competency:** Use of an ASP allows the customer organization to focus the resources that would have been used to host an application in-house on activities related directly to the customer's core business.
- **Cost control:** Use of an ASP generates a predictable and controllable cost for the application service in the form of a predictable monthly subscription fee in place of the less-controlled and less-predictable costs of hosting the same application internally.
- **Reduced need for information technology (IT) expertise:** ASP applications reduce the need to recruit and retain information technology staff personnel knowledgeable in the application being hosted.
- **Reduced capital expenditures:** Renting applications from an ASP reduces the need for large up-front investments in computing hardware, software licenses, and integration services that frequently accompany the implementation of new applications.
- **Access to best computing practices:** ASP services typically include such industry best practices as application and data backup–and–recovery services, access control and security, data redundancy, and disaster recovery. ASP offerings in these services are frequently more sophisticated than the services that ASP customers could provide for themselves.
- **Service delivery:** The ASP provides help desk and application support, eliminating the need to provide that support internally.
- **System availability:** ASPs can provide the availability levels for mission-critical applications that the customer's own organization may not be able to support.
- **Rapid implementation:** ASPs can generally deploy applications for customers in less elapsed time than the customers would require for implementing the same application.
- **Decreased implementation effort:** ASP software generally requires less implementation effort on the part of the customer organization than if the customer organization hosted the application internally.
- **Guaranteed service levels:** Use of an ASP results in improved application service and customer service. ASP application service and customer-service delivery levels are governed by service-level agreements (SLAs), which guarantee the quality of service. Similar agreements with service-level guarantees are typically not available when applications are hosted internally.
- **Lower cost of ownership:** The ASP computing model provides customer organizations with the opportunity to reduce overall costs of ownership of the rented applications, thereby eliminating the need for the customer to invest in computing hardware and software or to incur the continuing costs of maintaining, upgrading, and supporting that hardware and software.
- **Return on investment:** Subscribing to ASP services and leveraging the ASP's capabilities to implement rapidly allow the customer to avoid high start-up costs and provide service at a continuing cost that does not exceed a customer's internal cost of ownership. This allows customers the opportunity to achieve a positive return on investment in less time than if the same applications were hosted internally.

ASP Software Application Offerings

The ASP industry offers subscription access to commercial software applications and to custom-developed applications implemented by the ASPs themselves. Table 1 lists examples of application categories offered by ASPs and specific commercial software applications offered in each category.

The applications in Table 1 are of general interest across all industries and are typical offerings of what might be called "horizontal ASPs"—ASPs that offer applications of general interest and applicability to all industries. In addition to general commercial software applications as shown in Table 1, some ASPs offer applications with a specific vertical market focus. Examples of such applications include association membership management, financial risk management, medical practice administration, and truck-routing and fuel management.

A few ASPs offer applications that might be of specific interest to the transit industry. These applications include vehicle-fleet management, traveler information, fuel management, and passenger count reporting. Overall, the most popular applications according to the Information Technology Association of America (ITAA) are e-mail, e-Commerce, accounting and finance, office productivity, and human relations, in that order (*13*). Pring (*14*), in the results of a different survey conducted by Gartner Group, confirms that human-relations applications are among the most popular ASP service offerings.

ASP Services Offered

In addition to software application access, ASPs also offer a wide range of services that are associated with hosting,

TABLE 1 Examples of ASP commercial software application offerings

Application Category	ASP Commercial Software Offering*
e-Commerce	Broadvision BEA Weblogic Microsoft .NET Services
Customer Relationship Management	Siebel
Professional Services Automation	Microsoft Great Plains Peoplesoft Solomon Software
e-Mail/Collaboration	Microsoft Exchange 2000
Manufacturing and Distribution	Microsoft Great Plains Peoplesoft Solomon Software
Human Resources Management	Oracle Peoplesoft SAP
Business Intelligence	Cognos
e-Procurement	Ariba CommerceOne
Enterprise Resources Planning	Lawson Peoplesoft SAP
Personal Productivity	Microsoft Office

* Commercial software packages listed in Table 1 are examples of applications offered by active ASPs in each of the corresponding application categories. These are not the only applications available in the listed categories; this list does not imply any endorsement of these applications.

operating, and maintaining software applications and providing support to the customers who subscribe to those software applications. Some ASP services are included as part of the overall service subscription; other services may require a separate service subscription. Examples of services offered by ASPs are as follows:

- Computing operations;
- Software installation;
- Software maintenance and upgrading;
- Technical support;
- Network management;
- Performance monitoring, management, and reporting;
- Access management;
- Basic help desk and technical support;
- Application availability;
- Application performance monitoring;
- Hardware installation;
- Hardware maintenance and upgrading;
- Capacity planning and management;
- Backup and recovery;
- Data and application redundancy and mirroring;
- Disaster recovery;
- Off-site data storage;
- Application customization;
- Integrating (interfacing) with other ASP-hosted applications or customer in-house applications;
- Network and data security;
- End-user training and education; and
- Dedicated help desk and technical support.

ASP Adoption

Recent surveys conducted by industry analysts, the trade press, and trade associations have shown that ASPs have secured a foothold in the market and that while the current rates of ASP adoption are low, there is a future for this business model. Terdiman (*15*) predicts that during calendar year 2002, the ASP model will be accepted as a mainstream alternative rather than as an untested or experimental option for outsourcing computing services.

ITAA (*16*) published results of a customer-demand survey conducted in early 2000 in which 18.5% of the survey respondents were using ASP services and in which another 23.9% of respondents were planning to evaluate ASP services within the following calendar year. The survey also revealed that the survey respondents considered themselves to be well acquainted with the ASP business model and the customer value proposition offered by ASPs. Of the respondents, 35.7% considered themselves to be very familiar with the ASP concept; 40.5% considered themselves to be somewhat familiar with the concept.

Pring (*17*) documented the results of a survey conducted by Gartner Dataquest and published in August 2001 that

found that 19% of its respondents currently outsourced one application to an ASP; the survey found that another 18% of respondents outsourced more than one application to ASPs. Another 13% of respondents were actively evaluating ASPs at the time of the survey.

Borthick (*18*) shows a case of slightly less-positive survey responses. This survey was the Business Communications Review of outsourcing trends. This survey found that only 11% of respondents currently outsourced data applications to ASPs; 7% outsourced voice applications. A significant negative result of this survey was that a full 24% of responses said that they would not consider outsourcing either data or voice applications to an ASP. In the federal government market, ITAA (*19*) found that ASP usage among federal agencies lags that found in the more general surveys. This survey revealed that only 6.5% of the surveyed agencies currently outsourced applications to ASPs and that another 20% were evaluating the ASP option.

These surveys show that the ASP business model has secured a place in the market for providing outsourced computing services both in the private sector and for the federal government and has achieved the status of an alternative source of services to be considered.

Barriers to ASP Adoption

Although there are benefits and advantages to adopting the ASP model for obtaining computing services and although surveys show that this computing model has been accepted, in general customers have been slow to adopt this computing model. Some of the reasons for this reluctance are listed below.

- **Customer confusion:** There is no commonly accepted definition of "application service provider." Vendors with different product and service offerings and differing business plans have all adopted the label. As a result, some potential customers become confused with the many options available in the ASP market and the difficulty in attempting to compare the varying service offerings.
- **Culture:** The ASP business model represents a new way of doing business for many prospective ASP customers; many are not ready to experiment with what is viewed as an untried and untested mode of operation.
- **Fear of loss of control:** Some organizations fear the loss of control that would accompany outsourcing mission-critical applications to ASPs.
- **Data security:** Many organizations are concerned over the possible compromise or theft of critical enterprise data while the data is in the custody of an outside agent.
- **Fear of ASP failure:** Concern about the potential of ASPs to cease service delivery because of bankruptcy, merger, acquisition, or decision to exit the service-provider market has caused some prospective customers to defer considering ASP services or to bypass consideration of ASP services altogether.
- **Single-application outsourcing:** The ASP model outsources one application at a time. Many organizations seeking to outsource applications hope to outsource their entire portfolio of applications, not just selected individual applications.
- **Application performance:** Concern regarding the inadequate performance of applications accessed over the Internet or over a private network eliminates ASPs from consideration as viable alternatives.
- **Software availability:** The inability to find ASPs offering the specific application functionality or the specific commercial software applications desired is also a reason for reluctance.
- **Continued software availability:** The fear that an ASP may discontinue a software application at some point in the future is another reason for slow adoption of the service.
- **Scalability:** The concern that the ASP may be unable to scale an application to meet the service demand of all of its customers for that application also causes reluctance.
- **Applications already in-house:** Organizations that already have operating applications hosted in-house or that are obtaining application services from another source may be reluctant to consider outsourcing those same applications to an ASP unless there is come compelling reason to replace the existing application service.
- **Service delivery:** Concern that the ASP will be unable to meet the performance specifications and customer-service levels committed to in an SLA creates reluctance to adopt.
- **Lack of application customization:** ASPs generally attempt to deliver generic applications to their customers with little or no customization of applications beyond corporate logos. Large organizations frequently insist upon extensive customization of packaged applications prior to use. The unavailability of this level of customization discourages some organizations from considering ASPs.
- **Lack of application integration:** Many applications interface data with other enterprise systems. There is a concern that ASPs do not have the capability or resources to interface data from one application hosted at their data centers to other enterprise applications, whether the other enterprise centers are hosted in the ASP's data center, at the customer's operating location, or at a third-party location.
- **Conversion cost:** The anticipated cost to convert from an existing application hosted in-house to an ASP-hosted application is considered excessive.
- **Low market awareness:** Potential customers are not sufficiently aware of the services offered by ASPs or the overall ASP value proposition to seriously investigate the ASP alternative.

- **Problem resolution:** Concern that the vendor will be unresponsive to customer problems, especially if the customer is a small customer, creates reluctance to use ASPs.
- **Service interruption:** Fear of loss of service from outsourced mission-critical systems because of network outages also causes reluctance.

ASP Customers

The ASP model has been described as being intended for small- and medium-size organizations that do not have the resources or financing to host and operate state-of-the-art applications internally. These types of customers were the first targets for ASP services. However, Pring (*20*) points out that based on Gartner Group research, 40% of ASP business volume originates within Fortune 500 businesses. The ITAA 2000 customer-demand survey indicated that of its 1,526 responses, 20.3% were from organizations with more than 5,000 employees and 10.8% were from organizations with more than 25,000 employees (*21*). On the other hand, this survey also showed that 42% of responses were from organizations with fewer than 100 employees, and 37.6% of responses were from organizations with between 100 and 500 employees. These results show that while a clear majority of customers are small organizations, there is a significant investment in the ASP computing model by organizations of all sizes.

THIN CLIENT COMPUTING

Thin Client Computing Model

Thin client computing is an application system software architecture that concentrates application business functionality and processing capability on a central server and limits the client-side portion of the application to user-interface display. End users access the central application using client software loaded on desktop workstations and connect to the central server over a network. Thin client computing has become a standard application architecture because of the emergence of applications designed to run either over the Internet or over a private network using only a client-side Internet browser to access the application. Lowber (*22*) cites a trend toward the use of an Internet browser such as Microsoft Internet Explorer or Netscape Navigator as the standard client-side software application for accessing networked systems.

The desktop workstation used with the thin client applications can be either a standard personal computer (PC), or it can be a thin client device. The concentration of processing and data storage on the server reduces the processing burden on the client-side device and allows the use of a less-powerful computing device than would otherwise be required. This device needs to run only the client-side, user interface–display software, which may be an Internet browser for web-enabled applications or a minimal user interface–display application.

Thin client devices are specialized computers that include a central processor, monitor, keyboard, mouse, and memory, but do not include local storage in the form of floppy or hard disks and do not include CD or DCD disk drives. These devices are used to run client interface software hosted on a server or interface software burned into read-only memory.

Lowber (*23*) reports that the most popular method for implementing thin client computing is through the use of Microsoft Windows Terminal Services in conjunction with Citrix Metaframe. This implementation allows Windows-based applications that normally run on a PC to be run from a server and accessed from thin client workstations.

Thin client computing is best suited for hosting applications that are transaction-oriented. Lowber (*24*) recommends against installing thin client computers as a general across-the-board replacement for PC-based applications and is in favor of installing thin client applications to support work that is structured or repetitive but not for work that is creatively driven. Lowber (*25*) identifies applications supporting call centers, customer-service functions, medical-records processing, package tracking, insurance-claims filing, and airline-reservation processing as being well suited for the thin client computing model. Applications similar to these—along with occasional use of Microsoft Office applications, e-mail, and Internet browsers—are also well suited for thin client computing.

However, applications supporting users who are classified as power users or those who use applications in support of creatively driven work activities are generally not good candidates for thin client application support. Heavy usage of Microsoft Office applications, computation-intensive and data-intensive processing, graphics, and multimedia applications are all poor candidates for replacement with thin client applications. User populations that require the capability to work in a mobile environment or the ability to work while disconnected from the network are also inappropriate candidates for thin client processing support. In spite of these restrictions, Lowber (*26*) finds that thin client computing can support 85% of most users' needs.

The desktop workstation used with thin client applications can be a thin client device, or it can be a PC configured with an Internet browser. The essential components of a thin client device are a display monitor, a central processing unit, memory, and a keyboard. These devices are designed to have as few moving parts as possible and frequently have no hard disks or floppy disks. These devices may have an Internet browser burned into read-only memory, or it may run the browser from a server. An alternative device in a thin client configuration is a PC configured with an Internet browser. Lowber (*27*) reports that 85% of thin client desktop devices are PCs. Because these computers only need to run a browser to access the server-based central thin client application, they can be older machines that lack the system resources to run other desktop applications.

Thin Client Benefits

Thin client computing offers several benefits to those organizations that choose to implement it. Lowber (*28*) identifies the following benefits:

- **Reduced costs:** Thin client computing reduces the amount of support required to install, maintain, support, and upgrade software residing on desktop computers. If thin client computing devices are adopted, the use of these devices reduces the cost of desktop hardware support and repair in addition to reducing software support costs.
- **Reduced staffing:** The reduction in desktop software and optionally hardware support requires fewer staff to provide that support and allows those staff hours previously dedicated to desktop support—especially help desk and desktop support—to be reallocated to other duties.
- **Accelerated application deployment:** Thin client applications typically require only server-side installation, especially if they are designed for access with an Internet browser. This allows new applications to be installed without having to perform an installation on desktop workstations once the thin client infrastructure is in place.
- **Ease of remote access:** Thin client applications accessible from an Internet browser promote remote access.
- **Increased client reliability:** The use of a thin client hardware device provides a client hardware device that is more reliable than is the typical PC because of the absence of disk drives and other moving parts.
- **Reduced support:** Thin client usage reduces or eliminates client-side hardware and software support.
- **Desktop standardization:** The use of the thin client architecture provides control over the software that can be run on client workstations.

Thin Client Limitations

The thin client computing model does have several limitations that offset its benefits. The following is a list of issues that should be considered prior to deciding to implement thin client computing:

- **Increased server cost:** Added server capacity will normally be required for installing and operating the server-centric thin client application systems. If new servers are required, this may require a capital expenditure.
- **Increased server support costs:** The concentration of processing capability and application software on the server increases the amount of effort required to support the server environment and, therefore, server support cost.
- **Increased software license costs:** License costs for the software that enables the server-based thin client computing and the license costs for the thin client applications increase server software license costs.
- **Required expertise:** Thin client computing requires skilled technical personnel who can install, configure, maintain, and operate the server-side thin client software applications and who can provide the ongoing support for those applications and the servers in which those applications reside.
- **Scalability:** The central servers must be able to accommodate the processing load generated by the desktop users accessing the thin client applications residing on them. Servers must be sized to accommodate peak processing loads and must have an available upgrade path in the event of future increases in processing loads.
- **Network infrastructure upgrades:** Thin client computing increases network usage by introducing server-to-desktop data transfers that did not exist under a client-server architecture. The increase in data transfer may require an increase in network bandwidth to deliver optimum performance to desktop users. This bandwidth increase may require network upgrades as part of the cost of system implementation.
- **Server and network dependence:** Thin client applications can only be used if the servers hosting those applications are running and if the client workstations are connected to the network.
- **Inability to work offline:** The thin client architecture requires continuous access to the server-based application from the desktop device in order to use the application. Server or network failures will result in end-user downtime. End users will be unable to work offline in a purely thin client environment.
- **Application performance:** Delivery of application access over a network makes application performance dependent not only upon the central server's performance, but also upon network performance.
- **End-user reaction:** One of the major drawbacks to thin client computing is the reaction of PC users to thin client devices. Users accustomed to working with full-functioned PCs with resident software may consider the introduction of thin client systems as a reduction in their stature in the organization. Lowber (*29*) claims that 85% of end-user computing needs can be met with a thin client device and system. However, thin client devices are not appropriate for users who are classified as power users or for those who need to work offline.
- **Staffing:** The inability to attract and retain the trained technical staff required to implement, maintain, and operate server-based applications and the servers in which those applications reside is also an issue to consider.

Thin Client Adoption

Thin client adoption is driven by different dynamics than is the adoption of the ASP outsourcing model. Thin client

technology has been available for a number of years and appears to be well on its way to universal acceptance. Lowber (*30*) forecasts that by 2005, 75% of enterprises will adopt thin client computing for at least some applications. Of these applications, 80% are forecast to be Windows Terminal Services installations implemented for specifically targeted applications used in specialized, task-oriented environments. Only 2% of enterprises are expected to convert completely to thin client architecture.

The adoption of thin client computing is driven by cost-of-ownership considerations and the emergence of software designed for operation over a network. Thin client reduces the amount of software to be installed, maintained, and supported on desktop workstations and provides a means to reduce the cost of that desktop support. Network software architecture has emerged in response to a demand for software that can run on a central server and that can be accessed across a network using an Internet browser. Network computing has become the preferred software architecture for many enterprises with an Internet browser as the client-side software for accessing central applications.

Any organization with the technical resources and expertise to install and operate central servers, server-based applications, and a network that allows desktop workstations to access the central applications can consider installing thin client applications internally. Large- and medium-size organizations are those most likely to have the required infrastructure and expertise to implement, maintain, support, and operate thin client systems. Technically astute smaller organizations may also consider thin client computing as an alternative as well. Lowber (*31*) asserts that the best fit for thin client applications and thin client desktop devices is in areas in which the users perform structured, repetitive tasks such as data entry that are not creatively driven.

From a Gartner Group survey published in April 2001, Lowber (*32*) reported that organizations that had previously had an unmanaged desktop computing environment achieved a 32% reduction in cost of ownership as a result of thin client implementation. An unmanaged environment is one in which central management and administration services have not been implemented and service and support for desktop workstations requires that a technician physically visit the workstation. In contrast, organizations that had already implemented centralized desktop administration achieved only a 1% reduction in the overall cost of ownership.

Lowber (*33*) identified savings resulting from a switch to thin client computing in both direct and indirect costs. Direct costs include those such as software maintenance and distribution, hardware maintenance and operation, staffing, and administration. Indirect costs include the costs of end-user self support, casual colleague support, casual and formal training, and file and data management. When moving to a thin client environment from a loosely managed PC environment, indirect costs decreased by 90% on average; direct costs fell by 26%. When moving from a well-managed PC environment, indirect costs fell by 32% and direct costs fell by 13%. However, cost reductions as a result of thin client implementations are not guaranteed and must be examined on a case-by-case basis. Many of those organizations reporting the greatest cost savings from implementing thin client applications were those that had not implemented industry best practices in managing desktop workstations and applications.

Barriers to Thin Client Adoption

In spite of the cost and management advantages associated with thin client computing, there are negative considerations that must be considered when contemplating thin client implementation. These include the following:

- **Lack of information technology expertise:** The lack of sufficient expertise in the internal information technology organization to implement, maintain, and operate thin client applications and the servers required to host them is a consideration.
- **Capital expenditures:** The cost of the capital expenditures required to license the thin client application systems and the cost of acquiring the servers required to run those applications should be considered.
- **Cost of infrastructure upgrades:** The cost of upgrading the internal network to provide the bandwidth required for the operation of thin client applications is an element to consider.
- **Application suitability:** Not all applications and environments are well suited to the thin client computing model. Environments in which users employ applications that require the performance of structured and repetitive tasks are well suited to thin client computing. Those environments in which end users are engaged in creative activities and that require extensive data transfers from client to server are less well suited.
- **Inability to work offline:** If users must be able to continue working in the event of a network or server outage, thin client is inappropriate.
- **Application portfolio:** Generally, it is not possible to implement an organization's entire application portfolio using thin client technology. This results in a mixed environment that includes both thin and fat client applications that frequently must be accessed from the same client device.
- **Existing investments in hardware and software:** The presence of applications that have not yet reached the end of their operational lifetime presents a barrier to the adoption of thin client computing. Unless the implementation of thin client systems to replace the existing systems is accompanied by a substantial economic benefit, the presence of existing systems will generally delay the consideration of thin client adoption until a replacement for the existing systems is required.

COMPARISON OF ASP AND THIN CLIENT

The fundamental difference between the ASP service delivery model and thin client computing is that in the ASP case, application hosting and operation is outsourced to an external vendor, the ASP. Under the ASP model, the ASP vendor takes responsibility for all hardware and software issues, system implementation, operation, hardware and software maintenance and upgrades, performance monitoring, and user support. Under the thin client model in which systems are hosted internally within an organization, the organization itself assumes all of the responsibilities that would have been outsourced under the ASP model.

Both the ASP and thin client models rely upon network access to the hosted systems. For the ASP model, the network may be either the Internet or some other private IP-based network. In the thin client model, the network is usually a private corporate network.

ASP RISKS AND RISK MITIGATION

This section and the next discuss the major risks associated with outsourcing applications to ASPs and the risks in using thin client computing, respectively, and discuss techniques for mitigating each risk.

The major risks associated with outsourcing applications to ASPs are as follows:

- **ASP failure or bankruptcy:** A full investigation of the ASP financial position is required to assess whether the customer will be at risk of sudden loss of service caused by ASP failure. For publicly held ASPs, check Securities and Exchange Commission filings. For all ASPs, ask for a full customer list and assess whether the ASP has a positive cash flow; assess whether the ASP is profitable. Determine whether the ASP relies upon venture capital or whether its business generates operating revenue. For privately held ASPs, ask for financial statements directly from the ASP; check trade publications and the Internet for news items mentioning the ASP. Pay particular attention to any items mentioning layoffs, restructuring, or problems raising capital. If the ASP has business partners, perform similar checks on each of the partners.
- **Loss of access to ASP applications:** Ensure that the applications that the ASP operates are compatible with the customer's internal computing infrastructure so that the customer can load and operate those applications if required. If the ASP has developed its own applications, negotiate the rights to license that software should the ASP exit the business. Alternatively, negotiate a code escrow agreement to ensure access to application source code in the event of ASP failure.
- **Interruption of service:** To avoid interruption of service problems, ask the ASP for a list of reference accounts that subscribe to applications and services similar to those under consideration. Check these references thoroughly. Ask for copies of the SLAs that apply to each of these references. Interview each reference account and inquire specifically about continuity of service—the ASPs track record in meeting the service levels specified in the SLA. Inquire about ASP handling of situations in which the SLA has not been met. When negotiating an SLA with the ASP, insert specific performance metrics that the ASP must meet. Also, insert provisions for performance reporting to the customer. Include provisions in the SLA for the use of a third-party performance-monitoring service to track delivery service levels or provisions for the customer to operate monitoring software at the customer site and tie penalty clauses in the SLA to the results of this monitoring. Ensure that all of the ASP's business partners are covered by the terms and conditions in the SLA so that the ASP is accountable for failures by any one of its partners.
- **Loss or compromise of sensitive or mission-critical data:** If data security is of paramount importance, the prospective customer may decide not to outsource the systems that process that data. If the decision is made to proceed with outsourcing, include in the SLA provisions for the periodic delivery of backup copies of critical data to the customer in a format the customer can interpret and process. Insert provisions into the SLA requiring storage of copies of data backups at off-site storage locations where the customer can access them.
- **Loss of control of applications:** To avoid the loss of the expertise required to maintain and operate mission-critical systems, do not outsource those systems to an ASP—rather, keep them in-house.
- **Vendor lock-in:** To avoid becoming trapped in a contract with a vendor who does not or cannot fulfill the terms of an agreement, include the terms and conditions in the SLA under which the customer may unilaterally terminate the contract with the vendor. Specifically state the vendor's obligations under such a termination for returning data, providing access to software application licenses or source code, and any other services that may be required during the course of termination. In addition, the customer should develop a contingency plan for transferring its application to another ASP, into its own organization, or to another type of service provider.
- **End-of-engagement problems:** All business relationships eventually come to an end. Plan this separation initially and include specific provisions in the SLA that address these end-of-relationship processes.
- **Quality-of-service risks when accessing applications over the Internet:** ASPs have no control over the performance of the Internet. To minimize this risk, deal only with ASPs that employ private networks as well as the Internet and in which either the ASP or one of the ASP's partners will be accountable for network performance.

- **Failure to meet specified service levels:** Check the ASP's prior service-delivery performance with existing ASP customers. Investigate how the ASP delivers service and how the ASP handles customer problems and increases the priority given to problems remaining unresolved after fixed periods of time. Determine exactly what service levels are required and specifically insert those levels and the metrics to be used to evaluate the levels into the SLA. Include application availability, application response time, any other technical performance criteria, and escalation procedures for problem resolution.
- **Costs:** Investigate the ASPs business model and cost structure thoroughly. Investigate any one-time initial setup and conversion charges, assess monthly subscription fees, and examine the basis for those fees. Investigate how fees change in response to increases and decreases in the number of users and to increases and decreases in transaction volumes.

THIN CLIENT RISKS AND RISK MITIGATION

Unlike the case with ASPs in which many of the potential risks are in dealing with an outsourcing vendor, all the risks in thin client usage are internal to the organization itself:

- Inability to attract and retain the technical staff required to implement, maintain, and operate the thin client systems;
- Resistance by traditional PC users;
- Unavailability of budgets for infrastructure improvements, servers, and software licenses; and
- Availability of operations and maintenance budgets.

ASP AND THIN CLIENT USAGE IN THE TRANSIT INDUSTRY

The following section provides a summary of the survey conducted as part the e-Transit research project (TCRP Project J-09, Task 1). A more-detailed summary is provided in Appendix B. The goal of the survey was twofold: first, to determine the extent to which transit agencies are aware of and understand the concepts of ASP outsourcing and thin client computing; and second, to assess the degree to which transit agencies currently use ASP outsourcing and thin client computing and the effects that use has had on business operations.

The survey was conducted through a combination of telephone interviews and e-mail solicitations. A total of 64 transit agencies were contacted; of these, 10 responded—a 15% response rate. Table 2 provides a summary of the survey responses. Of the survey responses, 70% of respondents indicated that they were familiar with the ASP business model and ASPs in general while 30% were not. Currently, 30% of the respondents use ASPs. Of those respondents who do not currently use ASPs, 29% had considered using ASPs but elected not to do so, and 71% had not given any consideration to using them. The survey showed that 50% of the respondents were familiar with thin client computing and that 20% currently use thin client systems. Of those respondents not currently using thin client applications, none had previously considered their use.

The agency interviews provided a few additional insights. The transit agency institutional setting has a direct impact on agency consideration and awareness of ASP services and thin client systems. Some transit agencies are units of local government and obtain their computing services from some

TABLE 2 Survey response

ASP	Yes		No	
Are you familiar with ASP?	7	70%	3	30%
Do you currently, or have you previously, used an ASP?	3	30%	7	70%
If NO, have you considered using an ASP?	2	29%	5	71%
Thin Client	**Yes**		**No**	
Are you familiar with "Thin Client"?	5	50%	5	50%
Do you currently, or have you previously, used a "Thin Client"?	2	20%	8	80%
If NO, have you considered using a "Thin Client"?	0	0%	8	100%

SOURCE: TCRP Project J-09, Task 1.

other local government agency. In these cases, the transit agency, either by choice or by statute, has effectively outsourced its applications to the computing service–providing agency and is not directly responsible for providing its own application system services. If the providing agency happens to provide access to the outsourced applications over a network, then that agency functions in a manner similar to an ASP in providing computing services to the transit agency. If the applications provided to the transit agency are server-based and if the transit agency employees access those applications through a network computer, thin client computing device, an Internet browser, or other minimal client-side software application, then the service-providing agency is probably employing thin client applications.

Although lowering costs is a benefit claimed by both the ASP and the thin client computing models, reducing existing operating costs is not a major objective when agencies consider ASP outsourcing or thin client applications. The major considerations are obtaining a new application service with the shortest possible lead-time and in the most economically advantageous manner possible. Major decision factors include the time required to implement the solution; the initial investment required; ongoing operating costs; and the rapid achievement of business objectives, which deliver a return on investment. A further consideration is that by outsourcing applications to an ASP, the customer agency is able to concentrate more of its internal staff resources on its primary mission—public transportation—rather than on what is viewed as a peripheral service—software application support.

Those agencies currently using ASP services currently subscribe to financial and accounting applications and traveler information services. There appear to be very few ASP applications available that are aimed directly at the transit industry. The applications available are limited to vehicle-fleet management and maintenance, traveler information, and safety-incident reporting.

CHAPTER **3**

INTERPRETATION OF FINDINGS

ASP AND THIN CLIENT VALUE PROPOSITION

Across industry in general, the ASP business model has achieved early adopter acceptance as a legitimate option for obtaining outsourced computing services. Survey findings show that between 11% and 18.5% of respondents already subscribe to ASP services, and analyst predictions are for continued expansion of ASP use in the future. The major value proposition cited for the selection of an ASP is the return on investment that results from being able to achieve organizational business objectives with the help of outsourcing computing services rather than hosting those services internally or obtaining those services from a more traditional outsourcing vendor.

This return on investment is distinct from pure cost reduction. Few ASP customers have chosen to transfer applications hosted internally to the ASP in order to reduce costs. ASPs generally claim that subscribing to their computing services rather than operating applications internally can lower an organization's total cost of application ownership. This claim—although widely accepted as a fundamental tenet of the ASP computing model—has not yet been demonstrated in any conclusive way. Although ASP customers describe savings, Netto (*34*) points out that most businesses do not understand their costs of application software service operation and delivery and rely upon educated guesswork to estimate their pre-ASP costs. Even if the businesses understand their internal cost structures, those structures are typically not broken down to the individual application level. Organizations may know how much it costs to deliver overall desktop computing service to their employees, but may not know the cost of specific applications. Because the ASP model is based on subscribing to computing services one application at a time, accurate cost comparisons are generally not possible.

Some observers question whether the full cost of subscribing to ASP application services is actually lower than the total cost of provisioning the same application service internally when full life-cycle costs are calculated. The question remains unanswered partly because the ASP computing model is too new to have allowed the collection of cost data over a full system life cycle. There is the additional problem that many organizations do not invest in tracking their internal computer system operating costs. There is agreement, however, that subscribing to ASP services avoids the substantial initial investment in hardware, software licenses, and customization services that normally accompany in-house application provisioning; subscribing also allows a more rapid implementation than is usually possible internally. These factors provide the opportunity for the business to benefit from the new service sooner than would otherwise be possible and to achieve an earlier payback.

IDC (*35*) documented the results of a study in which ASP customers reported an average return on investment over 5 years of 404% to 280% for mission-critical applications and 636% for non-mission-critical applications. These results were achieved on an average initial investment in ASP services of $399,000 and on an average investment of $4.2 million over the life of the investment. The average payback period was 1.33 years.

The ASP service–provisioning model gave the organizations that participated in the IDC study the opportunity to add some significant new computing service that had an immediate positive impact on their business results with the minimum up-front investment. The strengths of the ASP model are its ability to deliver a new computing service in a short span of time while requiring little, if any, infrastructure investment on the part of the prospective customer, thus allowing the customer to participate in the benefits of state-of-the-art applications without a large initial investment.

In spite of its benefits, the ASP industry is in a state of flux and many current ASPs may not survive. Sweeney (*36*) reported Gartner Group's forecast that more than 60% of ASPs in business in mid-2000 would fail by the end of 2002. Hollerbach (*37*) asserts that this failure rate is symptomatic of new industries and that the failure of weaker competitors is beneficial in the long run. In the short term, this poses a serious problem for prospective ASP customers, who must expend time and energy assessing the financial health of their prospective service providers in addition to evaluating their service offerings.

Thin client computing shares a technological base with ASPs—the server-centric application accessed remotely over a network from a client-side Internet browser or other minimal client-side application. From this point, the models of these two service-provisioning schemes diverge. The ASP model outsources application hosting, maintenance, operation, and support. Initial set-up and implementation of the application are the responsibility of the ASP. In the thin client model, all

hosting, maintenance, support, and operation responsibilities remain inside the organization. The change that an organization makes in adopting thin client computing is that application processing moves from the desktop workstation to a central server, allowing desktop operations to proceed with a less capable or "thin" desktop software application.

The value proposition in thin client computing comes in the shift of technical support costs from the desktop workstation to a central server. With less software on the workstation, less software support is required, which translates into less support cost. Less client-side hardware capability is needed, allowing additional value to be derived from older PCs that can be used to support client access to thin client applications. If thin client devices are used in place of PCs, client hardware reliability increases, providing savings in the form of reduced client hardware maintenance. Central server support does increase under thin client computing, and additional network infrastructure may be required. Lowber (*38*) finds that the implementation of thin client computing in an environment in which desktop workstations are unmanaged results in a 32% cost savings. The introduction of thin client computing into an environment in which desktop workstation management and support has been automated yields only a 1% cost savings.

The current trend of designing applications to operate over the Internet or over an internal IP network is promoting thin client computing in the guise of web-centric or web-enabled computing. Web-centric software is designed to have its user interface presented as a web page that can be accessed using an Internet browser. Centralized application and database servers reside behind the web server to provide the actual application processing and associated data storage. This structure is the thin client software architecture.

TRANSIT INDUSTRY VALUE

The transit industry can share the same benefits as other types of customers of ASP services. Unlike ASP customers in other industries, it is unlikely that the implementation of a new application will result in the kinds of return on investment that IDC (*39*) reported as a result of implementing ASP services. The return-on-revenue results cited by IDC were achieved because of the ability to exploit new business opportunities and to tap new sources of revenue generated by rapid ASP application implementation. Transit agency revenue sources are generally limited to subsidies, fare-box receipts, and advertising revenues, with little opportunity for system-driven increases in revenue. However, when a transit agency is confronted with the need to implement a new service to the public, when an existing application requires replacement, or when the agency would like to add some new computing service, the ASP computing model that allows application implementation without capital investment and with minimal up-front cost may offer a better results on investment than do other alternatives and may be an attractive alternative when considered within the context of the agency's overall budget.

There are very few ASPs that offer applications focused on the vertical transit industry, so there are limited opportunities for ASP usage for transit-specific applications. However, there is a wide range of general business applications available. ITAA (*40*) showed that the most popular applications for outsourcing to ASPs include e-mail, accounting and financial processing, office productivity software, and human relations management. These types of applications probably represent the best opportunity for transit agency use of ASP outsourcing.

The case for automatic reductions in cost of ownership has not been proven as a result of the implementation of ASP-based applications. Outsourcing existing applications to an ASP on the theory that cost savings will accrue would be an ill-advised experiment. However, if a new computing service is required or if an existing application reaches the end of its operational life and must be replaced, then outsourcing the application to an ASP should be considered as one of the alternative means for provisioning that service. At that point, assuming that the agency is willing to consider outsourcing the application, it should select the provisioning alternative that will give it the greatest return on its investment and will provide the greatest benefit to the agency whether that agency is hosting the application internally or outsourcing it to an ASP or to another type of outsourcing vendor.

ASP OUTSOURCING GUIDELINES

The choices available for provisioning a new computing service are to host the application providing the service internally, to provision the service with an application provisioned by a traditional outsourcing vendor, or to outsource the application to an ASP. No one approach is inherently superior to another, and no one approach will necessarily provide a greater return on investment to the organization than will the others.

Organizational Readiness

Prior to conducting an analysis of available ASP applications and services, a transit agency should perform a self-assessment to determine whether the agency is ready to consider outsourcing computing applications to an ASP. The following guidelines are intended to assist in determining when it is appropriate to consider the option of outsourcing application services to an ASP:

- **Openness to ASP outsourcing:** Is the organization open to the concept of outsourcing applications to ASPs? One of the barriers to ASP usage is internal resistance to the fundamental concept. If this resistance is too strong, other alternatives should be considered.
- **Level of technical expertise:** If information technology is not considered a core competency within the organization

or if the specific competency required for the desired application is not present in the organization, then outsourcing to an ASP may be a means of compensating for the lack of internal expertise.

- **Technical resource availability:** If the organization has internal technical expertise but if that expertise is fully occupied with current duties and cannot support an additional application, then ASP outsourcing can be a means to augment overburdened internal resources.
- **Staff retention difficulties:** If the organization has difficulties attracting and retaining skilled information technology staff, outsourcing additional applications to an ASP may be an alternative. It may be inadvisable to add support for additional applications to an existing workload in the information technology department when it will prove difficult to maintain staffing levels.
- **Acceptance of standard applications:** Use of an ASP is an option if the organization is willing to use the ASP application under consideration with minimal or no customization or modification. ASPs prefer to deliver unmodified access to standard applications to their customers. Some ASPs do perform application customization, but that typically raises the start-up costs and subscription fees and makes future upgrading of the application software more difficult and costly.
- **Minimal integration requirements:** Integrating outsourced applications to other applications hosted by the same or another outsourcing vendor or to applications hosted at the customer's operating site increases the complexity of services requested by the ASP, decreases the flexibility of the implemented solution, and erodes the cost case for ASP usage. Extensive integration requirements may be better satisfied internally.
- **Network connectivity:** If the organization already possesses a high-speed networking infrastructure and high-speed connection to the Internet, only minimal infrastructure upgrades will be required to implement ASP service.
- **Mission criticality:** Outsourcing mission-critical applications raises the issue of loss of control of key operating capabilities to the outsourcing vendor. Considering only non-critical applications minimizes this concern.
- **Data security:** Concerns over theft or loss of critical data entrusted to an ASP can be approached by limiting consideration of ASP outsourcing to those applications that do not require data to be stored by the ASP. Mission-critical applications can be excluded altogether from consideration for ASP outsourcing.
- **Rapid deployment:** Rapid application is required, but internal resources are unavailable to implement the application. ASP resources can be used to implement and host the application. If required, the application can be brought in-house at a later date.
- **Lack of capital budget:** Lack of capital investment funds may prevent the acquisition of the servers, software licenses, and infrastructure upgrades that might be required to implement a new application. Implementation of the application with an ASP should be possible for a much lower initial cost than would be incurred if the application were to be provisioned internally.

ASP Selection Guidelines

When an agency has determined that it is willing to seriously consider ASPs as computing service providers, it can then undertake an investigation of available ASP alternatives. As described previously, there are a number of risks associated with outsourcing applications to external providers. In the current ASP market, these risks are exacerbated by the very real risk of ASP financial failure and by the general lack of a proven history of service delivery in an industry that is only a few years old. Bolding (*41*), Gantz (*42*), Sartain (*43*) and Whalen (*44*) cite concerns to investigate when choosing an ASP.

The following is a list of guidelines to assist in minimizing the risk associated with selecting an ASP to host an outsourced application:

- Identify the business function requiring support.
- Identify the application(s) desired to support the business function.
- Determine whether the organization will accept alternatives to the desired application.
- Determine whether the organization will accept a standard version of an application or whether the organization will insist upon some level of customization.
- Determine what types of end-user access to the application the organization will require.
- Determine what results the organization expects from the application and in what form those results are required (online interaction and information displays; reports; interfaces to other systems hosted by the ASP, the organization itself, or a third party).
- Determine whether integration with other systems will be required.
- Specify minimum application performance levels, in terms of the business processes to be supported.
- Specify the specific performance metrics that must be met.
- Establish data-storage requirements including initial data volumes and projected growth in data volumes.
- Establish minimum organizational requirements for application recovery following a disaster.

- Determine how many concurrent users the application must support.
- Estimate the cost of provisioning that application internally, including all costs for hardware, software licenses, development, application customization, operations, maintenance, technical support, help desk support, and training that may be associated with implementing the application.
- Determine the schedule that must be met for application deployment.
- Select ASPs that offer applications capable of supporting the organization's business functions and associated supporting services.
- Screen the list of ASPs based on the established organizational requirements and ASP capability to satisfy those requirements.
- Assess the stability of the ASP's management team.
- Examine the ASP's financial statements to determine whether the ASP has the staying power required, look for a steady increase in revenue over time as a sign of health, and look for the capability to fund operations from current period revenues rather than from venture capital.
- Examine the ASP's business plan and determine whether the ASP has a sustainable business offering.
- Determine whether the ASP has business partners and ensure that each partner is financially sound and that the primary ASP is accountable for the performance for all business partners.
- Examine the quality and stability of the ASP's technical infrastructure.
- Determine how many data centers the ASP has, the location of each, and which facility will provide hosting services.
- Inspect the ASP's physical facilities.
- Examine the ASP's disaster recovery plan and compare that plan with disaster recovery needs.
- Ensure that ASP facilities are not in disaster-prone locations.
- Ensure that the ASP has high-bandwidth connections of at least 45 Mbps to a minimum of two Tier 1 Internet backbone carriers if delivering application access over the Internet and similar connectivity to at least two private network carriers if using a private network.
- Check computing platforms supported and determine whether the platforms used by the ASP are compatible with those supported internally—this ensures that if it becomes necessary to bring the application in-house, hardware compatibility and support are not issues.
- Check the ASP's ability to scale its computing and communications infrastructures.
- Check the ASP's policy on upgrades to commercial software applications and assess whether the ASP's policy will match the customer's expectations for the implementation of upgrades to commercial software applications.
- Check the ASP's policy on computing hardware upgrades.
- Investigate the ASP computing and communications redundancy capabilities.
- Ensure that the ASP has alternative electrical power facilities, preferably power feeds from at least two different electrical substations and a backup power system.
- Examine the ASP's security capabilities in detail, both physical security and information security.
- Determine how many other customers the ASP has for the application services to be subscribed, what the forecast is for subscription growth for those services, and how the ASP plans to scale its infrastructure to handle the projected growth.
- Determine what applications the ASP currently offers and what applications the ASP plans to add to its portfolio in the future; also determine whether the ASP plans to drop or replace applications in its current portfolio.
- Determine whether the ASP has the capability to integrate hosted applications with other applications hosted at its facilities, with applications hosted at a customer's facility, and with applications hosted at a third party's facilities.
- Inspect security arrangements for dedicated servers.
- Check ASP procedures for controlling access to dedicated servers.
- Check ASP procedures for controlling access to customer data.
- Check ASP customer references, preferably customers with similar organizational characteristics and who subscribe to applications and services similar to those under consideration.
- Check the ASP's history for application service delivery.

- Check the ASP's record for maintaining quality of service and meeting the provisions specified in SLAs.
- Check the ASP's record of responding to customer problems and the ASP's record for resolving those problems.
- Determine what customer support services the ASP offers and how those services are delivered.
- Assess the accessibility of the ASP's support staff, determine when support is available, and assess the ASP's provisions for providing additional levels of support.
- Check the ASP's staffing levels for applications support, system administration, security, and customer support; determine whether the staff are ASP personnel or contractors, the level of staff expertise, and the rate of staff turnover.
- Investigate all of the ASP's partners—some ASPs known as "aggregators" function as general contractors and subcontract hosting, software maintenance, development, operations, and security to various business partners; if this is the case, investigate each partner for organizational stability and viability as though that partner were the primary ASP—a failure by any partner could jeopardize the ASP's ability to continue to deliver service.
- Investigate the ASP's pricing structure and billing policies; identify one-time costs for establishing service, data conversion, user training, software licensing, and infrastructure implementation; identify ongoing application subscription fees and any other fees that will be billed on an ongoing basis.
- Examine the ASP's standard SLA terms and conditions.
- Determine the ASP's willingness to negotiate customized SLA terms and conditions.

The depth of investigation required will depend upon the criticality of the application to be outsourced. An extremely thorough investigation is required if the application is mission-critical. On the other hand, if the application is non-critical or perhaps even non-essential, a more cursory investigation may suffice. The depth required has to be decided on a case-by-case basis.

Using the guidelines above, the agency should determine what criteria are important to it in selecting an ASP and develop a weighting factor for each criterion. The evaluating agency will have to select a scoring mechanism for use in rating the ASPs. The ASPs under consideration can then be rated against each of the selected criteria, and an overall ranking of ASPs can be calculated. In addition to this rating exercise, the agency should conduct a full economic analysis of each alternative under consideration, whether they are ASPs or other alternatives. Most ASPs offer an online economic evaluation tool. It is recommended that the agencies develop their own cost models to ensure proper consideration of all of the cost factors that will affect the decision. This will also ensure that any non-ASP solutions under consideration are treated appropriately. After evaluating criteria and performing economic analysis, the agency will be in a position to make a well-informed business decision to select a provider for its software applications.

Managing the ASP Business Relationship

The key elements in managing the business relationship with an ASP outsourcing vendor are due diligence in investigating the ASP prior to subscribing to the ASP's service and the negotiation of a comprehensive SLA. Due diligence in researching the ASP's financial condition minimizes the risks of having the ASP's business fail during the contracted service period. Due diligence in checking customer references and the ASP's history of service delivery will minimize the risk that the ASP cannot fulfill its obligations under its SLAs. The primary tool available to the ASP customer for managing and controlling the business and service delivery relationship with an ASP is the SLA.

All ASPs have standard SLAs that may be acceptable for non-critical applications that have little impact on the organization's operations. If, however, the application outsourced to the ASP is mission-critical or if critical or sensitive data must be entrusted to the ASP, then a standard ASP SLA may not address all of the issues that the customer organization may wish to address. ITAA (*45*) has published a set of ASP SLA guidelines that outline a basis for crafting and negotiating a specific SLA with an ASP. There are a number of critical issues that can be used to enhance the basic ITAA SLA outline. These issues are the following:

- **Data ownership:** The SLA should specifically state that any data entrusted by the customer to the ASP remains the property of the customer and that the customer retains all rights to that data and assigns no rights to the ASP. This is particularly important if the data are mission-critical or sensitive. The SLA should grant access to the data to the customer at any time and should detail the data-backup and data-storage procedures that the ASP will perform. The customer should negotiate the periodic delivery of copies of data backups either to the customer's facility or to an agreed upon storage location where the customer has unimpeded access to the data. These backups should be in a standard, readable format. The agreement should also detail the regular storage of backups in an off-site storage facility where the customer has access to the data.
- **Escalation procedures:** The SLA should detail the procedures for raising problems to higher levels of priority when rapid solutions to customer problems are not forthcoming. This procedure should specify procedures

for both the customer and the ASP and should specify clear timeframes for moving to each level of escalation.

- **Performance metrics:** The SLA should include specific, quantified metrics to be used in measuring service delivery. Specific metrics should be included for each application or support service that the customer considers critical to business operations. These metrics may include application response time; network response time; application service delivery in business terms (e.g., able to invoice customers from 9:00 A.M. to 5:00 P.M., Monday through Friday); elapsed time to respond to customer trouble calls; elapsed time to resolve customer problems; and transaction throughput.
- **Application availability:** The hours of application service availability should be listed specifically. This specification should account for any downtime planned by the ASP for system maintenance activities. Availability should be specified only for those hours when access is actually needed.
- **Performance monitoring:** The customer should include provisions in the SLA requiring the ASP to account for the quality of service delivery. This is a necessary measure for ensuring service delivery for mission-critical systems. Both Bolding (*46*) and Betts (*47*) recommend requiring the ASP to provide monthly reporting on service delivery against the metrics specified in the SLA. They also suggest negotiating the right to use third-party monitoring services to independently monitor ASP service delivery or to use third-party software at the customer's site to monitor performance.
- **Rights to software:** The customer should negotiate the rights to any software custom developed by the ASP or any software developed for the customer by the ASP in the event of ASP failure. Should the ASP go out of business, the customer may need this software to be able to re-host the application provided by the ASP either internally, with another ASP, or with other outsourcer. The customer should negotiate a code escrow agreement for any developed code and the rights to purchase any associated licenses.
- **Performance penalties:** Liquid penalties should be negotiated in the event the ASP fails to fulfill service delivery obligations stated in the SLA. These penalties should impact ASP revenue either in the form of subscription fee rebates or in reduced future payments. Betts (*48*) recommends penalties in the range of 5% to 15% of the monthly subscription fee.
- **Termination conditions:** All business relationships terminate at some time. At termination time, issues dealing with data and software ownership, transition to a new service provisioning environment, and general service termination must be resolved. It is recommended that these issues be identified and addressed during the negotiation of the initial SLA so that when termination occurs, both the ASP and the customer know exactly what each owes the other and what obligations each has during the close-out phase of the business relationship. These conditions should apply both to the normal termination of subscription services and to termination for non-performance, non-delivery of service, or other violation of the SLA.
- **Termination for cause:** The customer should include provisions in the SLA that describe the conditions under which the customer may unilaterally terminate the business relationship with the ASP.

THIN CLIENT GUIDELINES

Unlike the decision to use an ASP, the decision to use thin client applications does not include a decision to outsource application hosting to an external provider; therefore, the investigation required when choosing an external ASP is unnecessary. The decision to use thin client technologies can be based entirely upon internal organizational capabilities and the organization's internal business and economic objectives. The following are guidelines when considering the use of thin client applications:

- **Server infrastructure:** Thin client applications are server-centric and concentrate application processing and data storage on central servers. Either the required servers must already be in place, or a budget must be available to upgrade existing servers to host the anticipated thin client applications or to acquire new servers for that purpose.
- **Thin client software costs:** Funding must be available to cover the cost of the software licenses for the thin client applications, for any client-side software required for accessing the thin client applications, and for any operating system–level software necessary to enable thin client computing.
- **Staff expertise:** A shift to thin client computing shifts support requirements from desktop workstations to central servers. The organization must either already have staff skilled in server and central application support or have good prospects for attracting and retaining the staff necessary to support thin client applications.
- **Network infrastructure:** Either the organization must have in place a network with sufficient capacity to support accessing thin client applications hosted on centralized servers, or it must incur the cost of installing new network infrastructure or upgrading existing infrastructure to provide the needed network capacity.
- **Offline usage:** Thin client applications can only be accessed if the network is accessible and if the central servers hosting the thin client applications are running. Thin client applications are not suitable for supporting workers who need to access applications while not connected to the network or when either central servers or hosted applications are not available.
- **Workstation usage:** Thin client applications are most appropriate in supporting applications used during struc-

tured, repetitive, transaction-oriented tasks and are not for tasks requiring creative activity. Thin client applications are also not good candidates to support computation-intensive processing or data-intensive processing.

- **Management environment:** Organizations that have implemented industry best practices for desktop workstation management will have a reduced opportunity for realizing cost savings from converting applications to a thin client architecture because they have already achieved most of the benefits and savings from workstation standardization and central management.
- **Cost analysis:** Consideration of converting to thin client applications should be supported by a cost analysis that compares the costs of hardware, software licenses, maintenance, operation, technical support for servers and desktop workstations, help desk support and staff training, server acquisition and upgrade, thin client device acquisition and upgrading, and network capacity installation or upgrading.
- **Thin client device usage:** Thin client devices are suitable desktop devices for supporting structured, repetitive tasks and for use as PC replacements in hostile environments such as high-traffic areas, retail operations, shop floors, and factory environments.
- **Web-enabled applications:** Web-enabled applications are inherently thin client applications. Plans to introduce the use of web-enabled applications are, in effect, plans to introduce thin client applications that use an Internet browser as the client-side software.

CHAPTER **4**

RECOMMENDATIONS

The use of ASPs as providers of application computing services is only one of several alternatives available to transit agency management at this point in time. The consolidation currently underway in the ASP industry adds an element of risk to the ASP decision and demands the expenditure of the time and effort necessary to execute a due diligence investigation of the ASP to obtain a reasonable assurance that the ASP will be able to deliver on its commitments to the customer. The nature of outsourced service delivery also imposes the need to carefully craft and negotiate an SLA for all but the least mission-critical systems and to manage the performance of the ASP vendor according to the terms of that SLA throughout the duration of the service contract.

Those agencies willing to accept the risks that exist in the ASP industry and willing to assume the due diligence investigation, SLA negotiation, and relationship management responsibilities for which current market conditions call can include application outsourcing with an ASP among the options they consider when deciding how to provision a new or replacement software application. Those unwilling to assume those responsibilities should not consider outsourcing any applications with an ASP until such time as the ASP market consolidation is complete and as clearly stable ASP vendors emerge.

The use of thin client applications and thin client computing within an organization is not subject to the risks associated with outsourcing that are present when considering the use of an ASP. This computing model is well established and—with the emergence of applications designed to run over a network and the trend to web-enable existing applications—is becoming a standard model for accessing enterprise applications. Organizations considering the use of thin client computing should assess their internal capabilities; if the capability to support thin client computing is present and if the thin client applications will be beneficial to the organization, there is no obstacle to its adoption.

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APPENDIX A

TRANSIT INDUSTRY THIN CLIENT AND ASP USAGE SURVEY FORM

This appendix contains the survey form used to collect survey information from transit agencies. The same form was used to document telephone interviews and for distribution through e-mail for return either through e-mail or by facsimile.

Application Service Providers

Application Service Providers are commercial ventures that offer a form of outsourcing by hosting applications on servers in their own or a partner's data centers and rent the use of those applications to customers. Users access the applications over dedicated communications lines, the Internet, frame relay links, or some other network. This enables businesses to save on software licenses, avoid installation, training and software upgrade responsibilities, and leverage the ASP's hosting economies of scale.

1. Are you familiar with "Application Service Providers (ASP)"? Yes No

2. Do you currently, or have you previously, used an ASP? Yes No

3. If NO to #2, have you considered using an ASP for you transit agency? Yes No

   If YES to #3, what was the primary reason for not using an ASP?
   (security of data, customization limitations, contract terms, cost, other)

If YES to #2, please proceed to question 7 on Page 2.
If NO to #2, please proceed to question 17 on Page 3

Thin Client

Thin Client is a term used to describe a software architecture in which applications are designed to execute on a server and do not require the installation of software residing on a client (desktop) machine. The adjective "thin" is used to describe the capabilities of the desktop device where "thin" refers to a low-powered machine with minimal computing resources and minimal installed software in contrast to "fat" client computing where the desktop machine is a very capable device with a large amount of installed software and significant computing resources such as CPU and disk storage.

4. Are you familiar with "Thin Client"? Yes No

5. Do you currently, or have you previously, used a "Thin Client"? Yes No

   If YES:

   What application(s) do you access using Thin Client?

   What do you use as your Thin Client? (Citirx Mainframe, Windows Terminal Server, Web Browser, etc.)

6. If NO to #5, have you considered using a Thin Client? Yes No

   If YES to #6, what was the primary reason for not using a Thin Client?
   (security of data, customization limitations, contract terms, cost, other)

If YES to #5, please proceed to question 7 on Page 2.
If NO to #5, please proceed to question 17 on Page 3

	ASP	**Thin Client**
7. How long have you used either ASP or Thin Client?		
8. For what application do you use ASP or Thin Client:		
All Industries:		
Human Resources	☐	☐

	ASP	Thin Client
Financial	☐	☐
Customer Relations	☐	☐
Transit Specific Industry:		
Vehicle Maintenance	☐	☐
Route Planning	☐	☐
Scheduling/Dispatching	☐	☐
Traveler Information (i.e. NextBus)	☐	☐
Communications or Radio	☐	☐
Other:	☐	☐
9. Did the size of your staff change as a result of using ASP or Thin Client?		
Increase	☐	☐
Decrease	☐	☐
How Much?	_____%	_____%
10. Did your organization realize any benefits from using ASP or Thin Client?	Y N	Y N
If YES, please describe below.		
11. Did your organization encounter any problems while implementing ASP or Thin Client?	Y N	Y N
If YES, what were those problems and how were they resolved?		
12. How were your organization's overall computing costs affected by the change to ASP or Thin Client?		
Increase	☐	☐
Decrease	☐	☐
How Much?	$_____	$_____
13. Which of your organization's specific costs were affected by going to ASP or Thin Client? (please circle Increase or Decrease and indicate a dollar amount or percent if known)		
Hardware (increase or decrease)	_____	_____
Software Licenses (increase or decrease)	_____	_____
Technical Support (increase or decrease)	_____	_____
Maintenance (increase or decrease)	_____	_____
Other:		

	ASP	Thin Client
14. Were any staff functions eliminated by going to ASP or Thin Client? If YES, please describe below.	Y N	Y N
15. Were any staff functions or roles introduced by going to ASP or Thin Client? If YES, please describe below?	Y N	Y N
16. Based on your experience do you consider the use of ASP or Thin Client Processing beneficial? Please describe below:		
17. Are there any transit-specific applications that you think would be particularly well suited for ASP or Thin Client? Please describe below:		

APPENDIX B

ASP AND THIN CLIENT USAGE SURVEY

INTRODUCTION

The following sections describe the transit agency surveys that were conducted as part of the research into ASP and thin client use. The goal of these surveys was threefold. First, the research team wanted to determine the extent to which transit agencies understand the concept of ASP or thin clients. Second, if transit agencies were currently using ASP or thin clients, the research team wanted to understand how the ASPs or thin clients were being used and what effects they have had on business operations. Finally, the team was interested to know what the agencies' thoughts were on transit-specific ASPs or thin client applications.

DATA COLLECTION

In order to collect the necessary data, a survey form was developed (see Appendix A). The survey was designed to gain a quick understanding of a transit agency's use of either ASP or thin clients. If the transit agency did not currently use ASP or thin clients, the survey took about 4 minutes to complete. If the transit agency currently uses or had used ASP or thin clients, the survey form took about 20 minutes to complete.

The survey form was divided into two parts. Part I was filled out by all of the respondents while Part II was only filled out if certain questions in Part I were answered. In addition, all survey respondents were asked to give thoughts on possible transit-specific applications that were well suited for either ASPs or thin clients. Part I was divided into two sections: one section was for ASPs, and the other was for thin clients and asked general questions about the transit agency's understanding, current use, and consideration of using ASPs or thin clients. Part II of the survey form was filled out only if the transit agency currently uses or had previously used an ASP or thin client. Part II of the survey was much more detailed in the questions and asked the respondent to quantify how ASPs or thin clients have affected his or her agency's operations. The following questions were asked in Part II:

- How long have you used either ASP or thin client?
- Did the size of your staff change as a result of using ASP or thin client?
- Did your organization realize any benefits from using ASP or thin client?
- Did your organization encounter any problems while implementing ASP or thin client?
- How were your organization's overall computing costs affected by the change to ASP or thin client?
- Which of your organization's specific costs were affected by going to ASP or thin client? (Please circle Increase or Decrease and indicate a dollar amount or percent if known.)
- Were any staff functions eliminated by going to ASP or thin client?
- Were any staff functions or roles introduced by going to ASP or thin client?
- Based on your experience do you consider the use of ASP or thin client processing beneficial?

The survey was initially designed to be completed over the phone through interviews. A list of transit agencies to be surveyed was developed using the APTA 2001 Member Directory. The list was quite diverse and included transit agencies of different size, geographic location, and operations. In all, 39 transit agencies were identified to be surveyed. Between November 19, 2001, and December 3, 2001, the 39 transit agencies were contacted. Eight of the 39 transit agencies responded to the survey—a 21% response rate.

An additional list of transit agencies to be surveyed was compiled from various sources, including the TCRP Project J-09 Steering Committee, FTA Bus Rapid Transit Consortium members, and the FTA APTA Stakeholders. These contacts were e-mailed an electronic version of the survey. In all, 25 people were e-mailed the electronic version of the survey and 2 responded—an 8% response rate. All totaled, 64 transit agencies were contacted and 10 responded—a 15% response rate.

ANALYSIS

The following transit agencies responded to the ASP and thin client survey:

- Birmingham-Jefferson County Transit Authority (Alabama);
- Central Arkansas Transit Authority;
- Greater Peoria Mass Transit District (Illinois);
- Topeka Metropolitan Transit Authority (Kansas);
- Blacksburg Transit (Virginia);
- City of Fairfax City-University-Energysaver (CUE) Bus (Virginia);
- Virginia Railway Express;
- Beaver County Transit Authority (Pennsylvania);
- Orange County (California) (via e-mail); and
- Maricopa County (Arizona) (via e-mail).

Table B-1 provides a summary of the responses to Part I of the survey. Because of the response rate and the number of transit agencies currently using ASP or thin clients, a similar analysis was not conducted for Part II. Instead, summaries of the responses are provided in the following two sections.

ASP Survey Response

Initially, those interviewed were asked the question: "Are you familiar with an ASP?" Some were unsure, but after a definition of an ASP was read to them, seven respondents (70%) were familiar with what an ASP entails. Of those that were familiar with ASPs, two (29%) currently use an ASP. Overall, three respondents (30%) currently use an ASP. However, the only anomaly was with the City of Fairfax CUE Bus (in Virginia). The person interviewed was not familiar with ASPs but after a conversation regarding the agency's operations, it was determined that the agency does indeed use an ASP for traveler information services. Of the seven respondents that do not currently use an ASP, two (29%) had considered using an ASP. The reasons for not using an ASP were concerns regarding uptime of the computer software and system and the availability of resources within the organizations to use ASP.

The two transit agencies that currently use ASPs are the Birmingham-Jefferson County Transit Authority (in Alabama) and the Fairfax's CUE Bus. Both use an ASP for two completely different functions. Birmingham-Jefferson County Transit Authority currently uses an ASP for both human-resource and financial functions. The primary reason for this was to enable the agency to concentrate on its core mission of providing transportation services to its citizens. By not having to worry about the human-resource and financial functions of the operations, the agency was better able to allocate all available resources to providing better transit service. On the other hand, Fairfax's CUE Bus uses an ASP for traveler information. The City of Fairfax has a contract with NextBus to use its technology to provide CUE Bus riders with traveler information.

Thin Client Survey Response

As with the ASP section of the survey, those interviewed were initially asked the question: "Are you familiar with thin client?" Some were unsure, but after a definition of a thin client was read to them, five respondents (50%) were familiar with what a thin client entails. Of those that were familiar with ASPs, two (40%) currently use a thin client. Overall, two respondents (20%) currently use a thin client. Of the eight respondents that do not currently use a thin client, zero (0%) had considered using a thin client. There were no specific reasons given as to why the transit agencies did not consider using a thin client. However, there seemed to be a general lack of awareness regarding the benefits of thin clients and their specific use with transit agency operations.

Two of the transit agencies currently use a thin client—Orange County, California, and Maricopa County, Arizona. Both agencies use a Citrix MetaFrame as their thin client. Orange County currently uses its thin client for route planning, scheduling and dispatching, occurrence tracking, passenger count reporting, and fuel management. The size of its staff did not increase or decrease; however, the new role of Citrix MetaFrame Administrator was created as part using thin clients. The benefit that Orange County gained from using thin clients was a single point of application for installation and upgrading of software rather than hundreds of points. The problems encountered were printing and the installation of print drivers on the Citrix MetaFrame computer. Orange County believes that thin client will be beneficial; however, the initial start-up cost and psychological barriers were hurdles that had to be overcome.

CONCLUSIONS

The response to the surveys regarding transit agency use of ASP or thin client did not provide any groundbreaking insights. There are several reasons for this. First, many of the transit agencies were not currently using an ASP or thin clients. Second, those transit agencies that are using ASP or thin clients did not have any data regarding the cost savings associated with their use. This was due in part to the amount of time the agencies had been using the technology—in some cases, just 4 months. Third, the chosen methodology to collect the data, limited by both available time and funding, made it difficult to collect the necessary data from the knowledgeable person within the organization. Finally, in general, transit agencies have not necessarily been thinking about using either ASPs or thin clients. Agencies might hear about ASPs or thin clients in magazines, on the news, or in journals, but they are not sure of the application as it relates to their operations. In many instances, it is just a matter of education and information dissemination.

Regardless of the survey responses and the amount of data collected, the phone interviews with the various transit agencies did provide valuable insights. First, the institutional setting of the transit agency will have a direct impact on its use of an ASP or thin clients. For instance, a number of transit agencies were not their own operating authority, but rather a department of the local county or city government. In these instances, all of the human-resource and financial functions (some of the more common functions for ASPs or thin clients) were controlled by the local government. Therefore, the transit agency had little, if any, knowledge of how ASPs or thin clients were being used.

Second, the use of an ASP or thin client may not necessarily be to control costs. Instead, the use may allow the transit agency to focus more on its core mission of providing transportation services. This argument for using an ASP or

TABLE B-1 Part I survey response

	Birmingham - Jefferson County Transit Authority	Central Arkansas Transit Authority	Greater Peoria Mass Transit District	Topeka Metropolitan Transit Authority	Blacksburg Transit	City of Fairfax CUE Bus	Virginia Railway Express	Beaver County transit Authority	Orange County California	Maricopa County (Arizona)				
ASP											**Yes**		**No**	
Are you familiar with ASP?	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	7	70%	3	30%
Do you currently, or have you previously, used an ASP?	Yes	No	No	No	No	Yes	Yes	No	No	No	3	30%	7	70%
If NO, have you considered using an ASP?	n/a	No	No	No	No	n/a	n/a	No	Yes	Yes	2	29%	5	71%
Thin Client											**Yes**		**No**	
Are you familiar with "Thin Client"?	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	5	50%	5	50%
Do you currently, or have you previously, used a "Thin Client"?	No	No	No	No	No	No	No	No	Yes	Yes	2	20%	8	80%
If, NO, have you considered using a "Thin Client"?	No	No	No	No	No	No	No	No	n/a	n/a	0	0%	8	100%

thin client was brought up in a number of the interviews—for example, the transit agency already uses an outside vendor to provide Internet and e-mail access for employees to concentrate on the core mission. In another instance, a transit agency used an ASP specifically for human-resource and financial functions so that it does not have to worry about them.

Third, there needs to be more attention provided for transit-specific ASP or thin client applications, primarily the applications' availability and benefits. When discussing the use of ASP or thin clients, many of the transit agencies had heard of non-transit ASP or thin client uses. When asked the question of whether they see any transit-specific applications well suited for ASP or thin client, most agencies did not have ideas. However, some agencies did provide possible transit-specific applications that included the following:

- Vehicle management,
- Traveler information,
- Passenger count reporting,
- Occurrence tracking,
- Fuel management,
- Call centers,
- Trip planning system, and
- Complaint system.

Finally, the size of the transit system may dictate the need for an ASP or thin client. In some cases, the larger transit agencies may provide all of their needed computer applications in-house. Because of their size or number of years in operation, the larger agencies may have systems that work efficiently, and the cost to change to an ASP or thin client may not be warranted. Medium-size transit agencies may have similar computing requirements as the larger agencies, but may lack the ability to procure the needed hardware or software. In this instance, an ASP or thin client model may prove to be beneficial. The smaller agencies, aside from Internet or e-mail services, may not have the need for many of the more robust applications required by the larger agencies; however, their small size and limited technical resources may make the ASP alternative an attractive option for implementing new computing services without having to invest already-scarce capital and technical resources.

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation