Multi-State GIS Cloud Services Assessment Team

RFI Response Assessment, Business Case & Recommendation

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Summary

An RFI was developed to obtain information on the economic and technical feasibility of government GIS services being sourced by cloud computing providers. Montana was the lead state with assistance from Oregon, Utah and Colorado. 23 providers responded to the RFI, representing a broad range of cloud computing companies and business models.

While there was insufficient detailed financial information in the responses to perform a credible economic business case analysis, it was clear that there are viable vendor solutions that meet the technical and general business requirements of the states.

From what limited pricing information was provided and the tone of the responses in general, it is clear that vendor business models are based on individual relationships with government units using a term contract approach. This approach fails to give the states the full benefit of aggregating their demand; a means of representing the collective volume of demand for government GIS services is needed to best serve states' interests.

The pricing information provided in the responses showed there is significant cost advantage to using cloud services even at the volume levels of the four states currently participating in the project. Involving more states, local government units and, especially, Federal agencies would present a major increase in volume and the opportunity for a dramatic reduction in cost for all participants.

The Multi-State GIS Cloud Team recommends:

1. That the extent of Federal agency interest and impact of recent GSA contract announcements be fully explored prior to acting on recommendation #2. Our analysis suggests that federal agencies have a GIS data volume that is orders of magnitude greater than the states' volume. Inclusion of significant Federal volume is likely to be a critical factor in securing large volume discounts in the RFP process.

    a. That the GSA's "Infrastructure as a Service" offering be explored to determine if it holds significant promise to meet the objectives of this project. If it appears to provide a plausible solution, the sponsoring CIOs will assess the impact on recommendations #1.b through #4.

    b. Interest by any significant Federal agency assures sufficient volume to maximize provider discounts and to proceed with developing the RFP.

    c. In the absence of Federal agency interest, prior to acting on recommendation #2, a more thorough financial analysis should be performed using actual data volume and server usage provided by all states and major units of local government. The analysis will be forwarded to the sponsoring CIOs for their consideration prior to launching the RFP development effort.

2. That the four state CIOs continue to pursue cloud-based GIS services by sponsoring an RFP project in conjunction with WSCA/NASPO to procure government GIS community cloud services. They will identify a lead state for the RFP development, issuance and evaluation and seek additional RFP governmental unit participants to represent the largest possible volume of cloud activity, thereby soliciting the best possible pricing from

the vendor community.

3. Form a government GIS “community cloud” governance structure that assures the best possible contract terms by representing the aggregate GIS services demand of government organizations. Government entities would be asked to commit to use the community cloud whenever possible and to estimate their data and processing volume for aggregate pricing negotiations.

4. As part of the RFP development effort, we recommend that the RFP team conduct a workshop for RFP participants developing the detailed RFP requirements. Furthermore, we recommend that multiple cloud providers be invited to deliver cloud presentations to the team early in the workshop to enhance the knowledge and perspective of the workshop participants.

RFI Purpose

The Western States Contracting Alliance (WSCA), for the NASPO Cooperative, issued a "Request for Information" (RFI) to assess the technical and financial feasibility of using public cloud hosting services to support GIS applications and data presently supported by the individual states. The RFI effort was led by the state of Montana, with active participation from the states of Colorado, Oregon and Utah (referred to as the States).

This report contains an assessment of the GIS cloud marketplace and recommendations to the four sponsoring state CIOs. Acceptance of this report by the sponsoring CIOs marks the end of the RFI assessment of GIS cloud services.

Primary Objectives of the Project

The States have three primary objectives for considering GIS cloud services:

Cost efficiencies: States are under unprecedented pressure to operate as efficiently as possible. Internal state IT infrastructure is often designed around transaction processing. The high availability and recoverability requirements of these applications are not applicable to the full breadth of GIS processing and services and may unnecessarily increase GIS processing and data storage costs. The use of properly tailored cloud services may avoid unnecessary processes and gain economies of scale, resulting in cost efficiency improvements.

Flexibility and scalability: GIS may well be the most dynamic, rapidly changing area of IT. New applications, new types of data, unanticipated growth and new projects appear frequently, and with little advance notice. State infrastructure acquisitions are severely constrained by budgeting processes, making capital expense acquisition especially challenging. By shifting expenses to the operating side of the ledger, cloud computing may increase the effectiveness of the States' responses to the rapid-fire changes of GIS.

Reduction in staff support time: Budget pressures are forcing states to operate with minimal staff. Assuring the most effective and efficient use of staff is imperative for all IT organizations. GIS is a support-intensive discipline. By minimizing redundant support within states and offering efficiencies of scale, cloud computing may allow states to refocus some support resources to other critical areas of need within the States.

RFI Vendor Questions

3.4 General Questions

3.4.1 What are the financial, legal, and operational advantages and disadvantages of your cloud model? Are there unique issues about which we should be aware?

3.4.2 What scale of operation would be required for our concept to be attractive to potential bidders on any future RFP? Is there a critical mass below which you would not be interested in bidding on a proposal for this approach? What metrics are pertinent to that decision?

3.4.3 Describe your relationship with ESRI and licensing implications for the States. What issues, if any, would limit states ability make use of your cloud services?

3.4.4 Please provide a copy of your standard Service Level Agreement (SLA), or equivalent.

3.4.5 Please characterize your offerings as SaaS, PaaS or IaaS cloud services.

3.4.6 Please highlight any unique strategies or capabilities that you would provide to make our initiative successful.

3.5 Transition to/from the Cloud

3.5.1 Describe the process for establishing applications and hosting data in your cloud environment ("on boarding"), including testing, acceptance and cutover. What guidelines can you provide to assist the customer in project planning (level of effort, timeline, decommissioning legacy services, etc.)?

3.5.2 Describe your method for protecting and returning a customer's data either on demand or in case of contract termination ("off boarding").

3.5.3 Please explain any application and data portability considerations (i.e. exit strategy for applications running in your cloud).

3.6 Customer Service/Support

3.6.1 Please discuss your model for providing customer support, including charges for support contacts.

3.6.2 Describe your incident/problem reporting and tracking systems, and the ability for authorized customer staff to access those systems directly.

3.6.3 What types of access to your customer support are available (website, email, chat, telephone)?

3.6.4 What level of automatic alerting can you provide to customer staff in the event of failure, degraded service, or exceeded planned utilization?

3.7 Availability & Performance

3.7.1 Describe your mitigation strategies for potential availability and performance issues such as network outages, bandwidth shortages, or spikes in service demand?

3.7.2 Describe the redundancy features of your cloud services that ensure availability and performance.

3.7.3 Discuss your roles and responsibilities for system maintenance as the service provider and the maintenance roles and responsibilities that the user is expected to assume. Please include information about your procedures for operating system and other cores software upgrades, patches, and service pack application.

3.7.4 Please provide the past quarter's availability statistics for your cloud services that you feel may be appropriate for this initiative.

3.7.5 Discuss features of your cloud services that provide for scalability of customer applications and data hosted in your environment.

3.8 Data Ownership

3.8.1 Describe your policies, roles and responsibilities regarding data ownership.

3.8.2 Who owns the Intellectual Property for data hosted in your cloud and artifacts developed in or hosted in your cloud?

3.8.3 How do you handle data remanence once customer data is removed from your storage media?

3.9 Security

3.9.1 Describe your approach to addressing IT security challenges in cloud computing, in particular - dealing with hacker attacks, the potential for unauthorized access, and inappropriate use of proprietary data and IT applications.

3.9.2 What are your processes and solutions for preventing these challenges from occurring?

3.9.3 What controls are in place for administrative access, both internal to your company and for administrative access from government clients? Please include discussion of administrator controls over provisioning.

3.10 Cloud Interoperability

The States have, or may in the future, establish internal cloud environments or external cloud services with other providers, i.e. private, public, hybrid or community cloud environments. Describe how your cloud services integrate with other cloud services to provide seamless interoperability for the end user.

3.11 Pricing

3.11.1 Describe your pricing models and other relevant pricing factors such as CPU, memory, storage, bandwidth, and data transfers. Include break points for price changes and prices for transition services. Please be certain bandwidth charges for uploading and downloading data are clearly described.

3.11.2 Describe your pricing model for loading data on a recurring basis and for transaction processing.

3.11.3 Describe your pricing model for on-demand extraction of data by third parties and any approaches that would control cost for the states.

3.11.4 Describe the pricing differences for non-volatile data that requires only restore rather than recovery capability.

3.11.5 Please add any additional financial information that would be useful in evaluating the suitability of your cloud services.

Approach & Methodology

Our team approach employed a lead state with supporting states. Montana served as the lead state for the RFI and Colorado, Oregon and Utah provided support. The Western States Contracting Alliance (WSCA) actively participated in a supporting and advisory role as well. State team members are listed below.

Since the primary objective of the RFI was to assess the technical and financial feasibility of sourcing GIS services in the cloud, it wasn't necessary to "score" vendor responses as would be required in a procurement action. Instead, vendor responses were reviewed to determine whether the reviewer believed there is a viable cloud marketplace that could fulfill State's requirements. The assessments of the vendor question responses were "yes/no" for all but a handful of questions. The remaining handful had qualitative reviews of "poor" to "excellent".

Vendor responses were sent to the State of Montana. Montana statute requires that all responses be available to the public, except for trade secret information. A number of responses contained confidentiality statements in conflict with Montana law. These responses were not accepted unless they were revised to remove the confidentiality references. All accepted responses were made available to the other states by posting them to a Wikispaces, Inc. web facility arranged by WSCA for this project.

A review checklist document was drafted by Montana to record the assessment of the various reviewers. The reviews by the States were then consolidated into a single document and a consensus was struck on each question's responses to represent a market-level assessment for each question. The market-level assessment is the basis for the conclusions and recommendations in this report.

Project Team

Core Team:

Robin Trenbeath	MT	Project Lead
Mike Boyer	MT	Technical Lead
Kyle Hilmer	MT	Lead Analyst
Doug Bermingham	MT	Procurement Specialist
Jon Gottsegen	CO	Reviewer

Sean McSpaden	OR	Reviewer
Spencer Jenkins	UT	Reviewer
Cy Smith	OR	Reviewer
Bob Granberg	UT	Reviewer
Matt Peters	UT	Reviewer
Paul Stembler	WSCA	Multi-State Procurement Advisor

In addition to the Core Team, an extended team of GIS and IT specialists in each State contributed to the development of the RFI and assessment of the responses.

Vendor RFI Responses

Montana accepted 23 RFI responses, including some resubmissions that previously included confidentiality statements inconsistent with Montana procurement law. Responders ranged from the most prominent names in the industry, such as Amazon Web Services and Google, to some that were completely new to team members, such as Skygone. The following table lists the responders:

A-10 Networks	Amazon	Cisco	Citrix
Crowe	CSC Engineering	Dell	DeLoitte
Edifixio	EquaTerra	ESRI	Google
HCLA	IBM	Infocrossing WiPro	INX
Microsoft	Qwest	Rackspace	Sales Force
Sanborn	Skygone	Terremark	

Some vendors offer comprehensive cloud services; some specialize in GIS hosting. A couple provide infrastructure only and require the customer to engage one of their partners for the platform services. Some have no background in GIS and a couple have very long-standing, rich relationships with ESRI. A small number of responses completely missed the mark by touting only hardware or only professional services with no operational capability.

As is the case with RFIs, some responses were quite thoughtful and addressed our questions directly. Others were little more than general sales brochures and one, surprisingly from a major hardware vendor, focused almost exclusively on their application selection service. If this had been the actual procurement step, several vendors would have been deemed non-responsive. However, that said, out of the remaining pool there were easily 12 to 15 vendors who could credibly participate in a formal acquisition process.

Summary of Responses

Following are summary statements by question categories (see above for detailed questions):

3.4 General Questions

Most all responses included the predictable list of benefits of cloud computing with little mention of any downside characteristics. Scale was not an issue as they all seem to accommodate any size customer footprint. Some have robust ESRI relationships; most did not. A few provided SLA samples but a surprising number indicated they were negotiated on a case-by-case basis. The full range of SaaS, PaaS and IaaS offerings are readily available and, of course, most all felt they were uniquely equipped to meet our needs. Very few responses listed specific benefits.

3.5 Transition to/from the Cloud

Most described a pretty straightforward process for establishing the hosting relationship. A few had formal migration processes and some involved professional services at additional cost. They highlighted the trade-off between a well-planned transition and a fast/easy transition. All claimed to protect data (some lengthy security discussions) and to assure easy removal of applications and data. All the providers emphasize the flexibility to enter and depart the cloud environment quickly and easily.

3.6 Customer Service/Support

All responders touted their customer support. Some provide a base level of support in their hosting charges and premium services at additional cost. Some responders' base level support would probably be inadequate. Several employ ITIL framework support services. Most all had a variety of support channels and some gave the customer visibility into the vendor's monitoring facilities, which provided the alert capabilities.

3.7 Availability & Performance

Highly available environments are the norm among the vendors. Redundancy is the watchword for assuring highly available infrastructure services. Most had several sites to provide geographic redundancy as well as local redundancy in power, cooling and

telecommunications infrastructure. Some emphasized their control process for upgrades to hardware and software as availability features. Very few gave clear role and responsibility replies, especially as they pertain to the customer; these may be covered in the negotiated SLA. Most responders quoted 99.95% availability or better; a couple declined to quote numbers. Scalability is usually handled by adding instances or processors/storage dynamically. Load balancing played a key role in seamlessly adding capacity and in the availability capabilities of their offerings.

3.8 Data Ownership

All are clear on customer ownership of data and some vendors elaborated on their policies to safeguard customer data. Intellectual property ownership appears not to be an issue. Some may have been a bit confused by the question and focused on third-party licensing issues and the need for customers to comply with licensing terms.

All claimed to effectively remove customer data when a customer “off boards”. Some referenced Department of Defense wiping standards while others simply reformatted the media and returned it to a storage pool. This may be adequate for most GIS data but would be a cause for concern with any confidential or personal identification data.

3.9 Security

Very few responses were comprehensive in their approach to security. Several responses described multi-level security architectures incorporating both physical and logical security features. In addition to facility security, they described customer isolation through VLANs and containers and intrusion detection/prevention. Provisioning was usually limited to specific customer staff (controlled by the customer). A couple of responses aligned with FISMA and the RAMP cloud security initiative of the Federal government.

3.10 Cloud Interoperability

Some replies talked about active support for hybrid clouds, even services for them to manage the private cloud portion. Others specified standards for interaction between cloud environments. The technology to support this type of interoperability appears somewhat immature. How truly seamless the integration would prove to be is open to debate. However, the ability to have a reasonable degree of SOA-type interaction between environments appears realistic. Interoperability would be an excellent topic for the recommended workshop, page 17 #4.

3.11 Pricing

A few responders were very straightforward about their pricing structures and emphasized their simplicity as a strength, though one, in particular, seemed to have no flexibility posture. Few made any pricing distinction for load, bulk offload, or transaction workloads. Some offer a tiered storage pricing structure to accommodate non volatile data at a lower cost; others clearly made no distinction between types of data and the integrity processing it may/not require. Some providers had significant charges for additional telecommunication ports, which could add significant cost for a GIS hosting environment.

Important Response Observations:

1. The pricing information provided was so limited that it is not possible to perform any meaningful financial analysis to determine the economic feasibility of hosting GIS services in the cloud. This aspect of the RFI purpose cannot be satisfactorily accomplished with the information provided in the RFI responses.

2. The pricing responses do make it clear that the vendors foresee a term contract for states to enter into individual relationships with the providers. While there may be some advantageous pricing in a term contract, it would likely not represent the significant volume discounts that should be warranted by the combined volume of many government entities (states, local governments, and even Federal agencies). The report recommendations propose an approach to address this issue.

3. The pricing information provided in the responses showed there is significant cost advantage to using cloud services even at the volume levels of the four states currently participating in the project. Involving more states, local government units and, especially, Federal agencies would present a major increase in volume and the opportunity for a dramatic reduction in cost for all participants.

4. Some providers offered to participate, at no cost or obligation, in a session to discuss their approach to cloud computing. While there is little doubt the providers hope to influence the content of the RFP, there is also the opportunity to learn a great deal about the marketplace and subtleties between provider offerings.

5. States with existing ESRI Enterprise Licensing Agreements will have no additional charges associated with using ESRI software with cloud vendors.

6. Several vendors described the ability to implement customer charges for downloading GIS files. In addition, many of the vendors have separate bandwidth charges for data transfers in and out. The states will have to address these costs, and who will pay for the charges before any contracts are signed.

7. Flexibility and scalability was one of the three primary objectives of this project. It was very obvious that the vast majority of the respondents easily met our requirements in this area.

Business Case

State IT Business Climate

The IT business climate at the state level is as grim as the state budget projections. FY2011 state general fund spending will be $42 billion less than in FY2008. States are facing a wide variety of business and technical challenges, but two regularly rise to the top in NASCIO polls of state CIOs:

- priority strategy, management processes, and solutions
  #2 budget and cost control
  #4 cloud computing

- priority technology, applications, and tools
  #2 cloud computing

The GIS cloud initiative is aimed at addressing both of these priorities by investigating a cloud computing alternative to states' in-house GIS infrastructures. The cloud computing approach offers the potential for significant cost savings.

Technology changes and pressures to reduce IT spending are also changing the federal IT playing field. The Office and Management and Budget is requiring federal agencies to adopt a "cloud first" policy as part of the 2012 budget process. Jeff Zients, chief performance officer and deputy director for management at OMB: "OMB will require that agencies default to cloud-based solutions whenever a secure, reliable, cost-effective cloud option exists." OMB also wants to reduce the number of data centers by a minimum of 40% by 2015.

Since 2002 states have been able to purchase information technology off federal Schedule 70. GSA is working to include cloud computing services on Schedule 70, but when this will happen is undetermined. Unfortunately the structure for state usage is not based on aggregate volume. Each state's discount level is based on the individual state's volume, and not the combined volume purchased by all states as is the model recommended in this report.

Business Requirements

The effort to gather information on GIS cloud usage is not a formal RFP; the States did not compile a detailed list of requirements and rate each vendor on each requirement. The RFI is an attempt to gather information and assess whether there is any merit to proceed with a procurement. Instead of long list of specific requirements, the States have a short list of areas of interest.

1. Cost efficiencies
2. Flexibility and scalability
3. Reduction in staff support time
4. Transition to/from the cloud
5. Customer service and support
6. Availability and performance
7. Data ownership
8. Security
9. Interoperability

The first three are the primary objectives of the RFI, and the other 6 are areas of interest; areas where the States want to know if cloud vendors are likely to meet or exceed specific requirements.

The following table was constructed based on the responses from 19 vendors. Four of the 23 respondents were not counted since they were only hardware vendors or purely consulting firms, with no available cloud services.

The percentages represent the cumulative responses from all 19 vendors on several questions in each area. For example, the security area had 3 questions within the RFI. A "yes"

assessment indicates the vendors' responses meet the states' requirements in this area. In two areas responses to some RFI questions were also rated on a sliding scale: poor/fair/good/excellent. A "no" was scored for responses that did not meet requirements, or for poorly written responses.

		States Assessment						
RFI Section	Description	yes	no	unknown	poor	fair	good	excellent
1	cost efficiencies	92%	8%	0%				
1	flexibility and scalability	86%	11%	3%				
1	reduction in staff support time	81%	14%	6%				
3.5	transition to/from the cloud	79%	16%	5%	17%	40%	30%	14%
3.6	customer service and support	89%	7%	4%				
3.7	availability and performance	88%	10%	3%	11%	31%	33%	24%
3.8	data ownership	87%	7%	7%				
3.9	security	83%	16%	1%				
3.10	cloud interoperability	77%	14%	9%				

In all of the requirement areas the majority of vendors were judged to have met the States' requirements. Two thirds, or a minimum of 12 vendors, met the States' requirements in each area. The responses to the RFI indicate that a significant number of GIS cloud vendors have a high probability of meeting specific requirements of any follow-on RFP or procurement.

Strategic Alignment

The question of whether a joint state effort to acquire cloud services aligns with states' IT strategy is simple. The overriding project objective, cost reduction, is #2 on the NASCIO state CIO strategy list and the proposed technology solution is the #2 NASCIO state CIO technology priority.

Financial Analysis

A classic cost/benefit or ROI analysis on the proposal is impossible at this stage. Many RFI responses did not contain specific rate information. In any case, the vendors' RFI rates are significantly higher than the charges that would result from a competitive procurement process.

As a starting point the state and representative vendor infrastructure costs were assembled.

Note: All rates and costs are annual unless otherwise noted.

States

Cloud Component	Montana	Oregon	Utah	Colorado
Storage Space	$10.50/GB Tier 1 $5.71/GB Tier 2 (FY2013)	$6.72/GB Tier 1 $4.32/GB Tier 2	$4.80 /GB (SAN)	$474.50/GB $1.30/GB per day

Server Hosting (VM, 1 CPU 2 GB memory unless noted otherwise)		$571/month per allocated unit x 1 CPU x weighting factor pSeries x 15 iSeries x 10 Legacy x 3	Hosting subscription rate?	
Managed Server Hosting (VM, 2 CPU, 2 GB memory unless otherwise noted)	$2,447 per server		$2,160 plus hosting subscription?	$4896 (FY09-10)
Data Transfer	None	None	None	None

Sample RFI Vendors

Cloud Component	IBM	Skygone	Microsoft	Rackspace	Amazon
Storage Space	$1.31/GB	$1.80 - $2.28/GB	$1.80/GB	$1.80/GB	S3 pricing for Northern California $1.67/GB to .84/GB for 5000 TB
Server Hosting (VM, 1 CPU 2 GB memory unless noted otherwise)	(4 GB memory) $2321.40/Linux instance $2102.40/Windows instance	(1 GB memory) $540/ instance	$1051.20/Linux instance	$1051.20/Linux instance $1401.60/Windows instance	EC2 pricing for Northern Cal. (1.7GB memory) $832.20/Linux-Unix instance $1138.80/Windows instance
Managed Server Hosting (VM, 2 CPU, 2 GB memory unless otherwise noted)				(1 CPU) $2102.40/Linux instance $2452,80/Windows instance Plus $1200 account fee	
Data Transfer	$.15/GB in and out	First TB per month is free	$.10/GB in and $.15/GB out	$.08/GB in and $.22/GB out	$.10/1M I/Os

Software costs are normally about 20% of all IT costs. ESRI software licensing costs will probably not change significantly if the States' use the cloud. Although several of the vendors are formal ESRI business partners, none commented that licensing costs were a potential source of cost savings.

The critical financial question is whether significant cost reductions are possible through a joint state acquisition of GIS cloud infrastructure. Achieving this goal is dependent on positive responses to several basic questions. Details behind the estimates of data/server volumes, costs, and savings can be found in the appendix.

a. *Can the states aggregate their purchasing power and volumes?* Yes.

The states have several existing alternatives to combine their purchasing power. They may use the WSCA/NASPO structure, or enter into a multi-state consortium agreement. Whatever structure is used it must be flexible enough to allow other participants from the state, federal, and local level. The major benefits from volume discounts will only appear if the program has wide participation across the country, far beyond the initial four states. GSA has also announced a program where states can participate on GSA contracts.

b. Can a cloud solution provide significant cost savings over what a state could achieve independently? Yes.

None of the individual states has a storage cost structure that comes close to the rates available through cloud vendors. At best the states appear to be 4 times more expensive. On the server side the picture is not as clear. Some of the cloud vendors appear to be significantly less costly, but the pattern is not as consistent.

The best published cloud vendor rates are available only for those customers who require massive amounts of servers and storage. Unfortunately, the states cannot meet these larger quantities even if they aggregated all their GIS requirements. Combined the state GIS requirements may only be 220 TB and 3750 servers. At those quantities the combined states only reach the first of 5 Amazon discount levels for storage. The major cost savings are far beyond reach even if the states purchase as one entity.

Achieving the largest vendor discounts for GIS cloud services will require participation of federal agencies. Federal agency GIS requirements are probably more than 100 times as large as the combined states. An informal search of published agency data found close to 26 petabytes of geospatial data in only three agencies.

- ✓ USGS 4 petabytes
- ✓ NOAA 18 petabytes and growing roughly 25% per year
- ✓ USDA 3.8 petabytes; 99% is imagery

If a single state purchased storage from Amazon, the state's GIS data volume would only qualify for Amazon's highest rate, $1.67/GB. If the state could combine its purchasing with federal agencies they could reach Amazon's lowest rate of $.84/GB, and drop their GIS storage costs by 50%.

c. Will the vendors permit the states to aggregate volumes to achieve deeper discounts? Maybe.

If the states and federal agencies join forces and present a single customer face to the cloud vendors, several factors will push vendors to price their service as if it was for a single customer.

- ✓ Competition among cloud vendors for the GIS business.
- ✓ Vendor marketing costs may decrease if the agencies agree to use a single standard contract and SLA. Local vendor marketing teams will not have to spend time marketing to agency GIS management.

Factors working against vendors offering deep discounts.

- ✓ Vendor operational costs will not decrease. Provisioning, problem management, and performance management will still be done for each individual agency.
- ✓ Vendor administration costs will not decrease. Vendors will still be invoicing and

processing payments from separate agencies.

- ✓ Vendor marketing costs may not decrease.

d. Will federal agencies be motivated to participate in a joint procurement with the states? Maybe.

Although several federal agencies have already expressed an interest in joining a state RFP effort, the states' GIS business volumes are small enough that they bring no significant cost savings to large federal GIS agencies.

Risks

Using cloud solutions for GIS systems incorporates many common IT risks, just with a slightly different perspective since part of the system and responsibilities are external. None of the risks are huge, and there are significant mitigating factors.

1. Security

   Several responses described multi-level security architectures incorporating both physical and logical security features. In addition to facility security, they described customer isolation through VLANs and containers and intrusion detection/prevention. Provisioning was usually limited to specific customer staff (controlled by the customer). A couple of responses aligned with FISMA and the RAMP cloud security initiative of the Federal government.

2. Control

   Lack of control is a common criticism of systems that are outsourced. Long term contracts, restrictive access to the data, and inflexible application logic are often cited as the root causes of the risk. The cloud computing business model is quite different from older outsourcing or early ASP models. The cloud model relies on short term contracts and on applications normally supplied and controlled by the customer.

3. Customer Service and Support

   Managing the business relationship with a cloud vendor will require frequent communications about technical problems, performance, and capacity issues. The State's will be responsible for constantly monitoring the vendor's performance. Fortunately, technical support staff will have several methods of communication (phone, email, text, alerts) and many vendors offer access to their internal problem tracking systems. Service and support levels will be documented in Service Levels Agreements (SLAS.)

4. Availability/reliability

   Highly available and redundant environments are the rule for cloud vendors. Most vendors had several sites to provide geographic redundancy as well as local redundancy in power, cooling and telecommunications infrastructure. Some emphasized their control process for upgrades to hardware and software as availability features. Most responders quoted a minimum 99.95% availability.

5. Vendor Viability and Data Extraction

   A common concern and risk is long term vendor viability and data extraction if the vendor fails. The responding vendors included Google, Microsoft, IBM, CISCO, Dell, and Amazon; some of the biggest names in the industry. It is unknown whether any of these vendors would ultimately be chosen vendors. Size is not always a solid indicator of stability, but at least there should be warning signs a long time in advance.

   Recovering State's data Most of the vendors described their processes for returning customer data. The processes were relatively simple and didn't appear lengthy. The risk is always that procedures can break down if a firm is under severe financial stress or staff is distracted.

The major risks of using GIS cloud services are heavily mitigated by several factors:

- Short term contractual relationship The normal structure of the customer to cloud vendor relationship is month-to-month rental. A formal RFP process and negotiated contract may introduce a longer contractual time period, but the current industry standard is month-to-month. This short window provides great flexibility and freedom to react if the service relationship doesn't live up to expectations.

- Non-confidential data The vast majority of the GIS data is non-confidential; aerial imagery being the largest component. Data theft is much less of a concern than data and application corruption.

- Wealth of alternatives If the States find themselves in an intolerable cloud services relationship, they can quickly implement a different service delivery model. None of the vendors have cancelation charges.

  a. Migrate to another cloud vendor
     The RFI produced 19 cloud vendors with a large majority meeting the States' requirements. It is very likely that States will have several reasonable options if the original vendor is unsatisfactory. If the GIS cloud contract is structured to qualify several vendors, a second procurement effort would be unnecessary.

  b. Move the GIS applications and infrastructure in-house
     This choice might require the most time to procure and install the necessary infrastructure, but it is still a valid option. Rebuilding internal IT staff would be the most time and effort, but adding staff might be totally unnecessary for states that did not downsize staff during the migration to the cloud.

- States are the Original Data Source The States will be the original source of the vast majority of GIS data moved to the cloud. The data might be manipulated and edited while residing in the cloud, but the States should have an original version for the bulk of their data. Cloud customers can also extract copies of their cloud data on a periodic basis. There will not be a major, unmitigated risk of a cloud vendor being the only location of large amount of customer data.

Team Recommendation:

The Multi-State GIS Cloud Team recommends the following actions:

1. That the extent of Federal agency interest and impact of recent GSA contract announcements be fully explored prior to acting on recommendation #2. Our analysis suggests that federal agencies have a GIS data volume that is orders of magnitude greater than the states' volume. Inclusion of significant Federal volume is likely to be a critical factor in securing large volume discounts in the RFP process.

    a. That the GSA's "Infrastructure as a Service" offering be explored to determine if it holds significant promise to meet the objectives of this project. If it appears to provide a plausible solution, the sponsoring CIOs will assess the impact on recommendations #1.b through #4.

    b. Interest by any significant Federal agency assures sufficient volume to maximize provider discounts and to proceed with developing the RFP.

    c. In the absence of Federal agency interest, prior to acting on recommendation #2, a more thorough financial analysis be performed using actual data volume and server usage provided by all states and major units of local government. The analysis will be forwarded to the sponsoring CIOs for their consideration prior to launching the RFP development effort.

2. That the state CIOs of the states sponsoring this project further sponsor an RFP project in conjunction with WSCA/NASPO to procure government GIS community cloud services.

    a. Identify a lead state for the RFP development, issuance and evaluation.

    b. Seek additional RFP governmental unit participants so as to represent the largest possible volume of cloud activity, thereby soliciting the best possible pricing from the vendor community.

3. Form a government GIS "community cloud" governance structure that assures the best possible contract terms by representing the aggregate GIS services demand of government organizations. Government entities would be asked to commit to use the community cloud whenever possible and to estimate their data and processing volume for aggregate pricing negotiations.

    A community cloud can be thought of as a multi-tenant cloud environment where all tenants share a common interest. In this case the common interest is the provision of homogeneous resources (e.g., storage) and government GIS-based services. This concept would allow the public sector participants, i.e. states, local government, and Federal agencies, to aggregate their demand and secure the most favorable volume pricing. It also would allow the cloud provider(s) to deliver a single, consistent service, which reduces provider costs which, in turn, allow rates to be lower.

    Some discussion of this approach has already taken place:

    a. The governance organization could take a number of forms, including being

under the auspices of WSCA/NASPO.

b. The Oregon State CIO, Dugan Petty, has agreed to lead the governance effort.

c. WSCA's Paul Stembler has expressed interest and support for an aggregate approach to an RFP and contract(s) for subsequent operation of a government GIS community cloud.

4. As part of the RFP development effort, we recommend that the RFP team conduct a workshop for RFP participants developing the detailed RFP requirements. Furthermore, we recommend that multiple cloud providers be invited to deliver cloud presentations to the team early in the workshop to enhance the knowledge and perspective of the workshop participants.

    a. Presenters will be asked to avoid sales pitches and to concentrate on concepts that constitute cloud "best practices".

    b. Participation is completely voluntary and presenters participating will not be compensated.

    c. The participation or non-participation of the invited cloud providers will not be considered, either positively or negatively, in the evaluation of RFP responses.

Additional Benefits of a Government GIS Community Cloud

1. The existence of a government GIS community cloud will provide a high quality GIS environment for all participants. This will be especially beneficial for smaller local units of government that would not have had the ability to support a comparable environment on their own.

2. The collocation of multiple units of government in a shared, consistent environment will streamline the process of creating cross-jurisdictional GIS solutions.

Concerns & Challenges

1. One of the most attractive features of cloud computing is rapid entry and exit by customers as their business needs dictate. Committing to a GIS community cloud may be perceived as counter to that feature by both potential government participants and by providers.

    Mitigation: All parties need to understand that the community cloud is merely a way for governmental units to bring an aggregated demand to the market to get better pricing. Likewise it's a mechanism for providers to bring a single, lower cost set of services to a large customer segment.

    An individual state's use might be on a month-to-month or quarterly basis. The community cloud would result in all users being charged for their portion of the aggregate use of all participants during the billing period. While rates likely will fluctuate from period to period depending on the level of participation, the rates will always be far more affordable than could be obtained by an individual government unit based on its

volume alone. Some level of governance and commitment may be required to mitigate the cost variability from parties joining and exiting without notice.

2. The governance organization will likely take a loosely federated form. State and local government funding cycles, and their funding instability, constrain their ability to make concrete, ongoing commitment to services. The fact that state and local dollars will flow outside the jurisdiction, regardless of cost effectiveness, will compound commitment stability issues.

   Mitigation: As discussed in the previous point, individual commitments may be on a month-to-month or quarterly basis and customers pay only for what they actually use. Government customers moving into and out of the community cloud simply affect where the aggregate group of users are on the rate scale for any particular billing period.

3. GIS solutions are not identical across the states. There must be sufficient variety in the provider services accessible through the community cloud to meet individual state requirements or to permit states to move existing GIS solutions without expensive redevelopment.

   Mitigation: The best approach to this issue is to develop a thorough set of business and technical requirements for the RFP based on industry standards, and to structure the RFP to permit selection of which services that will be provided in the contract. A requirement of a single state that adds unacceptable cost to other state participants might not be suitable for the community cloud. Hopefully there will be few, if any, requirements that can't be met by the community cloud in a cost effective manner for all participants.

Community Cloud Options

There are a wide range of government GIS Community Cloud governance structures that might be pursued. Following is a discussion and contrast of two options, one from each end of the spectrum where one end has the governance structure at the center of the customer's relationship with the provider and the other where it is more detached from the ongoing relationship. Selection of a governance model from the spectrum should be a foremost priority of the sponsoring CIOs. Recognizing that there are many options that fall between the two structures contrasted below, the team expects that the optimum model will fall somewhere between these two examples.

"Passive": In this model, the governance structure is focused on essentially establishing a term contract with provider(s) based on the aggregated demand the government units expect to place on the GIS environment provided under the contract. The operational relationship between a particular government customer and the services provider would be contracted directly under the terms of the negotiated community cloud term contract. All aspects of the relationship would be handled between the provider and the government unit. Periodically, the governance organization would solicit proposals and/or renegotiate the community cloud term contract(s).

Based on the tone of the RFI responses, it appears this is the model anticipated by most of the providers and one they are likely most comfortable with.

"Active": In this model, the governance structure does the negotiation tasks of the "passive" model plus it plays an active, central role in the administration of the operational relationship between government customer and the providers of the community cloud. Here the governance organization stands between the government unit and the services provider. While the services are provided directly to the customer, the provider bills the governance organization and the customer pays the governance organization. This model drives down cost/rates by assuring that the maximum volume goes through the community cloud and simplifying the provider's administration and marketing expense.

This model was not even hinted at in the vendor responses to the RFI.

The following table contrasts the two approaches:

	Passive Model		Active Model
Comparative simplicity/complexity	**Simple**: centers on establishing a "term contract" for states to use.		**Complex**: involves the governance organization in the ongoing administration of the relationship between states and providers.
Relationship with provider(s)	Establishes **"term contract(s)"** for direct relationship between provider and government customer		**Passive model plus:** 1. **Services billed to** on behalf of customers **2. Defines services/policies**
Relationship with government units	**Represents** aggregate service demand for bidding and contract negotiation		**Passive model plus:** 1. **Services paid** on behalf of customers 2. **Defines services/policies** 3. **Bills government customer.** for services used

	Passive Model		Active Model
Requires establishing an ongoing administrative organization	**No**: term contracts would readily fall under the structures already in place for WSCA contracts		**Yes**: acting as the intermediary for the flow of payments and other ongoing aspects of the relationship would require a staff of 2 or more (depending on volume); may need a "managing director" position
Justification for lower rates from provider(s)	Aggregate volume of services demand from all levels of government		• Aggregate volume of services demand from all levels of government • Simplified administration of A/R and reduced risk • Elimination of most sales/marketing overhead
Requires working capital fund	**No**		**Yes**: to support organization expenses and for a working capital fund to cover service payment float
Government unit "Board" involvement	**Minimal**: probably only needed for rebidding or renegotiation activity		**Substantial**: Expect considerable policy activity, financial review, etc.
Comfort zone for providers and government customers?	**Yes**, for both		• **Government customers**: very unusual approach; will take a great deal of discussion on pros/cons • **Providers**: unusual approach but has some potentially great benefits that lower costs

Assumptions

We are assuming:

1. There is sufficient interest among government GIS organizations to represent a significant volume of GIS services, far greater than any individual government unit itself

could muster.

2. Providers have enough flexibility in their business models to deal with a community cloud concept. Some responses mentioned community clouds so this assumption should be valid.

3. Providers will understand the value of an aggregated, community cloud model as a way to serve a large community of customers with and streamlined, consistent set of services. Sales and marketing

4. The RFP and any resulting contracts will likely be quite complex. The lead state will be taking on a sizable effort. Other states should be prepared to lend significant assistance.

5. WSCA/NASPO will likely play a key role in how the contracts are structured with the provider(s).

6. The contracts will be “no money up front/no guarantee” in nature. The value of the services offered have to be what compels states to use the services rather than a contractual obligation.

7. Each government unit will be responsible for controlling which staff is authorized to establish financial commitments under contract(s) resulting from a procurement process.