Lowering the cost of using imagery by 60%

Assessing the Business Case of using

Image Web Server™ With GIS Map Servers such as ArcIMS®

A White Paper from Earth Resource Mapping
# TABLE OF CONTENTS

**EXECUTIVE SUMMARY** ................................................................................................................................. 3  
**APPROACH** .................................................................................................................................................. 4  
**IMPACT OF IMAGERY ON THE STAKEHOLDERS OF THE COMPANY** .............................................................. 5  
  - Owners ............................................................................................................................................................ 5  
  - Customers ...................................................................................................................................................... 7  
  - Staff ............................................................................................................................................................. 10  
  - Vendors ....................................................................................................................................................... 11  
**WHAT IF WE ALREADY HAVE AN GIS MAP SERVER ?** .................................................................................. 12  
**CONCLUSIONS** ............................................................................................................................................ 13
Disclaimer and copyright notices

All rights to this document are reserved. No part of this work covered by copyright herein may be reproduced in any form or by any means – graphics, electronic or mechanical – including photocopying, recording, taping or storage in an information retrieval system without the prior written approval of the copyright owner.

Whilst every care has been taken to ensure the accuracy of details in this document such as (but not limited to) Product Specifications, Features, Pricing and Performance Analysis, ABSOLUTELY NO GUARANTEE IS GIVEN AS TO THEIR ACCURACY. We strongly recommend anyone using this information to perform their own research and analysis to verify any required details prior to making any decision based on this document. Mention or discussion of a product or company in this document is not meant to imply endorsement of ERM or ERM products by that company unless endorsement is explicitly so stated.

This document may contain brands, company names and product names of third parties, and following are the requirements for identifying trademarks and registered trademarks of those third parties. This list is not exhaustive and the document may contain brands, company names and product names of additional third parties.

All brands, company names, product names and service names may be trademarks or registered trademarks of their respective holder. Adobe PhotoShop is a registered trademark of Adobe Systems Incorporated. ESRI, ArcGIS, ArcIMS, ArcARCSDE and ArcView are trademarks or registered trademarks of Environmental Systems Research Institute, Inc (ESRI). AutoCAD, AutoCAD Map, MapGuide, Autodesk and Autodesk World are registered trademarks of Autodesk. MapInfo and MapXtreme are registered trademarks of MapInfo Corporation. Microsoft, Microsoft Office, Microsoft Word, Microsoft Excel, Microsoft Internet Explorer and Windows are registered trademarks of Microsoft. MrSID is a registered trademark of LizardTech, Inc. Netscape Navigator is a registered trademark of Netscape Communications Corporation. Oracle is a registered trademark of Oracle Corporation. Enhanced Compressed Wavelets (ECW), ECW Connector, Image Web Server are trademarks of Earth Resource Mapping, Ltd (ERM). ER Mapper and ER Storage products and documentation are © Copyright 1989-2003 by Earth Resource Mapping, Ltd.
Executive Summary

Imagery adds great value to maps, providing reality and detail, improving understanding and often enhancing the user’s comprehension. For this reason, most organizations want to add imagery to their web based maps.

This paper examines ways to drive dramatic improvements to the bottom-line savings by integrating the high performance Image Web Server technology with your GIS map servers.

Earth Resource Mapping (ERM) is a recognised world leader in imagery technology.

We understand the true cost of proving image data, and want to help the prospective purchasers of image serving solutions to make truly informed decisions. This means providing an insight into all the areas where there is a cost impact, both direct and indirect. When considering these savings in terms of lifetime costs of ownership, this can represent a dramatic bottom line improvement.

For direct savings, we demonstrate how Image Web Server will lower:

- Hardware and software costs by up to 40%
- Staff costs by 60%
- Data processing times by 80%
- On-going support and maintenance of the image serving solution by 60%

In addition, we reflect on the indirect, or ‘soft’ benefits that an organisation will receive, over and above the direct improvements in the bottom-line, specifically how Image Web Server can:

- Deliver substantial benefits to viewers of the data through performance enhancements
- Avoid undue GIS vendor preferences
- Broaden the use and access of image data, providing a greater return on investment
- Free-up an organisations critical resources to drive competitive advantage

Following the approach as outlined in this paper will allow organisations to construct a business case for the purchase of image serving solutions that is robust, considered and fully informed.

This paper leverages ERM’s experience of providing corporate image server solutions to over 300 clients globally, with systems processing and serving terabytes of image data on a daily basis.
Approach

To enable a realistic comparison of the benefits of Image Web Server, we have compared the system to a standard internet GIS Map Server, namely ArcIMS, running on a HP ProLiant ML570 G2 with 4GB RAM. We refer to this as the GIS Map Server version. When comparing the two systems it is important to remember that GIS Map Server systems such as ARCSDE are not designed with imagery in mind. Handling of imagery imposes complex and difficult problems – a factor which means that any system which is not specifically designed from the ground up will require compromises leading to impacts on performance and efficiency ranging from moderate to severe.

Whereas a large GIS Map Server might manage and server a few GB of vector based data, images are routinely 100’s of GB or even TBs in size. GIS Map Servers have performance and cost issues when serving such images.

While the costs here are based on a ‘greenfields’ situation (no existing infrastructure), the total additional costs inefficiencies incurred by using an existing GIS Map Server solution for the serving of imagery remain very considerable indeed.

Another major issue considered is the need to integrate the imagery solution with existing infrastructure and software. It is important to view the imagery solution as part of the wider, integrated information and decision-making processes.
Impact of Imagery on the stakeholders of the company

This paper looks at the true cost of using imagery, and how the use of the Image Web Server can dramatically improve the bottom-line performance for all stakeholders of a company. We have broken down the stakeholders into 4 categories:

- Owners
- Customers
- Staff
- Vendors

Owners

In considering the position of the owners of the organisation, we will be covering the following major issues

- Costs of purchasing and running the system
- Strategic considerations
- Socio/political considerations

Under cost of the system there are a number of factors to consider, including system cost, bandwidth costs, ongoing support and training.

Before examining the cost differences in detail it is useful to have an understanding of how the systems differ. The two alternatives are shown in the diagrams below:
The following table shows a comparison of the costs of Image Web Server versus an GIS Map Server solution for serving imagery.

### Table 1: Cost comparison Image Web Server vs ARCSDE – in US$

<table>
<thead>
<tr>
<th></th>
<th>Image Web Server</th>
<th>GIS Map Server</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware required</strong></td>
<td>Dual Xeon + .5Gb Ram</td>
<td>HP ProLiant ML570 G2 + 4Gb RAM</td>
</tr>
<tr>
<td><strong>Hardware Cost</strong></td>
<td>$10,000</td>
<td>$30,000</td>
</tr>
<tr>
<td><strong>Storage Required</strong></td>
<td>120Gb Serial IDE Drive</td>
<td>SCSI Raid 6 Tb</td>
</tr>
<tr>
<td><strong>Storage Cost</strong></td>
<td>$500</td>
<td>$30,000</td>
</tr>
<tr>
<td><strong>ARCARCSDE</strong></td>
<td>$0</td>
<td>$40,000</td>
</tr>
<tr>
<td><strong>Database software</strong></td>
<td>$0</td>
<td>$100,000</td>
</tr>
<tr>
<td><strong>Image Handling software/ Application Layer</strong></td>
<td>$50,000</td>
<td>$20,000</td>
</tr>
<tr>
<td><strong>Client end software (assuming 20 users)</strong></td>
<td>$0</td>
<td>$20,000</td>
</tr>
<tr>
<td><strong>Ongoing annual maintenance</strong></td>
<td>$6,000pa</td>
<td>$35,000pa</td>
</tr>
<tr>
<td><strong>System support staff</strong></td>
<td>$20,000</td>
<td>$120,000pa</td>
</tr>
<tr>
<td><strong>Data Processing staff</strong></td>
<td>$150,000pa</td>
<td>$350,000pa</td>
</tr>
<tr>
<td><strong>Training costs</strong></td>
<td>$12,000</td>
<td>$30,000</td>
</tr>
<tr>
<td><strong>Total staff annual costs</strong></td>
<td>$150,000 pa</td>
<td>$470,000pa</td>
</tr>
<tr>
<td><strong>Total costs - one time</strong></td>
<td>$72,500</td>
<td>$270,000</td>
</tr>
<tr>
<td><strong>Total costs - ongoing</strong></td>
<td>$176,000pa</td>
<td>$975,000pa</td>
</tr>
</tbody>
</table>

**Assumptions:**

Image Web Server uses existing client end software via plugins, so no client software required. Plugins are free.

Because imagery can range from 100s of GB to many TB of files, most serving solutions have very demanding hardware and database requirements. Image Web Server, because of its efficient storage algorithms, requires very much lower capacity; support is minimal and can probably be handled within existing resources. GIS Map Server solutions will require maintenance for all of the database, ARCSDE and Client software applications.

Data processing staff numbers needed are greater for GIS Map Servers because of longer processing cycles, more complex and less stable operations.

Training costs are greater for GIS Map Servers because of greater number of software products and far greater complexity.

Because of the lack of effective compressed imagery storage capability in GIS Map Servers the size of the imagery datasets that need to be stored will result in additional storage costs that could equal or exceed the cost of a complete Image Web Server installation.

**Information Sources:**

- ArcSDE: ESRI hp_arcARCSDE.pdf
The ongoing support saving is largely driven by the simplicity of the Image Web Server Solution, dedicated as it is to serving imagery. Fewer software products, purpose-built software, reduced software interfaces and smaller hardware requirements reduce both the cost and the likelihood that something will go wrong. Moreover, the simplicity of the Image Web Server system means that non-specialised staff can undertake the support tasks, training is easier and quicker and recruiting and retaining the necessary staff is facilitated.

Strategic issues. In the strategic area there are a number of important considerations. Firstly, a typical GIS Map Server solution will require subsidiary software manufactured by that vendor. This, coupled with the massive effort involved in swapping, effectively locks in the organisation to that vendor. As everyone is aware, the lack of competition in any situation tends to escalate prices, diminish service and is generally not in the organisation's best interest. The situation is exacerbated when the vendor concerned has proprietary standards. On the other hand, an open standard integrated imagery solution leaves the organisation capable of using the best solutions from whatever vendor develops them in the future. In fact, the organisation should seek as far as possible to create an open and even-handed opportunity for all its vendors – in that way maximising the potential to the organisation.

The third element from the owners' point of view is the socio-political environment. Whether the organisation is privately or publicly owned, there are a variety of interested groups. This is perhaps more important for the government sector where a variety of political and policy factors need to be taken into account. Issues such as the perceived performance of the organisation, the need to avoid undue vendor preferences, the demonstration of value for money and satisfaction of customers (voters) needs all interplay with the guiding functions provided by political and governmental parties. For this reason, open-standard products such as Image Web Server, enhance the organisation's ability to interface with a variety of vendors. GIS Map Server solutions, on the other hand, tend to restrict the organisation's ability to use other vendors. Any perceived lack of performance or inability to meet targets and deadlines is worsened by an inability to switch vendors.

Customers

Any organisation has two categories of customers – internal and external. Defining the boundaries is important in individual cases but for the purposes of this white paper we will treat them as one. What do customers look for in a service that provides them with imagery? We believe that these are the important factors:

- Convenient access to information
- Information must be relevant
- Information must be up-to-date.
- Access must be fast
- Price must present value for money.

Dealing with these issues, convenience includes allowing customers to use the data when and where they need to, in their software programs of choice, such as Word Processors, Presentation Tools, CAD Packages and a range of GIS tools. Requiring customers to change their software
packages, or expecting them to go through convoluted routines to use the imagery is an anathema to the concept of customer service.

That information should be up-to-date and relevant is a given. However, sometimes the system constrains the ability of the provider to achieve this. For example, if the update process requires days or weeks of mosaicing, colour balancing followed by re-archiving, then this objective is not met.

The issue of speed of access by the customer is often not addressed by the vendor. As shown in the table below, delays in access, multiplied by the number of users and views, adds up to a massive cost – and much of it is not visible to the organisation. But it does build customer resentment and that translates to lost business in a competitive situation, and/or in a negative view of the organisation as a whole. Let’s build a typical scenario, comparing Image Web Server with an GIS Map Server solution, such as ArcIMS.

<table>
<thead>
<tr>
<th></th>
<th>Image Web Server</th>
<th>GIS Map Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of customers</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Views per day</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Days used per year</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Views per year</td>
<td>6,000,000</td>
<td>6,000,000</td>
</tr>
<tr>
<td>Time taken to view in secs per view</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Total time taken in viewing - hrs</td>
<td>1,668</td>
<td>25,000</td>
</tr>
<tr>
<td>Additional time in person-years</td>
<td>0</td>
<td>15.6</td>
</tr>
<tr>
<td>Value of this time at $50 per hour</td>
<td>0</td>
<td>$1,167,000 per year</td>
</tr>
</tbody>
</table>

The above table is based on a relatively low number of users in order to give a reasonable comparison. An important issue is that as the number of users climbs, the GIS Map Server suffers massive degradation in performance.
The following chart demonstrates that:

- The Image Web Server uses 16% of one computer’s CPU load to serve 50 clients
- An ArcSDE based GIS Map Server server-side solution consumes 12 computers’ CPU load at 100% to serve 50 clients with the same level of response time.
- At even a low load of 50 clients, the GIS Map Server requires ~70x the CPU resources to match the responsiveness and performance of Image Web Server. This means that the organisation has to buy an extra 12 CPUs, or that the customer gets poor service. This is a lose/lose decision for the organisation.

But the cost issue does not end there. Given the higher investment costs required for an GIS Map Server solution (discussed earlier) it is likely that the charge to the customer will have to be higher to justify the investment decision.
Leaving that aside until later, let us surface some of the other costs that are sometimes not appreciated by an organisation. One important cost is bandwidth and internet access costs by customers.

Table 2: Assessment of customer access costs

<table>
<thead>
<tr>
<th></th>
<th>Image Web Server</th>
<th>GIS Map Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of customers</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Views per day</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Days used per year</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Views per year</td>
<td>6,000,000</td>
<td>6,000,000</td>
</tr>
<tr>
<td>Average view size in k</td>
<td>50</td>
<td>480</td>
</tr>
<tr>
<td>Total imagery viewed in Mb</td>
<td>300,000</td>
<td>2,880,000</td>
</tr>
<tr>
<td>Customer volume cost (c/Mb)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Total Customer volume charges</td>
<td>$30,000</td>
<td>$288,000</td>
</tr>
<tr>
<td>Customer access requirement</td>
<td>2Mb</td>
<td>20Mb</td>
</tr>
<tr>
<td>Cost per customer (p.a.)</td>
<td>$12,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Total Customer access costs</td>
<td>$3.6m</td>
<td>$12m</td>
</tr>
</tbody>
</table>

**Staff**

Looking at the requirements of the organisation’s staff in implementing and running an image serving system, the following are important considerations:

The system should be easy to implement and to maintain. Preferably, the implementation and maintenance should be capable of being carried out by generalist staff to minimise costs and disruptions when staff are changed.

The ongoing task of preparing and maintaining the image data should be streamlined, quick to do and preferably automated.

In some organisations, the data must be distributed. Any system should be capable of doing this at low cost while maintaining security and records.

More effective use of development resources. Because several highly skilled staff are not required for support of a complex system, they can be more effectively deployed in design and further development of the system.

Typically, a GIS Map Server system may require staff to change over their existing GIS systems to one that is compatible with the GIS Map Server. This involves a considerable investment, not only in purchasing new software, but also the attendant heavy training required, as well as the loss in productivity and the waste of existing skills and knowledge. A system that allows staff to continue using existing GIS systems is clearly preferable.

Basing the staff cost savings on the total staff costs set out in table 1 above, the staff costs drop by as much as 62%, from $470,000 to $150,000. This cost analysis ignores other real but hard to measure factors such as reduced error rates, improved morale because of easier learning tasks and faster achievement of tasks.
Vendors

An organisation is looking to its vendors for competence and experience in the product and services they supply. It is worth noting that the vendor’s background is very indicative of its likely experience with a product. For example, a GIS Map Server vendor would have had very limited prior experience in Imagery and would therefore be less likely to understand the subtleties and complexities of handing imagery compared to a vendor with a lifelong experience in that field. The probability is that the less experienced vendor would attempt to shoehorn solutions into existing products – leading to sub-optimal solutions.
What if we already have an GIS Map Server?

Many of our customers already have a GIS Map Server, which could have been purchased for a number of reasons:

- Storage of non-image data
- Secure storage of data – preservation of data integrity
- Centralised data storage

In this case using the Image Web Server in conjunction with the existing Vector GIS Map Server has a turbo-boosting result that accelerates the speed and ability to serve customers as the graph below shows.

![Response Time Graph](image)


In summary the benefits include:

- 10 times faster response when there are 50 simultaneous users. Response time differences increase exponentially as the number of users grows.
- 1/3 of the Central Processing Unit (CPU) load at 50 users
- 10 times faster input/output at the 50 user level

Even in a situation where an GIS Map Server is required for other purposes, adding Image Web Server to the configuration results in the following benefits to the organisation and its customers:

- Reduced hardware CPU and storage requirements; in some cases the savings in hardware and storage is greater than the Image Web Server cost.
- Much faster access by customers and users.
- Easier upgrade and maintenance of imagery
Conclusions

The table below summarises many of the issues raised above.

From the performance table it is clear that for serving Imagery, Image Web Server is undoubtedly the superior option. Other factors that demonstrate Image Web Server to be the superior image serving solution include:

- Ease of implementation
- Ease of use
- Integration with existing and future systems
- Better and faster access by users
- Lower capital and operating costs

Summarising from the tables above, we see that the organisation can make significant savings in costs – in the region of 60% to 80% where an ‘either-or’ option is considered or around 60% of the additional costs to serve imagery where the organisation already uses ARC-SDE for GIS data.