



# Internet Mapping

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- ☐ **Make maps for the masses**
- ☐ **Geoprocessing on the Internet**
- ☐ **Intranet enterprise GIS**

# Internet Mapping

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## ❑ Maps for the masses

- Non GIS users
- Environmental, historical, scientific, community data
- Recreational mapping
- Level playing field
- Publisher discretion
- Increased speed = increased information
- Get results through maps \*\*\*\*\*

# **Internet Enabled Geoprocessing**

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- ☐ **GIS Users**
- ☐ **Spatial data for analysis**
- ☐ **Publish and download spatial data**
- ☐ **True client/server connectivity (data and services)**

# Internet mapping

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## ❑ Static Maps

- Publish images of pre-generated maps
  - JPEG, GIF, PNG, etc.

## ❑ Dynamic Maps

- Custom maps generated and *Spatial Analysis* performed on demand

# Dynamic Maps

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- ☐ **High performance Map server**
  - Map renderer
  - Spatial Analysis
- ☐ **Client browser**
  - HTML, Java, ActiveX
- ☐ **Object based integration**
  - Web server and the internet map server
- ☐ **Coupled to Spatial Database Engine**
  - High performance, multi client
- ☐ **Incorporates process manager**
  - Control throughput and agents

# **Intranet Enterprise GIS**

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## **❑ Connect to enterprise information**

- **ArcSDE, Oracle, MS SQL, DB2, etc.**
- **Results of spatial analysis**
- **Distributed, organizational clients using enterprise spatial databases linked to GIS server processors**

# Flavors

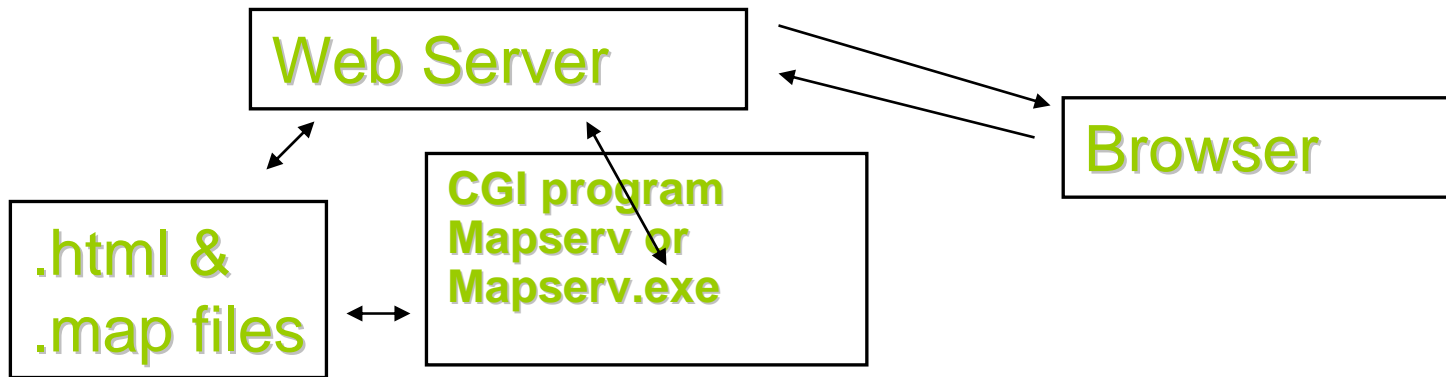
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- ❑ **ArcIMS**
  - <http://www.esri.com>
- ❑ **AspMap**
  - <http://www.vdstech.com/aspmap.htm>
- ❑ **Demis Map Server**
  - [http://www.demis.nl/DEMIS\\_UK/](http://www.demis.nl/DEMIS_UK/)
- ❑ **Geode**
  - <http://geode.usgs.gov/>
- ❑ **GeoServe.org**
  - <http://sts.gsc.nrcan.gc.ca/>
- ❑ **IMapper**
  - <http://www.imapper.com/>
- ❑ **InterroMap**
  - [http://www.interromap.com/im\\_portal](http://www.interromap.com/im_portal)
- ❑ **MapServer**
  - <http://mapserver.gis.umn.edu/>
- ❑ **Map TV**
  - <http://www.spatialmedia.com/>
- ❑ **Web-Mapper**
  - <http://www.web-mapper.com/main.cfm>
- ❑ **WebView**
  - [http://www.zebris.com/english/main\\_produkte.htm](http://www.zebris.com/english/main_produkte.htm)



# Mapserver

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# MapServer

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- ❑ MapServer is an OpenSource development environment for building spatially enabled Internet applications.
- ❑ The MapServer was originally developed by (UMN) ForNet project in cooperation with NASA and the Minnesota DNR
- ❑ Current development is funded by the TerraSIP project, a NASA sponsored project between the UMN and consortium of land management interests.
- ❑ MapServer will run where most commercial systems won't or can't, on Linux/Apache platforms.
- ❑ MapServer is known to compile on most UNIXes and will run under Windows NT/98/95/00.

# MapServer Implementation Options

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- ❑ MapServer can be implemented as a CGI application.
- ❑ The MapServer CGI application provides a significant number of "out-of-the-box" features.
  - vector formats supported: ESRI shapefiles, simple embedded features, ESRI ArcSDE
  - raster formats supported: TIFF/GeoTIFF, GIF, PNG, ERDAS, JPEG and EPPL7
  - quadtree spatial indexing for shapefiles
  - fully customizable, template driven output
  - feature selection by item/value, point, area or another feature
  - TrueType font support
  - support for tiled raster and vector data (display only)
  - automatic legend and scalebar building
  - scale dependent feature drawing and application execution
  - thematic map building using logical or regular expression based classes
  - feature labeling including label collision mediation
  - on-the-fly configuration via URLs
  - on-the-fly projection

# MapServer Implementation Options

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- ❑ MapServer system supports MapScript which allows popular scripting languages such as Perl, Python, Tk/Tcl, Guile and even Java to access the MapServer C API.
- ❑ This is analogous to Active Server Pages (.asp) and ColdFusion (.cfm) in the ClosedSource world.
- ❑ MapScript provides a rich environment for developing applications that integrate disparate data.
- ❑ If the data have a spatial component, and you can get to it via your favorite scripting environment, you can map it.
- ❑ Additionally MapScript allows you to integrate your business data in an RDBMS (e.g., Oracle, MySQL, Sybase) into your MapServer application.

# Gory Details

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- ❑ The hardest part is the compilation process.
- ❑ Because it's open source it pulls from many different projects with many different developers.
- ❑ If you need support for something (e.g., TrueType fonts) it has to be compiled in (e.g., FreeType).
- ❑ This can be a pain.
- ❑ However, installation of most IMServers is a pain.

# .map File Example - simple

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LAYER

```
NAME counties                                #Layer name
TYPE POLYGON
DATA county                                  #shapefile name
STATUS ON
CLASSITEM tile_name                         #for queries use this
LABELITEM "name"                           #label using this item
SYMBOLSCALE 1500000                         #Start scaling at this resolution
LABELMAXSCALE 600000                       #Start labeling at this scale
HEADER county_header.html                  #Header template for queries
CLASS                                       #Start of a map class
  NAME "Counties"                          #Name for Legend
  EXPRESSION //                             #could be pop90 > 10000 e.g.
  OUTLINECOLOR 128 128 128
  COLOR 245 240 219
  TEMPLATE county.html                     #used to build query output
  LABEL                                    #Builds the label
    SIZE 8
    MINSIZE 2
    MAXSIZE 8
    COLOR 0 0 0
    BACKGROUNDCOLOR 255 255 204
    BACKGROUNDSHADOWSIZE 4 4
    BACKGROUNDSHADOWCOLOR 0 0 0
    TYPE TRUETYPE
    FONT tahoma
    ANTIALIAS
    BUFFER 1
  END
END
```

END

# MapServer Examples

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- ❑ <http://www.dnr.state.mn.us/maps/compass.html>
- ❑ <http://mapserver.gis.umn.edu/gallery.html>
- ❑ <http://www.vcrlter.virginia.edu/mapserver/>
- ❑ <http://www.vcrlter.virginia.edu/~jhp7e/evsc468/2003>

John Porter's MapServer

# ArcIMS

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- ❑ **Microsoft Windows NT 4.0, 2000, XP**
- ❑ **Sun Solaris, AIX, HP-UX, Linux**
- ❑ **Choice of operating system will determine:**
  - **Web Server**
  - **Java Servlet engine**
  - **Application Servers**
  - **Java Runtime Environment (JRE)**
- ❑ **Two different Viewers available**
  - **Java requires a one-time download 20mb file**
  - **HTML- very customizable**



# ArcIMS Evolution

**2004**

**ArcIMS 9**

**ArcIMS Tracking Server**

**ArcIMS ArcMap Server**

**ArcIMS 4**

**2002**

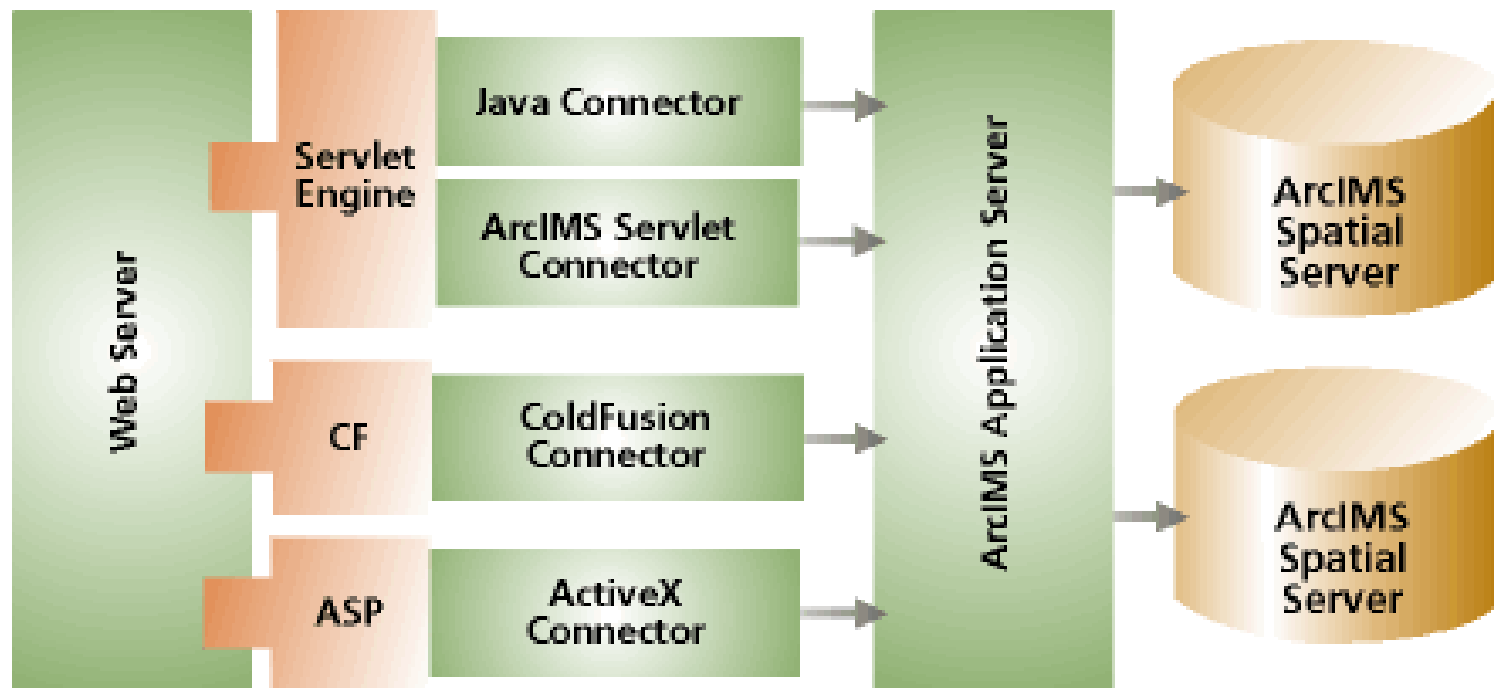
**ArcIMS Route Server**

**ArcIMS 3.1**

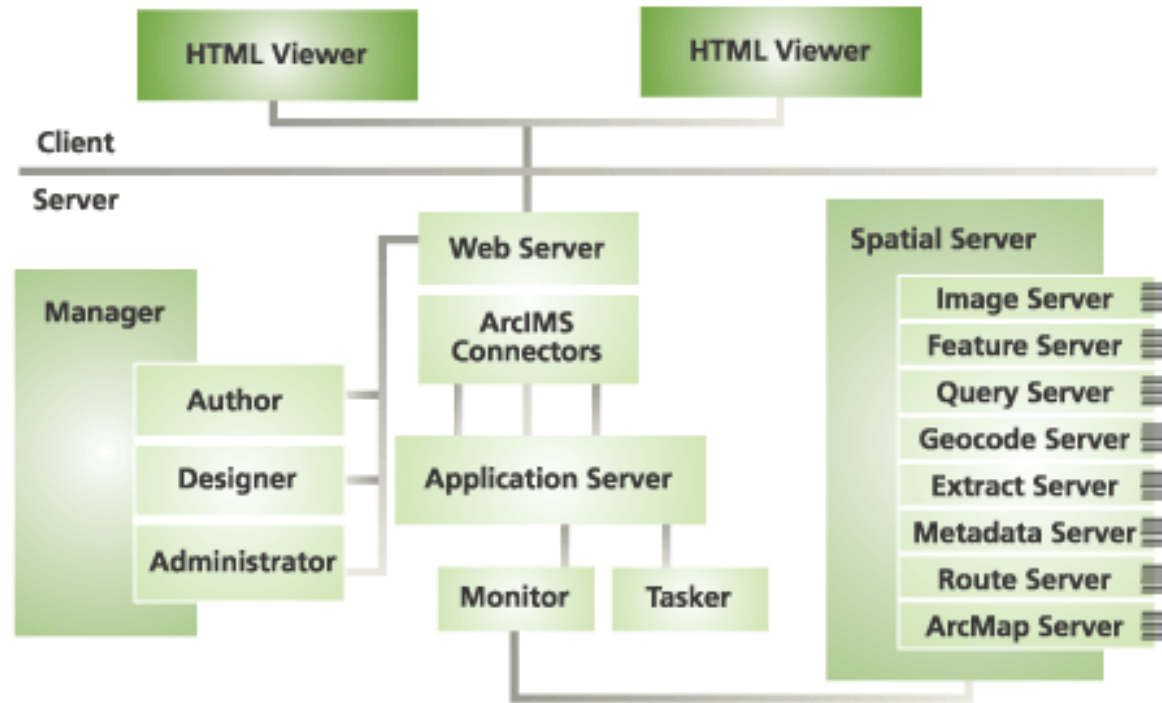
**2001**

# ArcIMS: Nuts and Bolts

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# ArcIMS: confusion matrix



# Helpful Tips

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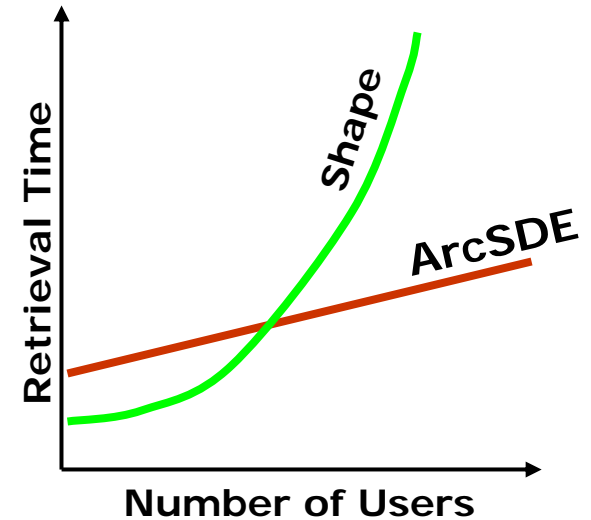
- ❑ Use test servlets that come with software
  - Example: ServletExec, test with
    - <http://localhost/servlet/TestServlet>
    - <http://localhost/servlet/DateServlet>
- ❑ Make sure virtual directories are in place
- ❑ Adequate system resources for ArcIMS Spatial Servers
- ❑ Network security issues: Firewalls, DNS issues
- ❑ Use the ArcIMS Diagnostics Page:
  - [C:\Program Files\ArcGIS\ArcIMS\Common\Diagnostics\ArcIMS\\_Diagnostics.html](C:\Program Files\ArcGIS\ArcIMS\Common\Diagnostics\ArcIMS_Diagnostics.html)
- ❑ Majority of installation problems start and end here!!!

# Performance

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## ❑ ArcSDE vs. Shapefiles

- Shapefiles
  - Faster setup
  - Faster single hit performance
  - More CPU usage on MapServer
- ArcSDE
  - Better maintainability
  - Better scalability
  - Offset CPU to DB server



ESRI 2003

# Performance

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- ❑ How long does a request take?
- ❑ Perceived vs. actual performance
  
- ❑ Focus on getting the fastest single user performance by
  - Tuning your data
  - Tuning your AXLs
  - Choosing your client applications

# Tune Your Data

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## ☐ Data

- Generalize data by reducing features and/or vertices

## ☐ Shapefiles

- Make sure your spatial index files (.sbn and .sbx) are in sync with your data

## ☐ ArcSDE

- RDBMS tuning
- Grid sizes

Vendor	Product Name	Client Cost	Base Server Cost	Client Browser Only	Plug-in Required	Plug-in optional	MS IE			Netscape			Client OS					Server OS Supported			Threaded	Footprint MB	Second MB
SYSTEM CHARACTERISTICS							IE 3	IE 4	IE 5	3.x	4.0	4.6	Any w/ browser	NT	Win 9x	Mac	UNIX	NT	Win 9x	UNIX			
Autodesk Inc.	MapGuide Release 4	free	\$9,990	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	128	
Bentley Systems Inc.	ModelServer Discovery	free	\$12,500	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	N	N	Y	16	16
Byers Engineering	Map Viewer Web	free	\$8,500	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	N	Y	128	2
Cadcorp	Cadcorp Active Server Component	\$300/seat	\$5,000	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	N	N	15.20	15.20
Earth Resource Mapping	Image Web Server	free	\$4,950	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	N	Y	128	128
ESRI Inc.	ArcIMS	free	\$8,000	N	Y	NA	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	128	128
ESRI Inc.	ArcView IMS	free	\$5,000	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	24.32	24.32
ESRI Inc.	Map Objects IMS	free	\$5,000	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	128	128
ESRI Inc.	RouteMAP IMS	free	\$2,995	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	64	64
Framework Technologies Corp.	ActiveProject 5.0	\$220.367/seat	\$11,995	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	N	N	N	128	
GeoMicro Inc.	AltaMap Server	free	\$4,995	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	8	0
Intergraph Corp.	GeoMedia Web Map	free	Not provided	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	5	5
Intergraph Corp.	GeoMedia Web Map Enterprise	free	Not provided	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	5	5
Laser-Scan Ltd.	Gothic Integrator: Java Edition GJJE	free	\$24,200	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	128	
MapInfo	MapXtreme 2.0																						
MetaMAP Inc.	MetaMAP Internet Spatial Database and Map Server	free	\$20,000	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	3.4KB	3.4KB
MicroImages Inc.	TNTserver	free	\$6,000	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	128KB	varies
PCI Geomatics																							
Smallworld	Smallworld Web	\$48 each for 1,000 users	\$240,000 for 1,000 seats	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	96	
Soft Reality Inc.	EarthKey Internet Mapping	\$5,000 for unlimited	\$25,000	N	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N	Y	5	0
Star Informatic	Star Next	\$600 for one to \$12,000 for unlimited	\$5,250	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y		24+	
Sysleco GIS AS	Tellus Internet Map Server	free	monthly fee																			128	0

Source: <http://www.geoplace.com/gw/1999/1199/images/limptb1.pdf>



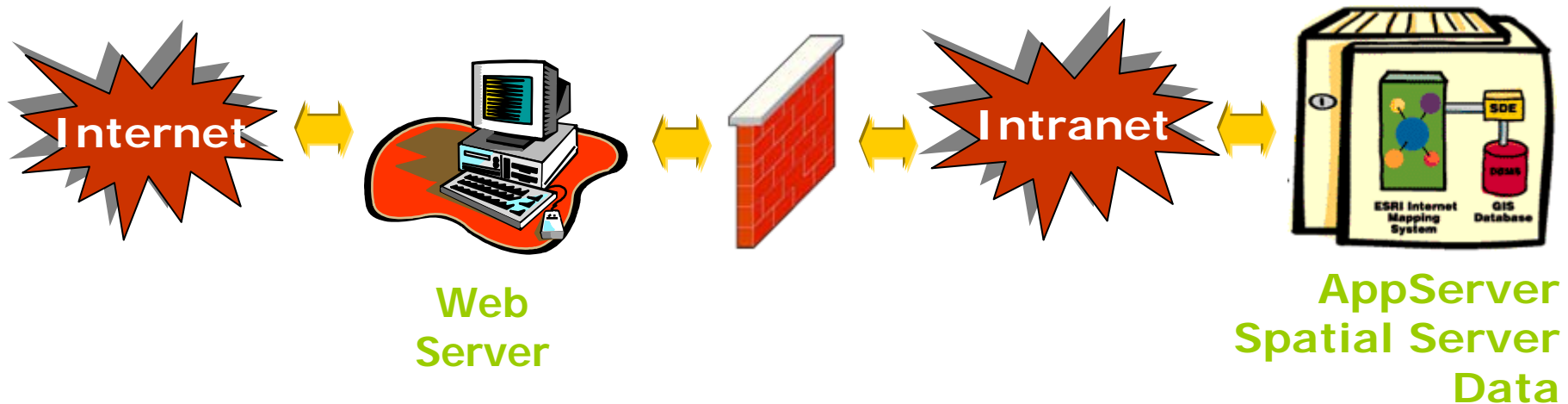
Vendor	Product Name	Client Cost	Base Server Cost	Client Browser Only	Plug-in Required	Plug-in optional	MS IE			Netscape			Client OS					Server OS Support		
							IE 3	IE 4	IE 5	3.x	4.0	4.6	Any w/ browser	NT	Win 9x	Mac	UNIX	NT	Win 9x	UNIX
Autodesk Inc.	MapGuide Release 4	free	\$9,990	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Bentley Systems Inc.	ModelServer Discovery	free	\$12,500	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	N	N
Esri Inc.	Map Viewer Web	free	\$8,500	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	N	Y	N	N
Intergraph Corp.	Cadcorp Active Server Component	\$300/seat	\$5,000	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	N
MapInfo Corp.	Image Web Server	free	\$4,950	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	N
RI Inc.	ArcIMS	free	\$8,000	N	Y	NA	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
RI Inc.	ArcView IMS	free	\$5,000	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
RI Inc.	Map Objects IMS	free	\$5,000	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
RI Inc.	RouteMAP IMS	free	\$2,995	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Software Technologies Corp.	ActiveProject 5.0	\$220-367/seat	\$11,995	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	N	N
Micro Inc.	AltaMap Server	free	\$4,995	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Intergraph Corp.	GeoMedia Web Map	free	Not provided	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Intergraph Corp.	GeoMedia Web Map Enterprise	free	Not provided	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
InterScan Ltd.	Gothic Integrator: Java Edition GIIJE	free	\$24,200	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
MapInfo Corp.	MapXtreme 2.0	free	\$20,000	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
MetaMAP Inc.	MetaMAP Internet Spatial Database and Map Server	free	\$6,000	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N
MicroImages Inc.	TNTserver	free	\$6,000	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Smallworld	Smallworld Web	\$48 each for 1,000 users	\$240,000 for 1,000 seats	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Earth Reality Inc.	EarthKey Internet Mapping	\$5,000 for unlimited users	\$25,000	N	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N
Star Informatic	Star Next	\$600 for one to \$12,000 for unlimited	\$5,250	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Deco GIS AS	Tellus Internet Map Server	free	monthly fee																	

# Most Popular

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## ❑ Web Server Outside Firewall

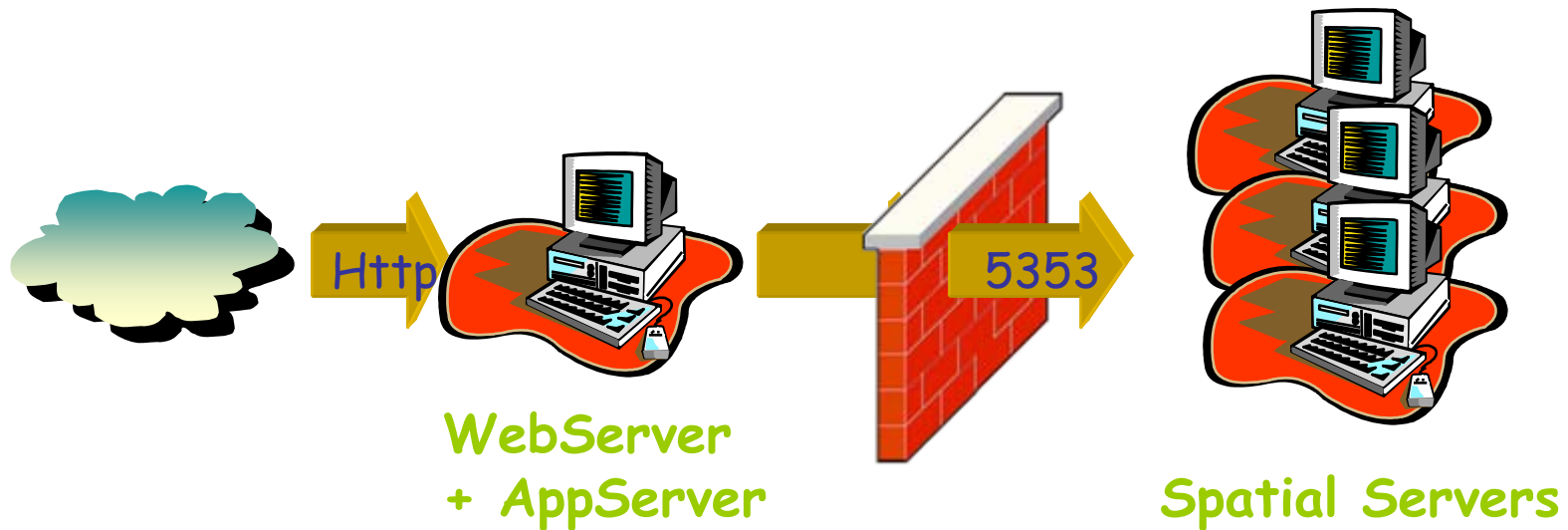
- Port 5300 Open
- File sharing from Intranet to Web server for image output



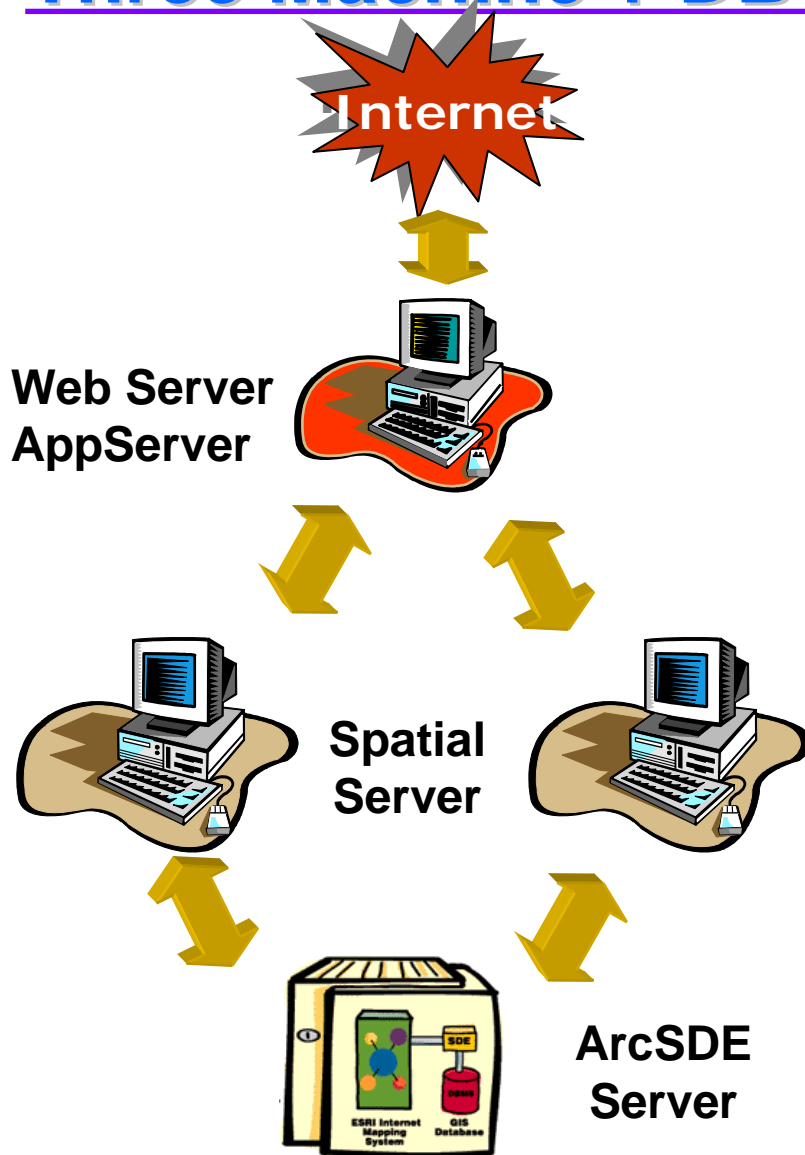
# Not Recommended

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- ❑ Connection between AppServer and spatial server persistent



# Three Machine + DB Server Scenario



## ❑ Capacity

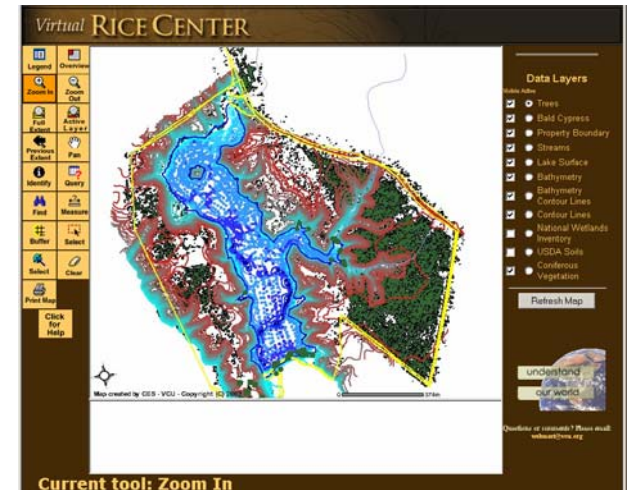
- 150,000 maps/day (16 max. req/s)
- 99% availability (3.6 days/yr)

## ❑ Configuration

- 1 machine for Web server and AppServer
- 2 machines for spatial server
- 1 ArcSDE server

# VCU Hardware Configuration

- ❑ **Sun Enterprise 450**
    - 4 – 450mhz Ultra Sparc III
    - 8 gb ram
    - 444gb SCSI HD
  - ❑ **2 Dell 2650 PowerEdge**
    - 2 – 3.06ghz Xeon
    - 8 gb ram
    - 3 – 73gb SCSI HD
  - ❑ **1 Dell 1750 PowerEdge**
    - 2 – 3.06ghz Xeon
    - 4 gb Ram
    - 3 x 146gb SCSI HD
  - ❑ **1 Dell 2850 PowerEdge**
    - 2 – 3.6ghz Xeon
    - 12 gb ram
    - 5 x 73gb SCSI HD
  - ❑ **220 PowerVault storage**
    - 14 x 146gb SCSI HD
- ArcMS Server
- ArcMS  
ArcGIS  
Server
- ArcSDE  
Server



# Resources

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❑ <http://www.freegis.org/>