University of Arizona

THE CAMPUS

SPATIAL DATA INITIATIVE

Presentation Review

1. **Background on Campus Mapping and Spatial Data**

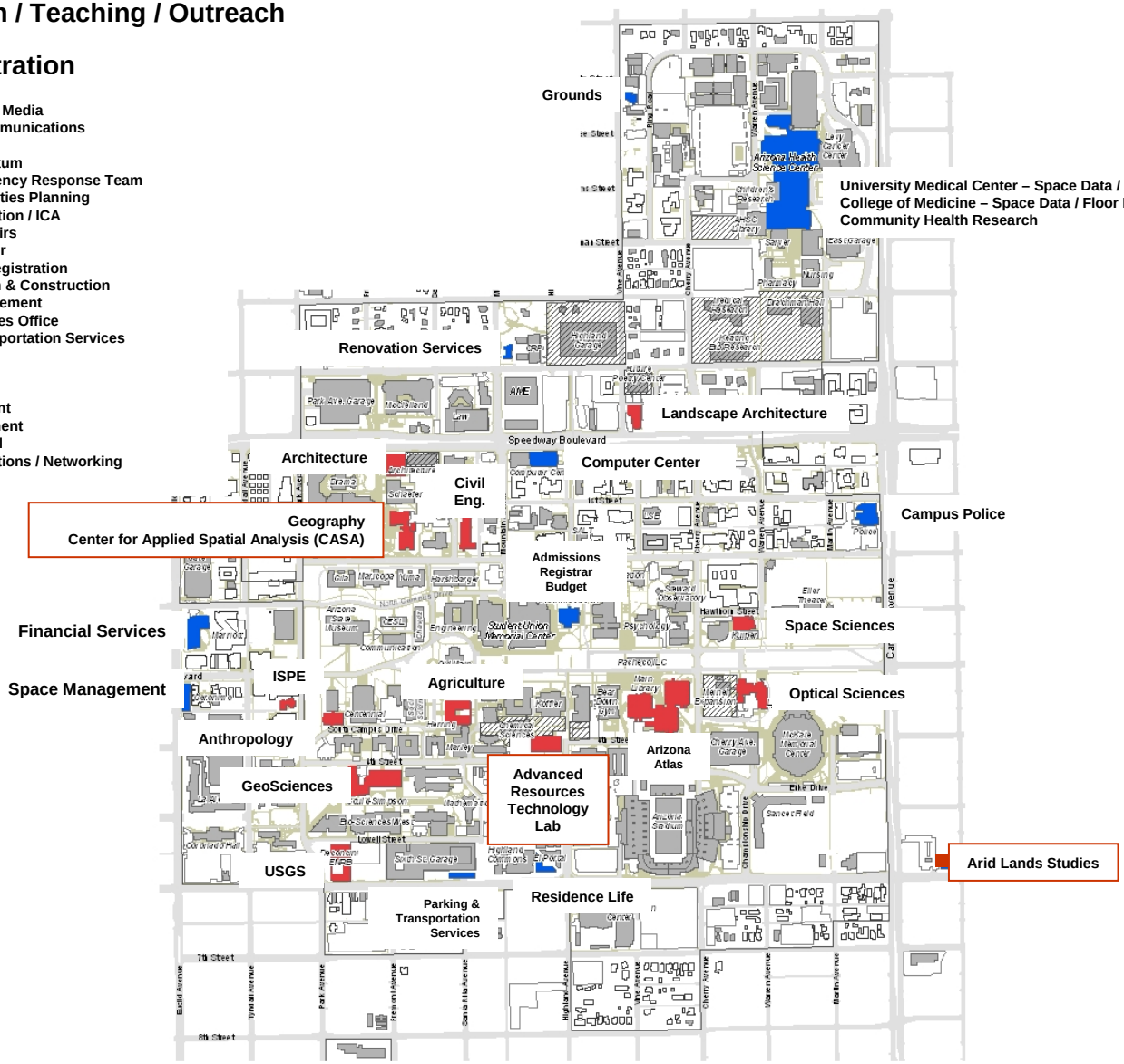
2. **The Campus Spatial Data Initiative**

Campus Spatial Data Users

Research / Teaching / Outreach

Administration

Admissions
Arizona Student Media
BioMedical Communications
Budget Office
Campus Arboretum
Campus Emergency Response Team
Campus & Facilities Planning
Campus Recreation / ICA
Community Affairs
Computer Center
Curriculum & Registration
Facilities Design & Construction
Facilities Management
Financial Services Office
Parking & Transportation Services
Police
Procurement
Residence Life
Risk Management
Space Management
Systems Control
Telecommunications / Networking
Visitor's Center



Background on Campus Mapping and Spatial Data at the UA

Prior to 1990	Most recordkeeping related to the physical campus was in paper format.
Late 1980's	Initiatives began to *convert data to digital formats* automation of "key plans" and creation of the space database.
1993	Study conducted to *assess issues and opportunities* for automation of spatial information on campus.
1995	Digital base mapping project began in an effort to *create a geographic framework* to integrate initiatives and address the concerns listed above.
1995 – 2004	Many discrete automation efforts in individual departmental operations.
2002	*Campus Mapping Committee* formed to coordinate graphic/publication oriented maps.
2003 – 2005	Presentations made on options for integrating campus spatial data. Launch of initiative in spring 2005.

Why Automate Spatial Data?

Improve ability to find information

Make data query's and analysis easier / quicker

Protect important records at risk due of decay

Have a single set of information maintained in one place

Reduce unnecessary error and effort

1996 Aerial Photos and Mapping

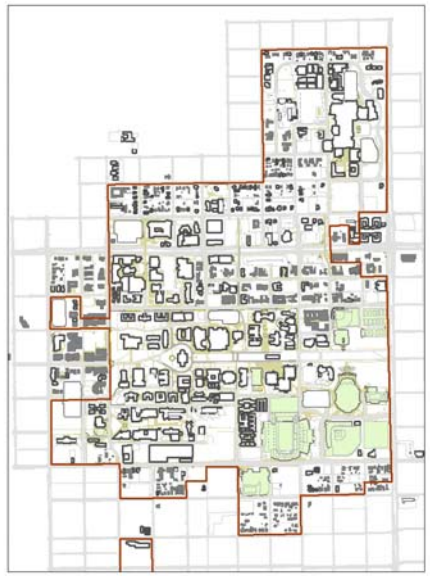
University Administration funded the creation of a scalable digital basemap and related digital orthophotos

GIS "Electronic Basemap"

Highly accurate & scalable

Based on a coordinate system widely used locally

GIS formatting allows "intelligent maps" (links to data tables)

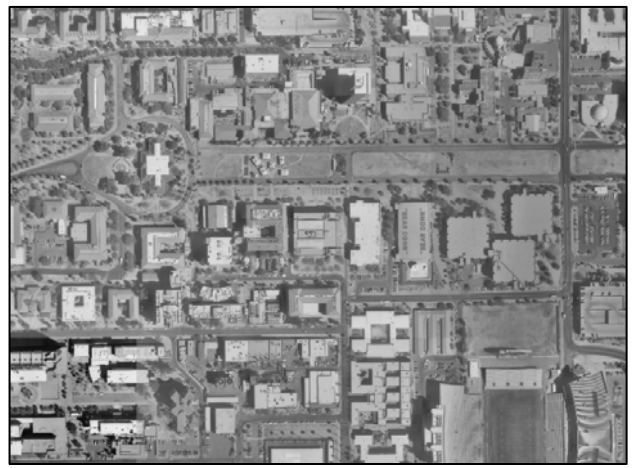


Digital Orthophoto "Photo Base"

Highly accurate & scalable

Based on a coordinate system widely used locally

Provides "visual information"

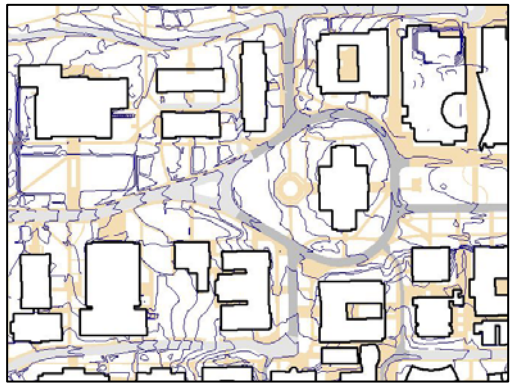


Digital Orthophoto overlaid with building map layer

1996 Aerial Photos and Mapping

Sampling of other map layers created by the Campus Photo/Mapping project.

Signs

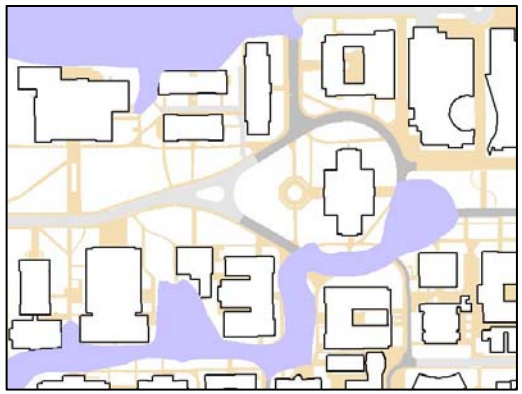


Topographic Contours

Trees

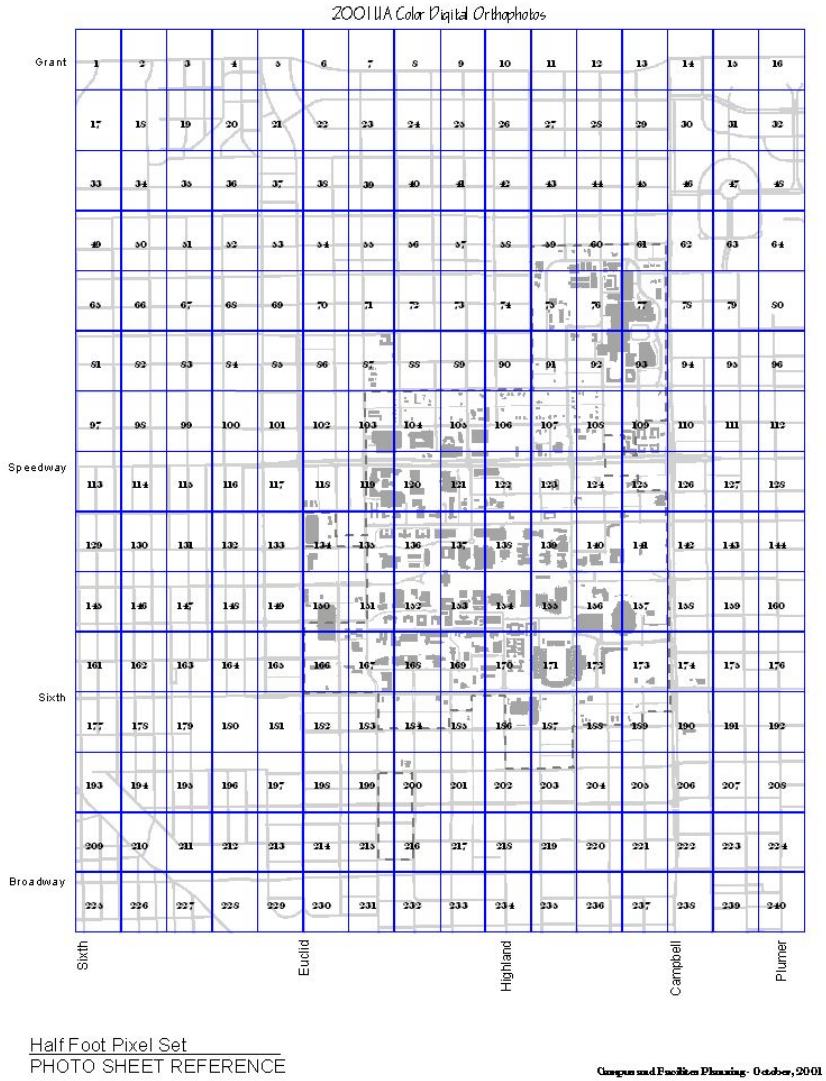
Manholes

Walls



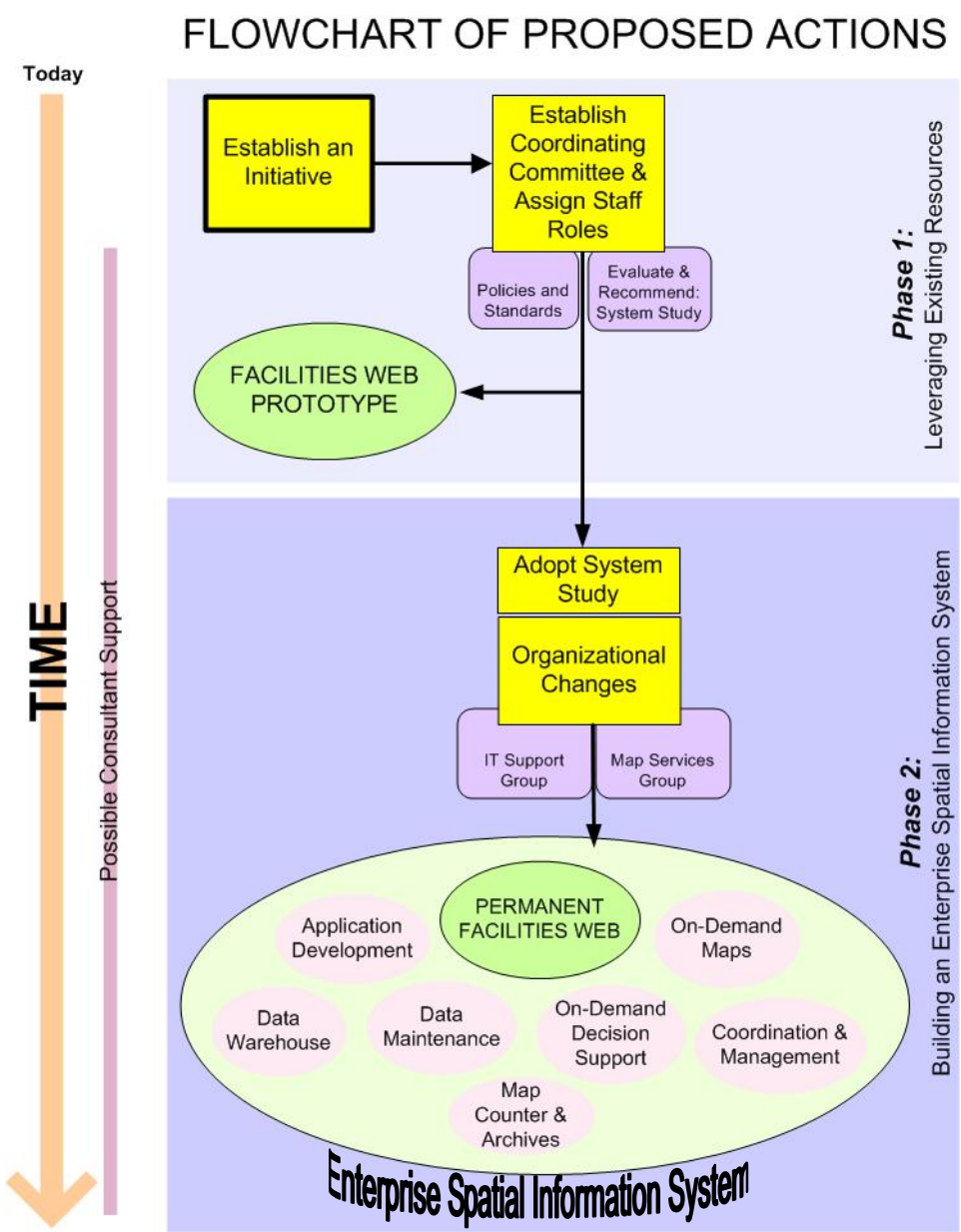
Floodplain

2001 Color Orthos



UA Spatial Data Initiative

The University of Arizona



PHASE ONE

1. Formally Establish an Initiative
2. Create Coordinating Committee
3. Assign Staff Roles
4. Official Basemap & Coordinate System
5. Spatial Data Standards Manual
6. Develop Prototype Projects
7. System Assessment / Specification Study

PHASE TWO

1. Adopt System Study
2. Implement “Facilities Web” Application
3. Implement Organizational Changes

Spatial Data Initiative Flowchart

What is Institutional *Spatial* Data?

It is relevant to planning, managing, or auditing a major administrative function of the University

It is referenced or required for use by more than one organizational unit

It is included in an official university administrative report; or

It is used to derive an element that meets the criteria above

AND

It is tied to a physical location related to the UA

Initiative Visions / Goals

Create a coordinating and technical framework into which departmental spatial data services / applications are plugged (with expertise and control remaining with departments).

Provide more consistent and complete spatial data services for products which are best delivered in a more consolidated fashion.

Automate paper information / processes to increase efficiency and usefulness of information (accuracy, currency, availability, etc.)

Use technology to work more intelligently and accomplish greater results with fewer resources by enabling fundamentally different approaches to defining and solving problems

Provide electronic access to all information needed by staff to do their jobs regardless of who "owns" the information, thereby increasing effectiveness and enabling a wider distribution of appropriate decision making ability.

Important Considerations .....

Departments don't have to give up control of their data. Appropriate access to information will be controlled.

Department are not required to change the software they use to store/update data

Much can be done with little or no new resources (e.g., a lot can be done through a clear mandate and effective coordination).

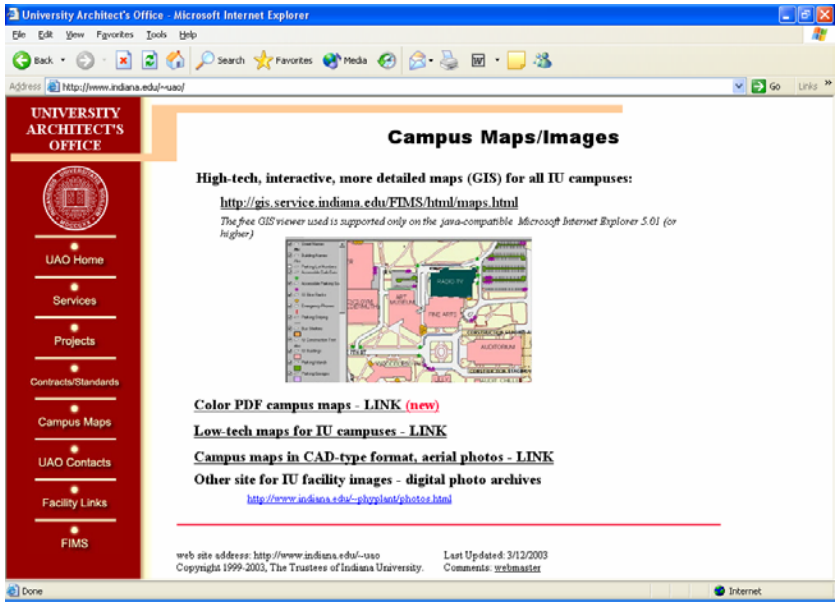
WHERE WE ARE NOW

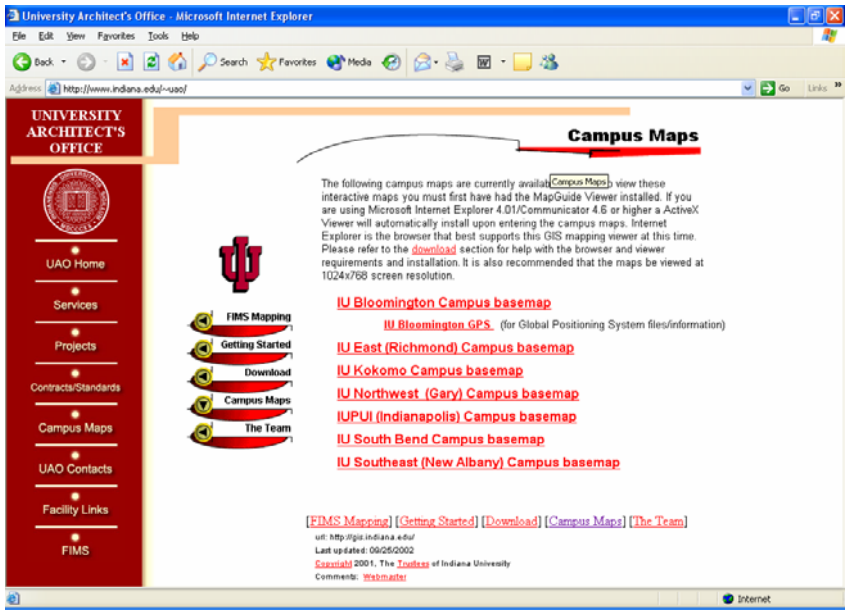
Formed Steering and Working Committees

Assessment of external entities: Universities, local jurisdictions

Assessment of UA units

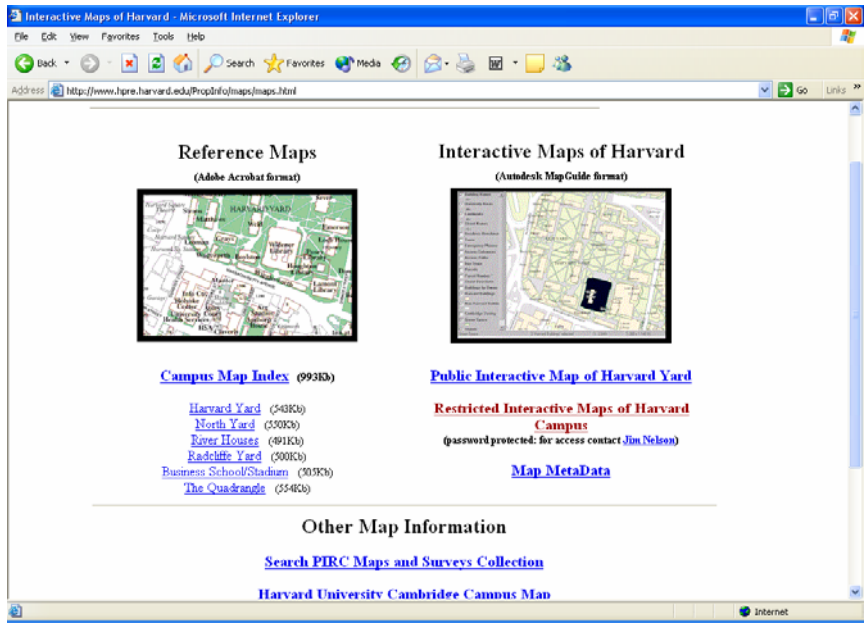
University of Virginia





EXTERNAL ASSESSMENT

Harvard



The University of Arizona

INTERNAL ASSESSMENT

Currently Implemented Systems / Data Development

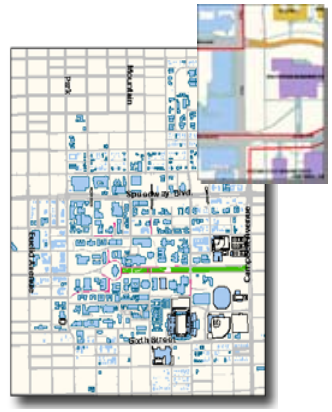
- Space Database
- On-line keyplan/data query
- CMS & Fire Alarms
- FM Automated Systems
- Risk Management Data
- 911 System
- Parking Management System
- Campus GIS and basemap
- Data Warehouse
- Etc.

Related Initiatives

- Lease Tracking System
- PTS GIS System
- Asset Management system for Telecommunication
- New student information system
- New financial information system

Ongoing Coordination

Ad Hoc Inter-departmental Collaborations



Risk Management

- Prototyping CAD-GIS conversion methods
- Blue light phone mapping
- Hydrant mapping

Facilities Design & Construction

- CAD Map Updates for Consultants
- Survey coordination/standards
- Map updates using “record drawings”
- Use of GIS basemap for routine mapping

Space Management

- Coordination of space data with flloorplans
- Tying floorplans to GIS basemap
- Use of updated CAD Map

Parking & Transportation Services

- Providing basemap in graphic format
- Potential collaboration on spatial data warehouse

CCIT

- Maintenance of web map interface
- Exploring options for “next version” of map

Preliminary Assessments

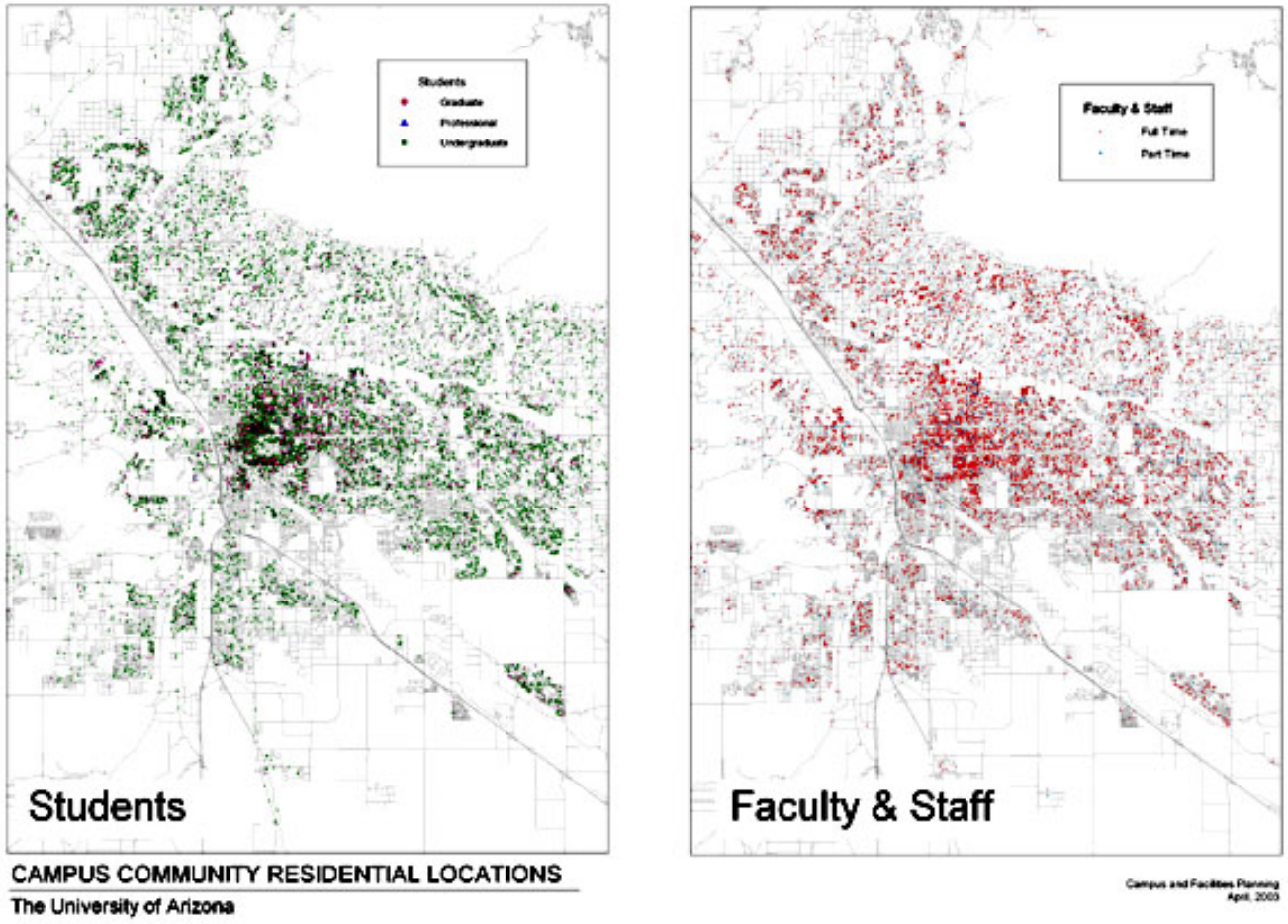
(Prior to Formal Initiative Launch)

- **Uses / Users**
- **Data Models**
- **Services Frameworks**
- **Organizational Models**
- **Application Concepts**
- **Evaluating UA**

Uses of Spatial Information

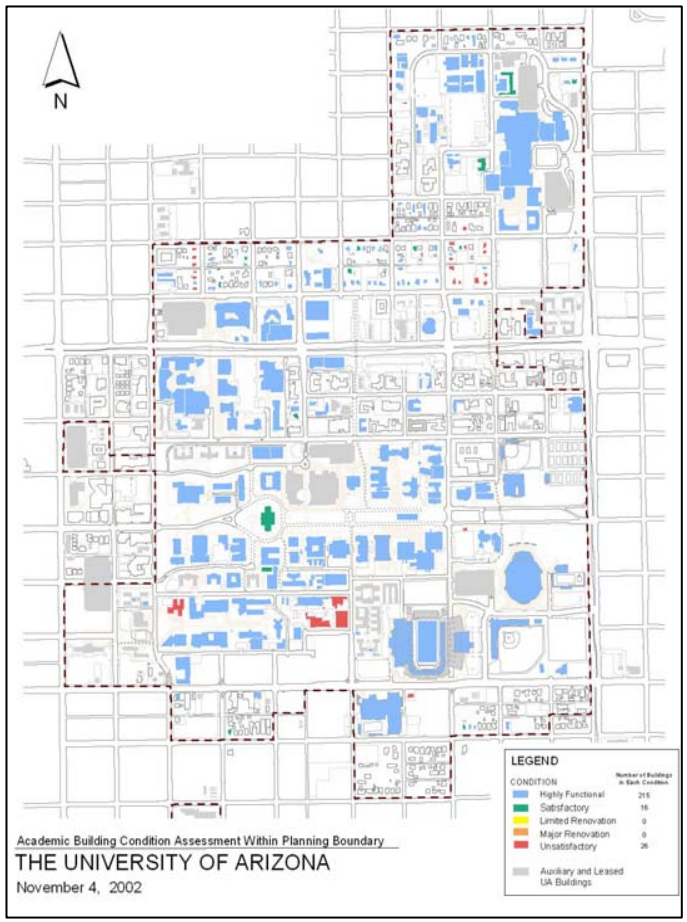
- Data Visualization and Spatial Analysis
- Decision Support / Physical Planning Studies
- Maps Conveying Technical Information
- Public Oriented Communication / Information
- Integrate Systems & On-line Info to Provide Better Customer Service
- Answer Questions
- Operate More Efficiently
- Archive and Access Records more Efficiently
- Basic Campus Maps
- Base for other map layers
- A Resource for Student Projects

Data Visualization and Spatial Analysis



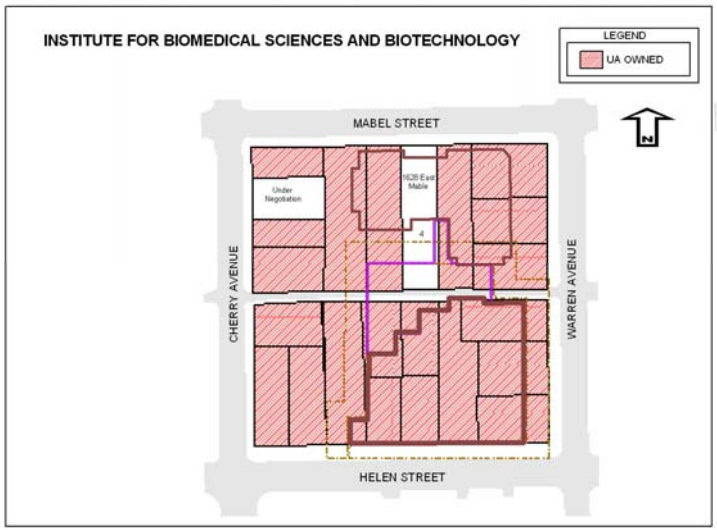
Evaluating Spatial Distribution of Campus Population (Residential)

Decision Support Studies



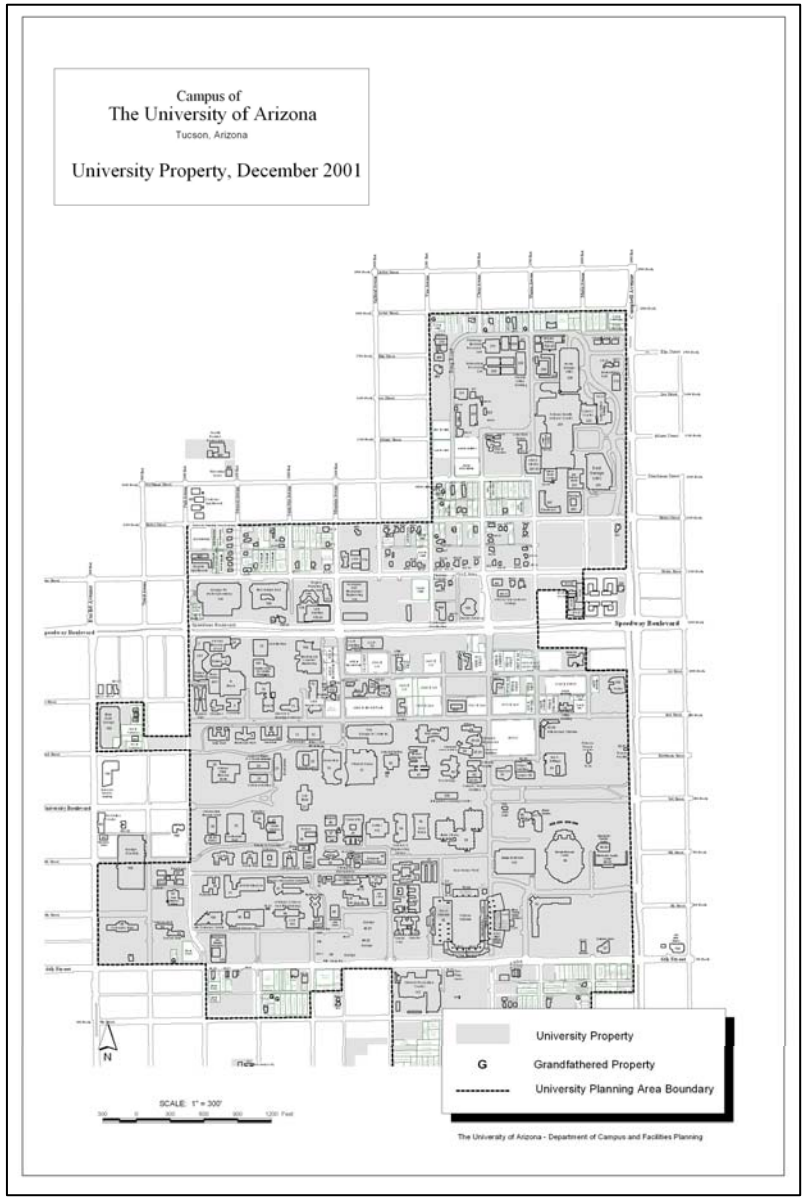
Building Condition Assessment

Future Development Pattern



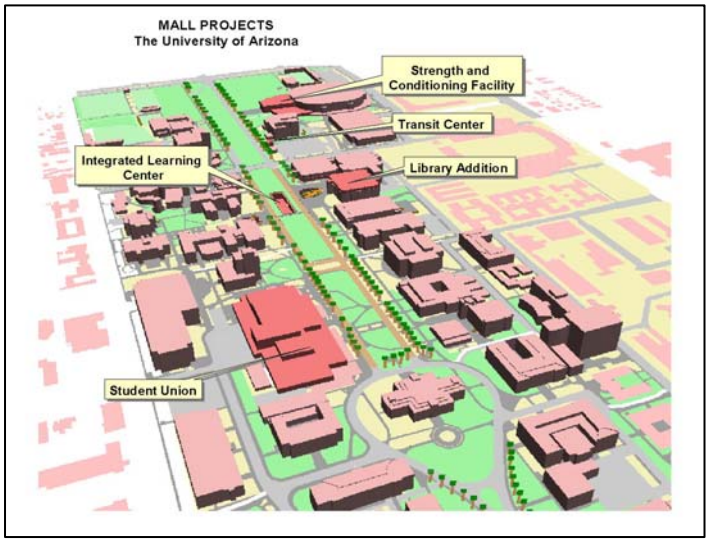
Relationship between
Property ownership and a building site

Maps Conveying Technical Information

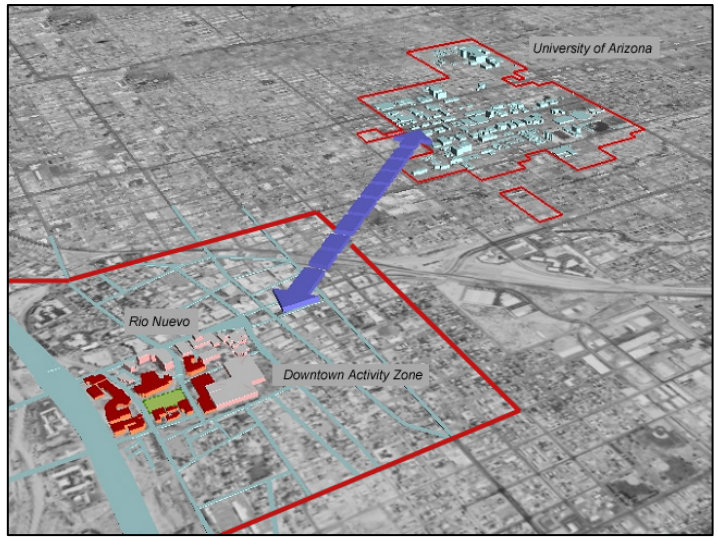


Property Ownership

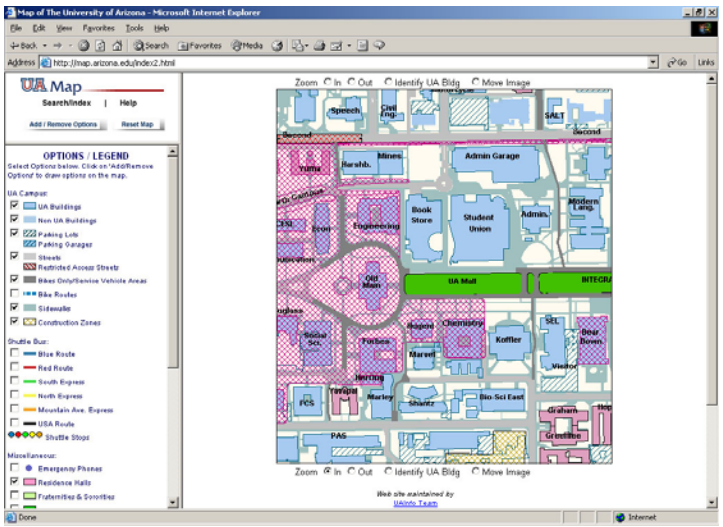
Public Oriented Communication / Information



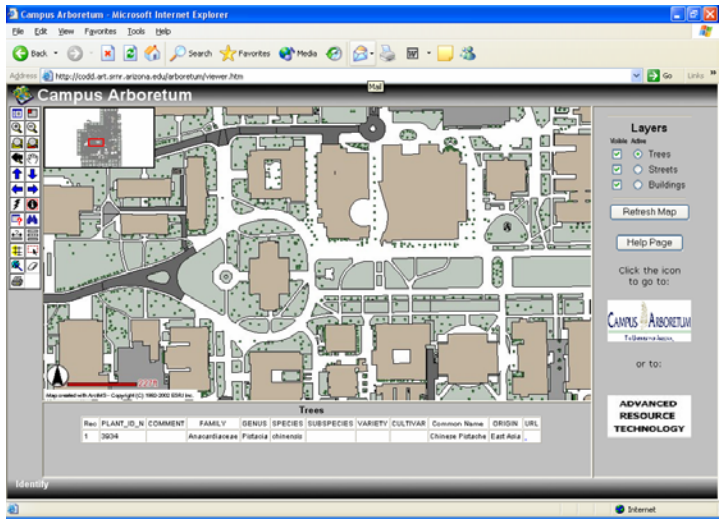
Main Mall Redevelopment



UA – Rio Nuevo Proximity



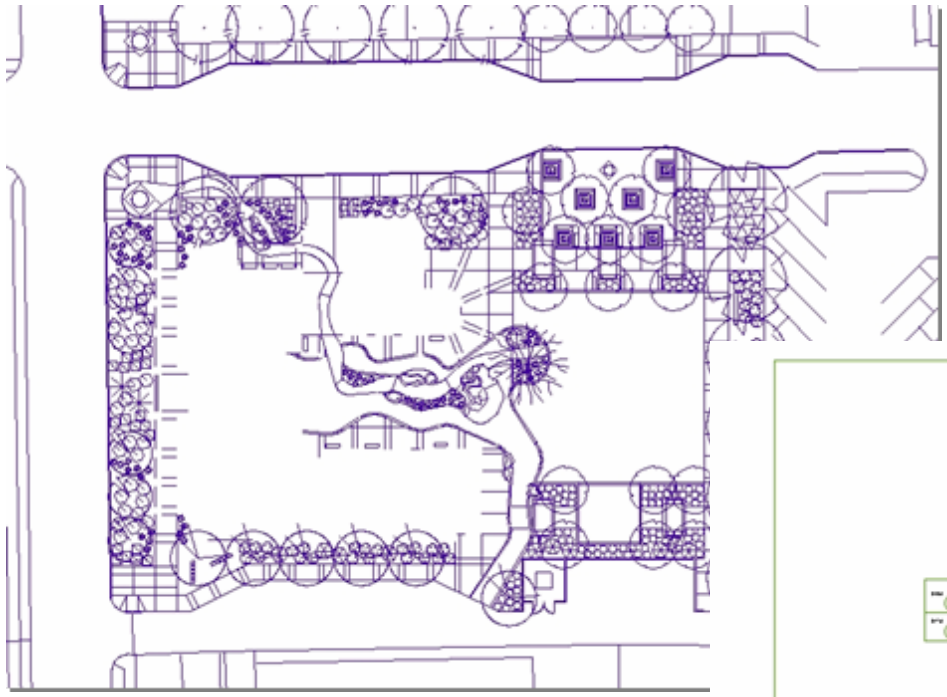
UA Online Web Map



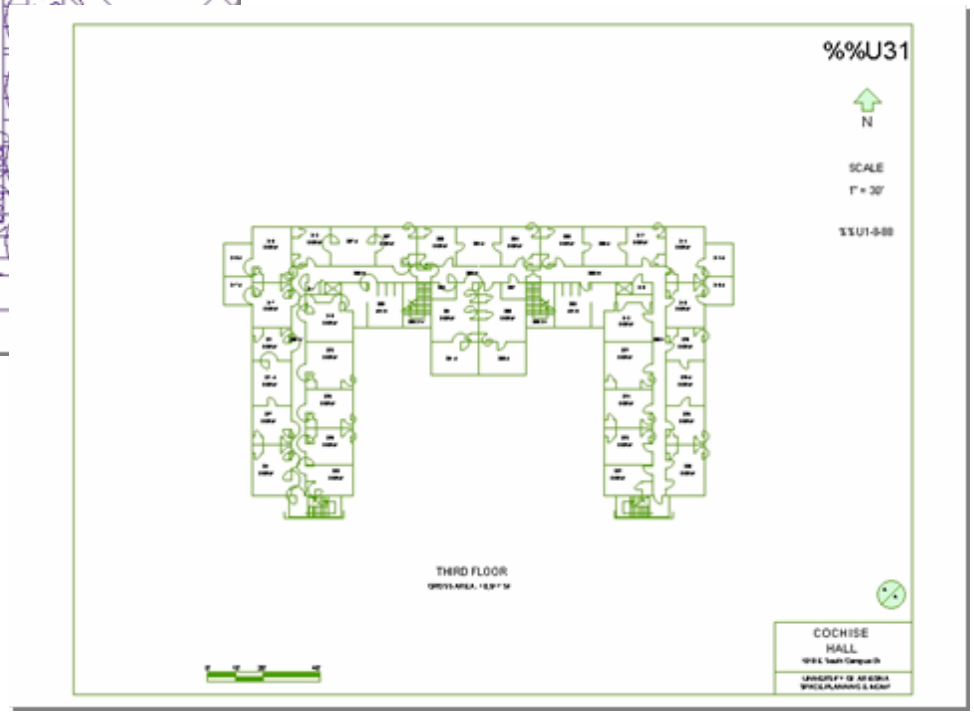
Campus Vegetation Interactive Map

Archive & Access Information More Efficiently

Protect valuable archives & provide means for easier access to records

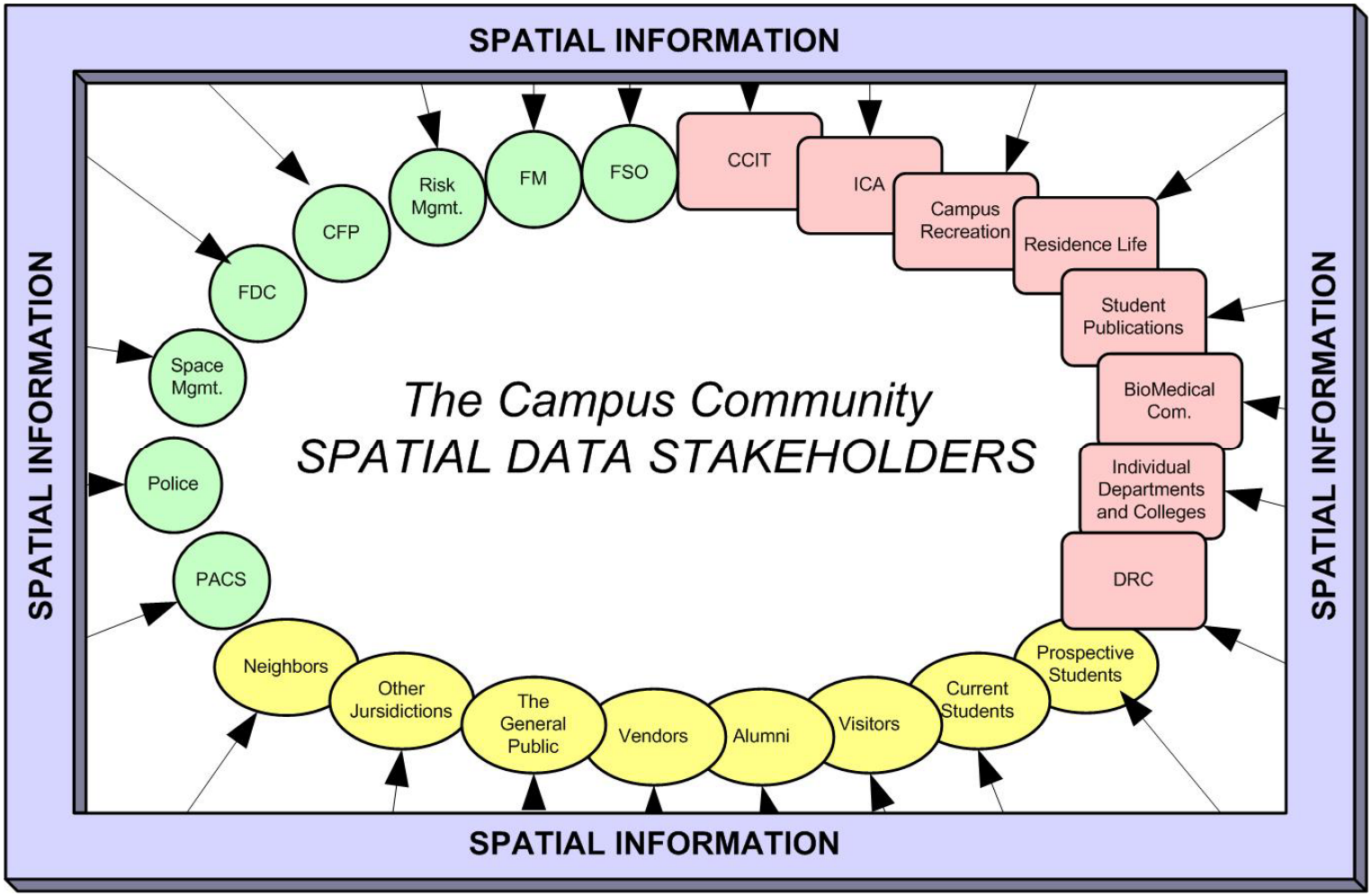


CAD record drawing for LSB landscape



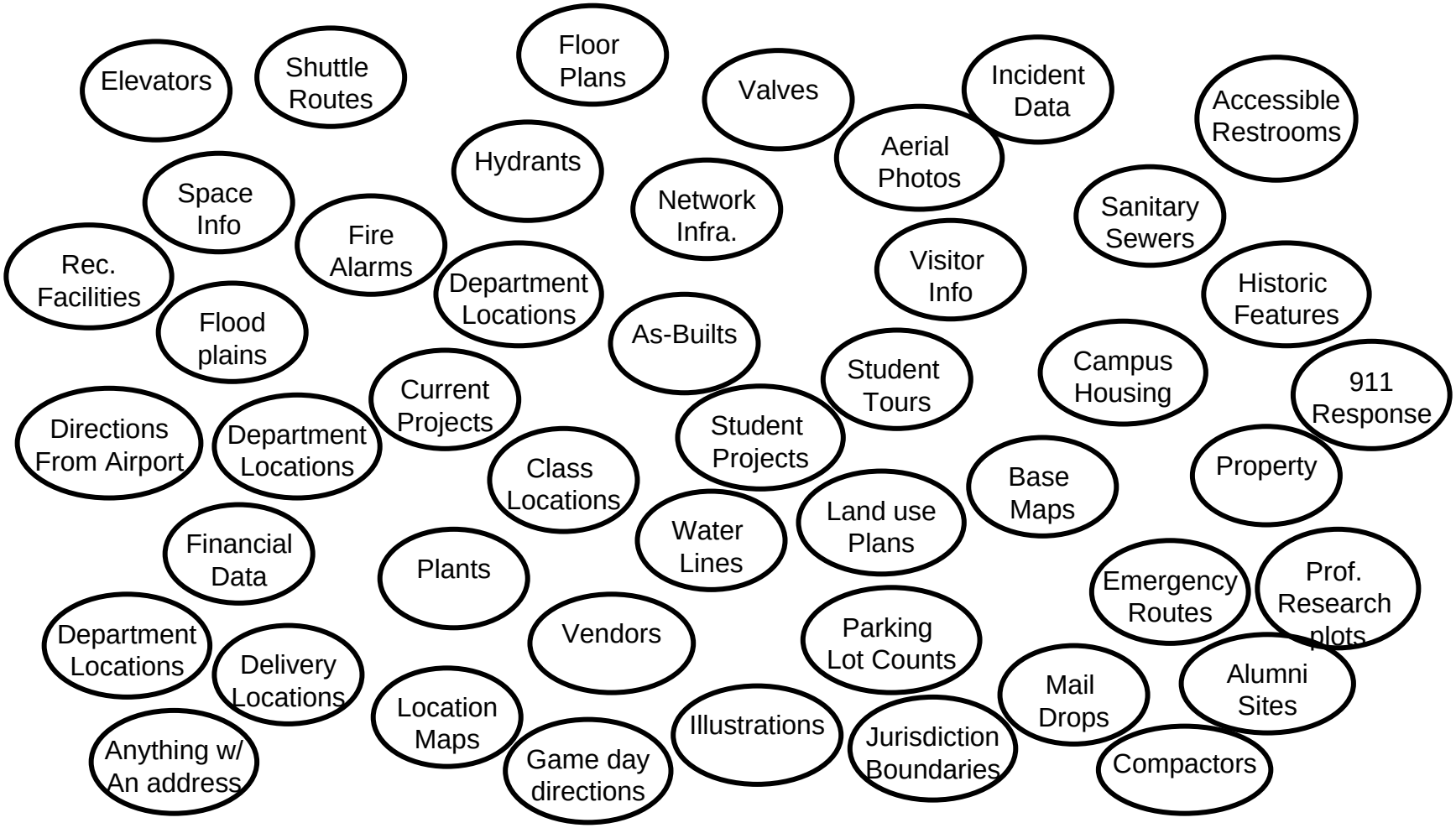
CAD Keyplan for Cochise

Many UA Users / Creators of Spatial Information



Extensive Spatial Data Exists Related to These Campus Stakeholders

How can it all be organized so as to be useful?



General Spatial Data Types

CAD Drawings
Asbuilts
Floorplans
Remodel Designs

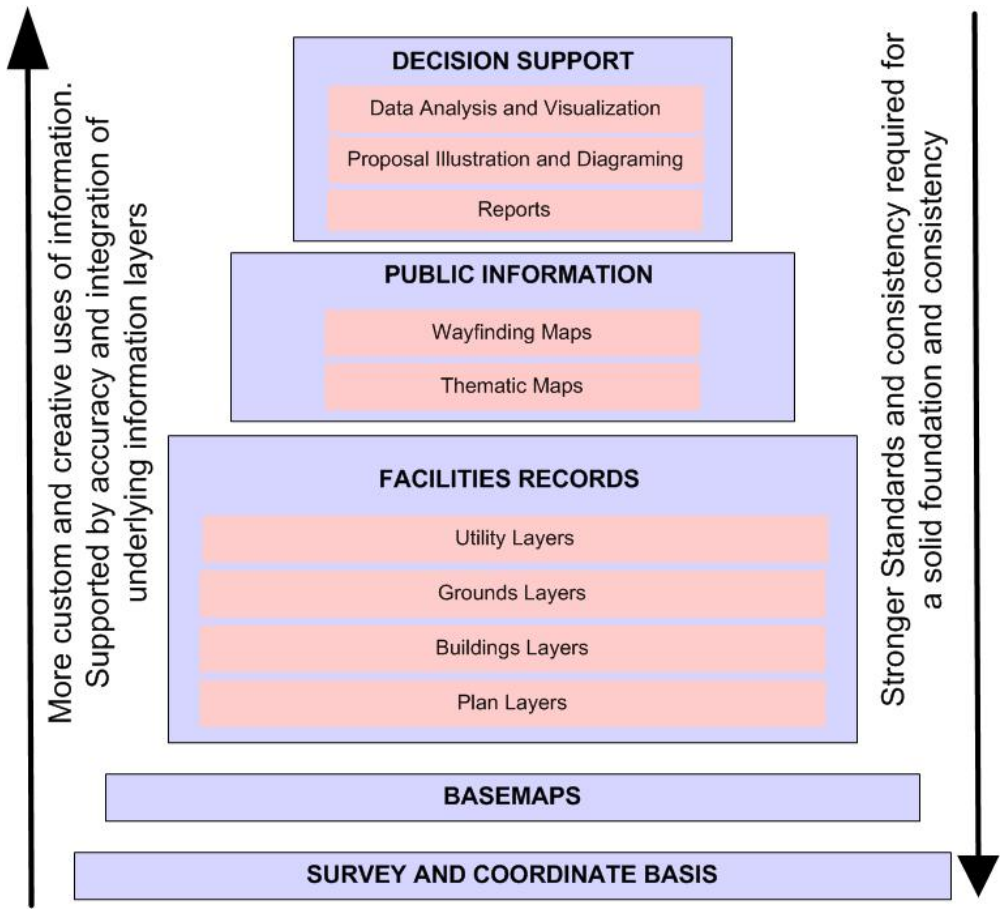
Graphic diagrams / Images

Tabular database files with location identifiers

Photographic Images
Aerials
Webcams
Etc.

Geographic Information System "intelligent map" layers

A Data Model for Organizing Diverse but Interrelated Spatial Data



Potential Spatial Data Services Framework

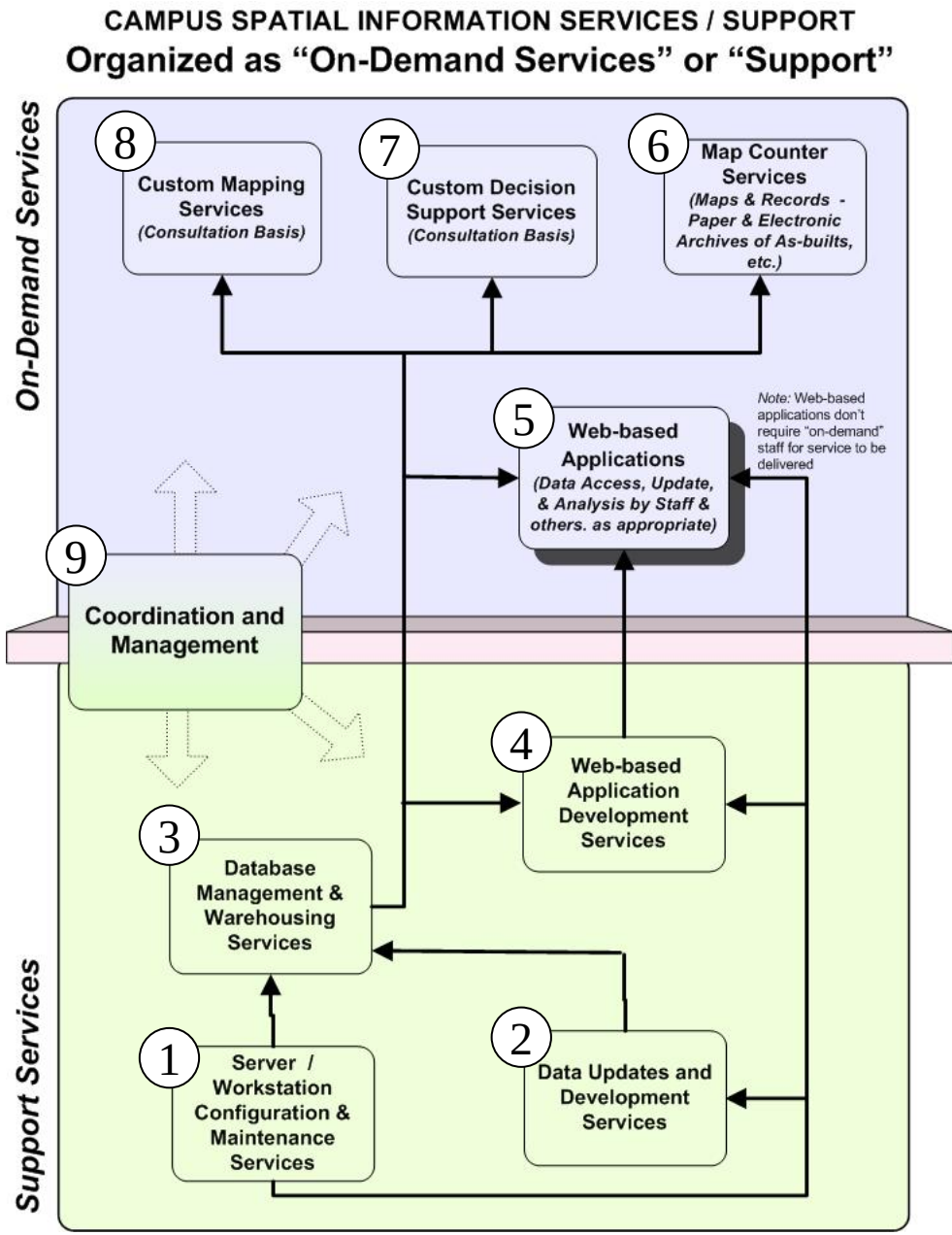
For

***On-Demand* Services**

(end user oriented)

And

***Support* Services**



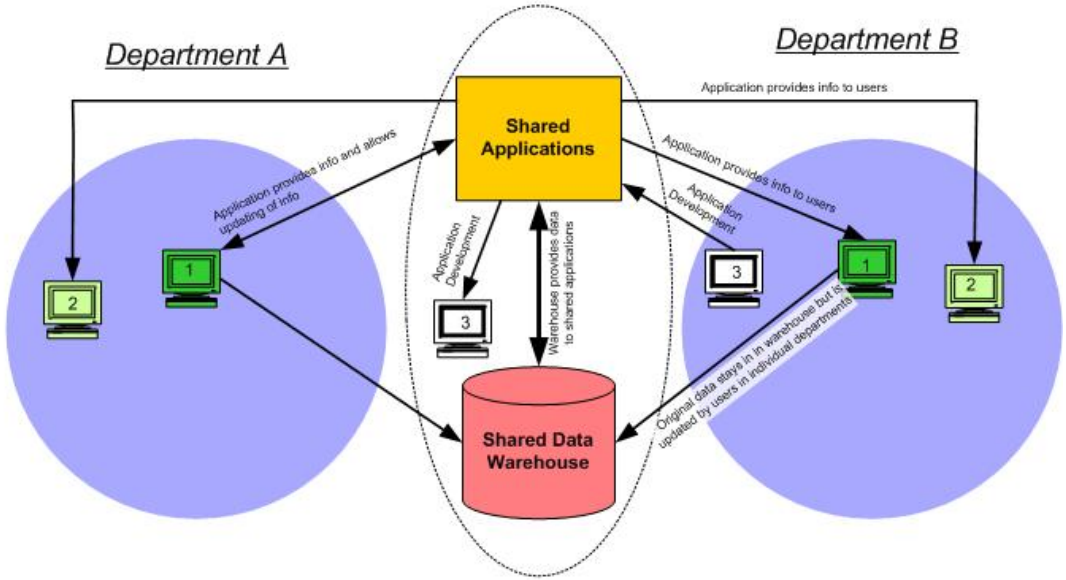
Information Technology Options

for Organizing a Spatial Data System

TECHNICAL OPTIONS FOR SYSTEM INTEGRATION (Page 3 - Continued)

"Enterprise Information System": All data is stored in a shared data warehouse, with access and update controlled by privileges given to various departments. This data is used by shared applications, which are the main points of access to the data for most University employees

OPTION 5



Notes:

This option involves keeping all shared data in the warehouse. One copy is stored for multiple uses: editing, downloading, serving to applications, etc.

Internal departmental applications / data may still exist, but with this model, all shared information would be maintained / accessed as a central resource.

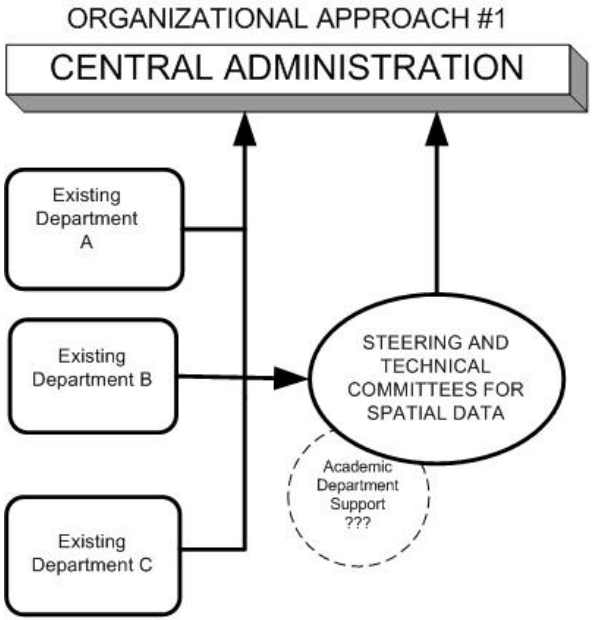
Data is updated either by data maintainers who access the warehouse directly, or by other authorized users who access the data through the application interface. The "shared application" may actually be a series of interconnected applications for various purposes and with various levels of permission.

Agencies / campuses which have now or are planning such systems for some functions include: UNC Chapel Hill, Vanderbilt, Stanford, Tucson Water, and several UA Ag Extension functions.

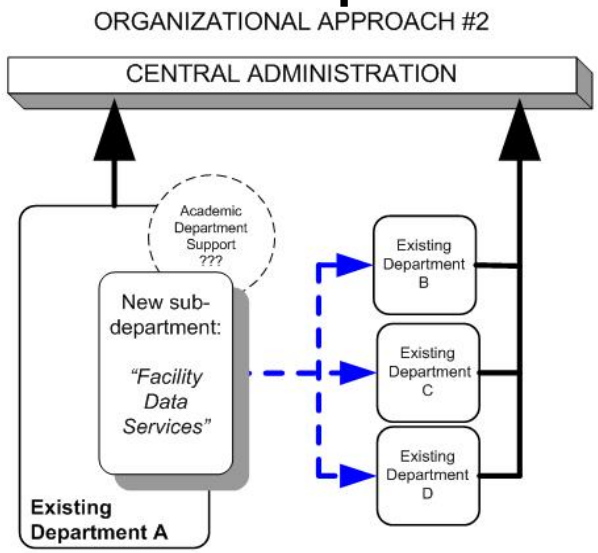
Administrative Models

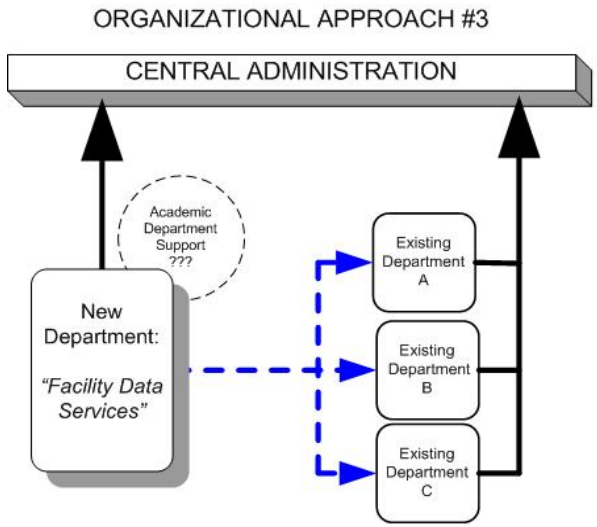
for Organizing Campus Mapping / Spatial Data Services

Coordinating Committee



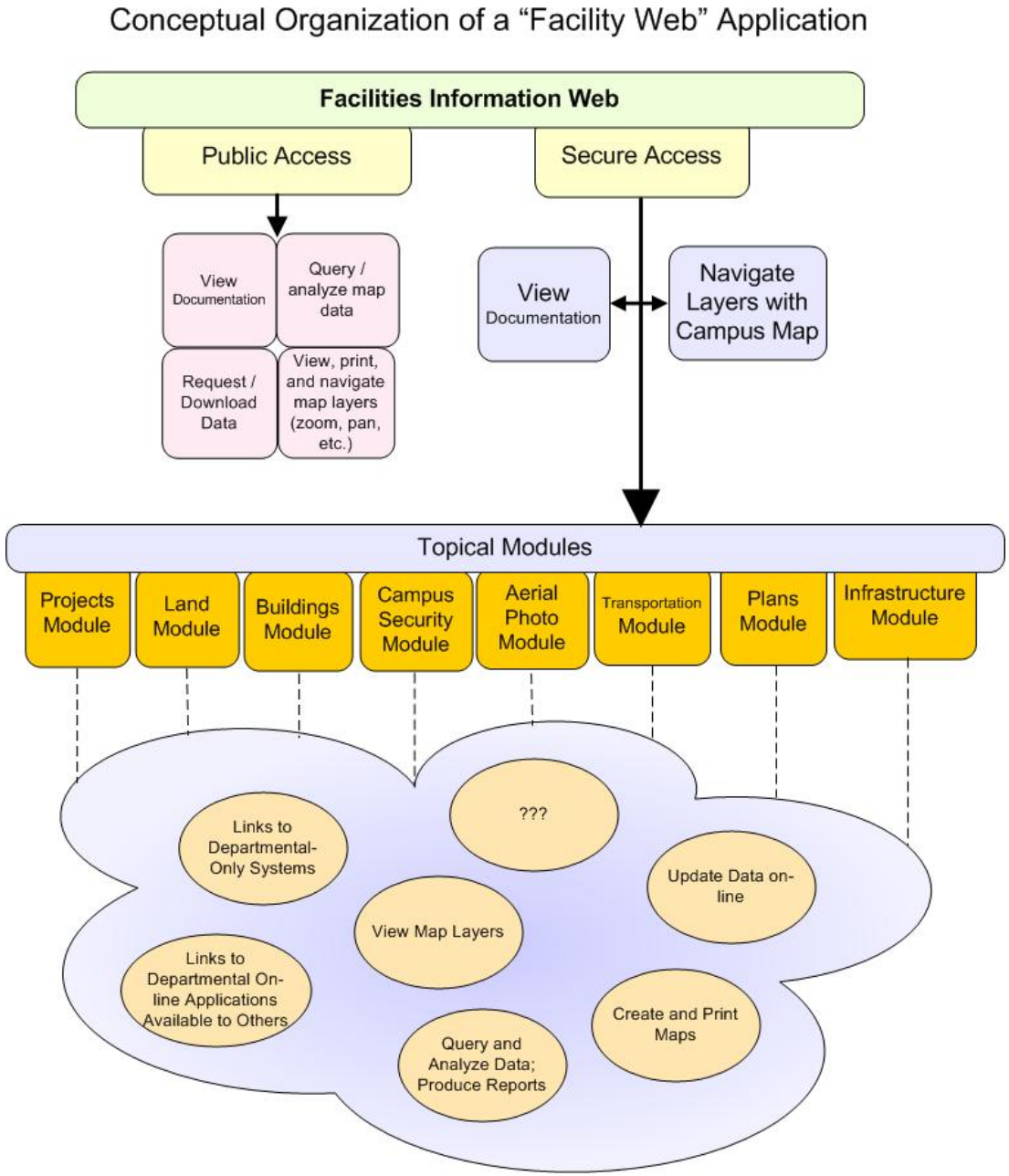
New Sub-department





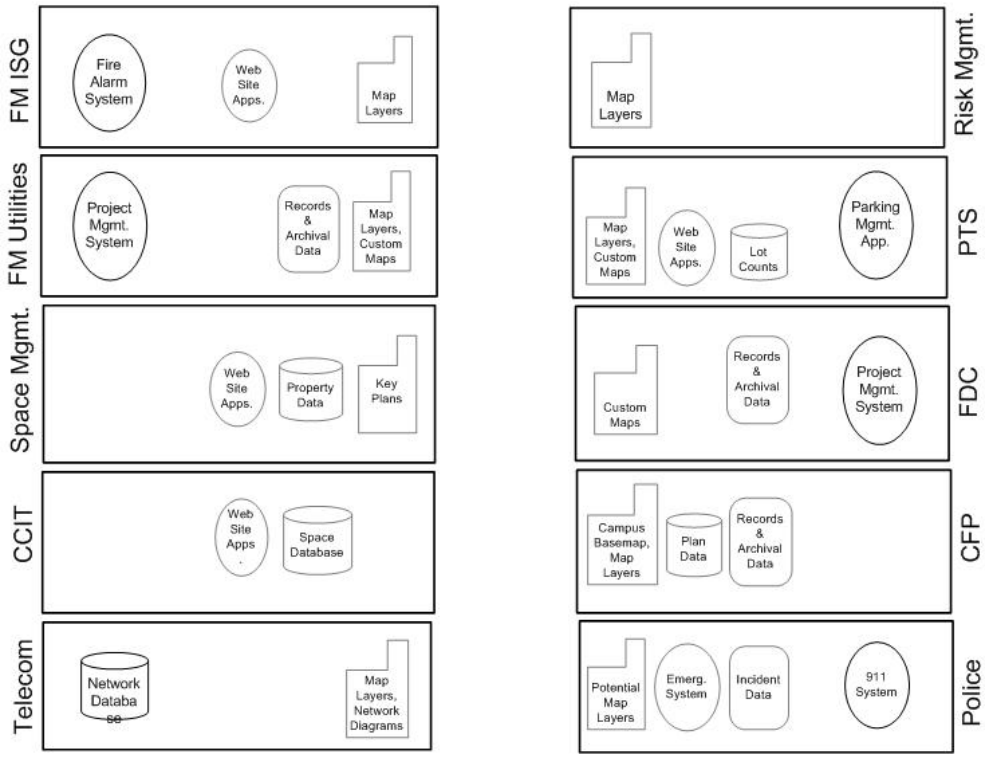
New Department

"Facilities Web" Application Concept



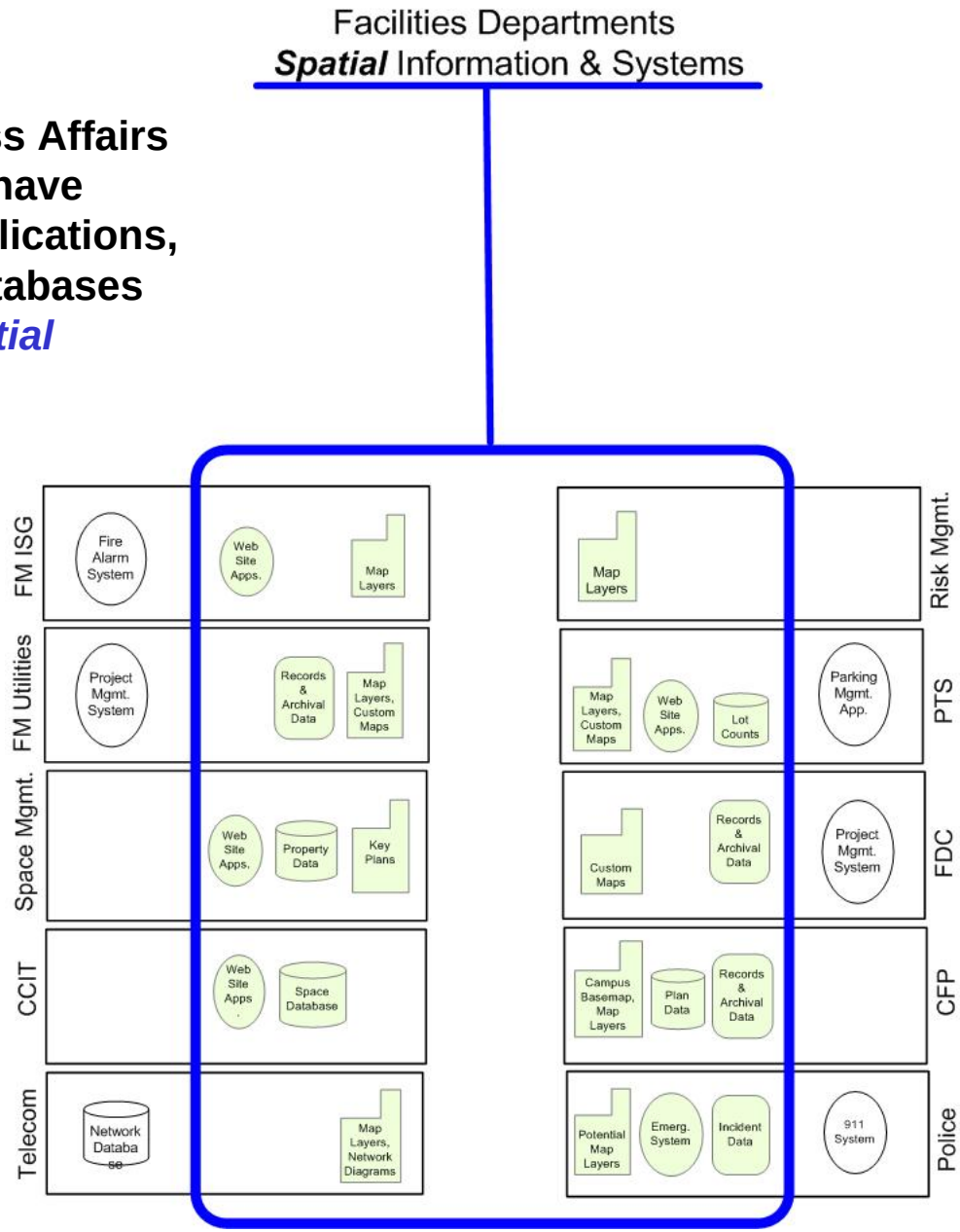
Facilities Departments
Information / Systems

Business Affairs Departments have computer applications, maps, and databases related to a wide range of topics.



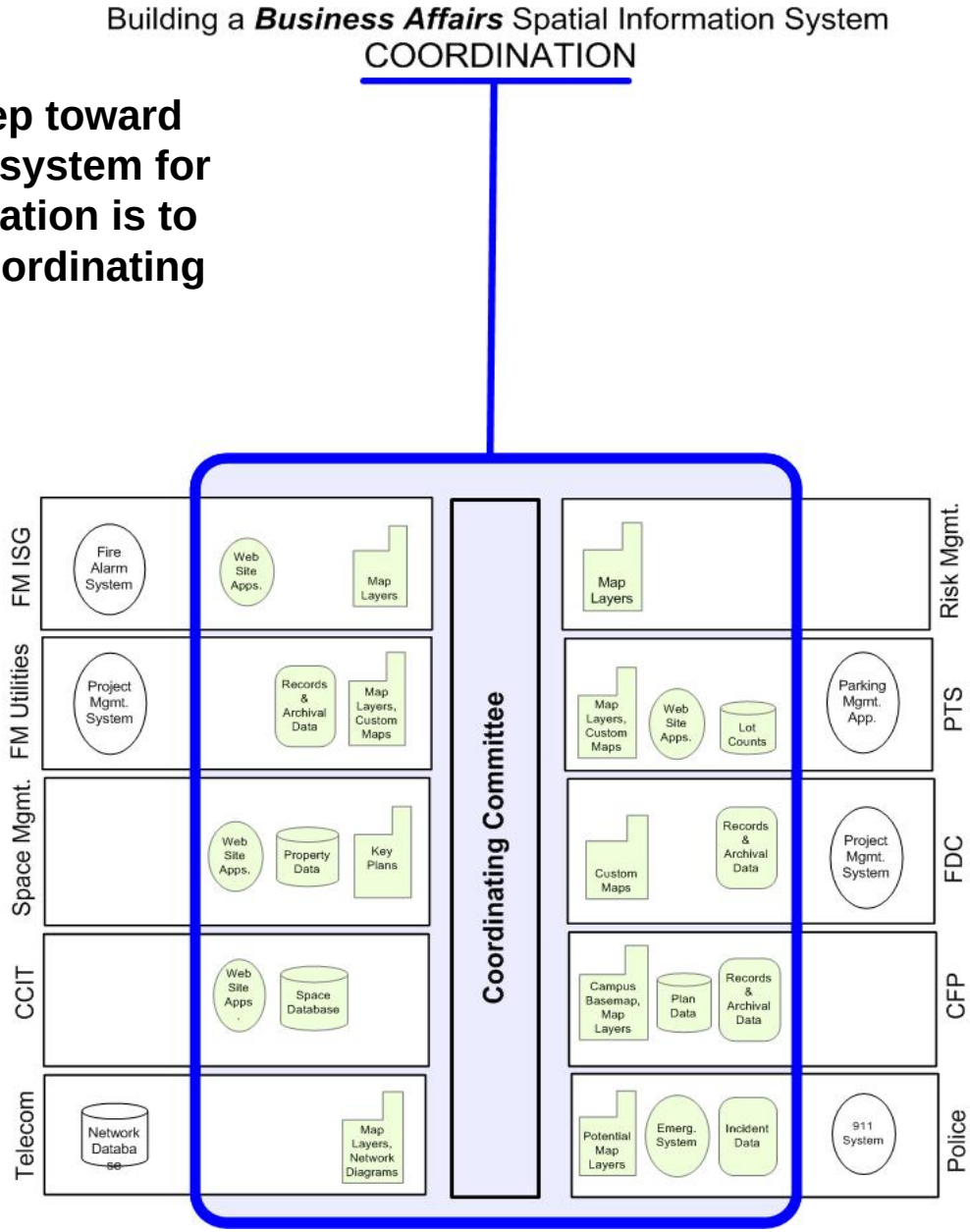
Applying Concepts to The UA

Many Business Affairs Departments have computer applications, maps, and databases related to *spatial information*

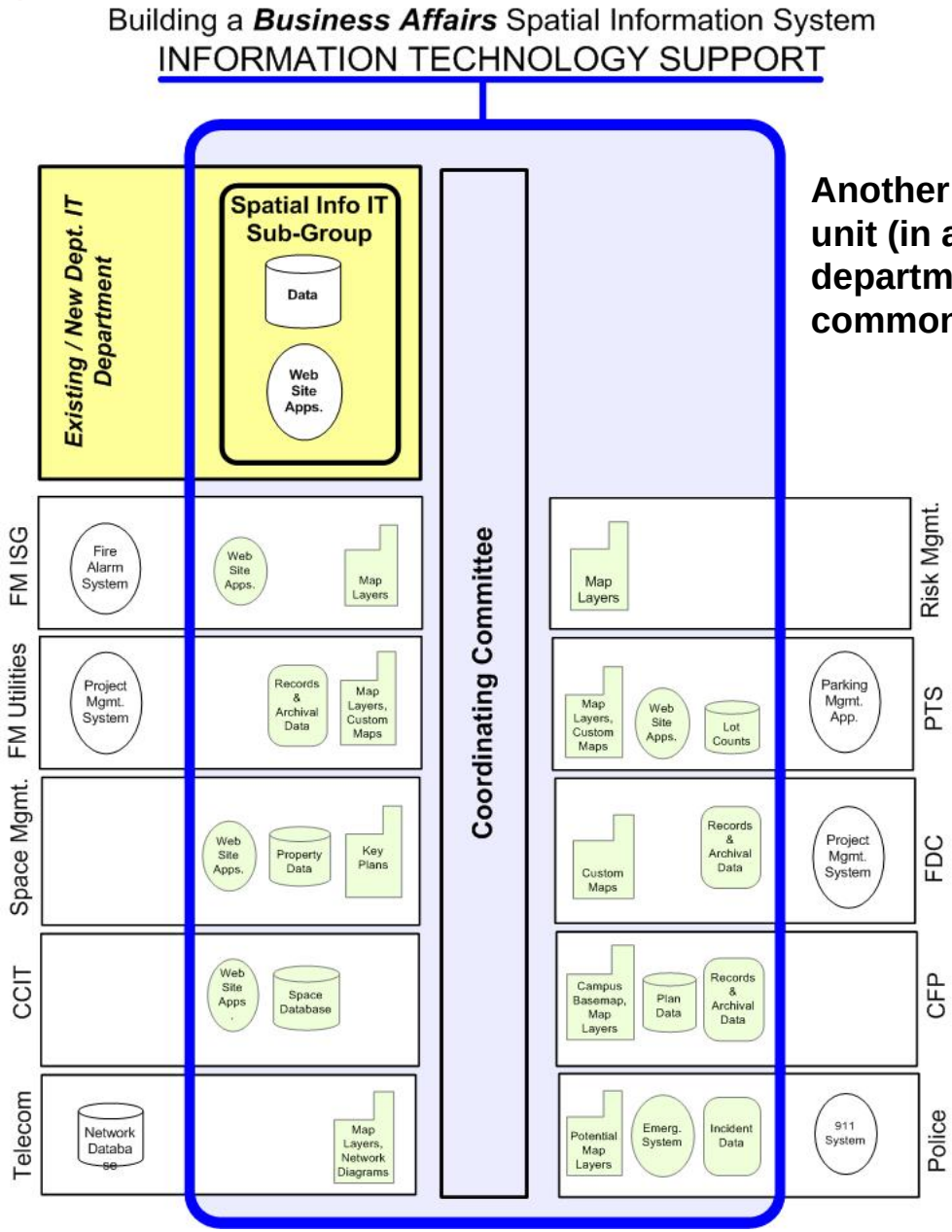


Applying Concepts to The UA

A possible step toward an enterprise system for spatial information is to establish a coordinating committee

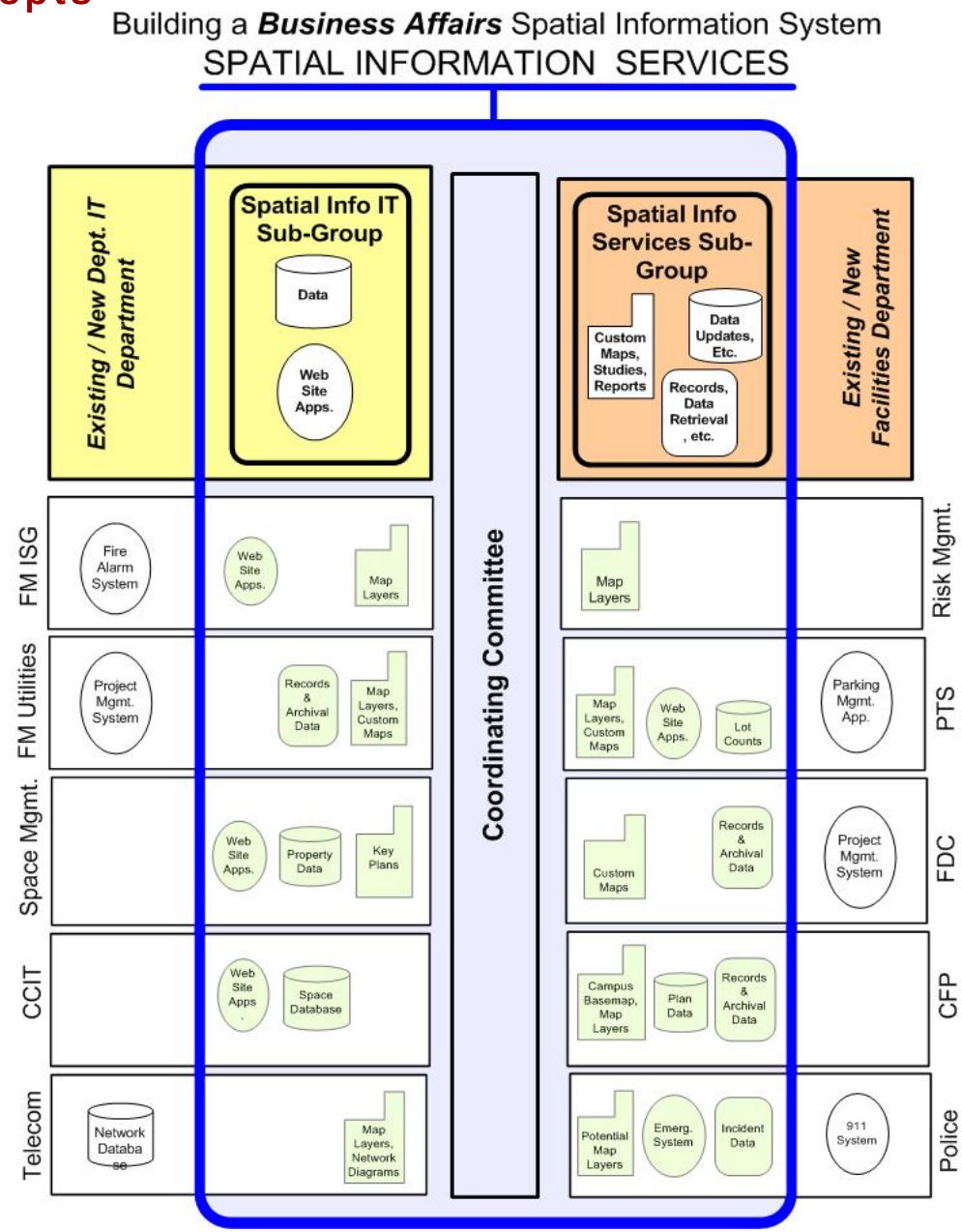


Applying Concepts to The UA



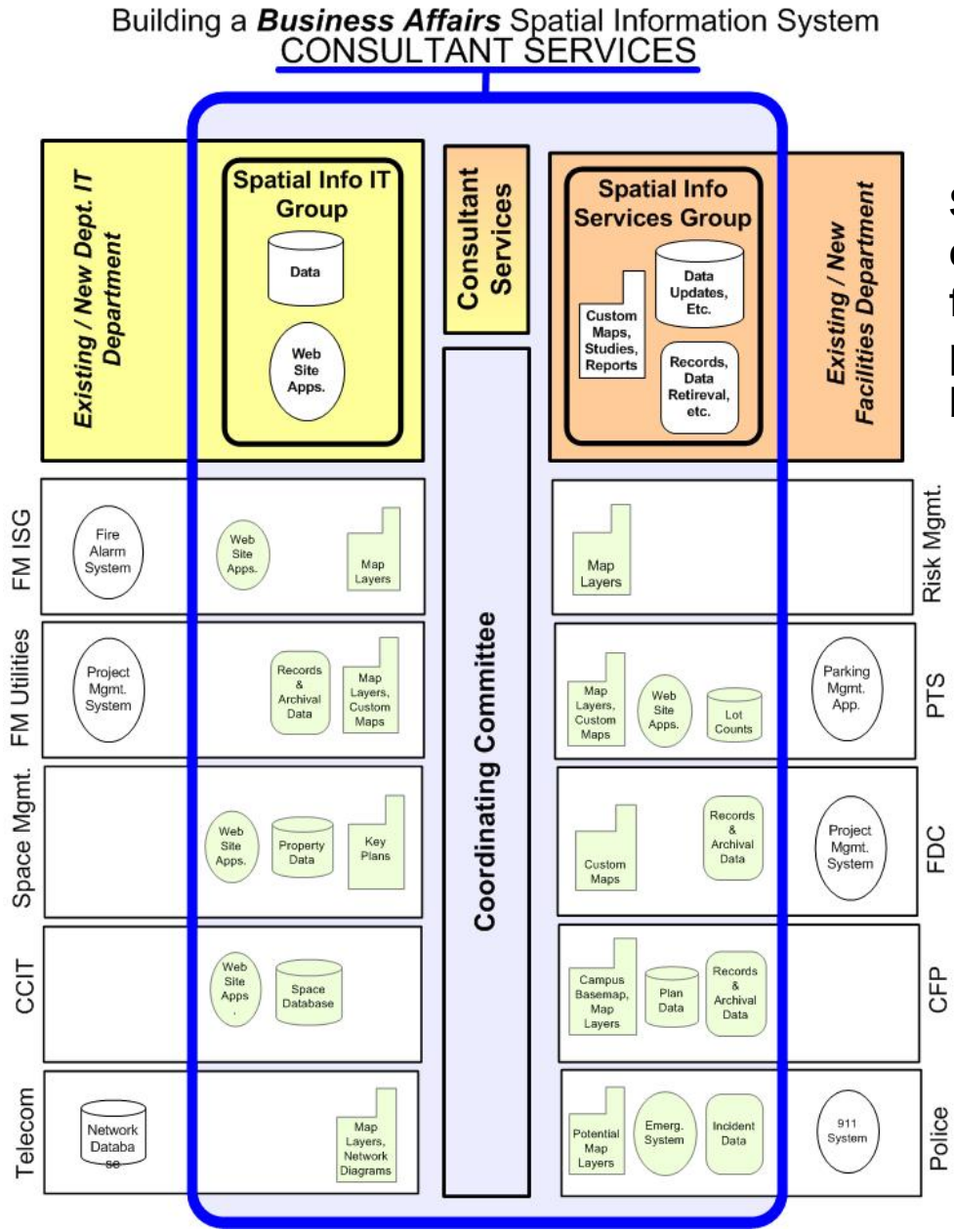
Another step is creating a new unit (in an existing or new department) to manage common IT elements which allow departmental systems and info to work together. Primary functions include database warehousing and application development

Applying Concepts to The UA



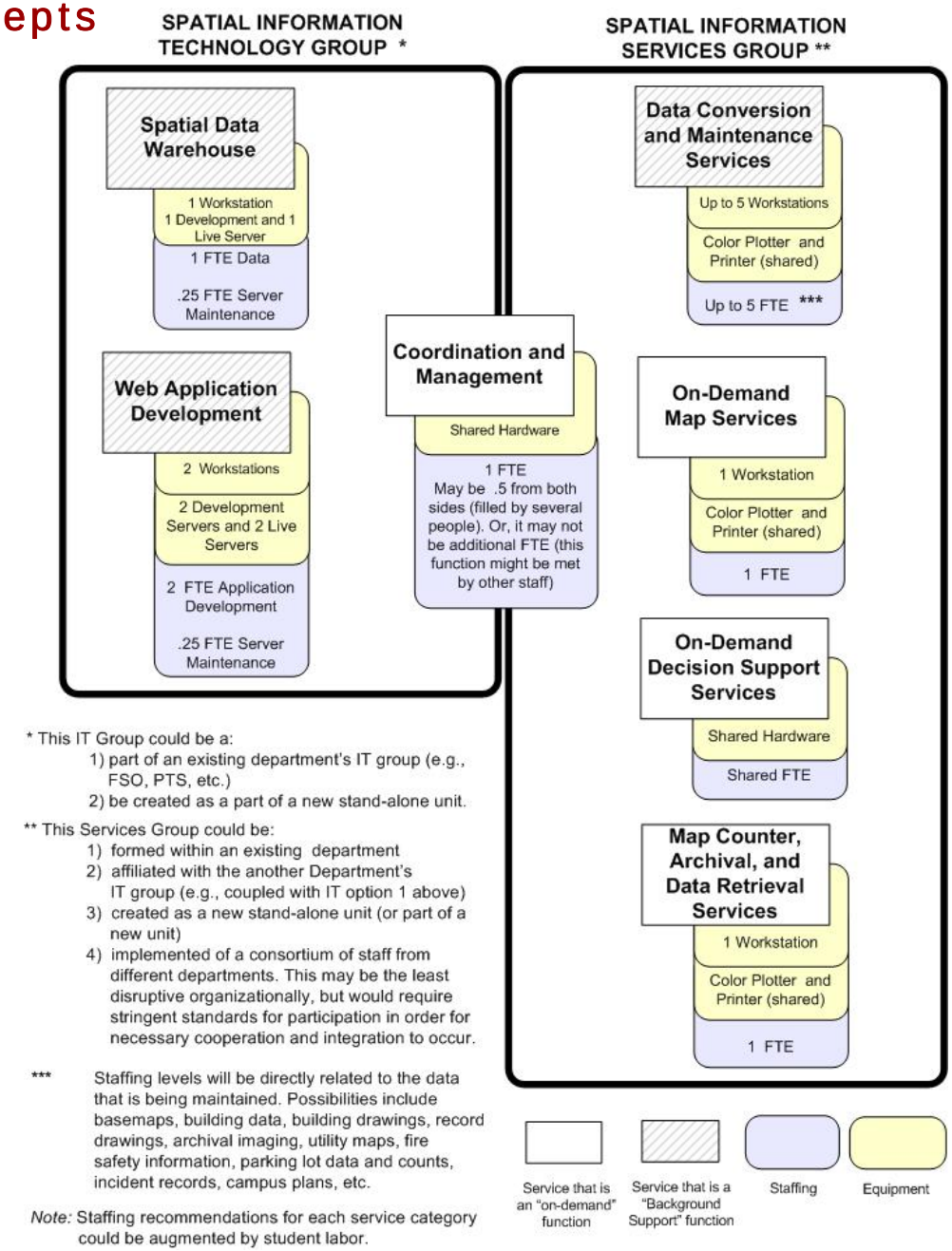
A final step is creating a new unit (in an existing or new department) to manage and use spatial info in a consolidated fashion. Functions could include on-demand mapping & reporting, data updates & development, archiving and data retrieval. Functions currently being done in departments could be moved all or in part here, or left where they are.

Applying Concepts to The UA



Some of the common functions could potentially be met by consultants

Applying Concepts to The UA

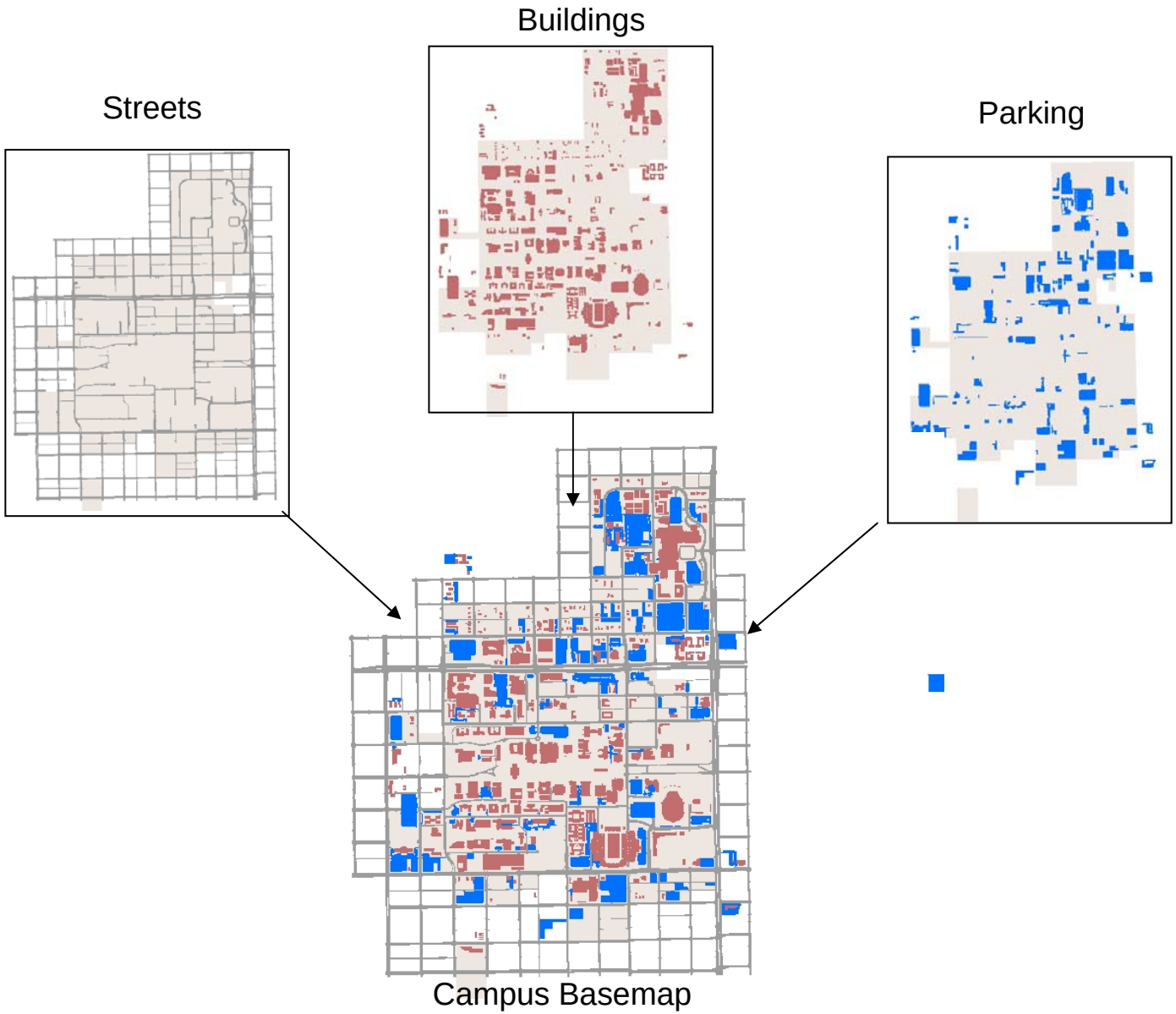


Preliminary review of resource implications of creating an IT Support Group and a Spatial Info Services Group

TECHNICAL MAPPING ISSUES

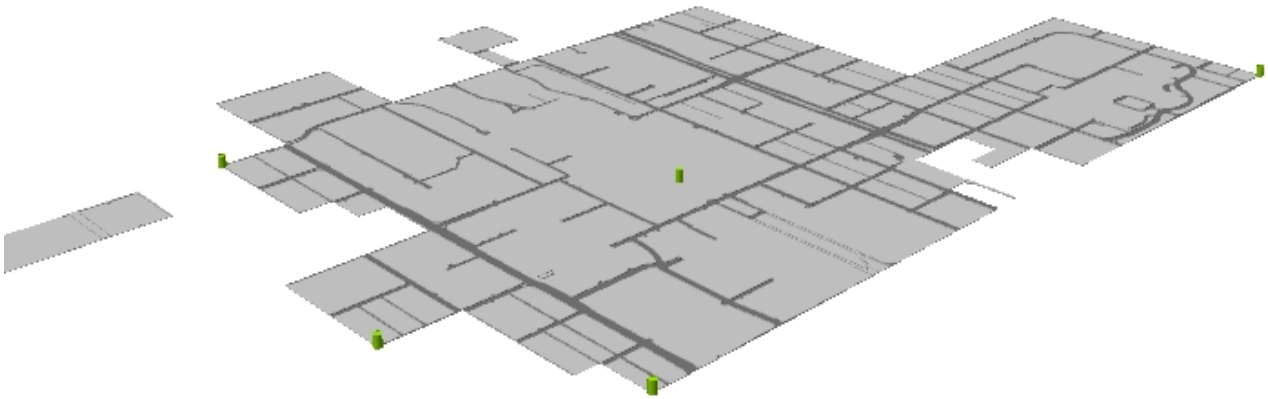
Communicating Key Ideas

Map Layers Overlay to Create a Basemap



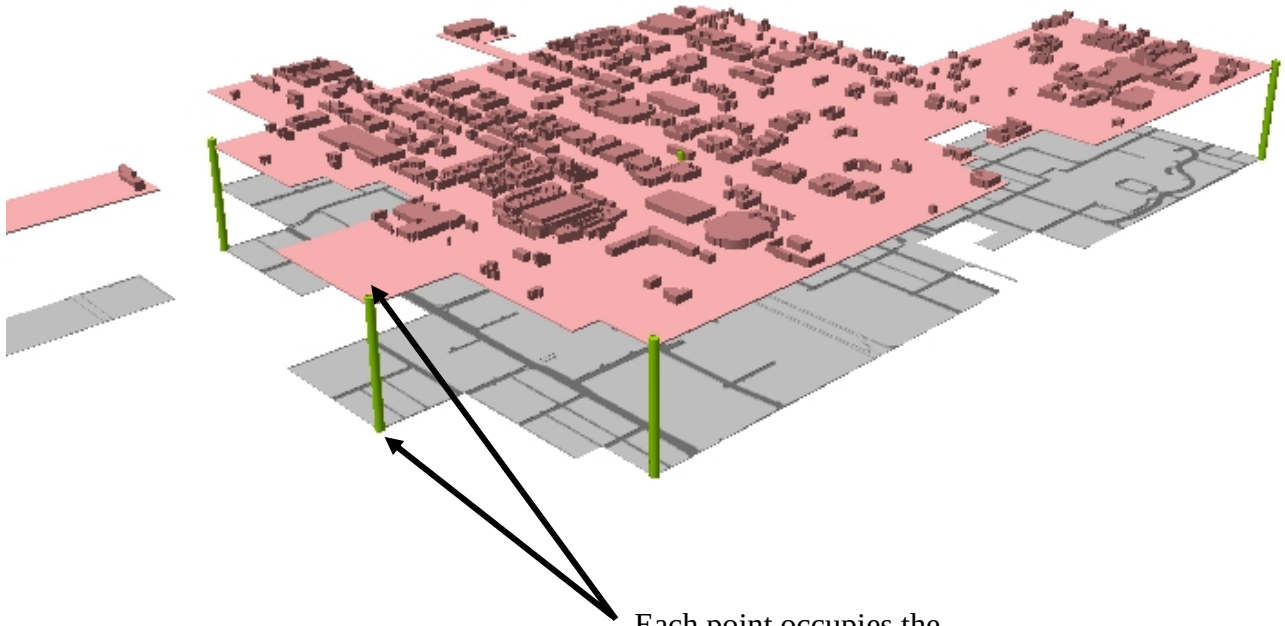
Basemaps, and other map features, are constructed as a series of layers

Streets "layer"



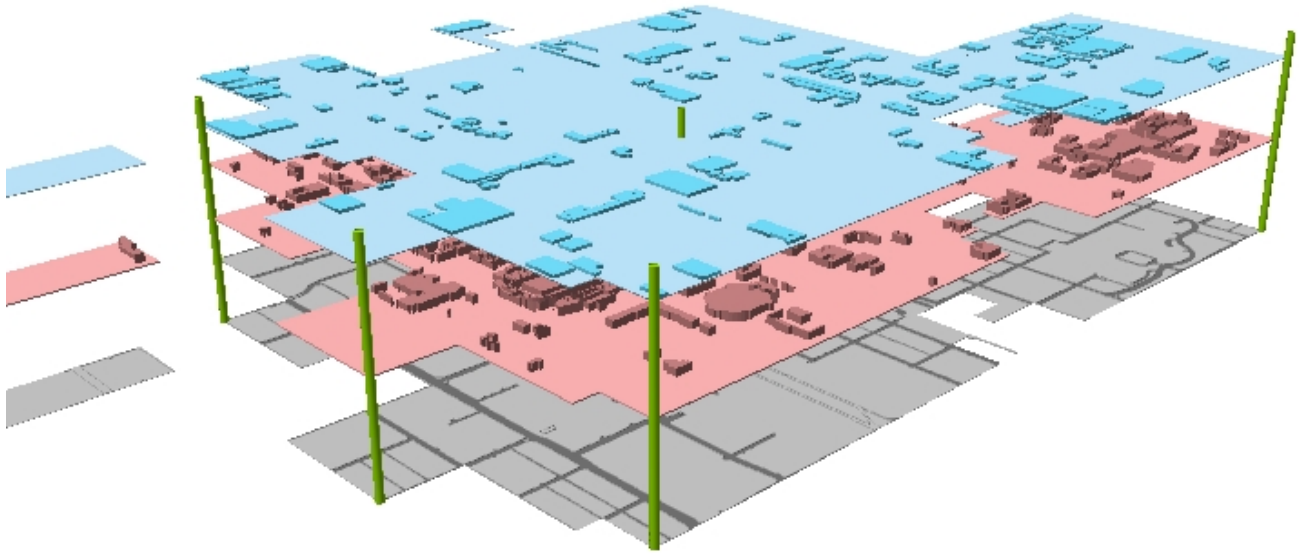
Proper Registration of Overlapping Layers Relies on Common Coordinates

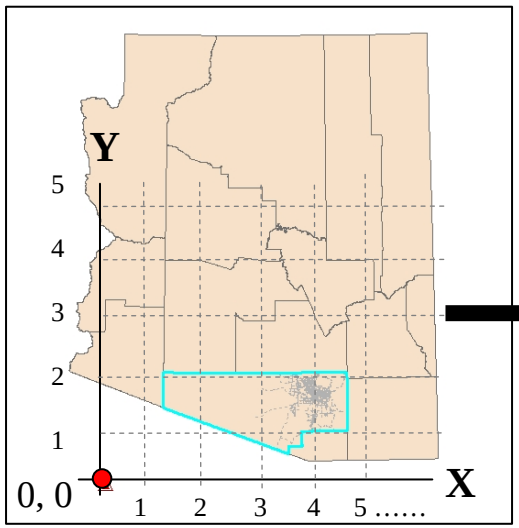
The red buildings layer was mapped in the same coordinate system as the streets layer to insure proper registration



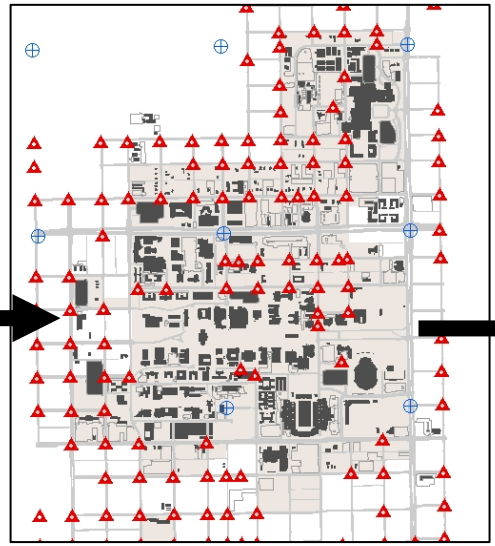
An unlimited number of layers may be built upon an appropriately constructed basemap

The blue parking lots are added as another layer.

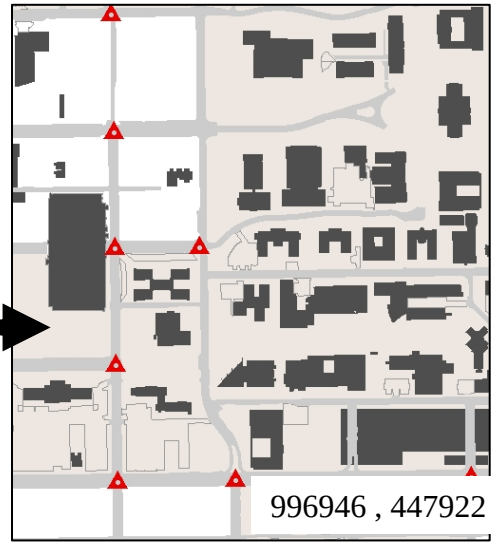




Grid defined by common points of origin / benchmarks (Arizona State Plane Coordinate System)



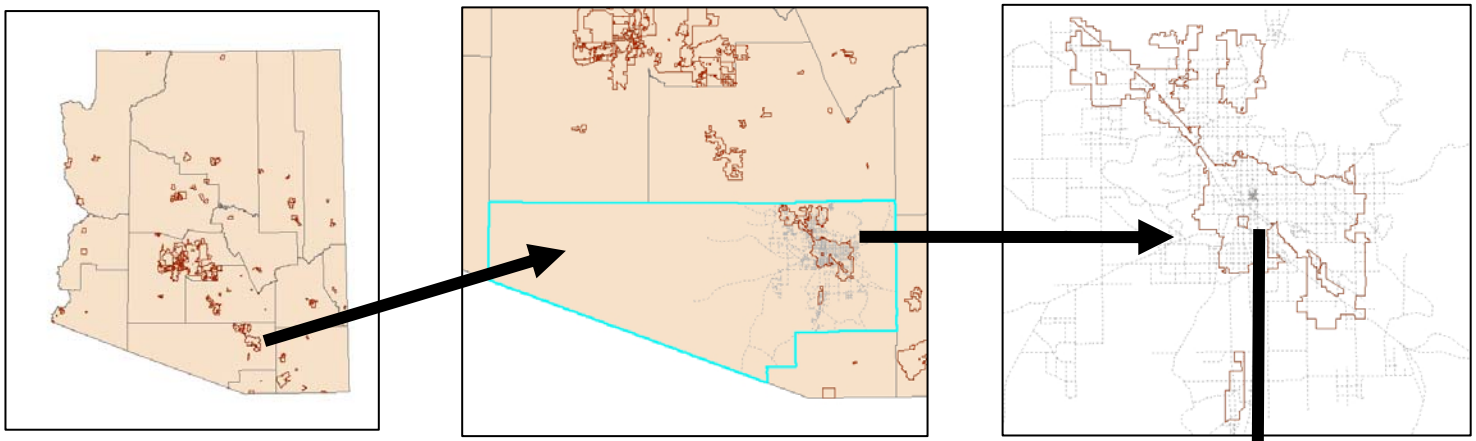
UA Survey Control Points, all in reference to common benchmarks.



Coordinate values of monument at Park & 6th

The *Arizona State Plane Coordinate System* Provides a Framework for the UA's System of Survey Control Points

Integrating Data Across Geographic Scales.....



Is enabled by a common coordinate system .....

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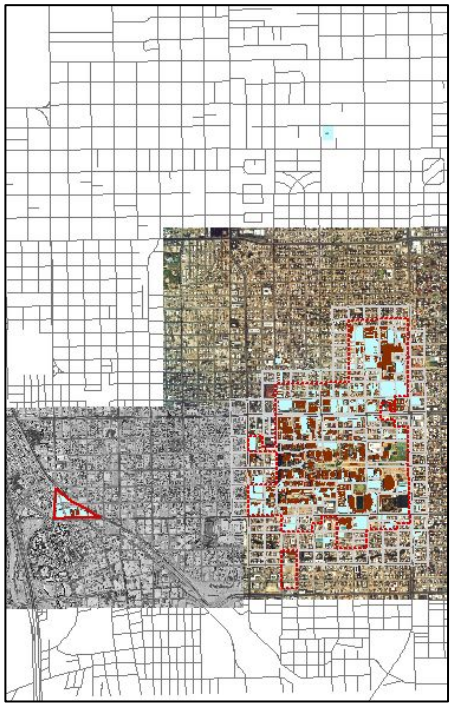
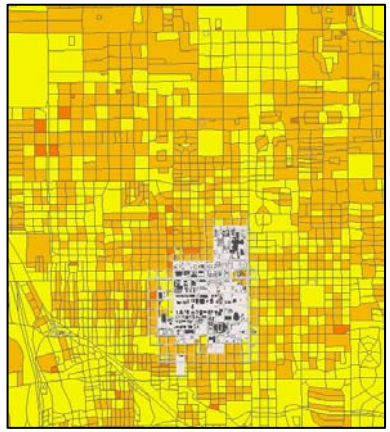
Standardized Coordinate System *Enables Data Sharing*

The State Plane Coordinate System is the "Standard" for local agencies. Collaborating with / sharing data with different jurisdictions is enabled by a common coordinate system

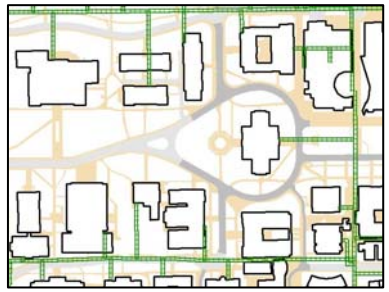


Data from four jurisdictions overlaid



Census data overlaid With campus basemap

***Different layers* may be reused, shared, and combined by different staff, allowing them to work more effectively and make better decisions**



Tunnels

Building Entrances

Sampling of Spatial Layers: A to Z

- Accessible Entrances
- Accident Locations
- Attractions on Campus
- Bike routes
- Building Expenditures
- Construction Zones
- Contours
- Crime Patterns
- Deferred Maintenance
- Delivery Routes
- Emergency Phones
- Housing Distribution
- Hydrants
- Land Use
- Manholes
- Service Districts
- Shuttle Routes
- Utility Tunnels
- Park&Ride Lots
- Project Locations
- Property Ownership
- Regional UA Sites
- Vegetation
- Zoning

…. and much more

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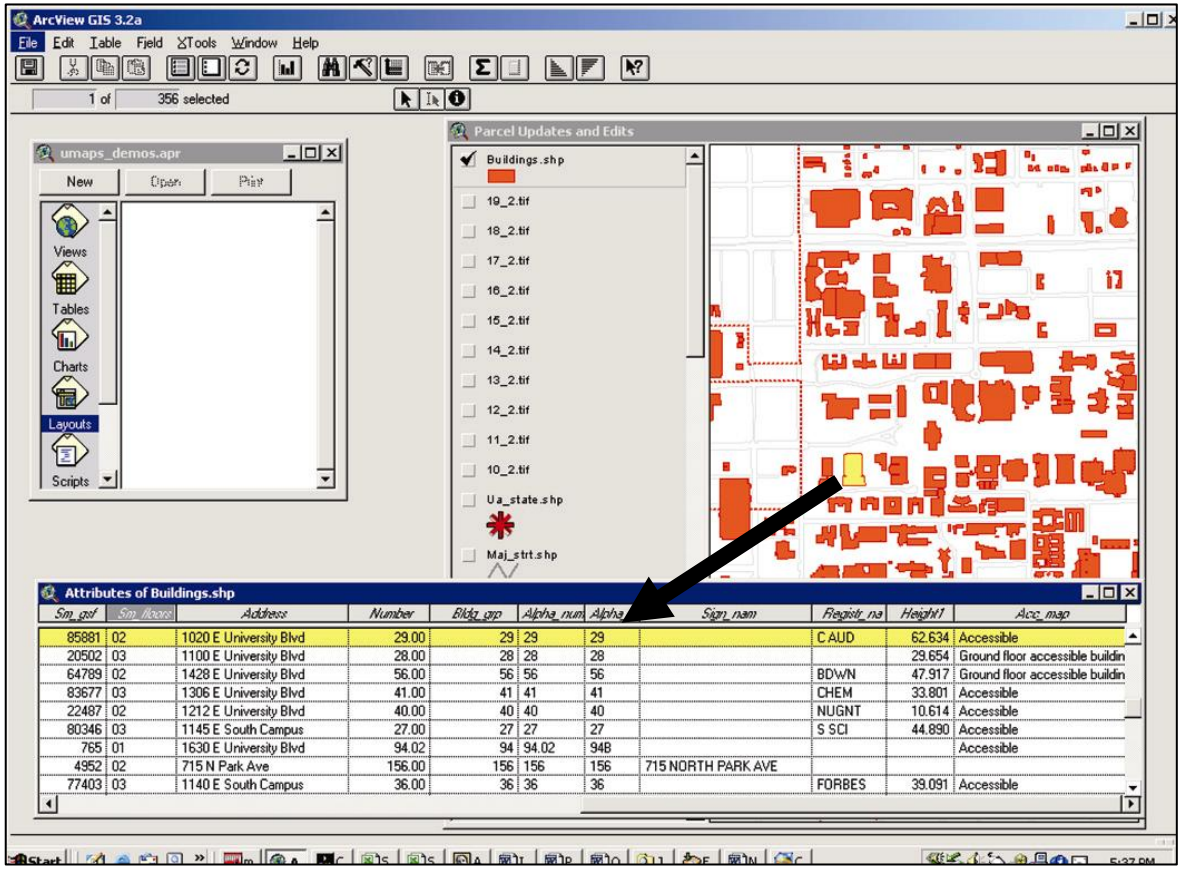
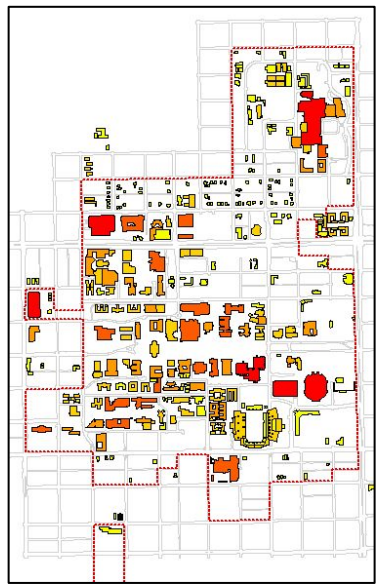
Intelligent GIS Maps: linking tabular data to graphics



Each graphic object on the map (e.g., a building) relates to a record in a tabular database.



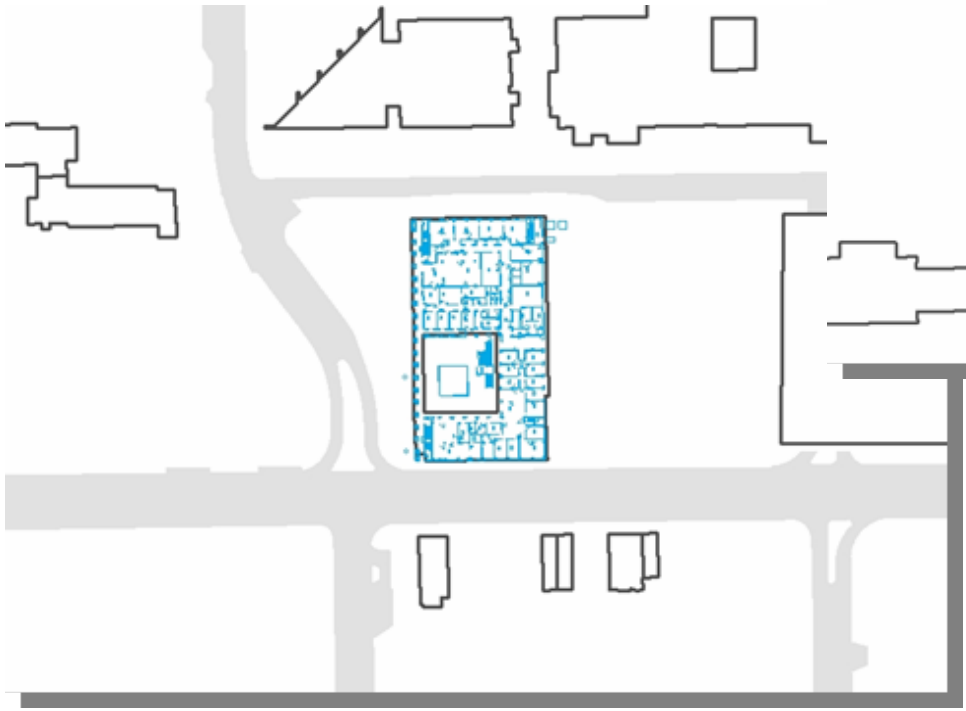
Building size symbolized by color (using Gross Square Feet data From Space Database)

- **Classify map graphics according to database values (i.e., thematic maps)**
- **Efficiently store and access tables of attributes about physical features**
- **Link maps to institutional tabular data**
- **Automate map labeling**
- **Query tabular data**

Integrating

COMPUTER AIDED DESIGN AND DRAFTING (CADD)

Record drawings for ENRB registered with campus basemap. Some conversion necessary (not originally in state plane coordinates)



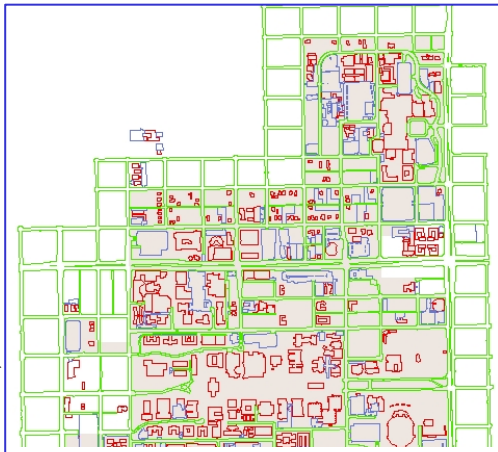
Park Student Union survey registered with campus basemap. No translation needed (began with campus benchmarks/coordinates)

Maintenance of Multiple Data Formats

Original basemap layers maintained in GIS format, then converted periodically to other formats

Basemap in Geographic Information System (GIS) format (e.g., ArcGIS)

Data Conversion



Basemap in Computer Aided Design & Drafting (CADD) format (e.g. AutoCad)

Basemap in Graphics format (e.g., Illustrator/Corel)

- Avoid Redundant Efforts
- Increase Accuracy
- Allow staff to use software of choice (but with consistent basemap)

Technical Procedures

Implementation in Progress

X-Ref procedures for CAD users

Basemap Standardization

Registering existing plans/drawings to basemap

Surveyor standards re: conversion from/to State Plane

Conversion of as-built/record drawings into State Plane

Etc.