THE UNIVERSITY OF ARIZONA

The University of Arizona Enterprise GIS

CFTA 2016

Facilities Geospatial Technologies Showcase

EGIS

PLANNING, DESIGN & CONSTRUCTION

UA Overview

Main Campus: Tucson, Arizona

Founded: 1885

Number of Buildings: 227

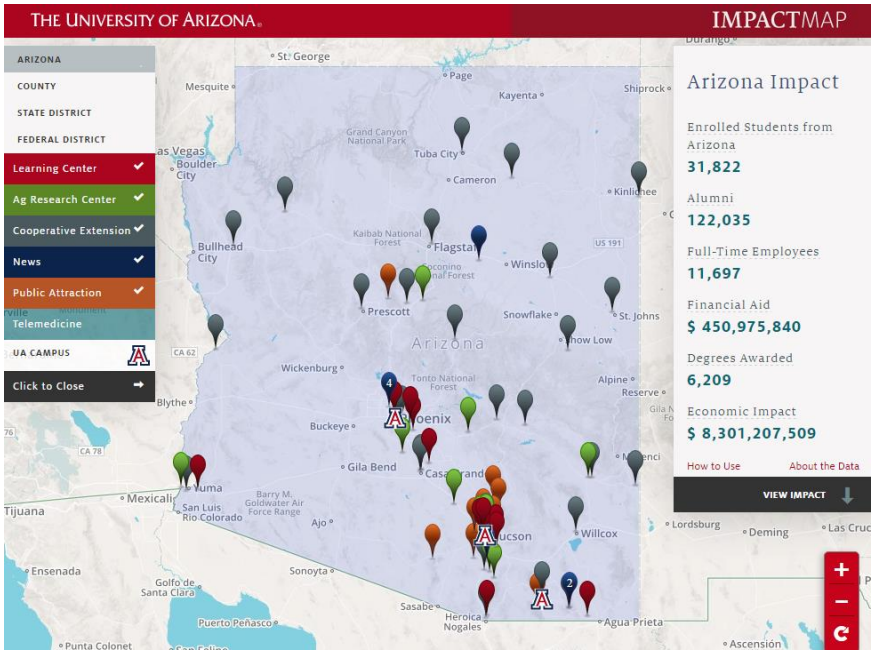
GSF: 9.4 million

Acres: 393

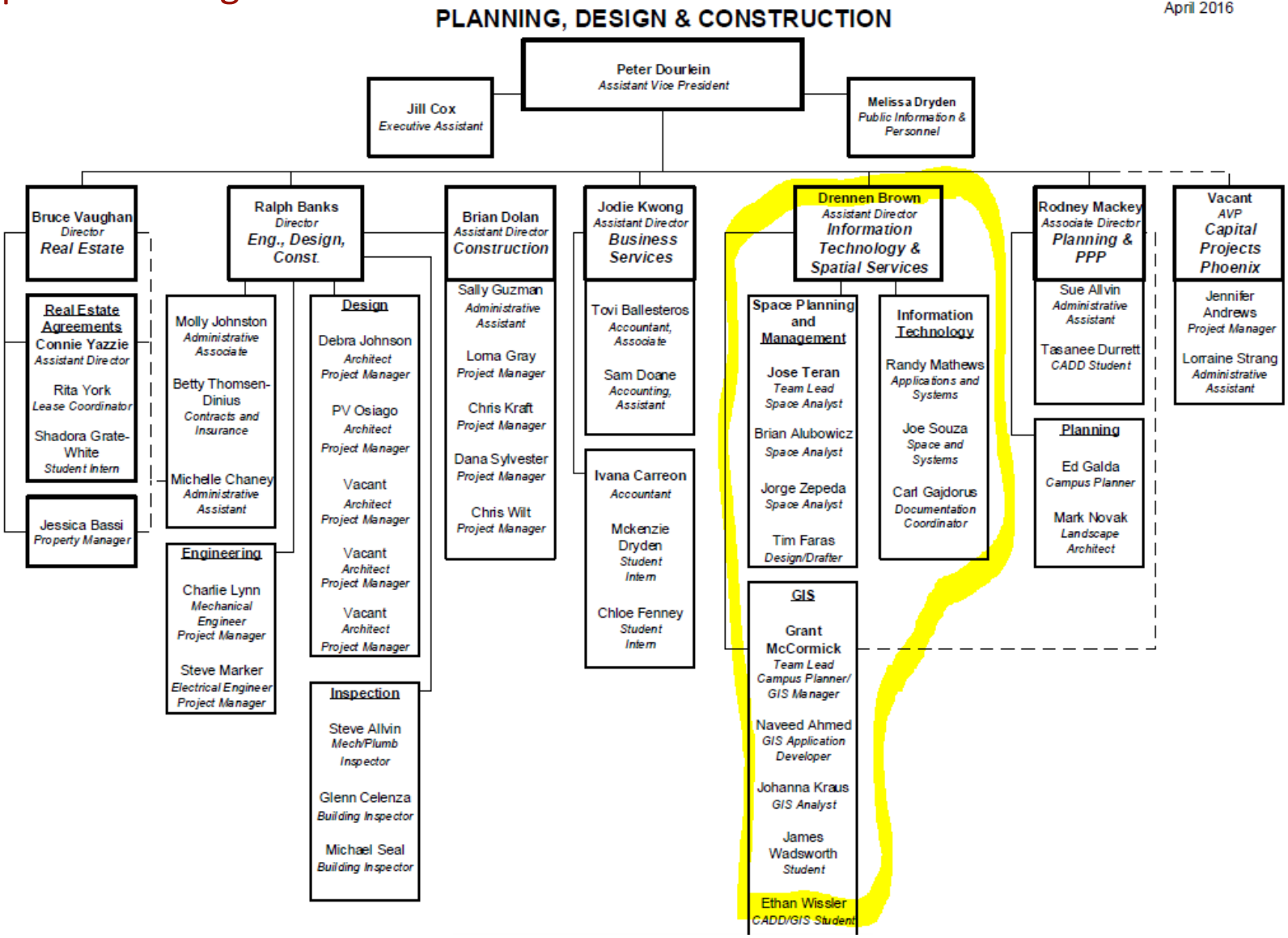
Total Students: 42,236

Total Employees: 15,615

Two Branch Campuses and numerous other sites around the state



Department Organization

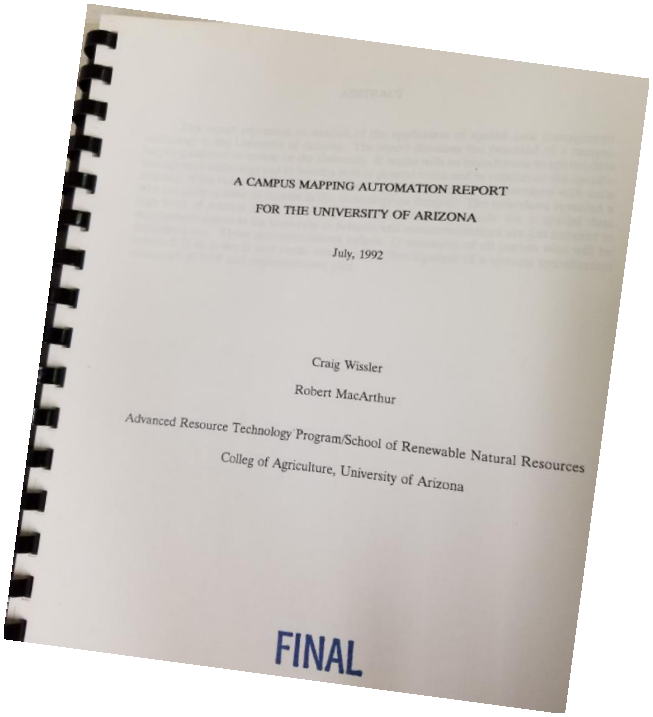


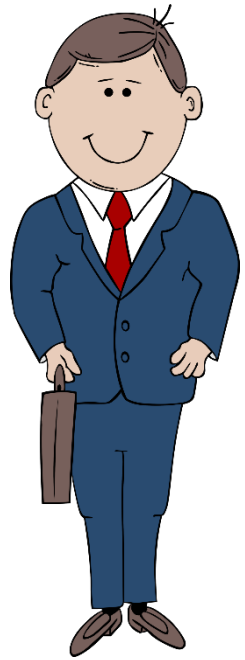
Discussion Topics

Background on the UA Enterprise GIS

Configuration of the System Today

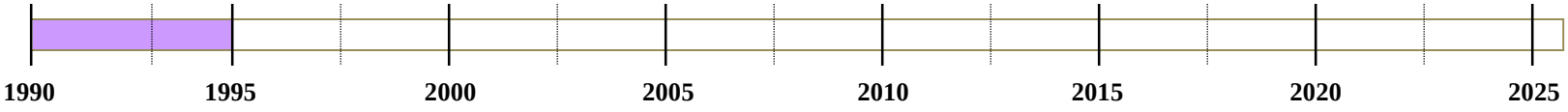
Current and Future Projects





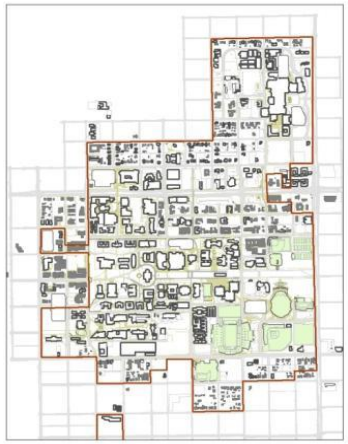
Report on need for Spatial Data Management System completed (1992)

1st GIS Staff Hired



Departmental System
Vision for Enterprise

EGIS



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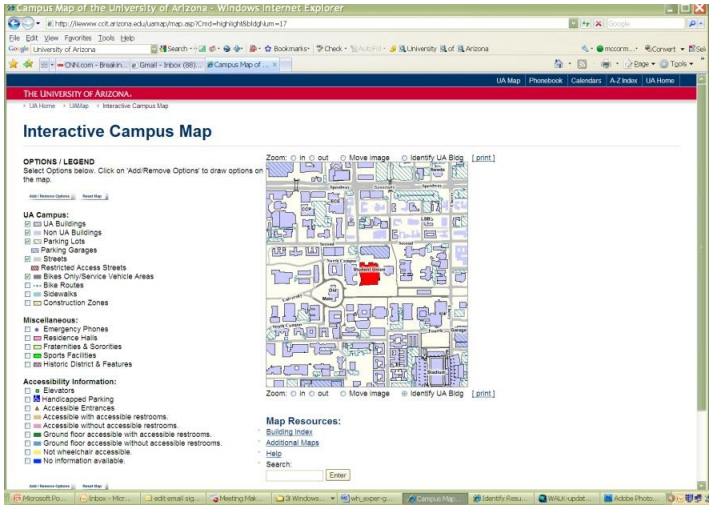
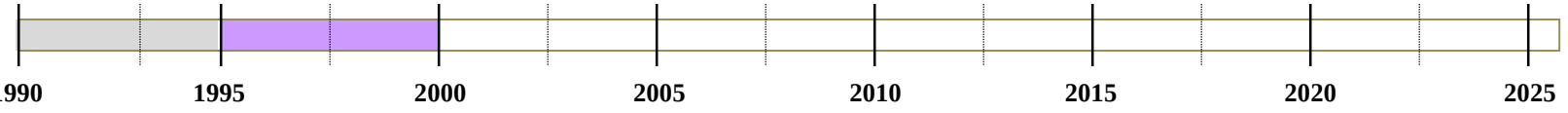
First Initiative to create Enterprise system (1997)

1st Campus GIS Web Map Created (1998)

ESRI UC Presentation on GIS use for Universities (1999)





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2nd Initiative to create Enterprise System (2004-2006)

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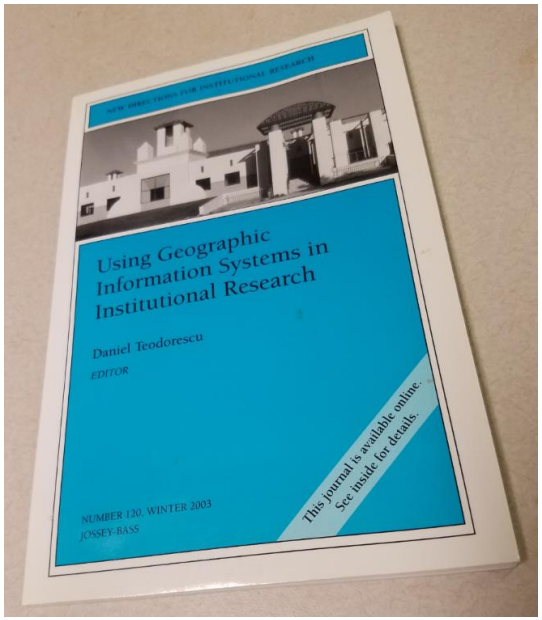


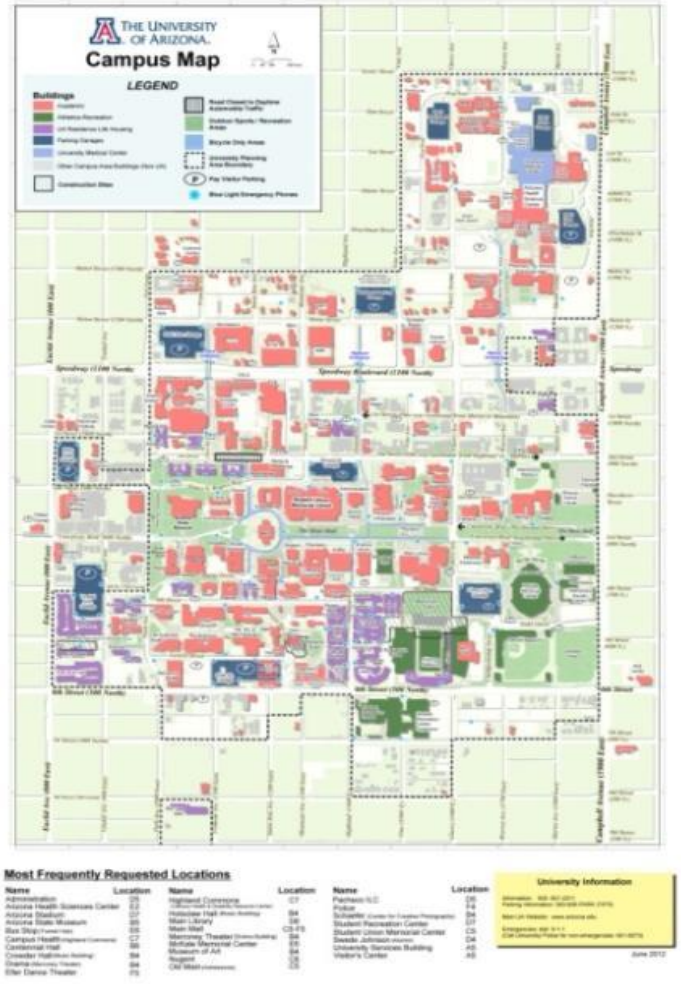
1990 1995 2000 2005 2010 2015 2020 2025

Departmental System
Vision for Enterprise

EGIS

Custom Products and Analyses

Visitor / Directory Map



Spring Fling Guide

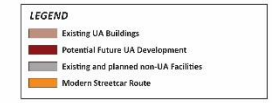
Development Density Analysis

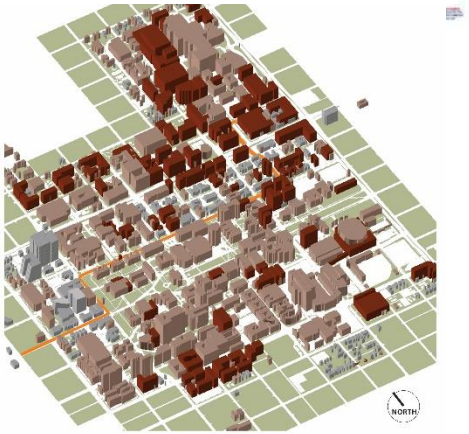
CAMPUS DENSITY ANALYSIS

	2003	2009	2013
TOTAL CAMPUS SQUARE FOOTAGE	8.6M GSF (w/831,000 GSF in design and construction)	10M GSF (w/372,000 GSF in design and construction)	10.4M GSF (w/800,000 GSF in design and construction)
TOTAL EXTIMATED CAMPUS CAPACITY	17M GSF	17M GSF	21M GSF
ADDITIONAL CAMPUS CAPACITY AVAILABLE	8.4M GSF	7M GSF	10M GSF

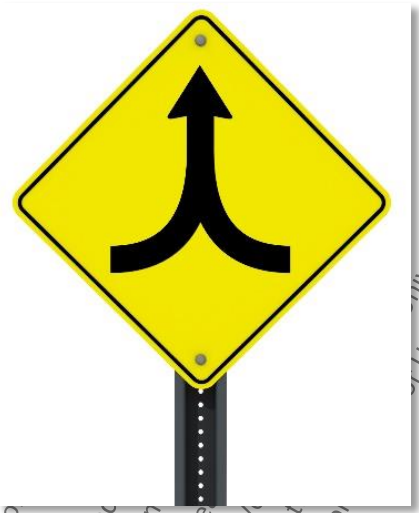
Conclusions

1. With fixed campus boundaries & continued enrollment and research growth – higher density is needed campus-wide.
2. Increased density is offset by a well-designed Open Space Network and the use of proven urban planning principles.
3. Off campus growth will also accommodate some future needs, and make best use of limited on-campus building sites.





Potential Campus Density at Build-Out



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Chapter in Book o
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2nd Initiative to create Enterprise System (2003-2005)
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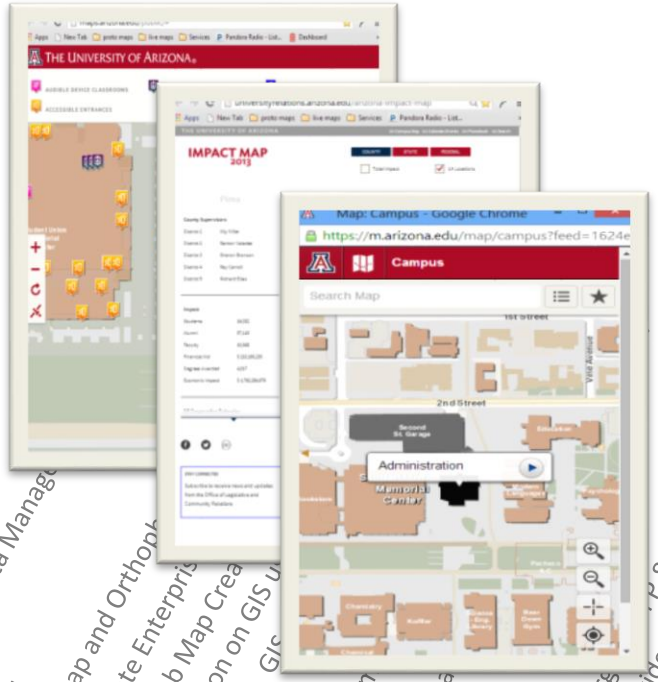
Departmental Merger – CFP & FDC become PDC (2008)
Seed Funding provided for Enterprise GIS (2009)

1990 1995 2000 2005 2010 2015 2020 2025

Departmental System Vision for Enterprise

Enterprise System Demonstration

EGIS



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ESRI UC Presentation on GIS U
Chapter in Book on GIS
GIS Used for Custom
2nd Initiative to crea
Departmental Merg
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P & FDC become PDC (2008)

Silverlight Web Maps launched, Enterprise GDB Created (2011)
ESRI UC Presentation on creating an Enterprise GIS (2012)
UA Adopts plans to use RCM Budgeting (2012)
Second increment of Seed Funding provided for Enterprise GIS (2013)
Campus 360 beta and PDC Projects Web Maps launched Fall 2013
360 V2 plus 3 new web launched Spring 2014: Public, AzMobile, Impact Map

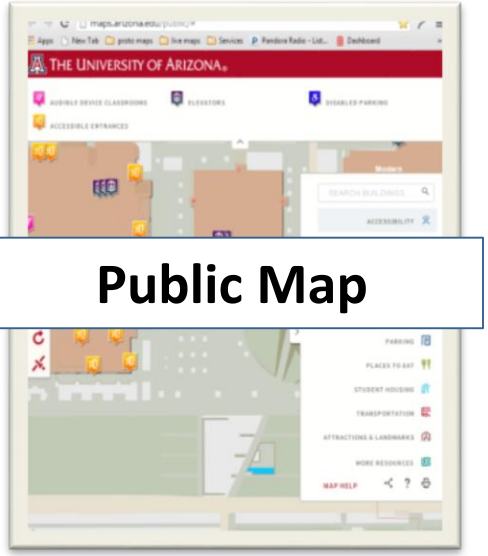
1990 1995 2000 2005 2010 2015 2020 2025

Departmental System Vision for Enterprise

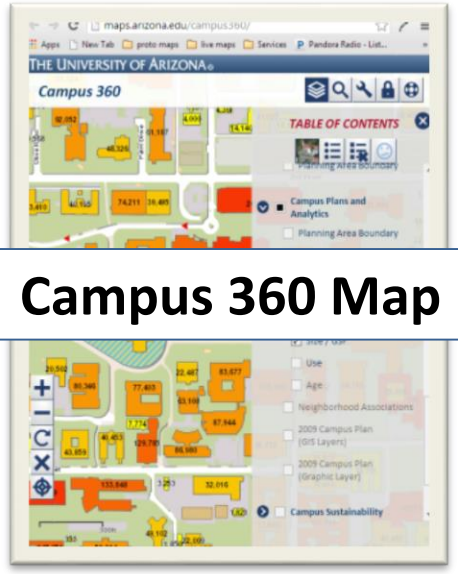
Enterprise System Demonstration

EGIS

Web Map Applications: *maps.arizona.edu*



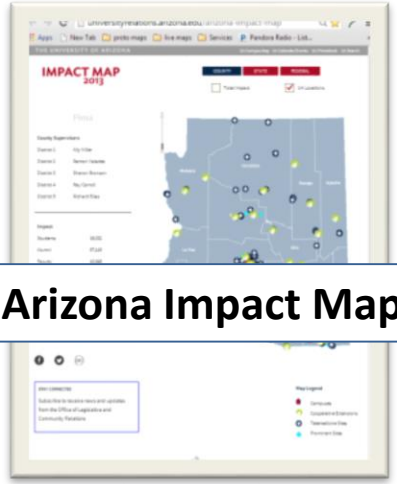
Public Map



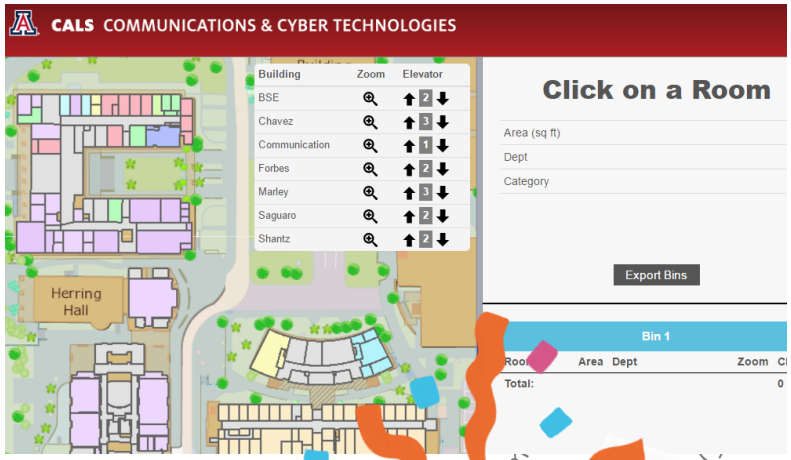
Campus 360 Map

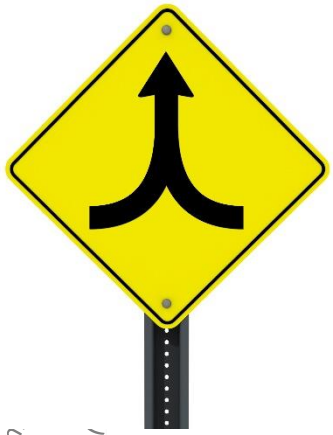
PDC Projects Map

Arizona Mobile Map



Arizona Impact Map





CALS launches Space Exchange Map - June

Departmental Merger – PDC and REA - October

New GIS Employees Approved - December

2015

1990 1995 2000 2005 2010 2015 2020 2025

Departmental System Vision for Enterprise

Enterprise System Demonstration

Enterprise System Full Implementation

EGIS

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Seed Funding
Silver
ESR
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3 ne
New GIS Employees Hired
GIS Infrastructure Upgrades, Code Modernization
Sustainability GIS, Arboretum App, 3D
Utilities and Room Apps / Services

2016

1990 1995 2000 2005 2010 2015 2020 2025

Departmental System Vision for Enterprise

Enterprise System Demonstration

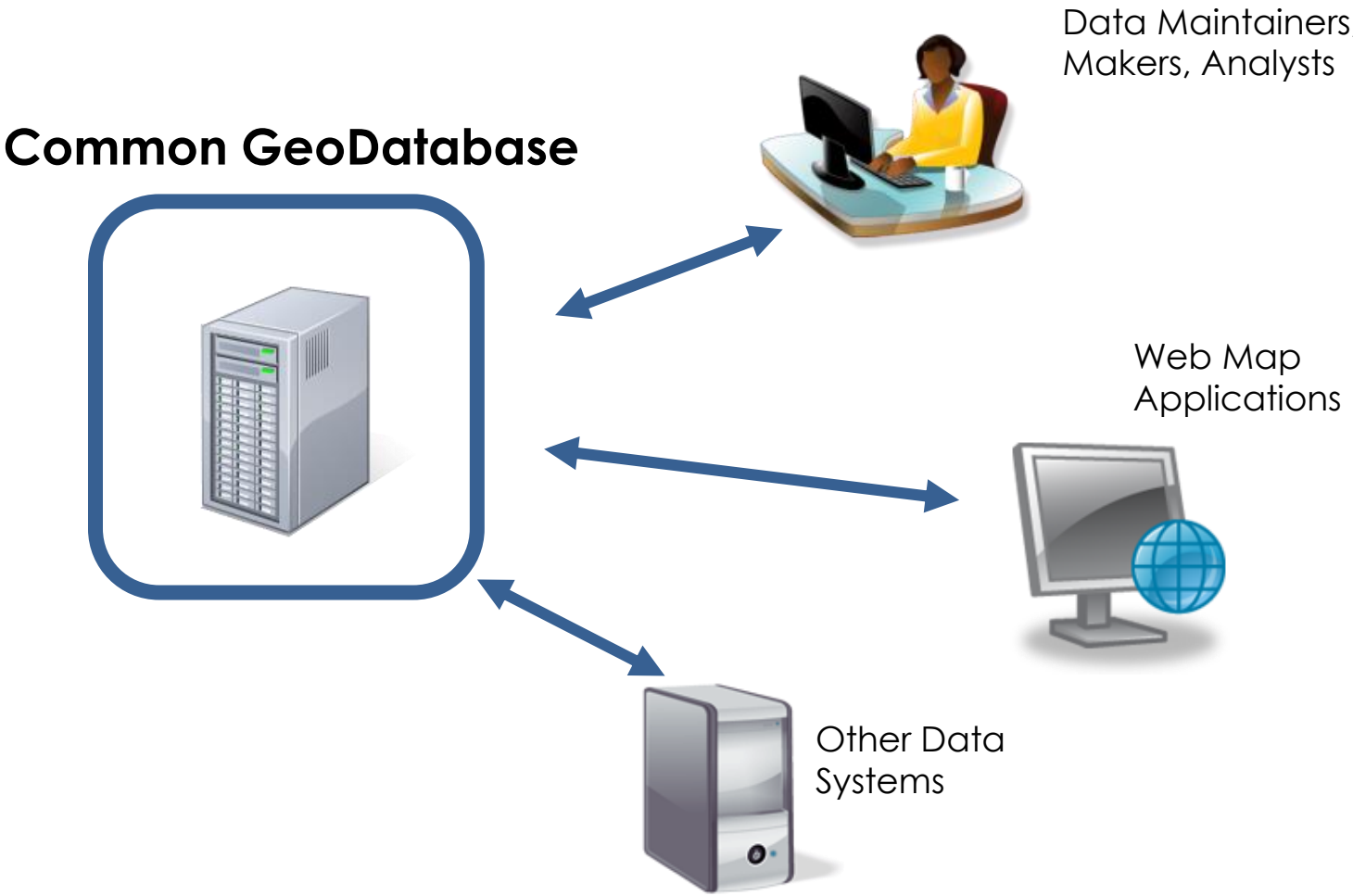
Enterprise System Full Implementation

EGIS

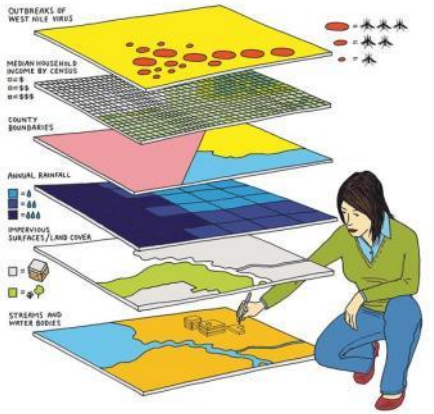
UA Enterprise GIS Today

Current Configuration

Enterprise GeoDatabase



Enterprise GeoDatabase



UAGIS.STRUCTURES.Buildings

BuildingID	CartoName
92	Maricopa
107	Old Main
111	Douglass
127	South
124	Shantz
126	Yavapai
122	Marley
123	Herring
118	Forbes
114	Nugent
215	Koffler

Administration

Capital Projects, UA Site Points – Statewide, Athletic Sites, Land Parcels, Web Cameras

Arboretum

Trees, Tree Descriptions

Hydro

Drainage structures, watersheds, water harvesting features

Site Features

Signs, Bluelight Emergency Phones, Public Art, Automated External Defibrillators (AEDs)

Structures

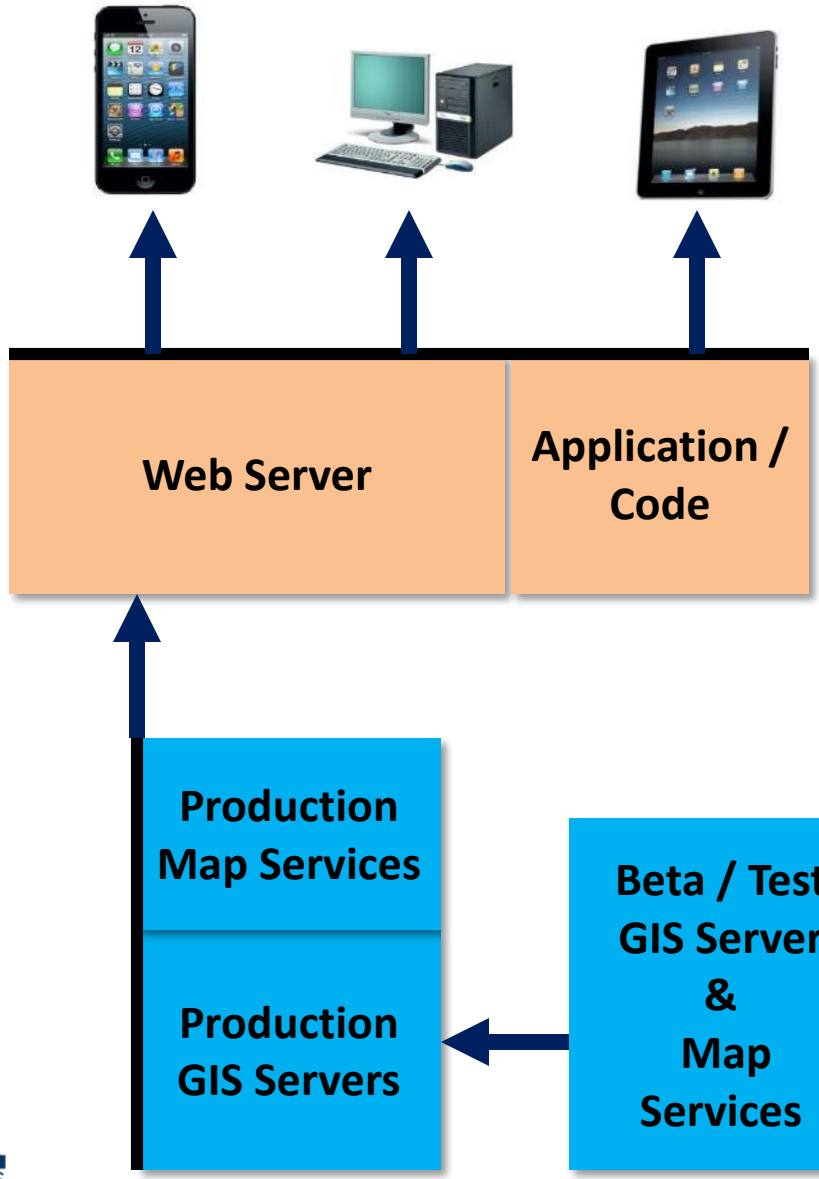
Building Entrances, Building Roof & Footprints, Misc. Structures

Transportation

Parking Spaces & Lots, Bike Parking & Paths, Shuttles, Streets, Walks

Utilities

Light Poles, tunnels, water lines

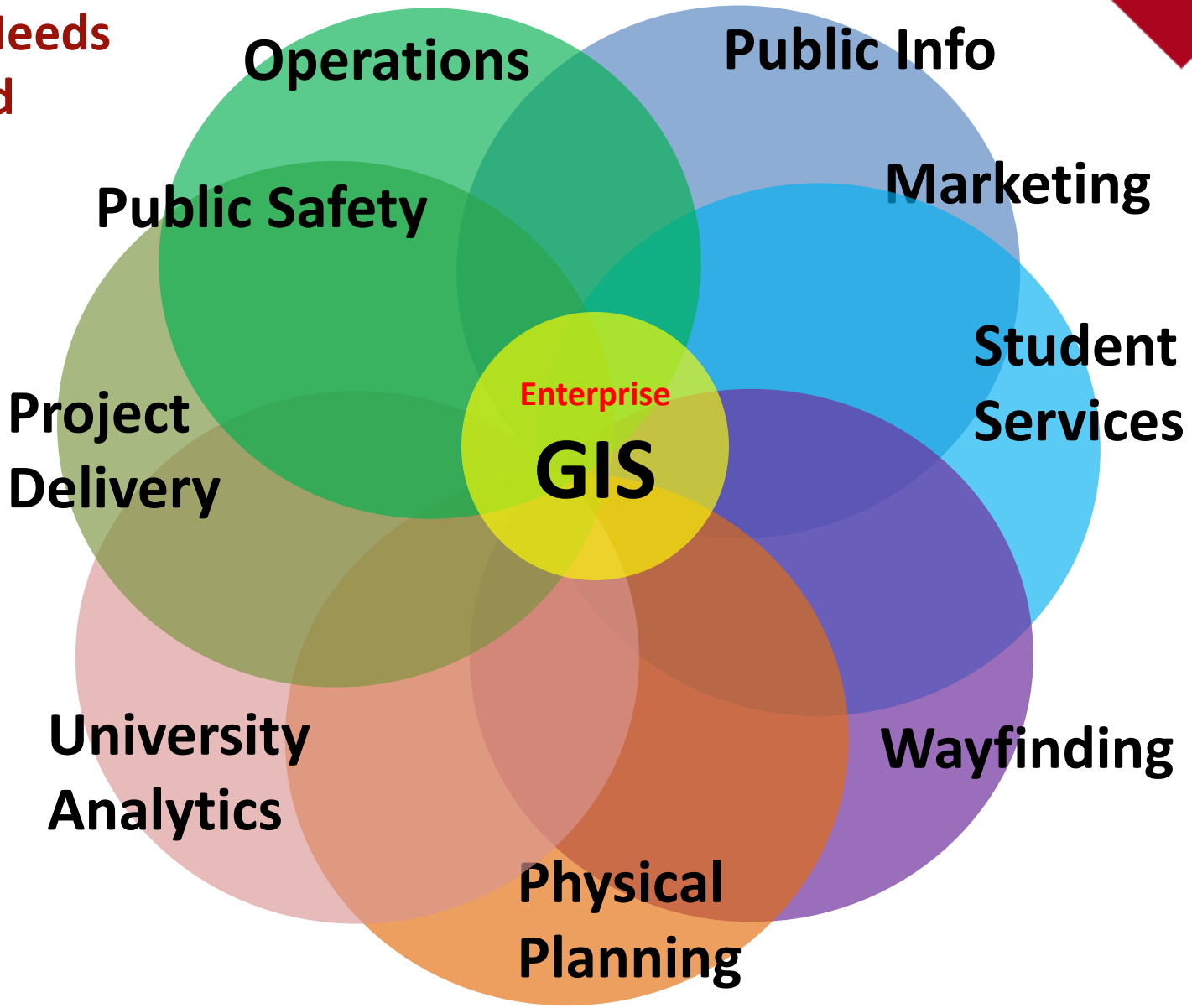


Web Map Applications

The EGIS/Esri Framework provides:

- "Ready to go" infrastructure
- An integrated platform
- Security
- Up to date and accurate information
- Control over branded and internal info
- Integrated enterprise information
- Expandability
- Responsiveness

Campus Needs Supported



Current GIS Projects

New GIS Data, Services, and Applications

Arboretum / FM Grounds Field App

Sustainability Web Map

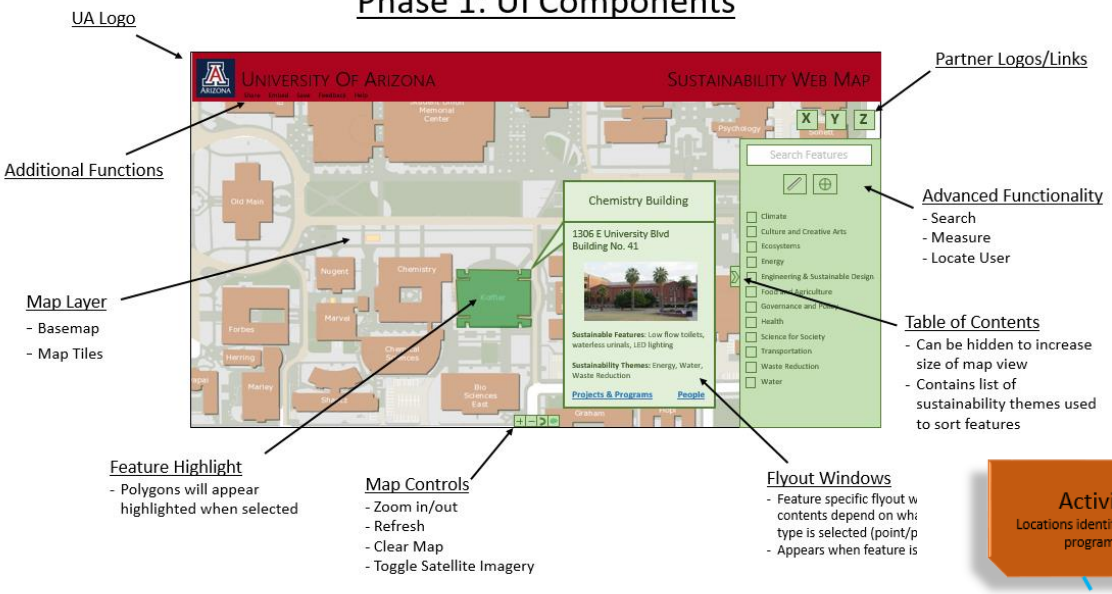
3D Building Data

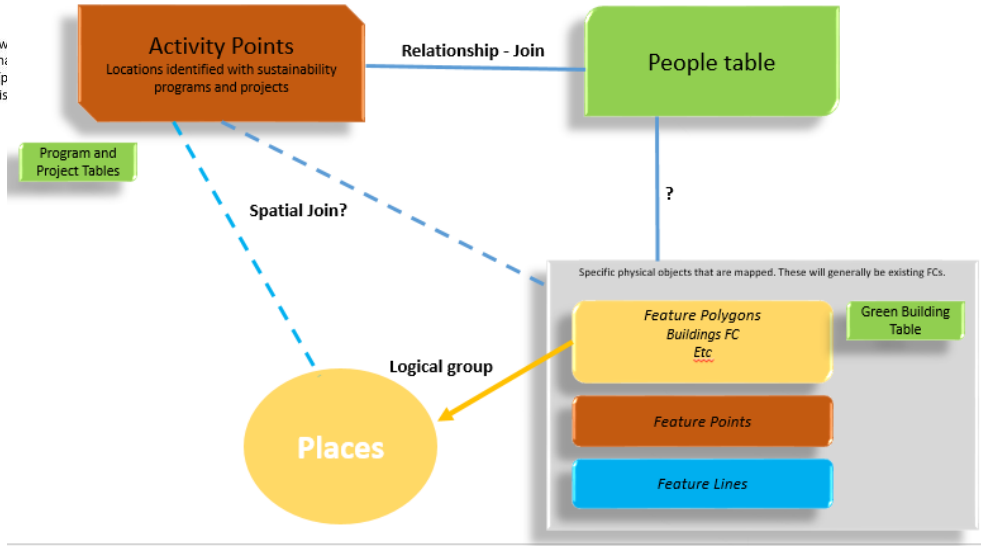
Utility Mapping

Room / Interior Mapping

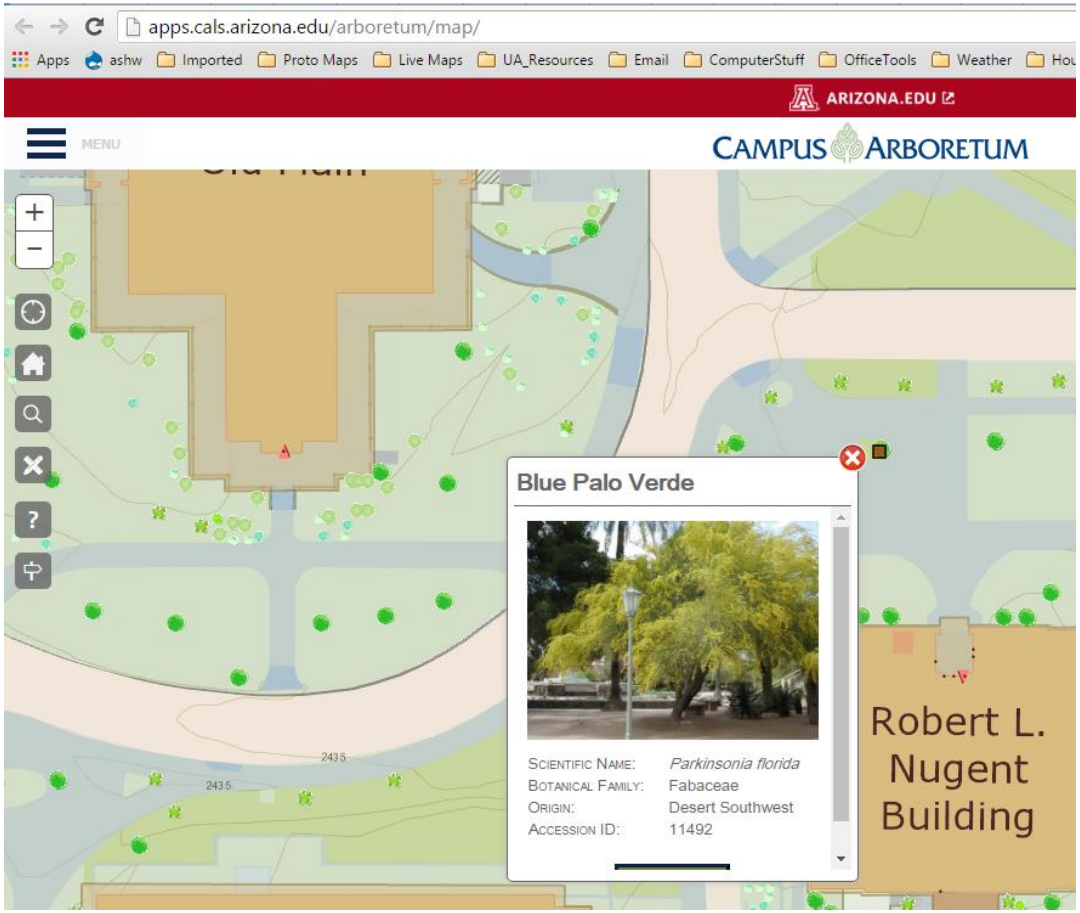
Sustainability Web Map / Database

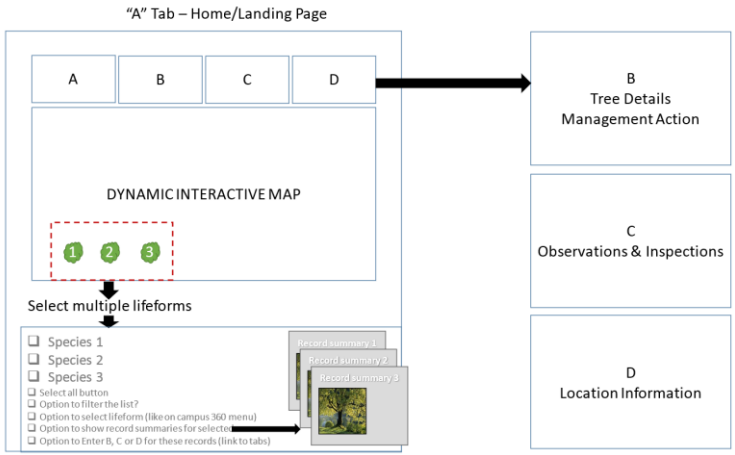
Phase 1: UI Components



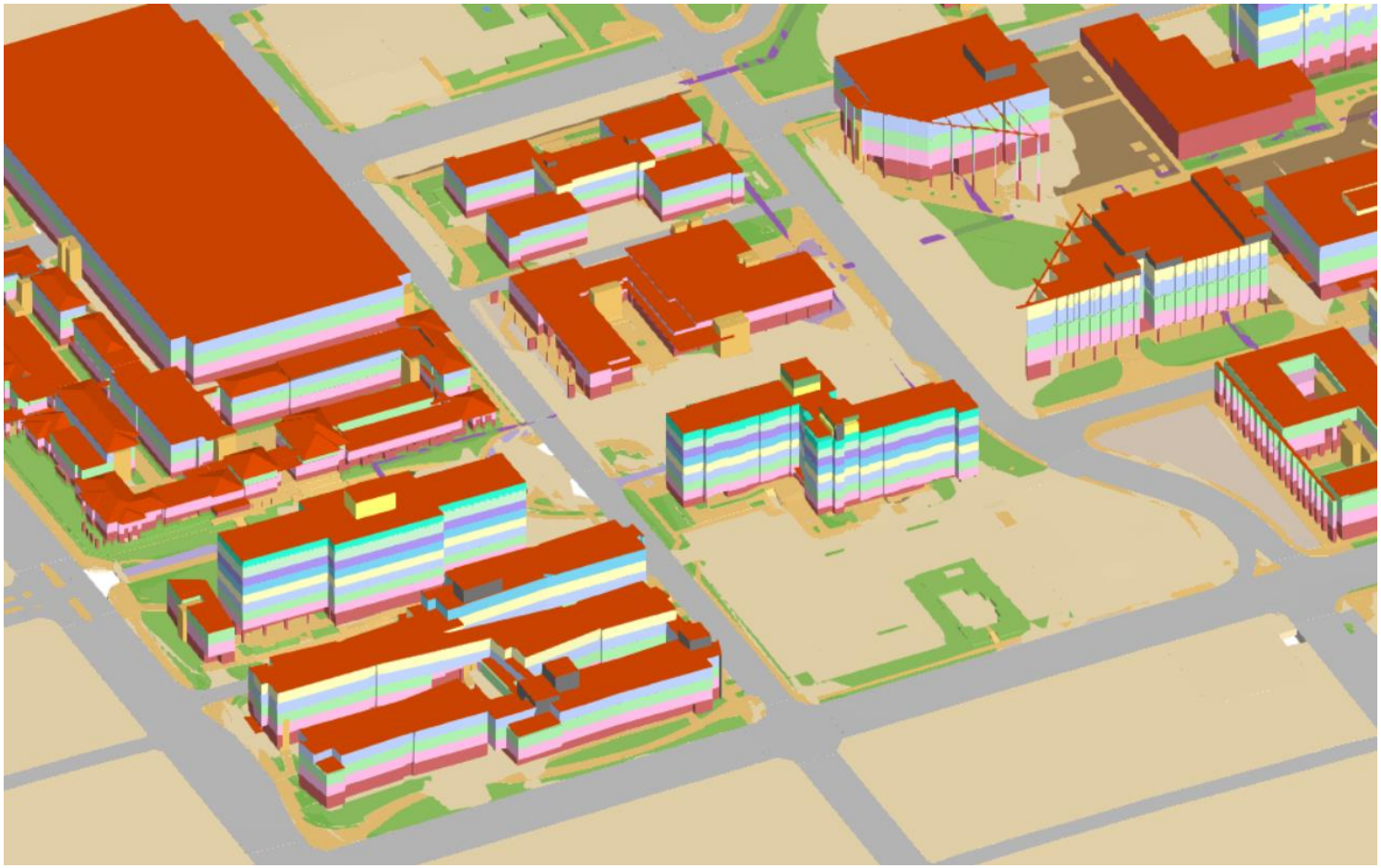


Arboretum / FM Grounds Field App





3D Buildings



Utility Mapping

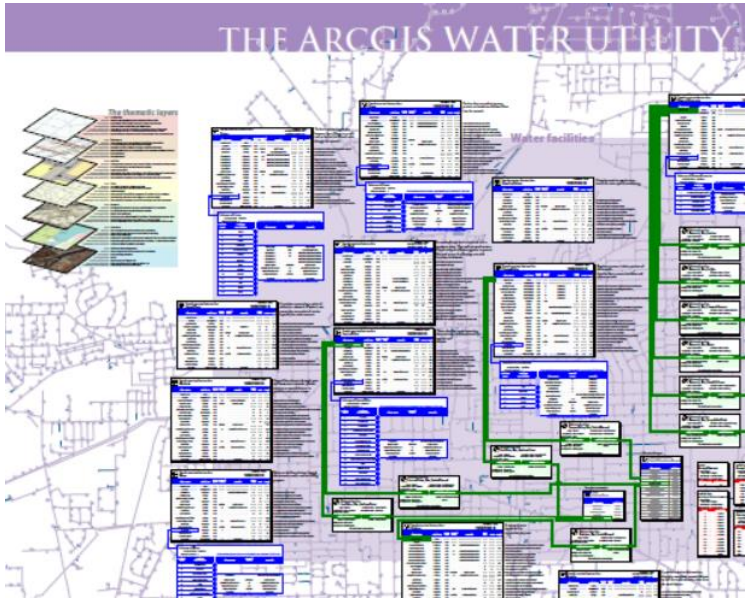
UA Utility Typology

Utility System Description and Priorities for Mapping: Utility Resources

12-Mar-15

	Utility Resources	
Utility Resource	**Elements**	**Contained In**
SANITARY SEWER LINES		
	Pipes	Direct Burial
	Sewer manholes	
CHILLED WATER		
	Supply	Direct Burial; Tunnels
	Return	Direct Burial; Tunnels
	Valves	Direct Burial; Tunnels
STEAM		
	Supply Lines	Tunnels
	Return Condensate Lines	Tunnels
	Condensate Pumps	Tunnels
	Isolation Valves	Tunnels

ESRI Data Model

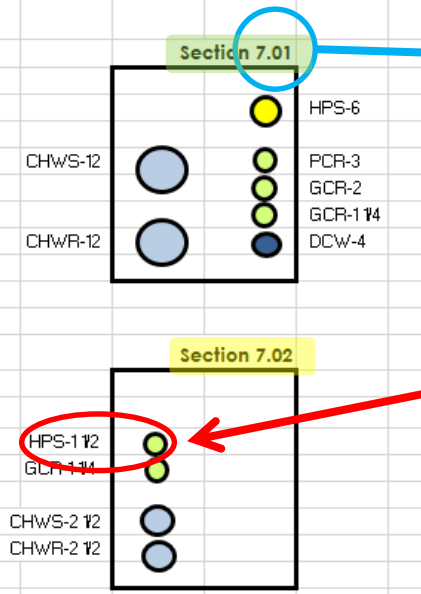


Initial Goal: Define <u>where</u> components are and <u>what</u> they are

Utility Report

Source Data for Tunnels / Contents

University of Arizona
GIS Tunnel Data



Section Utility Data Table

System	Size (in.)	SectionID
HPS	6	7.01
MPS		7.01
LPS		7.01
PCR	3	7.01
GCR	2, 1 1/4	7.01
CHWS	12	7.01
CHWR	12	7.01
DCW	4	7.01
RW		7.01
HPS	1 1/2	7.02
MPS		7.02
LPS		7.02
PCR		7.02
GCR	1 1/4	7.02
CHWS	2 1/2	7.02
CHWR	2 1/2	7.02
DCW		7.02
RW		7.02

Tunnel Section Reference Table

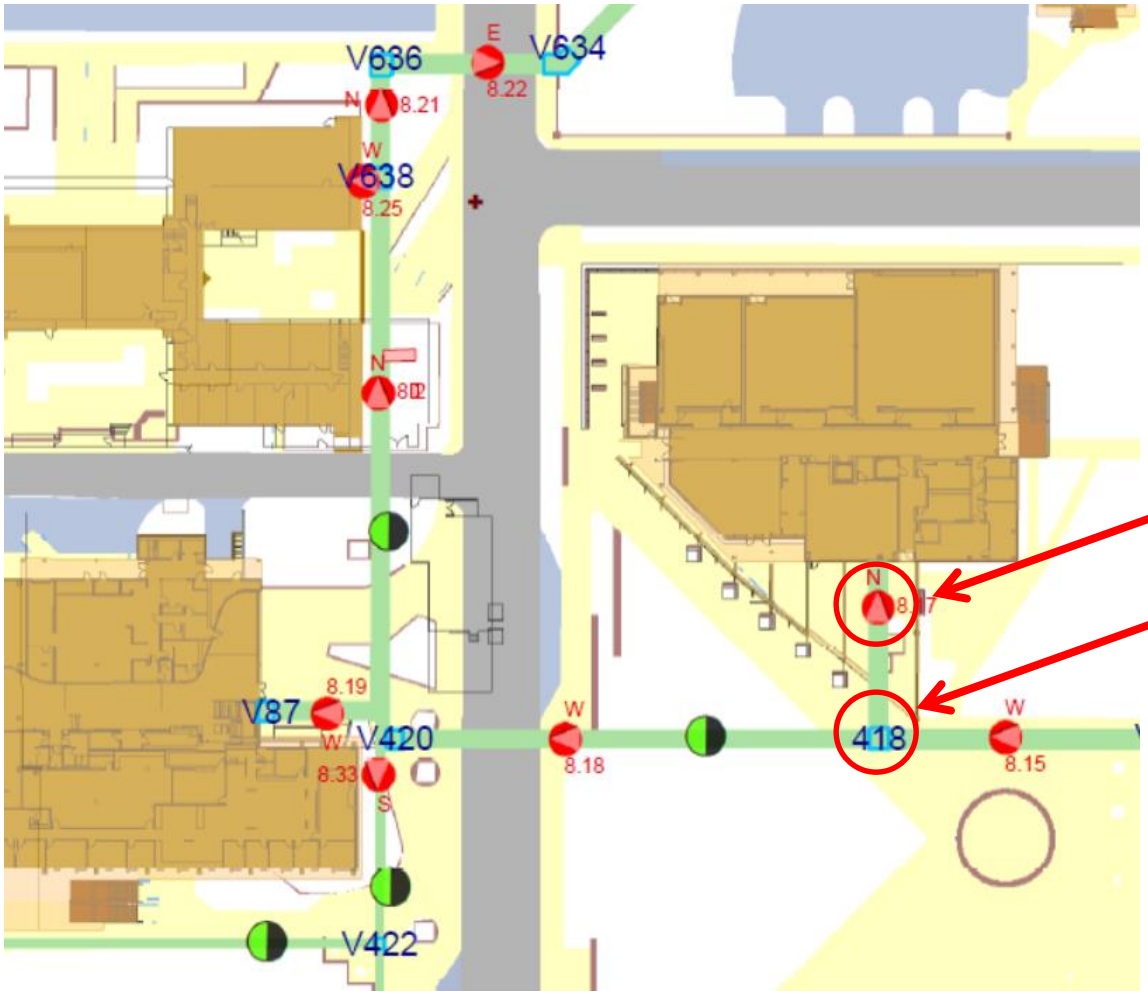
SectionID	Height	Width	View To	Start Vault	End Vault
7.01	6'-4"	4'-0"	East	V-660	V-666
7.02	4'-6"	3'-0"	North	V-666	V-13
7.03	6'-4"	4'-0"	East	V-666	V-668
7.04	6'-10"	6'-2"	North	V-668	V-726
7.05	6'-3"	4'-0"	East	V-668	V-670
7.06	6'-5"	3'-0"	North	V-670	V-12
7.07	6'-3"	4'-0"	East	V-670	V-672
7.08	6'-1"	4'-0"	North	V-672	V-11
7.09	6'-3"	4'-0"	East	V-672	V-674
7.10	4'-6"	3'-0"	North	V-674	V-20
7.11	6'-1"	4'-0"	East	V-674	V-680A
7.12	5'-0"	3'-2"	North	V-680A	V-10
7.13	4'-6"	3'-1"	North	V-680A	V-23A
7.14	6'-4"	4'-0"	North	V-680B	V-23
7.15	6'-4"	4'-0"	East	V-680B	V-682A
7.16	4'-6"	3'-1"	North	V-682A	V-681
7.17	6'-4"	4'-0"	East	V-682A	V-682B
7.18	6'-4"	4'-0"	East	V-682B	V-684
7.19	4'-1"	3'-2"	North	V-684	V-9
7.20	6'-4"	4'-0"	East	V-684	V-686
7.21	6'-4"	4'-0"	East	V-686	V-688
7.22	4'-6"	4'-0"	North	V-688	V-26
7.23	6'-4"	4'-0"	East	V-688	V-690
7.24	4'-6"	3'-0"	North	V-690	V-8
7.25	6'-4"	4'-0"	East	V-690	VTI

Updated Legend

ID	System
HPS	High Pressure steam
MPS	Medium pressure steam
LPS	Low pressure steam
PCR	Pumped condensate return
GCR	Gravity condensate return
CHWS	Chilled water supply
CHWR	Chilled water return
DCW	Domestic cold water
RW	Reclaimed water

CHWR-12
- Diameter of main
- System ID

Tunnel Mapping



Web Map Access to Utility Information

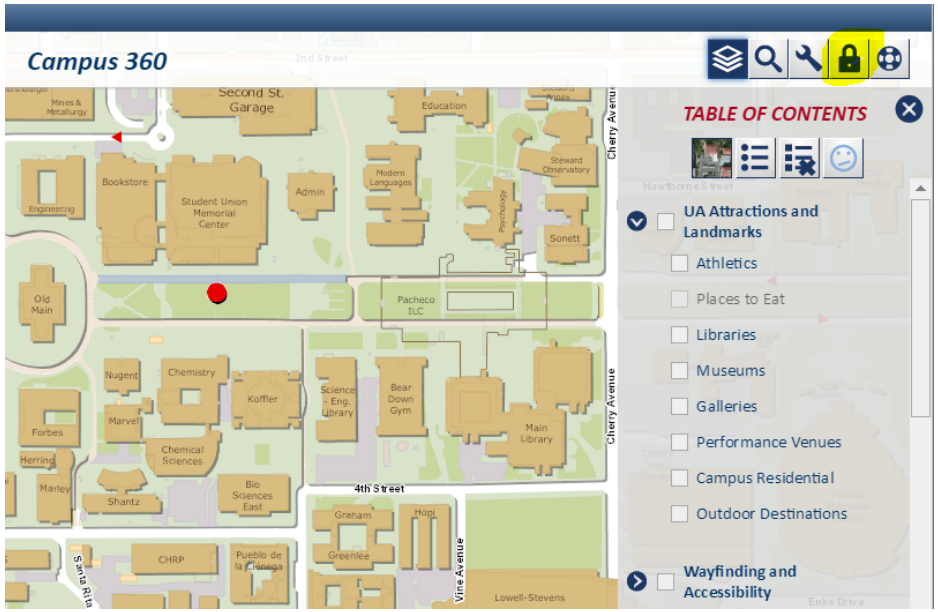
Access Levels

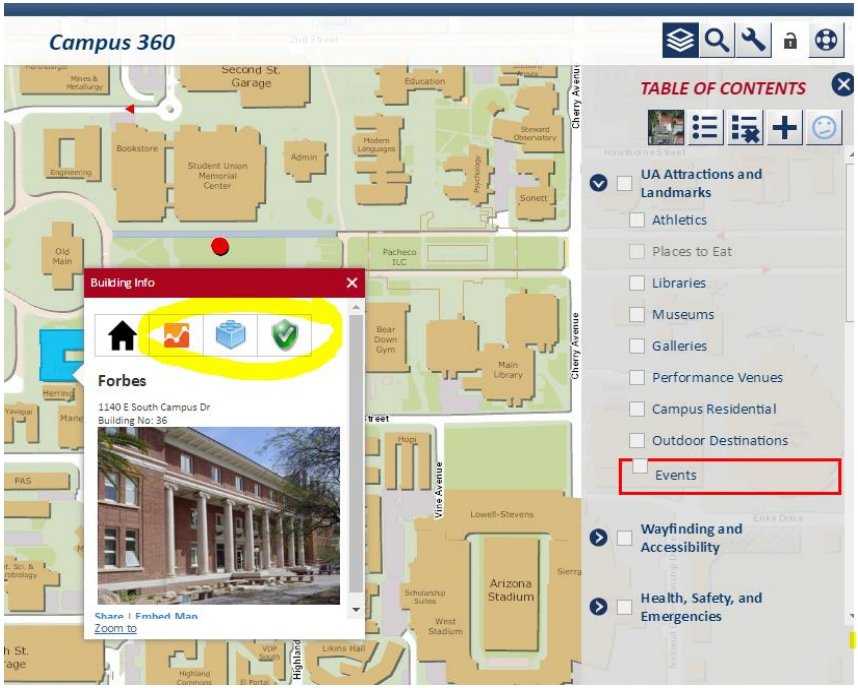
Public: *Tiled image basemaps. Dynamic features*

Business Intelligence: *Dynamic features, Admin / Planning focus*

Infrastructure: *Dynamic features, Facilities, assets, utilities, focus*

Emergency: *Dynamic features, Emergency response focus*





EGIS

Room / Interior Mapping Deep Dive

Introduction – Drennen Brown, Assistant Director IT and Spatial Services

Opportunities from merging with Space Management (Space Analysis, Management, Reporting)

Managing 1100 CAD Floor Plans in around 230 Main Campus buildings

Why integrate floor plans with GIS?

- Asset management
- Room / class scheduling
- Location services
- RCM (Responsibility Centered Mgmt) analysis
- Worker scheduling and routing
- Life and safety
- Space analysis tools
- All in the context of a relational Enterprise GIS!

How could we automate this?

Room / Interior Mapping

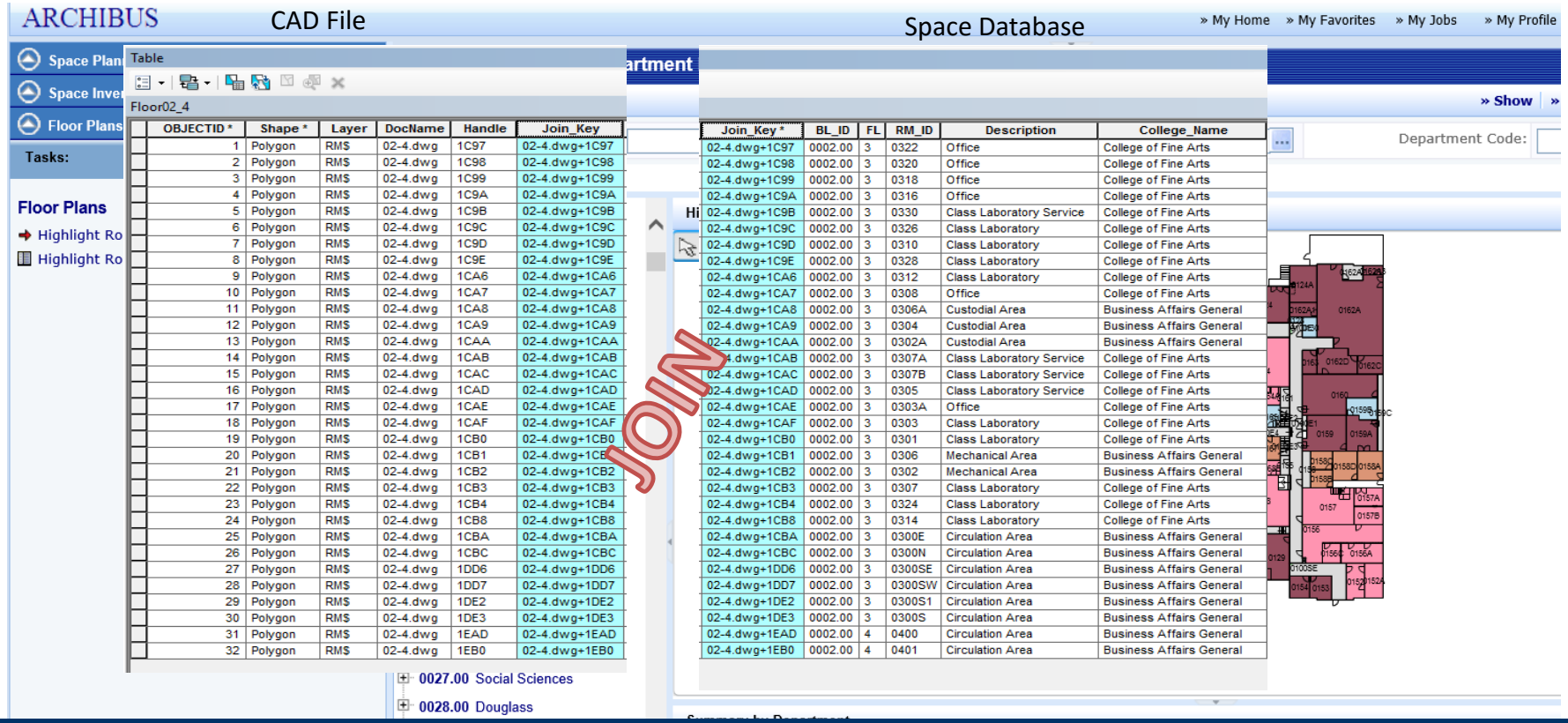
- Automation Process
  - Building Blocks
  - Leveraging what we have
  - Georeferencing
  - GIS Feature Creation Scripts
- Demonstration Applications
- Practical Applications

Room / Interior Mapping

ARCHIBUS is CAFM (Computer Aided Facility Management) software

Whats great? Whats not?

Discovery of “drawing-name + CAD ‘handle’”



Room / Interior Mapping

Leveraging Archibus

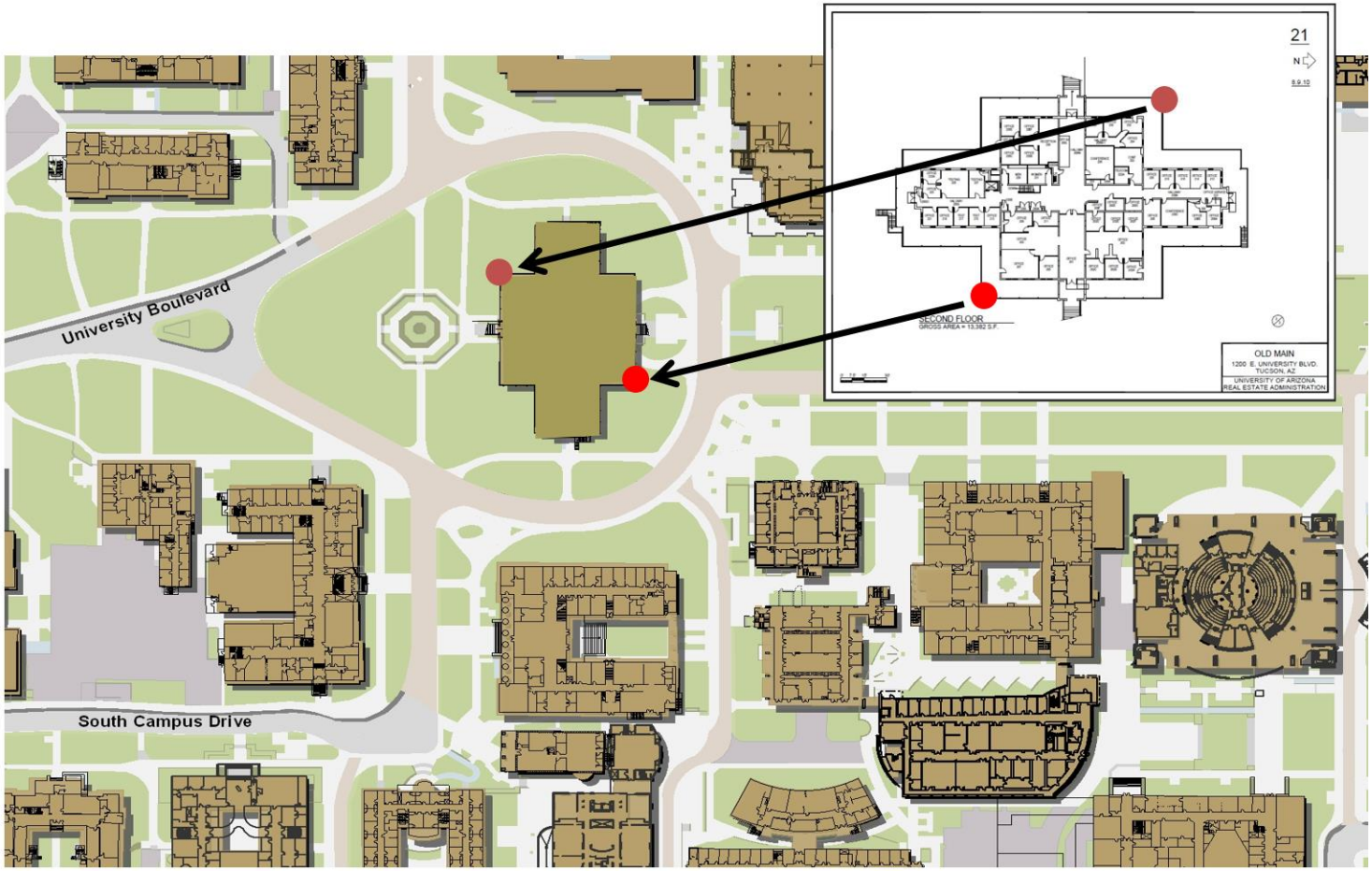
- Room Polygons already drawn
- Already associated with rich database

Leveraging Prior GIS work

- Many floor plans already georeferenced

Room / Interior Mapping

Stitching it together - Georeferencing



Room / Interior Mapping

Batch File

```
python importFloorplan.py 20
python importFloorplan.py 21
python importFloorplan.py 27
python importFloorplan.py 33
python importFloorplan.py 36
python importFloorplan.py 107
python importFloorplan.py 40
python importFloorplan.py 41
python importFloorplan.py 44
python importFloorplan.py 38
python importFloorplan.py 54
python importFloorplan.py 56
python importFloorplan.py 70
python importFloorplan.py 67
python importFloorplan.py 66
python importFloorplan.py 65
python importFloorplan.py 10
python importFloorplan.py 11+12
python importFloorplan.py 24
python importFloorplan.py 25
```

CAD files are named by Bldg/Floor
ArcPy Script Converts CAD Polygons to GIS Features
Re-creates database keys used by Archibus
Joins GIS features to matching database records
https://bitbucket.org/egisua/floorplanimport

ArcPy Script – importFloorplan.py

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
# importFloorplan.py
# Usage: cadToFC <Building_Number>
#
# 1) Convert one building's CAD files to Feature Classes within a file geodatabase using State Plane
# 2) World Files needed for georeferencing are in State Plane Coordinates
# 3) Reproject the feature class into Webmercator
# 4) Add layer to an MXD using new featureclass.  Refer to Level (B, 1, 2, etc) Crosswalk and append
# 5) Join to ROOMEXT (a stand alone table with Space data) using "Join_Key" = drawingName + eHandle
#
# Additional Scripts that can be run subsequently
# -----------------------------------------------
# layerProcessing.py - Sets symbology and labeling without changing/adding FCs or layers
# setMinLabelScale.py - Sets the minimum scale to show labels.
#
# REQUIRES
# --------
# Empty FGDB must be setup and ROOMEXT table added
# Test.gdb provided as example
# MXD Can be blank/empty
#
#
# Notes
# -----
# We could eliminate what seems like a duplication of args Building Name / Number
# Except that multi-drawing files like 11+12.dwg, 11+12 makes an illegal layer name
# in this case we call "cadToFC 11and12 11+12"
#
#
# ---------------------------------------------------------------------------

# Constants
FGDB = "myTest.gdb"
MXD = "Test.mxd"

# Import modules
import arcpy
import os.path # used for checking file existence


# Create Dictionary of Drawing / Actual Level Pairs
import csv
myfile = file('Level-Crosswalk.csv')
myfile.readline() # skip "date,value" line
levelCrosswalk = dict(csv.reader(myfile))

# Open logfile for append
fo = open("ConversionLog.txt", "a")

# Paths
file_path = "F:\\repos\\importFloorplan\\"   # This is where GDB and MXD live
workspace = file_path + FGDB
cad_path = "S:\\Floorplans\\CAD\\"

mxdpath = file_path + MXD

# Pointer to MXD
mxd = arcpy.mapping.MapDocument(mxdpath)
```

Room / Interior Mapping

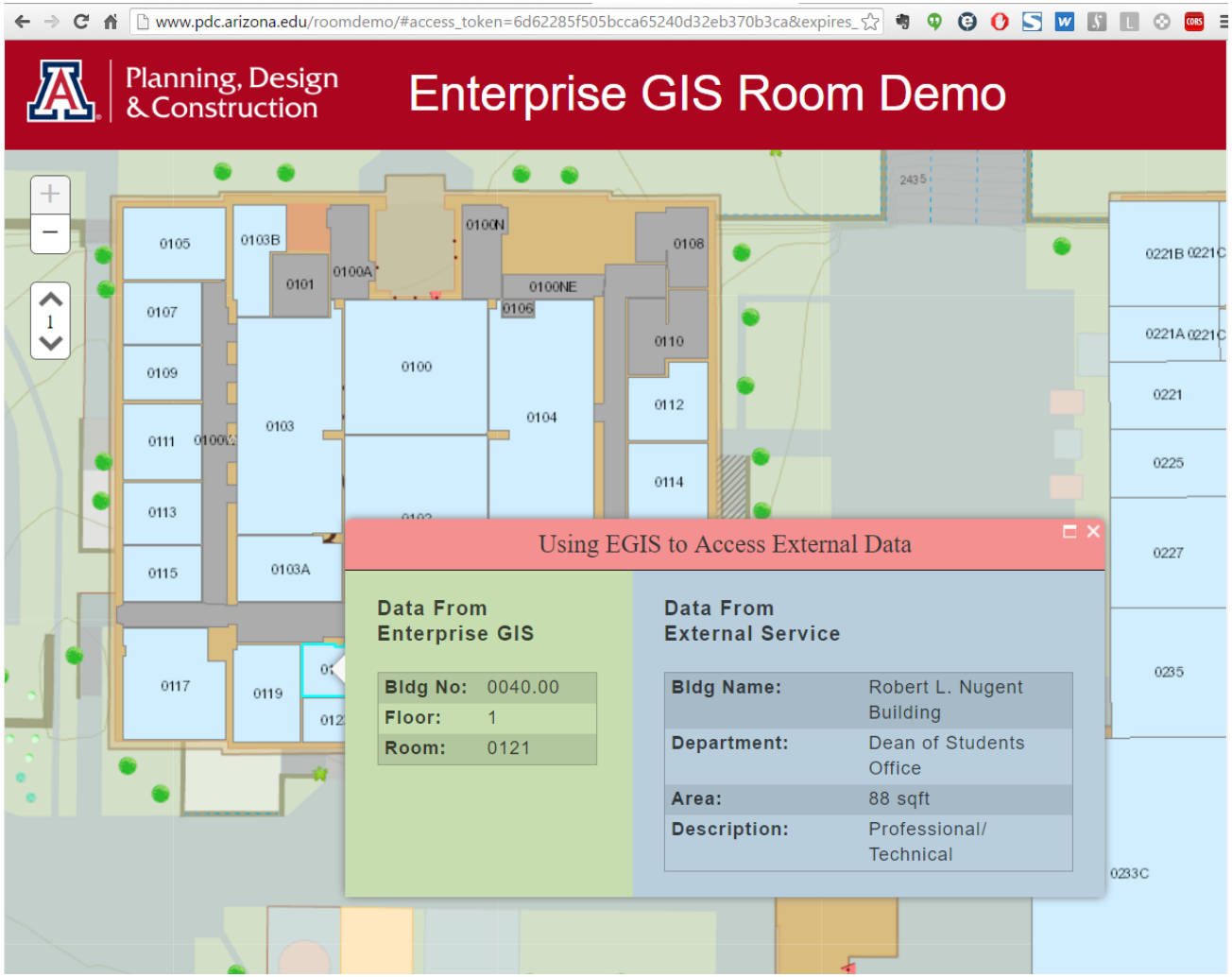
GIS Room Service

- Goal not to create every application
- Stand up a service for other developers

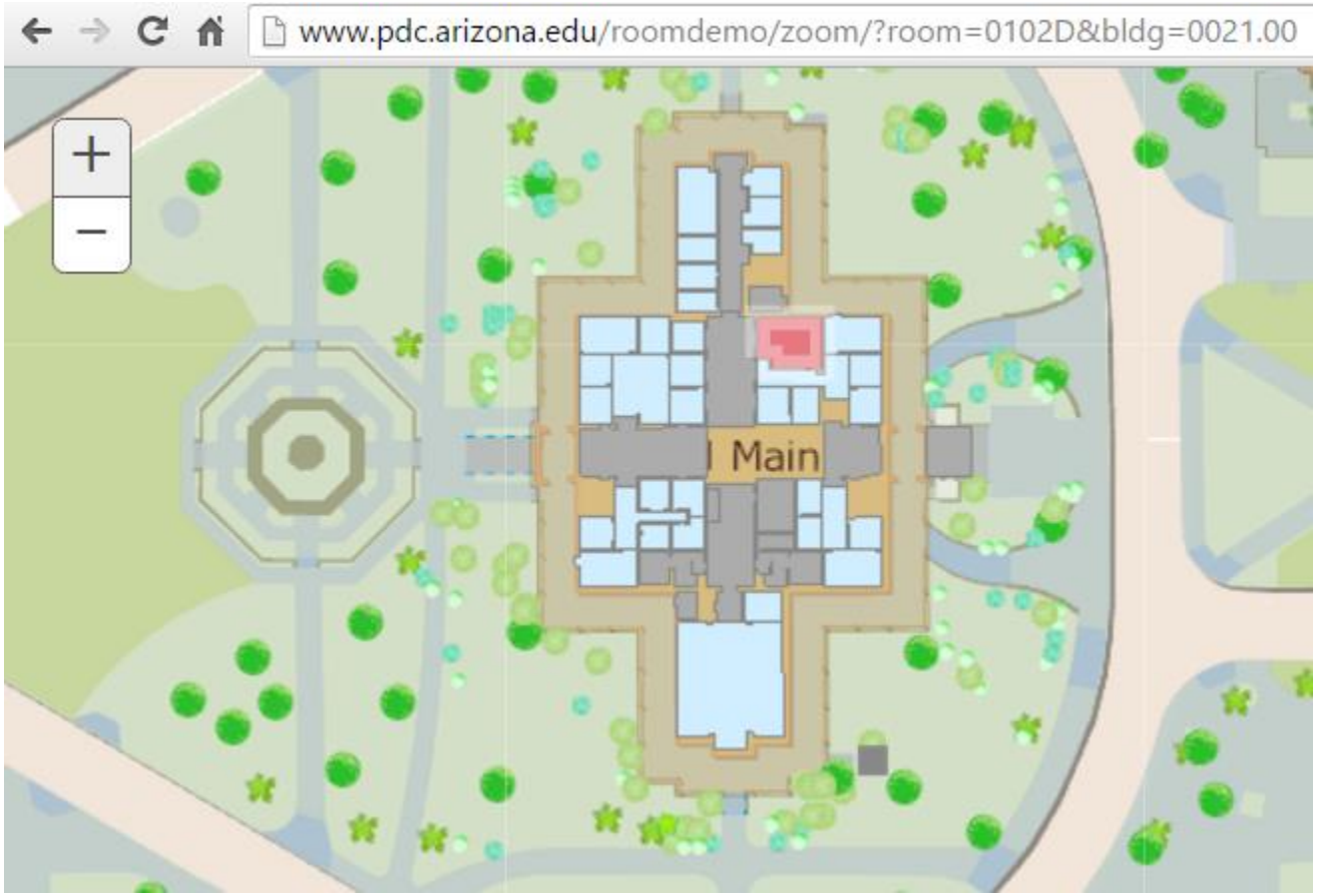
Current Partners

- Facilities Management
  - Custodial Routing, Shop Order Routing
- College of Agriculture
  - Space / RCM App
- Hazardous Waste
  - Location and Categorization of materials

Mashup Demonstration



Zoom to Room Demonstration



Zoom to Room Demonstration

MATH 120R - 001 Calculus Preparation
The University of Arizona | Fall 2016 | Lecture

Class Details

Status	Open w/Req	**Career**	Undergraduate
Class Number	35152	**Dates**	9/14/2016 - 12/7/2016
Session	Dynamically Dated Session	**Grading**	Regular Grades A, B, C, D, E
Units	4 units	**Location**	Tucson
Instruction Mode	In Person	**Campus**	The University of Arizona
Class Components	Lecture Required		

Meeting Information

Days & Times	Room	Instructor	Meeting Dates
MoTuWeThFr 8:00AM - 8:50AM	Phys-Atmos Sci, Rm 412	Staff	09/14/2016 - 12/07/2016

Enrollment Information

Enrollment Requirements MATH 109C, 112,113, 116, 120R, 122A or Proctored/Prep for College Algebra 88+ or Proctored/Prep for Calculus 65+.

Per Unit Fee	$0.00	**Flat Fee**	$0.00	**iCourse Fee**	$0.00

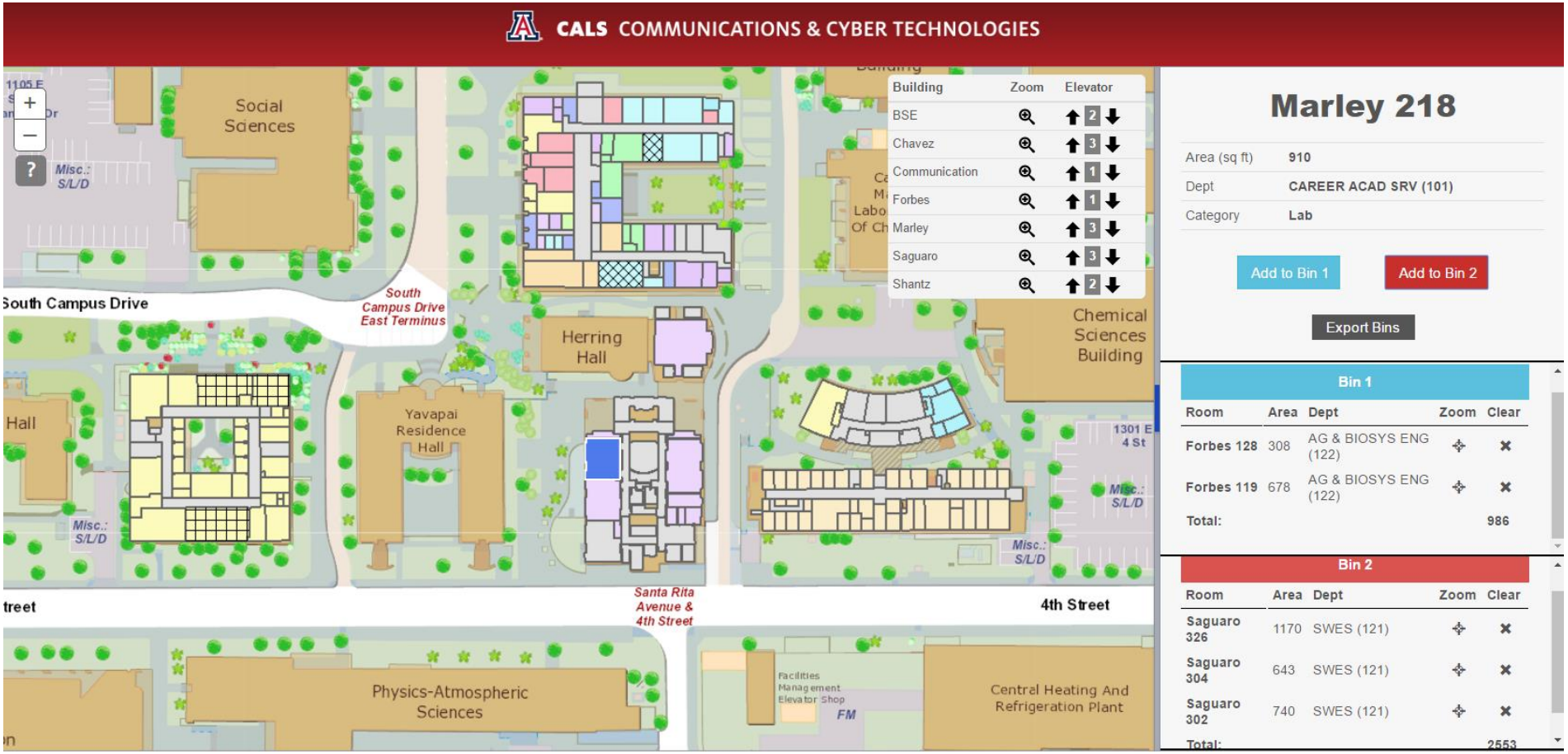
Class Availability

Class Capacity	17	**Wait List Capacity**	0
Enrollment Total	12	**Wait List Total**	0
Available Seats	5		

Location

EGIS

CALS Space Exchange Map



Room / Interior Mapping

Where Are We / Where are we going?

- Started in April
- Cleaning up Source Data
- Working on full automation
- Presentation
- Reach out and education

Thank you!

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