

The Development of a Geographic Information System Data Model for the city of Apache Junction

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February 14, 2019

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Objectives and Goals

- **Gather data requirements from city departments**
- **Develop listing of city business functions**
- **Develop conceptual data model from the business function listings**
- **Develop logical data model from the conceptual data model**

Geographic Information System Technology

- A GIS is a computer system that contains and manipulates geographically referenced information, such as spatial data
- An Enterprise GIS supports special features over and above a system not containing spatial data, such as relationships between spatial entities and entity versioning
- A GIS supports non-spatial data and two kinds of spatial data: vector and raster

GIS Terminology - 2

- A utility network in an enterprise GIS connects related spatial features together to enable the determination of flow and direction, such as the flow of water
- A transportation network also connects features together, but to enable the determination of the shortest distance between two points
- A topology is a set of rules that enable spatial entities to relate to each other. These relationships can support spatial data constraints, or spatial area containment
- Domains are constraints on entity attributes in order to manage the values that those attributes can be assigned

Conceptual Data Model

- Identifies the highest-level relationships between the different entities
- Very abstract, no technical detail
- End result: logical groupings of data

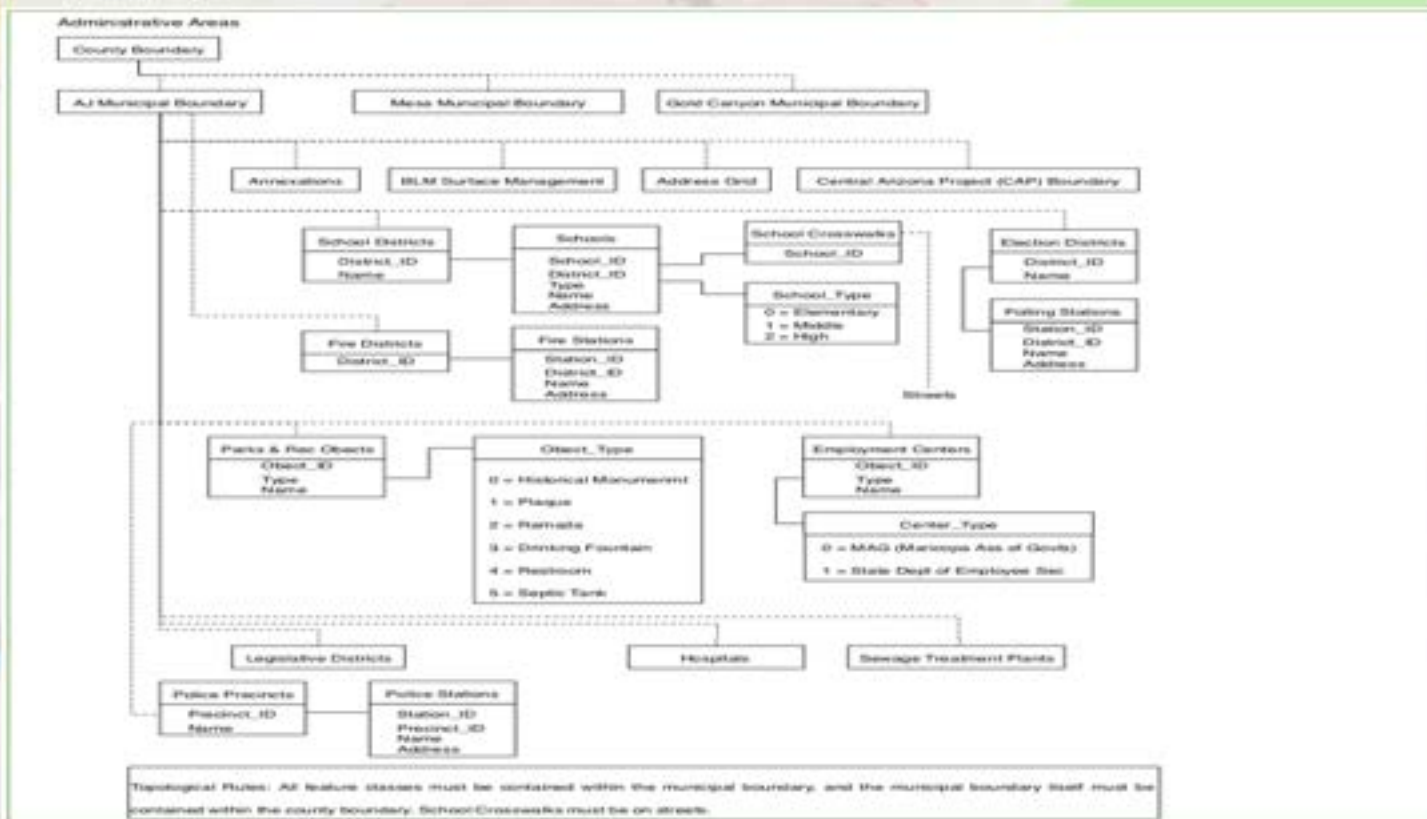
Department	Existing Data	GIS Functions
GIS Coordinator	GIS Internal Data: Basemaps, Rasters, DataOwners Table, MBRs; ArizonaBLM: Surface Mgmt Area PLSS Datasets; ArizonaCAP: Reach body, Centerline; County Boundary: External, Internal, State Boundary; School Districts: Schools, School Districts; Surface Management: Surface Mgmt Lines, Surface Mgmt Area; Rasters: DEM Contour 100', DEM Contour 10', DEM 10m, DEM 10m Hillshaded; Federal Census Data: Zipcodes, Tracts, Groups, Blocks; SRP: Substations, Transmission Lines, Survey Control Points, Parcel Points, Parcel Extents, Address, Accessways, Working Lines, Working Points;	GIS Development and Maintenance, Datasets external to the city, Features and datasets related to GIS functions



Administration	Land Usage	Utility Networks
City Limits County Boundary District Boundaries Point Features Schools Fire Stations Voter Polling Stations Hospitals Police Stations Employment Centers Historical Monuments Plaques Restrooms Zip Codes	Plans Parcels Owners Addresses Multihome Permits Property Tax Records Zones	Watersheds Water mains Hydrants Valves Wells Floodplain Tanks Reservoirs Meters Channels Culverts Outfalls Wet Crossings

Logical Data Model

- describes the data in as much detail as possible, without regard to how it will be physical implemented in the database
- Technical detail: generic data types and entities



Problem Statement

- City's procedures old, outdated
- City's departments use their own, proprietary GIS software
- GIS technology funding tightly constrained

Background

- 4/2016 – City Council approves hiring of GIS coordinator
- 5/2016 – GIS development approved; data entry begun
- Summer 2017 – City Council approves writing of 5 yr GIS Plan
- 11/2017 – GIS coordinator authorizes GIS simulation ONLY – no access to city's GIS systems or data, but can use the schema

The plan: simulate model without real data

- The original plan was to create some simulated datasets to use when designing the data model
- However, simulated data not needed because the implementation was not required

First Step: Gather business functions

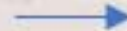
- Interview representatives of the various city departments
- Take notes
- Gather business functions from the notes



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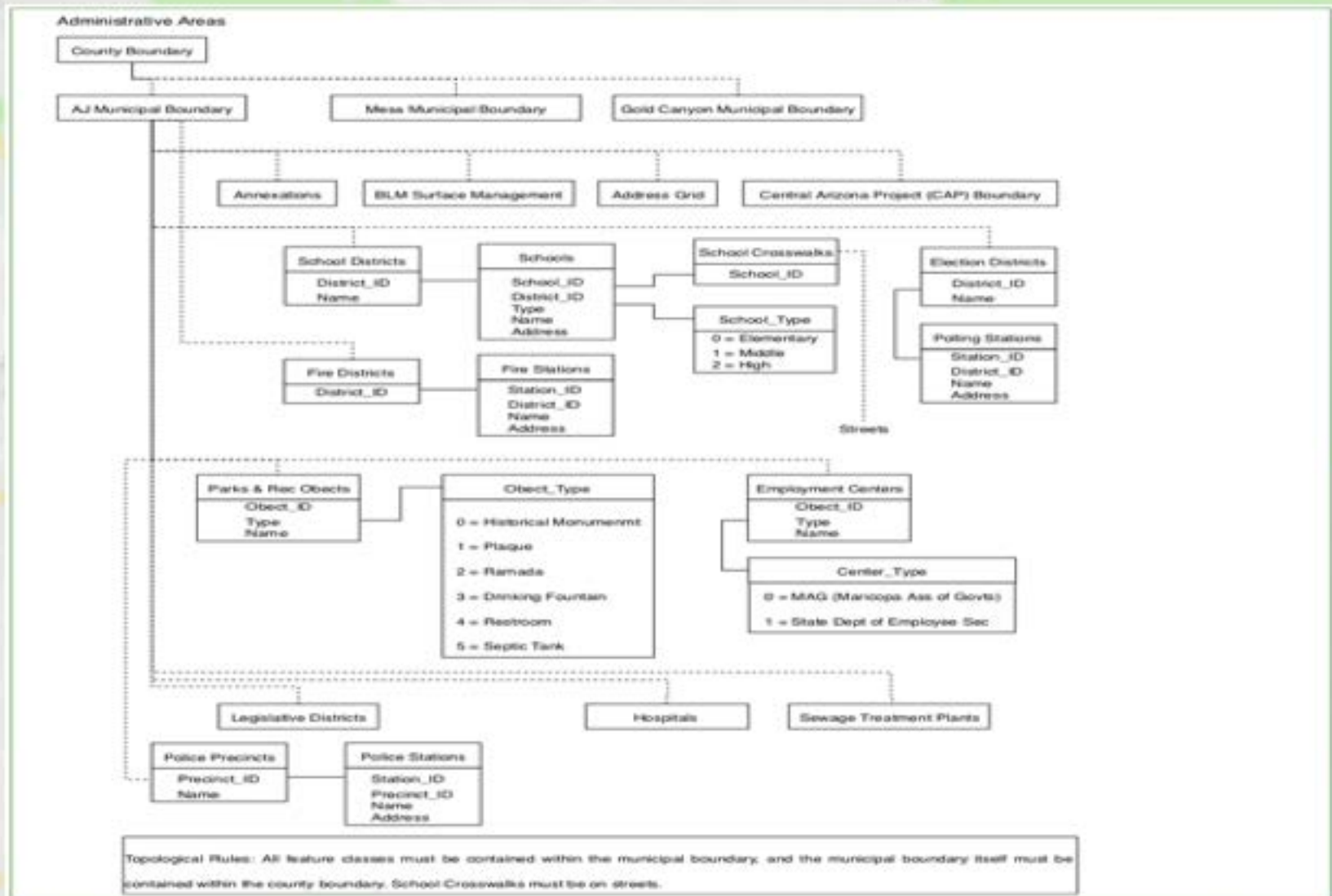
Second Step: Identify GIS Objects from Business Functions

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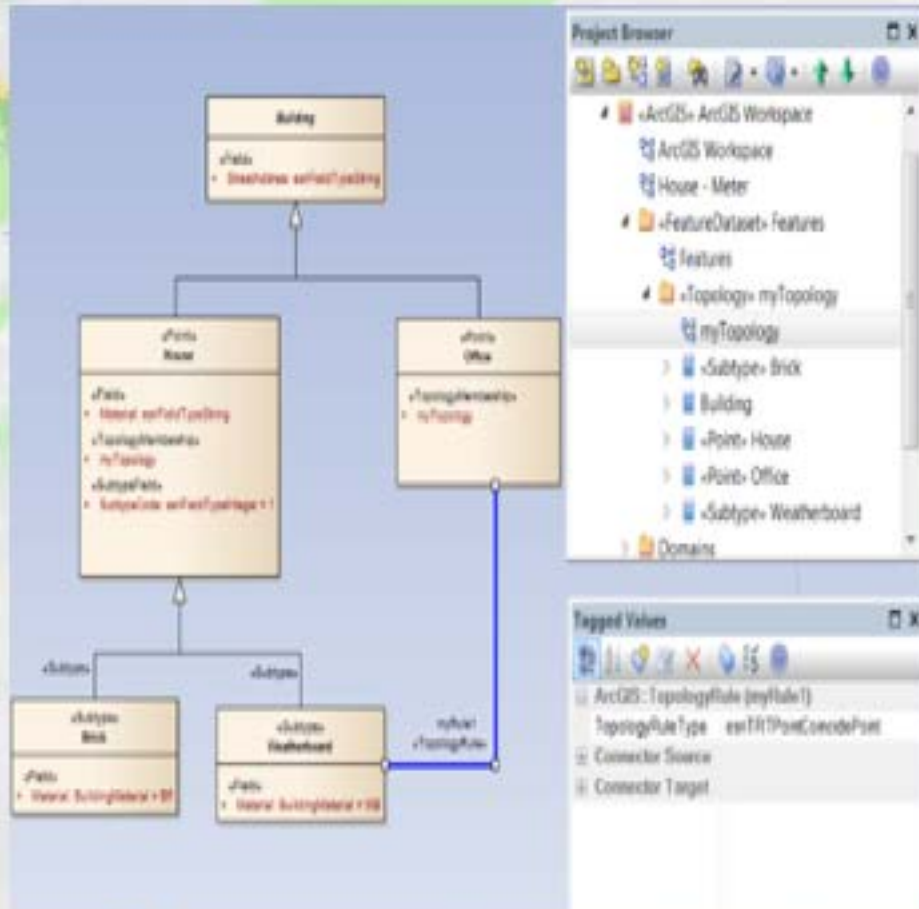


Administration	Land Usage	Utility Networks
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Third Step: Create Logical Schema



Implementation Using Enterprise Architect



XML
Document

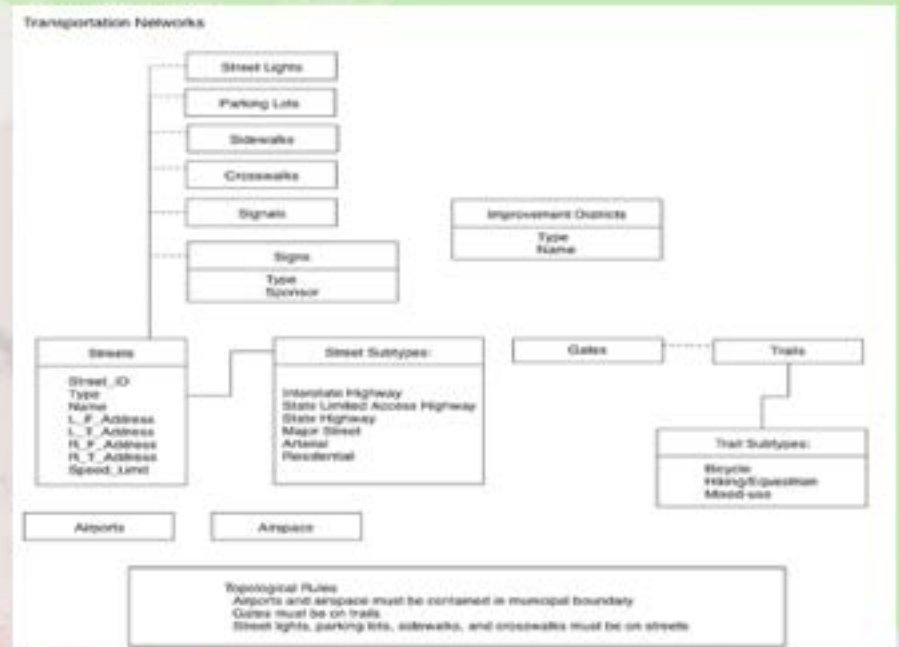


Database

Results: Schema Before... and After

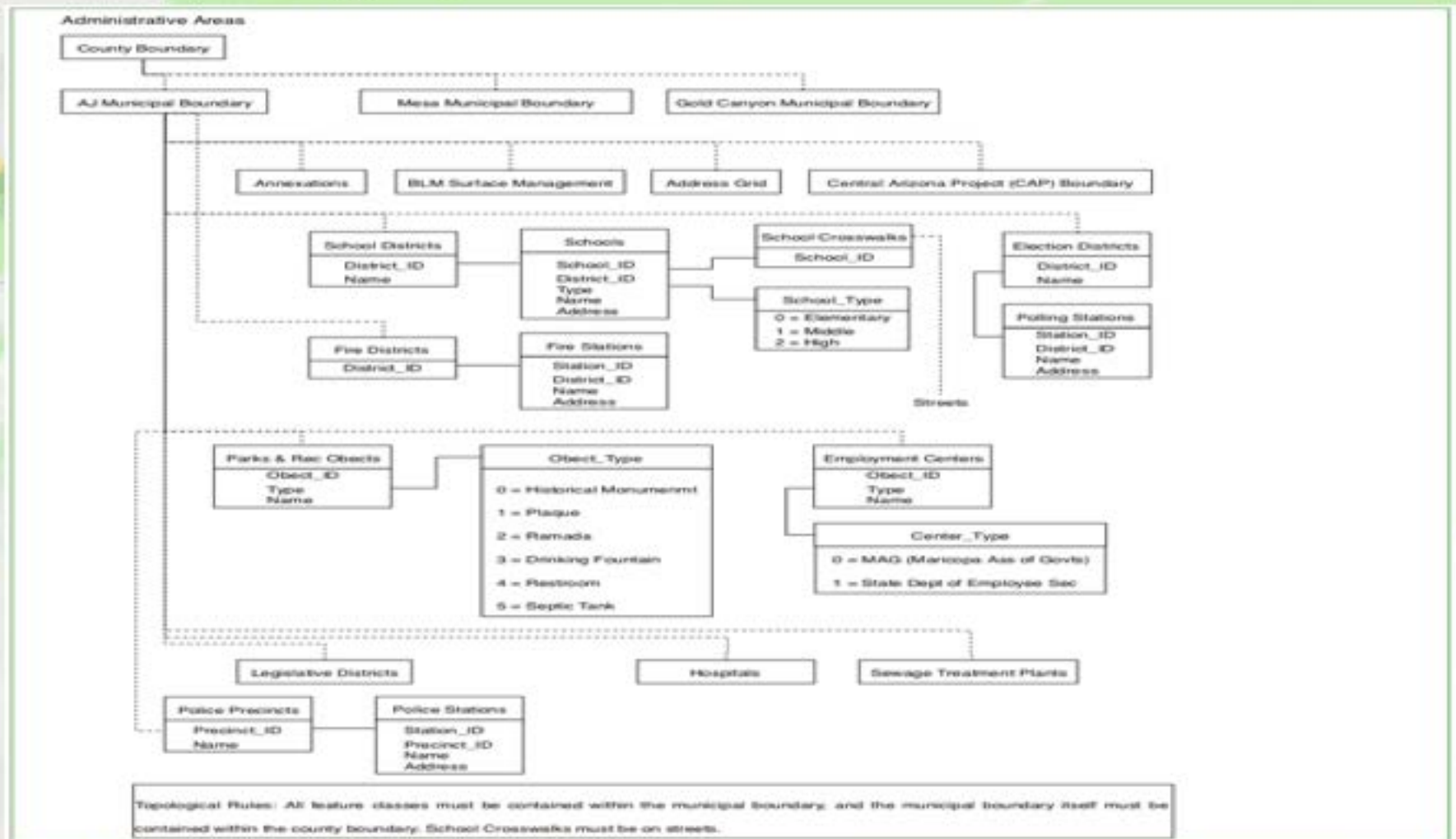


Duplicated objects and redundant attributes



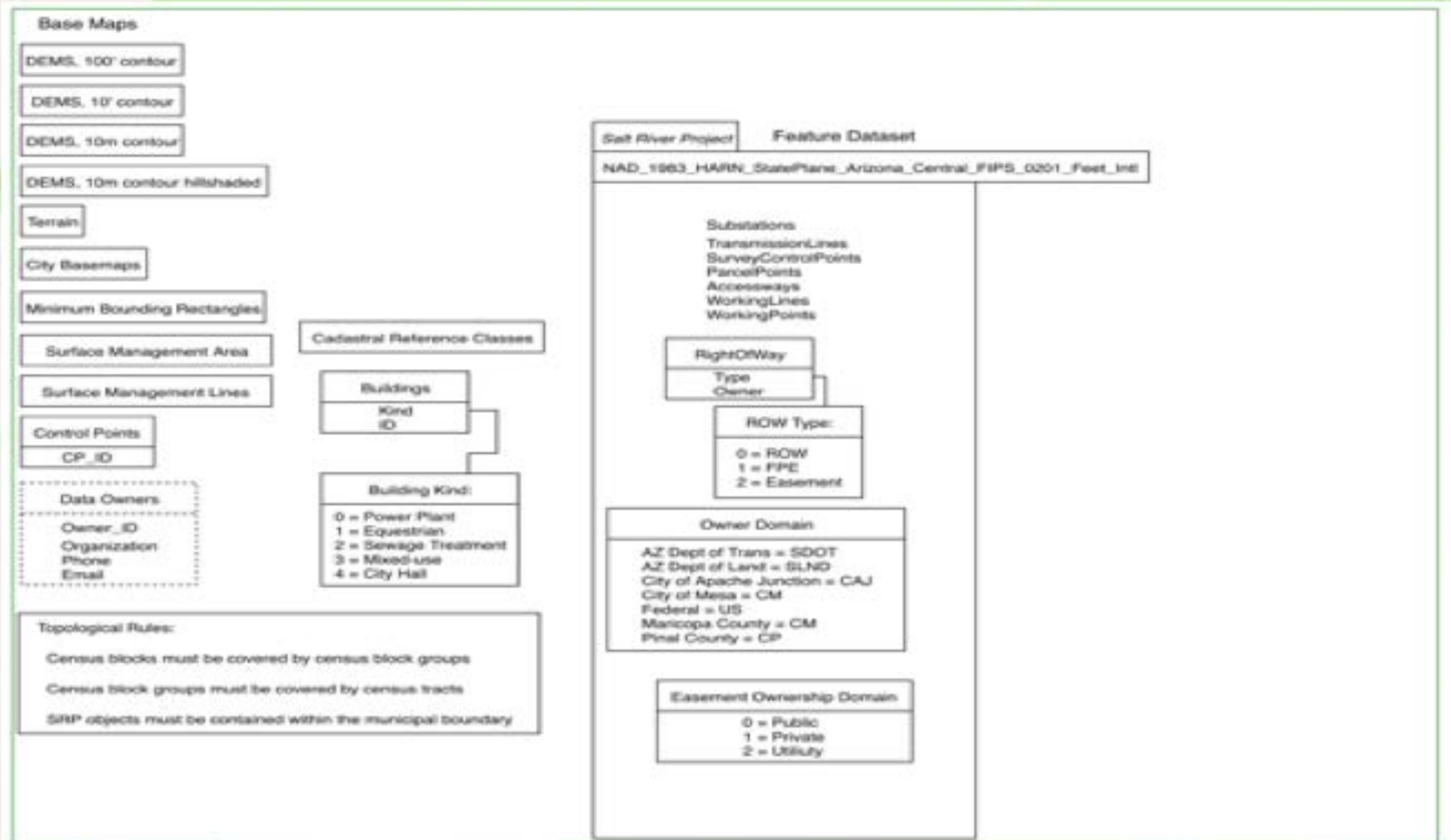
- Duplicate, redundant objects removed
- Relationships and topologies added to enforce data integrity
- Domains and subtypes added to enhance data accuracy
- Network functionality built-in for future use

Highlights: Administrative Areas



- Added containment topology, partly in support of unincorporated Pinal County 'Holes'
- Polygon feature – point feature – point feature relationships

Highlights: Base Maps

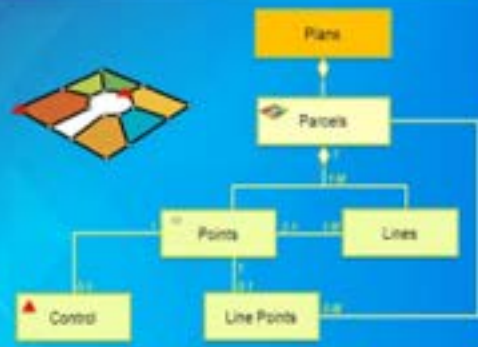


- Most reference objects, used only by the GIS Coordination team, moved here
- External objects from Salt River Project placed in their own feature dataset
- Data Owners table added for support of data accountability and audit trails

Highlights: Land Usage (Parcel Fabric)

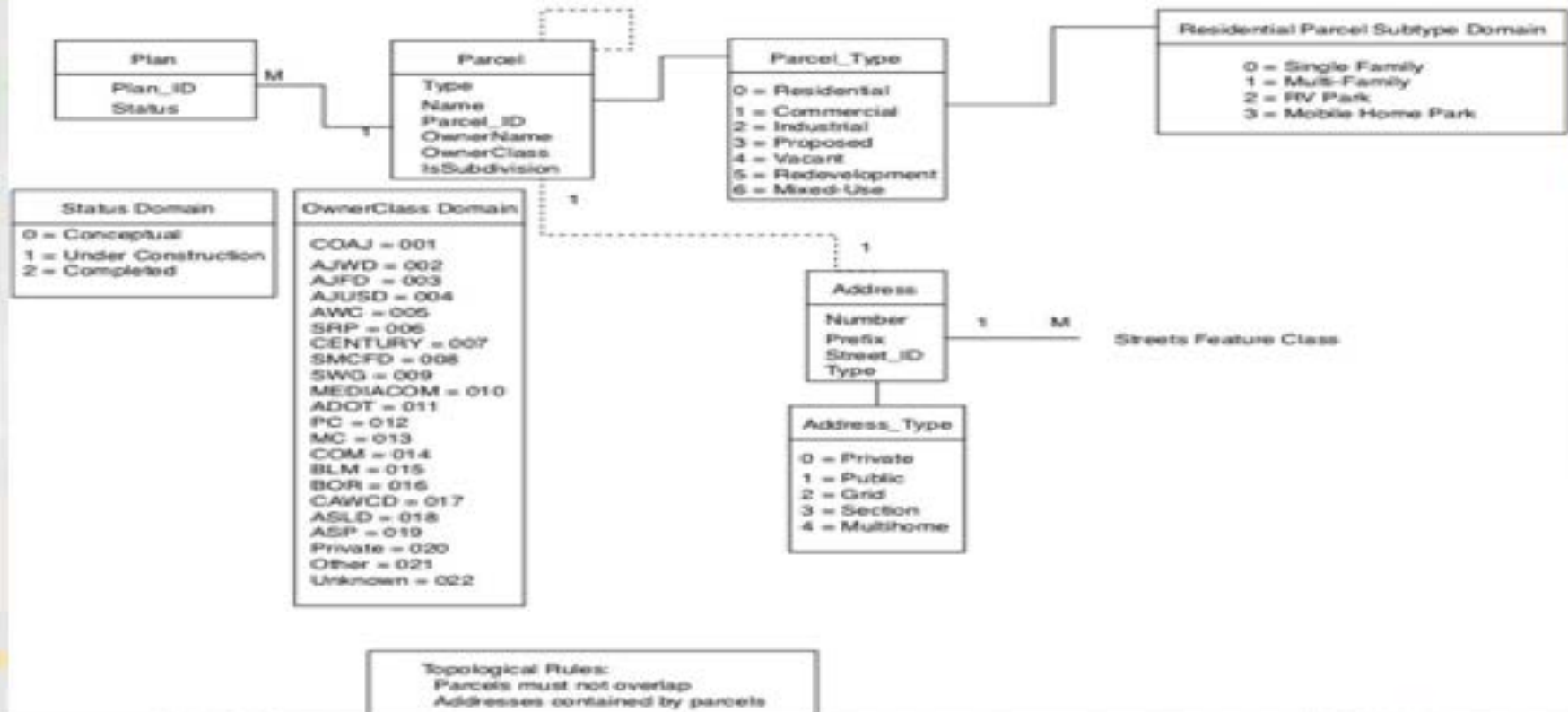
What is a parcel fabric?

- Dataset of related feature classes and tables
 - Polygons, lines, points, plans, etc.
 - Predefined system attributes
- Connected parcel groups
 - Form a parcel boundary network
- Explicit topology
 - Defined by common parcel corner points
- Parcel Editor toolbar

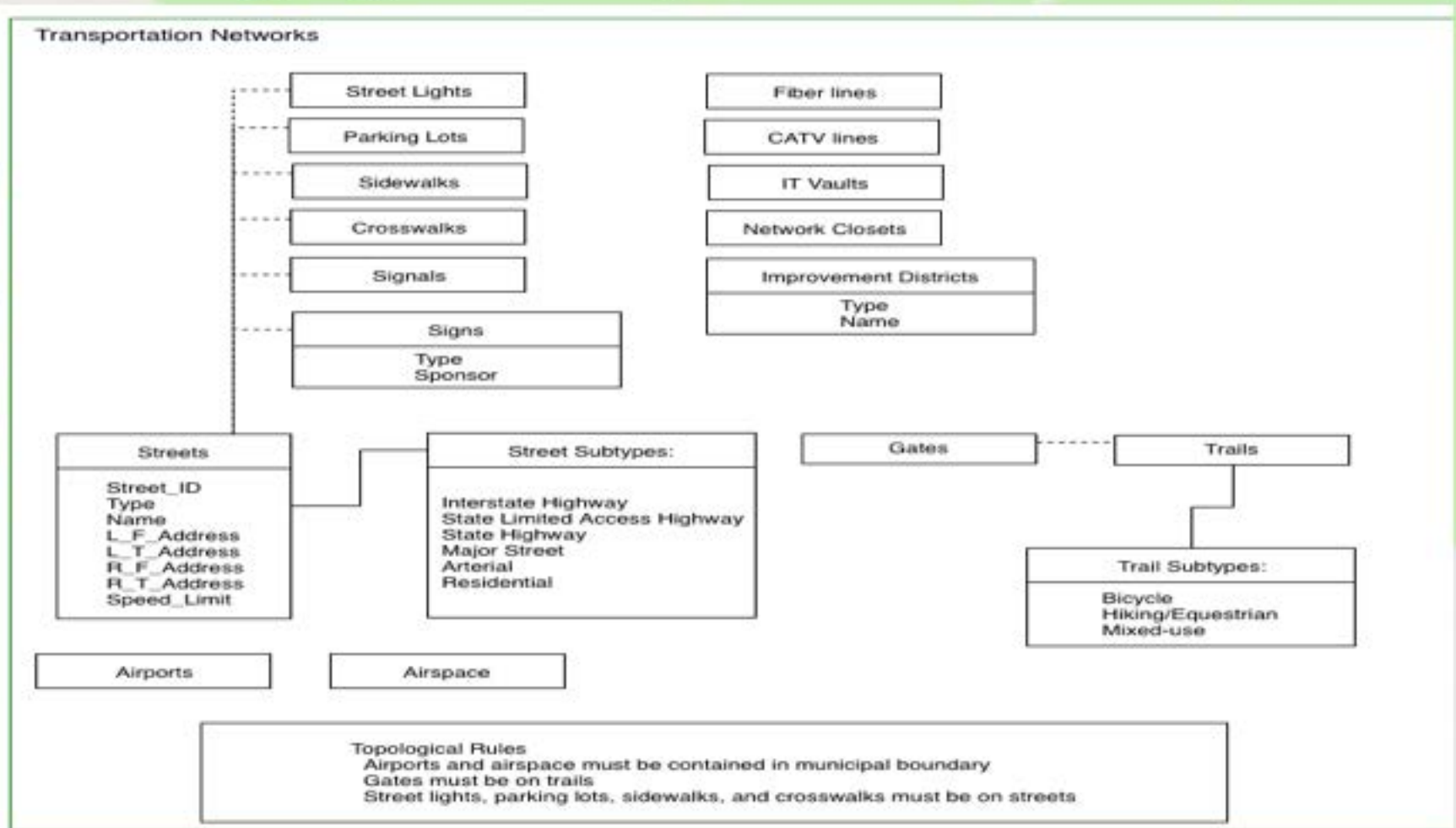


- Standardized, integrated
- PE Toolbar
- Parcel Workflows
- Tax parcels
- Plan directory
- History support

Land Usage (Development Services)

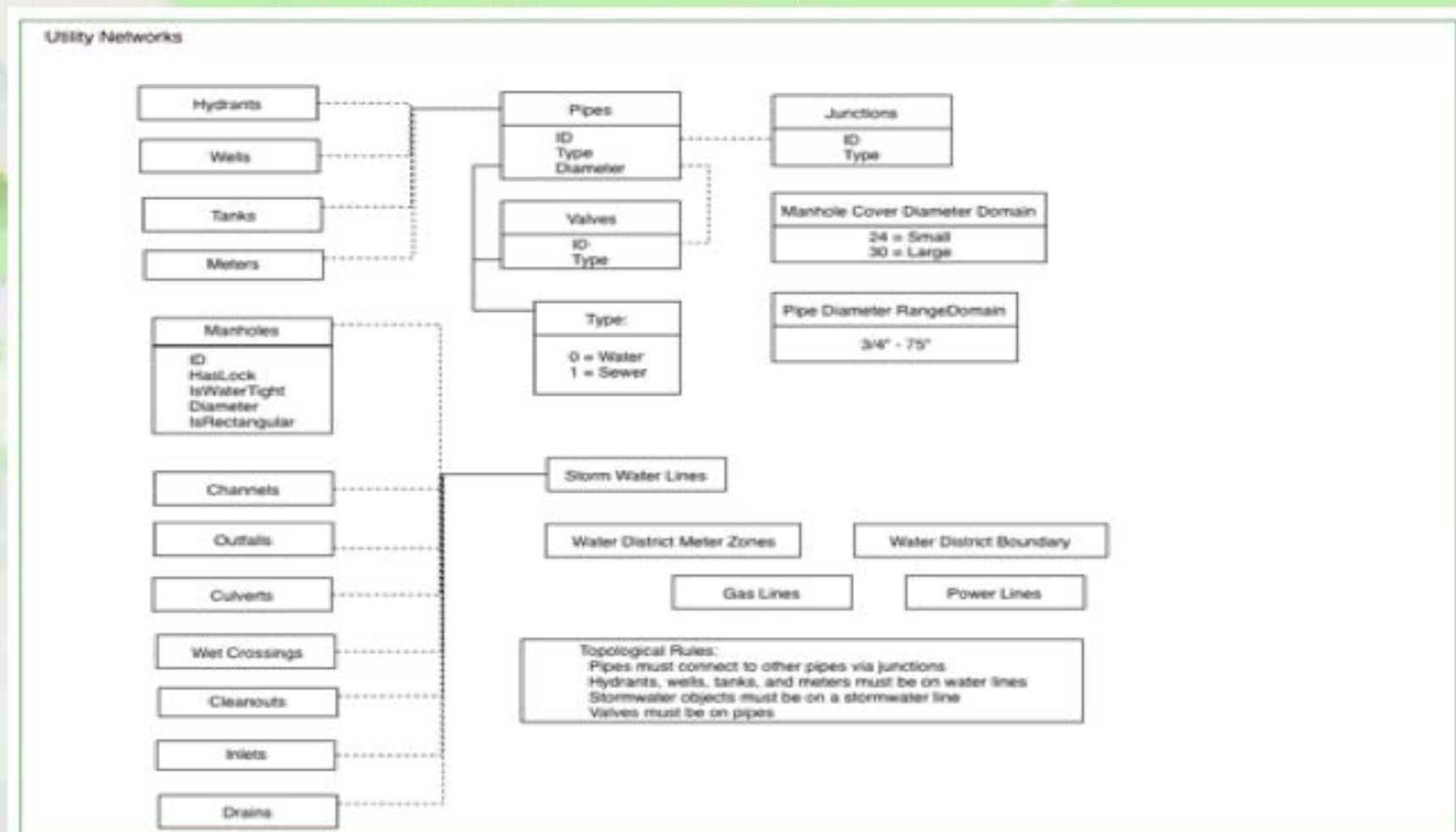


Highlights: Transportation (Network)



- Transportation feature dataset has companion: Transportation Networks
- In the future, this feature dataset and its companion will enable shortest-distance-between-two-points analysis

Highlights: Utility (Network)



- Utilities feature dataset has companion: Utility Networks
- In the future, this feature dataset and its companion, which supports geometric networks, will enable directional commodity flow analysis

Question and Answer Period

