Insight into the Utility Network

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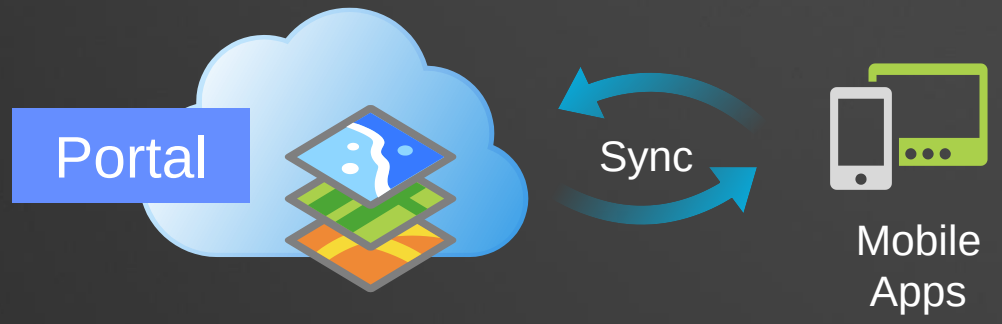
Utility network

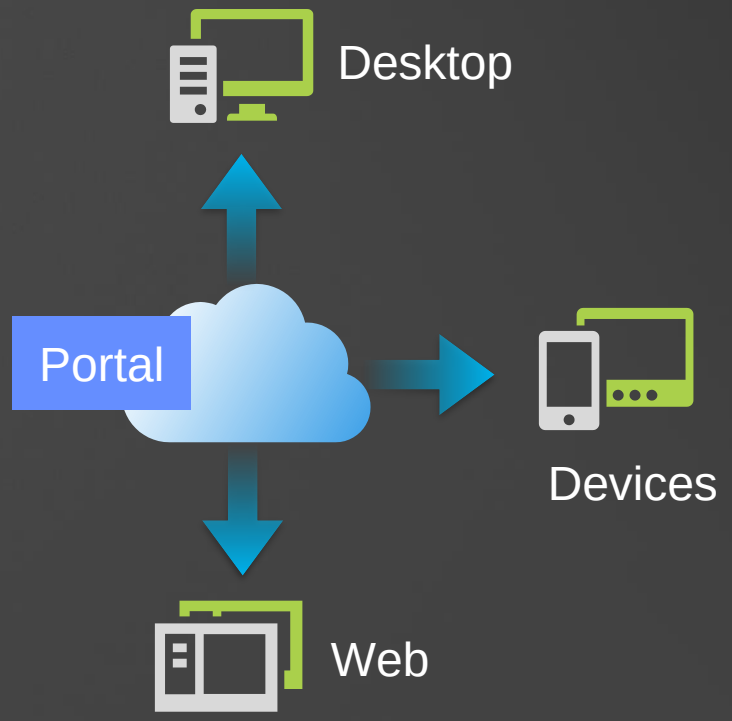
New network framework to support utility and telco solutions

Vision:

- Provide utility customers with the ability to model, edit, and analyze complex networks of facility infrastructure using all Esri platform clients
- Enable key modeling concepts to better support a true representation of what is on the ground, while fostering an easy exchange of network information with other mission critical systems



Network functionality everywhere



Utility network project

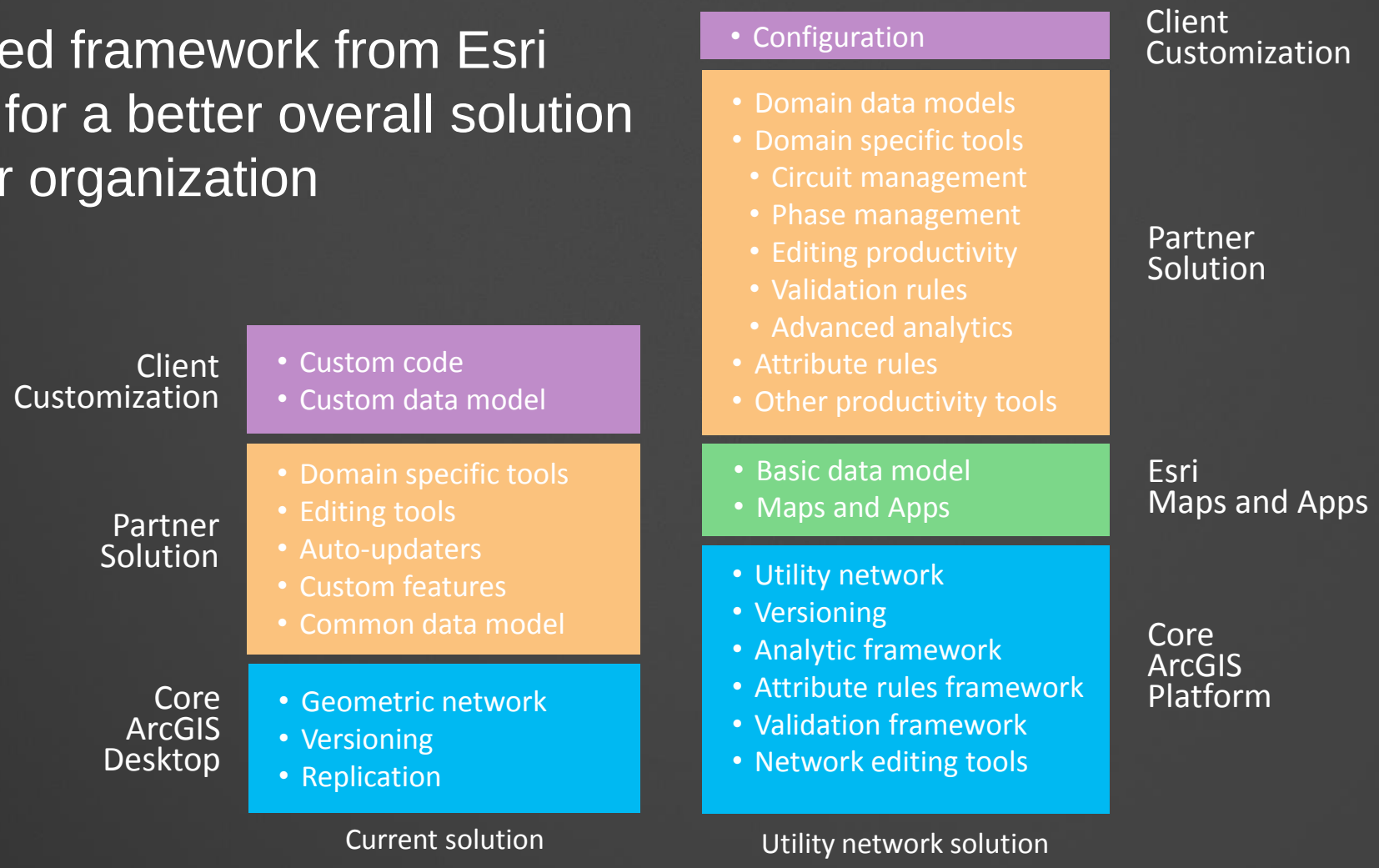
Key differentiators

- Cross platform support
- Services based architecture
- Updated network model
  - Connectivity associations
  - Containment associations
  - Structural attachments
  - Multiple terminals
  - Expanded tracing framework
  - Built in support for network diagrams
  - Validation framework
  - Basic source management
  - Export capabilities
- Updated transaction model
  - Based on change tracking model
  - More flexible, less overhead
- Attribute rule framework
  - Cross platform scripting capabilities
  - Scripts execute as features are updated
- Enhanced editing experience
  - Expanded feature template model
  - Snapping based on connectivity rules
- Composite map and subtype layers
- Central storage of maps and projects

Utility network

Building a better framework

- Improved framework from Esri makes for a better overall solution for your organization



Utility network

One or more domain networks

- Conceptually, the utility network is composed of a structure network and one or more domain networks
  - Each domain has a collection of networks (e.g., in electric domain: transmission, distribution, and structural; the gas and water domains could also include cathodic protection)
  - An organization determines which of the networks is relevant for their business (e.g., some will not manage or maintain transmission, only distribution, or vice versa)

Water network
- Water network
- Sewer network
- Structural network
- Cathodic protection

Gas network
- Gas network
- Structural network
- Cathodic protection

Electric network
- Transmission network
- Distribution network
- Structural network

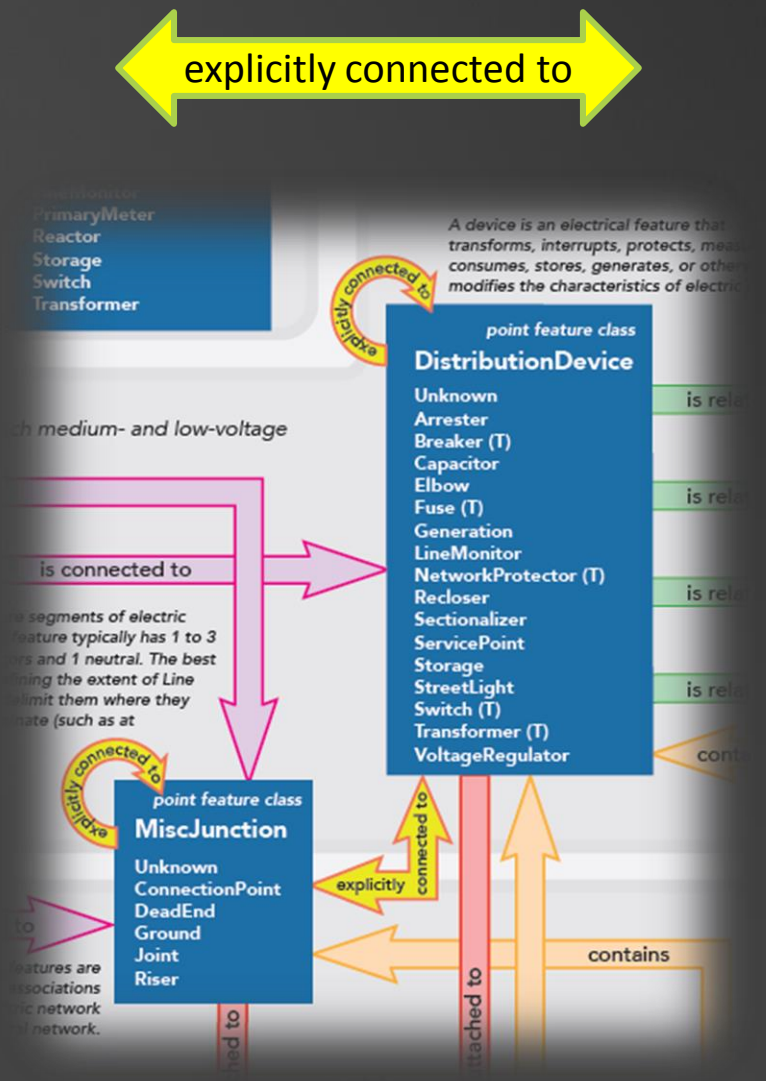
Telco network
- Fiber network
- Structural network

Demo

Utility network model

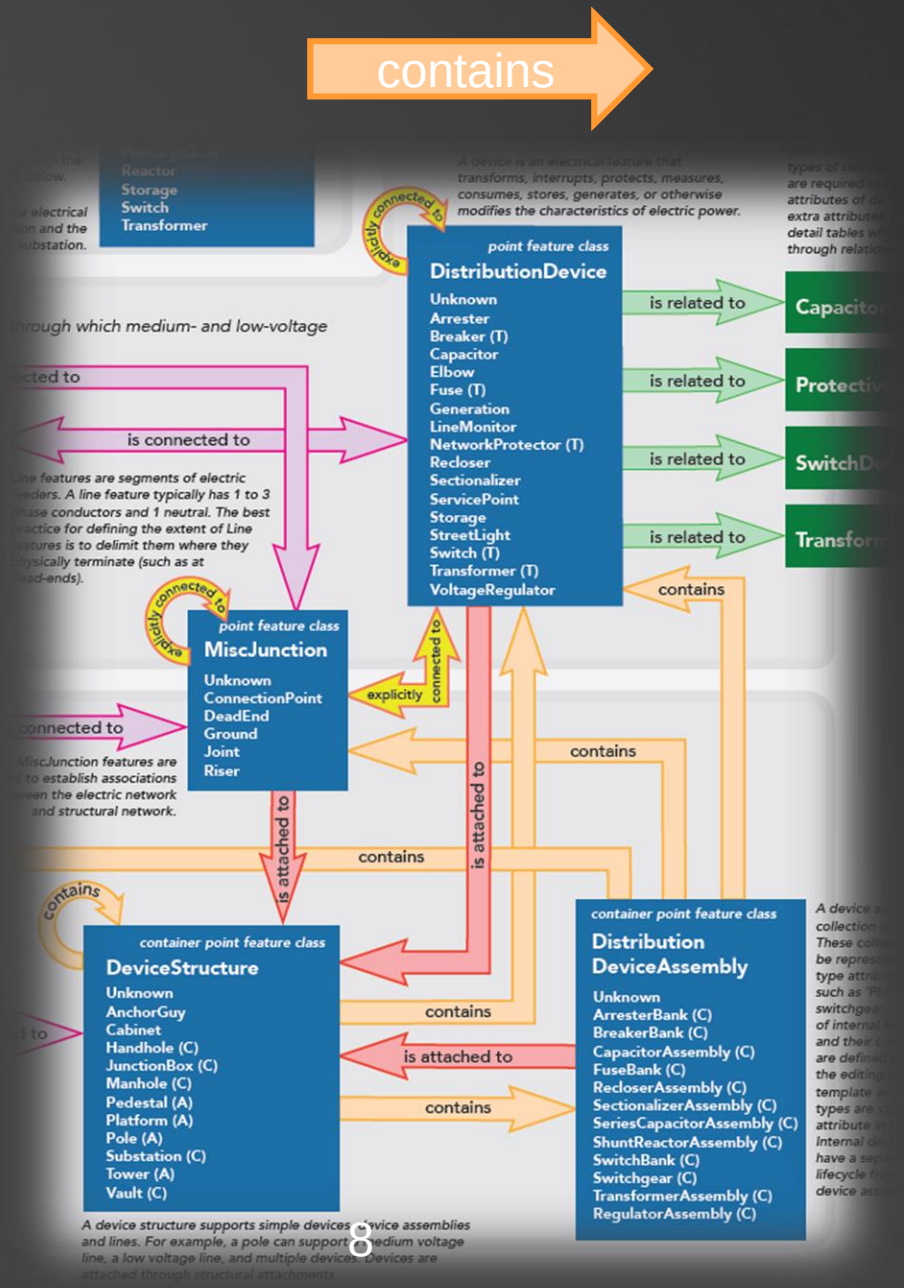
Connectivity associations

- Utility networks support connectivity based on x, y, and z coincidence
  - In addition, non-coincident features can also be connected
- Connectivity associations are used to model connectivity between two devices that are not necessarily geometrically coincident
- Connectivity associations are defined between two point features or between a line end and a terminal
  - Connectivity rules limit what can be connected



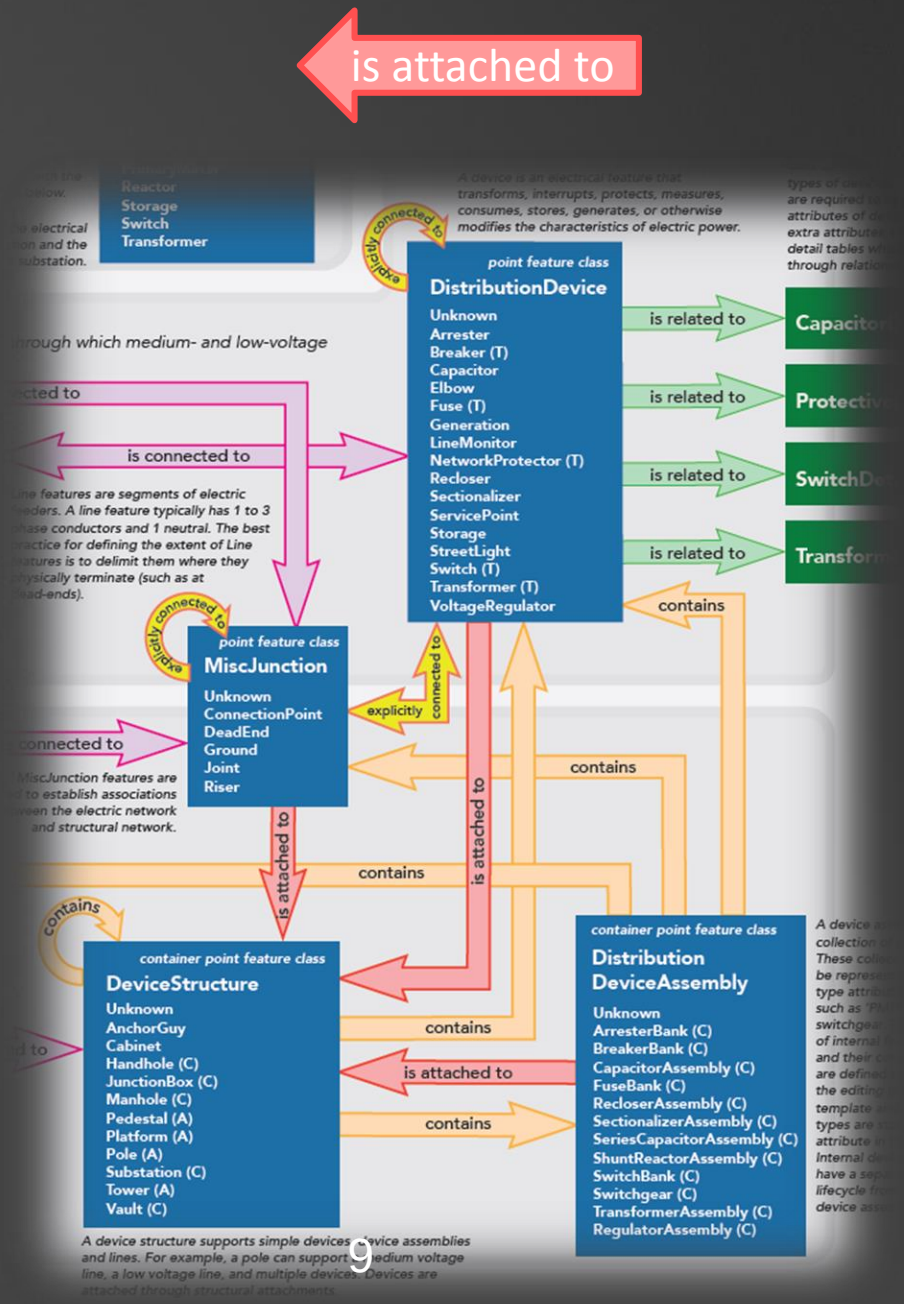
Containment associations

- Containment is used to model the association between devices and structures where the device is “contained” in the structure
  - E.g., a valve inside a pump station
- Only structures and assemblies can be containers
  - Devices cannot be containers, only content
  - Devices that are containers defined in data model
- Structures and assemblies can also be content
  - Lots of things can reside in a pump station or substation
- Containment associations can be supported on point, line, and polygon features



Structural attachment associations

- Structural attachment associations are used to model the associations between devices and above ground structures where the device is “attached” to the structure
  - e.g., a transformer on a power pole
  - Allows users to report all structures associated with a subnetwork
- Structural attachment capabilities are specified at the asset type level
  - An asset type can only support either structural attachments or containment; it cannot support both
  - Structural attachment rules are used to constrain what may be attached to what



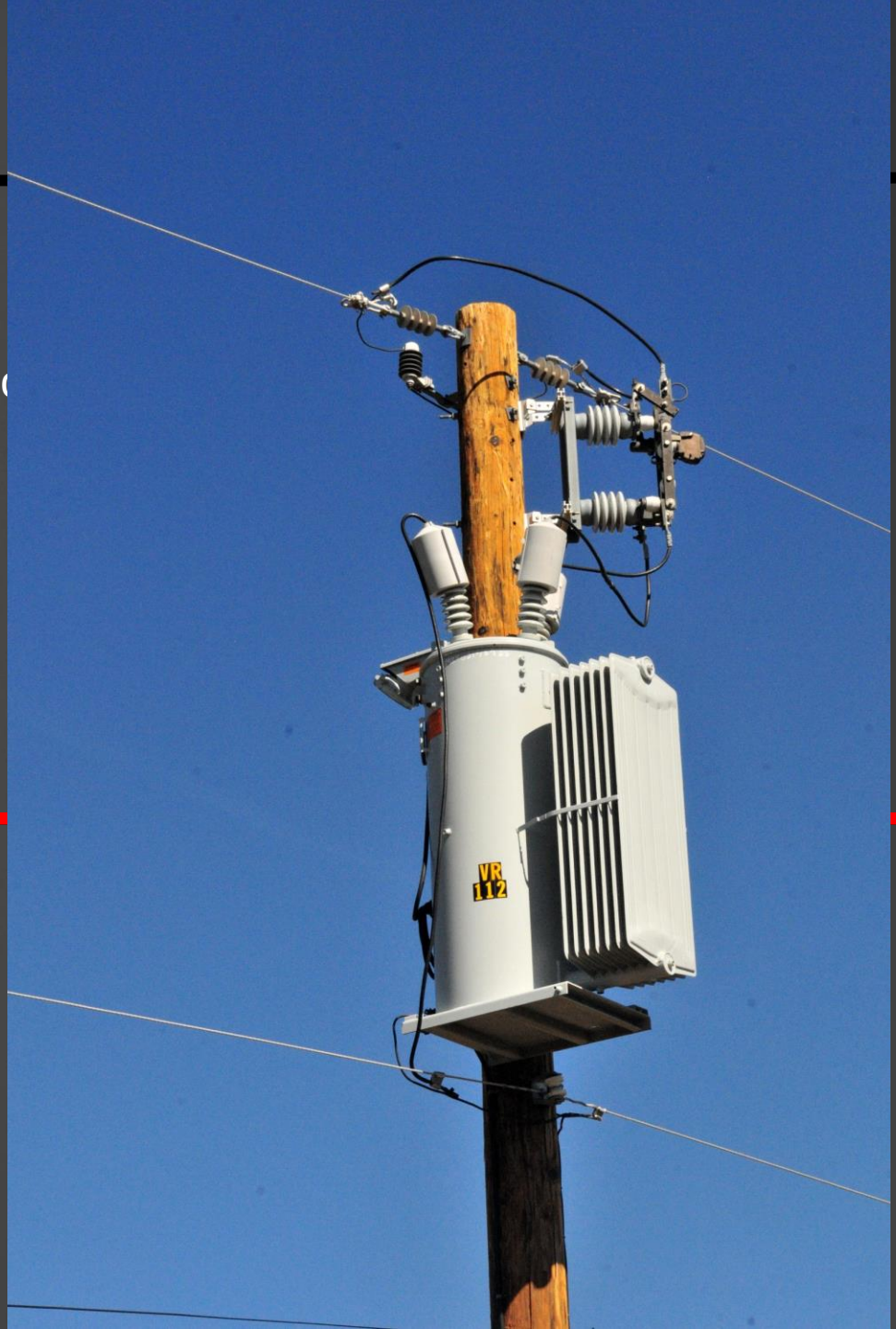
Terminals

- A terminal represents a connection point on a device
- Terminals support more realistic modeling of devices
  - Important for CIM as well as sophisticated analytics without data extraction
- Terminals are defined for certain devices; not all devices need to support terminals
  - Devices that serve as subnetwork controllers (sources or sinks)
  - Devices that require a high and low side for analytic purposes (e.g., transformers)
  - Devices whose traversal is asymmetric (e.g., network protector or a check valve)
  - Devices that require valences larger than two

Terminals

disc

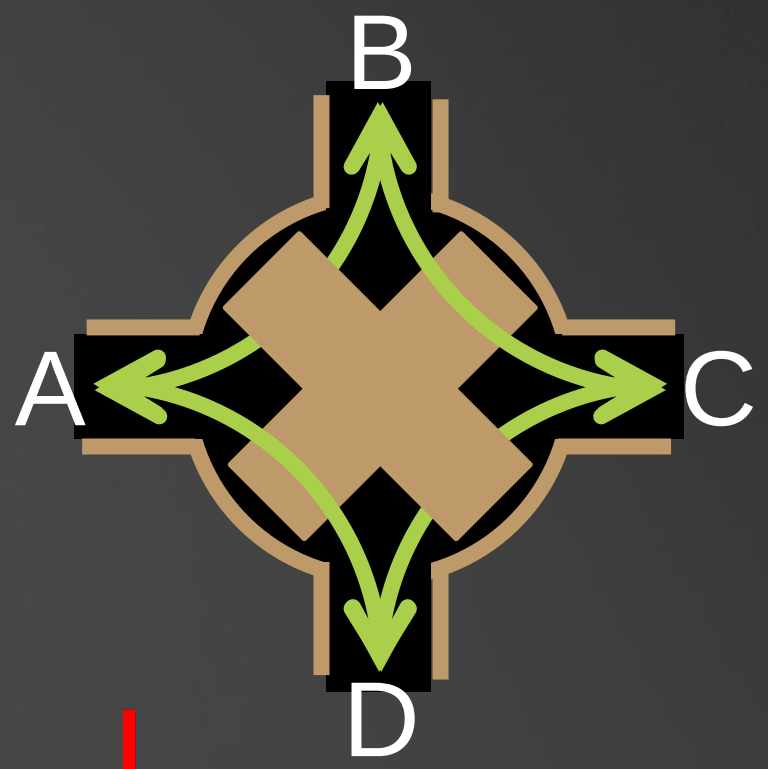
- Domains are used to constrain valid paths

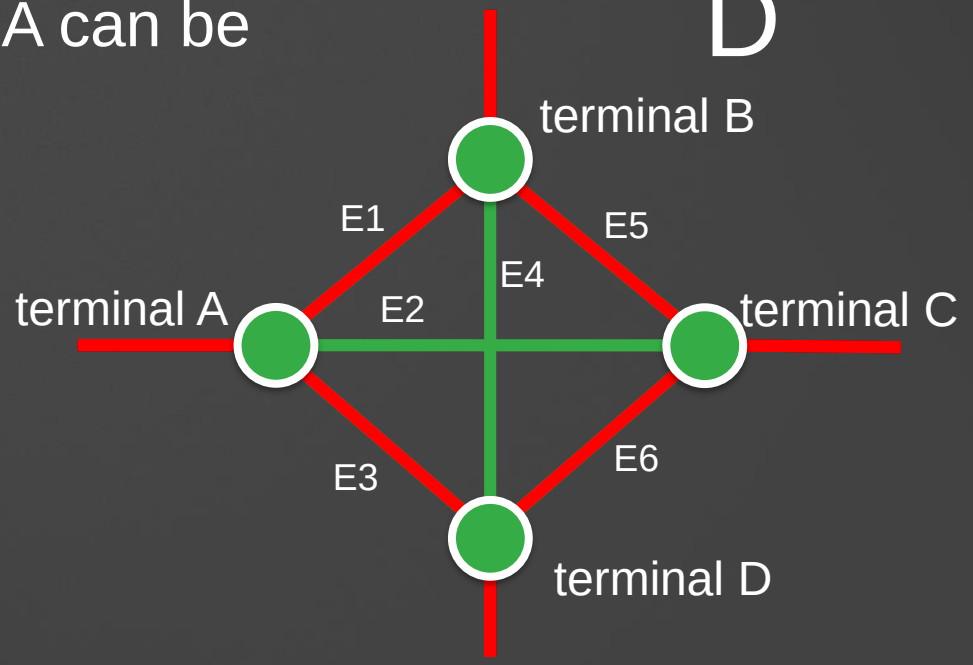


Terminals

Complex valves – dual flow 4 port diverter

- Another complex example from the water network domain
- With a dual flow 4 port diverter valve, A can be connected to B in parallel with C to D, or A can be connected to D in parallel with B to C
- Valid paths (enabled edges):
  - AB-CD: edge 1, edge 6
  - AD-BC: edge 3, edge 5

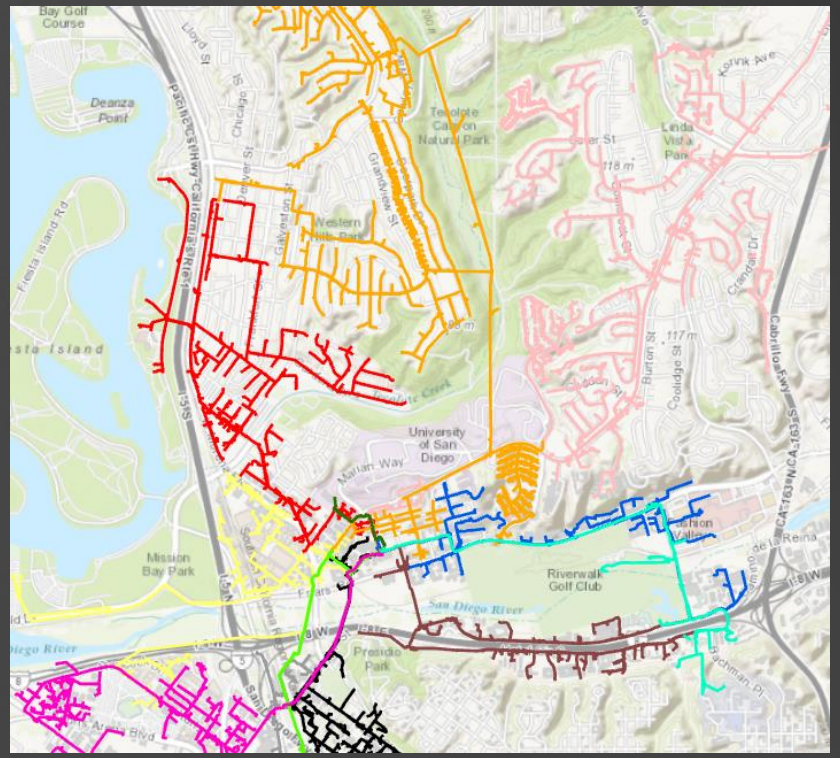




Subnetwork management

- Subnetworks are connected subportions of the network that are used for:
  - Driving analysis operations
  - Labeling/annotation, map making
  - Assigning units of work
  - Visualization (circuit map)
  - Exporting portions of the network

- Subnetworks correspond to circuits in electric, and pressure zone in gas or water
  - Structure networks do not have subnetworks

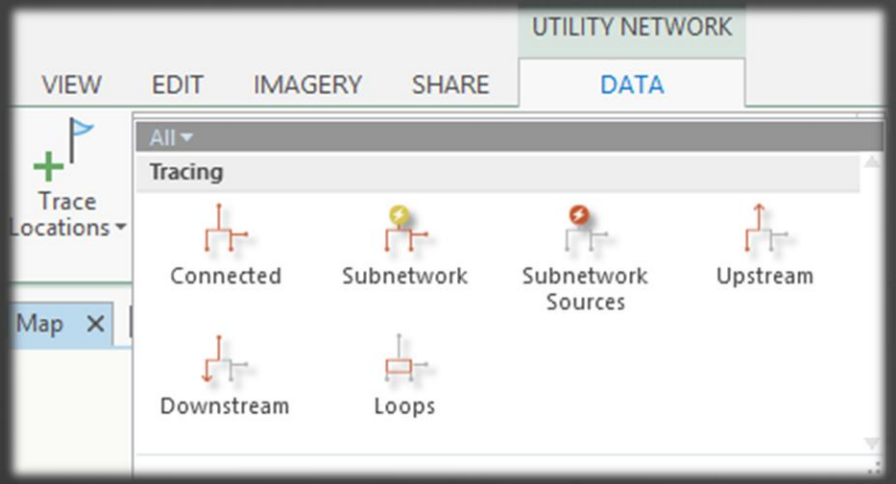


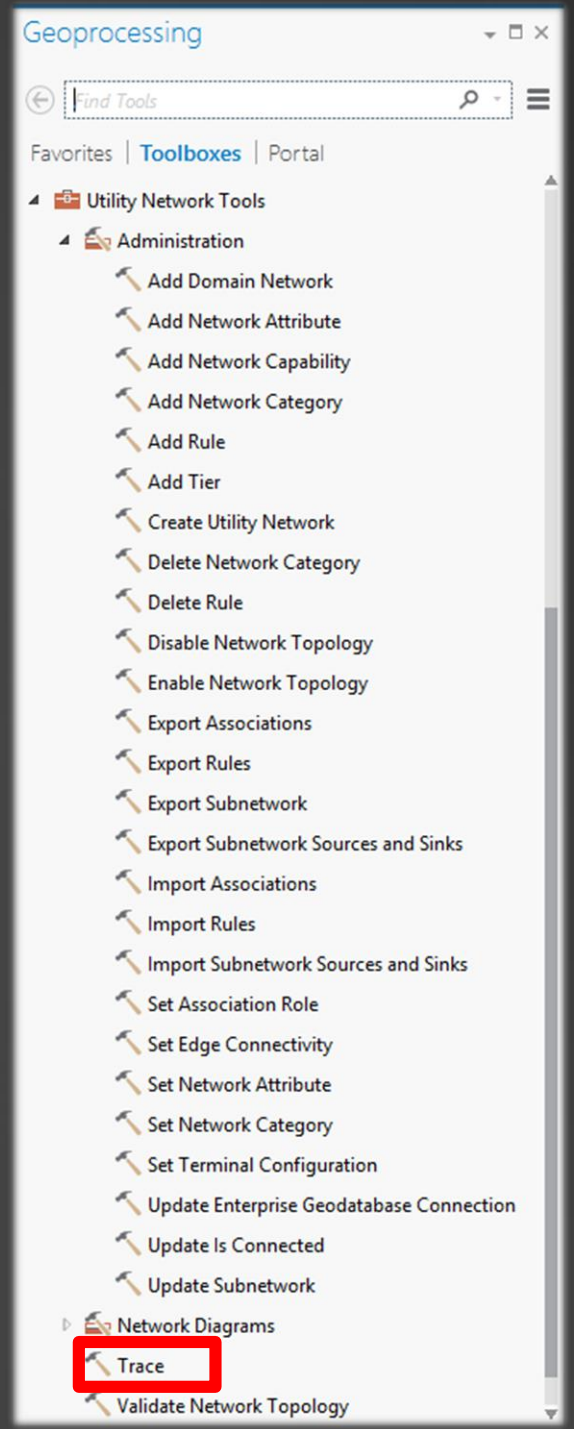
Demo

Subnetwork management

Tracing

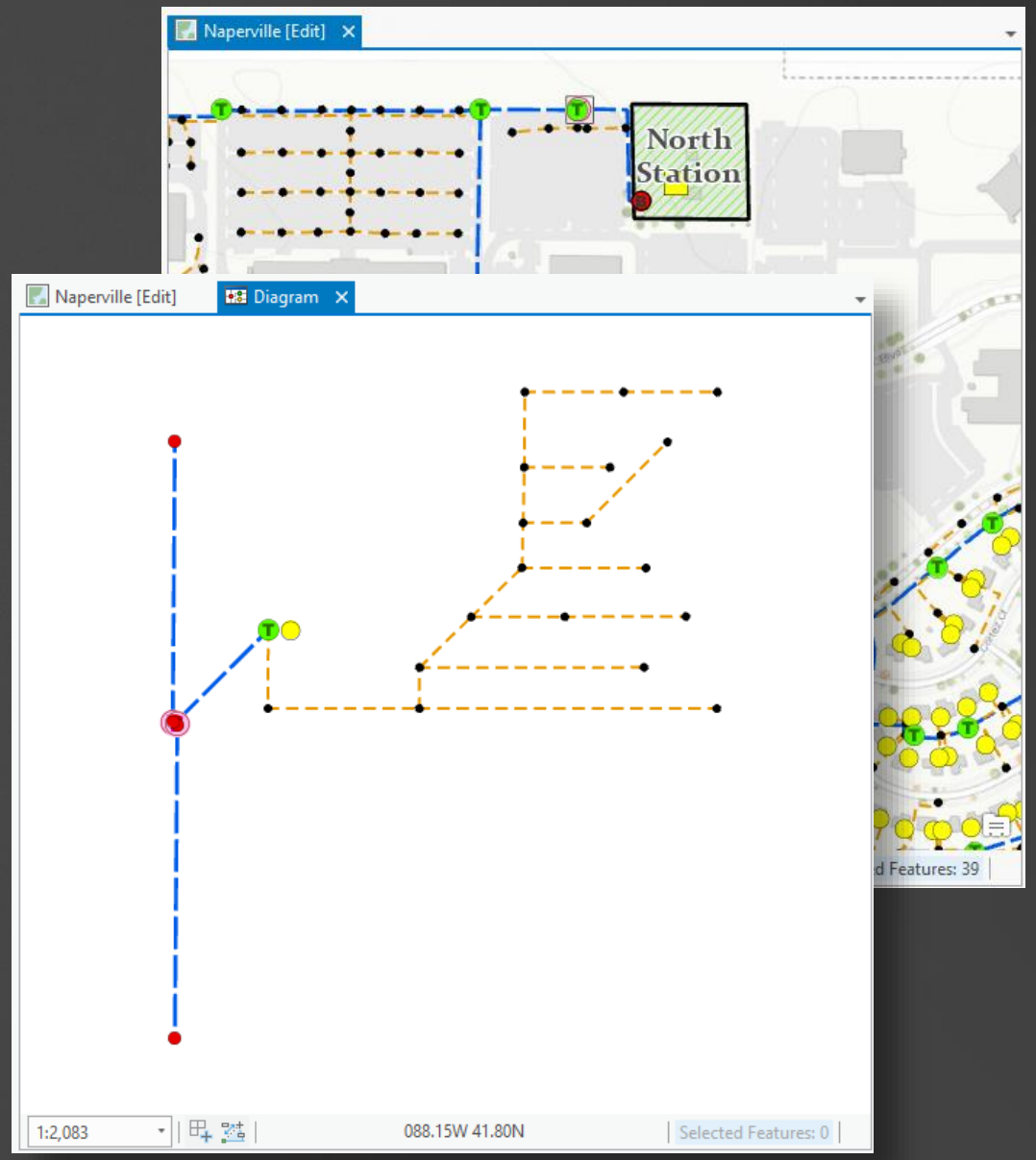
- Tracing is exposed in Pro as commands, as a GP tool, through the managed SDK, and as REST endpoints in the Utility Network Analyst service
  - Pro will come with basic preconfigured tools in the gallery
  - Business Partners and users can modify the gallery, adding and removing preconfigured tools





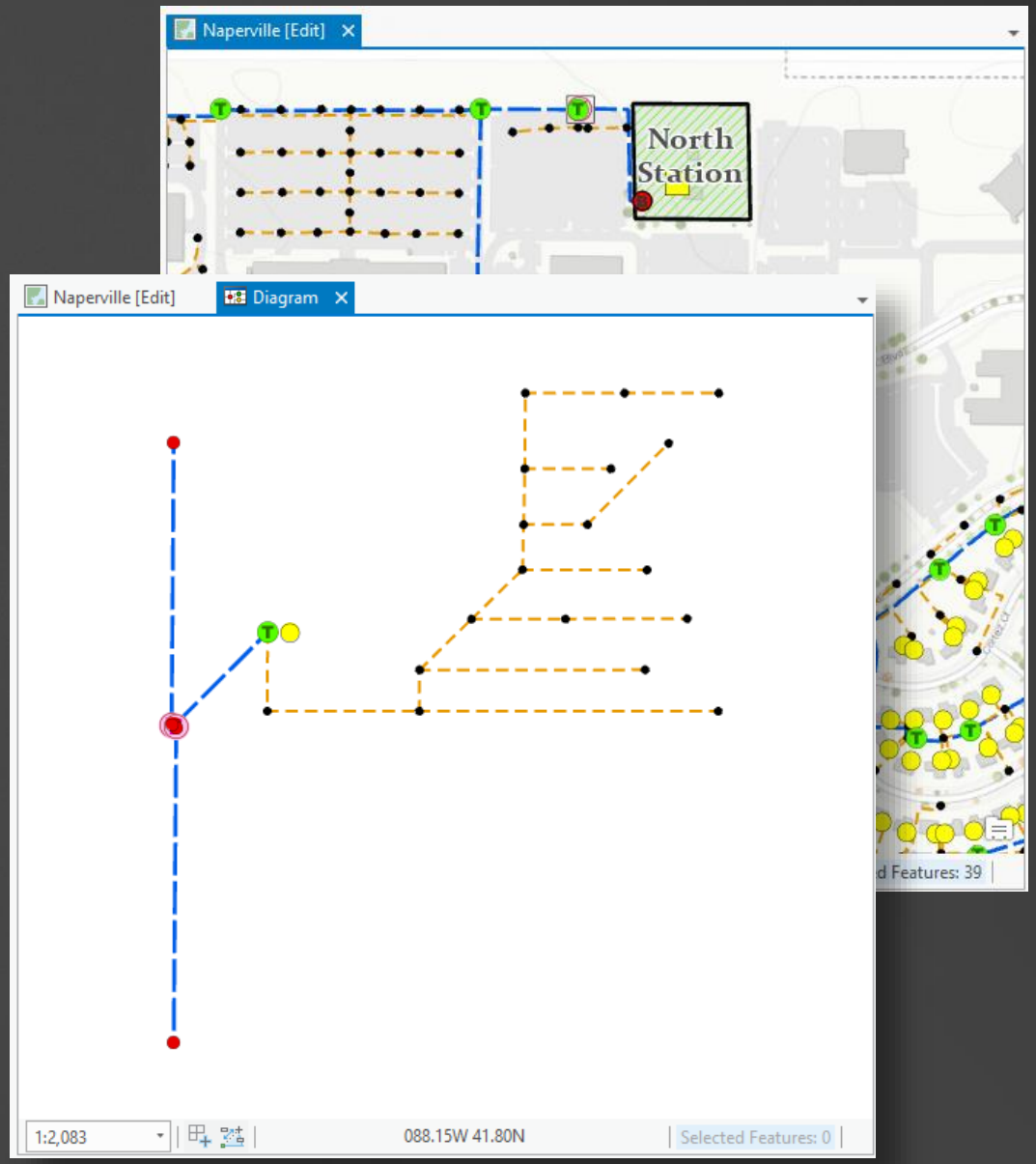
Network diagrams

- Integrated mechanism for utility network users to work with diagrams
- Comes with pre-configured schematic diagramming capabilities
- Default diagramming capabilities can be expanded to create simplified/enriched diagrams



Network diagrams

- Comes with a collection of layout algorithms to lay out diagrams content
- Users can control diagram persistence
- Diagram owners can control access rights on persisted diagrams
- Partners extend with custom layout routines



Demo

Analysis and diagrams

Validation of network topology

- Validation of data in the utility network is similar to topology validation
- The utility network information model will facilitate the specification of connectivity, containment, and attachment rules as part of the data model
- When features violate the specified rules, error features are created
- The user experience for discovery and inspection of errors is similar to ArcGIS Topology
  - Errors will be persisted in system maintained error tables at the workspace level
  - These error tables will be shared across the system

Transaction model

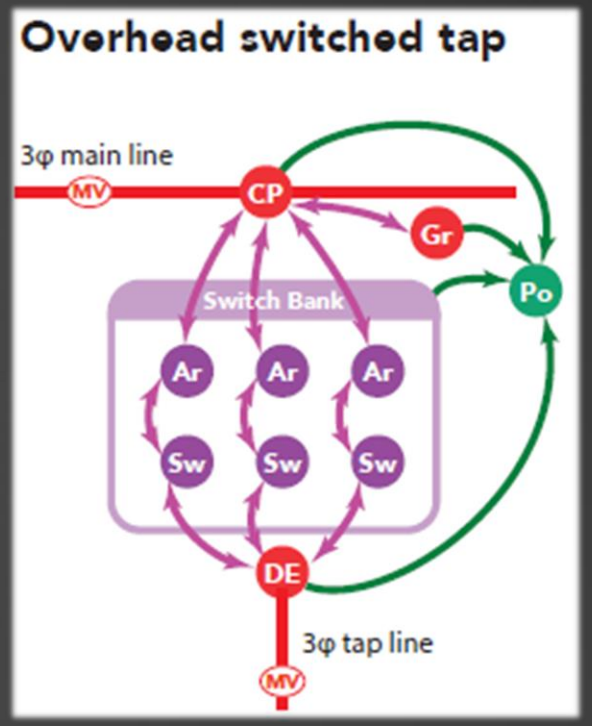
- Uses a new versioning model implementation
  - User experience is the same as with the current versioning model
- Three primary workflows will be supported:
  - High isolation (long transactions) when connected through Feature Service
  - Disconnected local editing (ArcGIS Pro or Runtime based apps) using Feature Services and Sync
  - Short transaction connected to the Feature and Utility Analyst services
- Benefits of the new versioning model:
  - No need to reconcile/compress nightly
  - Performance – well performing and scalable database queries
  - Temporal properties – history capabilities built-in, parallel posting, and future support for partial posting

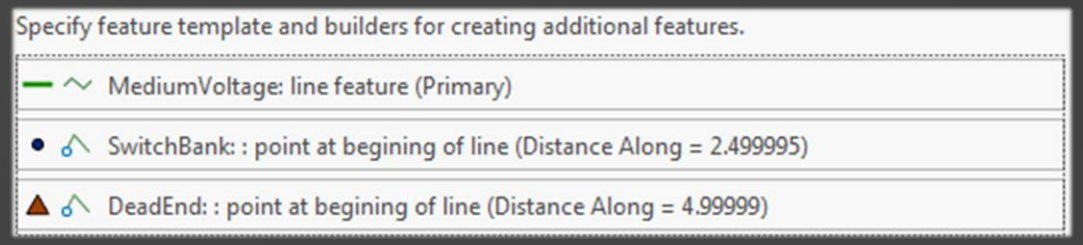
Attribute rules

- Configurable Attribute Rules will be exposed for the purpose of automatically populating field values for features
  - E.g., [fieldA] = [fieldB] + “::” + [fieldC]
- Cross platform scripting language ensures updates applied regardless of where edit performed (desktop, mobile, web)
- Attribute rule types:
  - Calculation rules – expressions that are used to populate attributes based upon other attributes on a single feature or other related feature
  - Constraint rules – expressions that specify permissible attribute configurations on a feature; when the constraint is violated, an error is raised when storing the feature
  - Validation rules – expressions that are checked during a batch validation process; applied when a feature is created, updated, or deleted

Editing

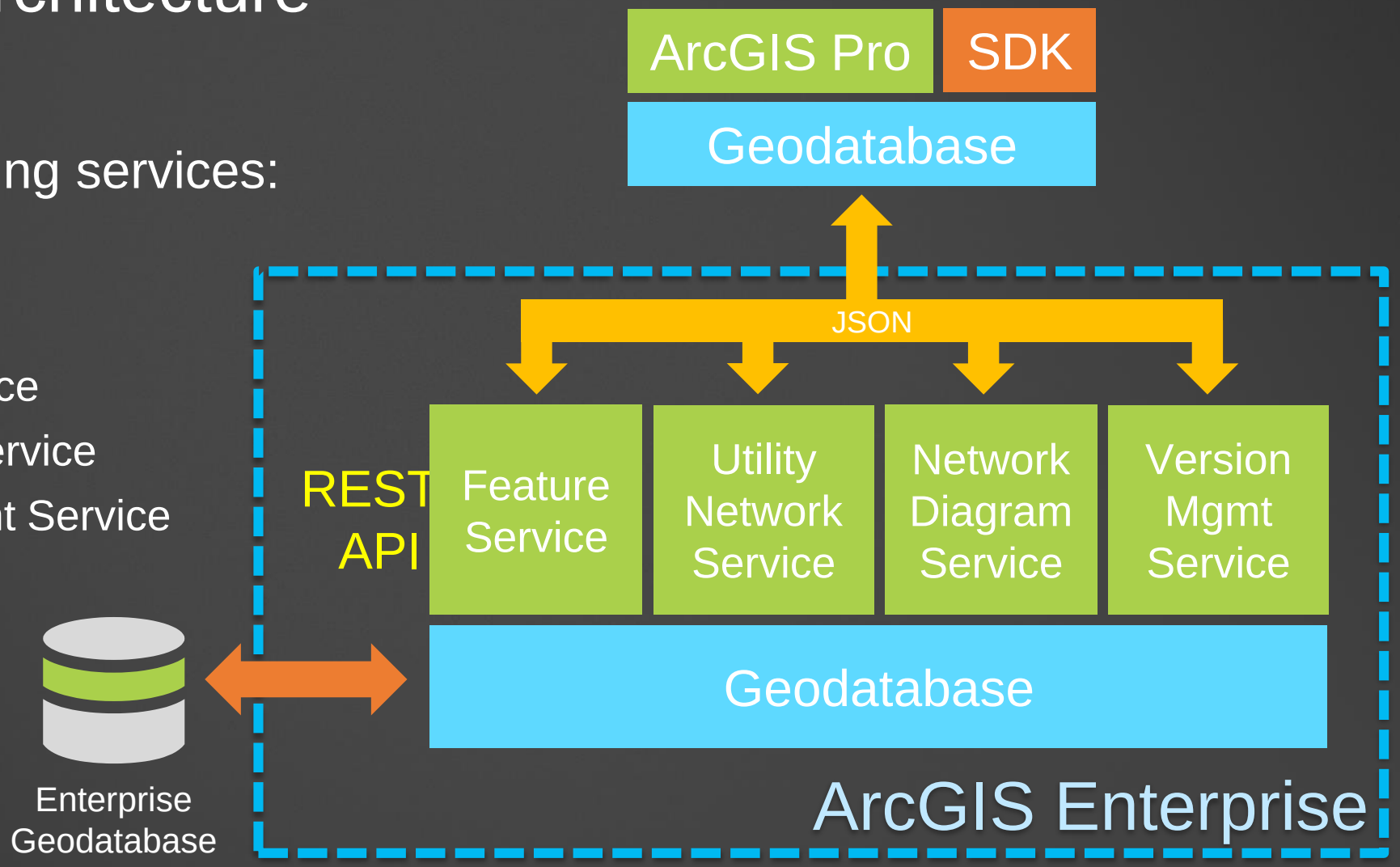
- Snapping based on defined connectivity rules
- Preset Template option for repeatable configurations
  - Automatic defining of containment, connectivity, and structural attachment associations during feature creation
- Storage of feature templates in the data source (e.g., the Geodatabase catalog)
  - Storage of template's definition (Group and Preset)
  - Storage of access requirements across the platform





Service-based architecture

- Extensions to existing services:
  - Feature Service
- New services:
  - Utility Network Service
  - Network Diagram Service
  - Version Management Service



Network management

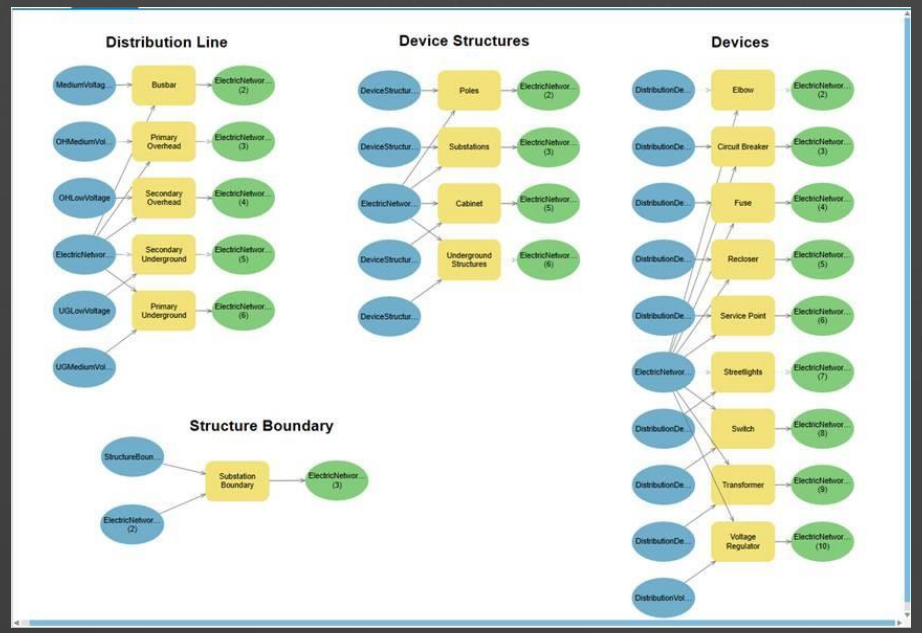
Partners continue to complete the solution

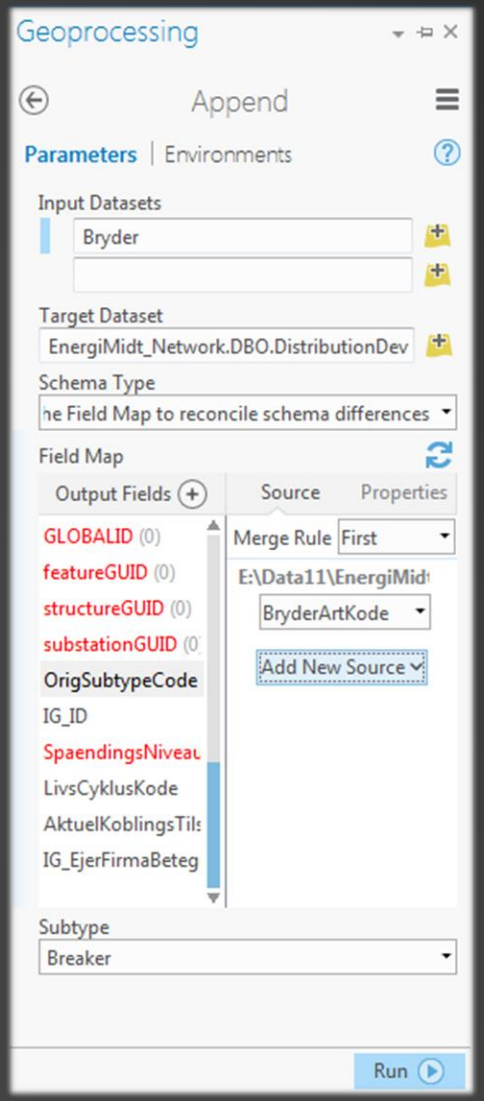
- Partners continue to extend and complete the solution
  - Partner solutions deliver: Design, Analytics, Analysis, Integration, Productivity, etc.
- Solution can be extended in different ways
  - Configurations, custom tools (desktop), services (including interceptors), custom applications (mobile and web), etc.

Network management

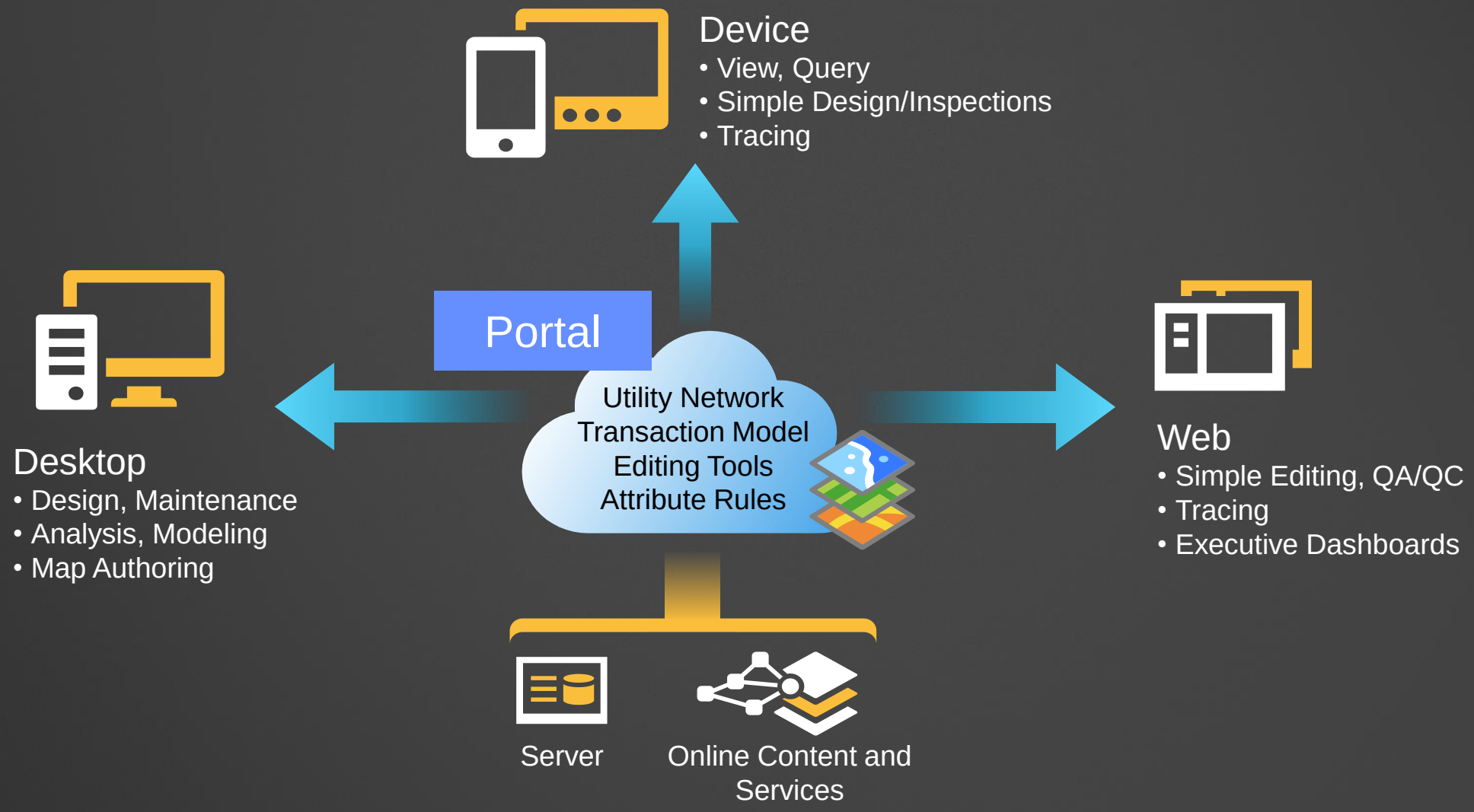
Moving to the utility network

- Partners continue to play key role in completing solution and assisting users in moving forward
- Esri provided data models
- Sample geoprocessing models and scripts to load your data





Continuing the growth of the platform



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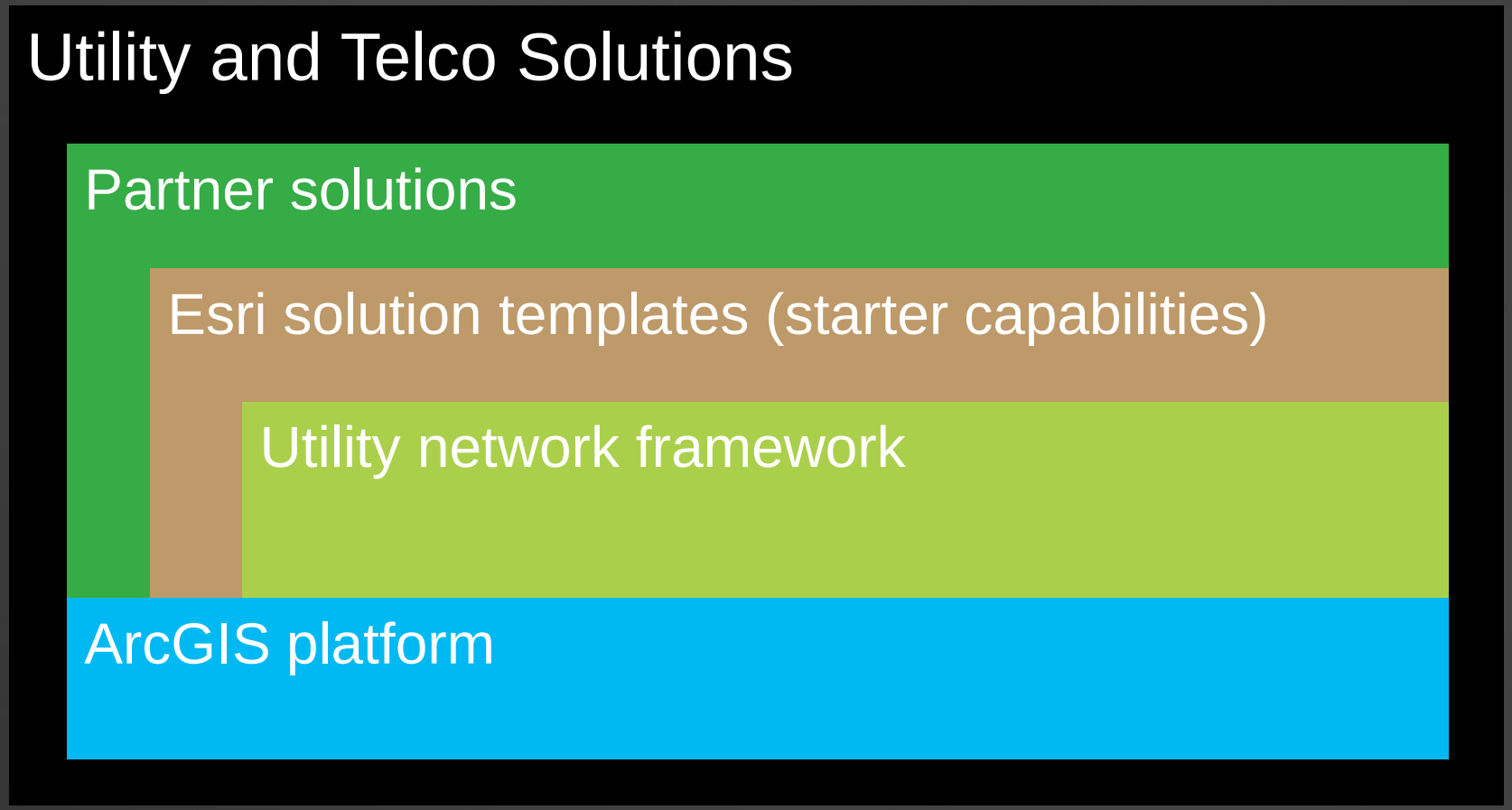

Timeframes

Subject to change – current plans

- Beta 1 – April 2017
  - Pro 1.4, ArcGIS 10.5
- Beta 2 – June 2017
  - Pro 2.0, ArcGIS 10.5.1
- PreRelease – September 2017
  - Pro 2.1 (beta), ArcGIS 10.6 (beta)
- Final – before end of 2017

Q & A

Please provide your feedback