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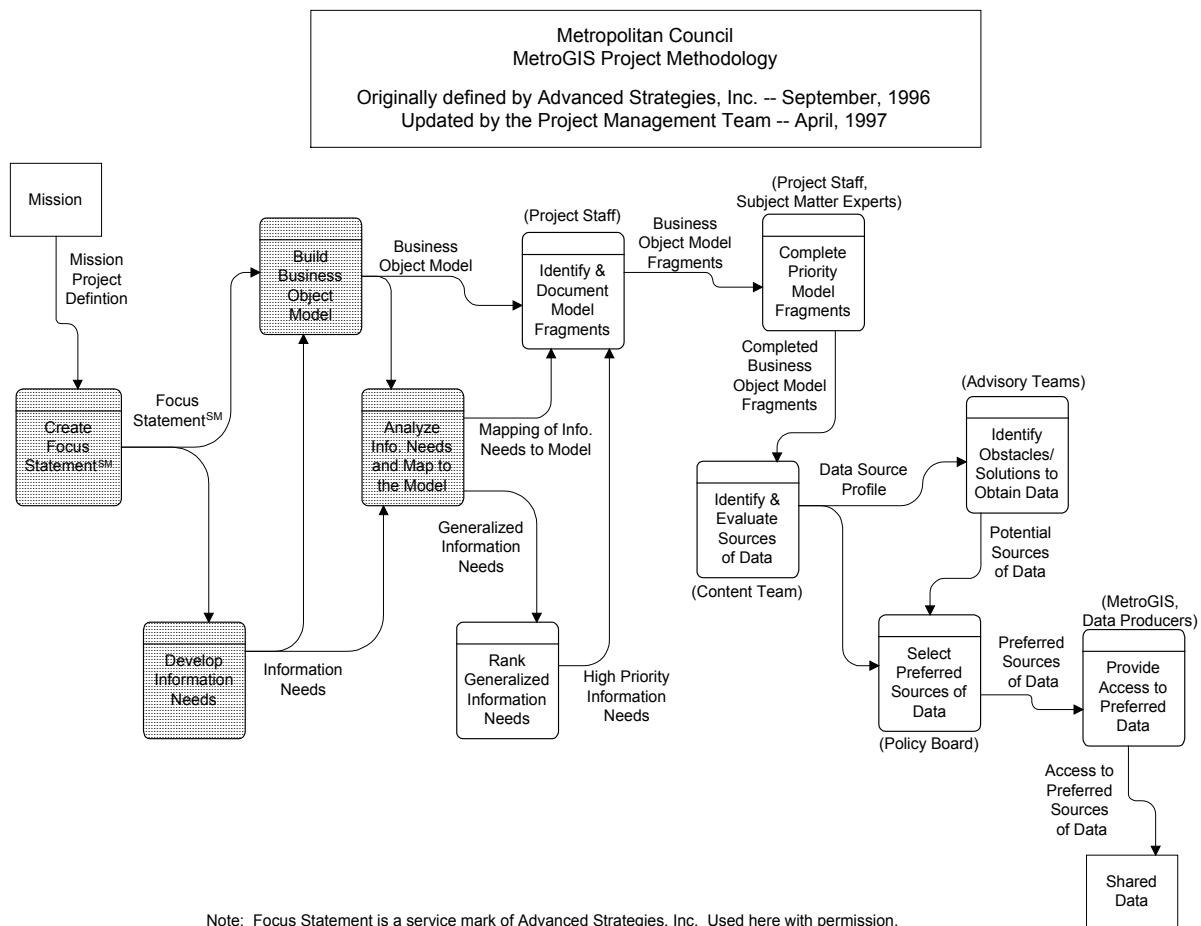
Introduction to the Modeling Appendix

What is Included in the Appendix

This appendix has been created by Advanced Strategies, Inc., the consultant who was retained to define and direct the modeling process for Phase I of the MetroGIS project. The appendix is a record of that work with some key work products included for reference.

The Overall Process and Where the Modeling Tasks Fit

To give the broader perspective of what tasks are included, here is a representation of the overall process for Phase I and beyond, with the modeling work for Phase I shaded:



The following highlights the modeling methodology used in Phase I. It is presented in chronological sequence.

Focus StatementSM

How and Why the Focus StatementSM was Created

The goal of the Focus StatementSM is to define what is valid for MetroGIS. Everything that is created for the project (the Information Needs, the Business Object Model, etc.) must fall within this area of focus. Therefore, this deliverable was a necessary prerequisite before any other work products were built.

Before the official start of this phase of the project, Richard Branton of Advanced Strategies facilitated a one-day planning workshop for the Project Management Team. This allowed the Project Management Team and Advanced Strategies to refine the details of the project approach and begin planning the first event. The key output was the Focus StatementSM.

Commentary on the Focus StatementSM

At each event during this phase of the project, the Focus StatementSM was used to explain or remind the participants about the subject area of MetroGIS. This was successful since none of the events contained lengthy disagreements or discussions about what was in versus out of focus. The participants seem to quickly and easily grasp and maintain focus, which is the ultimate goal of this deliverable. Although the Focus StatementSM is a living document (meaning it changes as our focus or our understanding of it changes), it did not require modification. Therefore, we can conclude that the team had a clear idea of the focus from the outset and it was confirmed with the participants and remained constant throughout Phase I.

The Final Focus StatementSM

Definition (what are we interested in):

- ◆ Geographical Characteristics: Physical characteristics of a geographical area, location or feature including those on, below, or above the surface of the land or water; and characteristics of other items of interest "organized" or "analyzed" by geographical areas, locations or features.
 - ◆ Some examples of physical characteristics include:
 - ⇒ Area: The extent of a city.
 - ⇒ Location: The location of a street, waterfall, or a fire hydrant.
 - ⇒ Feature: The presence of minerals in an area, the width of a street, or the depth of a lake.
 - ◆ Some examples of items "organized" or "analyzed" by geographical area include:
 - ⇒ The crime rate in a neighborhood.

- ⇒ The pollution level at a specific location at a point in time.
- ⇒ The species of wild flowers in a certain area.

Scope (the boundaries of our interest):

- ◆ We are interested in all geographical characteristics (as defined above) of the seven county Twin City Metropolitan area that is relevant to improving:
 - ◆ The effectiveness, efficiency, and/or completeness of results at participant operations (public and private),
 - ◆ The understanding of the dynamics of the area's people, places and things.

Perspectives (whose points of view are we interested in):

Primarily, we want to include the point of view of:

- ◆ Individuals within units of government responsible for providing services within the Twin City Metropolitan area.
- ◆ Individuals in government agencies seeking to improve the quality of living and/or economic competitiveness of the Twin City Metropolitan area.
- ◆ Individuals making decisions about public policies servicing the Twin City Metropolitan area.
- ◆ Individuals responsible for operation of the governments of the Twin City Metropolitan area.
- ◆ Individuals concerned with improving government's effectiveness using geographical information.
- ◆ Individuals interested in maximizing sharing of geographical information.
- ◆ Individuals representing non-government organizations who might collaborate with government entities on geographical data of common interest.
- ◆ Individuals in non-government organizations who provide essential public services and who might benefit from geographical information.

Secondarily, we want to consider the point of view of:

- ◆ Individuals interested in geographical information within the Twin City Metropolitan area including:
 - ◆ Researchers
 - ◆ Educators
 - ◆ Private organizations (including utilities)
 - ◆ Private citizens
 - ◆ Non-profit organizations

At this time, we will not specifically address the needs of:

Individuals within business seeking to locate in the area.

Universality (how “universal” should the solution be):

- ◆ We are interested in geographical information covering the Twin City Metropolitan area, extensible into impacts on and from neighboring areas.
- ◆ We are interested in a sufficient level of generality so that the models and resulting systems will achieve use among the widest array of participating organizations.
- ◆ We expect the models and resulting systems to be:
 - ◆ Stable for 6 months
 - ◆ Extensible for 24 months
 - ◆ Have a demonstrable life span of 60 months

Level of Detail (how much “depth” should the solution contain):

- ◆ Sufficient detail to be able to identify commonly needed data sets of geo-referenced data.

The Initial Information Needs

Why and How the Information Needs were Gathered

The official start of this phase of the project was a half-day session on September 19, 1996. The goal of this Business Information Needs Forum was to gather the business questions people needed to carry out their jobs. These would be used to start the modeling, validate the model as it was being developed, and rank the needs of the participants. Therefore, these Information Needs needed to be high quality and have good coverage across the scope of the project.

In order to obtain adequate representation across the scope, 15-20 people were invited for each of the following subject areas:

1. Community and Economic Development; Planning; Demographics; Housing; Research
2. Property Records
3. Public Works; Utilities; Transportation; Telecommunications
4. Parks and Recreation; Environmental Protection; Natural Resources
5. Public Safety; Judicial
6. Human, Social, Educational Services; Public Health; Libraries

The session was attended by over 100 people with diverse backgrounds, jobs, and employers, but all of them had an interest in geographic information. Initially, the entire group met to learn about the project and their role for the event. At this time, the Focus StatementSM was presented to the group to give everyone a common frame of reference.

Then the group was broken into six breakout sessions corresponding to the subject areas. A facilitator and two recording analysts were assigned to each of the six to solicit and document the information needs for that group. The facilitator prompted the group using various questions to get statements/questions about geographical characteristics to which the group wanted answers. For example:

- “Tell me ____”
- “I would like a map that shows me ____”
- “It really frustrates me that ____”
- “In the future, it will be important to know ____”

The results came so quickly that each group was asked to go back through their list and identify uses of the information need. In other words, “How would you use this information if you could get an answer to the business question?” This gave the project team much more insight into the original information need and the motivation of the need. It also provided the project with the opportunity to judge which information needs had greater utility for the users. In addition, the uses pushed the break out groups into more detail and thus, helped flush out additional information needs.

Commentary on the Initial Information Needs

At the Information Needs Forum, there were many “firsts”:

- The session was the largest of its kind
- It involved the most diverse group of its kind
- It had the largest support team for a single event (6 facilitators, 14 recording analysts, and multiple coaches)

At the end, over 750 information needs (and their uses) were identified and documented in the break out sessions. This is a very large number. The results varied somewhat by break-out group based upon the synergy of the participants, the skill of the facilitator, and the diligence of the recording analysts. However, the overall quality of the Forum results exceeded our expectations.

During the breakout portion of the Information Needs Forum, it was apparent that there was a great deal of overlap of needs both within and across the six functional groups. This validated a basic assumption of the project which is that people are not just concerned about data within their immediate scope; they want the opportunity to do analysis across functional and jurisdictional lines.

Business Object Framing Model

What is it and What Does it Represent

The next task for the project was to construct a model which would show the real world objects and their associations that were identified in the 750+ information needs. The Business Object Framing Model is the primary deliverable from Phase I. The model reads like English language sentences, so non-modelers can navigate the model with no formal training. This is important since GIS specialists, computer systems professionals, and users of information should all be able to read and use the model.

How the Business Object Framing Model was Created

To build this model, volunteers were tapped from each break out group at the end of the Information Needs Forum to represent their functional area in building the model. In total, 33 people participated in the three days of modeling which were held on October 30-31 and December 4, 1996. Steve Clowse and Richard Branton of Advanced Strategies facilitated these sessions.

At the 2-day Joint Development Approach (JDASM) session in October, the primary goal was to get the model started and get the basic framework of entities and relationships across the entire scope. By the end, the group identified 82 entities and 70 relationships. Another goal of the session was to begin to discover how much depth was needed in the model by the users. In a business object model, this means identifying attributes of the entities and relationships. To get a quick look ahead at the depth, we brainstormed over 320 attributes for five key areas of the model near the end of the 2-day session.

In between the JDA sessions, Advanced Strategies agreed to do two things to further the model in order to maximize the time on December 4:

1. Compile proposed enhancements based upon the Information Needs Analysis. As a part of Steve Clowse's analysis of the 750 information needs, he went back and identified where he felt the initial model did not address the information needs. He then drafted proposals to enhance the original model so that all 750 could be answered by the model.
2. Compile proposed enhancements based upon other GIS or similar business object models to which Advanced Strategies has access.

On December 4, most of the same participants from October returned to help advance the model. There were two goals: refine the model and add depth to it. We spent the first half of the day discussing areas of the model which required updating. In the second half of the day, the facilitator presented fragments which had been developed since the last session. The group discussed them briefly and either made changes or raised issues to the proposed enhancements. Because time was limited, many issues could not be addressed (although all were

documented). However, all proposed enhancements were incorporated into the model, whether they were fully discussed or not. This at least provided a “place holder” for additional analysis.

Once all of the updates and proposed enhancements were incorporated, the final model is very large. It contains 150 entities, 147 relationships, and 240 total attributes of the entities and relationships.

Commentary on the Business Object Framing Model

The effort to build the Business Object Framing Model was significant. To have over 30 active participants in a modeling JDA presented some logistical challenges. We had to move fast to hold interest over such a wide scope; we had to ensure that everyone could see the modeling; we used 5 recording analysts to capture the content; Steve Clowse and Richard Branton had to co-facilitate many times because the input from the participants was so fast. Fortunately for the project, the group of participants was interested, engaged, and active throughout the process. This pushed the entire support team, which was prepared and up to the task.

If you review the completed model, many of the relationships link to the same entities, such as: Person and Organization (via Legal Entity), Location, Space, Network, Structure, Occurrence, Asset, etc. Although different users may care about subjects (natural resources, housing, crime, parcels, utilities, public health, etc.), they generally want to tie information from these subjects back to the same objects. This indicates a key use of the Business Object Framing Model for the project. It is a broad framework will allows users to see relationships across current “stove pipes” of data.

As during the Information Needs Forum, it was clear during the modeling that the assumptions which caused MetroGIS to be created are correct: people have business questions which cross functional and jurisdictional lines and they want to ability to tie many different entities and relationships to locations and space (i.e. geo-referenced data).

The size of the Business Object Framing Model might be intimidating, but it is important to realize that it is like a United States roadmap: it is not intended to be absorbed in its entirety with one reading. There are hundreds of important facts which can be analyzed one at a time, as you might analyze a route one road at a time. This problem will be minimized because the future modeling work will focus on smaller areas of the model vs. the entire framework.

It is important to note that currently, the Business Object Framing Model is still a rough framework. The objective was not to create a perfect model because portions of the model will be analyzed and refined in subsequent phases. The goal was breadth vs. depth. However, to perform source data analysis and design solutions to data access issues, more detail will be required.

Because the Business Object Framing Model was geared towards planning vs. implementation, it is more generic, which is acceptable. If the team were ready to implement a solution for one of the Consolidated Information Needs, the model might become more specific to accommodate that need. However, the subject matter experts and the team must be careful not to sacrifice necessary flexibility. In addition, the team must guard against the temptation to modify the model (consciously or otherwise) to adhere to old “data” definitions of the world.

Just because a fact was represented in the Business Object Framing Model doesn’t mean the data exists today or if it does, it doesn’t mean the team has committed to find where it exists and gain access to it. In Phase I, the goal simply was to build a blueprint of the world.

The Final Entity-Relationship Diagram

The model is documented in two ways: graphically in an Entity-Relationship Diagram (ERD) and narratively in text. The text contains detailed supporting documentation about each component represented on the ERD. A copy of the [ERD](#) is included in this report; the text is available upon request.

List of Entities and Relationships

The following are the components of the Business Object Framing Model in textual form. These are the same components represented on the Entity-Relationship Diagram. The components in italics were presented and/or discussed during the JDAs, but the definition of these were not agreed to by the subject matter experts.

Entities

3-D Model
3-D Representation
Access Point
Activity
Animal
Animal Life
Asset
Assumed Parcel
Biological Entity
Boundary
Building
Cable Network
Cable TV
Capital Asset
Community
Comprehensive Space Plan
Computer
Condition
Container

Cultural Resource
Declared Boundary
Declared Space
Disease / Condition
Drawing / Illustration
Dwelling Unit
Dynamic Route
Earth
Educational Program
Election
Electric Network
Facility
Facility Type
Facility Usage
Feature
Feature Description
Flood Plain
For Profit Private Organization
Future Land Use Type Plan
Gas Network
Household
Housing Characteristic Plan
Human Made Structure
Image
Industry
Informal Association / Group
Informal Boundary
Job
Jurisdiction
Law
Legal Entity
Legal Parcel
Lein
Levied Tax
Location
Manufacturing Industry
Map
Material Generation
Material Storage
Measuring Device
Medium
Mineral Deposit
Mobile Response Unit
Natural Structure
Neighborhood
Network
Node
Non-Capital Asset
Non-Profit Private Organization
Occupation
Occurrence
Organization
Other Industry
Outdoor Structure
Parcel

Parks/Recreation Characteristic Plan

Permit

Person

Photograph

Physical Boundary

Physical Space

Plan

Plant Life

Plat

Political District

Population

Pre-defined Route

Private Facility

Private Sector Organization

Product

Property Record

Property Right

Provided Product/Service

Public Facility

Public Sector Organization

Purpose

Reason

Received Product/Service

Recorded View

Recreational Network

Response

Response Type

Restriction

Route

Rule

School / Institution

Segment

Service

Service Area

Service District

Service Industry

Sewer Network

Signage

Soil

Space

Space Plan

Spatial Data Store

Species

Stereograph

Storm Water Network

Structure

Substance / Material

Surface

Survey

Tax

Tax Forfeiture

Tax Parcel

Tax Payment

Telecommunication Network

Text

Trail
Transfer
Transportation Mode
Transportation Network
Type of Business
Type of Land Use Activity
Utility Characteristic Plan
Utility Network
Utility Structure
Vague/Informal Space
Vehicle
Videograph
View
Viewshed
Voting District
Water
Water Network
Water Space
Watershed
Weapon

Relationships

Animal is involved in Occurrence
Animal is raised in Space
Animal Life lives on Location
Asset has Location
Biological Entity is within Species
Biological Entity or Substance/Material causes Disease/Condition
Boundary is defined by Location
Comprehensive Space Plan collects Space Plan for Space
Dwelling Unit belongs to Structure
Earth contains Location
Earth is authorized for Type of Land Use Activity by Rule by Organization
Earth is subdivided into Space by Legal Entity according to Rule
Earth is used for Type of Land Use Activity by Legal Entity
Facility is at Location
Facility is related to Facility
Facility serves Person within Space
Facility Type classifies Facility
Facility Usage involves Vehicle
Feature Description describes Feature or Structure or ...
Feature exists on Segment at Location
Feature exists on Segment from Location to Location
Feature is at Location
Household occupies Dwelling Unit
Informal Association/Group is based at Location
Informal Association/Group is involved in Occurrence
Informal Association/Group operates in Space
Informal Association/Group or Legal Entity uses Facility
Legal Entity assesses Asset or Space or Structure
Legal Entity assesses fee to Legal Entity for Material Generation
Legal Entity belongs to Informal Association/Group
Legal Entity belongs to Population

Legal Entity conducts Type of Business at Location
Legal Entity controls use of Space through Rule
Legal Entity counts Biological Entity at Location or Space
Legal Entity declares tax forfeiture of Asset
Legal Entity develops Space Plan for Space within a Space
Legal Entity develops/changes Space or Structure subject to Rule
Legal Entity drains/draws Water from Water Space at Location via Water Network
Legal Entity encumbers Asset for Reason
Legal Entity exempts Declared Space from Tax
Legal Entity generates Substance/Material at Location
Legal Entity governs Space
Legal Entity governs View
Legal Entity has rights to Space or Structure or Dwelling Unit or Network or Segment
Legal Entity inspects/services Material Storage
Legal Entity invests in Asset
Legal Entity is affiliated with Legal Entity
Legal Entity is involved in Occurrence
Legal Entity maintains Space Plan
Legal Entity measures Water or Water Space at Location using Measuring Device
Legal Entity offers to sell/lease Asset
Legal Entity owns Asset
Legal Entity pays Legal Entity for Received Product/Service
Legal Entity pays Levied Tax
Legal Entity permits activity on Structure or Space by Legal Entity
Legal Entity plans/builds/maintains Network or Segment
Legal Entity projects development of Space
Legal Entity projects subdivision of Earth into Space
Legal Entity provides Product or Service through Network using Asset
Legal Entity receives Product or Service from Legal Entity at Location via Segment
Legal Entity represents Legal Entity for Product or Service
Legal Entity runs School/Institution
Legal Entity surveys Space using Feature
Legal Entity transfers Asset to Legal Entity
Legal Entity uses Segment to ship Product from Location to Location
Legal Entity uses Substance/Material at Location
Levied Tax is adjusted by Legal Entity
Location has View
Location is originating source of Water Space
Location is related as the crow flies to Location
Material Storage uses Container
Mineral Deposit exists at Location
Mobile Response Unit is composed of Person or Asset
Network connects Location to Location
Network has Feature
Network is composed of Segment
Occupation classifies Job
Occurrence causes Occurrence
Occurrence happens at Location
Occurrence impacts Segment
Occurrence requires Response Type by Organization for Location
Organization belongs to Industry
Organization changes Facility to Facility Type
Organization has available Job at Location
Organization manages Facility
Organization manages Space of Watershed

Organization responds to Occurrence via Network
Person attends School/Institution
Person belongs to Household
Person desires housing in Space
Person desires Job in Space
Person inspects Space or Structure
Person is arrested at Location for breaking Law during Occurrence
Person is citizen of Jurisdiction
Person is convicted of breaking Law during Occurrence
Person is employed by Legal Entity in Job at Location
Person is registered in Voting District
Person or Biological Entity has Disease/Condition
Person owns Animal
Person prefers Activity
Person represents Political District
Person uses Activity
Person uses Network to go from Location to Location
Person votes in Election
Plan documents Space or Structure
Plant Life grows at Location
Property Record documents Transfer
Provided Product/Service is intended for Space
Provided Product/Service is offered at Location
Recorded View is stored on Medium
Recorded View portrays Route or Space or Network or ...
Response involves Mobile Response Unit
Response Type classifies Response
Route is composed of Segment
Route or Segment or Space is accessed at Location
School/Institution offers Educational Program
Segment connects Location to Location
Segment connects to Segment
Segment is involved in Occurrence
Soil exists in Location at Earth
Space collects Location
Space contains Space
Space includes Surface
Space is delineated by Boundary
Structure contains Structure
Structure exists on Earth at Location
Structure is a part of Segment
Structure is involved in Occurrence
Structure is used by Voting District in Election
Structure or Space or Feature or Network is used for Purpose based upon Rule
Substance/Material has Condition at Location
Substance/Material is stored at Location
Substance/Material is used to construct Structure
Tax is levied on Legal Entity on Asset
Tax Payment or Transfer results from Tax Forfeiture
Transportation Mode is used on Route or Segment
Vehicle is involved in Occurrence
Vehicle or Person is at Location
Viewshed contains Location
Viewshed has Restriction proposed by Legal Entity
Water collects in Water Space or Watershed or Flood Plain

Watershed is defined by Earth at Location
Weapon is involved in Occurrence

Glossary of Modeling Concepts

Overview

- The Business Object Model is a view of your world of objects and their associations.
- The purpose of the model is to define the information requirements, within the area of focus.
- It contains facts about the business that are considered relevant.
- The model reads like English language sentences. Therefore, the notation style supports non-modelers navigating the model with no formal training.
- The model is independent of technology, available data, etc. It does not contain GIS abstractions such as centerlines. It contains the natural facts of the real world.

Model Documentation

- The model is documented in two ways:
 - Entity-relationship diagram (ERD)
 - Supporting text.
- The components of Business Object Modeling are explained below, along with how they are represented on the ERD.

Entities

Definition: An entity represents a category of things that exist within the business. They have independent existence.

Representation: Entities are named with nouns or noun phrases and are displayed in a rectangle with capital letters.

Examples: LOCATION, PERSON, PLAN

Entity Hierarchies

Definition: A subset of things than can be categorized. Also referred to as supertype and subtype entities.

Representation: Hierarchies are shown as boxes connected with thick lines.

Example: LEGAL ENTITY (the supertype) is subtyped into PERSON and ORGANIZATION.

Associative Entities

Definition: A relationship (see below) that is useful to consider as a ‘thing’ (i.e. an entity).

Representation: A box connected to a diamond with a thick line.

Example: The associative entity TAX PAYMENT comes from the relationship: LEGAL ENTITY pays LEVIED TAX.

Simple Relationships

- Definition:** An association between two things. It cannot exist by itself, without the entities. NOTE: an entity occurrence does not have to participate in a relationship.
- Representation:** Relationships are named with verbs or verb phrases and are displayed in a diamond with lower case letters. Use the ‘*’ to start your sentence. To read a relationship with two or more entities, start with the ‘*’, read to the blank entity link, then read to the entities with the additional words on the entity links.
- Example:** PERSON belongs to HOUSEHOLD.

Complex Relationships

- Definition:** A relationship among more than two things.
- Representation:** To read, start with the ‘*’ and read to the blank entity link first. Then read to the entities with the additional words on the entity links.
- Example:** PERSON is employed by LEGAL ENTITY in JOB at LOCATION.

Relationship Roles

- Definition:** A name used to describe an entity when it participates in a relationship.
- Representation:** Pointed brackets on a relationship link: < >
- Example:** When a LEGAL ENTITY receives PRODUCT or SERVICE from LEGAL ENTITY at LOCATION via SEGMENT, the receiving LEGAL ENTITY in this relationship is the <Customer>.

Multi-Member Relationship Links

- Definition:** One of many possible entities could participate in a relationship. This is an ‘or’ condition.
- Representation:** A large dot attached to a relationship diamond.
- Examples:** LEGAL ENTITY has rights to SPACE or STRUCTURE or DWELLING UNIT or NETWORK or SEGMENT.

Attributes

- Definition:** A descriptive characteristic of an entity or a relationship.
- Representation:** None. They are captured and documented in the text.
- Examples:** Parcel Value

Analyzing the Information Needs and the Business Object Framing Model

Consolidating the 750 Information Needs

After the Information Needs Forum, the project team had over 750 needs to digest. The first task was to determine how many truly unique needs existed. There were many duplicates and restatements of the same information need in the 750. In addition, many needs had significant overlap and could be viewed as different portions of a more “generalized” need. Steve Clowse of Advanced Strategies went through the 750 and categorized each need so they could be grouped and analyzed appropriately. He used the following categories:

- BEHV - human behavior
- BLDG - commercial/residential buildings, structures, facilities, complexes
- DEMO - demographics
- ECON - economics, including jobs, public investment, banks, etc.
- INCD - incidents, including criminal activity, storms, accidents, etc.
- LDEF - land definition, i.e. how humans define or visualize the land
- LUSE - land use, i.e. what humans/animals do on or to the land
- NATR - natural resources, animals, plants, etc.
- PROP - property, including taxation, assessment, valuation
- SERV - non-utility public services
- TRAN - transportation, including streets, buses, etc.
- UTIL - utilities: gas, electric, water, sewer, storm water, telecommunications, etc.

Once all 750 had been clustered around these categories, Steve was able to identify duplicates and similar information needs and group these together as a “generalized information need”. After some further refinement by the project team, 87 “generalized information needs” were agreed to as representing the full intent of the original needs at a higher level of detail. This gave all stakeholders an easier way to digest and analyze the results of the Forum.

There was an additional component to this work product which is important for the project. A mapping of each of the original 750 information needs to the 87 “generalized needs” was maintained throughout this analysis. As the 87 needs were used more in subsequent tasks, this provides a link back to the original, specific requirements to ensure the full intent is met.

The Final 87 Consolidated Information Needs

The [Consolidated Information Needs](#) in this report are listed in the order which they were ranked from the survey of users that was conducted during February of 1997. For more information about the survey, see the other appendix.

Mapping the Information Needs to the Business Object Framing Model

A key to the project is to understand how the Consolidated Information Needs map to the Business Object Framing Model. This is important since much of the team’s work will be driven off of the Consolidated Information Needs and this must be tied back to the framework, i.e. the Business Object Framing Model. In addition, the team will have the opportunity to see how each Consolidated Information Need interplays with others. So when the team chooses to move forward with one Consolidated Information Need, it can determine if there are “closely related” needs that should be included in additional work. The mapping to the Business Object Framing Model will help uncover these relationships of the Consolidated Information Needs.

During the consolidation of the Information Needs, Steve Clowse mapped the needs to the Business Object Framing Model. He examined each Consolidated Information Needs and determined what components of the model (entities, relationships, attributes) would be needed to answer the question(s) in the information need. Members of the project team, especially Chris Cialek, Bruce Abbott, and Dave Vessel, then took this analysis and updated it as the consolidated needs were refined. They are the custodians of this mapping and the consolidation of the information needs.

Overall Observations

MetroGIS is the only multi-participant metro area GIS project known. Before the first event was held, the team knew it was paving a new road.

All of the modeling tasks were ambitious: each one attempted to do a great deal of work in a short period of time with a maximum number of perspectives that could be accommodated. Using these measures, these tasks were performed successfully. The primary modeling deliverables, the Information Needs and the Business Object Framing Model, represent a substantial amount of input from a large number of people developed over a compressed period of time.

In addition to building deliverables at the events of Phase I, the project wanted to achieve certain social and political objectives. The project was designed from the outset to involve all major stakeholder interests in all facets of the project to strive for broadly supported results. Phase I accomplished this. The number of participants at each event (especially those who participated more than once) demonstrated this support. It was significant that groups from different perspectives got together and worked together (and socialized together during breaks at the events).

In hindsight, the magnitude of this effort exceeded the joint understanding of the Metropolitan Council and Advanced Strategies. The scope of the project and the resources needed for the events was greater than expected. Each party stepped forward with additional support to ensure that the effort was successful rather than reduce the quality of the results.

Recommended Uses of the Business Object Framing Model

In terms of the modeling technique, we recommend that it continue to be used to identify the detailed requirements of the users. We base this upon the positive response of the subject matter experts in the modeling JDAs. The technique serves as a means for all subject matter experts (GIS, technologists, users, etc.) to have a common communication vehicle. The English-language notation style of the model also makes it possible to bring new participants into the process without a significant learning curve to understand what has been done to this point.

As other projects in the Twin City Metropolitan Area use this same modeling technique to model objects and associations which overlap with MetroGIS, there is the opportunity to provide the MetroGIS model to these projects to foster consistency in how the world is viewed. If these projects have conflicts with or more detail than the MetroGIS model, these must be analyzed and incorporated, where appropriate. This allows for the MetroGIS model to live and grow without direct modeling being sponsored by the Metropolitan Council.

Most importantly, the Business Object Framing Model must become the framework which will be used to manage all subsequent work. As smaller pieces of the model are analyzed and detailed in later phases, these will be tied into the framework to ensure integrity with the comprehensive vision of MetroGIS. This is *critical* to the success of the project. If the “big picture” is lost, MetroGIS will simply become a project to repackage the existing stovepipes of data in new stovepipes. The users of the data might gain “better” access, but they will be unable to answer new questions and use the data in new ways. Thus, there would be no change in the business of what people do and no return on investment for the sponsors and stakeholders.

Next Steps

The following are next steps we recommend for continuing the modeling work in Phase II and beyond. These are tasks which would build upon the modeling work:

Add Detail to the Business Object Model:

First, working groups of subject matter experts must be created to add detail to the Business Object Model fragments which map to each key Consolidated Information Need. This is most effective in a JDA-type setting with a facilitator, coaches, and data/recording analysts to plan, conduct, and wrap-up each the sessions. To be completed or identified are:

- Additional entities or relationships which were not previously identified
- Definitions of entities and relationships
- Cardinality on all relationships
- Attributes must be identified and defined (most of this will come from source data analysis, although the team will probably want to verify this with the users at a later time).
- Any additional information which maybe pertinent during the Data Sourcing Analysis (examples: GIS specific qualities of an attribute).

Determine Fragment to be Analyzed for Source Data:

Before beginning source data analysis, the team should consider if the Business Object Model fragment(s) to be investigated should be expanded to incorporate other Consolidated Information Needs. If the Data Content Team is already going to be investigating a subject area, the team should consider the incremental cost of increasing the scope of the area to include some additional attributes. Keep in mind, just because a larger area is analyzed, it doesn't commit the team to implement this larger area.

Determine Sources to Investigate:

Who will have these sources of data? Consider:

- In scope jurisdictions (cities, counties, etc.)
- State and federal government
- Private businesses
- No one, which may indicate new source data captures. This one may be one that users will pay for...to get data they really need but they can't get today.

Create and Populate a Data Source Template:

When analyzing the source data, the Data Content Team should create a standard template of information that should be gathered for each source. Here are some sample questions to consider:

- How easy is access to the data; specifically, what format it is in (old file structures with embedded meaning vs. normalized tables with definitions vs. manual data).
- How clean/accurate is the data?

- Do multiple sources exist for the same data values, i.e. overlapping sources? If so, which will be the primary source?
- Will the data require any:
 - Conversion to get consistent, regional data.
 - Messaging to get it into the components that the Business Object Model requires.
 - Transformation for correct formatting, such as alphanumeric vs. numeric or consistent decimal places.
- How regularly will data be updated at the source? What are the implications?

The Data Content Team should document how each entity, relationship, and attribute in the fragment must have all above questions answered for each source investigated.

Discovering Attributes Which Were Not Previously Identified:

When investigating source data, the Data Content Team will discover that there are attributes which the subject matter experts did not identify (either through lack of time or lack of interest). If by sourcing other attributes, these new ones could be easily included, document this. Eventually, the project team will need to determine if these are to be included in a final solution (i.e., do the users want these additional attributes). In some cases, the logical place for new attributes will not exist in the Business Object Model. Put them as close to where they belong.

Determine Solution Strategy:

The project team must determine how it wants to make the data available. Here are some options that should be considered:

1. Build a data warehouse database where consolidated data storage would facilitate all data being available from one location. This was specifically eliminated from consideration in the initial assumptions about the project.
2. Build new databases to handle source data capture. This would be useful where current data capture is inadequate. It would also be a possibility where multiple jurisdictions and/or organizations capture the same data today.
3. Build real-time data exchange bridges. Users would log onto a system and request data which would be sent electronically. The Business Object Framing Model would be used to organize the data and store translation rules (i.e. computer programs) for how to get and use the data.
4. Create an electronic directory with links and/or software to get the data. Here, the Business Object Framing Model would become an electronic directory of the available data, who has it, how to get it, with the software necessary to get/translate the data.
5. Use the Business Object Framing Model as a paper directory to indicate who has the data.

Consider Interim or Phased Solution:

Whether one of the more cost and time intensive options above is pursued (i.e., numbers 1-3), there is an immediate opportunity for the team to use the Business Object Framing Model as an electronic and/or paper directory (numbers 4 or 5). For example, as the Data Content Team performs its source data analysis, this information about available data (who to contact for

which jurisdictions, quality of the data, format, etc.) could be stored using the model. This could be made available electronically on the web or in paper form in the short term.

Develop a Source Strategy for Each Component in the Model Fragment:

Once the determination is made as to what entities, relationships, and attributes will be included in a solution, there must be a sourcing strategy for each. Depending upon the type of solution, this might include:

- How will Metropolitan Council be informed of changes to the source which will affect the bridges (e.g. data modifications, source being eliminated, etc.)?
- Will the source data be pushed or pulled? What will the trigger be?
- Who will have responsibility for the process?
- How much auditing will be necessary to ensure reliable data?
- What validation will be necessary?
- How will errors and anomalies be flagged and deal with?
- How much logging is necessary, to be able to monitor bridge activity?
- How and when will loading occur? Real-time, queued up, batch runs?

Open Issues List

During the course of the modeling events held during Phase I, participants raised issues which addressed the approach of the MetroGIS project. The ones which are still open are consolidated here, along with other issues which were identified by the project team. As a part of “next steps”, these should be addressed by the project team:

#	Issue	Source
1.	Instead of trying to solve <u>every</u> problem (by exhaustively listing many detailed problems), shouldn't we be setting up a system that can solve <u>any</u> problem?	Info Needs Forum
2.	Information is not all in one place. Different coding / classification systems are used.	Info Needs Forum
3.	Information is not all in one place. Data collected for one purpose may be used for many other totally unrelated uses.	Info Needs Forum
4.	Who is going to use the data.	Info Needs Forum
5.	This is a spin-off from MetroGIS teams. We have to collect the data first.	Info Needs Forum
6.	How does data become integrated?	Info Needs Forum
7.	There are many <u>policy</u> issues to work through.	Info Needs Forum
8.	There are many <u>funding</u> issues to be dealt	Info Needs Forum
9.	The utility of data justifies the expense of the system.	Info Needs Forum
10.	What specific information does each user need?	Info Needs Forum
11.	I suspect a lot of the “data” we discussed somebody is already collecting - maybe we need a clearinghouse for public which could coordinate sharing of information.	Info Needs Forum
12.	Determining whether and how much to charge for distribution of data	October Object Modeling JDA
13.	Data privacy--particularly issue of identifying individuals with person, household, dwelling unit, or asset level of granularity	October and December JDAs
14.	There is a living list of modeling issues and areas for refinement that the project team has already identified. This list of potential “holes” is a place to pick up the analysis as part of the model are drilled down.	Project Team

Project Documentation

The following is a directory of project documentation from the modeling tasks which is organized by event. The tool used to create each document is also indicated:

September 19, 1996 - Information Needs Forum
Final Turnaround Document (Word)

October 30-31, 1996 - Business Object Modeling JDA
Final Turnaround Document (Word)
Entity-Relationship Diagram (hand drawn)
Business Object Model Text (Word)

December 4, 1996 - Business Object Modeling Follow up JDA
Final Turnaround Document (Word)
Entity-Relationship Diagram (Visio)
Business Object Model Text (Word)

Other
Information Needs Analysis (Excel)
Business Object Model Issues (Word)
Final Report (Word)