

Moving towards New Technology for Generalization

Dan Lee
ESRI Inc., USA

- ❑ R & D and practice with
Workstation ArcInfo
- ❑ ArcGIS technology
- ❑ Integration plans

R & D and practice with Workstation ArcInfo

- ❑ Supporting requests and benchmarks
- ❑ Making new tools and enhancements



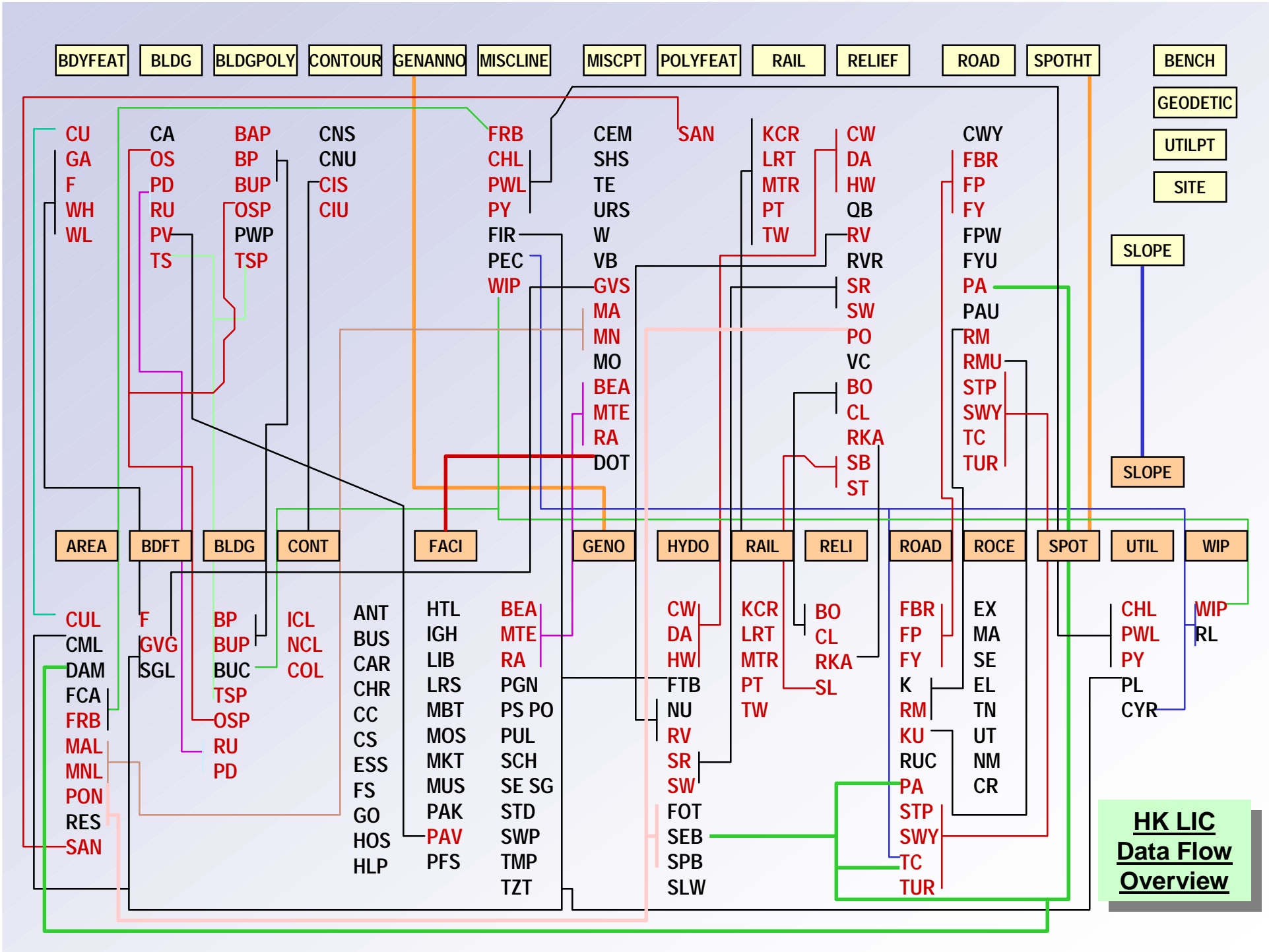
Using coverage data model

You can find the following white papers:

Automation of Map Generalization: The Cutting-Edge Technology

Map Generalization in GIS: - practical solutions with Workstation ArcInfo

under ArcGIS – Technical Papers at <http://arconline.esri.com/arconline>



BLDG (network)

BLDG_NEW

BP
BUP
TSP
OSP

GENSIMPLIFY (orthogonal; 3m) → CLEAN → BUILD (line) → AREAEXT (ortho.; 3m; constraint (road))

Eliminate (area < 40 sqm) → ADDITEM (PAT: type 3 3 c) → TABLES (CALC type = 'BP')

Identify BUP, TSP, OSP??

TS

GENSIMPLIFY (orthogonal; 5m) → CLEAN → BUILD (line)

AREAAGG (ortho.; 5m; constraint (road)) → Eliminate (area < 40 sqm) → TABLES (DROPITEM inside ADDITEM type 3 3 c)

OS

DISSOLVE → GENSIMPLIFY (orthogonal; 5m) → CLEAN → BUILD (line)

AREAAGG (ortho.; 5m; constraint (road)) → Eliminate (area < 5000 sqm) → TABLES (DROPITEM inside ADDITEM type 3 3 c)

RU

GENSIMPLIFY (orthogonal; 5m) → CLEAN → BUILD (line)

AREAAGG (ortho.; 10m; constraint (road)) → Eliminate (area < 200 sqm) → TABLES (DROPITEM inside ADDITEM type 3 3 c)

BLDG-PD

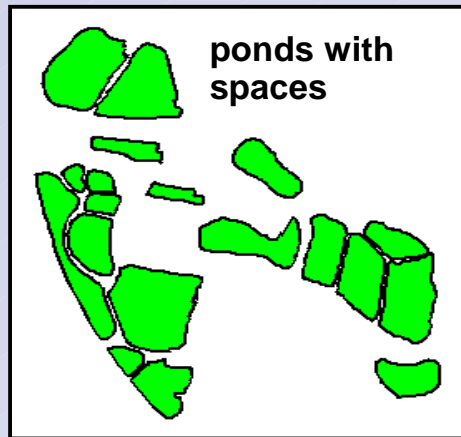
MAPJOIN (net)

BP
TSP
OSP
RU

PD

Generalization procedures

-- example: area extend



BUFFER the pond polygons with a positive buffer distance to get an aggregated polygon.

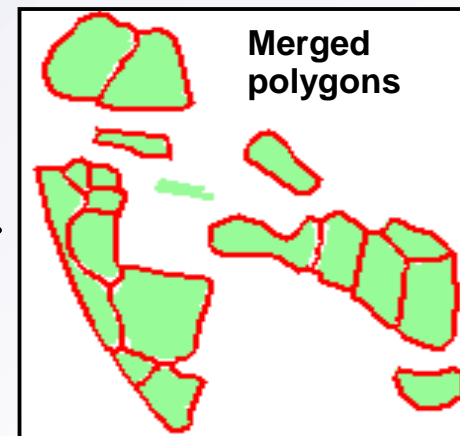
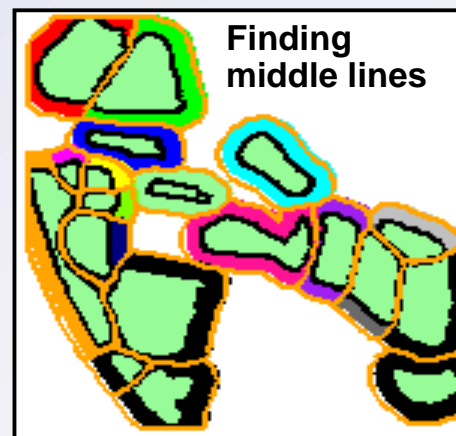
BUFFER that polygon with the same distance inwards to get the group polygons

Use **LINEDIST** to convert the polygons to grid and expand the grid polygons to find the middle lines between polygons.

Use **GRIDPOLY** to convert the expanded polygons, including the middle lines back to vector .

CLIP the expanded polygons by the aggregated polygons.

APPEND the middle lines with the aggregated polygon.



Making new tools and enhancements

For line/polygon simplification:

BENDSIMPLIFY operator – ArcInfo 7.1.2

For building simplification:

ORTHOGONAL operator – ArcInfo 7.2.1

BUILDINGSIMPLIFY command – Workstation ArcInfo 8.0.1

FINDCONFLICTS command – Workstation ArcInfo 8.0.1

For road centerline creation:

CENTERLINE command – Workstation ArcInfo 8.0.1

For polygon aggregation:

AREAAGGREGATE command – Workstation ArcInfo 8.0.2

Enhancements to the **GENERALIZE** command

a minor enhancement – Workstation ArcInfo 8.0.1;

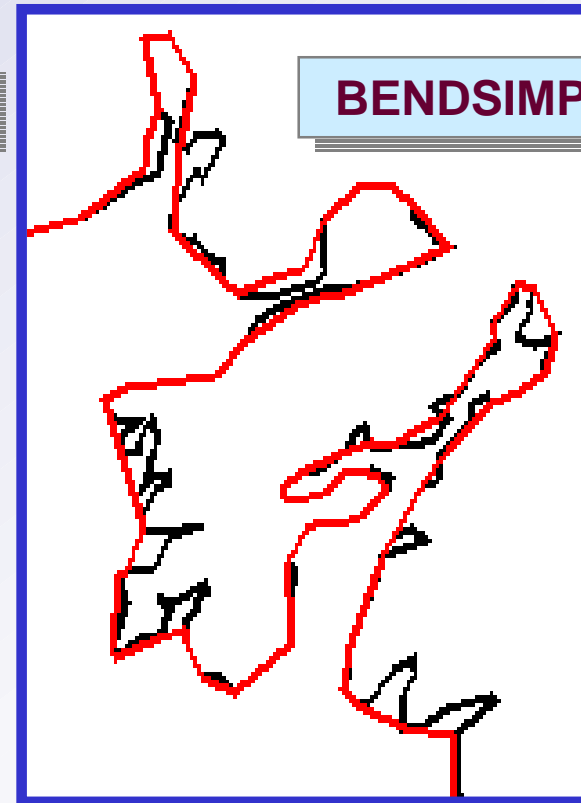
a major enhancement – Workstation ArcInfo 8.1

Line simplification

In Arc: GENERALIZE <in_cover> <out_cover> <weed_tolerance>
{POINTREMOVE | BENDSIMPLIFY}

In ArcEdit: GENERALIZE {default | * | distance} {POINTREMOVE | BENDSIMPLIFY}

In Arcplot: WEEDOPERATOR <POINTREMOVE | BENDSIMPLIFY>



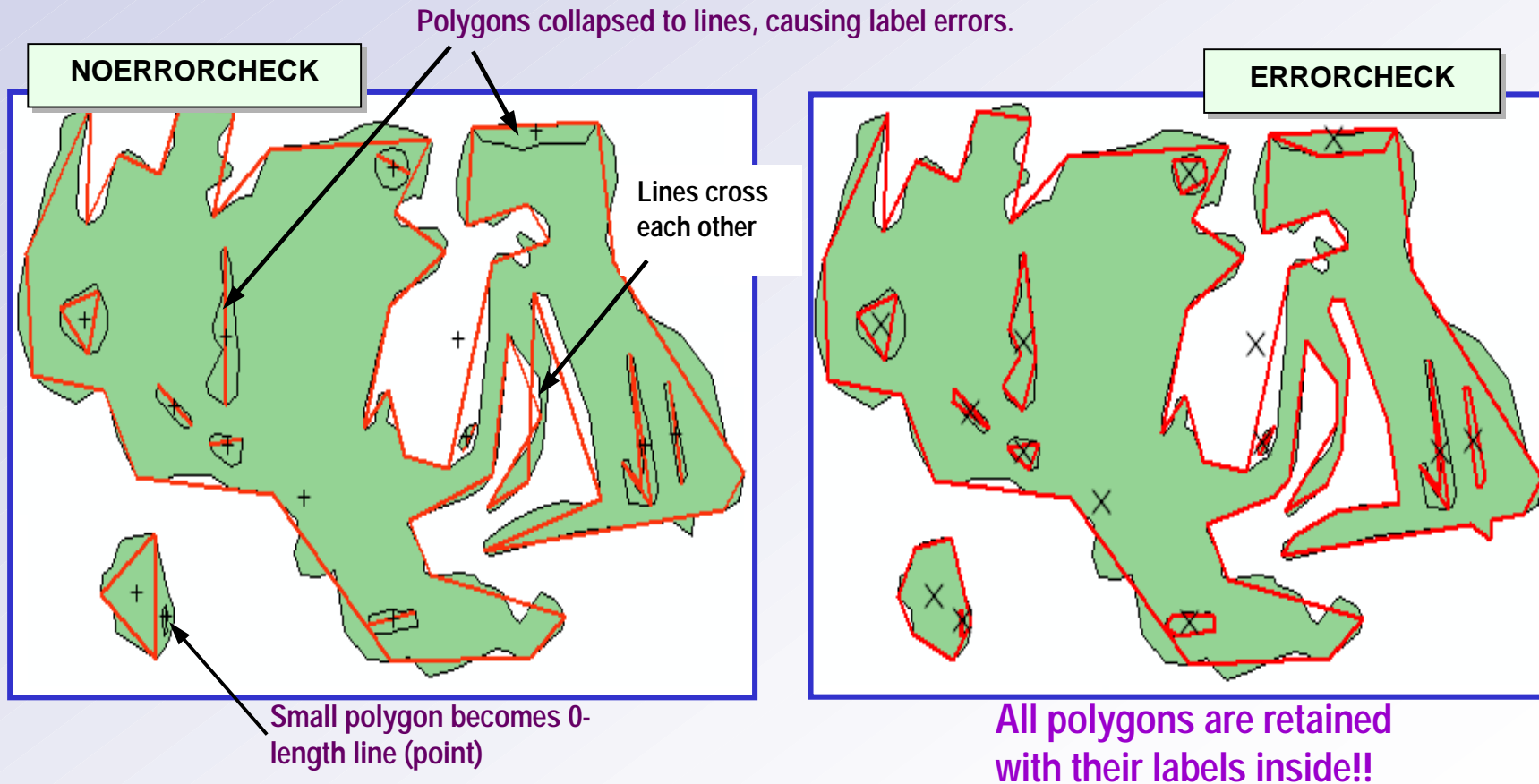


Major enhancement to GENERALIZE

In Arc: GENERALIZE <in_cover> <out_cover> <weed_tolerance>

{POINTREMOVE | BENDSIMPLIFY} {NOERRORCHECK | ERRORCHECK}

- ❑ Corrected most topological errors
- ❑ Tolflag in out_cover.aat
- ❑ You can use BUILD to obtain polygon topology



Building simplification

In Arc: **BUILDINGSIMPLIFY** <in_cover> <out_cover> <simplification_distance>
{minimum_area} {selection_file} {NOCHECK | CHECKCONFLICT}
The out_cover contains two new items, **BDS-STATUS** and **BDS-GROUP**

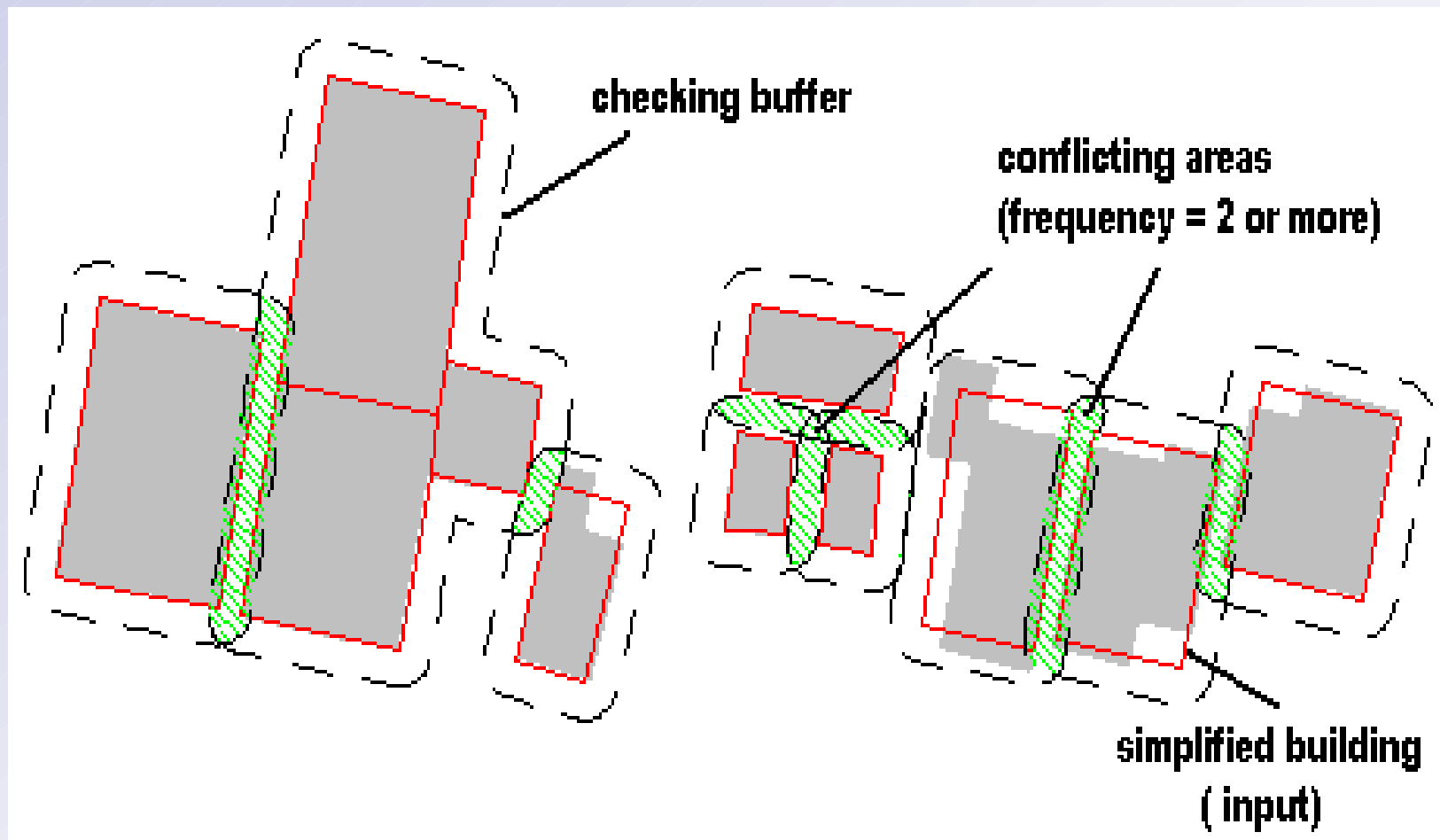
In Arcplot: **WEEDOPERATOR** <POINTREMOVE | BENDSIMPLIFY | **ORTHOGONAL**
{minimum_area} {NOCHECK | CHECKCONFLICT}>



Finding building conflicts

- overlapping or too close to each other

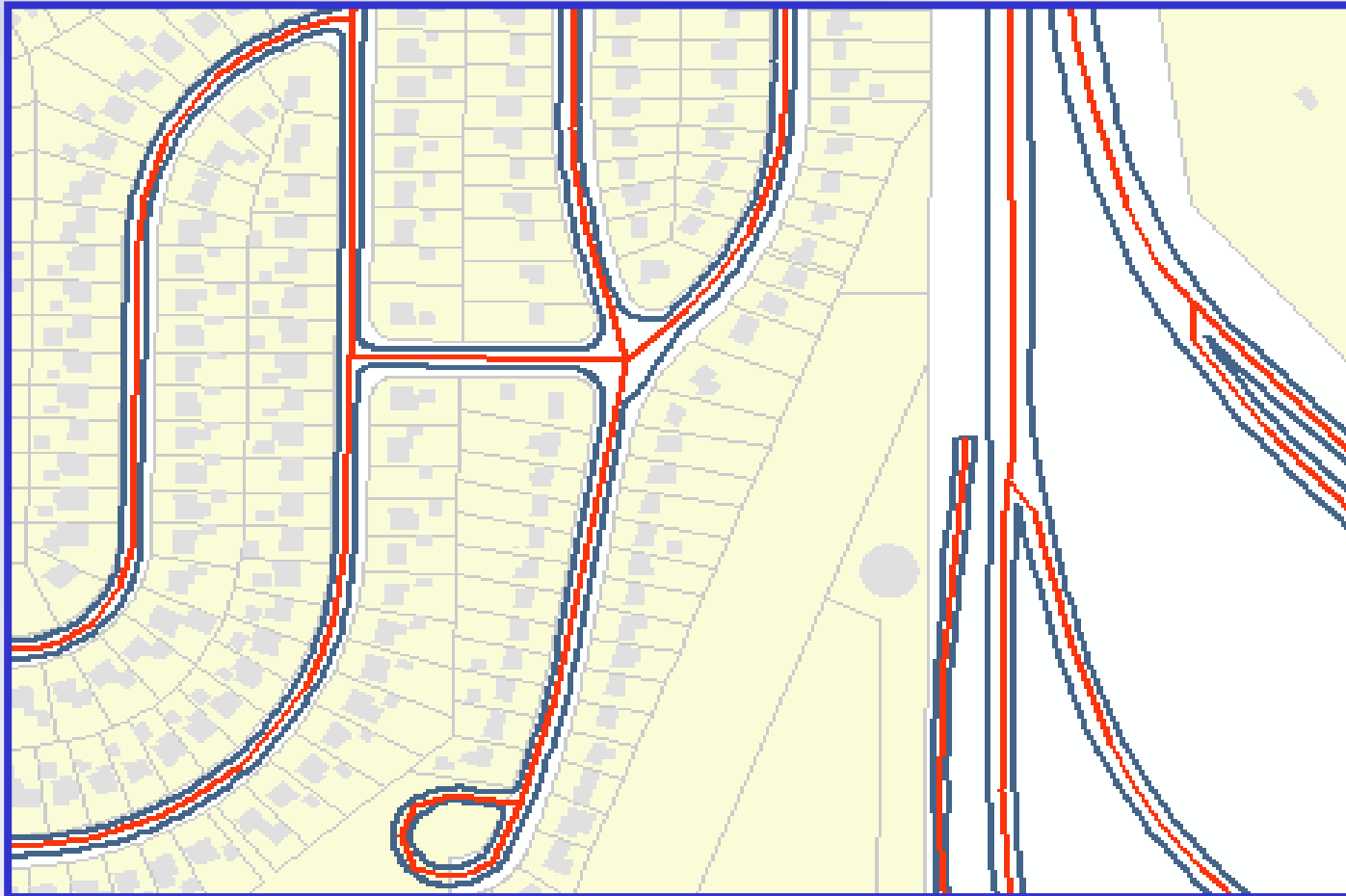
In Arc: **FINDCONFLICTS** <in_cover> <out_cover> <distance>

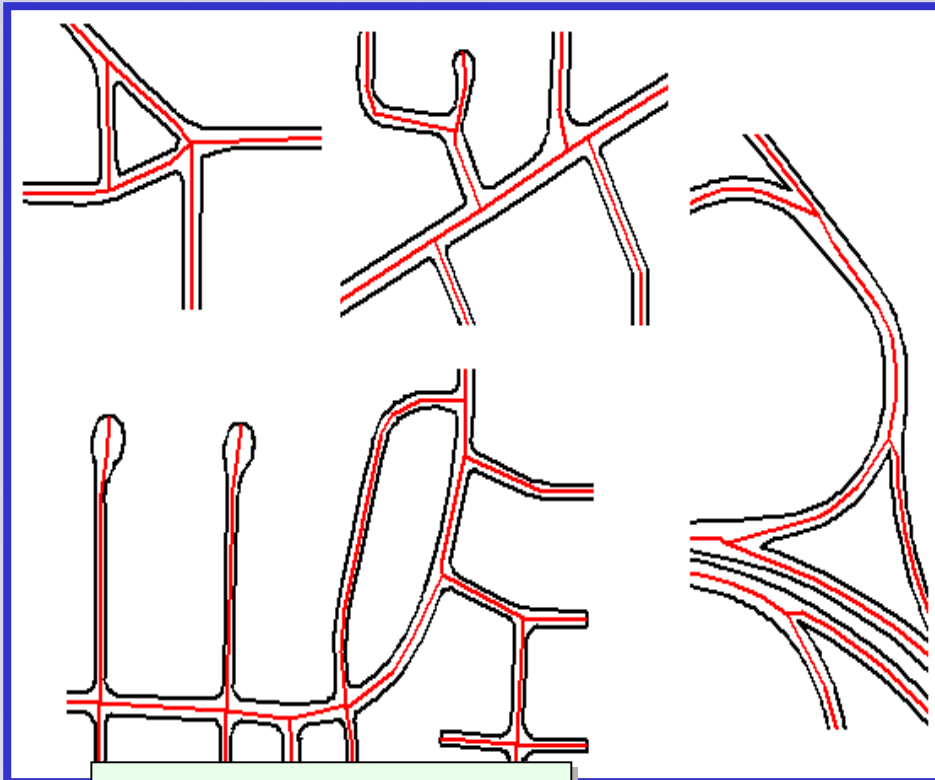


Creating road centerlines

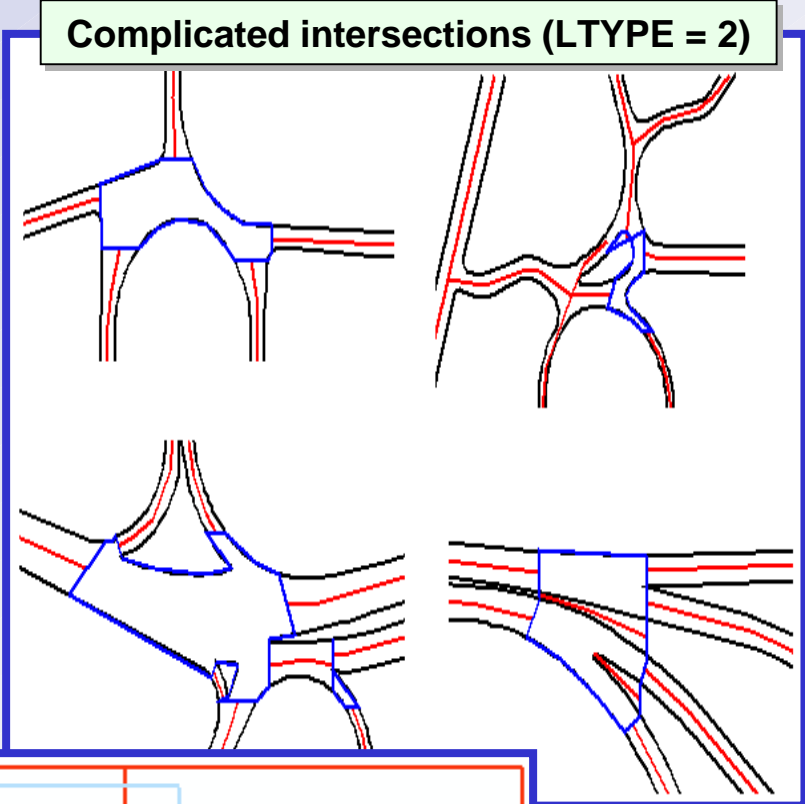
In Arc: **CENTERLINE <in_cover> <out_cover>
<maximum_width> {minimum_width}**

In ArcEdit: **CENTERLINE <maximum_width> {minimum_width}**

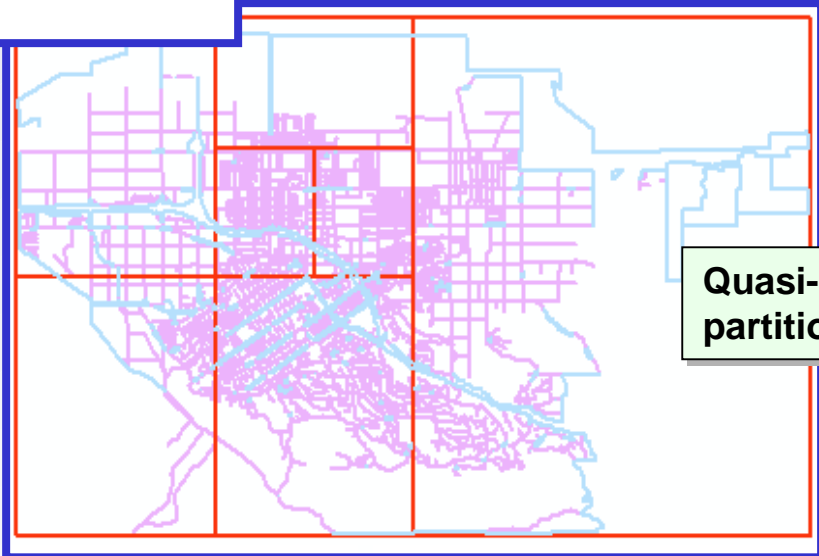




**Simple intersections
(2-, 3-, and 4-way)**



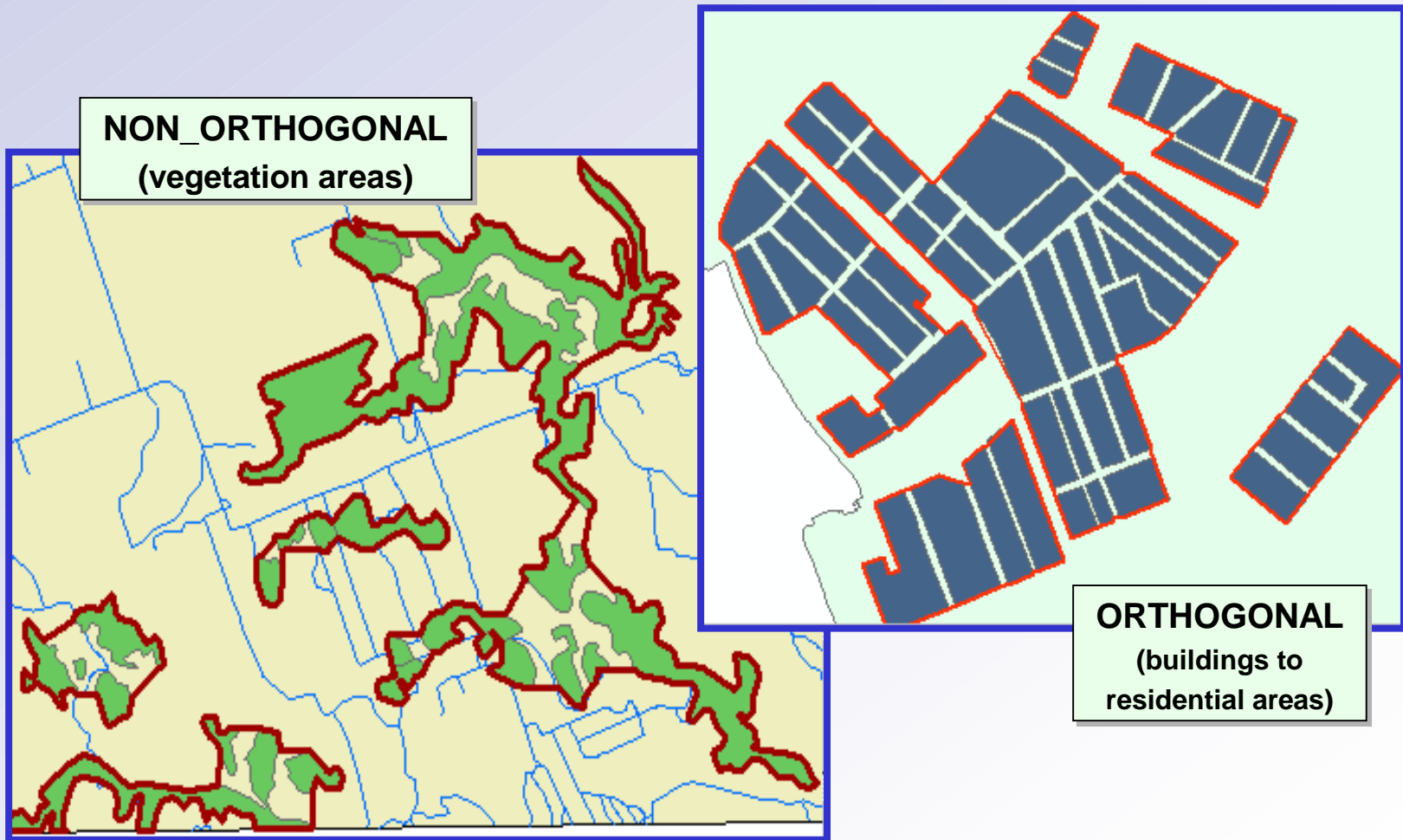
Complicated intersections (LTYPE = 2)



**Quasi-quad-tree
partitions (LTYPE = 3)**

Aggregating polygons

In Arc: **AREAAGGREGATE** <in_cover> <out_cover> <cell_size>
<aggregation_distance> {NON_ORTHOGONAL | ORTHOGONAL}



ArcGIS, the new generation of ESRI software

a single, unified, scalable, object-oriented GIS software with COM-based components, and geodatabase data model.



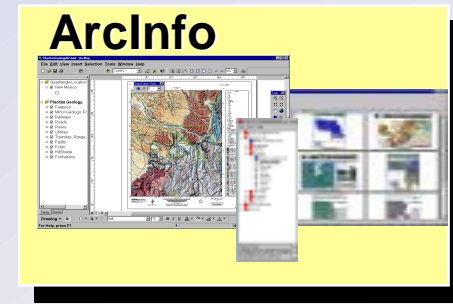
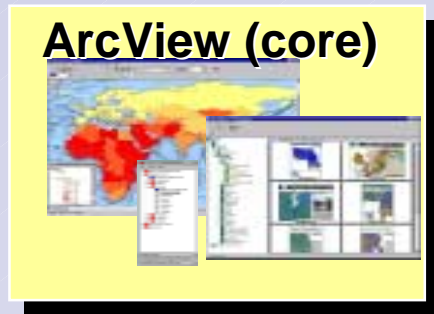
Recent articles:

“ArcGIS 8.1 Nears Release”, ArcNews Winter 2000/2001 issue, ESRI.

“An Overview of ArcGIS”, ArcNews Spring 2001 issue, ESRI

“ArcGIS 8.1”, July 2001 issue of GeoWorld, or see it on-line at
<http://www.geoplace.com/gw/2001/0701/0701qt.asp>

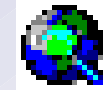
ArcGIS Seat Types: (ArcView, ArcEditor, and ArcInfo)



Additional functionality and increased usability and interoperability

- Each Seat includes ArcMap (map making), ArcCatalog (data management) and ArcToolbox (analysis and geoprocessing)
- Unifies the traditional ArcView and ArcInfo environments
 - common architecture
 - same underlying executables and user interface
 - common extension models

ArcMap

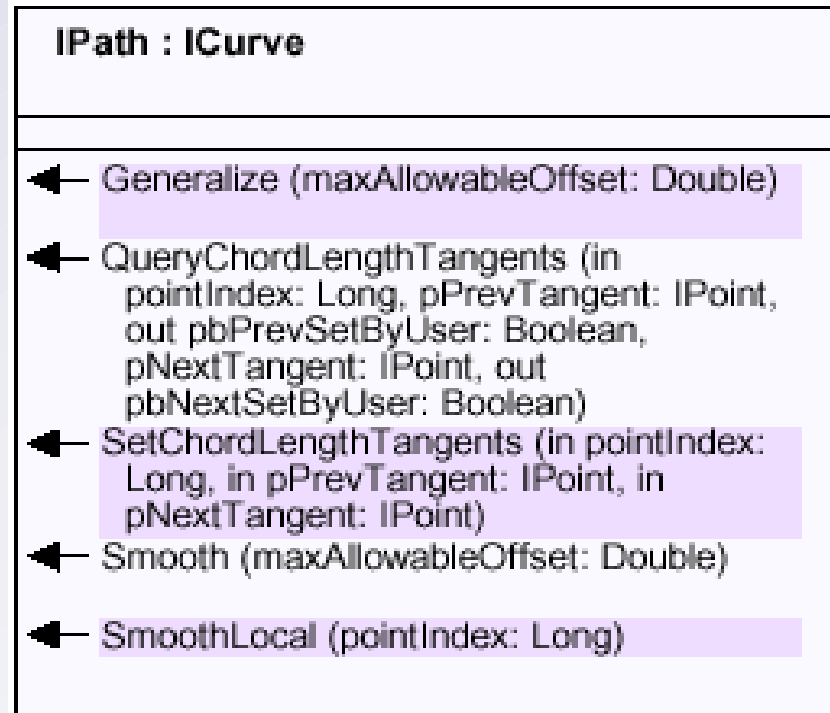
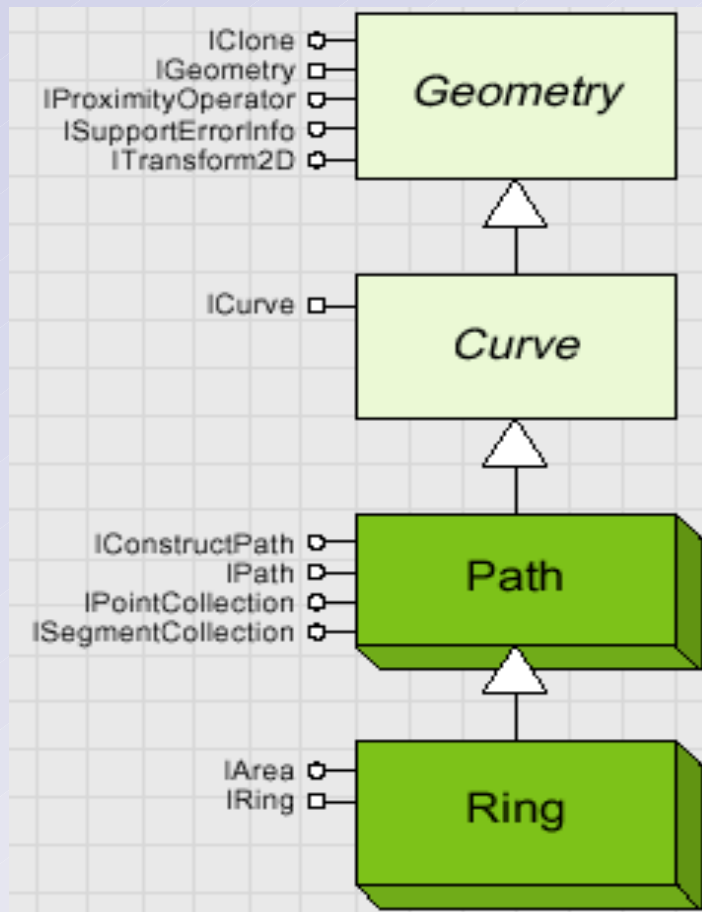


- **Start to finish professional cartographer's map production software seat**
 - Data compilation and editing tools
 - Advanced symbology methods and 1,000s of predefined symbols for 30+ industries
 - Automated text placement
 - Robust graphical tools for map layout and composition
 - Many export and printing options and formats
- **Map centric user interface**
 - Designed to allow map makers to work on their products from the context of the finished product
- **Tools and user interface are designed to make map making very efficient**

ArcObjects

-The collection of COM-based ArcGIS components

- The development platform for ArcGIS Desktop applications
- The open programming environment makes the full capability of ArcGIS accessible to all



Geodatabase

- an object-oriented data model created with ArcGIS

- **a storage mechanism for all types of geo-data**
 - single user personal geodatabases are stored in Microsoft Access
 - Multi-user databases, accessed by ArcSDE, are stored in IBM DB2, Informix, Oracle, or Microsoft SQL Server
- **a series of data access components**
 - allows multi-user access to continuous databases through versioning and long transactions
- **a framework for modeling and capturing the behavior of real-world objects**
 - intelligent features, rules, and relationships
- **allows the creation of common data models for specific industries and applications**

Integration of generalization into ArcGIS

Our ultimate goal:

Support data transformation and the creation of cartographic products with maximum automation, flexibility, and productivity.



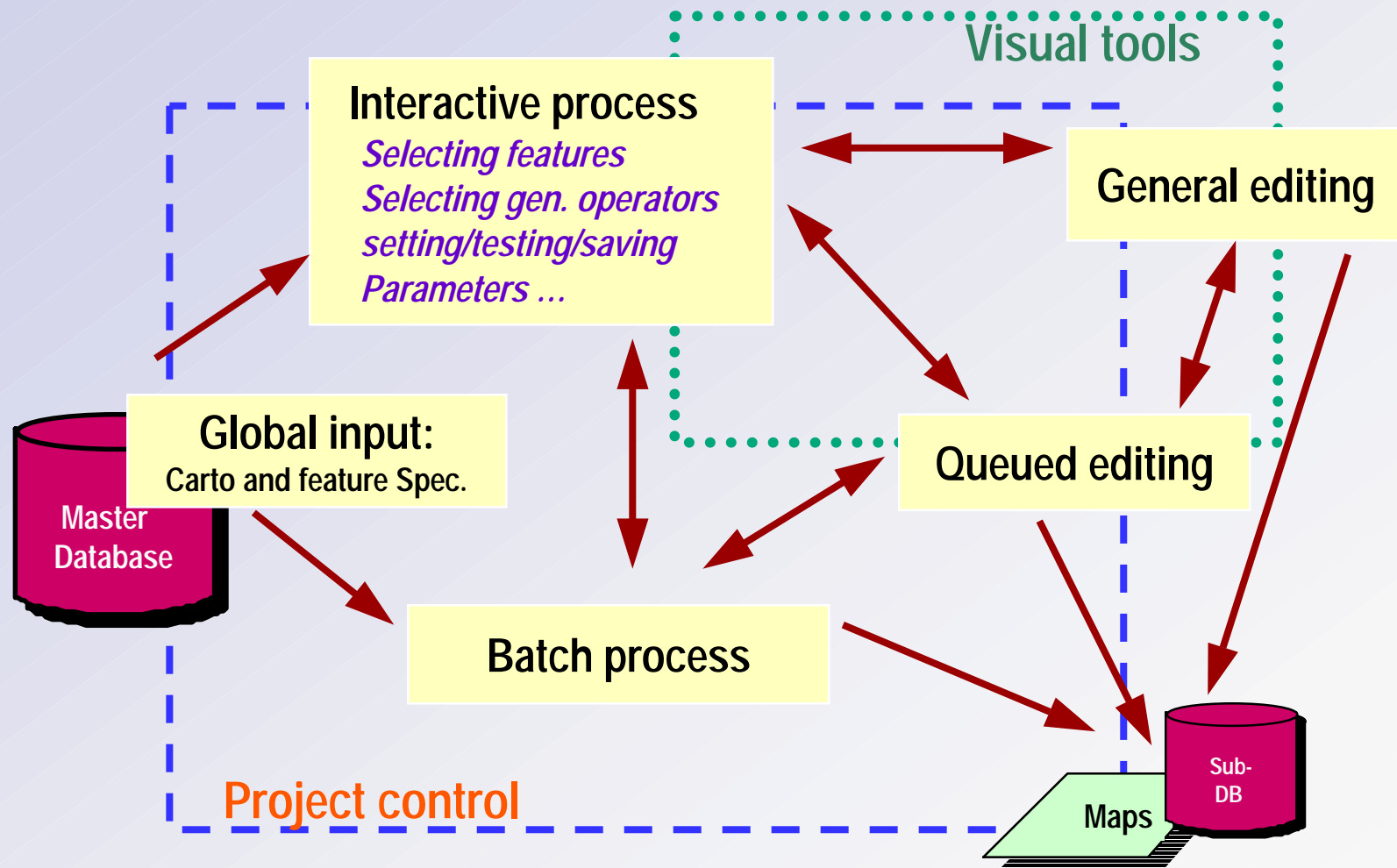
Gen-tools

Short-term plans and focus for ArcGIS

- **Developing Gen-tools along with other cartographic projects** (workflow management, NP, map sheet production automation, prepress automation, more carto. Symbology and color management, ...)
 - Porting and adding gen functionality
 - Supporting batch and interactive processes, and post-editing
 - Assessment and measurement of data before and after generalization
- **Focusing on NMAs' requests**
 - Production flow, specifications, scale range, priorities, performance, ...
- **Processing multi-layers with goal of generalizing the total map.**
 - Taking into account of feature importance ordering and maintaining positional accuracy of important features
- **Maintaining source-output relationship**

Support operator-driven approach

- follows the logic of map compilation with computer-assisted tools



Long-term plans and focus for ArcGIS

- **Continue to add new generalization functions to what we accomplish in the short-term**
 - Support more types of operators
 - Add/improve existing operators with more robust methods
- **Support other areas for Generalization in GIS**
 - Supporting surface or terrain data generalization
 - Generalizing/sampling remotely sensed data
 - Portraying linear networks and route data (Typification of Networks)
 - Portraying clusters of points (showing stacks of geocoded points clearly)
 - Automating unrelated functionality through generalization processes, e.g., automated creation of map insets or automatically arranging marginalia on a mapsheet