Features to Go:

Field Deployable GIS

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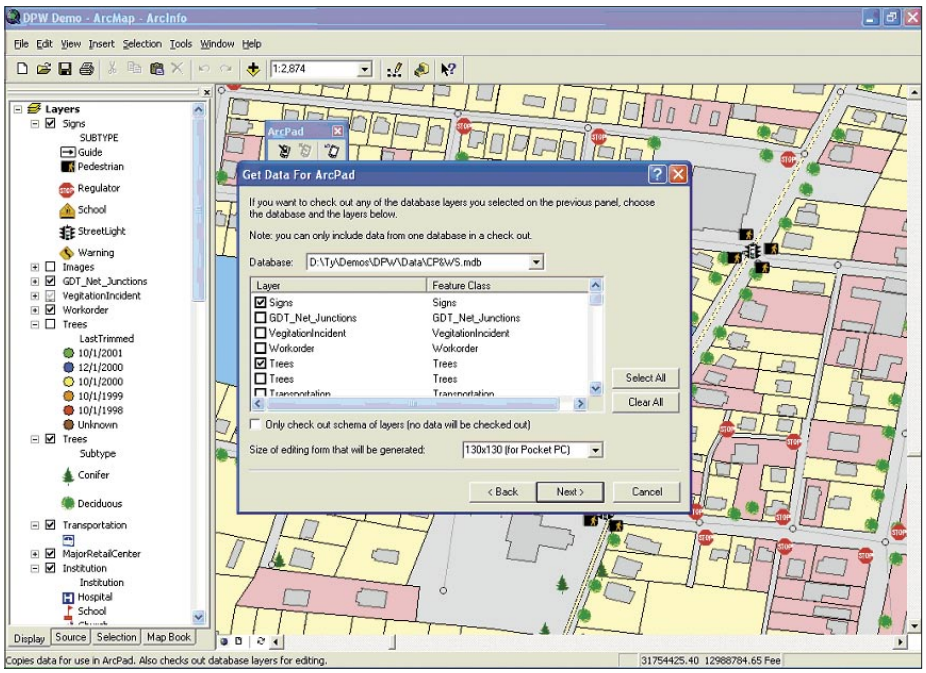
Advancements to infrastructure management have included the development of distributed data management techniques. The Internet, terminal servers, and disconnected geographic databases are some of the strategies that have been implemented for distributing geographic data to decentralized locations. Although the Internet and terminal servers are suitable solutions for many database-driven applications, disconnected databases are required when persistent network connections between databases are not available or when creating or updating data in the field is necessary.

Distributed data management also covers scenarios such as a remote office where dedicated network connections to a centralized database are not practical from an administrative or security standpoint. Using distributed data management enables satellite offices, subcontractors, and field technicians to complete independent tasks on a subset of data from a central database with minimal administrative impact related to synchronizing data changes.

Distributing data, in the form of personal geodatabases for ArcEditor (or ArcInfo) or shapefiles for ArcPad, gives organizations choices in cost and implementation style. Furthermore, field technicians in many disciplines, from electric and gas companies to environmental and government agencies, whether using ArcEditor or ArcPad, demand easy-to-use applications for updating centralized databases. Using a combination of the field-editing tools provided with ArcGIS can meet all the requirements for field data collection. This article will discuss disconnected editing and the ArcPad extraction tools for the geodatabase that are available in ArcGIS 8.3.



Select individual layers for extraction.

You Can Take It With You

Disconnected editing is designed for users requiring a fully functional ArcEditor seat in the field for the query, analysis, and design of geographic objects. Disconnected editing tools extract a subset of geographic features from a master geodatabase to a checkout geodatabase. Disconnected editing tools are accessed by choosing View > Toolbars > Editor > Disconnected Editing in the main menu or by choosing Editor > More Editing Tools > Disconnected Editing in the Editor toolbar. These tools check out and check in data, manage checkouts, and extract data. Extract data functionality is also perfect for creating a subset of the data in the enterprise database and copying it to a separate geodatabase that will not be checked back into the enterprise database.

Using disconnected editing is simple. Geographic and tabular data from a master geodatabase is checked out to a checkout geodatabase. The master geodatabase must be an ArcSDE geodatabase, and the data checked out must be in feature classes that are registered as versioned. The checkout geodatabase can be either an ArcSDE or a personal geodatabase. The master ArcSDE geodatabase will support multiple checkouts to personal or ArcSDE databases. If the checkout geodatabase is registered as versioned, it may also serve a dual role as both a master and a checkout geodatabase.

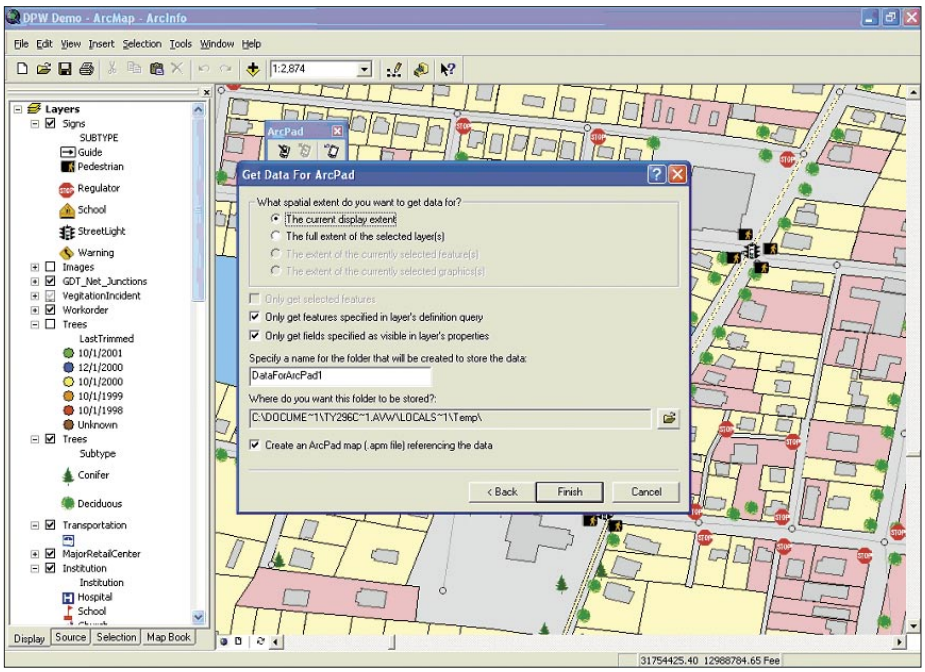
The Checkout Geodatabase

Map documents help to spatially define how data is checked out from a master geodatabase. Data can be checked out based on the extent of the current display, the full extent of the data, the extent of a currently selected graphic, or by user-defined coordinates. Attribute filters based on selected sets for individual feature classes can be used to further refine the data extracted. These techniques allow data extraction to be tailored to specific work flows.

All features in a geodatabase can be extracted from simple features (e.g., lines, points, polygons, annotation, and dimensions) to more complex features (e.g., geometric networks, topologies, and all types of relationship classes). When features have dependencies on other feature classes, as is the case with geometric network and topologies, all relative data is extracted. When extracting features in topologies and geometric networks, all spatial and geometric network integrity rules are also checked out and remain intact, and these features behave just as they do in the master geodatabase. Because all feature types and networks in a geodatabase are supported, field crews and remote offices can maintain and query geographic data as though they were using the master geodatabase.

Only a few steps are required to check out data. Simply define the version for the checkout, select the filter method for identifying geographic objects, further refine the selection criteria based on individual feature classes if necessary, and select a checkout geodatabase. The checkout geodatabase will contain a duplicate schema of the master geodatabase for those checked out features including feature class definitions, geometric networks, domains, and any other geodatabase rules. And because the data extracted from the master geodatabase must be registered as versioned, conflict detection rules are enforced when data is checked back in. Conflicts are resolved in the checkout version that was created during the checkout process.

Optionally, a map document may be created for each checkout. Each layer preserves the properties contained in the map document connected to the master geodatabase as well as all other document settings, ensuring the field



Refine selection criteria for the selected layers.

technician has the same experience as a user back at the head office.

Integrating Data Into the Master Geodatabase

Data can be checked in using either ArcCatalog or ArcMap. In ArcCatalog, right-click on the database connection and select Disconnected Editing > Checkin. In ArcMap, access the Disconnected Editing toolbar as previously described and click the Checkin button. Only updates, inserts, and deletes are posted back to the master geodatabase. These updates are resolved against the version defined for the checkout, and reinforced by all conflict detection rules during check-in.

Delta Databases

Checking in an update from a checkout geodatabase back to the master geodatabase can be accomplished in two ways. If a persistent database connection is available, changes between the master and checkout geodatabases can be incorporated directly. However, if a dedicated connection is not available, in the case of satellite offices, or where the infrastructure does not provide enough bandwidth, only the edits (or deltas) made to check out data can be exported to a delta database. The delta database is smaller and more portable than the entire checkout database. Consequently, delta geodatabases can be transmitted more easily than copying over the entire checkout geodatabase.

To create a delta database, choose Tools > Customize from the ArcMap main menu. In the Customize dialog box, select the Commands tab. Highlight Disconnected Editing in the right pane. From the left pane, drag and drop the Export Changes button onto the Disconnected Editing toolbar. This command, now available from the toolbar, will create a delta database containing only the changes created in the checkout geodatabase.

Custom Implementations

If out-of-the-box functionality does not meet all the needs for an organization's work flow, a full application program interface (API) is available. Larger organizations often require tailored implementations supporting dozens of field crews.

To streamline this process, scripts can be written that automatically incorporate detached databases with the enterprise GIS. Conflicts between critical features can be trapped and piped to log files and reports for engineers or managers to resolve at a later date. Many code samples demonstrating these types of implementations are available from the ArcObjects Developer Help by choosing Samples > Geodatabase > Disconnected Editing.

ArcPad Extraction

In a fashion similar to disconnected editing, ArcPad's extraction utilities check out a subset of geographic features from a geodatabase. However, these features are exported to a workspace of shapefiles rather than to a checkout geodatabase. These extraction tools are designed for organizations that require a low-cost solution in the field and don't require the editing capabilities of ArcEditor.

Typically, these users will perform basic data capture and attribute manipulation in addition to viewing and querying data on small, handheld devices. The user experience is similar to disconnected editing. To access these tools, in ArcMap choose View > Toolbars > ArcPad from the main menu.

The methodology for extracting data to ArcPad is similar to that for disconnected editing, but the naming conventions are an little different. Get Data for ArcPad replaces Checkout, Check in Data for ArcPad handles Checkin functions, and Undo Checkout is analogous to Manage Checkouts.

However, unlike disconnected editing, the data extracted from the master geodatabase can be either versioned and residing in an ArcSDE geodatabase or data from a personal geodatabase. This enables ArcView users to export data to ArcPad for use in the field. If data is being extracted from versioned feature classes in a geodatabase, versions will not be created for each checkout. However, applying the same principles designed for disconnected editing (i.e., creation of a version for each checkout) will reduce conflicts between editors.

Checking Features Out to ArcPad

ArcPad extraction also uses the map document to define how geodatabase objects are extracted, and several methods are available for further refining the selection of the data that will be exported from the master geodatabase. The same spatial methods used with disconnected editing—the extent of the current display, the full extent of the data, and the extent of the currently selected graphics, or features—are available. Filters can also be applied by defining definition queries to individual layers. Furthermore, only fields defined as visible in the layer properties will be extracted to the shapefiles schema. The experience for users of ArcPad with extracted features and disconnected editing is virtually the same.

Because shapefile datasets store feature data differently than geodatabases, not all complex feature type characteristics can be preserved. Because shapefiles don't support complex features (e.g., edges and junctions), they are converted to simple feature types (e.g., lines and points). Refer to the online help for specific

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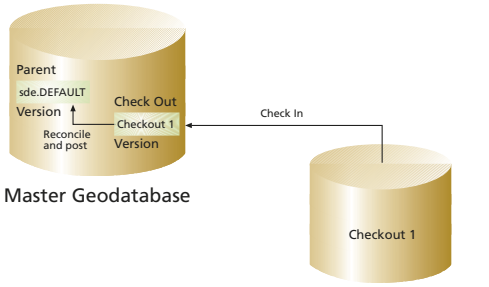
details on data type changes during ArcPad checkout.

An ArcPad project folder containing a map document with symbology for each layer of the ArcMap document is created during the checkout process. Property pages are created for each layer containing pull downs for all domains defined in the geodatabase.

When extracting data from a versioned geodatabase to ArcPad, create a version of the database for the checkout and start editing. Select the layers and workspace that will be checked out, and choose the filter method needed for identifying the desired feature classes. As the last step, define a destination folder for the exported shapefiles and ArcPad project.

Checking In Features From ArcPad

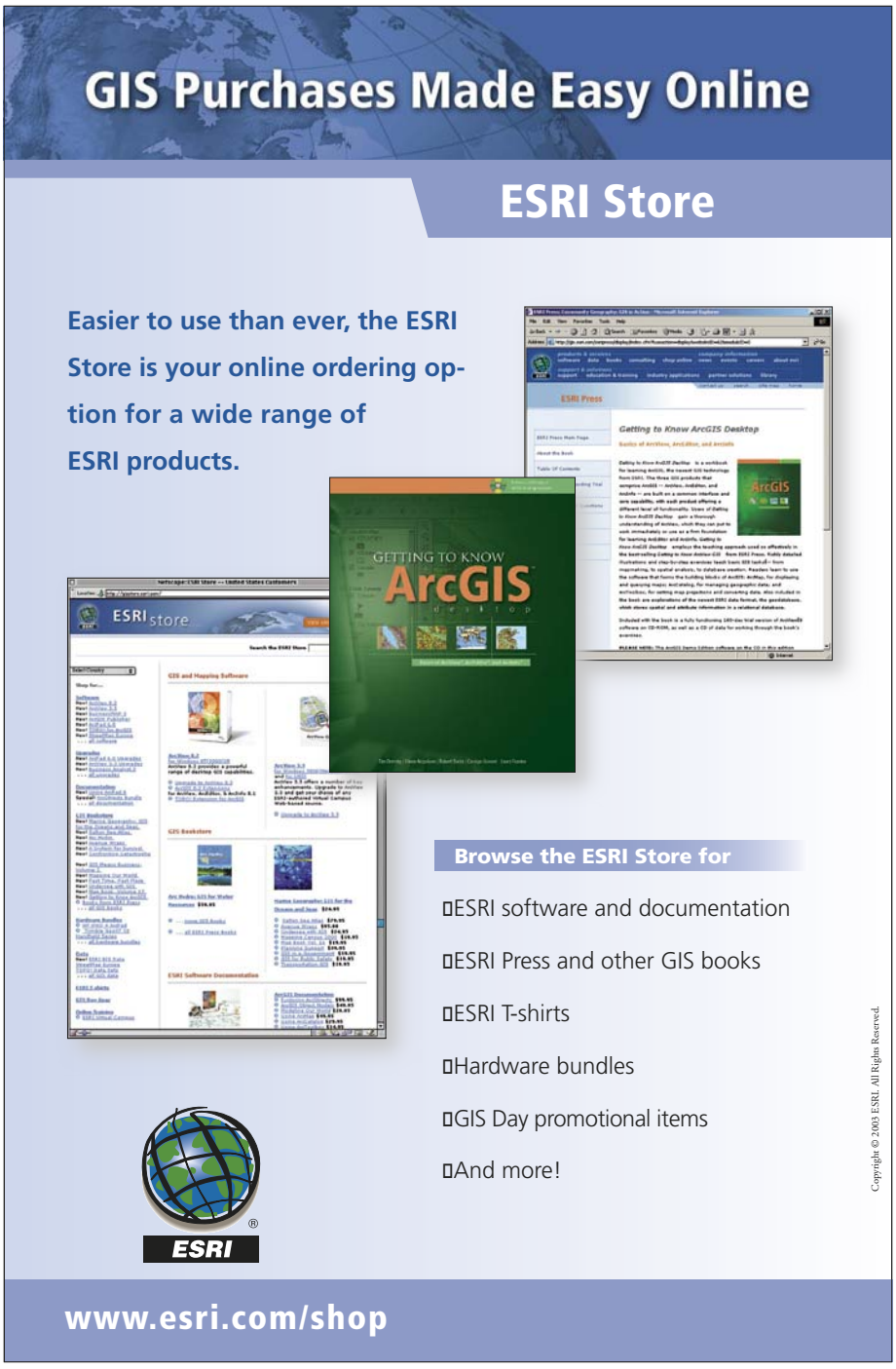
Checking in data from a device using ArcPad to the master geodatabase is just as easy as checking it out. If the master geodatabase is versioned, change the version to the field version created from the checkout and use Checkin Edits from ArcPad toolbar in ArcMap. Select the layers that will be incorporated back into the master geodatabase. All edits made to features and their attributes will be merged with the master geodatabase.



After the edits from ArcPad have been incorporated into the master geodatabase, reconciling and posting of those features with the parent version will resolve any conflicts that may have been introduced. If a personal geodatabase is being used with ArcView, edits will be merged with the current edit session.

Wrap-Up

For some organizations, data collection in the field is a fundamental aspect of their business model. To meet these requirements, the disconnected editing and ArcPad extraction tools available in ArcGIS 8.3 can help users in satellite offices or in the field access, update, and then reconcile data with the master geodatabase, which provides a more flexible work flow. ArcGIS not only supports distributed data management right out of the box but also allows for extensive customization to serve the specific needs of large organizations. For more information on disconnected editing and the ArcPad extraction utilities, refer to the online help.



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