Toward a Generic Subsetting Engine

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What a Subsetter Does

- Generic Constraints are:
  - Instrumental
  - Temporal
  - Spatial or
  - Parametric

- Each Generic Constraint must be explicitly provided or implied

- Dataset-Specific constraints may also be necessary

- We dictate that constraints only specify what data to include in the subset, not how it is to be processed
GOALS

Develop a subsetting model that:

- Is highly Archive/DAAC independent

- Provides for output in a range of different file formats by default

- Allows for custom tailoring of the supported file formats on a DAAC-specific basis (within limits)
Project Has Dual Focus

- Develop a subsetting model that works for JPL's PO.DAAC

- Sufficiently generalize basic concepts to allow model to be used at other DAAC's
Method: Object-Oriented Analysis and Design

- Encapsulate dataset-specific functionality within a series of dataset-specific objects that have uniform interfaces

- Design and apply generic rules that handle commonly occurring cases

- Allow overriding (through inheritance) of the generic rules to handle unusual cases
Limitations

- We do not consider processing of data, only subsetting proper
  - exception is casting to types necessary for target format

- No support for point data

Handles:

- Any data that can be represented as n-dimensional arrays of
  numbers

- Tabular data (eg, spreadsheet-like)

- Any associated metadata
Archive Hierarchy

- Archives can be represented hierarchically

- Subset can be isolated via a series of 4-tuples through an archive [Dataset, File, Parameter, Region]
  - We call these Path Descriptors or PD's
  - This is a dataset-independent intermediate representation of a subset
  - They serve as input to a back-end that translates them to files in a target format
  - The Subsetter must provide a mapping that yields PD's given the
constraints
Mapping from Constraints to Path Components of the Archive

- Typical example

- Actual mappings are dataset-specific

  - Does not imply there is no code sharing between the mappings for different datasets

- Any constraint mapping that is onto is appropriate

- Once we have the mapping, we have the means of generating a subset represented as a series of PD's.
PD Grouping

- A series of PD's by themselves do not adequately describe our subset

- PD's must be grouped

![Diagram showing PD's for a subset and files for a subset]

- Each group must be associated with an output filename

- PD's describe what goes into a subset

- Grouped PD's describe where the components of a subset are stored

- Given the grouped PD's, the back-end of the system determines how to complete the translation process
The Constraint Compiler

- Pipeline architecture creates the grouped Path Descriptors and associates each group with an output filename.

- Archive Tag Generator isolates subset-relevant path fragments through the Archive Hierarchy Tree.
  - Uses dataset-specific objects one per level in the AHT.
  - Objects associated with a single level for all datasets have the same interface.
- This allows for dynamic and transparent plug-and-play

- 4-Tuple generator walks the path fragments and emits a 4-tuple each time a leaf is encountered

- Then PD's are grouped
Basis for Generic Grouping/Naming Rules

- Basis formed by partitioning the Universe of File Formats according to similar capabilities
- Construct table based upon those capabilities
- Example:

  ![Venn diagram](image)

- $A =$ File formats capable of containing any number of $n$-dimensional arrays and tabular data
- $B =$ File formats capable of containing only a single 2-dimensional array
- Other $= U - A - B$
Constructing Table for Generic Grouping/Naming Rules

- Example (Continued)

- Construct table based upon the partitioning

<table>
<thead>
<tr>
<th>Source Format in</th>
<th>Target Format in</th>
<th>Grouping Rule</th>
<th>Filename Generation Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B</td>
<td>rasterGroup</td>
<td>cloneName</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>fileGroup</td>
<td>cloneName</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>rasterSequenceGroup</td>
<td>mergeName</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>rasterGroup</td>
<td>forkName</td>
</tr>
<tr>
<td>Other</td>
<td>Translation Disallowed (Source = Target)</td>
<td>fileGroup</td>
<td>cloneName</td>
</tr>
</tbody>
</table>

- Many other partitionings of U could form an appropriate basis for Generic Rules

- Generic rules can be overridden by constructing a DAAC-specific partitioning

- Can also be overridden in a dataset-specific manner
Subset File Generator

- Generic Access Layer receives a single PD Group

- Forms File Translation Layer (FTL) to handle generation of a subset file

- Then through a uniform interface to the FTL
  - Initiates read of data/metadata into an intermediate format
  - Writes intermediate format out to a single file in the target format
File Translation Layer Breakdown
File Translation Layer Breakdown (Con't)

- Chronological order of events
  1. Given PD's, data is read into the intermediate format from one or more source files
     - format-specific reader
  2. Given PD's, metadata is read in from those same source files
     - The metadata reader is format specific and potentially dataset-specific
     - metadata from multiple input files will be appropriately scoped
     - Format-specific structural metadata will be encapsulated and shared
  3. Scope is shifted if necessary to accomodate target format
     - Not necessary if source and target formats come from same format set
  4. Metadata is translated in a format-specific and potentially dataset-specific basis
  5. Intermediate format used to write output files in target format