



Containment Early Binding

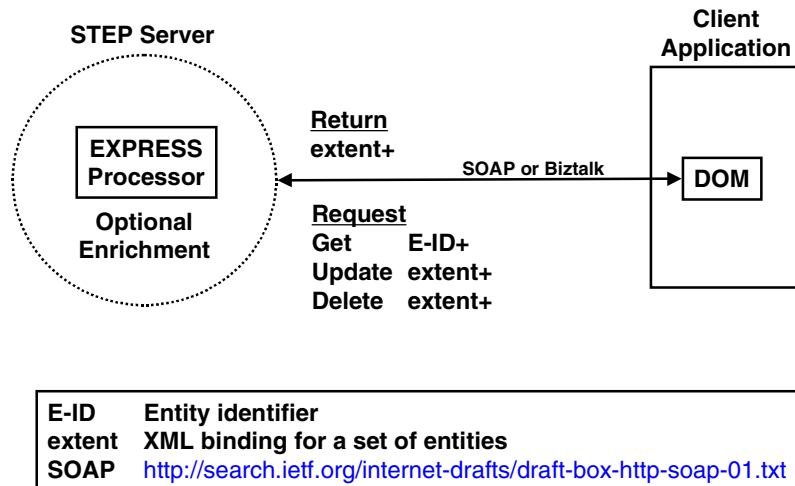
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Vendors using our STEP solutions

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- **CAD Translators**
 - SGI Alias, Bentley, Unigraphics, CADKEY, Cimatron, HZS, Entity Systems (Alibre)
- **CAE Translators**
 - Tecnomatix, Deneb
- **PDM Translators**
 - IMAN, Boeing DCAC/MRM (Metaphase)
- **CAM Translators**
 - Bridgeport Controls, Licom, Fanuc Robotics
- **Other products with STEP translators**
 - AutoCAD, CATIA, Intergraph, Pro/Engineer, SDRC, MSC NASTRAN....



- **Look like other XML data on the web**
 - Compatible with OAG models (Nesting)
 - Simple (no redundant tags)
 - Conventional inheritance
- **Apply to STEP models (Release 1 and 2)**
 - CEB maps entities and attributes
 - Mr. Jones Garden can be mapped but is out of scope
- **Work with the DOM to give applications a light weight interface to STEP data**
 - Do not require a class to exist for every single entity/element
 - Do not require an EXPRESS processing system to be in the client
 - Take advantage of the DOM's ability to rapidly scan through nested strings looking for an element

- Section 2.1.2 - Reference by containment
- Section 2.1.3 - Simple attributes
- Section 2.1.4 - Derived attributes
- Section 2.1.5 - Attribute names
- Section 2.1.6 - Super-types

The Part 21 data is:

#10 = circle (10.0, #20);

#20 = point ((1.0, 1.0));

The XML data is:

```
<circle E-ID = "#10" , radius="10" >
```

```
<center>
```

```
<point E-ID = "#20">
```

```
<coordinate>1.0</coordinate>
```

```
<coordinate>1.0</coordinate>
```

```
</point>
```

```
</center>
```

```
</circle>
```

- **Describe contained entity in place**
 - Much easier to read and update
 - May require data repetition

Simple attributes

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The Part 21 data is:

#10 = product ('a product');

#20 = product_definition_formation (#10, 'A1');

The XML data is:

```
<product_definition_formation name="A1">
  <of_product>
    <product name = "a product"/>
  </of_product>
</product_definition_formation>
```

- **Strings, Integers and Reals mapped to XML attributes**

- Fewer name clashes for STEP data
- Shorter names

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Derived Attributes

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The Part 21 data is:

#10 = circle (10.0, #20);

#20 = point ((1.0, 1.0));

The XML data is:

```
<circle perimeter="62.84" area="314.2">
  <radius positive="true">10.0</radius>
  <center>
    <point>
      <coordinate>1.0</coordinate>
      <coordinate>1.0</coordinate>
    </point>
  </center>
</circle>
```

- **Server computes values of non-explicit attributes**

- Optional
- Can be helpful to client

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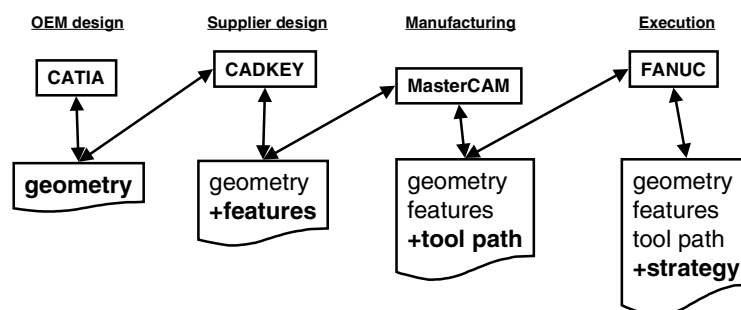
- Part 21 algorithm for attribute inheritance
- Part 22 algorithm for AND/OR entities
- See Example 5 in specification

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- **As STEP moves downstream writing data exchange translators becomes more difficult.**
 - Downstream vendor must write upstream information plus value add
 - Downstream vendors are typically smaller

Traditional Data Exchange



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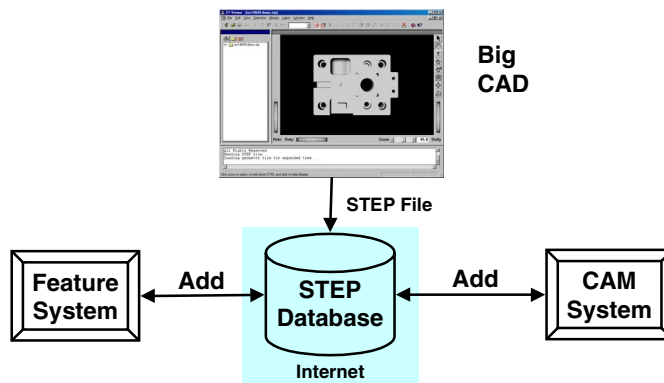
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The requirement

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- **Need a method to add data to a database**

- First CAD vendor makes geometry and starts database
- Second CAD vendor adds features to database
- Third CAM vendor adds tool paths to database
- Fourth SFP vendor adds strategy choices to database



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New solution

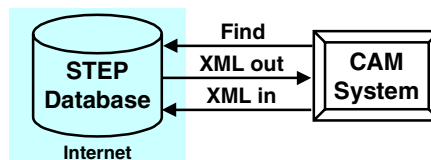
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- **Use a new Internet standard called XML**

- Find data fragment in database
- Send fragment to applications as an XML file
- Application updates the XML
- New XML is used to update the database

- **Advantages**

- Do not have to translate data multiple times
- Easier implementation by downstream vendors
- Concurrent engineering



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New tool - ST-Repository

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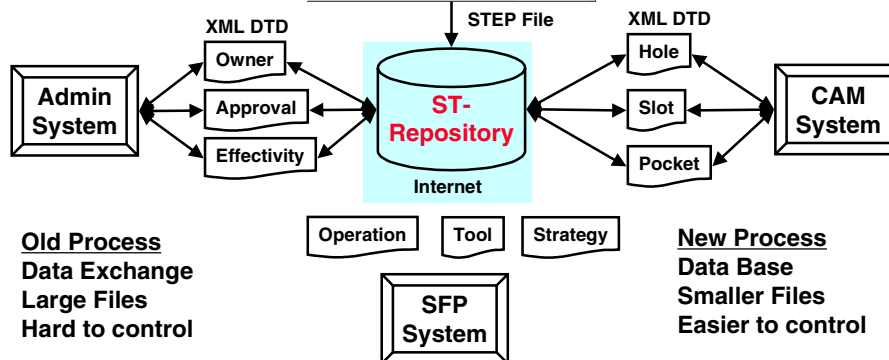
Players

Customers
Supplier
Primes
Contractors

CAD

Functions

Design
Analysis
Manufacture
Fabricate
Support



Old Process
Data Exchange
Large Files
Hard to control

New Process
Data Base
Smaller Files
Easier to control

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Implementing the new process

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• Discovery phase

- Find a STEP file containing the information required by your application
- Use a STEP browser to find the entities containing the information
- Translate the entities to XML using the CEB
- Use an XML browser such as MS Explorer to find the values in the XML required by your application

• Implementation phase

- Write an EXPRESS-X query to find the information
- Customize the DOM libraries to get and set the required values
- Write an application that uses the DOM libraries

• Execution phase using **ST-Repository**

- Find the data by executing the EXPRESS-X query
- Convert to XML using the CEB
- Edit the XML using the application
- Use the modified XML to update the database

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Summary of Advantages

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- **No need to translate data multiple times**
 - New process adds data to existing files/databases
 - Old process translates entire file to an internal structure
 - New process is “ideal” for PDM
- **Easier to understand and debug**
 - XML browsers are easy to use
 - A STEP expert can quickly verify if data is correct
 - All users can understand the data more quickly
- **Smaller footprint in the client**
 - DOM does not require one class to exist for every entity (unlike an early SDAI binding)
 - DOM does not require the client to contain an EXPRESS processing system (unlike a late SDAI binding)
 - DOM “string searching” functions are easy to use and encapsulate within methods
 - Available for both C++ and Visual Basic

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Why the CEB

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- **The browsers are only easy to use when the data is nested.**
 - Opening and closing nested elements shows content and context
- **The DOM libraries are only easier to use when applied to nested data.**
 - Do not need a separate class for each kind of element
 - Use string searching functions to find the nested element containing the required parameters
 - Encapsulate just the element containing the parameters in a class

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