ENTERPRISE DATA WORLD

SHERATON HOTEL & MARINA
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The Model Doc Approach to Information Design

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#EDW16

Agenda
(are you in the right place?)

- Introduce myself and my company
- Describe our Model Doc approach to defining, maintaining and executing data models
- Go into the details of how Model Doc does Object -> Relational mapping at design time
- Show you a model; run the generator and show some output
- This is NOT a NoSQL session; currently we generate SQL!

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- Key Practices: Data management and Integration, Secure Software Development, Self learning Systems, Cyber Security, Process automation
  - Trustworthy computing, Cyber Security, PCI, HIPAA, SAS70 etc.
  - Large Complex Secure Products /Platforms: concept, design, build, support
  - Analytically based platforms: social, financial, marketing, gaming
    - Disparate data, data warehouse, OLAP, data mining, rules engines
    - Predictive modeling, symbolic regression, GP etc.
    - Secure systems that become smarter and make the right decision
- International
  - Global customers: USA, South America, Europe, China
  - 100+ employees: USA, China, Philippines and Peru
- I've been at EC Wise 17 of its 18 years in existence, have been developing or managing teams developing data oriented apps for over thirty years
- Effective communications with clients and among our teams is critical

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What is Model Doc?

- ModelDoc is an XML file that contains definitions of objects ("entities") and supporting data types and enumerations.
  - i.e. the object model for the system in design
- ModelDocProcessor is a program
  - Reads a ModelDoc, and validates
  - Generates DDL for creating a data schema, along with HTML documentation of the model.
- Sort of a design time ORM for app developers
  - Enables us to think in "objects" but generate the corresponding SQL DB

MOTIVATION FOR THIS APPROACH

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Inception

- Initially it was about documenting a domain model in a format that we could share and use as a basis for discussion with clients
- There are many ways to do this, and in many projects it is simply not done systematically
- Writing the code generator came later
- Doing so enabled us to establish a consistent set of policies for object to DB mapping

Advantages - General

- Guarantees consistency in the design of the physical database.
- Ensures that every attribute in every class is represented in the physical database, and we know how to find it.
- Switching to a different RDBMS is theoretically simple, providing support is implemented in the ModelDocProcessor engine.

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Advantages – Early Development

- Database can change instantly to support new classes, attributes, and relationships described in the object doc.
- Easy to add/change/remove custom data types
- We can experiment with different policies around mapping inheritance, containment, and other OO concepts into a physical database.
- We can switch naming conventions when necessary.
  - E.g. for a new client
- We can switch policies around primary keys, audit trails, and effective dating at any point.

What it Does Not Do

- Automatically generate a change script to upgrade/downgrade a production database
- However, you can easily generate two different versions of the data model and run a utility to generate a comparison report or script.

So, What's Wrong with Visual Schema Modeling?

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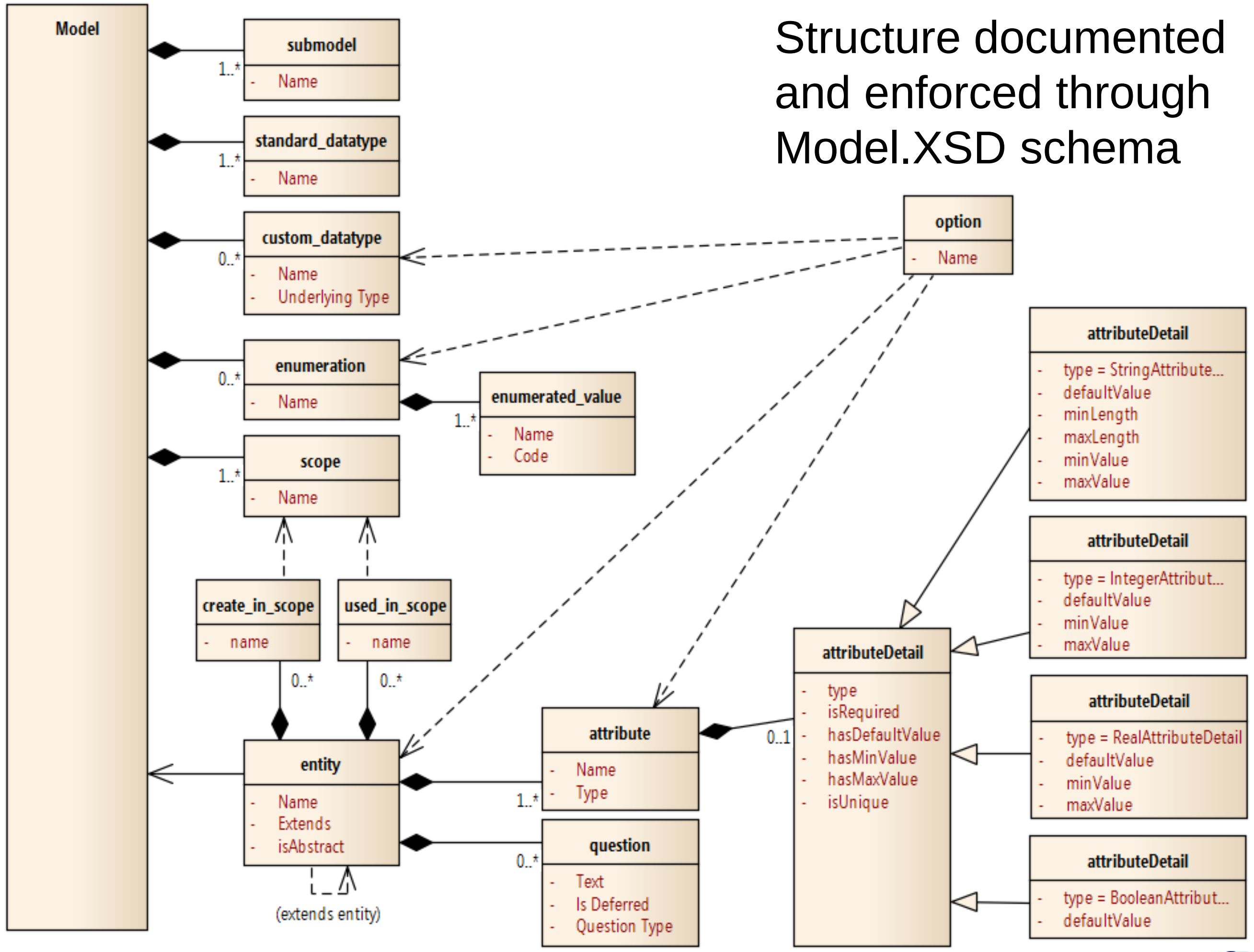
- The ORM challenge
  - Developing software requires designing both the business (object) layer and the DB schema
    - They may be a little different
  - Enterprise Architect addresses this to some extent
  - I had this problem two days ago with this model
- Not everybody gets crows feet, especially business clients
- We use EA too, to document, and otherwise

MODELDOC STRUCTURE/METAMODEL

Model Document Meta-model



Structure documented and enforced through Model.XSD schema

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Model Element – Top Level Header Info

```
<?xml version="1.0" encoding="UTF-8"?>
<model
    name="Simple Data Model"
    modelLabel="Version 1.0.0"
    confidentialFooterText="EC Wise - Confidential"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:noNamespaceSchemaLocation="./Model.xsd">
    <scopes/>
    <submodels/>
    <standard_datatypes/>
    <custom_datatypes/>
    <enumerations/>
    <entities/>
</model>
```

Scopes and Submodels

- For documentation purposes, a model is subdivided into **scopes** and **submodels**. These don't affect the generated DDL scripts. They merely illustrate functional sections of the system, and allow us to segment the file.

```
<scopes>
        <scope name=“CRM"/>
        <scope name=“Marketing”/>
</scopes>
<submodels>
        <submodel name=“Marketing only"/>
</submodels>
```

Standard Data Types

A **standard datatype** represents fundamental types such as *string* or *date* or *integer*. Every model should have the same set of standard data types. (Consider them "read-only" in the model xml.)

```
<standard_datatypes>
          <standard_datatype name="boolean"/>
          <standard_datatype name="date"/>
          <standard_datatype name="datetime"/>
          <standard_datatype name="guid"/>

</standard_datatypes>
```

Custom Data Types

A **custom datatype** is a convenience for mapping attributes to a type without having to specify all the attribute details more than once. The following is an example of a custom data type representing an email or SMTP address.

```
<custom_datatype name="SMTP Address" underlying_type="string">
  email address string. See http://tools.ietf.org/html/rfc3696#section-3
  Possible future enhancements:
    define regexp validation;
    constraints such as: ensure contains @ symbol; separating two strings
  <attributeDetail type="StringAttributeDetail" hasMaxValue="true"
maxLength="254"/>
</custom_datatype>
```

Enumerations

Enumerations are fixed lists of values. It is expected that the system logic (classes, stored procedures) will be aware of these values and include logic that takes them into account. Adding new enumeration values will probably require a change in business logic.

```
<enumerations>
  <enumeration name="Furniture Style">
      <enumerated_value name="Gothic"           code="GOTH"/>
      <enumerated_value name="Early Colonial"   code="ECOL"/>
      <enumerated_value name="Louis XIV"        code="LS14"/>
      :
  </enumeration>
</enumerations>
```

Entities

The most important object is **Entity**, which represents a basic business object like *Customer* or *Work Order*. Entities have attributes like *Customer Type* and *Work Order Number*.

Each entity in the model doc is a candidate to be a physical database table, although we try to merge some tables to support inheritance or containment relationships.

Components of an Entity:

- Created_in_scopes
- options (entity)
- Attribute, with “name”, “type”, “isCollection”
  - attributeDetail
  - options
    - option, e.g. “required”, “owner”, “default”

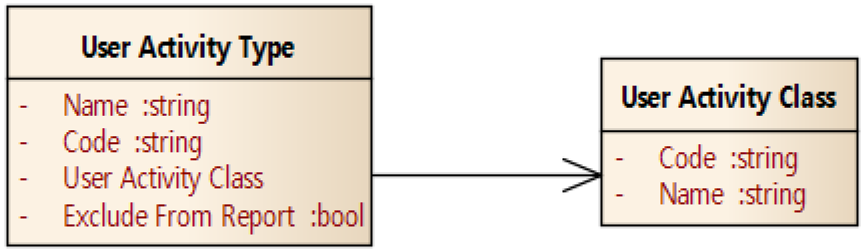
Link to examples – Schedule, Work Group, Item Condition

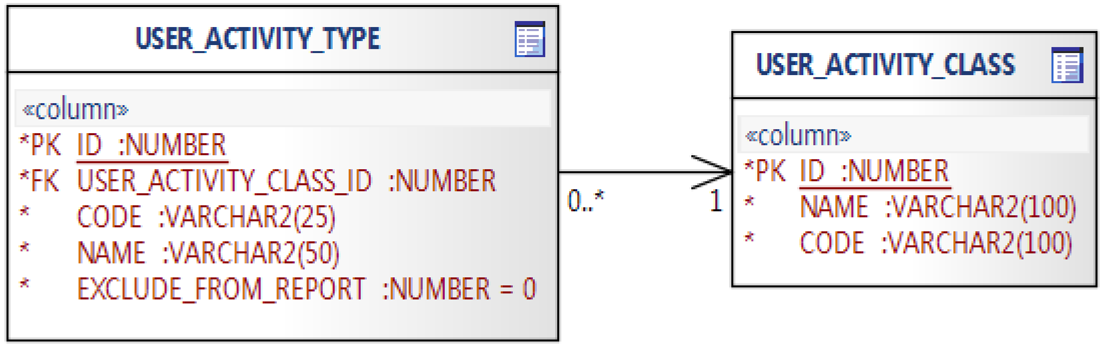
MAPPING POLICIES

Relationships
1. Share

- User Activity Type, note User Activity Class enumeration reference

Class Diagram



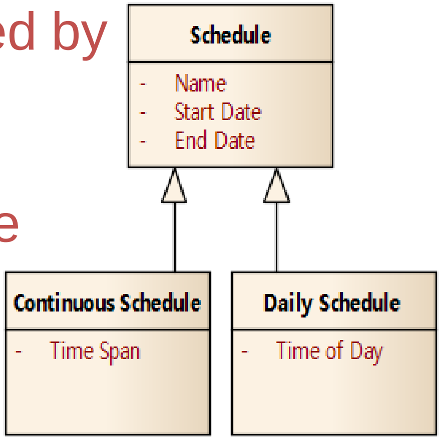


“ERD”

Relationships
2. Inheritance

- RDBMS does not have concept of inheritance, so RDBMS system that needs to store objects in an inheritance relationship needs to adopt a strategy

Here, the abstract *Schedule* entity is extended by entities for *Continuous Schedule* and a *Daily Schedule*.
Turning this into physical database tables, we have three options: Layer; Split; and Merge.



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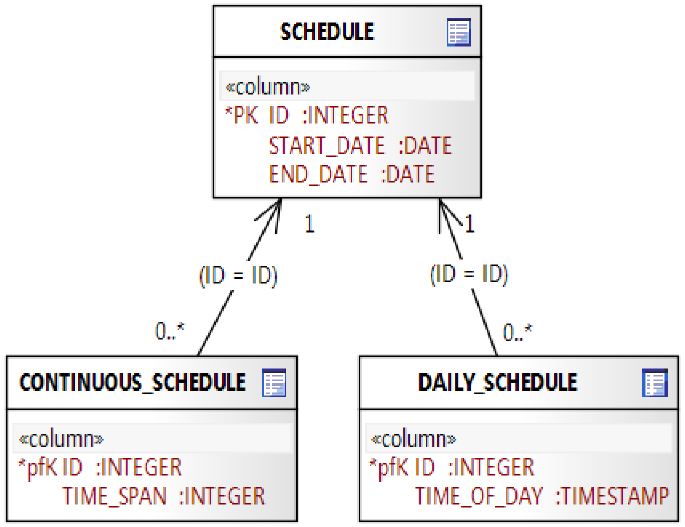
Inheritance: Layer Strategy

one table for each class, foreign keys show superclass/subclass relationships



- When an instance of a *Schedule* is a *Daily Schedule*, we get a row in both the **Schedule** and **Daily_Schedule** tables.
- To retrieve the full contents of a Schedule, we have to JOIN to the appropriate subclass table. If we don't know the subclass type, then LEFT JOINs should be used to all subclass tables - and some of the columns in the result set will be null:

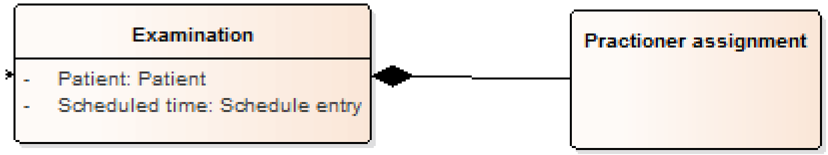
```
select s.*, c.*, d.*
  from Schedule s
  left join Continuous_Schedule c on
        c.ID=s.ID
  left join Daily_Schedule  d on
        d.ID=s.ID
where s.ID={key}
```

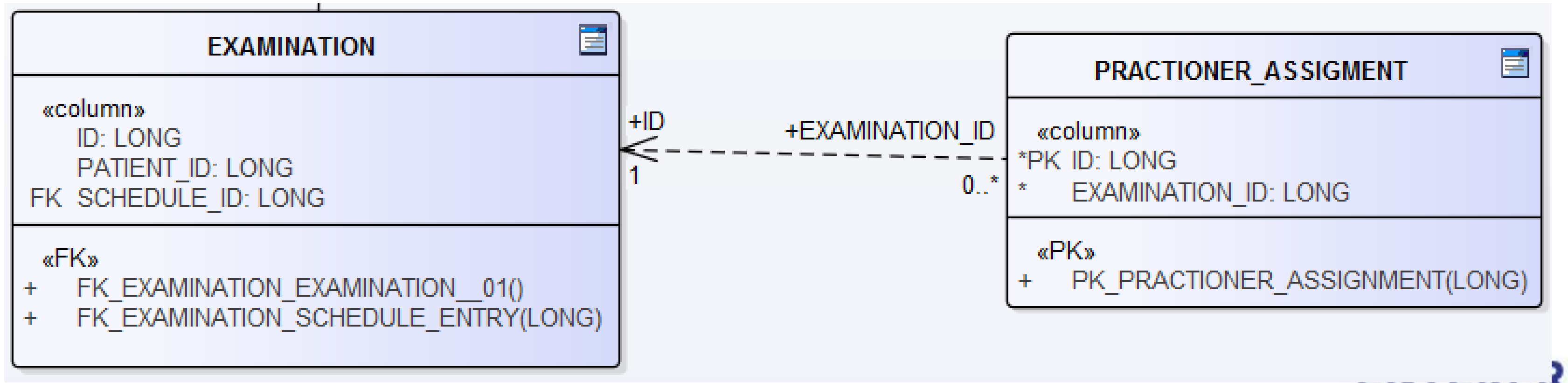
Other Inheritance Strategies

- **Split Strategy**
  - Here we don't create a separate table for Schedule (since it is abstract) but instead replicate its attributes in each of the subclass tables, e.g. DAILY_SCHEDULE, WEEKLY_SCHEDULE, etc.
- **Merge Strategy**
  - Create one Schedule table, with all attributes from all three classes. For any specific row in the Schedule table, various columns will be null depending on row type (Daily or Continuous)

Relationships
3. Containment

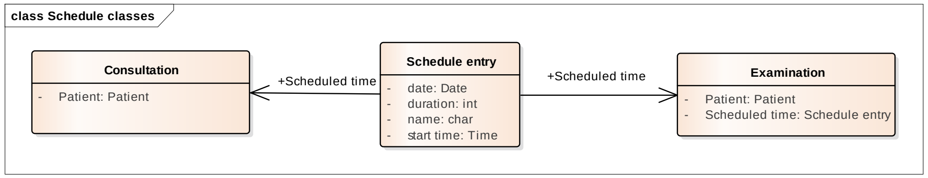
- When Entity A includes an instance of Entity B, that is usually implemented as a 1:1 Parent:Child relationship in the RDBMS, e.g.

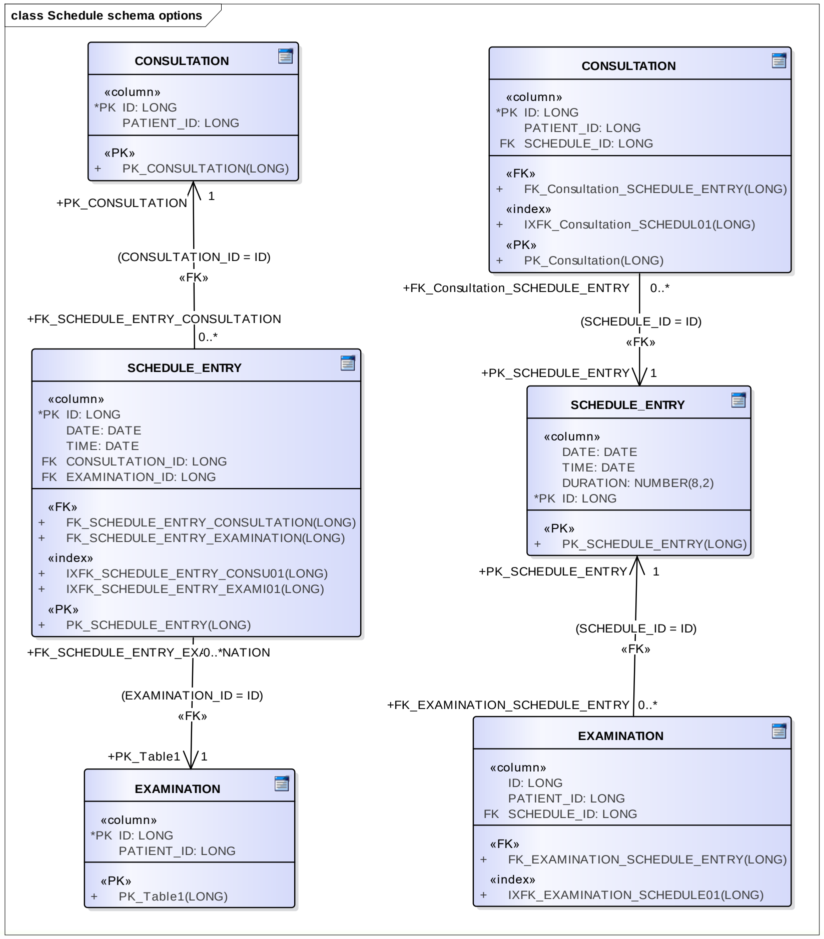




Entities used by multiple parents

This could be implemented in the database schema by adding a second foreign key to the Schedule table, and making them both NULL-able; A rigorous database schema would also implement a constraint preventing both columns from being populated.





Alternatively, each parent entity could have a foreign key column pointing to rows in the SCHEDULE_ENTRY table. This appears to be a more obvious representation, but has the problem that the ownership is not enforced by the DB schema: What is to prevent a row in each parent table from referencing the same row in the **SCHEDULE_ENTRY** table?

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EXECUTING THE MODEL

ModelDocProcessor = Compiler

• Compiler	=	ModelDocProcessor.exe
• Compiler options	=	config.xml
• Source code	=	model.xml
• Compiled executable	=	generated scripts & HTML documentation

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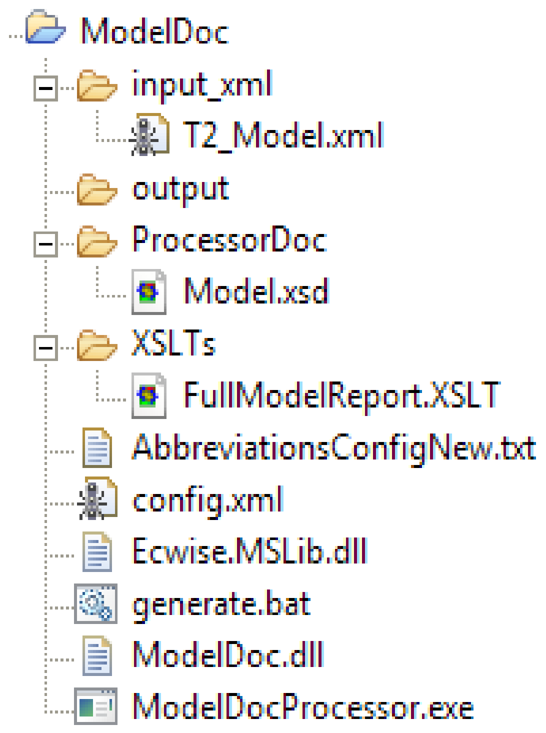
How to edit the XML

- Can read in Word using provided XSLT, but
- Edit in a text or XML editor
- We like the firstobject XML editor
  - http://www.firstobject.com/dn_editor.htm (Version 2.4.2)
  - It's a fast, compact program written in C
  - It edits large files without delay
  - It has a nice outline/tree view for navigating

How to Use ModelDocProcessor

- Create your data model in an .xml file
- Obtain the zipped binaries and supporting files
- Extract the contents of the zip to an empty directory on your local file system.
- Configure a config.xml parameter file to control how the code should be generated
- Run the ModelDocProcessor.exe with the config.xml file name as the parameter.

Setting up Working Directory



```
ModelDoc
├─ input_xml
│   └─ T2_Model.xml
├─ output
├─ ProcessorDoc
│   └─ Model.xsd
├─ XSLTs
│   └─ FullModelReport.XSLT
├─ AbbreviationsConfigNew.txt
├─ config.xml
├─ Ecwise.MSLib.dll
├─ generate.bat
├─ ModelDoc.dll
└─ ModelDocProcessor.exe
```

The *config.xml* tells the processor where to look for the source file, and where to generate the output.

In this example, the source is .\input_xml\T2_Model.xml, and the output will be generated in the .\output directory.

It is quite common to have multiple config xml files (with different file names) when testing different options.

The T2_Model.xml model document stores information about the business entities and attributes, and relationships between them.

Explore Config Options

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Execute the Model

Demo

Comments, Questions, Contact Info

- Does this look useful to anybody?

- Contact info
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