

# Introduction to XML Schema Document (XSD) visualization

## Part I: XSD Diagram

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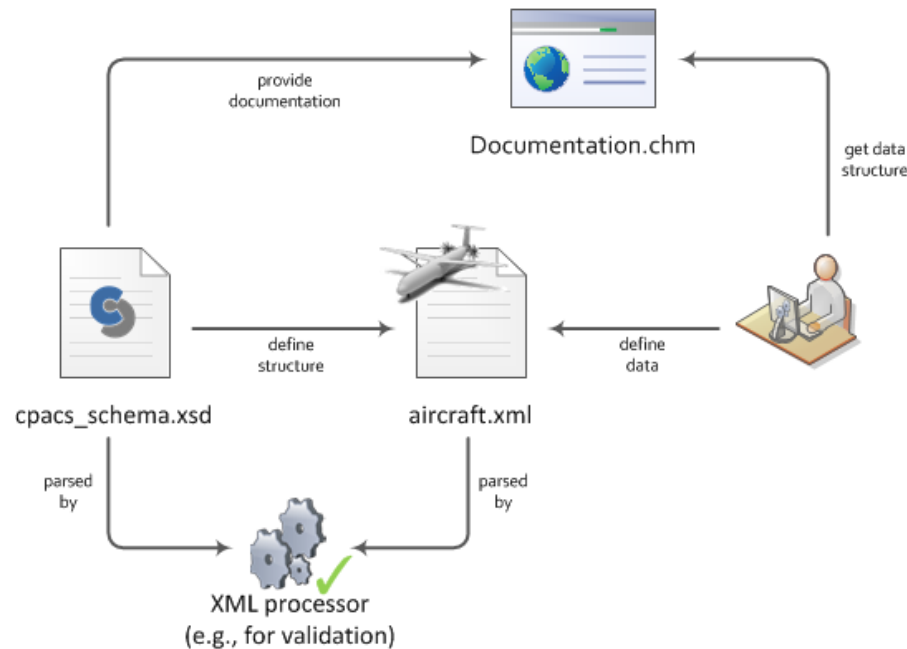
DLR Institute of System Architectures in Aeronautics  
Hamburg

A large, high-resolution image of the Earth as seen from space, showing the curvature of the planet, blue oceans, white clouds, and green landmasses. The image is positioned on the right side of the slide, partially overlapping the text.

Knowledge for Tomorrow

# What is a schema?

- A schema\* is itself an XML file (\*.xsd), which defines the rules/syntax how a CPACS file (\*.xml) may be structured:
    - how often and in which order may elements appear
    - what is the type of elements (string, double, complex type with sub-elements, etc.)
- summarized as *type* of an *element* 🧩



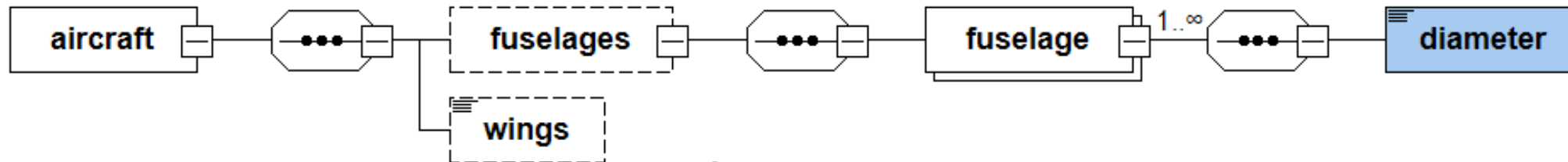
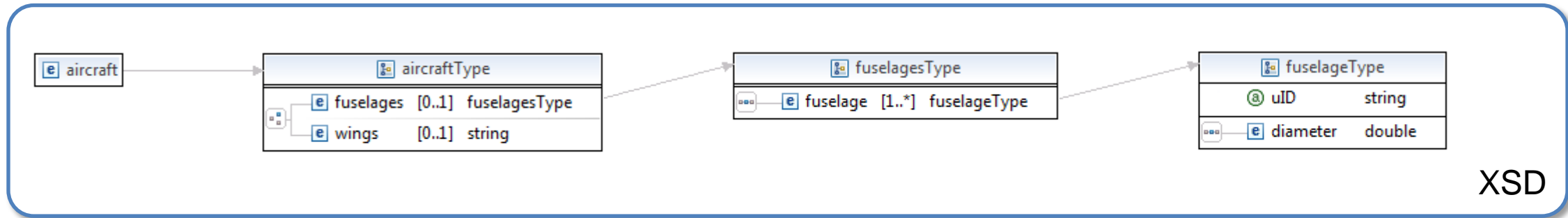
```

- <xsd:complexType name="aircraftType">
- <xsd:annotation>
- <xsd:appinfo>
- <sd:schemaDoc>
- <ddue:summary>
  <ddue:para>aircraftType</ddue:para>
</ddue:summary>
- <ddue:remarks>
  <ddue:para>Aircraft type, containing all the aircraft models</ddue:para>
</ddue:remarks>
</sd:schemaDoc>
</xsd:appinfo>
</xsd:annotation>
- <xsd:complexContent>
- <xsd:extension base="complexType">
- <xsd:sequence>
  <xsd:element maxOccurs="unbounded" name="model" type="aircraftModelType" />
</xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
  
```

\* ) in IT called *schema* and not *scheme*..

# What are elements and types?

## Simplified example similar to CPACS

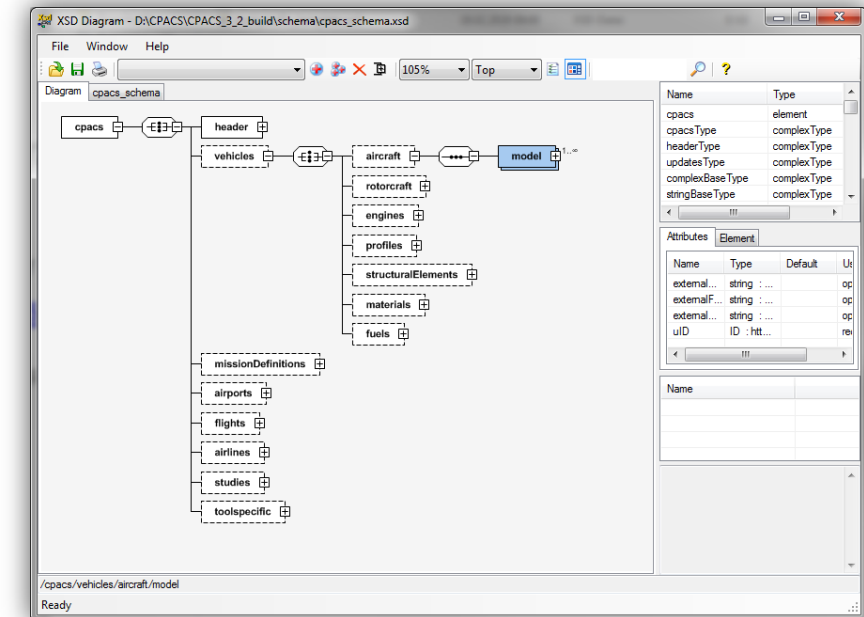


- **Simple types:** double, string, integer ...
- **Complex types:** specify sub-elements and attributes of elements  
→ used to build hierarchical structure

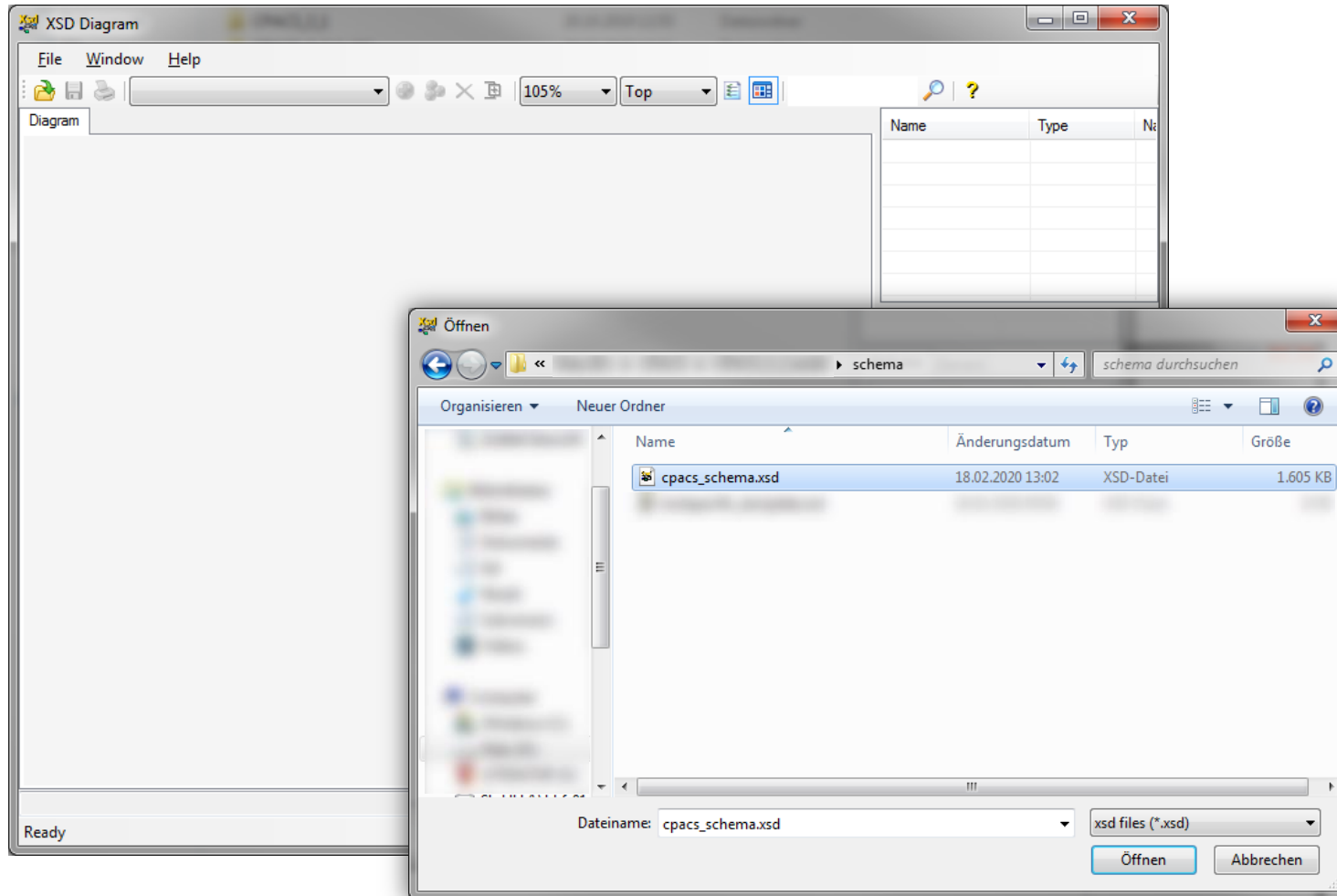


# XSDDiagram

- XSD Diagram:
  - A simple tool to visualize a schema quickly and easily
  - It's just a viewer, not an editor (i.e., not possible to modify the schema)
- Download the latest version:
  - <http://regis.cosnier.free.fr/?page=XSDDiagram&nomenu>
- Download the CPACS schema:
  - <https://cpacs.de/pages/download.html>
  - e.g.: [https://www.cpacs.de/schema/v3\\_2\\_0/cpacs\\_schema.xsd](https://www.cpacs.de/schema/v3_2_0/cpacs_schema.xsd)



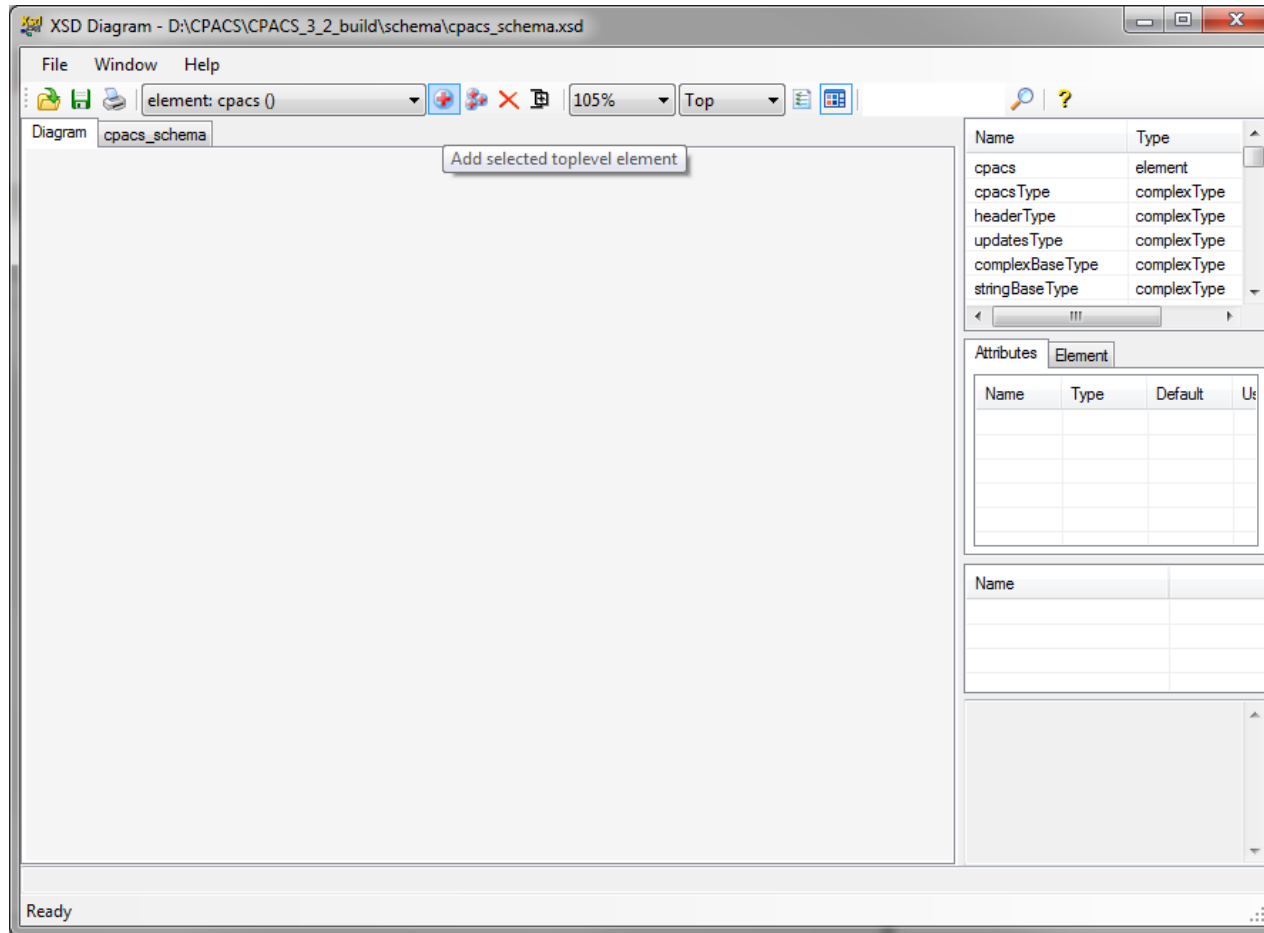
# XSDDiagram






- Run *XSDDiagram.exe*
- Drag & drop or use *File -> Open* the *cpacs\_schema.xsd* file



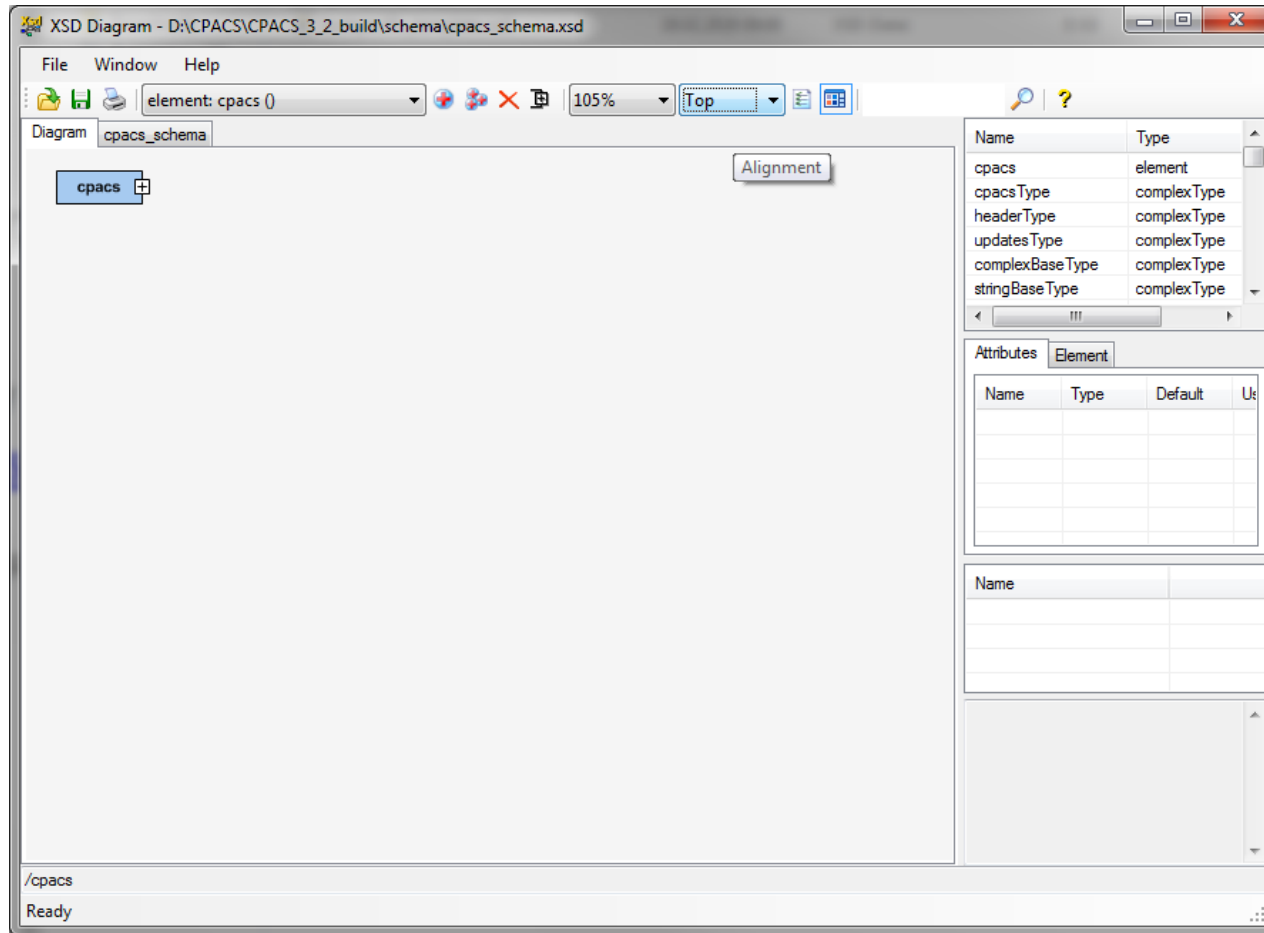
# XSDDiagram



- Click  to open the CPACS root node
- Might be useful:
  - Click on  to display the element description
  - Use  to open all sub-elements



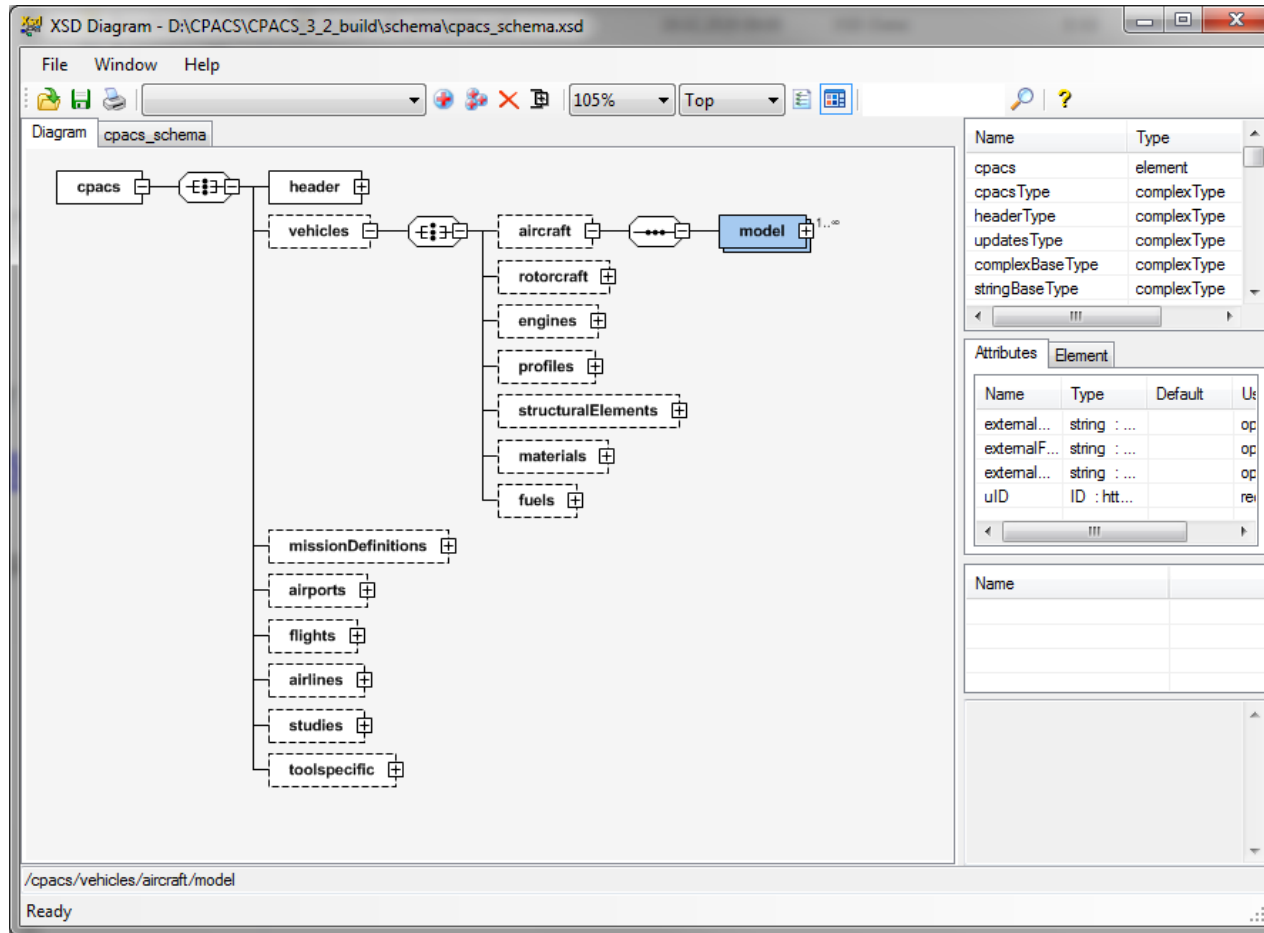
# XSDDiagram



- The *cpacs* root element appears
- Tip: Select *Top* in the dropdown menu to have a more intuitive waterfall structure of the schema



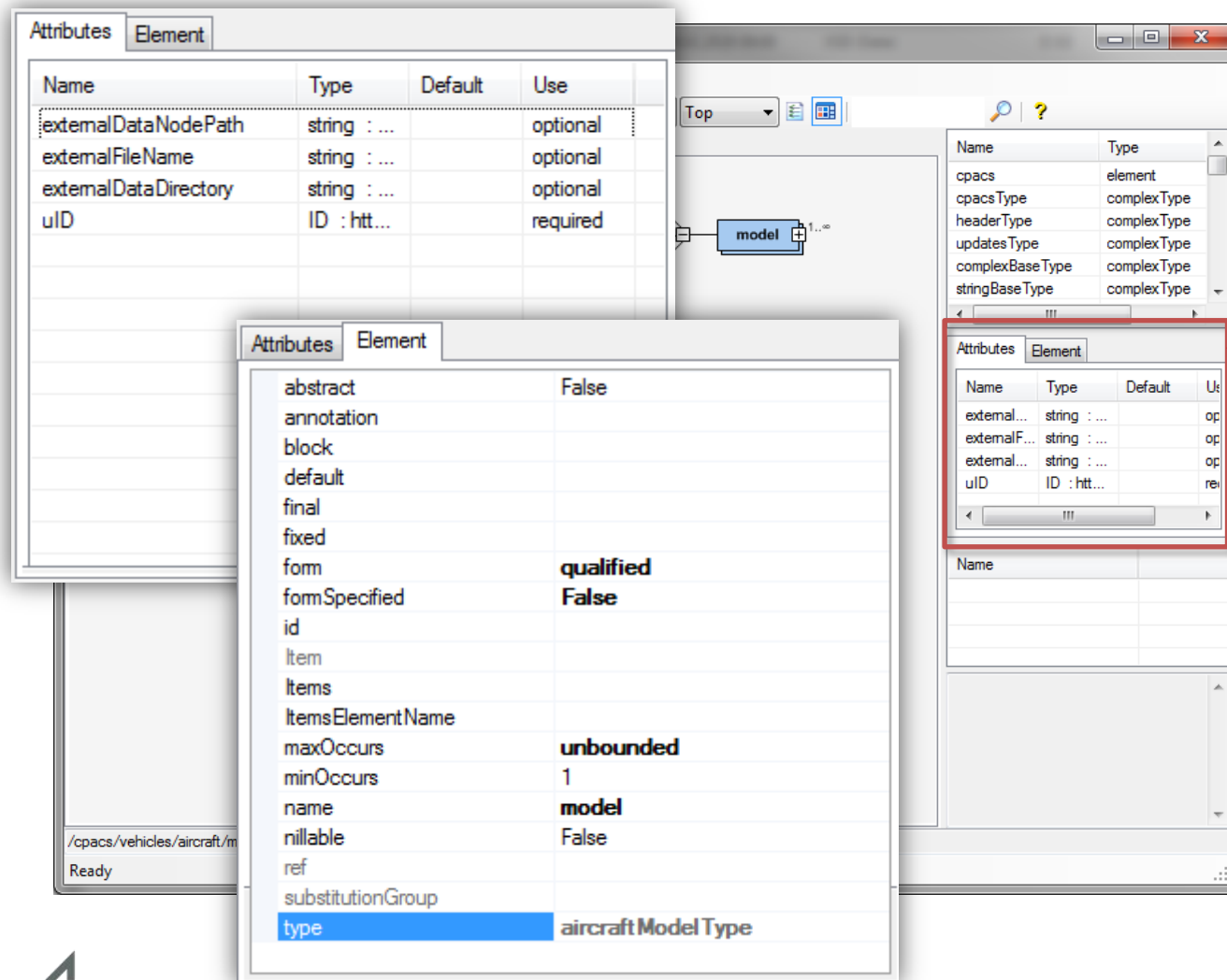
# XSSDiagram



- Use the arrow keys on your keyboard to navigate quickly and easily through the CPACS schema



# XSDDiagram



The screenshot shows the XSDDiagram application interface. The main window displays a diagram with a node labeled "model" in blue. A red box highlights a smaller window in the bottom right, which contains a table of attributes and element properties for the selected node.

**Attributes Window (Top Left):**

Name	Type	Default	Use
externalDataNodePath	string : ...		optional
externalFileName	string : ...		optional
externalDataDirectory	string : ...		optional
uID	ID : htt...		required

**Attributes Window (Bottom Left):**

Attribute	Value
abstract	False
annotation	
block	
default	
final	
fixed	
form	<b>qualified</b>
formSpecified	<b>False</b>
id	
item	
items	
itemsElementName	
maxOccurs	<b>unbounded</b>
minOccurs	<b>1</b>
name	<b>model</b>
nillable	False
ref	
substitutionGroup	
<b>type</b>	<b>aircraft Model Type</b>

**Attributes Window (Bottom Right):**

Name	Type	Default	Use
external...	string : ...		op
externalF...	string : ...		op
external...	string : ...		op
uID	ID : htt...		re

- The right part of the window contains the *attributes* (e.g., *uID*) and *element properties* belonging to the node marked in blue

# XSDDiagram

The screenshot shows the XSDDiagram software interface with several windows open. The 'Attributes' window is in the foreground, displaying a table with columns: Name, Type, Default, and Use. The 'Use' column is highlighted with a red box. The 'Element' window is also visible, showing a list of element properties. The 'model' node in the diagram is highlighted in blue.

Name	Type	Default	Use
externalDataNodePath	string : ...		optional
externalFileName	string : ...		optional
externalDataDirectory	string : ...		optional
uID	ID : htt...		required

Name	Type	Default	Use
external...	string : ...		op
externalF...	string : ...		op
external...	string : ...		op
uID	ID : htt...		re

Name	Type	Default	Use
abstract			False
annotation			
block			
default			
final			
fixed			
form			qualified
formSpecified			False
id			
item			
items			
itemsElementName			
maxOccurs			unbounded
minOccurs			1
name			model
nillable			False
ref			
substitutionGroup			
type			aircraft Model Type

- The right part of the window contains the *attributes* (e.g., *uID*) and *element properties* belonging to the node marked in blue
- Check whether an *attribute* is required or optional



# XSDDiagram

The screenshot shows the XSDDiagram software interface. The main window has two tabs: 'Attributes' and 'Element'. The 'Attributes' tab is active, showing a table of attributes for the selected element. The 'Element' tab is also visible, showing a table of elements. A separate window is open, showing the properties of the selected element, 'model'.

**Attributes Table:**

Name	Type	Default	Use
externalDataNodePath	string : ...		optional
externalFileName	string : ...		optional
externalDataDirectory	string : ...		optional
uID	ID : htt...		required

**Element Table:**

Name	Type
cpacs	element
cpacsType	complexType
headerType	complexType
updatesType	complexType
complexBaseType	complexType
stringBaseType	complexType

**Element Properties Window:**

Property	Value
abstract	False
annotation	
block	
default	
final	
fixed	
form	<b>qualified</b>
formSpecified	<b>False</b>
id	
item	
items	
itemsElementName	
maxOccurs	<b>unbounded</b>
minOccurs	1
<b>name</b>	<b>model</b>
<b>nillable</b>	False
ref	
substitutionGroup	
<b>type</b>	<b>aircraft Model Type</b>

- The right part of the window contains the *attributes* (e.g., *uID*) and *element properties* belonging to the node marked in blue
- Check whether an *attribute* is required or optional
- The *aircraft/model* node, for example, can occur any number of times, but must be specified at least once
- The above node is not *nillable*, i.e. `<model/>` is not allowed

# XSDDiagram

The screenshot shows the XSDDiagram software interface. The 'Attributes' tab is active, displaying a table of attributes for the selected element. The 'Element' tab is also visible, showing a list of elements. The 'model' element is highlighted in blue in the 'Element' list.

Name	Type	Default	Use
externalDataNodePath	string : ...		optional
externalFileName	string : ...		optional
externalDataDirectory	string : ...		optional
uID	ID : htt...		required

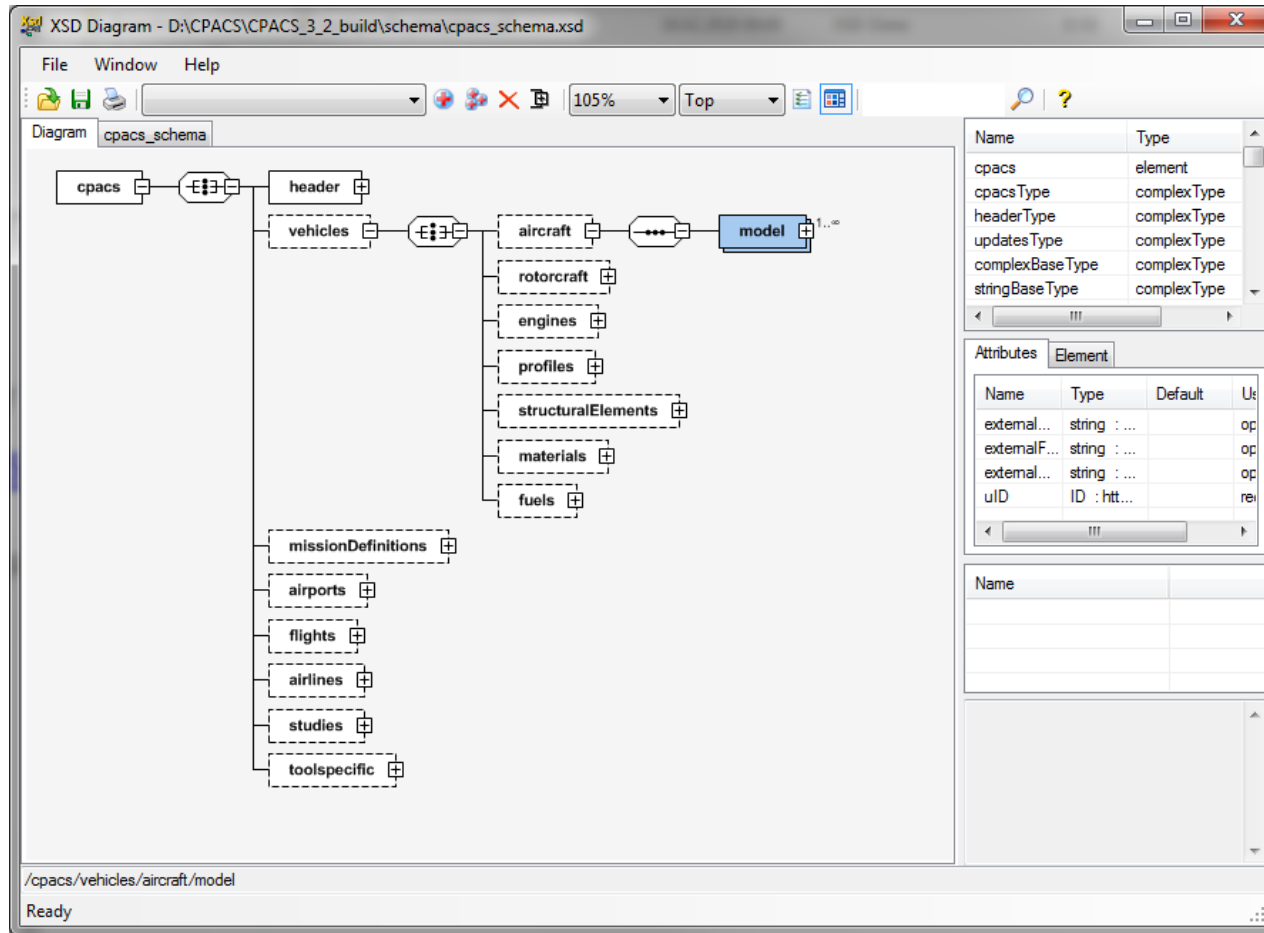
Name	Type	Default	Use
external...	string : ...		op
externalF...	string : ...		op
external...	string : ...		op
uID	ID : htt...		re

Name	Type	Default	Use
abstract		False	
annotation			
block			
default			
final			
fixed			
form		qualified	
formSpecified		False	
id			
item			
items			
itemsElementName			
maxOccurs		unbounded	
minOccurs		1	
name		model	
nillable		False	
ref			
substitutionGroup			
type	aircraft Model Type		

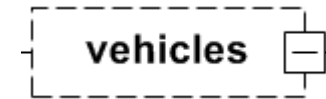
- The right part of the window contains the *attributes* (e.g., *uID*) and *element properties* belonging to the node marked in blue
- Check whether an *attribute* is required or optional
- The *aircraft/model* node, for example, can occur any number of times, but must be specified at least once
- The above node is not *nillable*, i.e. `<model/>` is not allowed
- The type of *model* is *aircraftModelType*

# XSSDiagram

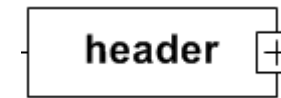


- How often may nodes appear in CPACS? (=occurrence):

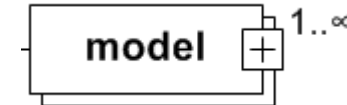
- Optional node [0..1]:



- Mandatory node [1..1]:

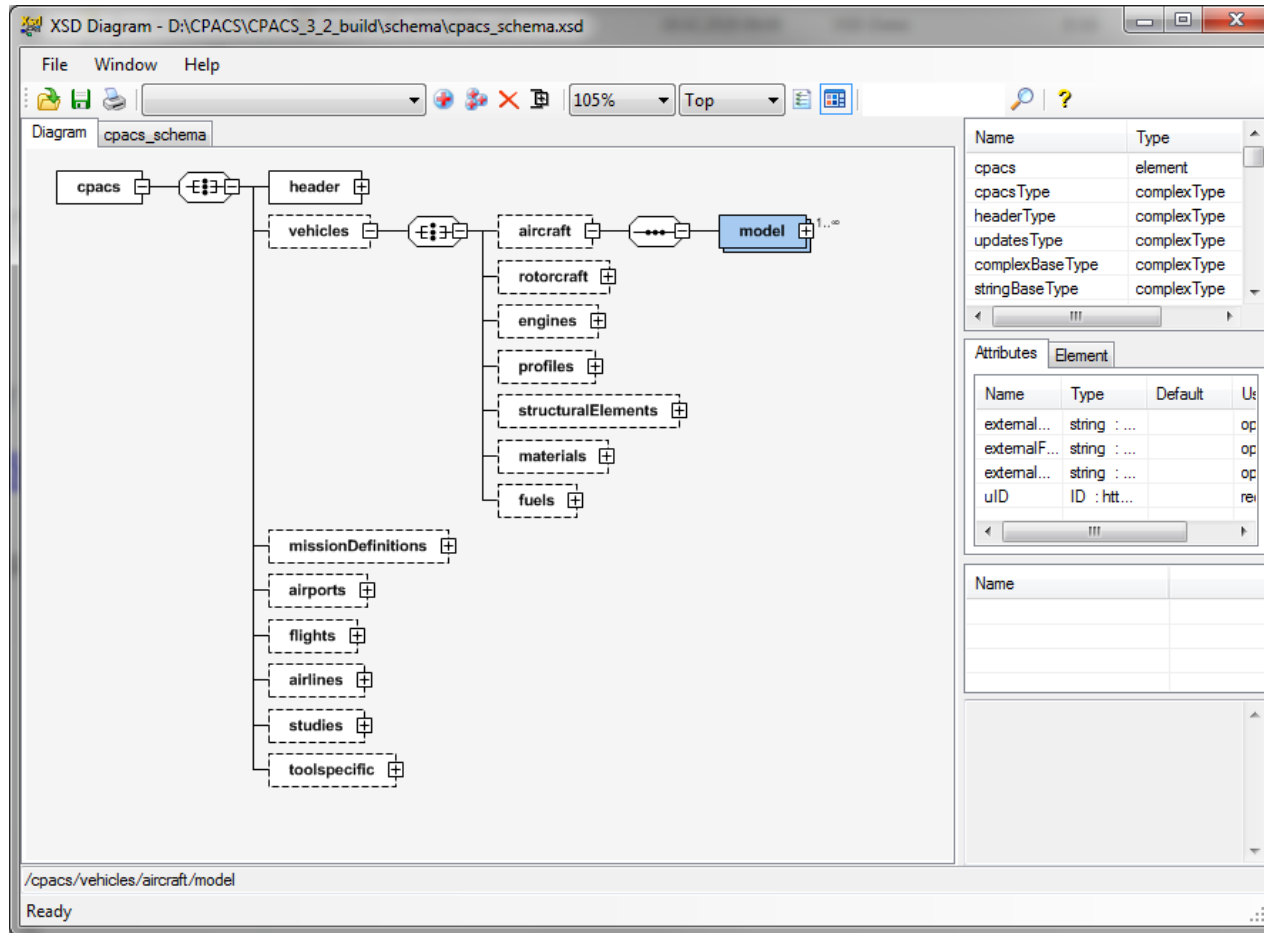


- Mandatory sequence [1..\*]:



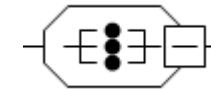


# XSSDiagram



- In what order may the elements appear?:

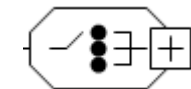
- Sequence is arbitrary (i.e. it does not matter whether *aircraft* is specified first and then *engines* or vice versa)



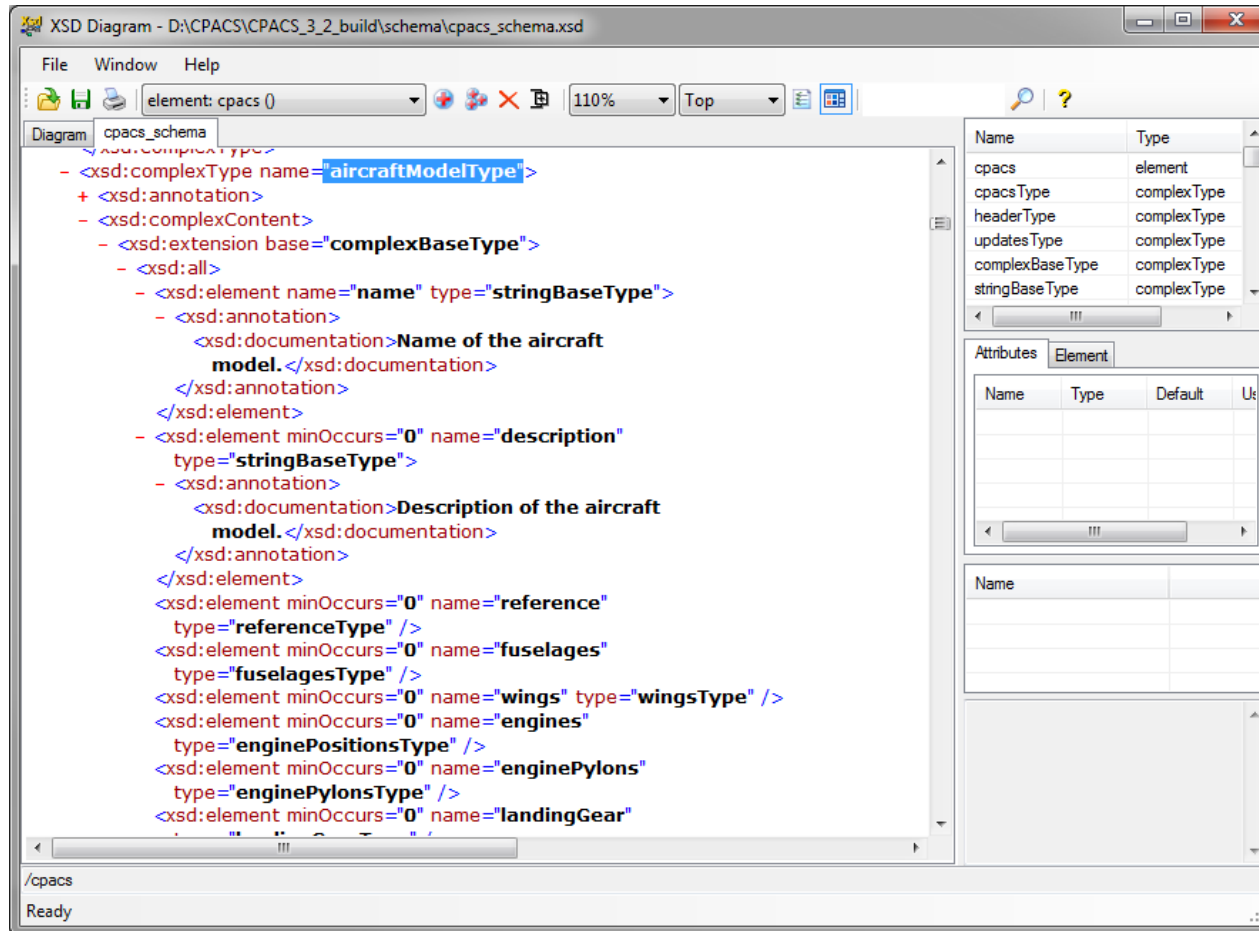
- Sequence must correspond to the representation in the XSD diagram



- Only one of the nodes may be specified (=choice element):



# XSDDiagram



- For the advanced user:
  - The complete XML code of the schema
- Note:
  - (In the current version) XSDDiagram is not the most suitable tool to analyze the XML code of a schema
  - Notepad++, Eclipse or RCE is recommended instead

