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Translation from XSD to JSON Schema

A short introductory report on conversion of two popular data interchange formats.

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January 12, 2022

CMPE541 - Advanced Databases‡

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‡Authors thank to Dr. Damla TOPALLI for her great support and contributions.

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1 Introduction

Today, almost every web application is working asynchronously. While a long-running user task is running in the background, the web application shows a waiting animation to the user. Asynchronous web applications immensely increase user satisfaction and provide informative feedback to the user.

Getting the necessary information to start a background task and informing the user that the background process finished its job is made possible by sending and receiving messages between server and client. These messages should have well-defined structures and standards. They should also structure the transmitted data and store it when necessary. These messages can be plain text as well as proprietary binary data. Both have their advantages and disadvantages. Employing plain text messages over HTTP has its advantages against using binary data. Because of that, text-based markup languages are developed and have quickly become popular. Two of the most famous ones are Extensible Markup Language (XML) and JavaScript Object Notation (JSON). Since these languages have similar/interchangeable tasks, converting one to another can be very useful in some contexts.

1.1 Motivation

XML Schema Definition (XSD) is a very stable and widespread set of elements to be used with XML to transfer data back and forth across the server and host. W3C published its recommendation of XSD in 2001. Since then, it has been maintained and protected by various standards.

The history of JSON Schema is quite similar to the one of XSD, with one key difference. The syntax of JSON is immensely influenced by the JavaScript dictionary notation. This property is very web developer-friendly since they are often familiar with JavaScript. In addition, JSON was developed mainly considering web technologies such as HTTP, Flash, and JavaScript.

All of these notches suggest some sort of conversion should be made possible from XSD to JSON. However, the literature has little research on the topic. Therefore, a summary of the existing studies can be advantageous to have for developing further research ideas. Besides, due to the popularity of XSD, some JSON suitable data have already been stored in XSD rather than JSON. The conversion of this type of data can be beneficial. Also, transmitting messages with JSON is much more optimized in some modern environments.

1.2 Preliminaries

In general, a schema describes the characteristics of an object and its relations with other objects. A schema defines elements and attributes of elements to represent an object such as a web page. Examples of such a schema can be HTML, XML. A schema does not have to be a document. It can be a byte stream or a database record. In this report, a schema is always interpreted as a document.

To understand the actual need for conversion, one should understand the underlying formats. In this section, a summary of both XSD and JSON Schema is presented. The explanations for each format are also supported with brief examples.

1.2.1 XML Schema Definition

Fallside et al. [1] start giving an example XML document (but not a schema yet) on a home products ordering and billing application in their primer work on XML Schema. Their example document can be seen in Listing 1.

```
<?xml version="1.0"?>
<purchaseOrder orderDate="1999-10-20">
<shipTo country="US">
    <name>Alice Smith</name>
    <street>123 Maple Street</street>
    <city>Mill Valley</city>
    <state>CA</state>
    <zip>90952</zip>
</shipTo>
<billTo country="US">
    <name>Robert Smith</name>
    <street>8 Oak Avenue</street>
    <city>Old Town</city>
    <state>PA</state>
    <zip>95819</zip>
</billTo>
<comment>Hurry, my lawn is going wild<!/comment>
<items>
    <item partNum="872-AA">
        <productName>Lawnmower</productName>
        <quantity>1</quantity>
        <USPrice>148.95</USPrice>
        <comment>Confirm this is electric</comment>
    </item>
    <item partNum="926-AA">
        <productName>Baby Monitor</productName>
```

```
        <quantity>1</quantity>
        <USPrice>39.98</USPrice>
        <shipDate>1999-05-21</shipDate>
    </item>
</items>
</purchaseOrder>
```

Listing 1: An XML document for a home products ordering and billing application.

Listing 1 starts with a version identification, continues with several subelements (elements that contain other elements) that are spanned by a top-level element called "purchaseOrder". Each element has its closing tag if they are not one-liners. Elements that carry subelements or attributes are called complex types. Other elements that only have numbers, strings, dates, etc. are called simple types.

An XML document is said to be an XML schema when its elements and subelements have "xsd" namespace associated with them. A partial example from Fallside et al. is given in Listing 2.

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">

<xsd:annotation>
    <xsd:documentation xml:lang="en">
    Purchase order schema for Example.com.
    Copyright 2000 Example.com. All rights reserved.
    </xsd:documentation>
</xsd:annotation>

<xsd:element name="purchaseOrder" type="PurchaseOrderType"/>

<xsd:element name="comment" type="xsd:string"/>

<xsd:complexType name="PurchaseOrderType">
    <xsd:sequence>
    <xsd:element name="shipTo" type="USAddress"/>
    <xsd:element name="billTo" type="USAddress"/>
    <xsd:element ref="comment" minOccurs="0"/>
    <xsd:element name="items"  type="Items"/>
    </xsd:sequence>
    <xsd:attribute name="orderDate" type="xsd:date"/>
</xsd:complexType>

...

</xsd:schema>
```

Listing 2: A partial XML schema for a home products ordering and billing application.

1.2.2 JSON Schema Definition

2 Methods

2.1 A Generic Translation Process From XSD to JSON Schema

2.2 Existing Methods

2.2.1 From XML Schema to JSON Schema: Translation with CHR

2.2.2 Towards Efficient and Unified XML/JSON Conversion

3 Results

4 Conclusions

References

[1] David C Fallside and Priscilla Walmsley. "XML Schema Part 0: Primer Second Edition". In: *October* October (2004), pp. 1–84. URL: http://www.w3.org/TR/xmlschema-0/.