

# Comparative Study of different Data Formats for IoT

Pooja Parmar<sup>1</sup> Tushar A Champaneria<sup>2</sup>

<sup>1</sup>PG Student <sup>2</sup>Assistant Professor

<sup>1,2</sup>Department of Computer Engineering

<sup>1,2</sup> L.D. College of Engineering, Ahmedabad, Gujarat, India

*Abstract*— Nowadays the internet plays a major role to exchange the information between any two ends of the world. And the information passed on the internet has should have some format just like XML, JSON, EXI etc. But all these data formats have some pros and cons according to the requirement. This paper compares XML, JSON and EXI data formats for data communication on the basis of different parameters.

**Key words:** JSON, XML, EXI, IoT

## I. INTRODUCTION

Data interchange formats evolved from being marked up and display-oriented to further support the encoding of meta-data that describes the structural attributes of the information [1]. There is a huge amount of data produces from various sources like IoT, online transactions, sensors, mobile phones, various sites etc. [2] there are different types of data. The data used for communication is in any form like text, multimedia (image, video, audio), in the form of any signal etc. But when we send these data on the web then the data available in different types will be converted to some common format. There are different types of data formats are used for data communication. For example, XML, JSON, EXI etc.

In this paper, we have discussed different data formats for data communication. And compared them on the basis of different parameters like processing time, CPU utilization, Memory utilization security, size, etc.

The remainder of the paper is organized as follows. Section II detail description of each data format which includes their basic information, sample code, used libraries etc. In Section III, we had compared the discussed formats on various parameters. Finally, Section IV concludes the paper which highlights all the key issues discussed throughout the paper.

## II. DATA FORMAT

In this section, we have discussed XML, EXI, JSON data communication formats with their sample code and libraries. While developing web applications in the background to safeguard unity and readability common data format is used for data communication. Which makes it easy for developers to build data interface for data transmission based on features of the application [3].

### A. XML

XML stands for Extensible Markup Format. It is much like HTML. But unlike HTML it can use predefined tags as well as used defined tags [4]. XML is just information wrapped in tags. XML format stores data in serialized manner. And these serialized data give good security. It simplifies data sharing, Scalability of tags allows programmers to configure depending on the appearances of the web service applications.

#### 1) Data Structure of XML [4]

```
<? xml version="1.0" encoding="UTF-8"?>
```

```
<breakfast_menu>
```

```
<food>
```

```
<name>Belgian Waffles</name>
```

```
<price>$5.95</price>
```

```
<description>
```

```
Two of our famous Belgian Waffles with plenty of real maple syrup
```

```
</description>
```

```
<calories>650</calories>
```

```
</food>
```

```
</breakfast_menu>
```

As shown in above code breakfast\_menu and food is used defined tags. And the name, price, description, a calorie is sub-tags of the tag food. With XML, the author must define both the tags and the document structure.

#### 2) Libraries for XML

Java XML API provides the capability of validating and parsing XML documents. It has three basic parsing interfaces [5].

- DOM (Document Object Model)
- SAX (Simple API for XML)
- StAX (Streaming API for XML)

### B. JSON

JSON stands for JavaScript Object Notation. Same as XML, JSON is also a data exchange language. Which is easy to read and interpret by user or computers, which can easily parse it. Unlike XML, JSON does not need extra libraries to salvage data from DOM objects. Thus, JSON is much faster than XML. But there are some significant downsides of JSON which comprise lack of namespace support, lack of input validation and extensibility.

#### 1) Data Structure of JSON [6]

```
{ "name": "John",
  "age": 31,
  "city": "New York"
};
```

As shown in the above code the data stored in JSON format is a key-value pair, separated by a comma. And curly bracket holds the object.

#### 2) Libraries for JSON

JSONQ is used in JavaScript for JSON compatibility.

There are some functions in PHP for handling JSON data format like json\_encode, json\_decode etc [7].

### C. EXI

EXI stands for Efficient XML Interchange. The EXI format removes redundant tags and values from XML documents and encodes numeric content in a binary format. Due to this file size will reduce and it improves processing efficiencies [8]. IoT with constraint nodes is expected to be heterogeneous and flexible. Due to the RAM and bandwidth constriction on these nodes, use of XML becomes difficult. To solve this problem we can use XMLless EXI, which will be a substitute of XML [9].

The data structure of EXI:

```
00000000 8a 40 8c ad c0 28 d4 c2 c4 c4 ca e4 5c ca f0 c2
00000020 da e0 d8 ca 5c de e4 ce 00 20 04 89 a1 d1 d1 c0
00000040 e8 bc bd 95 d1 a1 95 c9 e0 b9 a9 85 89 89 95 c8
00000060 b9 bd c9 9c bd cd d1 c9 95 85 b5 cc 21 cd d1 c9
00000100 95 85 b4 07 b5 30 b1 31 32 b9 1d 31 b6 34 b2 b7
00000120 3a 01 02 66 87 47 47 03 a2 f2 f7 77 77 72 e7 73
00000140 32 e6 f7 26 72 f5 84 d4 c2 f3 13 93 93 82 f6 e6
00000160 16 d6 57 37 06 16 36 50 57 86 d6 ca
0000174
```

Fig. 1: Data structure of EXI

#### 1) Libraries for EXI

A Java-based implementation of the EXI specification, called OPENER-EXI. In python to work with EXI there is one plugin called exifred [10].

## III. COMPARISON

In different situations, different XML data formats are used as per their requirement. In the below comparison, these formats are compared on various parameters like,

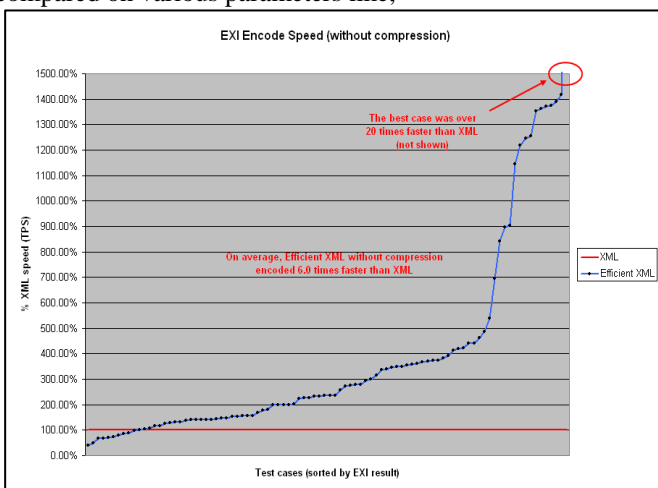


Fig. 2: EXI Encode speed without compression[11]

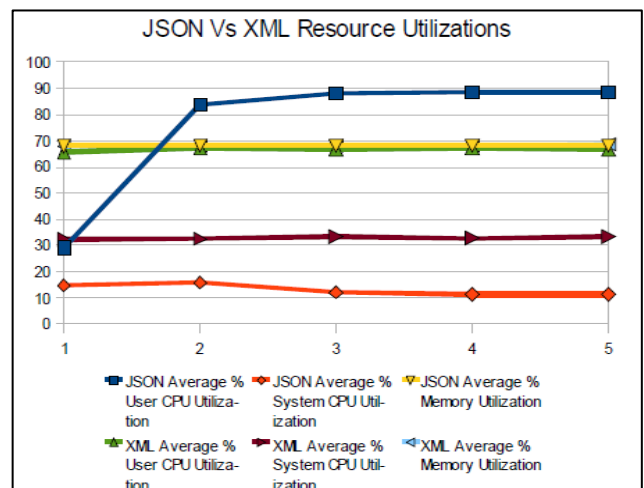


Fig. 3: JSON V/S XML resource utilization[1]

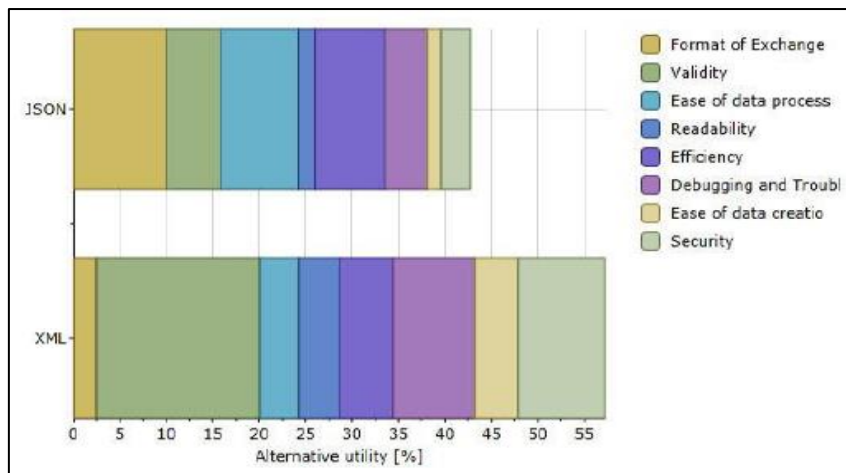


Fig. 4: XML and JSON comparison ranking[12]

	Size in Bytes[13][14]	Average time in ms for 2k bytes of transfer[15][16]	Supported in Java
XML	198	120.15	Yes
JSON	140	78.48	Yes
EXI	72	40	Yes

Table 1: XML, JSON, EXI

#### IV. CONCLUSION

As we have discussed different data format for communication. These formats can be used in IoT for data passing of different web services. As discussed in comparison XML, JSON, EXI these all can run on java. And as per the size of each format for the same object, we can say that the data in XML format has more size compare to JSON and EXI. Mostly in IoT JSON format is in use. But as per the results, we can say that EXI format, which is compressed form of XML requires less size and as a result, it requires less time to transfer.

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