

ARTICLE

COMPARATIVE STUDY ON WEB SERVICE DATA INTERCHANGE FORMATS

Vishawjyoti*, Rashmi Agrawal

Faculty of Computer Applications, Manav Rachna International Institute of Research and Studies, Faridabad, INDIA

ABSTRACT

With wide use of internet as a medium of communication, it is a need of time to have service oriented architecture. Web services are loosely coupled independent executable software components that help to provide data for communication to web applications. Data formats used in web services have pre defined data exchange formats like XML and JSON. These web services works on heterogeneous platforms having different network architecture and operating systems. The basic architecture extensively used in web services is RESTful architecture. The RESTful web services has REST APIs, that works on four simple methods of POST, PUT, GET, DELETE. This paper provides an insight of various features required to compare two widely used data exchange formats and present a comparative analysis on these features conducted by the researchers. This comparative analysis has proved that JSON has significant impact as compared to XML that provide its future scope for comparison in these two data sets on the basis of efforts required to learn and implement JSON objects.

INTRODUCTION

Due to wide increase of Internet for communication among many applications, developers are thinking more to simplify the concept of communication between client and server. The term web services were coined. Web is the model of communication between client and server over a network. A network can be internet or intranet. Web allows performing all type of communication over the Internet with the help of HTTP. All the information over the web is in the form of documents or other web resources. To access these resources there is requirement of URL. All the elements on the web is linked with each other making its model architecture complicated. Evolution of web starts from static web pages to dynamic web pages, to interactive web pages and finally to reactive web pages. Reactive web pages not only communicate with the users but also adapt the screen resolution and screen size. Service term is used for any software function performed for any business query, accessing data in various format or too perform certain comprehensive function like authentication etc. A service can be used to share logical functions across different applications. A web service is an independent executable software web component which is usually responsible for performing certain services required for reusable business function. A web service is a web application component that uses standardized format like XML and JSON to interact with other web applications over internet. Earlier data processing activities were integrated with web application development and made it a tedious task to access everything on the same machine i.e. server. Gradually with the development of technology, data processing service were separated and then this process data is used with web applications at the front end to generate certain specific output as per user specification. So web services are independent data processing services that provide processed data in special data exchange format like XML and JSON and provide this data to web applications. Web services are processed on different servers and provide the response to the client. Web services doesn't require any specific platform and they are loosely coupled, that is the reason they are usable in various types of business applications and generalized system factions. Thus a web service doesn't require a user interface where a web application has a GUI or a user interface to interact. Web services allows communication between various applications to be used with over Internet, here no human interaction are required. We can access various web services by HTTP methods specified GET, PUT, POST, DELETE etc. for example Google maps are the web services that can be used by web applications to display maps. To get the response from these service web Applications sends co-ordinates and get responses. [Fig. 1] below illustrates web service architecture.

Basic architecture of web services are of two types SOAP and REST, where SOAP is a set of protocols and REST is a software oriented architecture having rest APIs. The SOAP is a XML based protocols that defines the format of messages for communication on web services enabled web applications. The heterogeneous environment over internet demands a standard data exchange format representation that is designed in XML for SOAP architecture. SOAP message structure has three basic components: The SOAP header, the SOAP body and the SOAP fault.

The SOAP header is used to pass the information related to application. Authentication credentials and definition of complex types are embedded in header. The SOAP body contains the actual detailed message. The SOAP fault is an optional element that defines the nature of error message that can occur while processing. SOA is essentially a collection of services that required communicating with each other. Basic SOA architecture always has service provider and service consumer. In normal RPC style of communication, client just generate a request by calling a method and server access these requests and send the desired responses to the client. During this process requests are send in a pre defined format and this encapsulation of requests in SOAP message is called marshalling. At the server end, these requests are unwrapped for the generation of appropriate responses is called demarshalling. REST architecture is a style of software architecture that does not have pre defined standards and protocols. These architectures, also known as RESTful architecture, has proved a wide choice for web services

KEY WORDS

Web services, RESTful architecture, data exchange formats, XML, JSON

Received: 14 Feb 2019
Accepted: 18 March 2019
Published: 20 March 2019

*Corresponding Author
Email:
vishaw.fca@mriu.edu.in
Tel.: +91-9711135115

implementation. RESTful architecture is uniquely characterized by state and the functionality is divided into distributed resources. RESTful architecture has four basic methods for data access over web services.

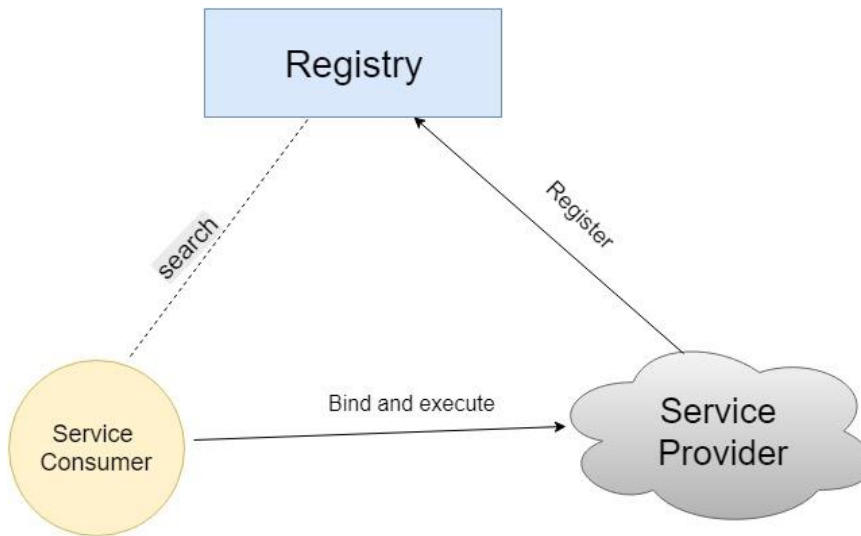


Fig. 1: Web Service architecture

LITERATURE REVIEW

Attempt has been made in the literature to find the use of various data exchange formats to improve the reliability of various standards of web technologies used in Internet. JSON and XML are 2 widely used data exchange formats having their own pros and cons. An attempt is made to discuss the contribution of some authors.

Research study [1] has given a broad outline of various features of JSON and XML as data exchange formats. And also describe the strength and weakness of both over each other. In this paper various criteria and their hierarchy for the comparison of JSON and XML formats is illustrated. A comparative analysis is performed and based on this, authors have concluded that XML bit edge over JSON and advised that a combination of can be used as per the requirement.

The comparative analysis in the paper [2] has given emphasis on selecting adequate data exchange format that can improve data transmission rate and performance significantly. The authors have shown comparative analysis between the two formats by considering 2 different scenarios on the size of java objects. The factors used for comparison were CPU time, memory utilization and data transferring time. The result in the study concluded that JSON is faster and used fewer resources.

The authors have proposed a web service model for data exchange between Heterogeneous databases. The data exchange format is in JSON format [3].

The benchmark comparison between the features of two most widely used data exchanged formats JSON and XML has provided a clear picture of performance of the two. On the basis of parameters stream size, memory foot prints and marshalling and unmarshalling time. JSON data format is best choice among the two [4].

In a paper [5] authors raised the issue of importance of data exchange formats in service based applications. Authors had used parameters like serialization and deserialization in various XML and JSON formats and concluded that JSON based data can be processed more efficiently.

In this paper [6] the authors presented the need of data storage on cloud and performed in-depth analysis of two most widely used data exchange formats JSON and XML based on a Web API implemented with PHP framework. Both formats were analyzed on two criteria, the response speed (in seconds) and the size of the data received (in KB). The overall evolution stated that JSON data exchange formats are better in terms of data size and speed over XML. The paper has provided with a future scope to convert XML data formats used in web services to JSON data formats.

In a paper authors emphasized the use JSON data format for storing the data in relational databases. The authors have used four most commonly used databases and represented their lesion with JSON to

represent database schemas. This is possible due the property of JSON to represent objects into key-pair values. An analysis was performed by testing various queries with this model representation. This provides a scope for JSON data formats to be used as schema representations of relational databases [7].

In another paper [8] the authors have propose a formal data model for JSON documents and, based on the common features present in available systems using JSON, the authors define a lightweight query language allowing to navigate through JSON documents. This proposed model has a prospect to provide theoretical framework for JSON documents.

In other study [9] the authors have raised the need of semantic web, as it allows easy retrieval and accessing of information by both man and machine. They have proposed a JSON data model to represent semantic web and linked data. The proposed model is PROV-JSON. This model helps in Provenance assertions.

PREVIEW OF XML AND JSON

XML stands for extensible markup language, a self descriptive hardware software independent tool for data exchange over Internet. It can be used with service oriented web application. Though data is encapsulated in tags but there is no pre defined mechanism for generation of tag definition. Tags can be created by the developers as per need and convenience. For example creating an object and encapsulating it in XML tags is shown below.

```
<MyName>
<first>Anu</first>
<middle>rag</ middle >
<last>Basu</last>
</ MyName >
```

All XML structures are self defined and well understood. The basic principle for effective design in XML is based on openness, extensibility, simplicity and scalability. XML has very simple and have logical syntax rules. The great support and availability of its understanding through tutorials has made its immense use in web, e business and portable applications.

JSON is java script object notation, has no predefined rules for organizing information. In JSON we can access logical data in human readable form. An example of creating a JSON data object in logical manner is as follows.

```
{
    "firstname": "Anu",
    "middlename": "rag"
    "lastname": "Basu"
}
```

JSON instances are fully immutable. It means without call or with call its instances never changed its existing architecture but create new instances as and when required. In JSON pairing is used for key and value and always focuses on content to be exchanged then format of the content. This feature of JSON improves its data transmission speed and save the time. JSON is not bounded by formatting rules, provides remarkable reduction in the size of JSON data format.

Table 1: XML stability over JSON

XML	JSON
XML has a predefined structure and certain rules for document specification that can act as a base for grammar rules.	JSON does not have a pre defined rules and grammar to represent data formats. Thus require interfaces for intended results.
It provides Namespace conventions to avoid duplicate name conflicts and has a great support for extensibility.	Namespace methods are not implemented with JSON and hence reduced its strength being extensible.
XML is decayed long standard used in industry and act as a support for various frameworks and browsers.	Framework support is very limited for JSON as it is relatively new in industry.
Human readability of XML documents is high.	JSON documents looks highly cryptic, as there is extensive use of parenthesis delimiters.
XML is extensively used in product development having web services oriented architecture.	JSON has limited support for web services.

Table 2: JSON stability over XML

JSON	XML
JSON meta data requirement is very less, hence provides high bandwidth performance.	XML tags are converted meta data that act as an overhead and provide slow bandwidth performance.
JSON has inbuilt object notation supported by java script and hence easier to map into objects.	It is difficult to map XML data formats into its corresponding objects due to their tree structure representation.
Serializing and deserializing can be effectively implemented with little code.	Special java scripts are written for serialization and deserialization.
JSON use key value pairing for representation of data objects and hence a comprehensive formats.	Tag representation of data objects provides prolonged data exchange formats.
JSON data objects can be effectively implemented with AJAX based web applications.	AJAX toolkits don't have strong support for handling XML.

COMPARATIVE ANALYSIS OF JSON AND XML DATA FORMATS

This paper [2] has presented a research work which compare JSON and XML data formats. The authors presented two different scenarios, one with large data and second with different size of data. The comparative analysis of their transmission time for data in the form of XML and JSON is tabulated in [Table 1] and [Table 2] below. The conclusion driven from the statistics available shown JSON has overpowered XML.

Table 1: Context 1 XML vs. JSON Timing

	JSON	XML
Number Of objects	100000	100000
Total Time taken (ms)	7827.79	454469.47
Avg. Time (ms)	0.08	4.54

Table 2: Context 2 XML Vs JSON timing

	JSON	XML
Exp 1. Number Of Objects	10000	10000
Exp 1 Total Time (ms)	1106.57	30666.84
Exp 1 Avg Time (ms)	0.11	3.07
Exp 2 Number Of Objects	20000	20000
Exp 2 Total Time (ms)	1563.99	61927.29
Exp 2 Avg Time (ms)	0.08	3.10
Exp 3 Number Of Objects	30000	30000
Exp 3 Total Time (ms)	2276.19	92968.13
Exp 3 Avg Time (ms)	0.08	3.10
Exp 4 Number Of Objects	40000	40000
Exp 4 Total Time (ms)	3003.36	123819.91
Exp 4 Avg Time (ms)	0.08	3.10
Exp 5 Number Of Objects	50000	50000
Exp 5 Total Time (ms)	3748.68	155008.74
Exp 5 Avg Time (ms)	0.07	3.10

CONCLUSIONS

With the increase in web based applications for data communications, has evolved web services utilization and provide researchers a new area of interest. Effectiveness of web service based data communication depends upon the selection of appropriate data exchange formats according to the need of the system. In

this paper Author has shown researchers' work to show significant impact of JSON over XML in the scenario where the data transmission speeds is a considerable issue. JSON as a better data exchange format is a widely accepted fact.

Not much of the work has been carried out by the researchers to authenticate the migration of development of web services from XML-SOAP architecture to RESTful-JSON architecture. This provides a future scope to carry out the impact of JSON data exchange format in parsing and efforts required in learning.

CONFLICT OF INTEREST

None

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

REFERENCES

- [1] Haq Z, Khan G, Hussain T. [2014] A Comprehensive analysis of XML and JSON web technologies, New Developments in Circuits, Systems, Signal Processing, Communications and Computers.102-109.
- [2] Nurseitov N, Paulson M, Reynolds R, Izurieta C. [2009] Comparison of JSON and XML Data Interchange Formats: A Case Study, 22nd International Conference on Computer Applications in Industry and Engineering.
- [3] Datt R. [2015] Data Exchange Model Using Web Service For Heterogeneous Databases, International Journal of Advanced Research in Engineering and Technology, 6(4): 107-111.
- [4] Zunke S, D'Souza V. [2014] JSON vs XML: A Comparative Performance Analysis of Data Exchange Formats, International Journal of Computer Science and Network, 3(4): 257-261.
- [5] Peng D, CAO L, XU W. [2011] Using JSON for Data Exchanging in Web Service Applications, Journal of Computational Information Systems, 7:5883-5890.
- [6] Breje A, Gyorodi R, Gyorodi C, Zmaranda D, Pecherle G.[2018] Comparative Study of Data Sending Methods for XML and JSON Models, International Journal of Advanced Computer Science and Applications, 9(12):198-204.
- [7] Piech M, Marcjan R. [2018] A new approach to storing dynamic data in relational databases using JSON, Computer Science Journal, 20: 1-18.
- [8] Bourhis R, Reutter JL, Suarez F, Vrgoc D.[2017] JSON: data model, query languages and schema specification, Cornell University Computer Science Journal, 1. DOI: <http://dx.doi.org/10.1145/3034786.3056120>
- [9] Pandey M, Pandey R. [2017] JSON and its use in Semantic Web, International Journal of Computer Applications,164(11): 10-16.