Abstract—Since 2006 the linked data was put forward first, five years have been past. The linked data have a great development. This article proceeds with the Linked Data, introduces what is the Linked Data, and what can I do with Linked Data. And then the article describes the relation between semantic web and Linked Data, the structure of semantic web, some of the technologies of which can be used by Linked Data. After this, the article describes the four principles of Linked data, the advantages of Linked data, the technologies of Linked data. In the followed chapter, the article shows how to publish Linked data in the web. The fourth chapter is about the application of Linked data. Finally, the article shows the challenges of Linked data, and then gives the summary.

Keywords: semantic web, linked data, RDF, URI

I. INTRODUCTION

Tim Berners-Lee, who is the initiator of the World Wide Web, divides the process of developing of World Wide Web into two phases. In the first phase, World Wide Web should be a powerful tool, which is useful for the cooperation among humans. In the first ten years World Wide Web achieves the goal: it provides lots of information as HTML to humans and with these information the cooperation among humans is much more than before and the life of human is changed.

In the second phase, the cooperation should be extended to the machines[1]. The machines should analyze all data on the Internet, including the content and links, and the human can cooperate with machines. That means the machines can understand the content or the concept of data, and then the machines can execute the some operation such as finding or analyzing. On the other hand, because our world consists of all kinds of data. So, in this phase, every book has a separate website; every author has a record, which can be accessed openly; every publication, publisher, key-word...... even every knowledge point has a unique identifier in the network. People can find the detailed description about all of the relationship among data, they can focus on all the data, and connect them. It is, as long as there are people, who look for the relation among data, they can focus on all the data, and connect them. The most important is, associated with more data, the data are more valuable. This is the linked data.

In a word, linked data can be considered as a set. The set uses the RDF data model, uses URI to name the entity. It publishes and deploys the instance data and class data, and through the HTTP protocol to access the data. At the same time, the set emphasizes the connection of the data[22][23].

B. What can I do with linked data?

With Linked data, man can find so many information step by step in the internet. For example, Bob has a friend called Kim. Kim has his identifier in internet. Bob click the link of Kim’s identifier. And then he will get many information of Kim, such as: Kim’s friends, the city where Kim lives now, the club that Kim has joined in and so on. If Bob is interested in Kim’s friends, he can click the link of Kim’s friends, and then Kim’s friends list will be showed to Bob, or if Bob is interested in the Kim’s club, he can click the link of the club, and then Bob can get the introduction about the club. This is only a small example in the normal life. Actually linked data has many application in many aspects in our life. I will mention them in the Chapter four.

In the next chapter, I will introduce the semantic web, the relation between semantic web and linked data, and the detail of linked data. In the third chapter, I will introduce how does the linked data work. In the fourth chapter I will write some applications of linked data. At the end of the paper I will give my conclusion.
II. Overview

In this chapter I will introduce the main technology of Linked data. But before this, I must mention semantic web. In the introduction, I have said, in semantic web, the cooperation should be extended to the machines. That means the machines can understand the content or the concept of data, and then the machines can execute some operation such as finding or analysing. Linked data can be seen as a method to publish resources on the web. Fortunately this method uses some technologies of semantic web. In addition, the formats of some published resources are the same, and they can be understood by computer and this is the basis of the interaction among the computers. In other words, the linked data is a method to achieve the semantic web. So, in order to understand linked data better, we must know the semantic web first.

A. The key technology of semantic web.

![Fig. 1. the structure of semantic web](image)

There are seven layers in the semantic web model of Tim-Berners-Lee. And the second, third and fourth are the key layers of the semantic web. These layers describe the semantic of the web information.[38]

The first layer is URI and Unicode layer. In the web environment, the applications should communicate with each other, and pass or publish the information. The format of information can be understood by computers. Most of these information are the description of the resources on the web. So, first the resources should be identified clearly. Semantic web uses the URI(Uniform Resource Identifiers) to identify the resources and their attributes. URI is a standard of internet, and is recorded in RFC 2396.[3] The difference between URI and URL(Uniform Resource Locator), URN(Uniform Resource Name) is that, URI refers to all the resources identified by the string on the internet, and URI contains URL and URN. In addition the semantic web wants to establish a network of the global information, this network should contain all the resources about all the language and characters. So, the semantic web uses the Unicode as the the coding scheme of character. This layer is the basis of semantic web. It can locate the resources on the web, and unifies the coding scheme of characters in different regions[39].

The second layer is XML layer. The XML layer is the grammatical layer. In this layer, the users can defined some tags to identify the published content, and use (Document Type Definition DTD)or XML Schema to limit the structure of the tag[4][5][6][7]. Because the XML tag can be made by users, it is possible that, some tags have same name. In order to avoid the situation, W3C use the NameSpace technology. For example, the user can make <author> tag: <k:author xmlns:k=http://foo.bar.com/xml/customer/dtd>. It shows that, the tag<author> is in the NameSpace of K: http://foo.bar.com/xml/customer/dtd. So, if other people make the same tag<author>, as long as the NameSpaces are different, the tags are also different. Because of this character of XML, the structure of document can be described. It should be noted that, people can understand the tag <author>, but the computer doesn’t know the meaning of the tag. That means, the XML is the format of data exchange. XML can solve the problem about the order and the structure of the document, but it can’t deal with the semantic and the connection of the document. How to allow the computer to understand the meaning of the tag, this is the task of the third layer.

The third layer is RDF(Resource Description Framework, RDF) and RDF schema layer. RDF is a opened Meta data Framework[8][9][10][40][43]. RDF doesn’t describe the semantic, but it provides an ability, that the semantic can be described. The Meta data Framework defines a data model, which can be understood by computer. Man can use the data model to describe the semantic. This data model contains three kinds of object:

1) The resource: maybe a webpage, or part of webpage, or an object that can’t be accessed through web.
2) The property: it describes the character, attribute or the relation of resources
3) The statement: it contains the resource, the name of the property of the resource, and the value of the property.

In a statement, the resource is the subject, the property is the predicate, and the value of the property is the object. In essence, the RDF defines the object-property-value triple as the modeling primitive, and establish the normal syntax. For example:

```
<k rdf : RDF>
<k rdf : Description about ="http://www.weibo.com/schwanlbx"> 
<author> boxuan li </author> 
<homepage>http://www.weibo.com</homepage> 
</rdf : Description>
```
This example shows that the author (predicate) of "http://www.weibo.com/schwanlbx" (subject) is boxuan li (object). We have known that RDF will provide some modeling primitive. But these modeling primitive are very simple. In the above example, RDF doesn’t tell us that the author should be a person but not an animal or something, and RDF doesn’t tell us that boxuan li is the name of the author. If we want to describe more details, we need more primitive. RDF schema can help us to solve this problem. It defines more modeling primitive[11].The function of the RDF Schema is:

1) Define the class of the resource and property.
2) Define the resource class of the property and the property value types.
3) Define the syntax of the declaration of the above class.
4) Declare some property classes which are defined by other organizations.

RDF Schema has defined:

1) Core classes contain rdfs:Resource, rdf: property, rdfs:Class. RDF can describe some objects. These objects can be seen as the instance of rdfs:Resource. rdf:property describes the property of the instance of rdf:Resource. Rdfs:class defines the concepts of RDFS.
2) Core properties contain rdf:type, rdfs:subClassOf, rdfs:subPropertyOf. Rdf:type establishes the instance-of model between resource and class. Rdfs:subclassof describes the subclass. Rdfs:subPropertyof describes the subProperty.

The function of RDF and XML are different. RDF can solve the problem: how to describe the resources unambiguously. RDF uses the syntax of XML to establish the bridge between RDFS and XML. In this layer, the problem of semantic model can be solved.

The fourth layer is the Ontology layer[42]. We have known that RDF Schema can define the class, subclass, superclass, the property, the subproperty, the constraint such as domain and range. In a sense, RDF Schema is a simple Ontology language. However RDF/RDFS is not good at describing the vocabulary, specially in some specific areas, such as: science or e-commerce. We must extend the ability. So we call the extension layer is Ontology layer. Ontology is a explicit specification of shared formal conceptualization[12].This concept has four key points. The first is conceptualization. Man can abstract some phenomenon in the objective world to get the concept model. The second is explicit. That means, each concept has a clear definition. The third is formal. That means, the computer can understand the Ontology. The last is shared. That means, the Ontology is the knowledge which is accepted by so many people. In a sense, ontology translates the different language into computer language and are used by people, database, and the application which need to share information[13].

Ontology has five Modeling Primitive: classes, relations, functions, axioms, and instances. The class is the object. The relation describes the interaction among the object, such as: subclass-of relation. Function is a specific relation, such as: Mother-of relation. Axiom is a logical statement that is true. The beginning of a typical Ontology is usually a namespace. Because before we use the Ontology, we must know which vocabularies will be used. For example: <rdf : RDF xmlns = "http://www.weibo.com/takerwu">

After we establish the namespace, we need the declaration about the ontology. This is the head of Ontology.

/owl : Ontology rdf : about = "takerwu">

The ontology header ends with the tag:

/owl : Ontology>

After this is the actual definition that make up the ontology and closed by the tag:

</rdf : RDF>

Currently five ontologies are used widely: Wordnet[15], Framenet[16], GUM[17], SENSUS[18], Mikrokmos[19]. Wordnet is the english dictionary based on the rules of psychological. Framenet is also the english dictionary. It uses the framework called Frame Semantics, provides strong ability of semantic analysis. GUM, SENSUS, and Mikrokmos are all oriented natural language. GUM supports Multi-language processing. SENSUS provides the structure of concept for the machine translation. Mikrokmos supports the Multi-language processing also. It uses a kind of intermediate language to express knowledge.

The fifth layer is the logic layer. Until now, man can use RDF/RDFS and ontology to describe the resources on the web. But only these description are not enough. The web application based on the semantic need to reason from these description according some specific rules. And logic layer can provide a method to describe the rules[20]. The Description Logic Markup Language is the method.

The last two layers are Proof layer and Trust layer. The researchers of semantic web believe that, the Proof and the Trust will be the important concept of next web[21]. In general, the application on the semantic web should be based on reality, through the logical reasoning, arrives at some conclusion. Every step of the reasoning should be checked by the users. The process of the reasoning is also a process of proving. The conclusion of the reasoning should be credible. All of the above are about the semantic web. The key technologies of semantic web are also parts of the key technologies of linked data. Because of this semantic web and linked data connect with each other. The goal of semantic web in short is: define the content of information in semantic web clearly, so that the computers can cooperate with other computers or humans better. Linked open data use the URI to locate the resources, and use RDF to describe the resources, so that the computer can understand the resources,
and then the computer can analyse the resources or interact with other computers. From this perspective, the linked data is a method to achieve the semantic web.

B. linked open data.

1) what is linked open data?: The linked data a set of best practices for publishing and connecting structured data on the Web[22][23][41]. Linked data use URI to link to a data object, rather than a document. And the data object is described by RDF (so as to ensure the data with semantic), and the RDF file should contain more other resources marked by URI. Tim Berners-Lee, who invents the Linked Data, give four principles for linked data[24]:

1) Use URI as names for everything.
2) Use HTTP URI, so that people can look up those names, can locate the specific object.
3) When someone looks up the URI, provide useful information, using the RDF standard.
4) Include the link to other URI, so that people can discover more information.

Linked Data uses URI to identify the resource object in the internet, furthermore it can locate with URI. The specific link is rely on the large number of links to resources in the RDF file. These links not only decide the semantics of the data, but also link with other relevant resource entities through properties. These properties are resource, and also should be defined and described by URI. What we say Meta data is a set of properties. These properties provide the semantics (need to be described) and their relationship, and themselves can be seen as a description of certain objects.

2) What is good about Linked Data?: [25]

1) Maybe the most important advantage of Linked Data is convenient and simple. Because of the 4 rules, the Linked Data can be easily conceived and immediately applied.
2) Because the Linked Data use the RDF framework, the structured data and the unstructured data have equal applicability.
3) Linked Data can connect all of the individual data. There is no islands of data.
4) Flexible and easy to update.
5) Data access, analysis and manipulation can be tracked by users.

3) What does Linked Data do?: We know that linked Data use RDF to achieve the interaction of computers. The RDF consists of triples. The triples connect a subject URI in one dataset with an object URI in another dataset. Using this technology man can navigate from his friends in dbpedia to the article of his friend provide by the RDF Book Mashup, from the food in dbpedia to the recipe in the DBLP database, from lakers basketball club in dbpedia to the personal information of kobe in the US census dataset. Until now, the web of interlinked datasets consists of dbpedia (91 million triples), Geonames (60 million triples), Musicbrainz (50 million triples), the dbtune music server (4 million triples), the DBLP bibliography (15 million triples), Revyu reviews and ratings (15 thousand triples), a US census dataset (700 million triples), and the RDF Book Mashup (several billion triples)[26].

Figure 2 is the Linked Open Data cloud diagram. It shows the datasets that have been published in linked Data format and
are interlinked with other dataset in the cloud. The size of the circles describes the number of the triples in each dataset. The bigger the circle is, the more triples the dataset contains. The numbers are usually rough estimates, and are provided by the dataset publishers. The link is an RDF triple where the subject URIs in one dataset and the object URIs in another dataset. The Arrays shows the existence of at least 50 links between two dataset. The direction of the Array indicates the dataset which contains the links. The thickness indicates the number of links.[27]

4) The technology of linked data: The Key technologies of linked data are URIs, HTTP, HTML, RDF. RDF has been discussed in the chapter 2.1, so here we talk about URIs and HTTP.

1) Hypertext Transfer Protocol (HTTP) is the universal access mechanism[28].It is the operating instruction of server. It shows that, when the server meets all kinds of requests, such as: GET/PUT/POST/DELETE, how can the server respond, how to deal with this requests.

2) The Hypertext Markup Language (HTML) can be used as a content format[29]. It is a web page document, stored in the server. It will be send to the browser according to the request. The standard of HTML defines the structure of the files, allows the file to contain many hypertext links.

3) Uniform Resource Identifiers (URIs) is the globally unique identification mechanism[30]. It allows user to operate the resources in the internet with specific protocol. Usually it is used to locate and name the resources in the internet.

We have mentioned the four principles about the Linked data[31].

1) The first principle encourages the people to identify the resources using URI. These resources contain not just the resources in the Web, but also the resources in the real world.

2) The second principle encourages people to identify object using Http URIs, so that the URIs can be dereferenced over the HTTP protocol.

3) The third principle encourages people to provide information using the unique model–the Resource Description Framework (RDF). Because there are so many applications on the internet, so it is important to standardized content formats.

4) The Fourth principle encourages people to connect many things using hyperlinks. For example, you can connect two persons, or you can connect an animal with a company. In the Linked Data the Hyperlink has the type to describe the relation between the connected things.

5) Naming things with URIs: URIs can identify not only the resources in the internet, but also the entity and their relation in the real world. For example: This is my space address: www.weibo.com/schwanlbx. This is the space address of my friend: www.weibo.com/takerwu. This is the space address of my another friend: http://weibo.com/ravene. We know each other, so the relation among us can be described by http://xmlns.com/foaf/0.1/knows.

Using URIs to name things has two advantages: First, it provides a simple way to create the unique name. And every owner of a domain name has an URI reference. Second, it shows not only the names of the entities but also the relationship among the entities.[31]

III. Publishing Linked Data on the Web

Linked Data uses the URI to name the objects in the world, these resources are not information resources. But the description of these objects, such as RDF files, images, audio and video, are information resources. The URI can name and locate the objects, but only the information resources can be used to communicate, describe and exchange. So we must solve the problem, how to use the URL to obtain the relational information resources. The key point is to ensure that, when the URI name the object, the URI can also locate the information resource of the object at the same time. To solve this problem, we can use the ‘content negotiations’ rule of the HTTP. For the URI dereference about the object from the client, according to the ‘content negotiations’, we return the information resource file. General information resource file has two categories: If the request comes from the browser, (in the head contains the request of text/html), we return the HTML file. If the request is application/rdf+xml, we return the RDF file.[2][31]

There are two different strategies to make URI that identify real-world objects dereferenceable. The strategies are called 303 URI and hash URI.

A. 303 URI

303 URI. Client send a request about the object to the server. Because the object is not existing, the server will send a ‘303 see other’ to the client. And then, according to the redirect rules, the client send a request. If the browser of client support HTML, then the client request the HTML file. If the browser
of client support RDF, the client request the RDF file. There are four procedures:

1) First the client request on a URI of a real-world object. It sends the HTTP GET instruction. If the client is a linked data application, it needs the RDF/XML, then it sends: Accept: application/rdf+xml header. If the client is a html browser, it sends: Accept: text/html header.

2) The server recognizes the URI of the real-world object. But the server can not return the object. So it responses the HTTP 303 See Other code and sends the client the URI of a web document which describes the real-world object.

3) The client request on this URI. It sends the HTTP GET again.

4) The server answers with a HTTP code 200 OK, and sends the requested document to the client in the requested format.

B. hash URI

The URI before the ‘♯’is used as address resolution by the browser. The URI and the segmentID with the ‘♯’are used to define non-information resource. The segmentID can redirect at the same time, and allows the browser which support RDF to dereference where the information resources are. This method requires the segmentID to be unique in the RDF files and the length of the RDF files can not be too long, otherwise the query efficiency will be low[31]. For example:

http://www.weibo.com/about♯takerwu
http://www.weibo.com/about♯schwanlbx

Clients will strip off the fragment part before requesting any of these URIs. So first the client request this URI: http://www.weibo.com/about RDF document describing takerwu and schwanlbx. Content negotiation can help to redirect from the ‘about’ URI to separate HTML and RDF documents.
And the 303 see other code will be used again[31]. The resulting is as Fig7.

IV. APPLICATION OF LINKED OPEN DATA

Because of the influence of opening linked Data, since 2007 a large number of experimental applications have appeared. The cloud diagram, which can show the application range of linked data, is increasing, the linked open data increase in geometric progression. As of 2010.11, LOD has more than 100 data set, the RDF triple are more than 13.1 billion. The content of the linked data is extended step by step, form the geographical information, life science data earlier to the media, publishing, government, graphics and images, almost everything is contained.

A. The linked data and the browser.

Until now people publish so many data as linked Data, so we need suitable browser to browse these data and navigate from this dataset to another dataset using the RDF link. Some linked data browser, such as: Tabulator RDF Browser, Disco Hyperdata Browser, OpenLink Data Web Browser, Objectviewe, Marbles, Sigma, are very popular. On the left side is the latest data. These data are all triples. And on the right side we can input the name of entity or the URI. When i input the URI: http://dbpedia.org/page/Cambridge i got the following result. And we find 882 triples about the Cambridge(Fig 9).

B. The linked data and Mashup.

Mashup service can be seen as the integration of data. And linked data can describe the structure information of data clearly, and enable the computers to connect the resources automatically. That is the basis of the automatic and intelligent integration of data. Revyu is a good example. It is a reviewing and rating site. This site applies the linked data principles. Fig10 shows a rating with rdfs:seeAlso link about the Borat.

C. The application in media industry

. BBC is the world’s largest, most successful television companies[45]. The website opened in 1994. After the semantic web was proposed, BBC establish a new semantic media library, not only uses the website to popularize, but also can release, send, organize and store the program. Through the linked data, BBC establish the webpage and static address (coolURL) for every program. Every knowledge unit has its own structural description and permanent address, and each webpage can generate for each knowledge unit according to the template by themselves automatically. At the same time, with the same method BBC establish complete information for more than 450000 artist information, more than 680000

![Sigma browser](image1)

Fig. 8. Sigma browser

![Search the Data Web](image2)

Fig. 9. Search the Data Web

![Mashup: Revyu](image3)

Fig. 10. Mashup: Revyu
the program, more than 7800000 audio tracks, and more than 31000 label. BBC think that, because of the linked data, the usability of webpage and data, the experience of customs has improved greatly. The results of search engine are optimized[2].

**Fig. 11. BBC-Programmes**

**D. The application in Library**

Since 2008 the National Library of Sweden for the first time released LIBRIS national bibliography as linked data, and the data were associated with DBPedia, to 2010, there have been more than 20 libraries, which have linked data set[44]. And in these libraries there are at least four international/national bibliography, which has opened the linked data service:

1) The United States of America Library of Congress and its subject headings(LCSH)(id.log.gov)
2) The German National Library (GemeinsameNormdatei) (d-nb.info/GND)
3) The National Library of France(BnF) RAMEAU subject headings(stitch.cs.vu.nl/Rameau/)
4) The Hungarian National Library Catalogue and Thesaurus (oszk-dk.oszk.hu/resource/DRJ/404)

Furthermore, the DC Meta data, the RDA list with FRBR, the BIBO bibliographic Ontology ( http://bibliontology.com/ ), SKOS knowledge organization coding mode and OAI-ORE object reuse and exchange model, all of them can be used as the semantic tools of linked data. And now, the more famous list are:

1) STW economics Thesaurus (zbw.eu/STW)
2) Social science Thesaurus (lod.gesis.org)
3) GEMET environmental Thesaurus (eionet.europa.eu/gemet)
4) Agrovoc (the United Nations Food and Agriculture Organization Thesaurus)(aims.fao.org/)
5) New York Times subject headings (data.nytimes.com/)
6) Scientific publications list (dblp.rkbexplorer.com/)

Because of such progress, 2010 was called Library linked data year.[2]

**E. Another application**

Man can use this software, which is developed by Microsoft research in Asia, called renlifang, the cubic of people. The function of the software, in short, man can use this software to find out his friends and the people who have relationship with them. First let’s see an example:

**Fig. 13. renlifang1**
The first and second images show the part of relationship of schwanlbx. And third image shows some relationship between angela mekel and other people. Every node is a name. The line between two the nodes is the relation. The colour means: if the colours of two nodes are totally different, for example, red and blue, that means the correlation degree between two names is more different. And when you click one node, it will show the links of news or article or others medium, where the name has appeared. Actually, the software has many defects. First, because the resources of name come from webpage, especially come from news, so the relation between two nodes maybe not true. Second, in chin there are so many people, who has the same name. But this software can’t distinguish with it. So, maybe the person you find with this software is not the person who you want to find. That is very normal. The third is the safety and privacy. You don’t know the name of the nodes is true or not. And because you ever appear on some news, your relation maybe showed with this software. All of these are the potential security holes. But no matter how to say it, this software is the pioneer of the application of linked data in normal life of Chinese. Before this software, there is no software, which can describe the relation of people quickly, clearly in China. The meaning of the software is, it lets Chinese directly know how powerful the linked data is, and it shows the early form of next generation of internet to Chinese.

V. Challenge

Linked data is a way to achieve the semantic web, and it represents the direction of the development of the internet in future. In recent years, though the linked data develops very rapid, it still faces some challenges.

A. How to match the rapidly changed resources?

The Linked open Data developed rapidly over the past years. So many datasets, such as: UK governmental dataset, the New York Times dataset, have been published. They provide many new RDF triples. These triples link with each other in the RDF framework. In other word, the new resources are created, updated. The old resources are removed. The new links are set and the old links are removed. When the individual resources updates, it will make small change. But when the data source’s infrastructure reorganize, the change will be huge. Some data, such as weather, the Sensor, the traffic, are likely to change more frequently. But in order to keep the local data dependencies consistent, this kind of changes must be solved. Dataset dynamics is a term we recently coined, essentially addressing content and interlinking changes in Linked Data sources.[33][34]

B. About the linked stream data.

Stream data sources, specifically sensor data, are very popular nowadays. The sensor data, such as the speed, the weather, the temperature, the heart rate, the blood pressure, the GPS, play the much more important role in our life. Gartner predicts that By 2015, wirelessly networked sensors in everything we own will form a new Web. But it will only be of value if the terabyte torrent of data it generates can be collected, analyzed and interpreted. If we can integrate the sensor data with other data, that will be good for our life. But there are two problems. First, the sensor data have few metadata. The lack of metadata makes the integration of sensor data with other data difficult. Second, if we can publish the sensor data following the linked data principle, the integration will be easier. But this is also difficult. Because many of sensor data are highly dynamic and temporal. So, how to integration with the sensor data is a interesting challenge of linked data.[35][36]
C. Other challenges

I think there are other two challenges of linked data. In the internet, there are so many information, parts of them are true and useful, but parts of them are fake. How to distinguish, whether the information is true or fake? That means, we need to do more research on data quality assessment and SPAM detection[37]. And another challenge is how to protect the privacy of people. When we enter the linked data age, so many information would be placed on the internet. For example, when we enter a name of one person to the web, we will get more information about the person, whose name is placed on the internet. If the information is related to the privacy of this person, that is very dangerous.

VI. CONCLUSION

The linked data used some technologies of semantic web, and it can be seen as a way to achieve the semantic web. In addition, the linked data can improve the quality of the people life greatly. It can increase the communication between human and machine; it can connect the all data on the internet, in order to make the internet as a whole. The most important is, after the data are linked, the people’s life will become more simple, more fast, and more efficient. And this is the most fundamental significance of the linked data.

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