Cloud Resource Scheduling System Based on Software Defined Network

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Abstract: The rapid development of computer network has undergone several major upgrades in the network environment of more than ten years. Although the demand for node capacity and bandwidth is increasing, the demand for it is still in short supply, especially during the network peak period, frequent network congestion and slow rate problem. How to deal with a large number of cloud computing data requests and services, so that each user access to better and more efficient network experience Internet development is now facing an important issue. The resource scheduling system is designed, which is realized by using SDN (Software Defined Network) and java language. The interface is simple and clear, user-friendly and practicable.

Keywords: Resource scheduling, weighted polling, dijkstra, SDN

I. INTRODUCTION

With the continuous development of the Internet environment, the number of Internet resources and the increasing number of users, a large number of users and too much resources to make the network efficiency is declining, how to deal with these resources and allow users to more efficient access to Internet development needs to be resolved Of the key issues. Cloud computing is the network computing technology which is developed on the basis of parallel processing, distributed computing, grid computing and so on. According to the American National Institute of Standards and Technology (NIST), cloud computing is a shared resource pool (such as network, services, storage, and storage) that can be used to access configurable computing on demand, on demand, Application), which can reduce the user's interaction and management overhead with the service provider when the resource is quickly acquired and released [1]. In the cloud computing mode, the user terminal equipment will become very simple, because users only need to send a request can be used by the cloud provider of computing resources, storage space and other applications, users no longer need to buy Products but direct purchase services [2]. The reason why the rapid development of cloud computing, the main reason is to follow the "on-demand billing" principle, the user access by the hardware and software, storage devices, such as resource pools do not need to understand the physical location of the resource pool and specific related technology. Cloud computing technology is economical and practical, high scalability, high reliability, convenient and on-demand services and so on. In recent years, the application of cloud computing technology is more and more widely. The application of cloud computing to the baseband cloud (mobile cellular) of mobile communication system can effectively solve the problem of frequent handover of high-speed mobile terminals such as high-speed rail [3]. However, there are still many problems in the traditional cloud computing network. For example, in cloud computing, configure different network layer structures such as switches, subnets, ACLs, etc. for cloud applications. This problem can be solved if a service-level network with highly automated connectivity is available as part of the cloud. As a new network technology Software Defined Network (SDN), by separating the control layer from the data layer, provides a programming interface to the user at the control layer, which enables the user to dynamically monitor and manage the network according to their own needs. At the same time, to achieve dynamic and flexible deployment of network resources [4].

Virtualization technology is a cloud computing data center, the essential technology of the network, making the cloud computing data center, the physical basic resources abstract form a shared resource pool, according to user needs dynamic allocation of resources. Network virtualization provides the ability to programmatically create, provision, and manage logical networks by completely separating network connectivity components from the underlying physical network infrastructure by providing logical network components such as logical switches, logical routers, logical firewalls, logical load balancers, and so on. To

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the connected workload. The use of network virtualization technology, you can shield the underlying differences in physical forwarding devices, increase the flexibility of network configuration deployment for tenants to order any network topology. Virtualization technology can achieve resource-specific software and the separation of the underlying hardware. Using virtualization technology can be divided into many virtual resources, can also be a number of virtual resource blocks together. According to the object of virtualization, virtualization technology can be divided into storage virtualization, computing virtualization, network virtualization and so on. Computing virtualization can be further broken down into system virtualization, application virtualization, and desktop virtualization. The logical abstraction and unified representation of resources can be achieved through virtualization technology, computing resources can be integrated or assigned to more operating systems to provide support for the upper cloud computing. Therefore, SDN combined with virtualization technology is considered to solve the current problem of cloud computing an effective way.

II. MODULE ARCHITECTURE

We use Java to achieve the SDN combined with virtualization technology to solve the current cloud computing problems, Java and SDN combined resource scheduling system consists of the following modules.

- General overview module: Displays basic information about the line, total line bandwidth, initial usage, and post-operational usage

- Bandwidth utilization module: According to the nodes and lines shown in the topology diagram, show the source node, target node, bandwidth usage and bandwidth utilization of each line.

- Traffic scheduling module: According to the topology diagram shown in the node and line, show each line of the source node, the target node, bandwidth usage and bandwidth utilization. The first node as the starting node, select the target node, select a different algorithm to calculate the information obtained after each link and display it, if you want to repeat the algorithm to run the data needs to continue after the refresh.

- View Demo Module: Generates a histogram based on the data obtained from traffic scheduling. It is convenient for observation. If there is no scheduling, the information will not be displayed. The information displayed in the histogram will be refreshed after each scheduling.

- Bandwidth Overload Module: Displays the source node, destination node, bandwidth usage, and bandwidth utilization for each line according to the nodes and lines shown in the topology diagram. The first node is the starting node. After selecting the target node, it selects different algorithms to calculate. After the overload information of each link is obtained, the information is displayed. If you want to repeat the algorithm operation, you need to refresh the data and continue.

A. Related Technologies

Servlet is responsible for processing user requests, jsp is responsible for data display, javabean is responsible for packaging data, which is a more basic underlying architecture, select the underlying architecture to better achieve the required functions. The essence of three-tier structure is more of a Controller, Servlet to distribute the client browser request. If the role of the controller from the role of the Servlet to understand the request for the client to prepare for the understanding of Servlet will be of great help. Through the web.xml configuration file can be found in user requests and specific servlet corresponding relationship, each Servlet has a specific Servlet object with the corresponding, so that the user request is a servlet object inherited from the HttpServlet.

B. JSP

JSP full name for the Java Server Pages, its Chinese name is the java server page, JSP is a simplified nature of the Servlet design, is a dynamic web technology, the system interface is written using JSP. Because JSP can insert JAVA statements, JSP and Servlet are running on the server side, so you can achieve the perfect dynamic web technology. It implements the java extension in the Html syntax. JSP and Servlet, as is the implementation of the server. Usually return to the client is an HTML text, so the client can browse as long as the browser. JSP technology uses the Java programming language to write XML-like tags and scriptlets to encapsulate the processing logic that generates dynamic web pages. Web pages can also access through the tags and scriptlets exist in the application server resources of the application logic. JSP separates the logic of the Web page from the design of the Web page, supporting reusable component-based design, making the development of Web-based applications quick and easy. JSP (JavaServer Pages) is a dynamic page technology, its main purpose is to separate the logic from the Servlet.In the system using JSP prepared

system interface to complete the basic design interface, the use of jsp Circ, Common, dispatch, Finallu, first, index, list, main, Many, manycirc, manycom, manyran, random, JSP specific process. The figure is as follows:
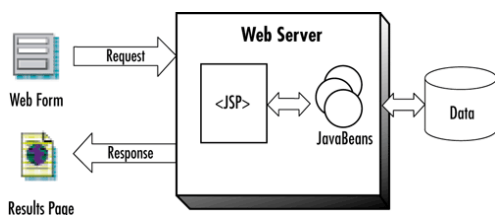

Figure 1.   JSP specific process.

C.   JavaBean

A JavaBean is a reusable component written in the Java language. In order to write JavaBean all the classes must be specific and common, at the same time, JavaBean also has a non-parametric constructor, JavaBean conform to the consistency of the design pattern by providing a public way to expose members of the internal domain attributes, set and get methods to obtain .

D. JDBC

JDBC (Java DataBase Connectivity) is a Java API for executing SQL statements that provides uniform access to multiple relational databases, consisting of a set of classes and interfaces written in the Java language. JDBC provides a benchmark against which you can build more advanced tools and interfaces that enable database developers to write database applications. JDBC is actually an interface, here in order to facilitate the use of MYSQL Based connection.

In this system in order to use JDBC to connect the use of the database using the c3p0 connection pool, c3p0 connection pool configuration xml, c3p0-config.xml.In the landing module in the system using the JDBC c3p0 connection pool to connect to the database, the other modules in the program is used to complete the Servlet + JSP database operation. At the same time, JDBC to achieve the need to prepare a tool to achieve JDBC.

III.   TRAFFIC SCHEDULING MODULE

Related objects and interfaces, LinkServlet class, LinkServlet1 class, CircServlet class, Band class, connect to the database and the database information removed. RoundRobinWeightTest class, load balancing of the weighted round robin algorithm, Dijkstra algorithm.

The nodes can be simulated by the Dijkstra algorithm, the random scheduling algorithm and the load-balanced weighted round-robin algorithm, respectively, and the nodes can be simulated by the Dijkstra algorithm, And display the information after the simulation run node information, you can also refresh the link information is not scheduled to refresh the state before, you can choose to re-scheduling.

1) The principle and implementation of weighted polling for load balancing: Because the main goal of the scheduling is the link bandwidth between the nodes, because the weight value is set according to the bandwidth usage, although the amount of bandwidth simulated in this system is relatively small, but in order to link in the larger chain In order to improve the efficiency of the system, we need to extract the maximum common divisor. The purpose of load balancing is to average the node pressure, each run from all nodes need to select the most suitable node to run a new service, and then continue to cycle know that all services running, the node information from the database so there is no need to redefine, The goal here is to link the operation of the traffic, the bandwidth is occupied by the link, and weighted polling is based on the proportion of weight allocated to the node flow, for example, the bandwidth of the third node is twice the first node , The load balancer will allocate twice the running traffic to the third node. Therefore, weighted polling is one of the most efficient algorithms.

Load Balancing Weighted Polling Algorithm The main code is as follows:

```
public class RoundRobinWeightTest {
    public static int[] server = new int[10];
    public static int cw = 0;
    public static int number = -1;1
    public static int max;
    public static int gcd;
    static {
        //init();
        max = getMaxWeight(server);
        gcd = gcd(server);
    }  server[0] = 5;
        server[1] = 15;    ……    }
    public static int gcd(int[] ary) {
        int min = ary[0];
        for (int i = 0; i < ary.length; i++) {
            if (ary[i] < min) {
                min = ary[i];         }}
```

```
while (min >= 1) {

    boolean isCommon = true;

    for (int i = 0; i < ary.length; i++) {

        if (ary[i] % min != 0) {

            isCommon = false;

            break;            …… }

public static int getMaxWeight(int[] ary) {

    int max = 0;

    for (int i = 0; i < ary.length; i++) {

        if (max < ary[i]) {

            max = ary[i];    ……

    public static Integer next(int[]server) {

    while (true) {

    number = (number + 1) % server.length;

    // System.out.println("number="+number);

        // System.out.println("cw="+cw);

        if (number == 0) {

            cw = cw - gcd;

            if (cw <= 0) {

                cw = max;

                if (cw == 0)

                    return 0;   }}

        if (server[number] >= cw)

            return number;……

        pool.execute(run);   }

    pool.shutdown();


pool.awaitTermination(Long.MAX_VALUE,
TimeUnit.DAYS);

    System.out.println("all thread complete");

    } catch (InterruptedException e) {

        // TODO Auto-generated catch block

        e.printStackTrace();        }
```

2) Dijkstra algorithm implementation: First, the link information in the database into a matrix of two-dimensional array of undirected graphs, and then through the array to find the shortest path, the use of traffic will give priority to use the shortest path. Dijkstra algorithm is simple, does not require too complex operations, in some cases suitable for operation, but in most cases because only rely on a link, a large amount of traffic in a long time after use

Resulting in network congestion, slow rate and other conditions.

Dijkstra algorithm main code is as follows:

```
package space;

import java.sql.ResultSet;

import java.sql.SQLException;

public class d2 {

static String sql = null;

    static DBHelper db1 = null;

    static ResultSet ret = null;

/*public static void main(String[] args) {

sql = "select *from link5";

    db1 = new DBHelper(sql);

    int[][] weight = { {0,0,0,0,0},……    };

    int[] path = Dijsktra(weight,0);

    for(int i = 0;i < path.length;i++)

        System.out.print(path[i] + " ");     }*/

        public static int[] Dijsktra(int[][] weight,int start){

            int n = weight.length;

                for(int i = 0;i < n;i++)

    if(visited[i]          ==          0          &&
weight[start][k]+weight[k][i] < weight[start][i])

        {               weight[start][i]               =
weight[start][k]+weight[k][i];

                shortPoint[k] = i+1;}
```

3) Algorithm analysis: When the link is not congested, it is obvious that the ordinary Dijkstra algorithm will only run one of the links from the source node to the nearest node of the target node, so it is easy to cause the link block. While the stochastic algorithm is very random, although not as Dijkstra algorithm used only as a link, but because of its large randomness, will make the use of too many links and take up a lot of unnecessary bandwidth , Thereby reducing the use of efficiency. The weighted average polling algorithm for load balancing is the most common algorithm in this scheme. By weighted polling, only the used link is used, and the traffic is evenly distributed to each link, so that the link efficiency is greatly increased. Users can also get resources faster and better.

IV. CONCLUSION

When using the common scheduling algorithm, only 355M traffic is used when the link is congested.

When the random scheduling algorithm is used, when the link is congested, 2482M traffic is used. When using the polling scheduling algorithm, when the road blockage is only 2888M of traffic.

It can be seen that using the ordinary Dijkstra algorithm to minimize the efficiency of link scheduling, but because of the use of fewer links from the original node to the target node distance is small, so the speed will be faster, in the chain The Dijkstra algorithm can be used to schedule the link to make the data transmission rate faster.

The stochastic scheduling algorithm has a great deal of randomness. Since the data from which route is random every time, although the Dijkstra algorithm is not used as the excessive use of the line, but the source node and the target node The distance is greatly increased, and because each transmission is random, so the use of each link is not necessarily, may be surprisingly high efficiency, but also may be slower than the Dijkstra algorithm, but relatively random The efficiency of the algorithm is not low, generally higher than the Dijkstra algorithm.

When the load balancing weighted polling algorithm is used, the traffic is evenly distributed across the link, making full use of each link, maximizing the use of each link, and thus maximizing traffic when the link is congested , And at the same time, due to the use of weighted algorithm, each link is calculated by the algorithm, it

will not waste too much traffic on the redundant lines, the source node to the target node distance efficiency will be the highest, it is recommended to use load balancing Polling algorithm.

The weighted round robin algorithm, which is also a network congestion and load balancing, will be congested after a larger traffic usage. The Dijkstra algorithm is only suitable when the link is very loose. Using weighted polling can make the link bandwidth more efficient, users get a better experience.

REFERENCES

[1] M. The Caesar, D. Caldwell, N. Feamster, J. Rexford, A. Shaikh, and J. van der Merwe, "Design and implementation of a routing control platform," in *Proceedings of the 2nd conference on Symposium on Networked Systems Design & Implementation*, 2005, pp. 15-28.

[2] N. Gude, T. Koponen, J. Pettit, B. Pfaff, M. Casado, N. McKeown, and S. Shenker, "NOX: towards an operating system for networks," *ACM SIGCOMM CCR*. vol. 38, pp. 105-110, 2008.

[3] N. Handigol, S. Seetharaman, M. Flajslik, N. McKeown, and R. Johari, "Plug-n-Serve: Load-balancing web traffic using OpenFlow," *ACM Sigcomm Demo*. vol. 4, pp. 268-270, 2009.

[4] N. Handigol, S. Seetharaman, M. Flajslik, N. McKeown, and R. Johari, "Plug-n-Serve: Load-balancing web traffic using OpenFlow," *ACM Sigcomm Demo*. vol. 4, 2009.

[5] M. Koerner and O. Kao, "Multiple service load-balancing with openflow," in *2012 IEEE 13th International Conference on High Performance Switching and Routing*, pp. 210-214, 2012.