A SYSTEMATIC APPROACH FOR ALLOCATION OF CONFLICT FREE CLASS-C STATIC IP ADDRESSES IN LOCAL AREA NETWORK

[1] Dr. Harish Rohil, [2] Narinder Kumar

[1] Assistant Professor, Department of Computer Science and Applications,Chaudhary Devi Lal University, Sirsa, (India)

[2] M.Tech. Scholar, Department of Computer Science and Applications, Chaudhary Devi Lal Univeristy, Sirsa, (India)

Abstract- When same IP address is allocated to two or more nodes in computer network, problem of IP address conflict occurs. IP addresses are divided into five classes which are class A, class B, class C, class D and class E. Class C IP addresses are used for small networks. There are two types of IP Addresses: Static IP Addresses and Dynamic IP Addresses. Both, Static and Dynamic types are used to allocate IP addresses in network. A series of continuous numbers is used to allocate the Static IP addresses and dynamic host configuration servers are used for Dynamic IP addresses in local area network. When network grows then there are more chances of conflict of IP addresses. In conflict of IP addresses, it halts sharing resources, files, data information over internet. When IP address conflicts occur, a message is displayed on screen about occurrence of IP address conflict. It consumes much time to resolve this IP address confliction. New network administrator does not have knowledge of adhoc approaches used by previous network administrator for allocation of IP addresses for. To resolve these problems, a systematic approach for allocation of Class-C Static IP Address is proposed in this paper. The proposed approach was implemented in java and MySql. To validate the efficiency of the proposed approach it was compared with commonly used current adhoc approaches.

Keyword: *IP Address, Static IP Address, IP Address Conflict, IP Address Class, Local Area Network (LAN),*

1. INTRODUCTION

IP Address is the logical address which is allocated to nodes attached to network for identification of node in network. IP address is a 32-bit numeric address which is divided into four octets; each octet is separated by periods/dots. In octet there are eight bits which can have values either 0 or1 so total number of possible combinations per octet is 256. So each octet can contain any value between 0 and 255. Combine the four octet and a possible 4,294,967,296 unique values will be obtained. To distinguish network and host, IP Address is separated into Network ID and Host ID for identification of type of network and host [6]. IP Address format is given below:

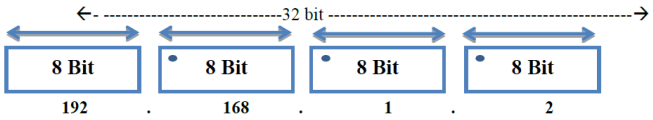

Figure 1 IP Address in Octet

1.1 IP Address Classes

There are five classes of IP Address: Class A, Class B, Class C, Class D and Class E. 8 bits are used for network id and 24 bit is used for host id in Class A IP Address. 16 bits are used for network id and 16 bits are used for host id in Class B IP Address. 24 bits is used for network id and 8 bits are used for host id in Class C IP Address. Class D and Class E are reserved for future purpose. Following table shows the format, purpose, order bits, range etc. about classes of IP addresses [5].

Table 1 IP Address Classes Details

Class	Format	Purpose	Address range of first octet	No. of Bits for Host IP	Maximum hosts in network
A	N.H.H.H	Large Organization	0-127	24	16,777,214
B	N.N.H.H.	Medium Size Organization	128-191	16	65,534
C	N.N.N.H	Small Organization	192-223	8	254
D	N/A	Multicast Group	224-239	N/A	N/A
E	N/A	Experimental	240-255	N/A	N/A

1.2 Types of IP address according to access

According to access there are two types of IP addresses mentioned below:

- Public IP address
- Private IP address

Public IP address is used for accessing with internet. Network Information Centre registers these public IP

addresses. Computers which are attached to internet gains the functionality of public IP address. With the help of public internet, computers are used for sharing information, resources etc. over internet. There is no control of user on the public IP address. Private IP Address is used in private network. It is mostly used in schools, colleges, campuses, organizations whose have their own Local Area Network (LAN). Network topologies such as bus topology, ring topology, star topology, tree topology etc. are used to establish network as per the requirements. Private IP Address can be further classified into Static IP Address and Dynamic IP Address. Static IP address is used by the service providers, hosting webpages, because static IP address does not change while dynamic address can be changed and are chosen from a pool of addresses [1] [8].

2. REVIEW OF LITERATURE

Literature on managing static IP address was studied and it was found that spreadsheets are being used for managing the static IP addresses in Local Area Network (LAN) from decades. A series of continuous numbers is used for providing unique address to computers in network. D. Jonathon proposed a graphical technique in his paper. Two phase method was considered; first produce and order on the vertices in the graph and then ordering into tree [3].

Jadhav Sachin et all had given idea for developing an application which manages the IP Addresses and system configurations and detects any conflict in assignment of IP Address and any changes or updating in the system configuration. If the user on client machine assigns an IP address then it is sent to server for checking any conflict in the database. If conflict occurs then server/administrator will assign a feasible IP address to the client machine or display a warning message to client [13].

Vinge Vernor suggested solutions for conflict of IP in paper with title 'What You Need to Know Reduce IP Conflicts Now '.Solutions were based on manually checking of IP one by one of each device and the second methods was based on dynamic host configuration protocol. It provides practice using; use network segmentations, Avoid using an Address space used by consume grade device, use reliable and vendor supported dynamic host configuration protocol services, IP address management software. But it does not give much for local area network [26].

Taylor Bolduc provide a solution for IP Confliction on the website with title "What's an IP Conflict, and How Do You Resolve It?" in this method, the writer uses the command prompt to resolve the problem of IP Address confliction. A number of steps are given in the solution. After opening the command prompt write "ipconfig/release" in the window. After written this there is required to press the button enters. A new IP address to the computer will be assigned by the DHCP server. Another proposed solution is given by checking the routers dashboard and the third method given by the writer assign manually IP address [25].

All solution goes in the direction of dynamic host configuration for resolving IP Address conflict. Some solution providers suggest detecting machines which have same IP Address and assign new IP Address manually. This exiting approach is adhoc approach. The solution to this problem has been provided as:

Click Start/Control Panel/Network Connection on each of the computers,

Right click on the concerned connection [Properties],

Select "Internet Protocol (TCP/ IP)" then properties, if the "obtain an IP address automatically" is not checked then change it.

3. CURRENT ADHOC APPROACH FOR ALLOCATION OF IP ADDRESSES IN SMALL LOCAL AREA NETWORK

In current adhoc approach for static IP addresses, a series of continuous numbers is used to allocate IP addresses for nodes connected in Local Area Network. When IP address conflicts occurred in network; to resolve this, numbers which come after the last used numbers are allocated. When new nodes are added in network then same process is used for allocation of IP address; when existing node is deleted from network, IP address of deleted node is skipped and not used again. When new administrator is appointed then he has no knowledge of adhoc approach used by previous administrator for generation of IP addresses due to this there are more chances of allocation of same IP address in network which is main reason of conflicts of IP address. Dynamic Host Configuration Protocol hardware/software is sued for dynamic purpose for small and large scale. In DHCP each time request is required for node to server to allocate IP address, after receiving request form node IP address is allocated to requested node as per algorithm/ approaches used by DHCP.

4. PROPOSED SYSTEMATIC APPROACH FOR ALLOCATION OF IP ADDRESS

A systematic approach is proposed to resolve the problems of current adhoc approach which is more suitable for Class-C static IP address in network. In proposed approach, random IP address is generated for each node in network and generated random IP address is compared with other already allocated IP addresses, if generated IP address is matched with other IP address, then this generated random IP address is discarded and again random IP address is generated, if generated IP address is not matched with already allocated IP address, then this generated IP address is allocated to new node in network. Random number of days is also generated for each allocated IP address, specific IP address will be deleted after assigned random number of days and new IP address will be allocated.

If a user having malicious intension change the Class-C static IP address on client machine, chances of IP address conflict is reduced in network using proposed approach. In proposed approach, on the starting of the day, due date is checked, If today is due date of client machine then Class-C static IP address is deleted and new static IP address is assigned randomly. If user having malicious intension has

changed the IP address of machine today, which machine has due date on next day, then there will be no effect on performance of Local Area Network, because IP Address assigned by the user having malicious intension will be deleted on the next day. Even if next day is not due date there are less chances of allocation of same IP address because IP addresses are assigned randomly not in series.

In proposed approach due date of IP Address of client machine is shown to the network administrator. Network administrator will delete the IP Address from the client machines which have due date and assign new Class-C static IP address to machine with new random due date according to proposed approach. There are also chances of use of IP address which were deleted in proposed approach.

4.1 Algorithm

An algorithm is a step by step method to find a solution for problem in finite time.

Proposed approach consists of four algorithms-

1) Generation of new node and allocation of IP Address
2) Identification of the nodes whose IP Address are to be changed
3) Deletion of selected node
4) Show all nodes

These algorithms have been given in natural languages in the next sub-sections. The same algorithms have also been presented in pseudo codes to ease their implementation.

4.1.1 Generation of New Node and Allocation of IP Address

The algorithm in natural language is given as under:

Step 1 Initialize IP list for first and last address.
Step 2 Generate Random IP for New Node.
Step 3 Compare Generated Random IP with all IP already allocated.
Step 4 If Random IP matched with current IP then Go to Step 2 else go to Step 5
Step 5 Generate random numbers of days
Step 6 Calculate Due Date based on current date and based on Step 5
Step 7 Assign Random IP and Due date for New Node.
Step 8 Exit

The above algorithm in pseudo code is given as under:

GENERATE_IP_ADDRESS (IP_ADDRESS, DUE_DATE, PC_NAME, NODE)

IP_ADDRESS is an array which contains the already allotted IP addresses in network. DUE_DATE is also an array which contains the due dates of the IP Addresses. PC_NAME is also an array contains the name of the PC. NODE represents the total number of nodes in network.

Step [1] RANDOM_IP, RANDOM_DAY, DATE, I,PCNAME (local variables)
Step [2] DATE= CALENDER.DATE(SYSDATE(), RANDOM(15))
Step [3] RANDOM_IP = RAND (254)
Step [4] REPEAT STEP 5 FOR I=0 TO NODE
Step [5] IF(RANDOM_IP== IP_ADDRESS[I])
CONTINUE TO STEP 3
[END IF]
Step [6] NODE= NODE+1
Step [7] IP_ADDRESS[NODE]=RANDOM_IP
Step [8] DUE_DATE[NODE]=DATE
Step [9] PC_NAME[NODE]=PCNAME
[END OF STEP-4 LOOP]
Step [10] EXIT

Explanation: In the above algorithm random IP address and random number of days are generated and assigned to new node. Step 2 generate number of day for due date of generated IP address. Step 3 generates random IP and it is compared in step 5 in already allotted IP addresses. If IP address is matched in step 5 then control is transfer to step 3 otherwise generated random IP is assigned to new node. Due date for IP address is calculated in step 8. PC name is stored in array in step 9.

4.1.2 Identification of the Nodes Whose IP Address are To be Changed

The algorithm in natural language is given as under:

Step 1 Today List, Today Date=Current Date, I=0, N = total number of nodes,
Step 2 Repeat Steps 3 to 4 for I to N
Step 3 Compare Today Date with Due date of Node
Step 4 If Today Date matched with Due Date of Node
Show ID of matched Due Date in Today List
Show PC Name of matched Due Date in Today List
Show IP Address of matched Due Date in Today
Step 5 Exit

The above algorithm in pseudo code is given as under:

SHOW_IP_ADDRESS_TO_DELETE_TO_DAY (IP_ADDRESS, IP_ID, DUE_DATE, PC_NAME, NODE)

IP_ADDRESS is an array which contains the already allotted IP addresses in network. IP_ID is an array contains unique id (primary key) for each IP address. DUE_DATE is also an array which contains the due dates of the IP Addresses. PC_NAME is also an array contains the name of the PC NODE represents the total number of nodes in network.

Step [1] INITIALIZE VALUE OF I , DATE
Step [2] DATE = SYSDATE()
Step [3] REPEAT STEP 4 FOR I=0 TO NODE
Step [4] IF(DATE < = DUE_DATE[I])
a) SHOW IP_ID [I]
b) SHOW IP_ADDRESS[I]
c) SHOW DUE_DATE[I]
d) SHOW PC_NAME[I]
[END IF]
[END OF STEP-3 LOOP]
Step [5] EXIT

Explanation: The above algorithm gives number of steps to sows list of IP addresses which has due list on day. Step 2

generates current date using sysdate function and stores it in DATE variable for comparisons in step 4. Step 4 compares due date of each IP address with current day and repeat Step 4-a,4-b, 4-c shows IP_ID, IP_ ADDRESS and Due Date.

4.1.3 Deletion of Selected Node

The algorithm in natural language is given as under:

Step 1 Choose ID of IP address which is to be deleted.
Step 2 Delete tuple with chosen ID
Step 3 Shift-up remaining tuples.
Step 4 Exit

The above algorithm in pseudo code is given as under:

DELETE_IP_ADDRESS (IP_ADDRESS, DELETE_IP, DUE_DATE, PC_NAME, NODE)

IP_ADDRESS is an array which contains the already allotted IP addresses in network. DELETE_IP is IP address to be deleted. DUE_DATE is also an array which contains the due dates of the IP Addresses. PC_NAME is also an array contains the name of the PC NODE represents the total number of nodes in network.

```
Step [1]    INITIALIZE VALUE OF I
Step [2]        REPEAT STEP 3  FOR I=0 TO NODE
Step [3]        IF(DELTE_IP== IP_ADDRESS[I])
            BREAK;
            [END IF]
            [END OF STEP-2 LOOP]
Step [4]        REPEAT STEP 5 TO 7  FOR I= TO NODE-
    1
Step [5]        IP_ADDRESS[I]=IP_ADDRESS[I+1]
Step [6]        DUE_DATE[I]= DUE_DATE[I+1]
Step [7]        PC_NAME[I]= PC_NAME[I+1]
            [END OF STEP-4 LOOP]
Step [8]        NODE=NODE-1
Step [9]        EXIT
```

Explanation: In the above algorithm IP addresses is deleted and list is updated after deletion of IP address. DELETE _IP store the IP address which has to be deleted. Step 3compares the IP address to be deleted with all IP addresses in the list. Step 5, 6,and 7 updates the list after deletion of IP. Step 8 decrease numbers of nodes in the list.

4.1.4 Show All Nodes

The algorithm in natural language is given as under:

Step 1 Initialize I = 0, N= total number of nodes attached.
Step 2 Repeat Step 3 to 6 for I to N
Step 3 Show ID.
Step 4 Show PC Name
Step 5 Show IP Address
Step 6 Show Due Date
Step 7 Exit

The above algorithm in pseudo code is given as under:

SHOW_ALL_IP_ADDRESS (IP_ADDRESS, IP_ID, DUE_DATE, PC_NAME, NODE)

IP_ADDRESS is an array which contains the already allotted IP addresses in network. IP_ID is an array contains unique id (primary key) for each IP address. DUE_DATE is also an array which contains the due dates of the IP Addresses. PC_NAME is also an array contains the name of the PC NODE represents the total number of nodes in network.

```
Step [1]  INITIALIZE VALUE OF I
Step [2]  REPEAT STEP 3 TO 6 FOR I=0 TO NODE
Step [3]  SHOW IP_ADDRESS[I]
Step [4]  SHOW DUE_DATE[I]
Step [5]  SHOW PC_NAME[I]
Step [6]  SHOW IP_ID[I]
            [END OF STEP-2 LOOP]
Step [7]  EXIT
```

Explanation: The above algorithm gives steps to show entire list of IP addresses, IP-ID, PC-Name and Due Date. Step 3 to step 4 are repeated for showing all nodes details in list. Step 3 shows the IP Address of the node, step 4 shows due date of IP Address 5 shoes the name of the PC and step 6 shows the unique ID of the each node in the list.

4.2 Implementation

A software was developed for the using proposed approach, Java programming language, Net bean (IDE) and MySQL is used. For graphical user interface, swings are used in java for frontend and MySQL is used for database.

4.3 Laboratory Experiment

Laboratory experiment was performed in computer lab for thirty days. Two computer Laboratories with star topology were established for proposed approach and current adhoc approach. In laboratory experiment, client server architecture was implemented on machines. Design of computer lab in college is shown in figure below.

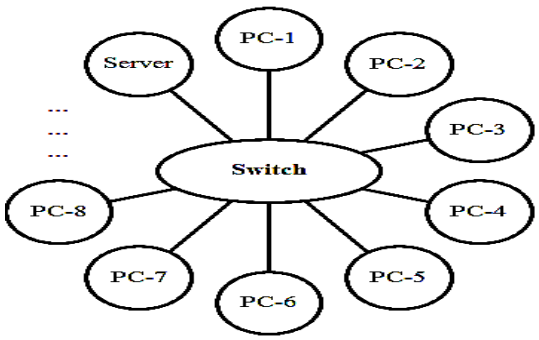

Figure 2 Star Topology of Computer Lab under Experiment

Window 7 operating systems were installed on all machines and network is established using network device switch. Same number of computers and same number of users were participants in laboratory experiment. During experiment, IP addresses were changed on machines with same number of users in both computer laboratories.

4.4 Comparisons of Proposed Approach with Current Adhoc Approach

During laboratory experiment data was collected from both computer laboratories shown in table given below. Day wise record is shown in table which includes number of computer in running state on different days, number of IP address changed at the end of the session and conflicts occurred in both computer laboratories. During experiment it was found that there was only two IP Address conflict occurred in computer laboratory-A which was established using proposed approach and there was six time IP Address conflict in computer laboratory-B which was established according to current adhoc approach.

4.5 Result and Discussion

Result and date after using proposed approach for allocation of conflict free Class-C satic Ip Address in Local Area Network is given below.

Table 2 IP Address conflict using Proposed Approach and current Adhoc Approach

Day	Number of Computer in running state	Number of IP Address Changed randomly at the end of session	IP Conflict Occurred Yes/ No LAB-A (Proposed Approach)	IP Conflict Occurred Yes/ No LAB-B (Current Adhoc Approach)
1	14	3	--	--
2	15	2	NO	YES
3	14	3	NO	NO
4	13	4	NO	YES
5	13	1	NO	YES
6	15	5	NO	NO
7	14	3	NO	NO
8	14	4	NO	NO
9	13	3	NO	NO
10	15	3	YES	NO
11	14	2	NO	YES
12	12	2	NO	NO
13	12	1	NO	NO
14	13	3	NO	NO
15	13	3	NO	NO
16	14	3	NO	NO
17	15	3	NO	YES
18	14	2	NO	NO
19	14	2	YES	NO
20	14	2	NO	NO
21	13	4	NO	NO
22	14	4	NO	NO
23	13	2	NO	NO
24	11	2	NO	NO
25	12	3	NO	NO
26	12	2	NO	NO
27	14	3	NO	YES
28	15	1	NO	NO
29	14	3	NO	NO
30	14	3	NO	NO

Above table data shows that there was only 6.667% IP Address conflicts in LAB-A and 20% conflicts in LAB-B. Using proposed approach 13.33% chance of IP address conflict is reduced. It proves that the proposed approach performs better than current adhoc approach under similar circumstances and keeping other parameters same.

5. CONCLUSION

IP addresses are required to identify the nodes in network. IP address is 32 bit IP address divided into four octets. For small network class-C IP addresses are used to uniquely identify node in network. IP addresses should be unique for each node in network. When same IP address is given to two or more nodes in network then IP address conflict occurs which halts the services over internet. Current adhoc approach uses a series of continuous numbers for allocation of IP address in network which have more chances of conflicts of IP address in network even new appointed network administrator does not have knowledge of adhoc approach used by previous network administrator. A systematic approach for allocation of conflict free class-c static IP address is proposed in this paper. IP addresses are generated randomly for each node by comparing already allotted IP addresses. Each IP address is deleted after random number of days. Proposed approach consists of four algorithms: Generation of new node and allocation of IP Address; Identification of the nodes whose IP Address is to be changed; Deletion of selected node; Show all nodes. To validate the proposed approach laboratory experiment was performed and it was found that there were only 6.6667% IP address conflicts in proposed approach but there were 20% conflicts in current adhoc approach and using proposed approach 13.33% chances of IP address conflicts were reduced. Proposed approach performs better than current adhoc approach under similar circumstances.

REFERENCES

[1] Andrew S. Tanenbaum , David J. Wetherall (2013). *Computer Networks, 5e* (5th Edition),India, Peasrson,

[2] B. Deepak, 2012, *Fundamental of Information Technology*, 4th edition, India, New Delhi, Excel Books.

[3] D. Jonathon, (2011, February), Automatic IP Address Assignment on Network Topologies, Retrieved Nov.,19,2017, from https://www.cs.utah.edu/flux/papers

[4] Dr. S. Hardeep, Er. S. Anshuman, S.K. Kakkar, 2011, *Fundamentals of Information Technology*, 4th Edition, India, Amritsar, Lakhanpal

[5] ForouzanBehrouz , (2006). *Data Communications and Networking Paperback* (4th Ed.). India, New Delhi, McGraw-HIill

[6] GoelSushil, 2006, *Fundamental of information technology*, India, New Delhi, Natraj

[7] Hunt Craig, (1997).*TCP/IP Network Administration(*2nd ed.*)*. US. Sebastopol, O'Reilly Media

[8] Singh Charanjeet, 2009, *Data Communications and Networks*, India, New Delhi, Kalyani

[9] SS Bhatia, S. Kartar, K. Harsimran, 2012, *Fundamentals of Computer Networks, Internet and scripting* languages, India, New Delhi, Kalyani

[10] Dr, T. Christopher, Kumar Jaya, (2012). Symmetric algorithms key Generate Using Static IP Address, *International Journal of Advance Research in Computer Science and Software Engineering*, Volume 2, Issue 7, 55-58.

[11] Dr. GiriNurpur, KhatriAkshay, KohleSankalp,(2016). *Dynamic address Allocation Algorithm for Mobile Ad hoc Networks*, Retrieved Nov.,29,2017,from https://arxiv.org/pdf/1605.00398

[12] H. Jonathan Chao, Goshal Deepak, Satish K. Tripathi, (1994, August). IP on TM Local Area Network, *IEEE Communication Magazine*, 52-59

[13] Jadhav Sachin, Morey Kapil, (2014, February), IP Address Conflict Resolution and Configuration Theft Management, *International Journal of Application or Innovation in Engineering and Management*, Volume 3, Issue 2, 235-237

[14] K. Usvir, K.Kirandeep, (2016), A Review on IPv4 and IPv6 in Networking, *International Journal of Computer Science and Technology*, Volume 7,210-211

[15] Bob Stockwell, How to Troubleshoot IP Address Conflicts , Dec.,19,2017, Retrieved from https://www.securitysales.com/integration/how-to-troubleshoot-ip-address-conflicts/

[16] Bradley Mitchell, *Resolving IP Address Conflicts*, Dec.,19,2017, Retrieved from https://www.lifewire.com/what-is-ip-address-conflict-818381

[17] Ibrahim El-Shekeil, Amitangshu Pal, and Krishna Kant, Aug.,2016, IP Address Consolidation and Reconfiguration In, *IEEE Exporer*

[18] Jesse Dubois, Apr 28, 2014, *Duplicate IP Address 0.0.0.0 Error Message* , Retrieved fromhttps://support.avaya.com/resources/sites/AVAYA/content/live/SOLUTIONS/ 269000/SOLN269547/en_US/116529-problemsolution-product-00.pdf

[19] Linksys, *Resolving IP address conflicts*, Dec.,2017, Retrieved from https://www.linksys.com/us/support-article?articleNum=132159

[20] M. Charlie,(2011). Integrated DHCP, DNS & IP Address Management , Cisco Prime Network Registrar, Retrieved Nov.,26,2017, from https://www.cisco.com/... /network-registrar/

[21] Microsoft Support, Fix duplicate IP address conflicts, Dec.,8,2017, Retrieved from https://support.microsoft.com/en-us/help/133490/fix-duplicate-ip-address-conflicts-on-a-dhcp-network

[22] Reuber Kent, *Build a HOME Network by Kent Reuber* 736-7650, Retrieved Nov.,23,2017, from https://web.standford.edu/dept,

[23] REVIEWER'S GUIDE Retrieved from *https://www.jtc-i.co.jp/support/documents/guide-e/ipam_reviewers_guide.pdf*Retrievedhttps://appuals.com/solved-windows-has-detected-an-ip-address-conflict/

[24] Singh. A.K., (2015, October),Internet Protocol (IP) Address – Subnetting and Supernetting, *International Journal of Emerging Trends and Technology in Computer Science*, Volume 4, Issue 5(2), 87-90

[25] Taylor Bolduc , dec, 2017,*What's an IP Conflict, and How Do You Resolve It?*, Retrieved Dec.,17,2017,from https://www.makeuseof.com/tag/whats-ip-conflict-resolve/

[26] VingeVernor, (2015). *What you need to know to reduce IP Conflicts now.* Retrieved Nov.,23,2017, from cdn.swcdn,net,