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Distribution of Load Traffic Using Cell Breathing Techniques In Cellular Network

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Abstract: RECENT studies, on operational IEEE wireless LANs (WLANs) have shown that traffic load is often unevenly distributed among the access points (APs). In WLANs, by default, a user scans all available channels and associates itself with an AP that has the strongest received signal strength indicator (RSSI), while being oblivious to the load of APs. As users are, typically, not evenly distributed, some APs tend to suffer from heavy load, while their adjacent APs may carry only light load. Such load imbalance among APs is undesirable as it hampers the network from fully utilizing its capacity and providing fair services to users.

Introduction

In this paper, we present a novel load balancing scheme that reduces the load of congested APs by forcing the users near the boundaries of congested cells to move to neighboring less congested cells. We achieve this via cell size dimensioning by controlling the transmission power of the AP beacon messages. In this paper, a WLAN cell is defined as a region in which the AP beacon signal has the strongest RSSI. Our approach is conceptually similar to cell breathing in cellular networks, we present an optimal algorithm that finds deterministic min-max load balancing solutions.
Informally, a WLAN is called min-max load balanced, if it is impossible to reduce the load of any AP without increasing the load of other APs with equal or higher load. Our approach is practical since it does not require either user assistance or standard modification.

Ease of Use

- Several studies have proposed a variety of association metrics instead of using the RSSI as the sole criterion. These metrics typically take into account such factors as the number of users currently associated with an AP, the mean RSSI of users currently associated with an AP, and the bandwidth that a new user can get if it is associated with an AP, e.g., Balachandran et al. proposed to associate a user with an AP that can provide a minimal bandwidth required by the user.
- In Velayos et al. introduced a distributed load balancing architecture was the AP load is defined as the aggregated downlink and uplink traffic through the AP. In Kumar and coworkers proposed association selection algorithms which are based on the concept of proportional fairness to balance between throughput and fairness. In Kauffmann et al. provided a mathematical foundation for distributed frequency allocation and user association for efficient resource sharing. Recently, in Shakkottai et al. considered a no cooperative multi-homing approach and showed that under appropriate pricing, the system throughput is maximized. In a strong relation between fairness and load balancing is shown.
- Most of these works determine only the association of newly arrived users. Tsai et al. is an exception, in which Tsai and Lien proposed to re-associate users when the total load exceeds a certain threshold or the bandwidth allocated to users' drops below a certain threshold. While the existing load balancing schemes achieved considerable improvement in terms of throughput and fairness, they require certain support from the client side. In contrast, the proposed scheme does not require any proprietary client support.

Solution of the Problem

- We address the problem of min-max load balancing. This is a strong NP-hard problem. In it is proved that there exists no algorithm that guarantees any coordinate wise approximation ratio, and the approximation ratio of any prefix-sum approximation algorithm is at least (login), where n is the number of APs. In this paper, we solve a variant of this min-max problem, termed min-max priority load balancing, whose optimal solution can be calculated in polynomial time for both knowledge models. Here, the AP load is defined as an ordered pair of the aggregated load contributions of its associated users and a unique AP priority.

PURPOSE OF THE PROJECT

The project has been planned to be having the view of distributed architecture, with centralized storage of the database. The application for the storage of the data has been planned. Using the constructs of MS-SQL Server and all the user interfaces has been designed using the ASP.Net technologies. The database connectivity is planned using the "SQL Connection" methodology. The standards of security and data protective mechanism have been given a big choice for proper usage. The application takes care of different modules and their associated reports, which are produced as per the applicable strategies and standards that are put forwarded by the administrative staff.

PROBLEM IN EXISTING SYSTEM

Several studies have proposed a variety of association metrics instead of using the RSSI as the sole criterion. These metrics typically take into account such factors as the number of users currently associated with an AP, the mean RSSI of users currently associated with an AP, and the bandwidth that a new user can get if it is associated with an AP, e.g., Balachandran et al. proposed to associate a user with an AP that can provide a minimal bandwidth required by the user. In Velayos et al. introduced a distributed load balancing architecture were the AP load is defined as the aggregated downlink and uplink traffic through the AP. In Kumar and coworkers proposed association selection algorithms which are based on the concept of proportional fairness to balance between throughput and fairness. In Kauffmann et al. provided a mathematical foundation for distributed frequency allocation and user association for efficient resource sharing. Recently, in Shakkottai et al. considered a no cooperative multihoming approach and showed that under appropriate pricing, the system throughput is maximized. In a strong relation between fairness and load balancing is shown. Most of these works determine only the association of newly arrived users. Tsai et al. is an exception, in which Tsai and Lien proposed to re-associate users when the total load exceeds a certain threshold or the bandwidth allocated to users' drops below a certain threshold. While the existing load balancing schemes achieved considerable improvement in terms of throughput and fairness, they require certain support from the client side. In contrast, the proposed scheme does not require any proprietary client support.

SOLUTION OF THESE PROBLEMS

We address the problem of min-max load balancing. This is a strong NP-hard problem. In it is proved that there exists no algorithm that guarantees any coordinate wise approximation ratio, and the approximation ratio of any prefix-sum approximation algorithm is at least (logn), where n is the number of APs. In this paper, we were partially involved to solve a variant of this min-max problem, termed min-max priority load balancing, whose optimal solution can be calculated in polynomial time for both knowledge models. Here, the AP load is defined as an ordered pair of the aggregated load contributions of its associated users and a unique AP priority.

SYSTEM ANALYSIS

Client Model

A client is an application or system that accesses a remote service on another computer system, known as a server, by way of a network. The term was first applied to devices that were not capable of running their own stand-alone programs, but could interact with remote computers via a network. These dumb terminals were clients of the time-sharing mainframe computer.

Server model

In computing, a server is any combination of hardware or software designed to provide services to clients. When used alone, the term typically refers to a computer which may be running a server operating system, but is commonly used to refer to any software or dedicated hardware capable of providing services.

Network Model

Generally, the channel quality is time-varying. For the ser-AP association decision, a user performs multiple samplings of the channel quality, and only the signal attenuation that results from long-term channel condition changes are utilized our load model can accommodate various additive load definitions such as the number of users associated with an AP. It can also deal with the multiplicative user load contributions.

Cell Breathing Approach

We reduce the load of congested APs by reducing the size of the corresponding cells. Such cell dimensioning can be obtained, for instance, by reducing the transmission power of the congested APs. This forces users near the congested cells' boundaries to shift to adjacent (less congested) APs. The separation between the transmission power of the data traffic and that of the AP beacon messages. On one hand, the transmission bit rate between a user and its associated AP is determined by the quality of the data traffic channel. Transmitting the data traffic with maximal power3 maximizes the AP-user SNR and the bit rate. On the other hand, each user determines its association by performing a scanning operation, in which it evaluates the quality of the beacon messages of the APs in its vicinity.

Congestion Load Minimization

The algorithms in this project minimize the load of the congested AP, but they do not necessarily balance the load of the no congested APs. In this section, we consider min-max load balancing approach that not only minimizes the network congestion load but also balances the load of the no congested APs. As mentioned earlier, the proposed approach can be used for obtaining various max-min fairness objectives by associating each user with appropriate load contributions. Unfortunately, min-max load balancing is NP-hard problem and it is hard to find even an approximated solution. In this paper, we solve a variant of the min-max problem, termed min-max priority-load balancing problem, whose optimal solution can be found in polynomial time.

PROJECT INSTRUCTIONS:

- Based on the given requirements, conceptualize the Solution Architecture. Choose the domain of your interest otherwise develop the application for ultimatedotnet.com. Depict the various architectural components, show interactions and connectedness and show internal and external elements. Design the web services, web methods and database infrastructure needed both and client and server.
- Provide an environment for up-gradation of application for newer versions that are available in the same domain as web service target.

NEED FOR COMPUTERIZATION

We all know the importance of computerization. The world is moving ahead at lightning speed and everyone is running short of time. One always wants to get the information and perform a task he/she/they desire(s) within a short period of time and too with amount of efficiency and accuracy. The application areas for the computerization have been selected on the basis of following factors:

- Minimizing the manual records kept at different locations.
  - There will be more data integrity.
  - Facilitating desired information display, very quickly, by retrieving information from users.
  - Facilitating various statistical information which helps in decision-making?
  - To reduce manual efforts in activities that involved repetitive work.
  - Updating and deletion of such a huge amount of data will become easier.

PROCESS MODELS USED WITH JUSTIFICATION

ACCESS CONTROL FOR DATA WHICH REQUIRE USER AUTHENTICATION

The following commands specify access control identifiers and they are typically used to authorize and authenticate the user (command codes are shown in parentheses)

Preliminary investigation examines project feasibility, the likelihood the system will be useful to the organization. The main objective of the feasibility study is to test the Technical, Operational and Economical feasibility for adding new modules and debugging old running system. All system is feasible if they are unlimited resources and infinite time. There are aspects in the feasibility study portion of the preliminary investigation:

- Technical Feasibility
- Operation Feasibility
- Economical Feasibility

Technical Feasibility

The technical issue usually raised during the feasibility stage of the investigation includes the following:

- Does the necessary technology exist to do what is suggested?
- Do the proposed equipment have the technical capacity to hold the data required to use the new system?
- Will the proposed system provide adequate response to inquiries, regardless of the number or location of users?
- Can the system be upgraded if developed?
- Are there technical guarantees of accuracy, reliability, ease of access and data security?

Earlier no system existed to cater to the needs of 'Secure Infrastructure Implementation System'. The current system developed is technically feasible. It is a web-based user interface for audit workflow at NIC-CSD. Thus it provides an easy access to the users. The database's purpose is to create, establish and maintain a workflow among various entities in order to facilitate all concerned users in their various capacities or roles. Permission to the users would be granted based on the roles specified. Therefore, it provides the technical guarantee of accuracy, reliability and security. The software and hard requirements for the development of this project are not many and are already available in-house at NIC or are available as free as open source. The work for the project is done with the current equipment and existing software technology. Necessary bandwidth exists for providing a fast feedback to the users irrespective of the number of users using the system.

Operational Feasibility

Proposed projects are beneficial only if they can be turned out into information system. That will meet the organization's operating requirements. Operational feasibility aspects of the project are to be taken as an important part of the project implementation. Some of the important issues raised are to test the operational feasibility of a project includes the following: -

- Is there sufficient support for the management from the users?
- Will the system be used and work properly if it is being developed and implemented?
- Will there be any resistance from the user that will undermine the possible application benefits?

This system is targeted to be in accordance with the above-mentioned issues. Beforehand, the management issues and user requirements have been taken into consideration. So there is no question of resistance from the users that can undermine the possible application benefits.

The well-planned design would ensure the optimal utilization of the computer resources and would help in the improvement of performance status.

Economic Feasibility

A system can be developed technically and that will be used if installed must still be a good investment for the organization. In the economic feasibility, the development cost in creating the system is evaluated against the ultimate benefit derived from the new systems. Financial benefits must equal or exceed the costs.

The system is economically feasible. It does not require any addition hardware or software. Since the interface for this system is developed using the existing resources and technologies available at NIC, There is nominal expenditure and economic feasibility for certain.

The software, Site Explorer is designed for management of web sites from a remote location.

INTRODUCTION

Purpose: The main purpose for preparing this document is to give a general insight into the analysis and requirements of the existing system or situation and for determining the operating characteristics of the system.

Scope: This Document plays a vital role in the development life cycle (SDLC) and it describes the complete requirement of the system. It is meant for use by the developers and will be the basic during testing phase. Any changes made to the requirements in the future will have to go through formal change approval process.

DEVELOPERS RESPONSIBILITIES OVERVIEW:

The developer is responsible for:

- Developing the system, which meets the SRS and solving all the requirements of the system?
- Demonstrating the system and installing the system at client's location after the acceptance testing is successful.
- Submitting the required user manual describing the system interfaces to work on it and also the documents of the system.
- Conducting any user training that might be needed for using the system.
- Maintaining the system for a period of one year after installation.

FUNCTIONAL REQUIREMENTS:

OUTPUT DESIGN

Outputs from computer systems are required primarily to communicate the results of processing to users. They are also used to provide a permanent copy of the results for later consultation. The various types of outputs in general are:

- External Outputs, whose destination is outside the organization.
- Internal Outputs whose destination is within organization and they are the
- User's main interface with the computer.
- Operational outputs whose use is purely with in the computer department.
- Interface outputs, which involve the user in communicating directly with

OUTPUT DEFINITION

The outputs should be defined in terms of the following points:

- Type of the output
- Content of the output
- Format of the output
- Location of the output
- Frequency of the output
- Volume of the output
- Sequence of the output

It is not always desirable to print or display data as it is held on a computer. It should be decided as which form of the output is the most suitable.

For Example

- Will decimal points need to be inserted
- Should leading zeros be suppressed.

Output Media:

In the next stage it is to be decided that which medium is the most appropriate for the output. The main considerations when deciding about the output media are:

- The suitability for the device to the particular application.
- The need for a hard copy.
- The response time required.
- The location of the users
- The software and hardware available.

Keeping in view the above description the project is to have outputs mainly coming under the category of internal outputs. The main outputs desired according to the requirement specification are:

The outputs were needed to be generated as a hot copy and as well as queries to be viewed on the screen. Keeping in view these outputs, the format for the output is taken from the outputs, which are currently being obtained after manual processing. The standard printer is to be used as output media for hard copies.

INPUT DESIGN

Input design is a part of overall system design. The main objective during the input design is as given below:

- To produce a cost-effective method of input.

- To achieve the highest possible level of accuracy.
- To ensure that the input is acceptable and understood by the user.

INPUT STAGES:

The main input stages can be listed as below:

- Data recording
- Data transcription
- Data conversion
- Data verification
- Data control
- Data transmission
- Data validation
- Data correction

INPUT TYPES:

It is necessary to determine the various types of inputs. Inputs can be categorized as follows:

- External inputs, which are prime inputs for the system.
- Internal inputs, which are user communications with the system.
- Operational, which are computer department's communications to the system?
- Interactive, which are inputs entered during a dialogue.

INPUT MEDIA:

At this stage choice has to be made about the input media. To conclude about the input media consideration has to be given to;

- Type of input
- Flexibility of format
- Speed
- Accuracy
- Verification methods
- Rejection rates
- Ease of correction
- Storage and handling requirements
- Security
- Easy to use
- Portability

Keeping in view the above description of the input types and input media, it can be said that most of the inputs are of the form of internal and interactive. As Input data is to be the directly keyed in by the user, the keyboard can be considered to be the most suitable input device.

ERROR AVOIDANCE

At this stage care is to be taken to ensure that input data remains accurate form the stage at which it is recorded up to the stage in which the data is accepted by the system. This can be achieved only by means of careful control each time the data is handled.

ERROR DETECTION

Even though every effort is make to avoid the occurrence of errors, still a small proportion of errors is always likely to occur, these types of errors can be discovered by using validations to check the input data.

DATA VALIDATION

Procedures are designed to detect errors in data at a lower level of detail. Data validations have been included in the system in almost every area where there is a possibility for the user to commit errors. The system will not accept invalid data. Whenever an invalid data is keyed in, the system immediately prompts the user and the user has to again key in the data and the system will accept the data only if the data is correct. Validations have been included where necessary.

The system is designed to be a user friendly one. In other words, the system has been designed to communicate effectively with the user. The system has been designed with pop-up menus.

USER INTERFACE DESIGN

It is essential to consult the system users and discuss their needs while designing the user interface:

USER INTERFACE SYSTEMS CAN BE BROADLY CLASIFIED AS:

1. User initiated interface the user is in charge, controlling the progress of the user/computer dialogue. In the computer-initiated interface, the computer selects the next stage in the interaction.
2. Computer initiated interfaces: In the computer-initiated interfaces the computer guides the progress of the user/computer dialogue. Information is displayed and the user response of the computer takes action or displays further information.

USER_INITIATED INTERFACES

User initiated interfaces fall into two approximate classes:

1. Command driven interfaces: In this type of interface the user inputs commands or queries which are interpreted by the computer.
2. Forms oriented interface: The user calls up an image of the form to his/her screen and fills in the form. The forms-oriented interface is chosen because it is the best choice.

COMPUTER-INITIATED INTERFACES

The following computer – initiated interfaces were used:

1. The menu system for the user is presented with a list of alternatives and the user chooses one; of alternatives.
2. Questions – answer type dialog system where the computer asks question and takes action based on the basis of the users reply.

Right from the start the system is going to be menu driven, the opening menu displays the available options. Choosing one option gives another popup menu with more options. In this way every option leads the users to data entry form where the user can key in the data.

ERROR MESSAGE DESIGN:

The design of error messages is an important part of the user interface design. As user is bound to commit some errors or other while designing a system the system should be designed to be helpful by providing the user with information regarding the error, he/she has committed.

This application must be able to produce output at different modules for different inputs.

PERFORMANCE REQUIREMENTS

Performance is measured in terms of the output provided by the application.

Requirement specification plays an important part in the analysis of a system. Only when the requirement specifications are properly given, it is possible to design a system, which will fit into required environment. It rests largely in the part of the users of the existing system to give the requirement specifications because they are the people who finally use the system. This is because the requirements have to be known during the initial stages so that the system can be designed according to those requirements. It is very difficult to change the system once it has been designed and on the other hand designing a system, which does not cater to the requirements of the user, is of no use.

The requirement specification for any system can be broadly stated as given below:

- The system should be able to interface with the existing system
- The system should be accurate
- The system should be better than the existing system

The existing system is completely dependent on the user to perform all the duties.

CONCLUSION

We presented a novel scheme for optimal load balancing in IEEE 802.11 WLANs. We provided rigorous analysis of the problem and presented two algorithms that find deterministic optimal solutions. The first algorithm minimizes the load of the congested AP(s) in the network, and the second algorithm produces an optimal min-max (priority) load balanced solution. These optimal solutions are obtained only with the minimal information which is readily available without any special assistance from the users or modification of the standard. We assume only the control on the transmission power of the AP beacon messages. The simulations show that even a small number of power levels, e.g., between 5 and 10, is enough to achieve near optimal results

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