ABSTRACT

The Telecom Billing Management System is a software application designed to streamline and automate billing processes in the telecommunications industry. This abstract provides an overview of the key features and functionalities of the system, highlighting its role in facilitating efficient billing, record management, and user authentication.

The system employs a console-based interface to interact with users and offers various functionalities such as adding new subscriber records, listing existing records, modifying subscriber details, deleting records, searching for specific records, and processing payment transactions. It utilizes file handling techniques to store and retrieve subscriber information, including phone numbers, names, and billing amounts.

One of the notable features of the Telecom Billing Management System is its user authentication mechanism, which ensures secure access to the system. Users are required to provide a valid username and password to log in successfully. This authentication feature helps protect sensitive subscriber data and prevents unauthorized access.

The system enables administrators to efficiently manage subscriber records by providing functionalities to add, modify, and delete records. It also offers the ability to search for specific records based on phone numbers, providing quick and accurate access to subscriber information.

Moreover, the Telecom Billing Management System incorporates a payment processing feature, allowing subscribers to make payments towards their billing amounts. The system displays current subscriber details, including the outstanding balance, and facilitates the entry of payment amounts. By updating the records with the payment information, the system ensures accurate billing management and timely payment tracking.

In conclusion, the Telecom Billing Management System provides an efficient and user-friendly platform for managing subscriber records, processing payments, and maintaining accurate billing information in the telecommunications industry. Its functionalities contribute to enhanced operational efficiency, data security,
and customer satisfaction.

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CHAPTER 1

INTRODUCTION

1.1 Outline

File structure is a combination of representation for data in files & of operations for accessing the data. Sequential file structure is a data organization method where records are stored in a sequential order, one after another. Each record has a fixed length and is accessed by traversing through the previous records. It is simple to implement but can be slow for random access. Sequential files are suitable for applications that require sequential processing, such as batch processing or reading data in a linear manner. However, they may not be efficient for scenarios that require frequent random access or updates to specific records within the file.

1.2 Motivation and Scope

Motivation:

The motivation behind developing the Telecom Billing Management System is to automate and streamline the billing process for a telecommunications company. Manual management of subscriber records, billing, and payment tracking can be time-consuming, error-prone, and inefficient. By implementing a computerized system, the company can improve accuracy, reduce manual effort, and enhance customer service.

Scope:

The scope of the Telecom Billing Management System is to provide a user-friendly interface for performing various operations related to subscriber management and billing. The system allows users to add new subscriber records, list existing records, modify subscriber details, search for specific records, delete records, and process payments.

The system aims to simplify the tasks involved in managing subscriber information, such as phone numbers, names, and amounts owed. It provides a centralized database to store and retrieve subscriber records, eliminating the need for manual record-keeping. Additionally, the system enables efficient billing and payment processing, ensuring timely and accurate payment tracking.

1.3 Problem Statement

Design and implement a Telecom Billing Management System that allows users to perform various operations related to subscriber records. The system should provide functionalities to add new records, list existing records, modify records, delete records, search for specific records, and process payments.

The system should prompt the user with a menu of options and allow them to choose the desired operation. The user should be able to add subscriber records by providing phone numbers, names, and amounts. The system should store these records in a file for future retrieval.

1.4 Methodology

The Telecom Billing Management System based on sequential indexing is designed to efficiently manage and process customer billing information. The system utilizes a sequential file structure where customer billing records are stored in a sequential manner. Each record is assigned a unique sequential index number based on its position in the file. When a new customer makes a call, their billing information is recorded and added as a new record to the sequential file, with the next available index number. To search for a specific customer's billing information, the system sequentially scans the file from the beginning until it finds the desired record based on the specified criteria, such as the customer's unique identifier or phone number. Once the record is located, the system retrieves the associated billing information and presents it to the user or performs any required calculations. In case of any changes or updates to a customer's billing information, the system locates the corresponding record based on its sequential index and modifies the relevant fields. The sequential indexing approach provides a simple and straightforward method for data retrieval and manipulation, allowing for efficient management of telecom billing records.

1.5 Limitations

Sequential indexing has several limitations that affect its efficiency and flexibility in managing data. Firstly, it is inefficient for searching operations, especially when searching based on non-sequential criteria. Since the file needs to be sequentially scanned from the beginning, it becomes time-consuming and resource-intensive for large files. Additionally, sequential indexing lacks flexibility, as updates or deletions require scanning the entire file to locate the desired record. This can lead to slower performance and increased processing time. The scalability of sequential indexing is also limited, as inserting new records in the middle of the file requires shifting subsequent records, resulting in increased overhead. Moreover, achieving sorted order in a sequentially indexed file is inefficient, requiring reorganization of the entire file. Concurrent access to the file is challenging, as the sequential nature of indexing does not support simultaneous modifications or searches by multiple users or processes. Lastly, direct access to records based on key values is not provided, necessitating sequential scanning and potentially leading to slower retrieval times. These limitations highlight the constraints of sequential indexing in terms of searching, flexibility, scalability, sorting, concurrent access, and direct record retrieval based on key values.

CHAPTER 2

INTRODUCTION TO FILE STRUCTURES

File structures, also known as data structures for files, are methods or techniques used to organize and manage data stored in computer files. They define how data is stored, accessed, and modified within a file, aiming to optimize data storage efficiency and retrieval performance.

In computing, files are used to store and organize data on various storage media such as hard drives, solid-state drives (SSDs), or other types of storage devices. A file structure provides a logical representation of the data within a file, allowing for efficient storage, retrieval, and manipulation of information.

File structures encompass different techniques and data organization methods, including: **Sequential Files:** In a sequential file structure, data is stored in a sequential manner, one after another. Each record in the file contains a fixed number of fields, and the records are accessed sequentially from the beginning to the end. Sequential files are simple and suitable for applications that require frequent access to all records in a specific order.

Indexed Files: Indexed file structures introduce an index, a separate data structure that allows direct access to specific records within a file. The index contains key-value pairs, where the key is typically a field or a combination of fields from the records. The index facilitates quick searches and retrieval of records based on the specified key.

Hashed Files: Hashed file structures use a hash function to map keys to specific locations within the file. The hash function generates a hash value based on the key, which is used to determine the storage location. Hashed files provide rapid access to records but may suffer from collisions (multiple records mapped to the same location) if not properly handled.

B-Trees: B-Trees are balanced tree structures that allow efficient insertion, deletion, and searching operations in large files. B-Trees are particularly useful for managing large amounts of data, as they maintain balance and keep the tree height relatively small, resulting in fast access times.

Directories: Directories are file structures used to organize and manage files within a file system. They provide a hierarchical structure, allowing files to be organized into directories and subdirectories for better organization and management. Directories typically maintain metadata about the files, such as names, sizes, and permissions.

File structures play a crucial role in data management, providing efficient and optimized methods for storing and retrieving data from files. The choice of file structure depends on the specific requirements of an application, including the type and size of data, access patterns, and desired performance character.

2.1 History of File Structures

Early work with files presumed that files were on tape, since most files were. Access was sequential and the cost of access grew in direct proportion to the size of the file. The indexes made it possible to keep a list of keys and pointers in a smaller file that could be searched more quickly. With the key and pointer, the user had direct access to the large, primary file.

Unfortunately, simple indexes had some of the same sequential flavor as the data files, and asthe indexes grew, they too became difficult to manage, especially for dynamic files in which the set of keys changes. Then in the early 1960’s, the idea of applying tree structures emerged. Unfortunately, trees can grow very unevenly as records are added and deleted.

In 1963 researchers developed the tree, an elegant, self-adjusting binary tree structure, called AVL tree, for data in memory. The problem was that even with a balanced binary tree, dozens of accesses were required to find a record in even moderate sized files.

It took nearly ten more years of design work before a solution emerged in form of the B-tree. AVL trees grow from top down as records are added, B-trees grow from the bottom up.
B-trees provided excellent access performance, but there was a cost: no longer could a file be accessed sequentially with efficiency. Fortunately, this problem was solved almostimmediately by adding a linked list structure at the bottom level of the B-tree. The combinationof a B-tree and a sequential linked list is called a B+ tree.

Being able to retrieve information with just three or four accesses is pretty good. But the goal of being able to get what we want with a single request was satisfied by hashing. From early on, hashed indexes were used to provide fast access to file. After the developed of B-trees, researchers turned to work on systems for extendible, dynamic hashing that could retrieve information with one or, at most, two disk accesses no matter how big the file became.

2.2 Types of File Structures

As we know that computers are used for storing the information for a permanent time or the files are used for storing the Data of the users for a long time period. And the files can contain any type of information which means that they can store text, any images or pictures or data in any format. So that there must be some mechanism which are used for storing the information.

Accessing the information and also performing some operations on the files. When we store a file in the system, then we have to specify the name and the type of file. The name of file will be any valid name and type means the application with which the file is linked. When we say that every file has some type, it means that every file belongs to a special type of application software. When we provide a name to a file, we also specify the extension of the file because the system will retrieve the contents of that file into application software.

1. **Ordinary file or Simple file:** Ordinary file may belong to any type of application. For example, notepad, paint, C program, music[mpeg] etc. All the files that are created by a user are ordinary files. Ordinary files are used for storing information about the user programs. With the help of ordinary files, we can store the information which contain text, database, images or any other type of information.

2. **Directory File:** Directory files are nothing but a place/area/location where details of files are stored. It contains details about file names, ownership, file size and time when they are

created and last modified.

3. **Special Files:** The special files are also called as device files. The special files are those which are not created by the user or the files which are necessary to run a system. These are the files that are created by the system. All the files of an operating system are referred to as special files. There are many types of special files and they are, system files or windows files, input/output files. System files are stored using .sys extension.

4. **FIFO Files:** The first in first Out Files are used by the system for executing the processes ina particular order. Which means that the files which comes first, will be executed first and the system maintains a order known as Sequence order. When a user requests for a service from the system, then the requests of the users are arranged into some files and all the requests will be performed by the system.

2.3 Operations on File Structures

File structures support various operations that enable efficient management of data storedwithin files. These operations include:

1. Creation: The creation operation involves establishing a new file structure on a storage medium. During this process, the file structure is initialized, and necessary metadata structures, such as file headers or indexes, are set up. This operation prepares the file structure for subsequent data storage and retrieval operations.

2. Opening and Closing: Opening a file structure involves establishing a connection or access point to an existing file on the storage medium. Opening a file grants the ability to perform read, write, and other operations on the file's data. After completing operations on a file, it is essential to close the file to release system resources and ensure data integrity.

3. Reading: The reading operation allows retrieving data from a file structure. It involves accessing specific records or blocks of data within the file and transferring the data into the application's memory space. Reading operations may involve sequential access, direct access using indexes, or hashed access based on keys.

4. Writing: The writing operation involves adding new data or modifying existing data withina file structure. It requires specifying the location or position in the file where the data should be stored or updated. Writing operations may involve appending data at the end of the file,

overwriting existing data, or inserting new records at specific positions.

5. Updating: The updating operation involves modifying the existing data within a file structure. It allows changing specific fields or attributes of records without completely rewriting the entire record. Updating operations are typically performed by locating the desired record within the file and applying the necessary changes to the identified fields.

6. Deleting: The deleting operation involves removing data or records from a file structure. Deletion can be performed on individual records or multiple records at once. Deleting operations may involve marking the deleted record as inactive or physically removing the record from the file structure, depending on the specific file organization method.

7. Searching: The searching operation enables locating specific records or data within a file structure based on given criteria. Searching operations may involve sequential scanning of records, direct access using indexes, or utilizing search algorithms such as binary search or hashing techniques for efficient retrieval of data.

8. Indexing: Indexing operations involve creating and maintaining index structures to facilitate faster access to data within a file structure. Indexes are used to map key values to specific locations in the file, allowing for direct access to records without the need for sequential scanning.

9. File Maintenance: File maintenance operations involve tasks such as reorganizing the file structure to improve performance, resizing the file to accommodate more data, compressing or decompressing data, and performing integrity checks to ensure data consistency.

These operations collectively enable effective data management within file structures, providing the necessary functionalities for storing, accessing, updating, and manipulating data in a structured manner. The specific operations and their implementation depend on the chosen file structure and the requirements of the application.

2.4 Advantages of File Structures

Simplicity: File structures are relatively simple and easy to understand compared to complex database management systems. They provide a straightforward way of organizing and managing data within files.

Direct Access: Certain file structures, such as indexed files or hashed files, offer direct access to specific records based on key values. This allows for quick retrieval of data without the need for sequential scanning, resulting in faster access times.

Low Overhead: File structures typically have low overhead in terms of memory and processing resources. They require minimal system resources to manage and maintain the file organization, making them efficient for handling small to moderate amounts of data.

Flexibility: File structures provide flexibility in terms of data formats. They can handle a variety of data types, including text, numbers, images, and more, allowing for diverse data storage and retrieval requirements.

Portability: File structures are portable across different platforms and systems. Files can be easily transferred or shared between different computers or software applications, ensuring data interoperability.

2.5 Disadvantages of File Structures

Limited Data Integrity: File structures do not offer built-in mechanisms for enforcing data integrity rules and constraints. It is the responsibility of the application or user to ensure data consistency and accuracy. Without proper validation and error-checking mechanisms, data integrity can be compromised.

Lack of Concurrent Access: File structures often lack built-in support for concurrent access by multiple users or processes. Simultaneous access to the same file by multiple users can leadto data inconsistencies or conflicts unless explicit locking mechanisms are implemented.

Lack of Query Language: Unlike database management systems, file structures do not provide a dedicated query language for complex data retrieval and manipulation. Retrieving specific data requires manual implementation of search algorithms or iteration over the file contents.

Limited Scalability: File structures may face challenges in handling large volumes of data efficiently. As the size of the file increases, sequential scanning and direct access operations may become slower, impacting overall performance.

Data Redundancy: File structures can result in data redundancy if the same information is stored in multiple files or multiple locations within a file. This redundancy can lead to increased storage

requirements and potential inconsistencies if updates are not properly synchronized.

Lack of Data Sharing and Integration: File structures do not inherently support data sharingor integration between different applications or systems. Sharing data stored in file structures often requires manual data export/import processes or file transfer mechanisms.

It's worth noting that while file structures have certain limitations compared to more advanced database systems, they still serve as effective solutions for managing data in smaller-scale applications or scenarios where simplicity and direct access are prioritized over complex data management capabilities.

CHAPTER 3

INTRODUCTION TO SEQUENTIAL FILE STRUCTURES

A sequential file structure is a method of organizing and storing data in a linear, sequential manner. In this file structure, data is stored one after another in a continuous sequence. Each record in the file is accessed by traversing through the preceding records, following the order in which they were added.

Sequential file structures are commonly used in scenarios where data processing occurs sequentially or in a batch fashion. For example, in applications that process large volumes of data in a specific order, such as reading data from a log file or performing batch calculations.

In a sequential file structure, each record typically has a fixed length, making it easier to calculate the location of subsequent records based on the position of the previous ones. This simplicity in structure and organization makes sequential file structures relatively easy to implement and understand.

However, sequential file structures may not be ideal for scenarios that require frequent random access or updates to specific records within the file. Since records are stored sequentially, accessing a specific record in the middle of the file requires traversing through all preceding records. This can be inefficient and time-consuming.

Sequential file structures are often used in conjunction with other data structures, such as indexes or hash tables, to improve access efficiency for specific operations. For example, indexed sequential access methods (ISAM) combine sequential file structures with an index to allow for faster direct access to specific records based on key values.

In summary, sequential file structures provide a simple and straightforward approach to organizing data in a sequential order. While they may not be suitable for scenarios that require frequent random access, they are commonly used in batch processing or situations where data is processed sequentially.

3.1 Operation on Sequential File Structures

1. Creation: The creation operation involves initializing a new sequential file structure. This includes defining the structure of the records, allocating storage space, and setting up any necessary metadata or control structures.

2. Opening and Closing: Opening a sequential file allows for subsequent read and write operations on the file. Closing the file ensures that all changes are saved, resources are freed, and the file is properly released.

3. Reading: Reading from a sequential file involves retrieving records from the file in the order they were stored. Sequential reading typically starts from the beginning of the file and progresses through each subsequent record until the desired data is found or the end of the file is reached.

4. Writing: Writing to a sequential file involves adding new records to the end of the file. Each record is appended to the existing data, expanding the file's size. Sequential writing ensures that the records are stored in the order they are added.

5. Updating: Updating a sequential file requires locating a specific record within the file and modifying its contents. Since sequential files are not optimized for random access, updating involves a two-step process: reading the file sequentially until the desired record is found, modifying the record, and then rewriting the entire file with the updated record.

6. Deleting: Deleting a record from a sequential file involves locating the specific record, marking it as deleted, and rewriting the file without the deleted record. Similar to updating, deleting in sequential file structures often requires rewriting the entire file.

7. Searching: Searching a sequential file involves scanning the file sequentially from the beginning until the desired record is found. Since the file is not indexed for direct access, searching can be time-consuming for large files.

8. Appending: Appending is the process of adding new records to the end of the sequential file without modifying existing data. This operation is useful for adding new data to the file without rewriting the entire file.

9. Sorting: Sorting a sequential file rearranges the records in a specific order based on one or more key fields. Sorting allows for more efficient searching and improves the performance of subsequent operations.

10. Merging: Merging involves combining two or more sorted sequential files into a single sorted file. This operation is useful when dealing with large volumes of data split across multiple files and enables efficient processing of the combined data.

3.2 Purpose of Sequential File Structures

1. Sequential Data Processing: Sequential file structures are designed to support sequential data processing operations. They allow for reading and writing data in a linear fashion, following the order in which records are stored. This is particularly useful for applications that process data in a step-by-step manner or perform batch operations.

2. Simple Implementation: Sequential file structures offer a straightforward and relatively simple approach to data organization. The records are stored consecutively, and their positions can be easily calculated based on the size and length of preceding records. This simplicity makes sequential file structures easy to implement and understand.

3. Storage Efficiency: Sequential file structures optimize storage space utilization. Since records are stored sequentially, there is no need for additional overhead or complex data structures to manage the order of the data. This makes sequential file structures efficient in terms of storage usage.

4. Ease of Access: Sequential file structures are suitable for applications that primarily require sequential access to data. Sequential reading and writing operations are straightforward, as the system can simply progress through the records one by one. This makes sequential file structures efficient for tasks like log file processing, batch calculations, and generating reports.

5. Compatibility with Physical Media: Sequential file structures are compatible with physical media, such as tapes or sequential access storage devices. The linear nature of sequential file structures aligns well with the way data is read or written in a linear manner on these media types.

6. Cost-Effective: Sequential file structures are often cost-effective compared to other complex file structures. They do not require additional index structures or data organization overhead, reducing both development and maintenance costs.

3.3 Advantages of Sequential File Structures

1. Simplicity: Sequential file structures have a simple and straightforward design. They organize data in a sequential order, one record after another. This simplicity makes them easy to implement, understand, and maintain. Developers can quickly grasp the concepts and logic behind sequential file structures, resulting in faster development and reduced complexity.

2. Sequential Processing Efficiency: Sequential file structures are highly efficient for sequential data processing tasks. Since the records are stored sequentially, accessing and processing them in the order they appear is efficient and straightforward. This makes sequential file structures well-suited for applications that involve batch processing, log file analysis, generating reports, or performing sequential calculations.

3. Storage Efficiency: Sequential file structures optimize storage space utilization. The records are stored one after another without the need for additional metadata or complex data structures to manage their order. This efficient use of storage space can be beneficial in scenarios where storage capacity is a concern, such as in environments with limited disk space or when dealing with large datasets.

4. Compatibility with Sequential Access Media: Sequential file structures are compatible with sequential access media, such as tapes or sequential storage devices. These media read or write data in a linear manner, aligning well with the sequential nature of the file structure. Sequential file structures enable efficient access and utilization of sequential access media, which can be advantageous in specific environments.

5. Cost-Effective: Sequential file structures are often cost-effective compared to more complex file structures. They do not require additional index structures or complex algorithms for record retrieval. This simplicity reduces the development and maintenance costs associated with the file structure, making it an attractive option in situations where cost optimization is a priority.

6. Data Integrity: Sequential file structures can offer good data integrity. Since records are stored sequentially and updates are typically performed by rewriting the entire file, data consistency and integrity are maintained during write operations. This ensures that data remains accurate and reliable within the file structure.

3.4 Disadvantages of Sequential File Structures

1. Lack of Random Access: One of the significant drawbacks of sequential file structures is the lack of efficient random access to individual records. To access a specific record, the system needs to sequentially traverse through all preceding records. This makes it time-consuming and inefficient for applications that require frequent random access or retrieval of specific records.

2. Inefficient Record Updates and Deletions: Updating or deleting a specific record within a sequential file structure can be challenging and inefficient. Since records are stored sequentially, modifying or removing a record often requires rewriting the entire file or large portions of it. This can lead to performance issues, especially when dealing with large files or frequent updates.

3. Limited Search Efficiency: Searching for specific records in a sequential file structure can be inefficient, especially for large files. Sequential searching involves scanning through the file from the beginning, which can be time-consuming and resource-intensive. Without indexing or other optimization techniques, searching becomes less efficient as the file size increases.

4. Difficulty in Handling Dynamic Data: Sequential file structures are not well-suited for handling dynamic data that undergoes frequent insertions, deletions, or updates. The need to rewrite the entire file or significant portions of it for modifications can lead to data fragmentation, increased storage requirements, and slower performance.

5. Challenging Sorting Operations: Sorting records within a sequential file structure can be challenging and computationally expensive. Since the records are stored sequentially, rearranging them to achieve a specific order requires extensive data movement and rewriting of the entire file.

6. Lack of Concurrent Access: Sequential file structures typically do not support concurrent access by multiple users or processes. Due to their sequential nature, concurrent modifications or accesses can result in conflicts, data corruption, or inconsistent results.

7. Lack of Flexibility in Data Retrieval: Sequential file structures are optimized for sequential processing and may not offer flexible retrieval options based on different criteria or conditions. Extracting specific subsets of data or performing complex queries may require additional processing steps or traversing the entire file.

CHAPTER 4

REQUIREMENT SPECIFICATION

4.1 Functional Requirements

1. Record Insertion: The system should allow for the insertion of new billing records when customers make calls or subscribe to services. This involves capturing relevant information such as customer details, call duration, call charges, and payment information.

2. Searching Records: The system should provide efficient search functionality to locate specific billing records based on various criteria. Users should be able to search by customer name, phone number or any other relevant parameters to retrieve the desired records quickly.

3. Modifying Records: The system should allow authorized users to modify existing billing records. This includes updating customer information, correcting call details, adjusting charges, or making any necessary changes to ensure accurate billing information.

4. Deletion of Records: Authorized users should be able to delete billing records when necessary. This may be required for removing duplicate records, handling cancellations, or complying with data retention policies.

5. Payments Management: The system should provide features for recording and managing customer payments. It should allow users to associate payments with specific billing records, track payment dates, amounts, and methods (e.g., cash, credit card, bank transfer), and update the payment status accordingly.

6. Displaying Records: The system should offer a user-friendly interface to display billing records. Users should be able to view individual records or generate reports that provide an overview of customer billing history, call details, outstanding balances, and any other relevant information.

4.2 Non –Functional Requirements

1. Performance: The system should be designed to handle a high volume of billing records efficiently. It should perform fast record insertion, searching, modification, and deletion operations, ensuring optimal response times even with large datasets.

2. Scalability: The system should be able to handle increasing data volumes as the number of customers and billing records grows over time. It should be scalable to accommodate future expansion without significant performance degradation.

3. Reliability: The system should be reliable and provide accurate billing information consistently. It should minimize the occurrence of errors, data inconsistencies, and data loss. Backup and recovery mechanisms should be in place to protect against data loss and ensure system availability.

4. Security: The system should have robust security measures to protect sensitive customer information and prevent unauthorized access. It should include user authentication mechanisms, access control, data encryption, and compliance with relevant data protection regulations.

5. Usability: The system should have a user-friendly interface that is intuitive and easy to navigate. It should provide clear and concise displays of billing information, and users should be able to perform tasks such as record searching, modification, and payment management with minimal training or assistance.

6. Maintainability: The system should be designed in a modular and well-structured manner to facilitate future maintenance and enhancements. It should be easy to understand, modify, and extend, with clear documentation and coding standards.

7. Integration: The system should support integration with other relevant systems or modules, such as customer relationship management (CRM) systems, accounting

systems, or data analytics tools. This allows for seamless data exchange and interoperability, enabling a holistic view of customer billing information.

8. Compliance: The system should adhere to applicable regulatory requirements, industry standards, and best practices for telecom billing systems. This includes compliance with data privacy regulations, billing accuracy standards, and auditability.

4.3 System Requirements

Hardware Requirements

- RAM: 4 GB RAM minimum
- Processor: intel 3 or AMD 3
- Storage: approximately 500MB storage

Software Requirements:

- Operating System: Microsoft Windows (64 bit)
- IDE: VS CODE (or any other C++ IDE)
- File: NOTEPAD (.txt File)

C++

C++ is a general-purpose programming language that was developed as an extension of the C programming language. It was created by Bjarne Stroustrup in the early 1980s and has since become one of the most popular and widely used programming languages.

C++ is known for its efficiency, flexibility, and performance. It offers a combination of high- level and low-level programming features, allowing developers to write code that is both expressive and close to the hardware. It supports both procedural and object-oriented programming paradigms, providing a rich set of features for building modular and reusable code.

Fig 4.1 C++ Logo

Key features of C++ include:

Object-Oriented Programming (OOP): C++ supports the concepts of classes and objects, enabling developers to encapsulate data and behavior within classes. It provides features like inheritance, polymorphism, and encapsulation, allowing for the creation of robust and modular code.

Standard Template Library (STL): The STL is a powerful library that provides a collection of generic algorithms and data structures. It includes containers (such as vectors, lists, and maps) and algorithms (such as sorting and searching), making it easier to write efficient and reusable code.

Performance: C++ allows for fine-grained control over memory management and provides features like pointers and references. This control enables developers to write code that is highly optimized and efficient, making it suitable for resource-intensive applications and

systems programming.

Portability: C++ code can be compiled and run on various platforms and operating systems, making it a highly portable language. This portability allows developers to write code that can be easily deployed across different environments without significant modifications.

Interoperability: C++ can seamlessly integrate with other programming languages, particularly C. It allows developers to call C functions and use C libraries directly, facilitating interoperability with existing codebases and libraries.

C++ has been widely used in various domains, including system programming, game development, embedded systems, scientific computing, and high-performance applications. It is supported by a vast ecosystem of tools, libraries, and frameworks that further enhance its capabilities. Its low-level features and freedom in memory management require developers to be mindful of potential pitfalls, such as memory leaks and undefined behavior. Nonetheless, with proper understanding and best practices, C++ remains a powerful language choice for a wide range of applications.

VS CODE

VS Code, short for Visual Studio Code, is a popular source code editor developed by Microsoft. It is designed to be lightweight, highly customizable, and optimized for modern programming languages and workflows.

Features and Functionality: VS Code provides a rich set of features to enhance the coding experience. It offers support for syntax highlighting, code completion, code navigation, and debugging capabilities. It also includes built-in Git integration, terminal access, and a wide range of extensions that can be installed to extend its functionality further.

Cross-Platform Compatibility: VS Code is available for Windows, macOS, and Linux, making it a versatile choice for developers working on different platforms. It maintains consistent performance and functionality across these operating systems.

Lightweight and Fast: VS Code is built to be lightweight and optimized for speed. It starts up quickly and consumes minimal system resources, ensuring a smooth and responsive coding experience even when working with large codebases.

Customization and Extensions: One of the standout features of VS Code is its extensive customization options. Users can personalize the editor's appearance, keyboard shortcuts, and settings according to their preferences. Additionally, the VS Code marketplace offers a vast selection of extensions created by the community, enabling users to enhance their coding environment with additional language support, productivity tools, and integrations with various development frameworks and technologies.

Integrated Development Environment (IDE) Features: While VS Code is primarily a code editor, it provides several IDE-like features to streamline development workflows. These include integrated terminal support, built-in Git version control, debugging tools, task automation, and more. These features help developers manage their entire development process within a single environment.

Fig 4.2 VS Code Logo

CHAPTER 5

REQUIREMENT AND SYSTEM ANALYSIS

5.1 Overall System Description

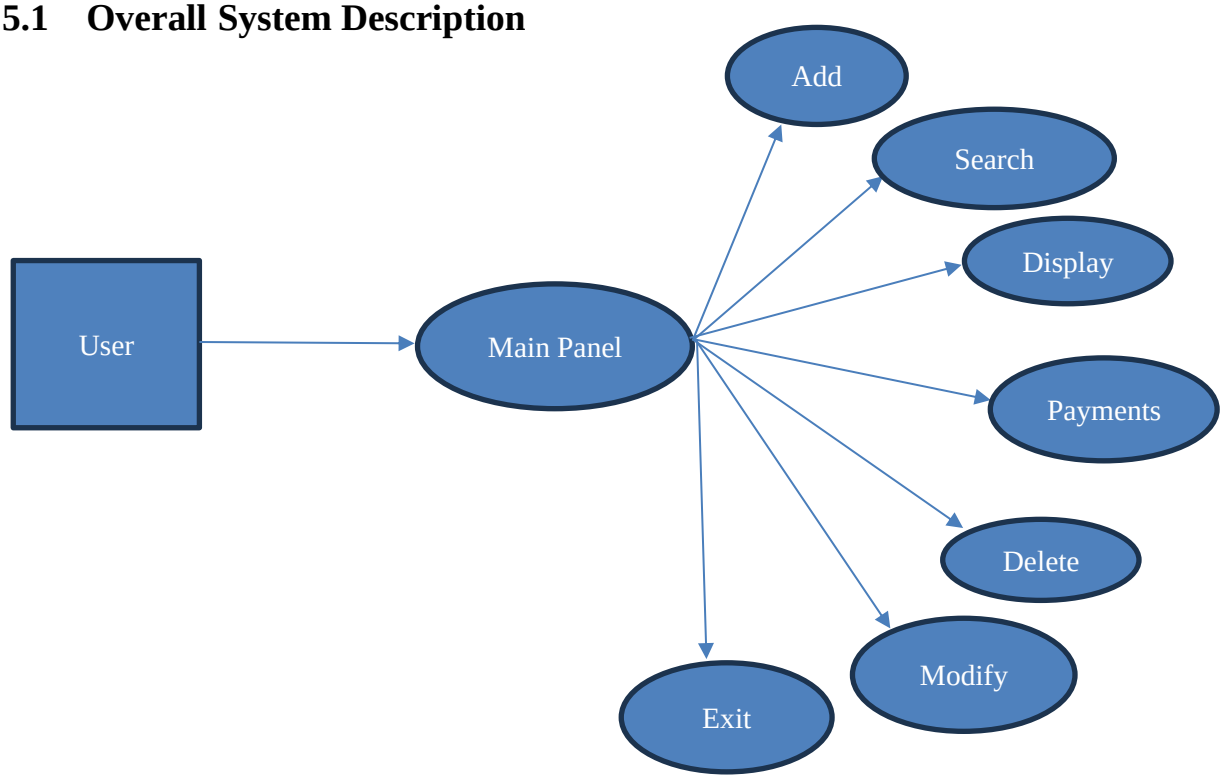

Fig. 3.1: Overall system design

1. Record Insertion:

The system should provide functionality for the insertion of new billing records. When customers make calls or subscribe to services, their billing information should be captured and stored in the system. This involves recording relevant details such as customer information, call duration, call charges, and payment information. The system should ensure data integrity by validating and storing the information accurately.

2. Searching Records:

The Telecom Billing Management System should offer efficient search capabilities to locate specific billing records based on various criteria. Users should be able to search for records using parameters such as customer name, phone number, date range, or any other relevant parameters. The system should retrieve the matching records promptly, allowing users to access the desired information quickly and easily.

3. Modifying Records:

Authorized users should be able to modify existing billing records in the system. This functionality enables the updating of customer information, correction of call details, adjustment of charges, and any necessary changes to ensure accurate billing information. The system should provide appropriate validation checks to maintain data integrity during the modification process.

4. Deletion of Records:

The system should allow authorized users to delete billing records when necessary. This functionality might be required to remove duplicate records, handle cancellations, or comply with data retention policies. The system should ensure that only authorized users can perform record deletions, and appropriate mechanisms should be in place to handle the deletion process securely.

5. Payments Management:

The Telecom Billing Management System should include features for recording and managing customer payments. It should provide the ability to associate payments with specific billing records, track payment dates, amounts, and payment methods (such as cash, credit card, or bank transfer). The system should update the payment status accordingly and maintain accurate records of customer payments for reconciliation and reporting purposes.

6. Displaying Records:

The system should offer comprehensive and user-friendly interfaces for displaying billing records. Users should be able to view individual records in detail or generate reports that provide an overview of customer billing history, call details, outstanding balances, and any other relevant information. The system should present the information in a clear and organized manner, facilitating easy interpretation and analysis of billing data.

7. Exit:

If user wants to exit the application, he can use exit option.

CHAPTER 6

SYSTEM FUNTIONALITIES

Implementation is the stage where the theoretical design is turned into a working system. The most crucial stage in achieving a new successful system and in giving confidence on the new system for the users that it will work efficiently and effectively.

The system can be implemented only after thorough testing is done and if it is found to work according to the specification. It involves careful planning, investigation of existing systems and its constraints on implementations, design of methods to achieve the change. Two major tasks of preparing the implementation are education and training of the users and testing of the system.

The implementation phase consists of several activities. The required hardware and software acquisition is carried out. The system may require the need to develop a software. For this purpose, programs are written and tested.

PSEUDO CODES:

Code Snippets of all the operations:

Insert Record :

```
{
    FILE *f;
    char test;
    f=fopen("pro.txt","ab+");
    if(f==0)
    {   f=fopen("pro.txt","wb+");
            system("cls");
            printf("Please wait while we configure your computer");
            printf("\npress any key to continue");
            getch();
    }
    while(1)
    {
            system("cls");
            printf("\n Enter phone number: ");
            scanf("%s",&s.phonenumber);
            printf("\n Enter name: ");
            fflush(stdin);
```

```
            scanf("%s",&s.name);
            printf("\n Enter amount: ");
            scanf("%f",&s.amount);
            fwrite(&s,sizeof(s),1,f);
            fflush(stdin);
            printf("\n\n Record Is Successfully Added");
            printf("\n Press esc Key to exit or Press any other key to add other record:");
            test=getche();
            if(test==27)
                  break;
    }
    fclose(f);
    system("cls");
}
```

Display Record :

```
{
    FILE *f;
    int i;
    if((f=fopen("pro.txt","rb"))==NULL)
            exit(0);
    system("cls");
    printf("Phone Number\t\tUser Name\tAmount\n");
    for(i=0;i<79;i++)
            printf("-");
    while(fread(&s,sizeof(s),1,f)==1)
    {
            printf("\n%s\t\t%s\t\tRs. %.2f /-",s.phonenumber,s.name,s.amount);
    }
    printf("\n");
    for(i=0;i<79;i++)
            printf("-");

fclose(f);
printf("\n\nPress Any Key To Go Back");
getch();
system("cls");
}
```

Delete Record :

```
{
    FILE *f,*t;
    char phonenumber[20];
    system("cls");
    f=fopen("pro.txt","rb+");
    t=fopen("pro1.txt","wb+");
```

```
    do{
    rewind(f);
    printf("Enter the phone number to be deleted from the Database: ");
    scanf("%s",phonenumber);
    while(fread(&s,sizeof(s),1,f)==1)
    {
            if(strcmp(s.phonenumber,phonenumber)!=0)
            {       fwrite(&s,sizeof(s),1,t);

            }
            else
            printf("Record deleted successfully.");
    }

    fclose(f);
    fclose(t);
    remove("pro.txt");
    rename("pro1.txt","pro.txt");

    f=fopen("pro.txt","rb+");
    t=fopen("pro1.txt","wb+");
   printf("\nDo you want to delete another record (y/n):");
    fflush(stdin);
      }
    while(getche()=='y'||getche()=='Y');
            fclose(f);
    getch();
    system("cls");
}
```

Search Record :

```
{
    FILE *f;
    char phonenumber[20];
    int flag=1;
    f=fopen("pro.txt","rb+");

    fflush(stdin);
    system("cls");
    printf("Enter Phone Number to search in our database: ");
    scanf("%s", phonenumber);
    while(fread(&s,sizeof(s),1,f)==1)
    {
            if(strcmp(s.phonenumber,phonenumber)==0)
            {       system("cls");
                    printf(" Record Found ");
                    printf("\n\nPhonenumber: %s\nName: %s\nAmount:
Rs.%0.2f\n",s.phonenumber,s.name,s.amount);
```

```
                flag=0;
                break;
        }
        else if(flag==1)
        {       system("cls");
                printf("Requested Phone Number Not found in our database");
        }
    }
    getch();
    fclose(f);
    system("cls");
}
```

Modify Records :

```
{
        FILE *f;
    char phonenumber[20];
    long int size=sizeof(s);
    if((f=fopen("pro.txt","rb+"))==NULL)
        exit(0);
    system("cls");
    printf("Enter phone number of the subscriber to modify: ");
    scanf("%s",phonenumber);
    fflush(stdin);
    while(fread(&s,sizeof(s),1,f)==1)
    {
        if(strcmp(s.phonenumber,phonenumber)==0)
        {
            system("cls");
            printf("\n Enter phone number: ");
            scanf("%s",&s.phonenumber);
            printf("\n Enter name: ");
            fflush(stdin);
            scanf("%[^\n]",&s.name);
            printf("\n Enter amount: ");
            scanf("%f",&s.amount);
            fseek(f,-size,SEEK_CUR);
            fwrite(&s,sizeof(s),1,f);
            break;
        }
    }
    fclose(f);
    system("cls");
}
```

Payments :

```
{
    FILE *f;
    char phonenumber[20];
    long int size=sizeof(s);
    float amt;
    int i;
    if((f=fopen("pro.txt","rb+"))==NULL)
            exit(0);
    system("cls");
    printf("Enter phone number of the subscriber for payment: ");
    scanf("%s",phonenumber);
    fflush(stdin);
    while(fread(&s,sizeof(s),1,f)==1)
    {
            if(strcmp(s.phonenumber,phonenumber)==0)
            {
                    printf("\n ***DETAILS***");
                    printf("\n Phone No.: %s",s.phonenumber);
                    printf("\n Name: %s",s.name);
                    printf("\n Current amount: %f",s.amount);
                    printf("\n");
                    for(i=0;i<79;i++)
                            printf("-");
                    printf("\n\nEnter amount of payment: ");
                    fflush(stdin);
                    scanf(" %f",&amt);
                    s.amount=s.amount-amt;
                    fseek(f,-size,SEEK_CUR);
                    fwrite(&s,sizeof(s),1,f);
                    break;
            }
    }
    printf("\n\n");
    printf("System Message: THANK YOU %s FOR YOUR TIMELY PAYMENTS!!",s.name);
    getch();
    fclose(f);
    system("cls");
}
```

CHAPTER 7

TESTING

Testing is finding out how well something works. Testing tells what level of knowledge or skill has been acquired. In computer hardware and software development, and is used at key checkpoints in the overall process to determine whether objectives are being met. Software testing can be stated as the process of verifying and validating whether a software or application is bug-free, meets the technical requirements as guided by its design and development, and meets the user requirements effectively and efficiently by handling all the exceptional and boundary cases.

Unit Testing

It focuses on smallest unit of software design. In this we test an individual unit or graph of inter related units. It is often done by programmer by using sample input and observing its corresponding outputs.

Example:

a. In a program we are checking if loop, method or if a function is working correctly.

b. Incorrect or misunderstood arithmetic procedures.

c. Incorrect initialization.

In this project we have implemented and tested for different inputs like Order Id, Product Name, Quantity, Price

Integration Testing

When a software test case covers more than one unit, it is considered an integration test. When developing a software test case, the lines between units can quickly evolve into integration tests. The dependency itself will not need to be tested and the integration to it will be mocked or faked. It is of two types: (i) Top down (ii) Bottom up

Example:

a. Black Box testing –It is used for validation. Here we ignore internal working mechanism and

focus on what the output would be.

b. White Box testing- It is used for verification. Here we focus on internal mechanism i.e., how the output is obtained.

System Testing

In this the software is tested such that it works fine for different operating systems. It is covered under the black box testing technique. In this we focus on required inputs and outputs without focusing on internal working.

Test cases built during the project development:

Sl. No	Functionality	Action	Expected Result	Actual Result	TEST RESULT
1	Adding records to the file	Add a new customer record to the files	Customer details are stored to the particular row in the file	Customer details are stored to the file	PASS
2	Searching of records from the files	Search the record according to the phone number	Should displaythe result after searching	Display the result accordingly.	PASS
3	Retrieval of all records from the files	Display all the records from the file	Should display all records from the files.	Displays all records from the files.	PASS
4	Modifying of records from the files	Modify the existing record according to the phone number	Should modifythe record after searching	Modify the record accordingly.	PASS
5	Deleting of records from the files	Delete the record according to the phone number	Should Delete the record after searching	Delete the record accordingly.	PASS
6	Payments of the customer	Payment of the customer's bills	Should make the payment	Payment done	PASS

CHAPTER 8

RESULTS

The result contains few of the screen shots of project pages.

Fig 8.1 Login

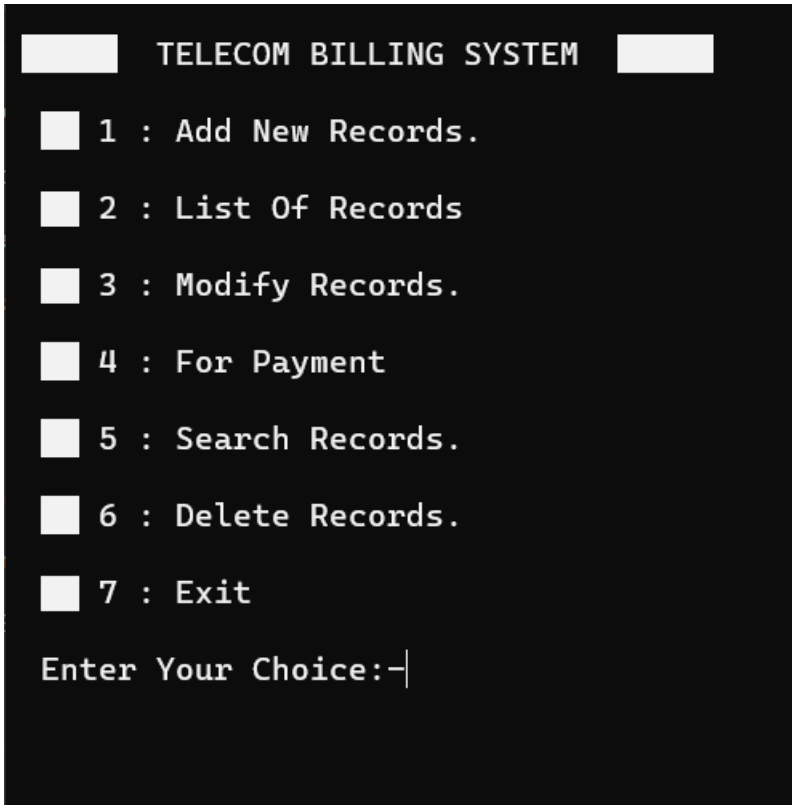

Fig 8.2 Dashboard

```
Enter phone number: 8904123276

Enter name: ROSHAN

Enter amount: 123


Record Is Successfully Added
Press esc Key to exit or Press any other key to add other record:
```

Fig 8.3 Inserting record into the file

```
Phone Number            User Name       Amount
------------------------------------------------------------------------
8904123276              ROSHAN          Rs. 123.00 /-
8904183276              SHOURYA         Rs. 5000.00 /-
9741325004              VIVEK           Rs. 12345.00 /-
9632492203              SV              Rs. 12345.00 /-
------------------------------------------------------------------------

Press Any Key To Go Back
```

Fig 8.4 Displaying all the records

```
Enter phone number: 899015371

Enter name: SHOURYA

Enter amount: 1234567
```

Fig 8.5 Modification of the record

```
Enter phone number of the subscriber for payment: 9632492203

 ***DETAILS***
 Phone No.: 9632492203
 Name: SV
 Current amount: 12345.000000
--------------------------------------------------------------------------------

Enter amount of payment: 12345


System Message: THANK YOU SV FOR YOUR TIMELY PAYMENTS!!
```

Fig 8.6 Payment of customer bills

```
 Record Found

Phonenumber: 9632492203
Name: SV
Amount: Rs.0.00
```

Fig 8.7 Searching of Records

```
Enter the phone number to be deleted from the Database: 9632492203
Record deleted successfully.
Do you want to delete another record (y/n):
```

Fig 8.8 Deletion of Record

CHAPTER 9

FUTURE ENHANCEMENTS

1. Real-time Data Processing: Integrate real-time data processing capabilities to handle streaming data from various sources. This would enable instant billing calculations and provide up-to-date information to customers.

2. Automated Billing Alerts: Implement automated billing alerts to notify customers about their usage, upcoming payment due dates, and any potential discrepancies or changes in their billing. This would improve customer engagement and reduce billing-related issues.

3. Advanced Reporting and Analytics: Enhance the reporting and analytics capabilities of the system to provide comprehensive insights into billing patterns, customer behavior, revenue trends, and other key performance indicators. This would help in making data-driven decisions and identifying areas for improvement.

4. Integration with Customer Relationship Management (CRM): Integrate the billing system with a CRM platform to have a holistic view of customer information, billing history, and support interactions. This integration would facilitate better customer service and enable personalized billing solutions.

5. Self-Service Portal: Develop a self-service portal where customers can access and manage their billing information, view invoices, make payments, and update their preferences. This would empower customers and reduce the dependency on customer support for routine billing tasks.

6. Enhanced Security Measures: Strengthen the security measures of the system by implementing advanced encryption techniques, role-based access controls, and regular security audits. This would ensure the protection of sensitive customer data and prevent unauthorized access or fraudulent activities.

7. Integration with Payment Gateways: Integrate the billing system with popular payment gateways to provide customers with multiple payment options and a seamless payment experience. This would improve the efficiency of the billing process and enhance customer satisfaction.

CONCLUSION

In conclusion, the Telecom Billing FS Management System mini project offers a comprehensive solution for managing telecom billing processes. It provides an efficient and organized approach to handle customer billing, invoicing, and payment tracking. The project demonstrates the importance of proper data organization and file structures in ensuring smooth billing operations.

Through the mini project, we have explored sequential file structures and their benefits in handling sequential processing of billing records. Sequential file structures offer simplicity in implementation and are suitable for batch processing scenarios. However, they may have limitations when it comes to random access and frequent updates.

To further enhance the Telecom Billing FS Management System, future improvements can be made. These enhancements include real-time data processing, automated billing alerts, advanced reporting and analytics, integration with CRM systems, self-service portals, enhanced security measures, integration with payment gateways, and scalability optimizations. Implementing these enhancements would lead to a more robust and user-friendly system, improving customer satisfaction, operational efficiency, and decision-making capabilities.

Overall, the Telecom Billing FS Management System mini project provides valuable insights into the importance of effective file structures and the potential for further advancements in telecom billing systems. It serves as a foundation for developing more sophisticated billing management systems that can cater to the evolving needs of the telecom industry.

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- **Links**

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[3] Raghu Ramakrishan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw Hill, 2003.