**SCHOOL OF COMPUTING**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**UNIT – V  - DISTRIBUTED DATABASE AND INFORMATION SYSTEMS- SCSA3008**

**UNIT 5**

**ENTERPRISE COLLOBRATION SYSTEMS**

Groupware – Types of groupware – Enterprise Communication tools – Enterprise Conferencing tools – Collaborative work management tools – Information System for Business operations – transaction processing systems – functional Information Systems – Decision Support systems – Executive Information systems – Online Analytical processing.

## GROUPWARE

Distributed System is a collection of autonomous computer systems that are physically separated but are connected by a centralized computer network that is equipped with distributed system software. One of the advantages of a distributed system is information sharing. A distributed system can be used efficiently when information is generated by one of the users and shared by the users working at other nodes of the system. This facility may be useful in many ways.

The use of distributed computing systems by a group of users to work cooperatively is known as computer-supported cooperative working (CSCW), or groupware. Groupware applications are primarily based on the sharing of data objects between programs running on different nodes of a distributed computer system. Groupware is an emerging technology that holds major promise for software developers.

It consists of computer programs where people work on common project but are separated geographically. They share the interface for communication and it is done with the help of groupware. alternative name of groupware is collaboration software. It consist of remotely accessible storage systems so that data files can be archived.

**Classification:**
Groupware can be classified based on when and where the participants are collaborating and the functionalities they need for their work.

**1. By time-space matrix:**
- ” When ” classification: When the participators are working at the same time or not.
- “Where” classification: Where the participators are working at the same place or not

Common axes for time-based classification are:

- Synchronous
- Asynchronous

For place classification, they are:

- Co-located
- Remotely located

Synchronous groupware are applications that allow individuals located at different locations in real-time. Coordination and sharing the resources is the main feature. An example is a telephonic conversation where they share audio channels. If they are co-located it will be like a face-to-face conversation in real-time.

Asynchronous collaboration happens when there is a replica of the data system with reading and writing data access. Users can execute all the updates concurrently. Collaborative writing,, file sharing systems, and email are examples.

**2. By functionality:** Cooperative work involves
- Participators who are working
- Artifacts which they work

There will be direct communication between participants, mediated by computer systems. Examples of computer media include email and bulletin board, video environments, text messaging. A common understanding is captured by meeting and decision support systems. meeting and decision system may have a meeting room, shared drawing interface, and argumentation tools. Applications and artifacts of the work will be shared among them. Control and feedback can be done by participants with the shared objects.

**GroupWare Tools:**
- Groove
- Microsoft Exchange
- Netscape Navigator
- Net Meeting

**Advantages:**
- **Enhances user creativity:** Different groups of people come up with the idea to foster creativity and improve the project that they collaborate upon
- **Facilitates communication:** users can discuss and come to joint conclusions via messages or chat and solve the issue.
- **Visualize vision and goals:** It enables the users to come up with a purpose.
- Any time – any place interaction.
- Open network and open client standards make it very efficient for use.

**Disadvantages:**
- **Cost factor:** The purchase and maintenance of the groupware is a challenging task.
- **Reliability issue:** Since it depends on the server, whenever there is internet issue or server is down, it becomes difficult to carry on the work.
- **Dependence on the single vendor:** Due to transportation, logistic, and security issues the overdependence on a single vendor is a common perception.
- Network security with slow speed, reliability, and access problems is a major disadvantage.

**ENTERPRISE COMMUNICATION TOOLS:**

**Communication is essential for starting and building a successful business**

**Types of Communication**

Communication is key to any business success. Strong external communication helps build your brand and sell your product or service by making customers aware of your company and what it has to offer. Internal communication between employees, teams, partners, and leaders is essential to making the business run smoothly and efficiently.

Two types of communication, external and internal, have different objectives:

- **External** communication reaches out to the customer to make him or her aware of your product or service and provide a reason to buy. This type of communication includes brochures, advertising, contact letters/direct mail, telephone calls, business cards, Web sites, and anything else that makes the public aware of what you do.  A couple of things to remember about external communication:
    - o Image is extremely important in external corporate communications! Your logo should represent who you are.
    - o Consistency is also very important. Use the same words and messages to communicate externally about your business.

- **Internal** communication with team members is essential to attracting and retaining a talented staff and monitoring business performance. Consistent communication about business goals will provide direction to the people in your company and make sure everyone is working toward the same objective.  Internal communication can be designed to motivate your team. Methods for communicating internally include performance awards, newsletters, meetings, telephone calls, and both formal and informal discussions. Periodic meetings with top project management groups, including your board of directors and advisory board, should be planned for regular intervals every year.
    - o As with external communication, consistency is very important. Use the same words and messages with all members of your team to make sure everyone is on the same page.
    - o Many large companies print key messages and goals on employee badges and ID cards so that every person in the organization has the same words at their fingertips.

**Basic Communication Tools**

A wide variety of communication tools are used for external and internal communication. These tools include mail, email, telephones, cell phones, smartphones, computers, video and web conferencing tools, social networking, as well as online collaboration and productivity platforms.

**Mail**

Even with all the modern methods of communication, regular postal mail is still a powerful tool for a business. It adds a personal touch, and is often used for delivering secure documents and contracts and for delivering purchased items to customers. A convenient way to handle mail from your own home or office is through a usps.com or Stamps.com account (in the U.S.), which allows you to print postage from your own computer. If you are sending mail internationally, there are a number of carriers available. Be sure to learn which carriers are most reliable in each region where you conduct business. You can compare costs to get the best combination of price, delivery date, and tracking options.

**Email**

Although you may already have a personal email that you use, having a business email will be

helpful in communicating with customers, vendors, and internal teammates. Checking email on a daily basis is essential. There are many email features available depending on the type of account you have. For example, for some accounts you can track email to ensure the recipient reads it. You can also postpone sending outgoing email, filter incoming email, and set-up automatic responses with different types of accounts. Platforms for hosting email include Gmail, Outlook, and Yahoo. There are also others. For additional cost, these platforms will set up your own business email address. For example, you could host jsmith@yourbusiness.com on one of the email platforms by paying an extra fee.

## Telephones

The cornerstone of your business communication, both external and internal, may be your telephone. There are many types of telephones, and only you can decide which type is right for you. Even the standard telephone (landline) that is installed in your office has many options. While you may have a telephone already, you should start with at least one line that is unique to your business. This line should have the capability to take messages in case it is not answered personally. Here are some telephone tips:

- It is important to treat the telephone as a business tool. Answer your phone in a timely manner (within three rings if you can). Always identify yourself when answering. Record a voicemail message that identifies the number, provides brief information about your business, and indicates when you will return the call. Then continually check your voicemail to return calls promptly.
- Have a separate line for your business phone and your personal phone. Don't have family members pick up or use the business phone. Get any required extra telephone lines installed before you start.
- When leaving phone messages, clearly state your company's name and phone number at the beginning and the end of the message.
- Be polite in cell phone use! Good business courtesy includes avoiding being interrupted by telephone calls, texts, or email when in a meeting or during a business lunch..

## Landline

The landline is the telephone system that uses a physical wire for transmission. You may have a landline in your home, your office, or at a public phone location. If the internet is unreliable, you will still be able to use your landline because it relies on a different technology for communication. There are many services available for landline telephones. If you have an existing landline and would like to add additional services such as voicemail, multiple lines, and conference calling, be sure to research the options offered by your service provider and its competitors. You may not have to switch phone companies to get the features you want.

## Cell Phones/Mobile Phones

The cell phone, also called a mobile phone, is used for mobile communications. There are numerous carriers/providers and plans. Many carriers have plans tailored for small businesses including options that bundle popular features and usage patterns making them very cost effective. Be sure to ask questions about your specific needs before selecting a carrier and a plan. Understand the duration and terms of your agreement. Many can be two years or more. Consider what type of communication you will use most for your business - conversations over the phone, texting, or data. Investigate plans that have unlimited access in your key area to

compare pricing.

When your usage or needs change, do not hesitate to request information on plans that more closely meet your new set of requirements. But be aware there are hefty fees for canceling early.

## Smartphones

A smartphone is a cell phone that offers advanced capabilities with computer-like functionality. A smartphone incorporates features like email, internet, and social media. Smartphones are capable of text messaging and include a camera with video capability.

Outside your office, a smartphone can be a valuable tool for business. In fact, if you don't have an office, or work from your home, a smartphone can be your office. With a smartphone you can use email, access the internet, review, edit, or scan documents, use GPS, accept and make payments, and use a multitude of applications (apps) to do almost anything. The most popular smartphones are the Apple iPhone (iOs) and Samsung Galaxy (Android), but new smartphones are emerging on the market everyday. Each has different strengths you will need to factor into your business needs.

## Internet Calling: Google Voice and Others

Internet calling is a way to make phone calls using the internet. There are several internet calling providers. Google Voice is the most popular and it is free. Google Voice provides voicemail, Short Message Service (SMS) and texting, and a local phone number.  Users can send free text messages, customize their voicemail, read voicemail text transcript, and more. Users can make or receive calls or texts from their computer or from their mobile smartphone. Google's voicemail service is now available for free to all Gmail users. Other internet calling providers include Grasshopper, MightyCall, Nextiva, DingTone, Telzio, Freedompop, Line2, Voiceably, and OnSIP, to name a few. Each provides a service for a monthly fee with different features, capabilities, strengths, and weaknesses.

## SMS Messaging and Texting

While not all mobile phones are smartphones capable of receiving videos and pictures, nearly all mobile phones can receive SMS (short message service) messages. These are texts of less than 160 characters that consist only of letters, numbers, and symbols. SMS messaging, and texting in general, is a powerful way to communicate. SMS messaging and texting provide one-to-one communication. As more and more people adopt mobile phones, there are more opportunities to connect directly and personally with mobile phone users (who may be your customers!).

Companies can use SMS messages as a way to remind customers of sales, product offerings, and other announcements. It is important to note that customers must opt-in to companies' SMS marketing campaigns and that it is illegal for companies to send SMS messages to customers who have not opted-in. Companies can often encourage customers to opt-in by offering them something in exchange. For example, a hot dog company could get customers to participate in their SMS marketing campaign by offering them $5 off their next meal for texting a code to their specialized SMS campaign number. Larger companies might purchase the services of an online text message marketing company to manage these marketing campaigns and to provide

them with a short phone number code for customers to use to opt-in to the campaign. Small businesses could also allow customers to sign up for text messages like they might sign up for a mailing/emailing list and send messages directly.

**Cell and Data Plans**

There are two major types of mobile phone plans: pre-paid and post-paid. Pre-paid allows you to pay a mobile carrier upfront for mobile services, and you must refill your minutes or data when they run out. Be aware that overage charges for minutes or data used that exceed your plan may be billed at a higher rate. You will need to understand if it is possible to go over your pre-paid amount, and what additional charges might be imposed. Post-paid plans allow you to sign a contract with a mobile carrier for different types of mobile services, and you pay for those services at the end of the month. Unused minutes or data may or may not roll over from one month to the next month, meaning you have to pay for your minutes or data each month whether you use it all or not.

Whichever plan you choose, be sure you understand the terms. There may be penalties for terminating your contract early. You should think about your business needs before deciding on a mobile service plan and whether you want to pay upfront or at the end of the month.

**Video and Web Conferencing**

Video conferencing provides a way to have face-to-face meetings without the expense of travel. It provides a more personal way to communicate both externally with customers and partners and internally with team members or employees who may work outside the office.

Video conferencing technologies transmit and receive images and voice in real-time so that you can have a "face-to-face meeting." Web conferencing adds another dimension - it allows you to share documents and applications during your online meeting. Both options allow you the flexibility to have one-on-one meetings, or conferences with multiple attendees. Seeing facial expressions and nonverbal cues during crucial business discussions and negotiations can be invaluable for your business.

Some common tools for video and web conferencing are listed below. These tools are offered at different levels and price points, although there are some you can access for free. Some examples of video and web conferencing tools include:

- Google+ Hangouts
- Skype
- Zoom
- Ring Central
- Webex
- Goto Meeting

All these solutions allow you to communicate as if you were face-to-face with customers, partners, and employees anywhere in the world. Time and money that would be spent on traveling can be used other ways for your business. You can share documents, make presentations, and conduct meetings on short notice. For example, without leaving your office,

you can collaborate with employees who work from home or from other company locations.

**Social Networking Sites**

If you are a member of a social networking site or utilize social media, you know that these platforms are popular for businesses that use them for marketing. A social network is an online community comprised of individuals or organizations that are tied together by common interests. Internet-based social networking occurs through a variety of website platforms that allow users with similar interests to share content and interact online. Some popular social networking sites include Facebook, Instagram, Twitter, LinkedIn, Pinterest, YouTube, and many others.

By creating social networks that follow your business, or the interests of your business, you can build relationships with current and future customers. For example, there are online social networks for companies, celebrities, politicians, and interests such as travel, home decor, cooking, and exercise to name a few. By posting content to these groups you can provide information to a large number of followers quickly and inexpensively.

Many companies pursue a social media strategy in their marketing efforts. Social media marketing is a relatively inexpensive way to reach specific customer segments that you believe will be interested in your product or service. To be successful it requires a steady effort and participation over time. One mistake companies make is jumping in and posting frequently initially, but then not maintaining the effort for very long. It's better to begin with a pace you know you can continue, whether it's once a month, once a week, or once a day. If you find you have more content to post, you can always do more. A note of caution on internet social networking: once you put something out there it's hard to take it back, so you have to be careful. Always be mindful of how a post will represent and reflect on your business. It's also a good idea to keep in mind that your personal social networks may also be visited by potential customers, partners, investors, and employees.

**Online Collaboration Tools**

The world is at our fingertips when it comes to being able to work online within our business, with partners, vendors and/or customers/consumers. From messaging to group chats, video conferencing, file sharing, document collaboration, elearning, and more, almost anything is possible right from your device. In addition to the tools and resources discussed above, below are some ideas and examples of tools that can be used depending on your goals.

- **G Suite:** Google offers a suite of products that enable online collaboration. Using Google Docs you can develop a document that can be edited by multiple people in different locations (or all within the same conference room) in real-time, and at the same time. Other G Suite products work the same way: Google Sheets, Google Slides, and Google Drive for example. You can create and manage your documents in a filing system that can be owned by one person or shared among a team. Google Calendar has become a popular way for organizing your own schedule as well as scheduling meetings among members of different organizations or businesses.
- **Office 365/Office Online:** Microsoft also offers a suite of products that enable online collaboration. Office 365 includes Outlook, OneDrive, Word, Excel, PowerPoint, One

Note, Skype, and other applications. The Office 365 suite is not free. Microsoft Online offers software in a cloud-based variety for free.

- **Messaging Tools:** Messaging tools allow for online chat and instant messaging between individuals or teams. Some also feature file sharing, file storage, video calling, searchable message-history, image viewing, and creating polls. Some of these tools integrate with Google Drive, Facebook, Dropbox and other softwares. A few examples are:
    - Slack
    - GroupMe
    - Google Hangouts
- **Online and Shared Calendar Apps and Software:** Online and shared calendar tools are wonderful for time-management and scheduling meetings with others. Some examples include but are not limited to:
    - Google Calendar
    - Doodle
    - Outlook
    - Teamup
    - Asana
- **Task Management Apps and Software:** Task management applications allows users to manage their tasks from a smartphone, tablet, computer, or smartwatch. Many of them are free; additional collaboration features are available in paid versions. They are a great way to keep track of your progress and projects whether working on them individually or as a team. Some examples include:
    - Trello
    - ClickUp
    - Todoist
    - Any.do
    - Quire

## ENTERPRISE CONFERENCING TOOLS

Video conferencing has experienced steady growth over the past decade, becoming an essential tool for connecting remote workers and distributed teams.

### 1. Zoom

Zoom has become a household name for video conferencing by offering the most robust and feature-rich software of any of its competitors. While there have been concerns about Zoom's security, it currently remains the best option for those who want reliable HD video and audio, and powerful functionality such as sophisticated permissions and host controls, virtual backgrounds, and more.

Zoom is also a great tool for holding webinars and other large group meetings.

### 2. Google Hangouts Meet

Google Hangouts, which offers free video calls to individuals, and Google Hangouts Meet, Google's enterprise video conferencing tool, are both fully integrated into G Suite. Hangouts

Meet is free to all G Suite users, who can create meetings of up to 100 participants right in Google Calendar.

While Hangouts Meet (currently being rebranded to Google Meet) lags behind Zoom in overall features, it does offer collaboration tools such as screen sharing and dial-in numbers for those joining by phone; it also runs entirely in the browser, so users don't have to download any other software.

Those with Business and Enterprise G Suite plans can hold meetings of up to 150 and 250 participants respectively. They also have access to features such as meeting recordings and livestreaming.

### 3. Microsoft Teams

For organizations that use Microsoft tools, Microsoft's communication and collaboration platform Teams offers increasingly impressive video conferencing functionality. Teams replaces Skype for Business, which is being absorbed into the broader Teams platform. Users can hold audio, video, and web conferences, or live events with up to 10,000 attendees.

Teams integrates with the Microsoft Office 365 product line and offers features such as in-meeting chat, recordings, notes from previous meetings, collaboration abilities, scheduling assistance, and more.

### 4. GoToMeeting

GoToMeeting by LogMeIn was the original leading enterprise video conferencing tool and still offers plenty of features for businesses of all sizes, such as a dial-in conference line, a custom meeting URL, in-app messaging, collaboration tools such as screen sharing and whiteboards, meeting transcription services, and no meeting time limits.

You can join meetings from either a mobile device or desktop, but if it's your first time using the software, you may need to download it.

### 5. Join.me
Join.me is a great option when you need to set up a video call as quickly and simply as possible. Users can instantly create and share a link to a personal meeting room without downloading any software or scheduling a meeting. The user-friendly interface allows one-click screen sharing but lacks the extensive features of other options.

### 6. BlueJeans

BlueJeans is a cloud-based conferencing app that combines simplicity with a rich set of features. You can launch meetings from a browser — no software downloads necessary.

Features include screen sharing, whiteboards, recordings, and chat. BlueJeans integrates with popular collaboration tools such as Slack, Microsoft Teams, and Google's G Suite.

### 7. Cisco Webex Meetings

A stalwart among large enterprises, Webex is Cisco's conferencing solution. It combines web video conferencing and voice calling.

Webex Meetings is now a great option for organizations of all sizes thanks to its recently improved free plan, which allows users to host up to 100 participants with no limits on meeting time or number of calls, and includes meeting controls and collaboration tools, dial-in numbers, and 1 GB of cloud storage.

### 8. Zoho Meeting

Zoho Meeting is a video meeting and webinar tool within the Zoho customer relationship management (CRM) software suite that focuses on client relationships. Zoho Meeting features functionality for question-and-answer sessions with clients, analytics and reporting to measure participant engagement, and publicity tools for webinars, as well as standard video conferencing features.

### 9. Slack

Slack is an incredibly popular communication and collaboration tool for teams of all sizes, but it also offers built-in video conferencing.

While Slack's video conferencing capabilities are weaker than standalone video conferencing solutions, they do offer a good option for Slack customers who just want to quickly jump on a video call. Slack also includes screen sharing and annotation functionality that allows participants to draw on each other's screens — a feature that can be useful for remote teams working collaboratively.

### 10. Owl Labs Meeting Owl

While not a software program, OWL Labs provides an impressive physical tool for in-office video conferencing: Meeting Owl. Meeting Owl is a smart video conferencing camera for meeting rooms that captures 360-degree video and audio, and automatically shifts the camera to focus on whomever is speaking.

## COLLABORATIVE WORK MANAGEMENT TOOLS

**What is collaborative work management tools?**
The Collaborative Work Management market consists of vendors offering **task-driven workspaces that support business users in work planning and execution**. They combine task, project, workflow, and automation capabilities with conversations, content publishing, reporting, analytics, and dashboards.

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➢ **Online and Shared Calendar Apps and Software:** Online and shared calendar tools are wonderful for time-management and scheduling meetings with others. Some examples include but are not limited to:

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   ➢ Trello
   ➢ Click Up
   ➢ To do list
   ➢ Any.do
   ➢ Quire

## INFORMATION SYSTEMS FOR BUSINESS FUNCTIONS
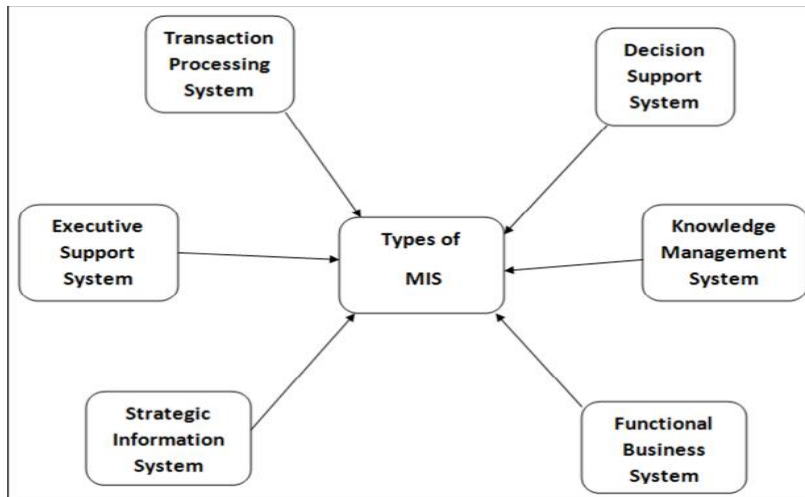
The principal *business functions* in a business firm are:

1. Marketing and sales

2. Production

3. Accounting and finance

4. Human resources

## TYPES OF INFORMATION MANAGEMENT SYSTEMS

There are many types of information management systems in the market that provide a wide range of benefits for companies.



**Fig 5.1 Types of Information Management Systems**

Transaction processing systems (TPS) collect and record the day to day dealings of an organization. This system is mostly used at lower level of management.

Management information systems (MIS) produce fixed, regularly scheduled reports based on data extracted and summarized from the firm's underlying transaction processing systems (TPS) helps to middle and operational level managers to provide answers to structured and semistructured decision problems.

 Decision-support systems (DSS) are mainly computer program applications used by middle management to compile information from a wide range of sources to solve problems and make decisions. These decisions are taken by top level management executives.

 Executive support systems (ESS) is a reporting tool that provides quick access to summarized reports coming from all levels of organization and departments such as accounting, human resources and operations. This system provides critical information in a wide range of internal & external source in easiest way to use display to manager and executives.

 Knowledge management system (KMS) is a knowledge based information system to support creation, organization and disseminating business knowledge to employees and manager throughout the company.

Strategic information system (SIS) applies Information Technology (IT) with firm's product, service and business process to help the organization to gain a strategic advantage over competition.

Functional business system (FBS) it focuses on operational and managerial application in support of business function like accounting and marketing etc.

## TRANSACTION PROCESSING SYSTEMS:

*What is a transaction in distributed DBMS?*

A program that includes a collection of database operations which are executed as a logical unit of processing the data is known as a transaction. In a transaction one or more of the data operations are performed such as insert, update, delete or retrieve. All this process is automated and if performed, is performed in completion or is not at all performed. The transaction that does not include any updating of data but only involve in retrieving the data is known as read-only transaction.

A high level operation is divided into many low level operations. For instance, the operation of data updation is divided into three different low level operations -

> - **read_item()** – The data items from the storage till the main memory is read.
> - **modify_item()** – The value of the item in the main memory is changed
> - **write_item()** – The modified value from the main memory is written to storage.

The access of the database is only restricted to the operations, read_item() and write_item().

Therefore, the basic database operations for any transaction include read and write.

*What are the different Transaction Operations?*

The operations that can be performed in a transaction at low level are:

> - **begin_transaction** – The start of the transaction execution is specified by this marker.
> - **read_item or write_item** – As a part of transaction, the operations of main memory are interleaved with the operations of the database.
> - **end_transaction** – The end of the transaction is specified by this marker.
> - **commit** – The successful completion of the transaction in its entirety is specified by this signal.
> - **rollback** – The failure of the transaction and the status that the temporary changes are undone in the database is specified by this signal. Once the transaction is committed, it cannot be rolled back.

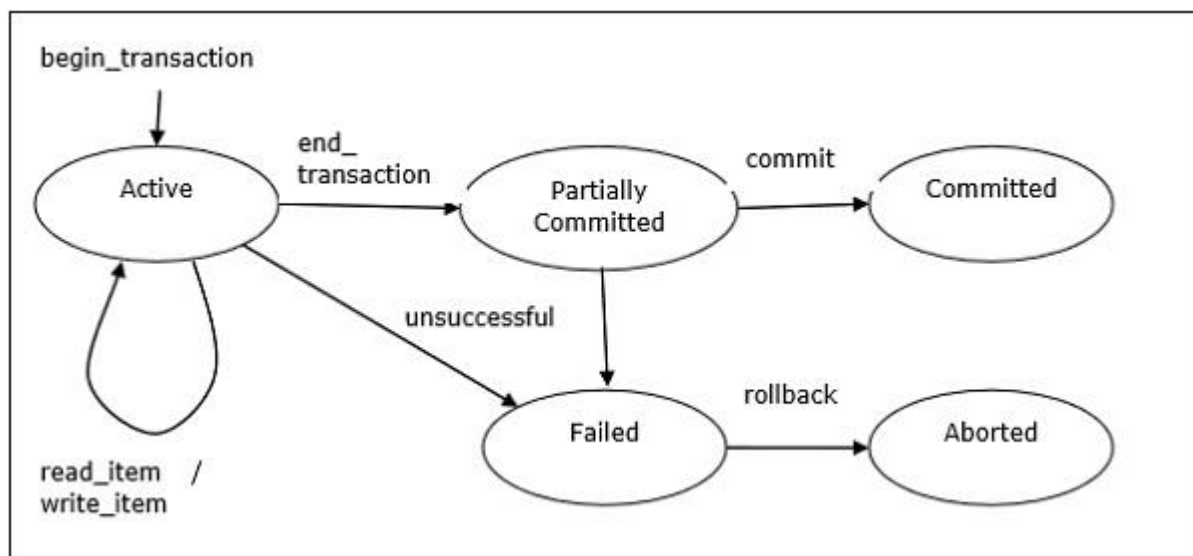*What are the different states of Transaction?*

There are set of five different states, which a transaction needs to go through. They are active, partially committed, committed, failed and aborted.

> - **Active** – This is the state when the transaction is entered into the active state. Operations like read, write or other operations are performed by the transaction by remaining in this state.

- ➢ **Partially Committed** – Only once the last statement of the transaction is executed, the transaction enters this state.
- ➢ **Committed** – After the transaction is successfully completed, and the commit signal is issued by the system check, the transaction enters this state.
- ➢ **Failed** – When it is realised that the transaction cannot proceed with the normal execution or when there is a failure on the system check, the transaction enters this failed state either from the active state or partially committed state.
- ➢ **Aborted** – The state when the transaction has been completely rolled back after restoring the failure database.

The diagram demonstrates the different states of the transaction and also the low level transaction operations that may lead to states being changed.



**Fig 5.2 Different States of the Transaction**

*What are the desirable properties of Transactions?*

The properties such as Atomicity, Consistency, Isolation and Durability, known as ACID need to be maintained by any of the transaction.

- ➢ **Atomicity** – According to this property, the transaction is either performed completely or not performed at all. There is no existence or no place for partial update of the transaction.
- ➢ **Consistency** – Without effecting the data item in the database, the database need to be taken from one consistent state to another consistent state by a transaction.
- ➢ **Isolation** – There should be any interference to the transaction from any other transactions which are running simultaneously. The transaction should be executed as a sole transaction in the system.
- ➢ **Durability** – The change brought by the committed transaction should be durable in the database and should not go away or get lost in case of failure transactions.

*What are Schedules in Distributed DBMS?*

The total order of the execution of the operations considered in a system with many simultaneous transactions is known as a schedule. Considering n transactions such as T1, T2,

T3………..Tn, and schedule S, and for any of the transaction Ti, the operations should be executed as specified and laid down in schedule S.

*Types of Schedules*

There are two types of schedules −

- **Serial Schedules** – At any given point of time when there is only one active transaction, it is known as serial schedule. In other words, no transactions overlap in serial schedule. The serial schedule is depicted below:
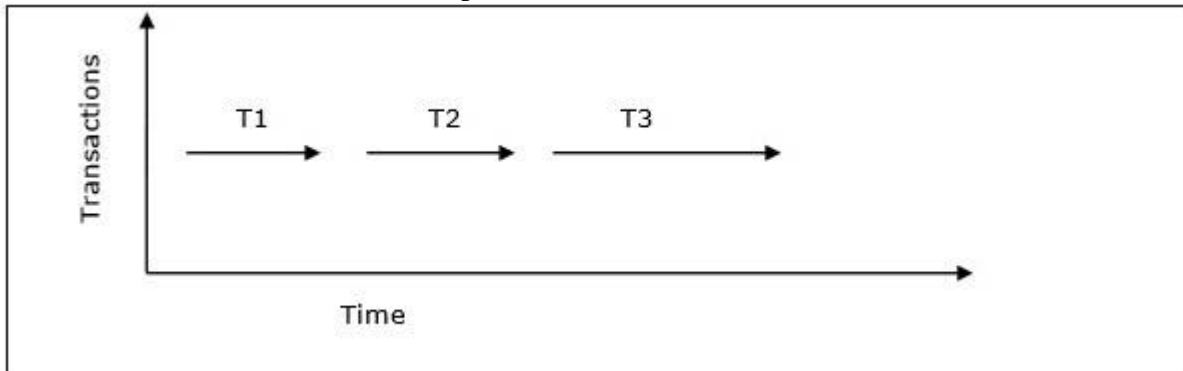


**Fig 5.3. Serial Schedule**

- **Parallel Schedules** – At any given point of time, simultaneously when there are more than one active transaction, it is known as parallel schedule. In other words, at a given point of time, the operations of the transaction overlap. The parallel schedule is depicted below:
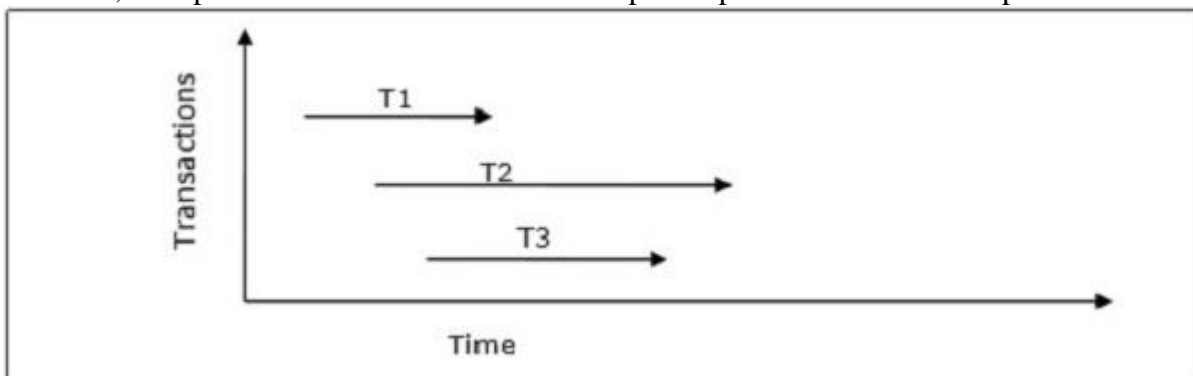


**Fig 5.4. Parallel  Schedule**

*Conflicts in Schedules*

When multiple transactions are included in a Schedule, and when non-compatible operations are performed by two active transactions, this leads to the occurrence of a conflict. The operation can be proved to be in conflict, only on the existence of the following three conditions simultaneously -

- ➢ When the two operations belong to different transactions.
- ➢ The same data item is accessed by both the operations.
- ➢ There should be at least one write_item() operation, which modifies the data item.

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FUNCTIONAL INFORMATION SYSTEMS

FIS is based on the various business functions such as Production , Marketing , Finance and HR etc. These departments or functions are known as functional areas of business. Each functional area requires applications to perform all information processing related to the function.

The popular functional areas of the business organizations are :-
- ➢ Financial information system
- ➢ Marketing information system
- ➢ Production/ Marketing information system
- ➢ Human resource information system

1. Financial information system:- FIS is a sub-system of organizational management information system. This sub-system supports the decision-making process of financial functions at the level of an organization .

2. Marketing information system:- This sub system of MIS provides information about various functions of the marketing system of an organization. Marketing is another functional area of the business organization ,which is engaged in marketing (selling)of its products to its customers.

Important functions of the marketing process include the following :-
 • The marketing identification function
 • The purchase motivation function
 • The product adjustment function
 • The physical distribution function
 • The communication function
 • The post –transaction function

3. Production/ Marketing information system :- manufacturing or production information system provides information on production / operation activities of an organization and thus facilitates the decision –making process of production manage process of an organization . The main decision to be taken in manufacturing system is product design.

4. Human Resource Information System:- this functional information system supports the functions of human resource management of an organization . The human resource management function ,in its narrow sense , it also known as personnel management .
The function involves :
 • Manpower planning
 • Staffing • Training and development
 • Performance evaluation
 • Separation activites

Characteristics of Functional Information System
- ➢ Many small changes in a large database
- ➢ Systematic records ( mostly numerical )
- ➢ Routine actions & updating .
- ➢ Data preparation is a large & important effort

EQUIPMENTS REQUIREMENTS OF FUNCTIONAL INFORMATION SYSTEMS

- ➢ Large auxiliary storage
- ➢ Dual use files
- ➢ Moderate input / output requirements
- ➢ Flexible printing capacity
- ➢ Offline data entry
- ➢ Often difficult to define the problem
- ➢ Needs fast random access to large storage capacity
- ➢ Organization of computer storage is difficult
- ➢ Versatile inquiry stations desirable