### Distributed Multimeda & Database System

1. **Distributed Database Management System (DDBMS)**
   - A distributed DDBMS is a centralized application that manages a distributed database as if it were all stored on the same computer. The DDBMS synchronizes all the data periodically, and in cases where multiple users must access the same data, ensures that updates and deletions performed on the data at one location will be automatically reflected on the data stored elsewhere.

   **Advantages of DDBMS**:
   - Sharing and availability of data, reliability and fast query processing

   **Disadvantages of DDBMS**:
   - Gate potentiality, high, high software development cost and increased processing overheads.

2. **Types of distributed database**

   - **Distributed Database**
     - **Heterogeneous**
     - **Homogeneous**

   - **Autonomous**
   - **Non-Autonomous**
   - **Systems**
   - **Gateways**

   **Partial Multidatabase**
   - **Full DBMS functionality**
     - **Un-federated**
     - **Federated**

   **Loose Integration**
   - **Tight Integration**

   - **Homogeneous** - The same DBMS is used at each node
   - **Autonomous** - Each DBMS works independently, forming merge back and forth to share data updates.
   - **Non-Autonomous** - A central, or master, DBMS coordinates database access and updates across the nodes.
Heterogeneity - Potentially different DBMSs are used at each node.

Gateways - Simple paths are created to other databases, without the benefits of one logical database.

Systems - Support some or all the functionality of one logical database.
- Full DBMS functionality - Supports all of the functionality of a distributed database.
- Partial-Multidatabases - Support some features of a distributed database.

- Unfederated - Require all access to go through a central coordinating module.
- Federated - Supports local databases for unique data requests.

Distributed Multimedia -

1. Characteristics of Multimedia Data -

   (1) Continuity -
   - Refers to the linear view of the data.
   - Video: a frame rate is replaced 25 times per second.
   - Audio: the amplitude value is replaced 8000 times per second.

   (2) Time-based -
   - The time at which the values are played or recorded after the validity of the data.
   - Hence, the timing should be preserved.

2. Quality of Service Management -

   The management and allocation of resources to provide such guarantees is referred to as Quality of Service (QoS) management. If there is a system component responsible for the allocation and scheduling of these resources. That component is referred to as the Quality of Service (QoS) manager.
The QoS manager's two main subtasks are quality of service negotiation and admission control.

**Admission Control**

- Application components specify their QoS requirements to QoS manager

  - Flow specification

  - QoS manager evaluates new requirements against the available resources: Sufficient?
    - YES
      - Reserve the requested resources
      - Resource contract
      - Allow application to proceed
      - Application runs with resources as per-resource contract
    - NO
      - Negotiate reduced resource provision with application agreement?
        - YES
          - Do not allow application to proceed
        - NO
          - Application notifies QoS manager of increased resource requirements

**QoS Manager's Task**

- **Quality of Service Negotiation**:
  - To negotiate QoS between an application and its underlying system, the application must specify its QoS requirements to the QoS manager. This is done by the transmission of a set of parameters. They are:
    1. Bandwidth - The rate at which a multimedia stream flows.
    2. Latency - The time required for an individual data element to move through a stream from the source to the destination.
      - Jitter is the first derivative of the latency.
    3. Loss rate - Data loss due to unmet resource requirements, or a rate of data loss that can be accepted.

- Resource requirement specification
Use of resource requirements specification:

1. To describe the characteristics of a multimedia stream in a particular environment. E.g., video conference (Bandwidth: 1.5 Mbps, delay: 150 ms, loss rate: 1%).

2. To describe the capabilities of resources to transport a stream. E.g., a network may provide: Bandwidth: 64 kbps, delay: 10 ms, loss rate: 1/1000.

Traffic Shaping:

It is a term used to describe the use of output buffering to smooth the flow of data elements. Two algorithms:

1. Concrete bucket algorithm:
   - Completely eliminate burst
   - A stream will never flow with a rate higher than R
   - B is the size of the buffer
   - B bound the time for which an element will remain in buffer

2. Token bucket algorithm:
   - Allow burst burst
   - Tokens are generated at fixed rate of R
   - The tokens are collected in a bucket of size B
   - Data of size R can be sent only if at least tokens are in the bucket
   - Lemma: that over any interval t, the amount of data is not larger than B [R t]

RFC specifications: A collection of DoS parameters

→ RFC 1333 →

1. Bandwidth: Maximum transmission unit and maximum transmission rate
   - Token bucket size is the determining factor for the size of the stream
2. Delay: Minimum delay that can application can notice and the maximum jitter it can accept
3. Loss rate: Total number acceptable no. of losses over a certain interval
   - Minimum no. of consecutive losses
### The REC 1363 flow specification:

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<thead>
<tr>
<th>Protocol Version</th>
<th>Maximum transmission unit</th>
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<tbody>
<tr>
<td></td>
<td>Token bucket rate</td>
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<td></td>
<td>Token bucket size</td>
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<td>Maximum transmission rate</td>
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<tr>
<th>DELAY:</th>
<th>Minimum delay noticed</th>
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<tbody>
<tr>
<td></td>
<td>Maximum delay variation</td>
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<tr>
<th>LOSS:</th>
<th>Burst loss sensitivity</th>
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<tr>
<td></td>
<td>Loss interval</td>
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<td>Quality of service guarantee</td>
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### Admission Control:

It regulates access to resources to avoid resource overuse and to prevent resources from requests they cannot fulfill.

- **Bandwidth reservation**: Reserve some portion of available bandwidth exclusively.
- **Statistical multiplexing**: Reuse minimum or average bandwidth.
- **Handles bursts**: Cause some service drops, but occasionally.
- **Hyperthesis**: A large number of streams that aggregate bandwidth required element remains nearly constant regardless of the bandwidth of individual streams.

### Case Study of Distributed System:

1. Amoeba
2. Mach
3. Chorus