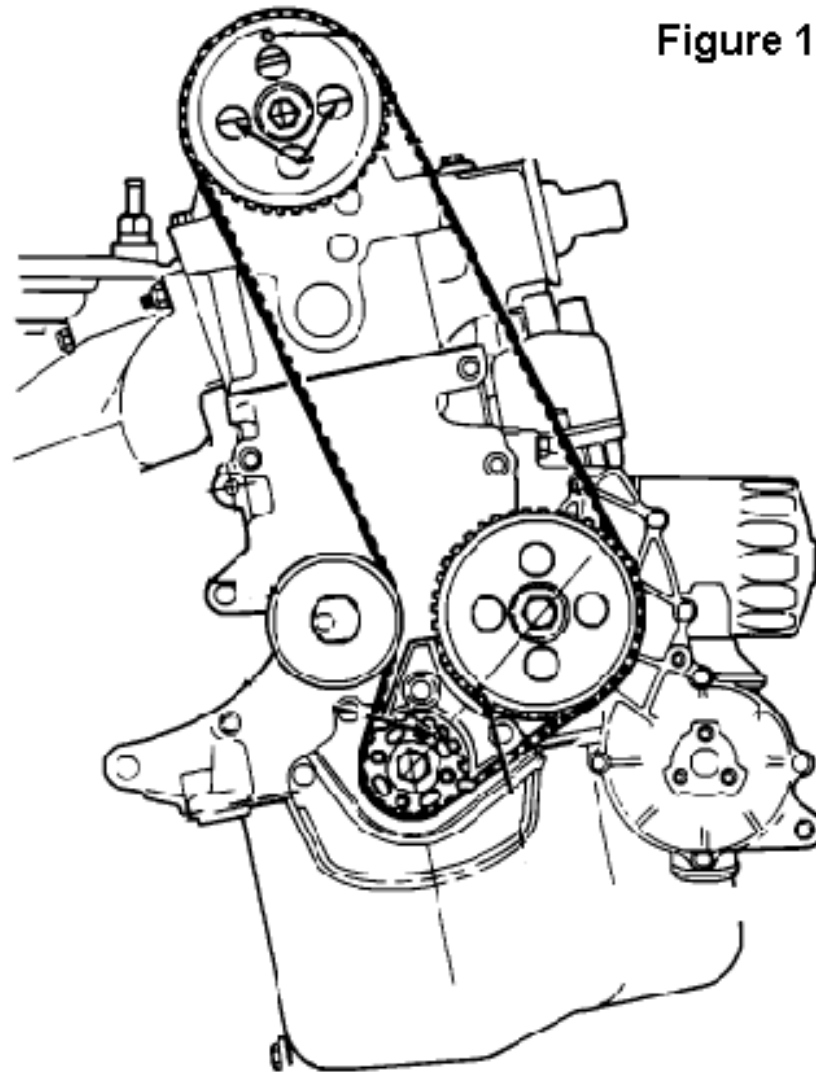


ICS 362 Distributed Systems

Distributed Systems: Part 8

Lecturer: Toby Daniel

Timing



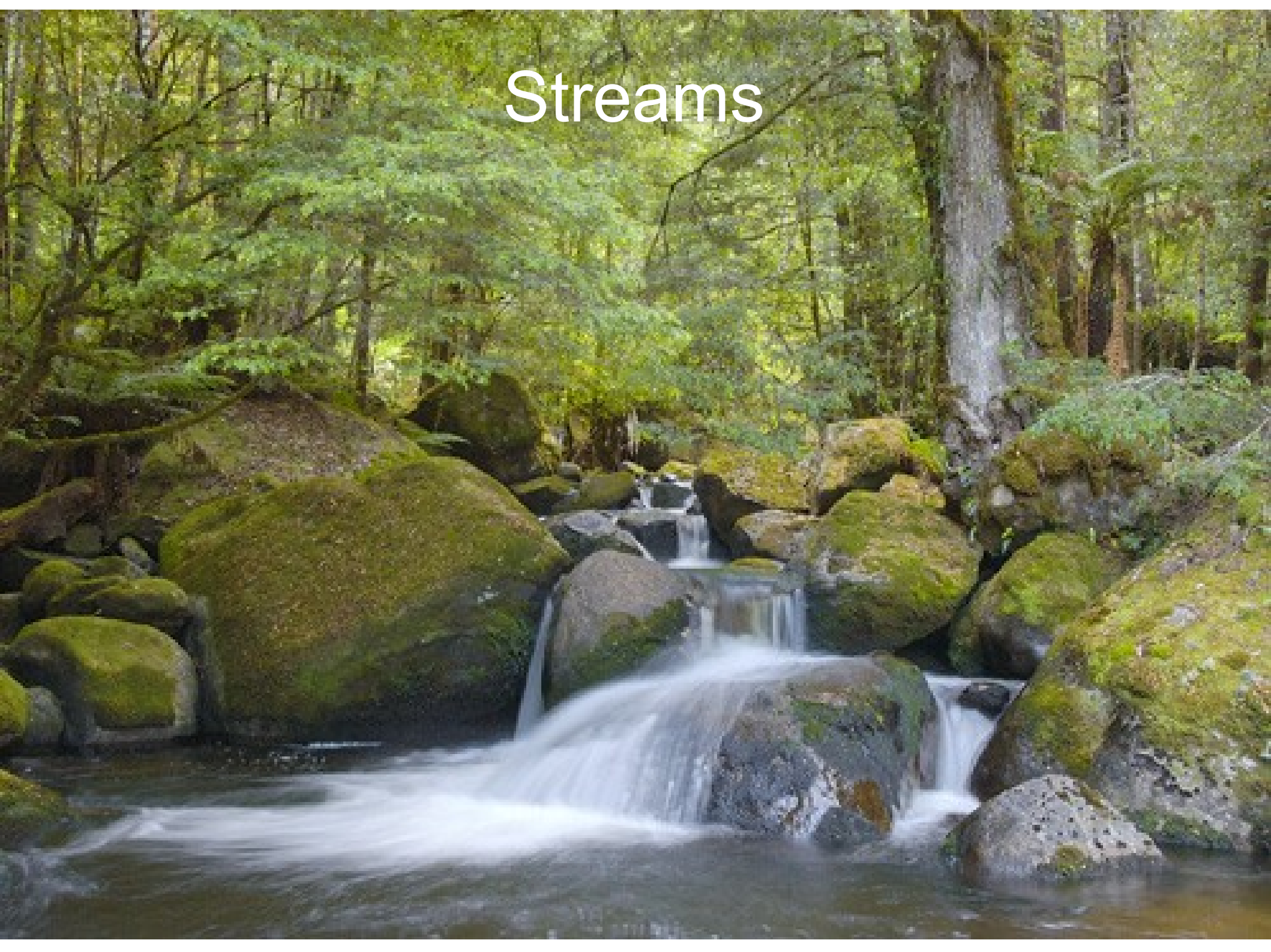
Timing

- So far we have considered communicating discrete, complete units of data, such as a method request.
 - In these cases timing is not so critical – if a process is too slow or too fast, correctness isn't affected.
- For some data timing is critical, for instance if wanting to play CD quality sound, which requires sounds to be played at $1/44100$ seconds exactly.
 - Here we need to consider streams of continuous media.

Transmission Types

- Asynchronous transmission
 - Data items are transmitted one after another, with no further constraints.
- Synchronous transmission
 - Maximum end to end constraints – i.e. if a data items arrives unexpectedly fast, there is no problem, so long as it isn't slower than a time constraint.
- Isochronous transmission
 - Maximum and minimum end to end constraints – data must be transferred on time – not early, or late!

Streams

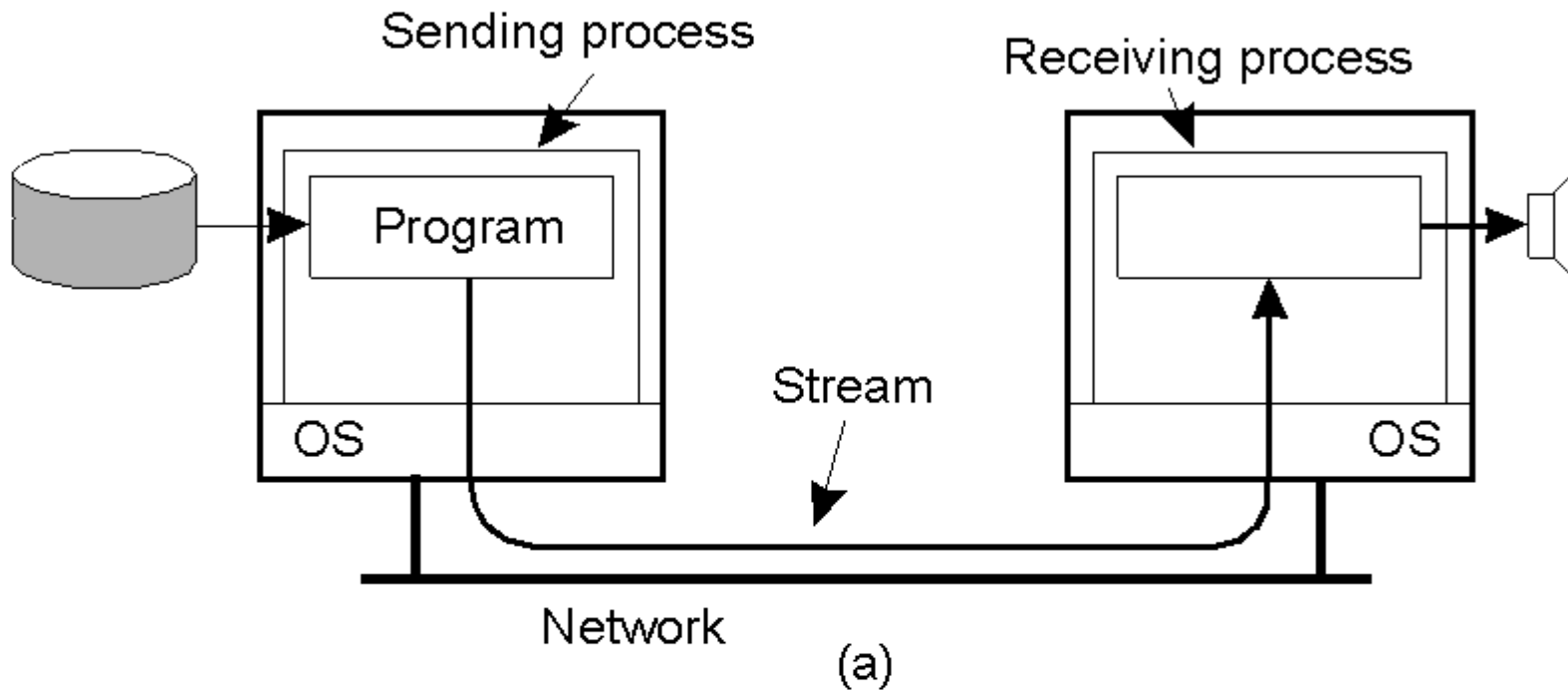


Streaming

- What is streaming?
- What type of data requires streaming?
- What are the implications for synchronisation?

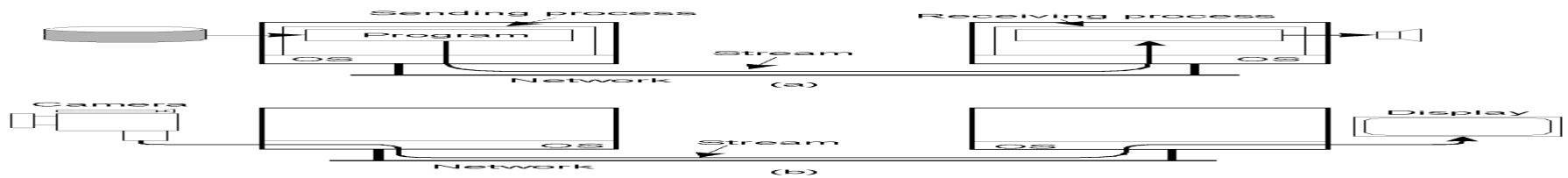
Streaming

Setting up a stream between two processes across a network.



Data stream

Setting up a stream directly between two devices.



Substreams

- Often data might be transmitted in substreams;
 - Left and Right audio streams.
 - Video, and surround sound streams.
- In this case all substreams need to be synchronised for satisfactory results.
 - This problem is amplified when there are multiple receivers.

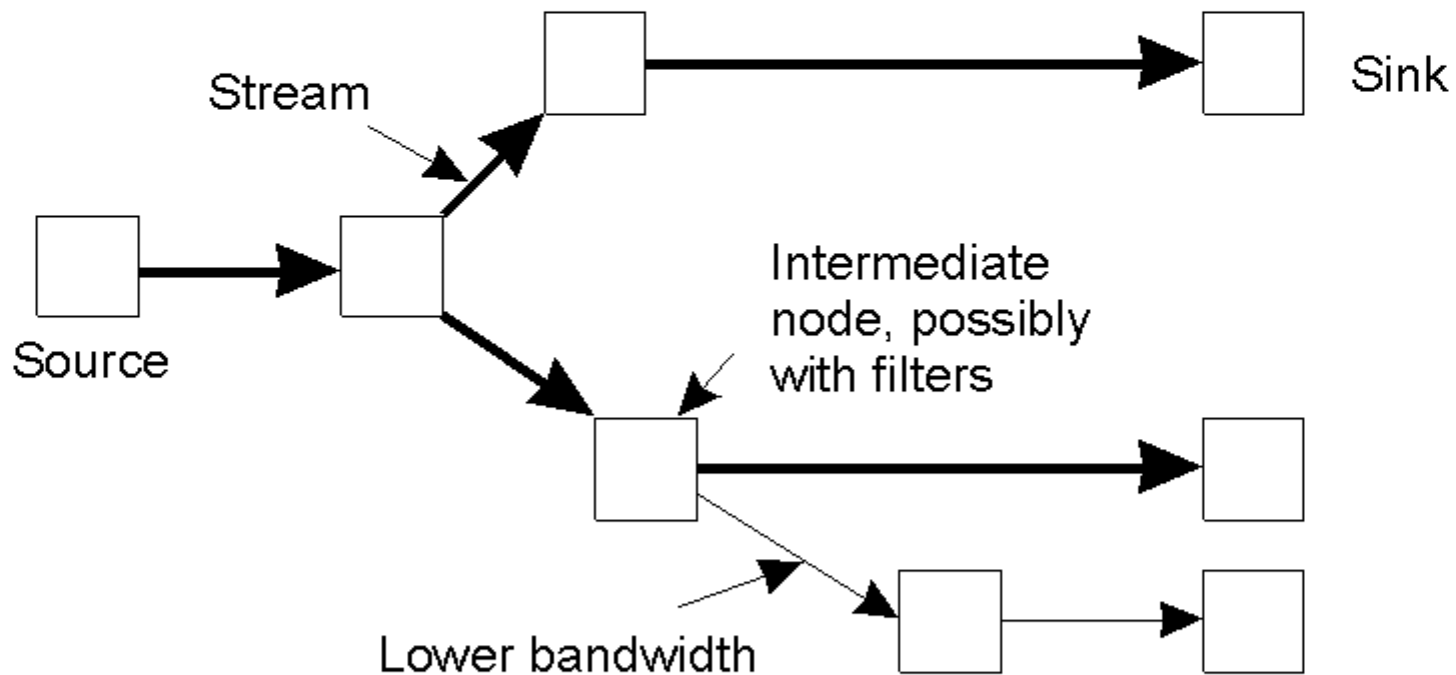
Multicasting

- What is multicasting?



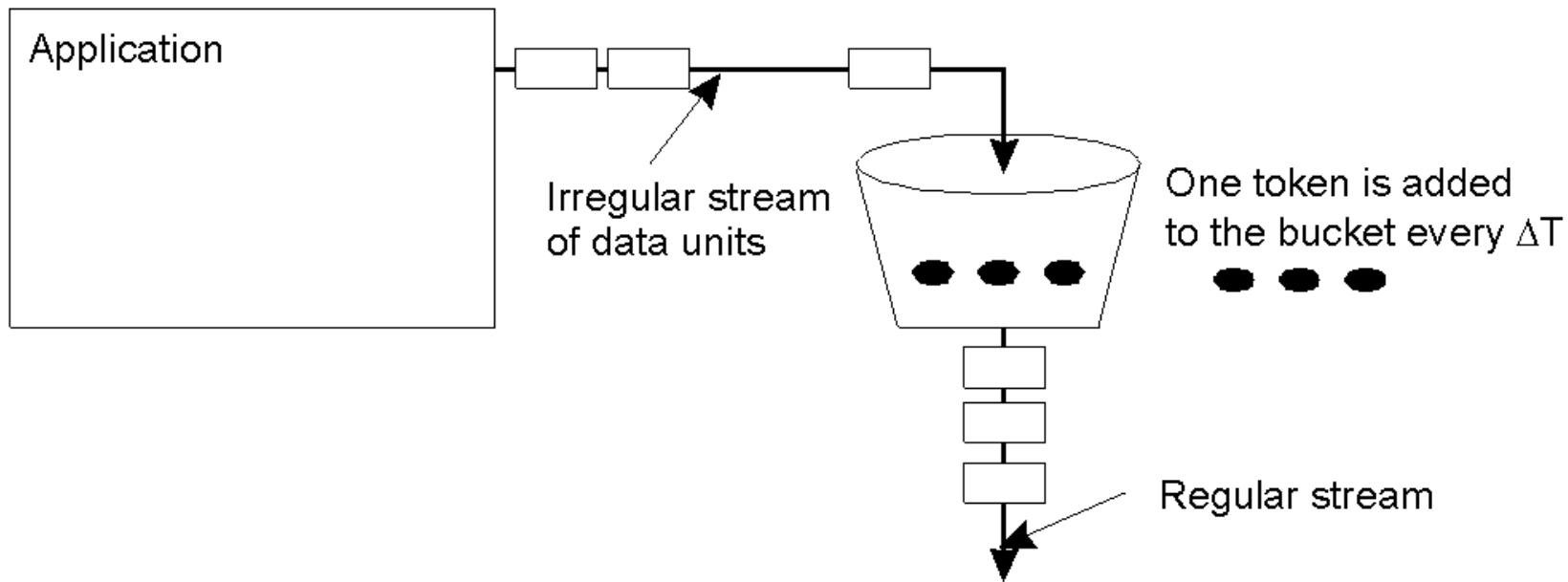
Multicasting

An example of multicasting a stream to several receivers.



Token Bucket approach

When data units arrive they are dropped as tokens into a bucket, and let out in a regular stream



Specifying QoS

A flow specification.

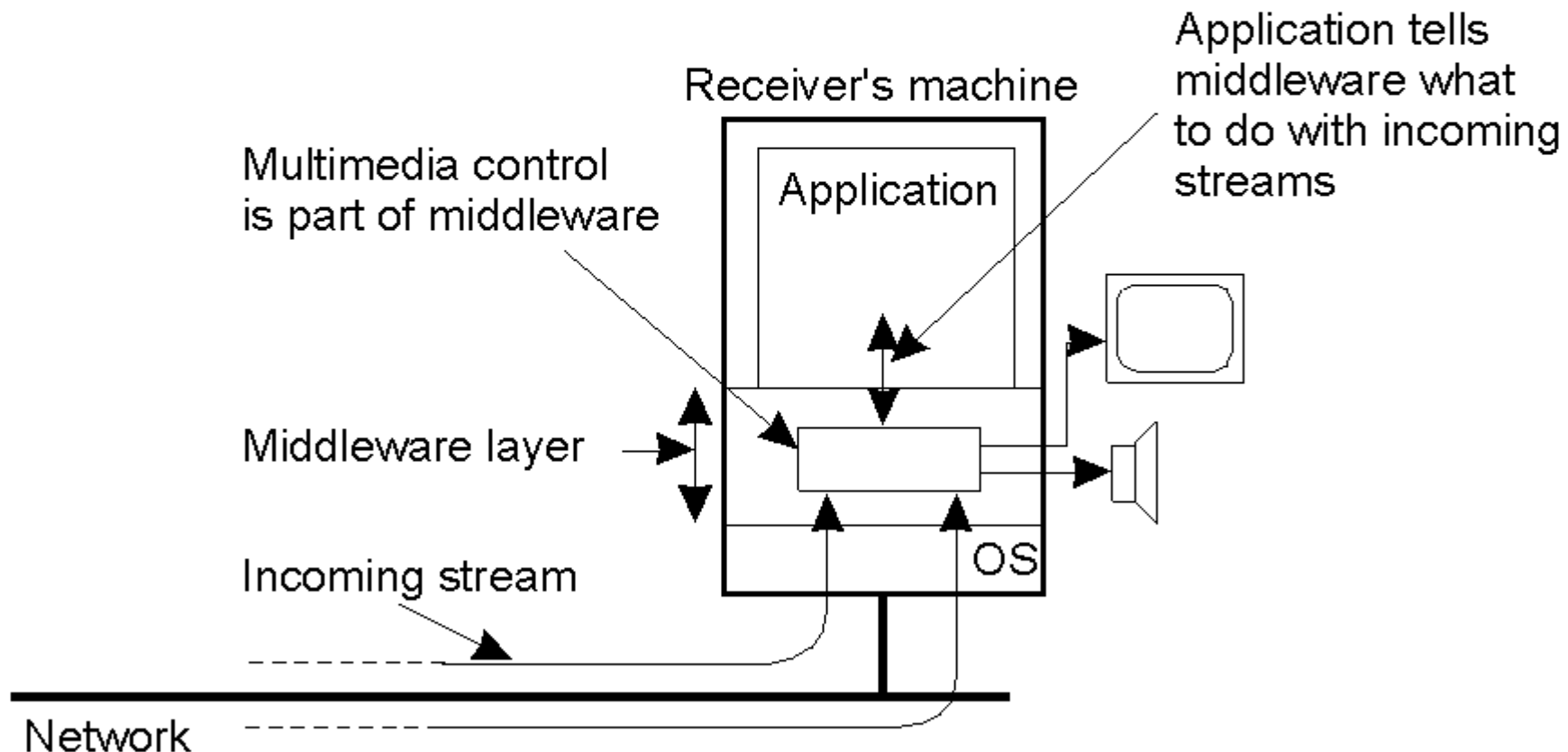
| Characteristics of the Input | Service Required |
|---|---|
| <ul style="list-style-type: none">• maximum data unit size (bytes)• Token bucket rate (bytes/sec)• Toke bucket size (bytes)• Maximum transmission rate (bytes/sec) | <ul style="list-style-type: none">• Loss sensitivity (bytes)• Loss interval (μsec)• Burst loss sensitivity (data units)• Minimum delay noticed (μsec)• Maximum delay variation (μsec)• Quality of guarantee |

Stream Measures

- ***Loss Sensitivity / Loss Interval*** : Measure of the maximum acceptable loss of data.
- ***Burst Loss Sensitivity*** : How many consecutive data items may be lost.
- ***Minimum / Maximum delay variation*** : How long the network can delay data unit delivery before receiver notices.
- ***Quality of Guarantee*** : How important are these measures?

Substream Synchronisation

- Further middleware exists to support synchronisation, for instance as set up by the Motion Picture Experts Group (MPEG)



Communication Summary

- Effective, flexible communication is necessary for distributed systems.
 - Remote Procedure Calls
 - Remote Method Invocation, for distributed Objects
 - Message Oriented Communication
 - Streams

Homework

- Make a sort presentation on the communication standard you have been given -
- Include:
 - How it works.
 - Issues of persistence, synchronicity & error handling.
 - Give a real-life example where it is used in CIS communication.