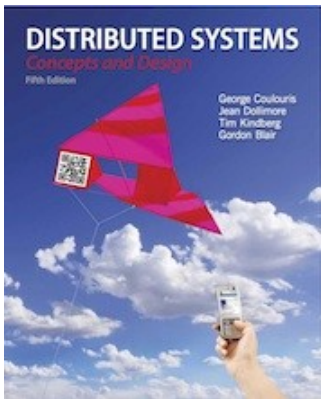


# Slides for Chapter 20: Distributed Multimedia Systems

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*From* **Coulouris, Dollimore, Kindberg and Blair**  
**Distributed Systems:  
Concepts and Design**

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Figure 20.1  
A distributed multimedia system

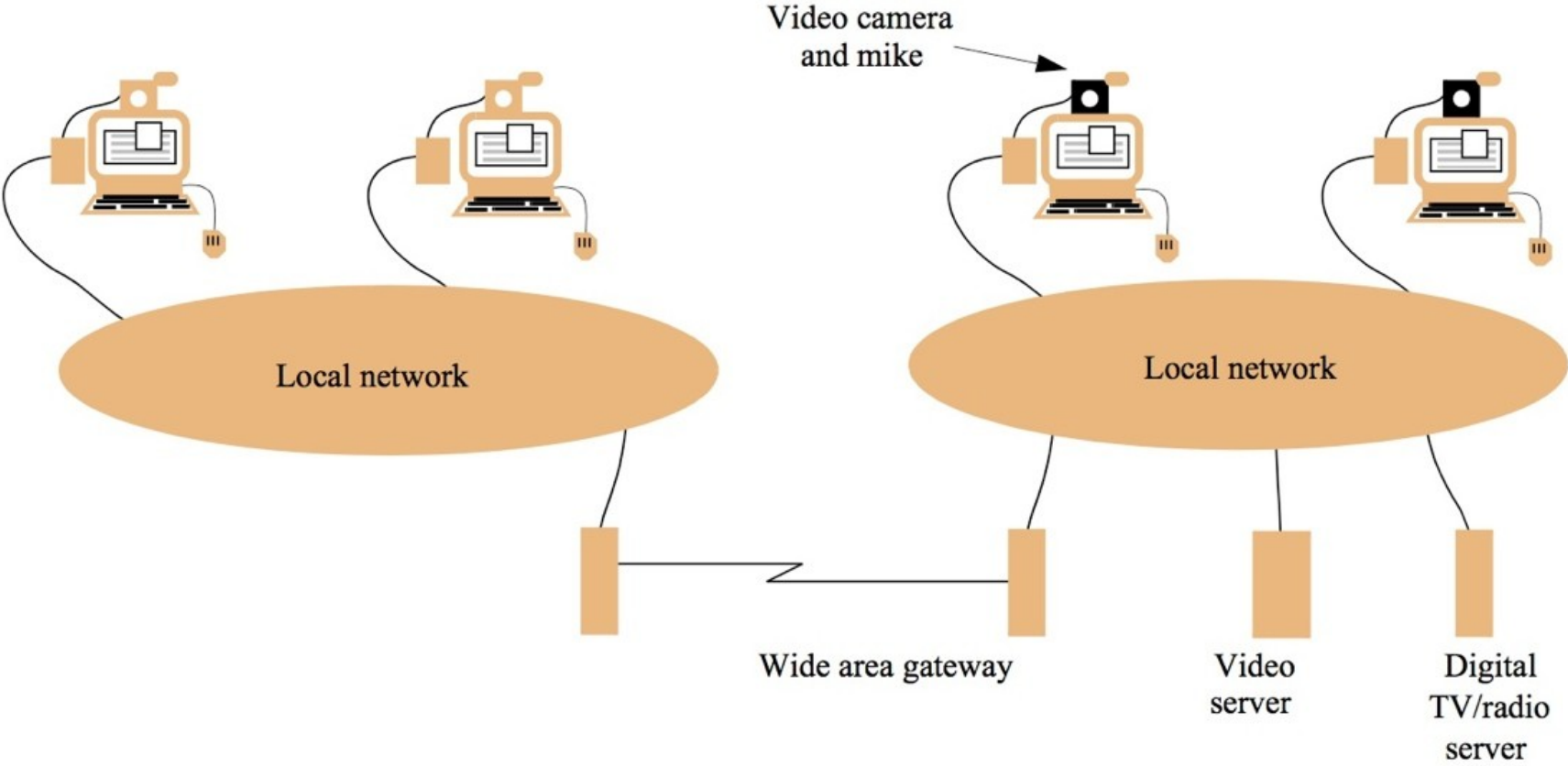
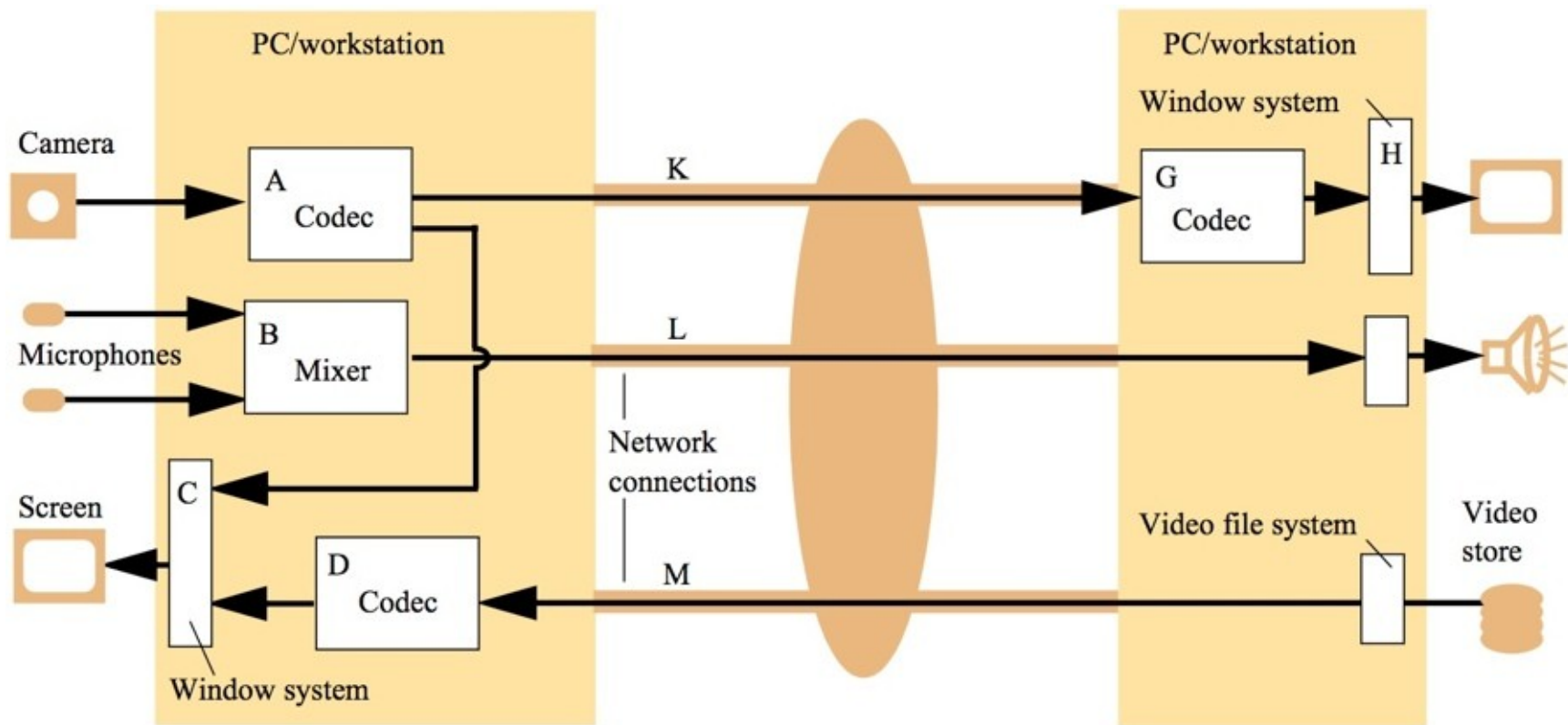


Figure 20.2  
 Characteristics of typical multimedia streams

	<i>Data rate (approximate)</i>	<i>Sample or frame frequency</i>	<i>size</i>
Telephone speech	64 kbps	8 bits	8000/sec
CD-quality sound	1.4 Mbps	16 bits	44,000/sec
Standard TV video (uncompressed)	120 Mbps	up to 640 x 480 pixels x 16 bits	24/sec
Standard TV video (MPEG-1 compressed)	1.5 Mbps	variable	24/sec
HDTV video (uncompressed)	1000–3000 Mbps	up to 1920 x 1080 pixels x 24 bits	24–60/sec
HDTV video (MPEG-2 compressed)	10–30 Mbps	variable	24–60/sec

Figure 20.3  
 Typical infrastructure components for multimedia applications



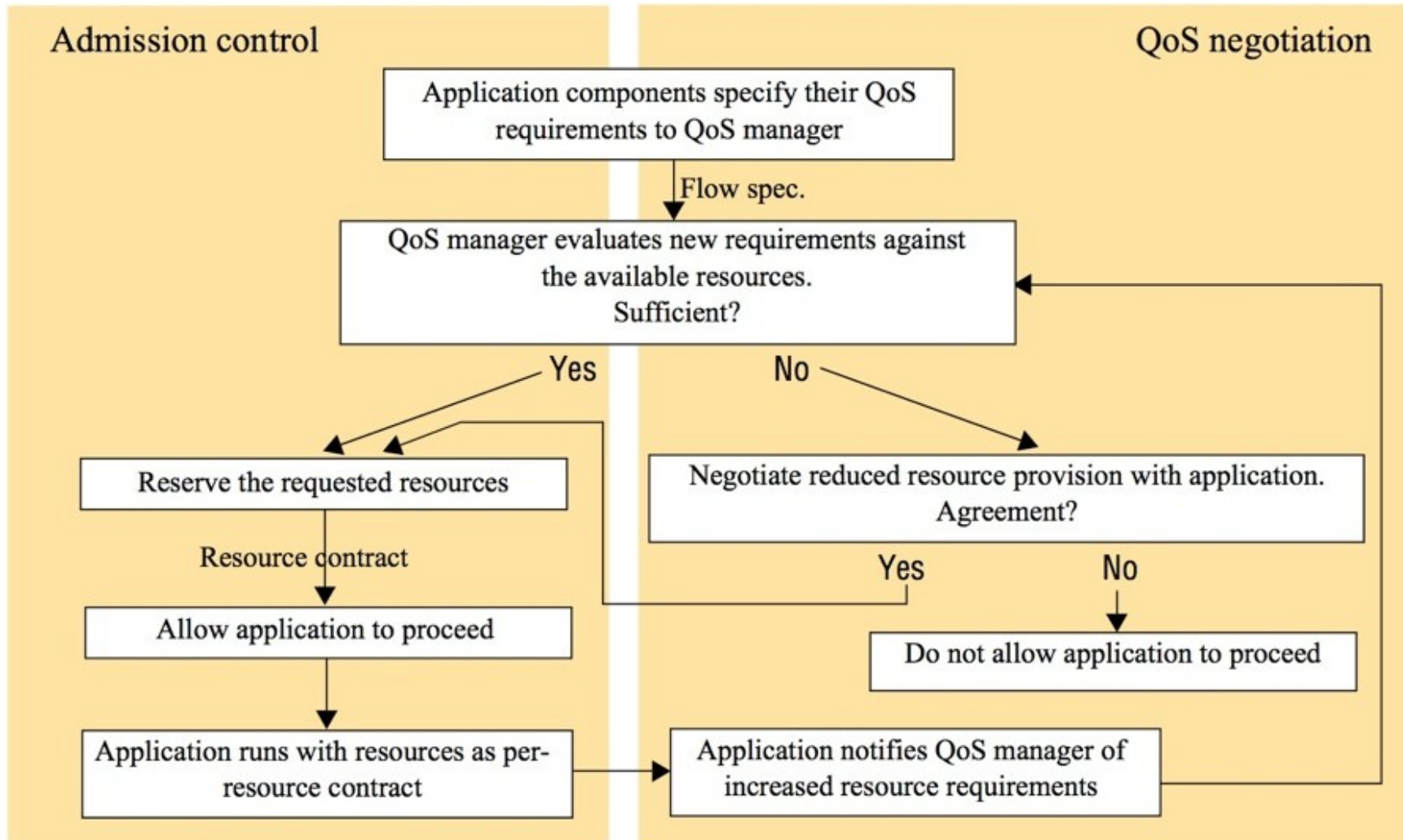
→ : multimedia stream  
 White boxes represent media processing components, many of which are implemented in software, including:  
 codec: coding/decoding filter  
 mixer: sound-mixing component

## Figure 20.4

### QoS specifications for components of the application shown in Figure 20.3

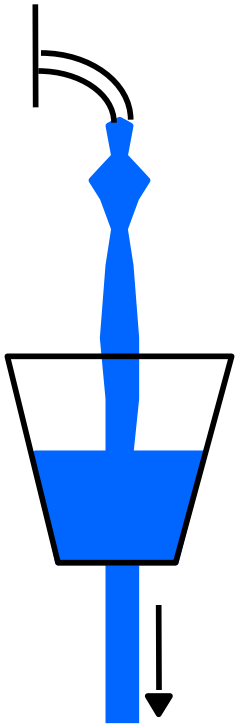
<i>Component</i>	<i>Bandwidth</i>	<i>Latency</i>	<i>Loss rate</i>	<i>Resources required</i>
Camera	Out: 10 frames/sec, raw video 640x480x16 bits		Zero	
A Codec	In: 10 frames/sec, raw video Out: MPEG-1 stream	Interactive	Low	10 ms CPU each 100 ms; 10 Mbytes RAM
B Mixer	In: 2 44 kbps audio Out: 1 44 kbps audio	Interactive	Very low	1 ms CPU each 100 ms; 1 Mbytes RAM
H Window system	In: various Out: 50 frame/sec framebuffer	Interactive	Low	5 ms CPU each 100 ms; 5 Mbytes RAM
K Network connection	In/Out: MPEG-1 stream, approx. 1.5 Mbps	Interactive	Low	1.5 Mbps, low-loss stream protocol
L Network connection	In/Out: Audio 44 kbps	Interactive	Very low	44 kbps, very low-loss stream protocol

Figure 20.5  
The QoS manager's task



## Figure 20.6 Traffic shaping algorithms

(a) Leaky bucket



(b) Token bucket

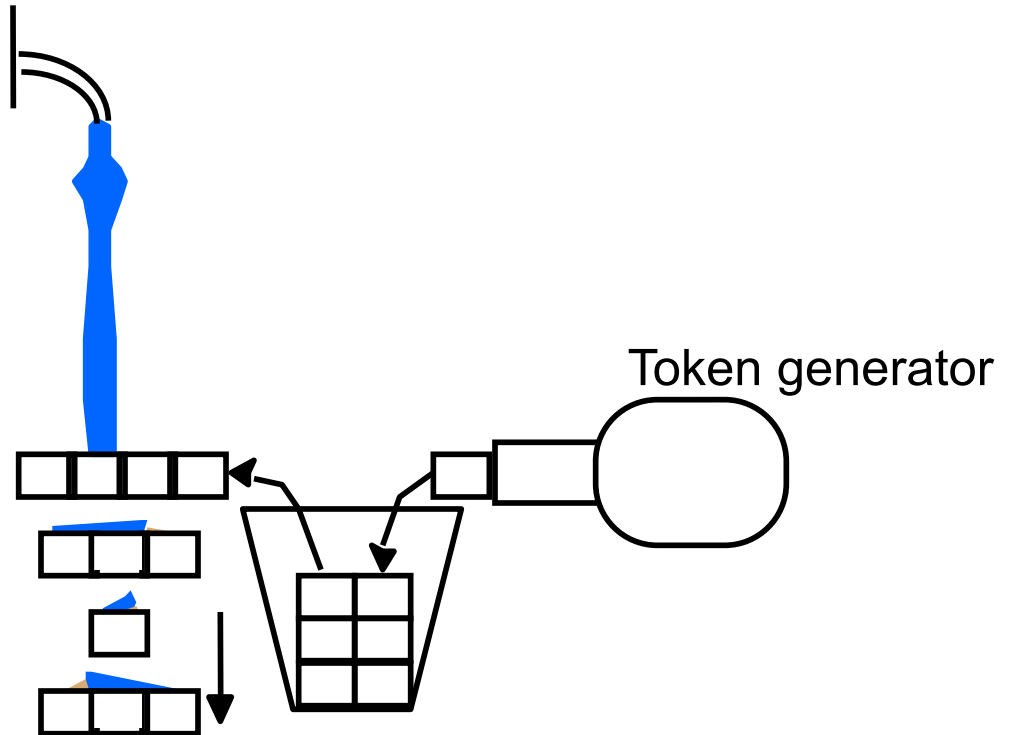


Figure 20.7  
The RFC 1363 Flow Spec

	Protocol version
Bandwidth:	Maximum transmission unit
	Token bucket rate
	Token bucket size
	Maximum transmission rate
Delay:	Minimum delay noticed
	Maximum delay variation
Loss:	Loss sensitivity
	Burst loss sensitivity
	Loss interval
	Quality of guarantee



Figure 20.8  
Filtering

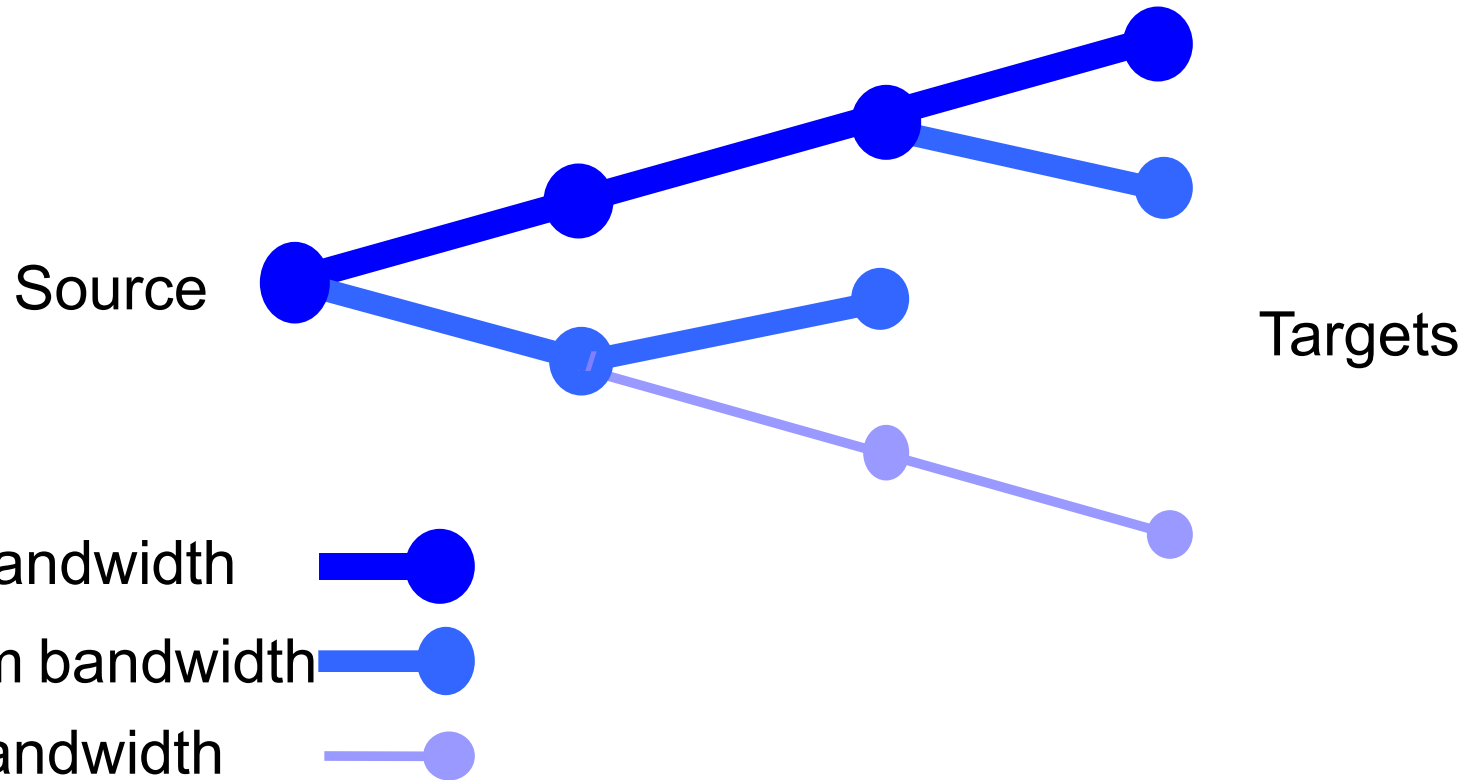


Figure 20.9  
Tiger video file server hardware configuration

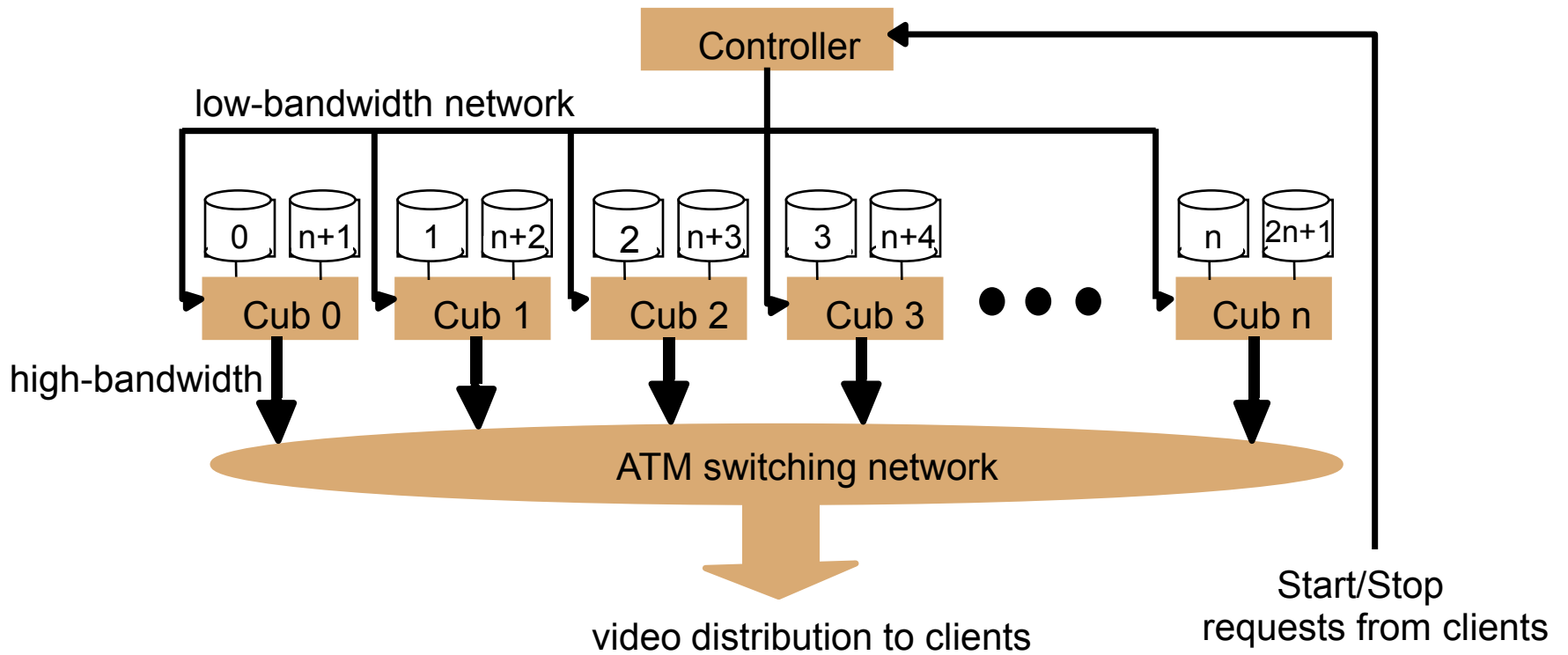
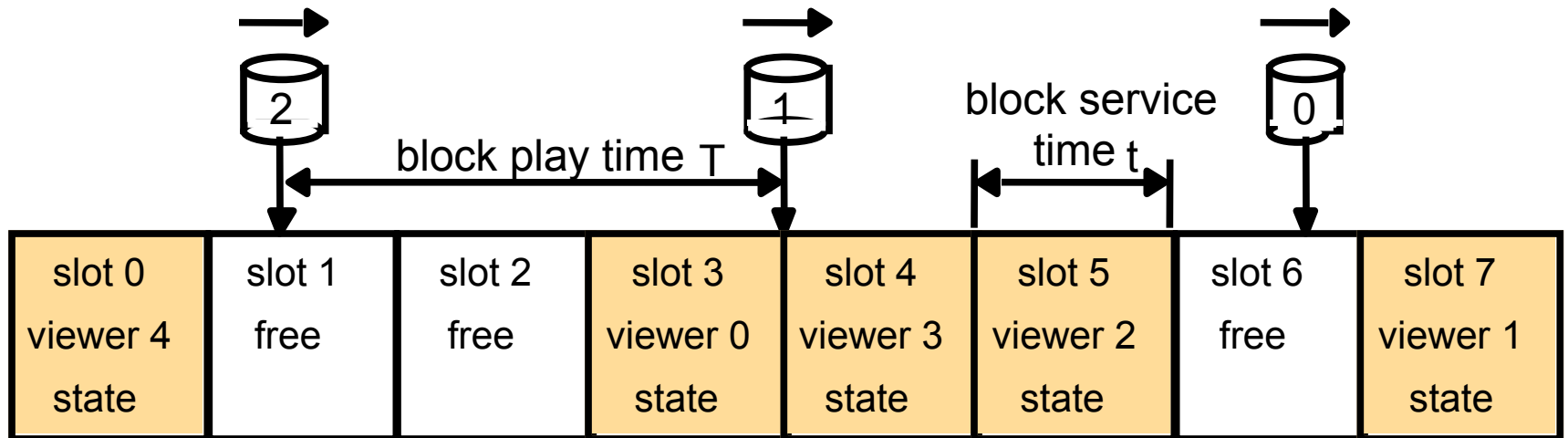


Figure 20.10  
Tiger schedule



## Figure 20.11 BitTorrent Terminology

<i>Term</i>	<i>Meaning</i>
<i>.torrent</i> file	A file that maintains metadata about an available file
tracker	A server containing information about the downloads in progress
chunk	A fixed size portion of a given file
seeder	A peer that holds a complete copy of a file (consisting of all its chunks)
leecher	A peer involved in downloading a file that currently holds only a portion of its chunks
torrent (or swarm)	A set of sites involved with downloading a file including the tracker, seeders and leechers
tit-for-tat	An incentive mechanism that governs the scheduling of downloads in BitTorrent
optimistic unchoking	A mechanism to allow new peers to establish their credentials
rarest first	A scheduling scheme whereby BitTorrent prioritizes frames that are rare within its set of connected peers

Figure 20.12  
Approaches to real-time video streaming

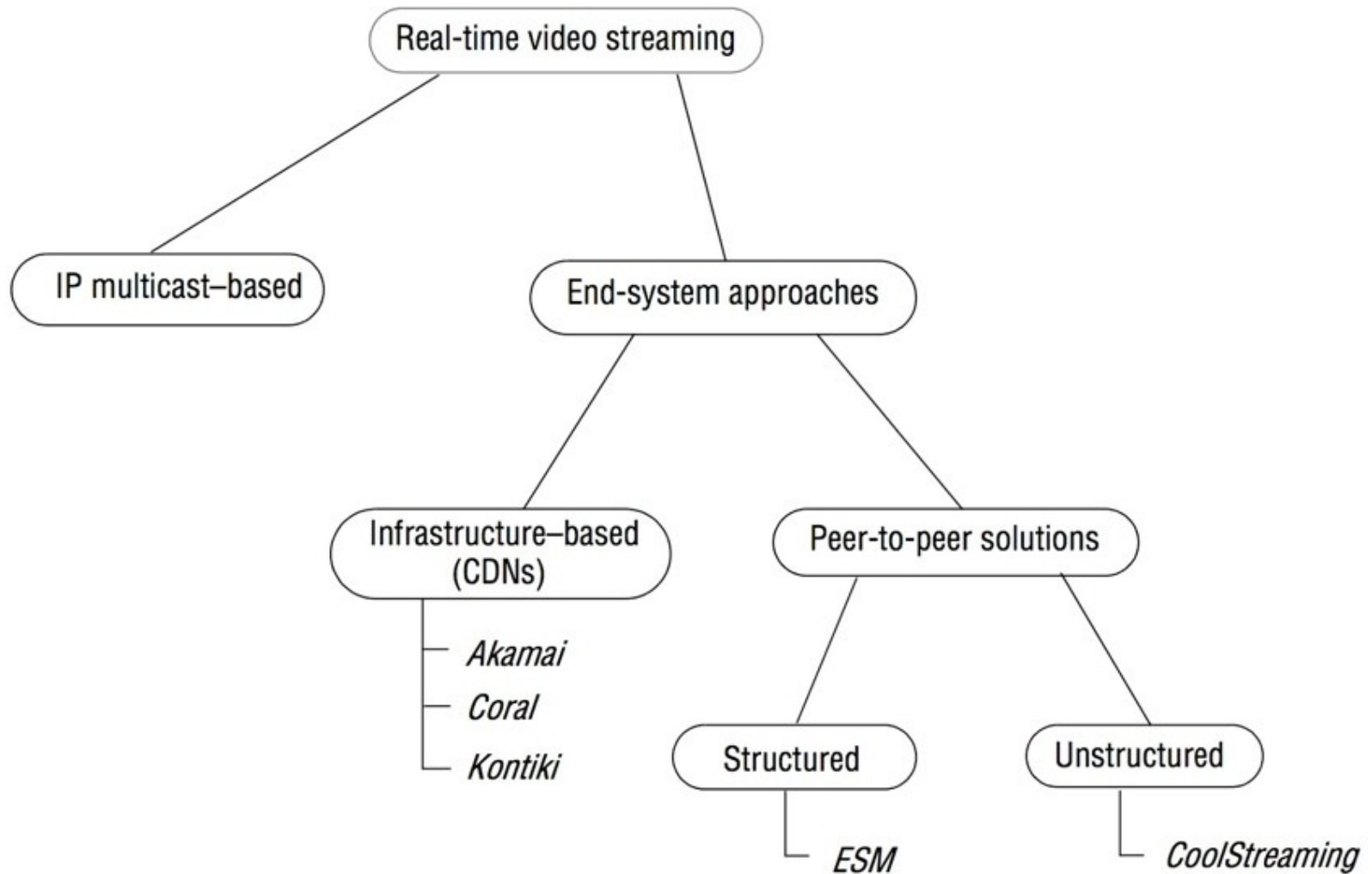


Figure 20.13  
An example tree in ESM

