# Asynchronous Video for Wireless Transport

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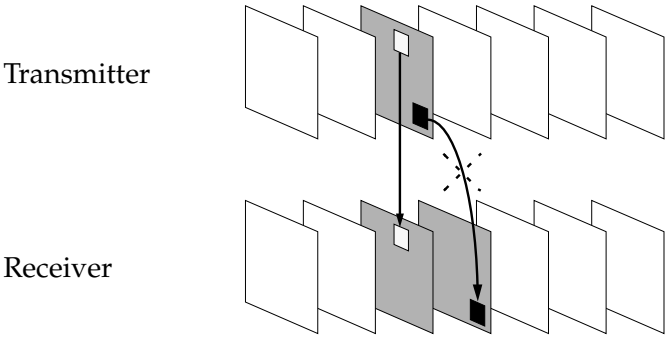
## Motivation

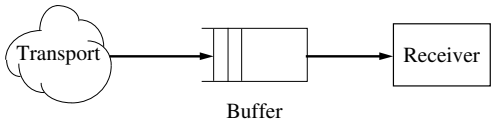
- **Network environment**
  - **— Wireless access the likely bottleneck**
- **Video applications on wireless channel**
  - **— Serious drawbacks to synchronous, frame-by-frame processing of video**
  - **— Advantages to be obtained by allowing delay jitter in transport?**
- **Proposed solution: *asynchronous* video coding**

## Traditional Video Processing



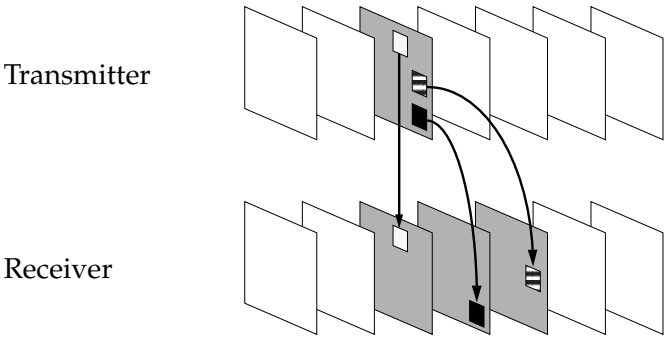

- **Synchronous, frame-by-frame procedure**
- **Stringent delay jitter requirement**

## How About Buffering at Receiver?



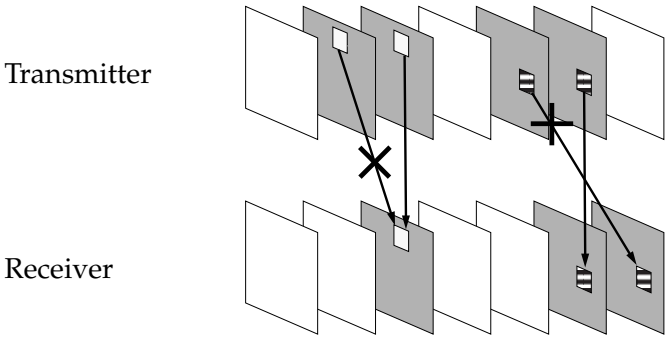

- **Can smooth out delay variations at receiver**
- **But unsuitable for applications with low delay requirement**
  - **— e.g., videoconferencing**

## Asynchronous Video (ASV)



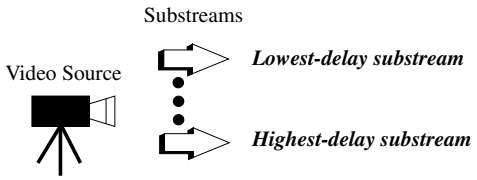

- **Wide range of delay requirements permitted**
- **Delay jitter of multiple frame intervals possible**
- **Reference: [ReLa94]**

## How Does Receiver Process Video Asynchronously?



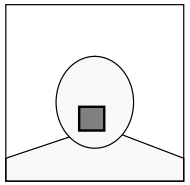

- **Use frame number as means of ordering information**
- **Use most current data available for each region**
- **Throw away out-of-date or "stale" information**

## Substream Abstraction



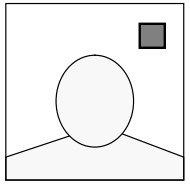

- **Application traffic *logically* partitioned among set of substreams**
- **Quality-of-service (QOS) provisioned for each substream**
- **Goal: maximize traffic capacity by relaxing delay requirement on certain substreams, maintaining good subjective quality**

## Mapping Image Areas to Substream by Motion Content



**High-motion areas**

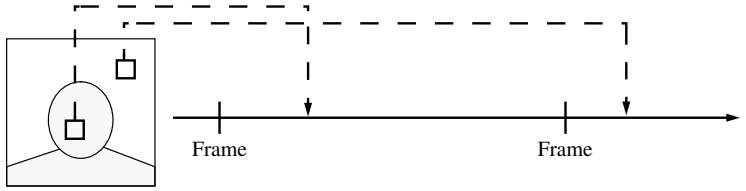
**Low-delay substreams**



**Low-motion areas**

**High-delay substreams**

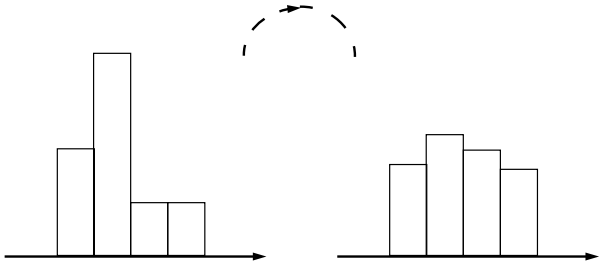
## *Contrast*: Asynchronous vs. Synchronous




**Asynchronous: Perceptual delay of application determined by lowest-delay substream**

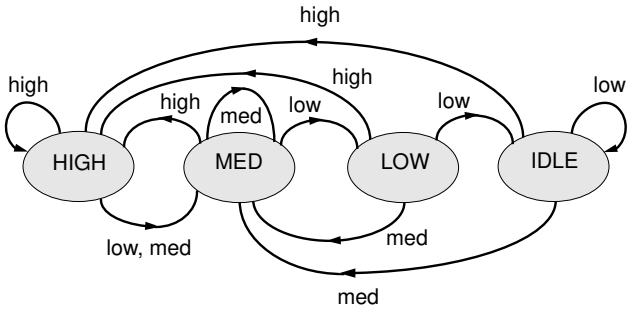
**Synchronous: Constrained by highest-delay information**

## Relaxed Delay Requirements ⇒ Traffic Capacity Gain



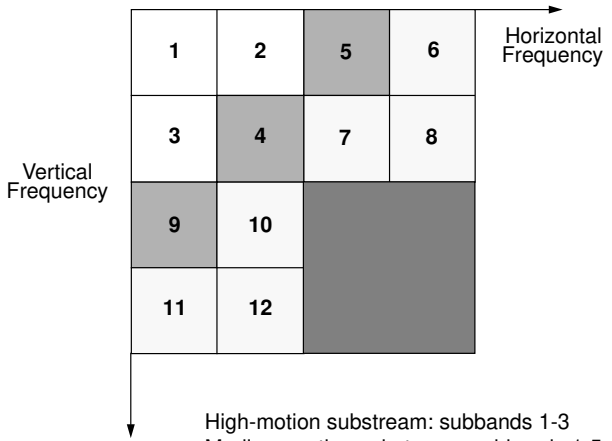
- **Smoothing of traffic by network nodes**
  - **— selective transmission and delaying of information**
  - **— more efficient resource utilization**

## Substream Coder



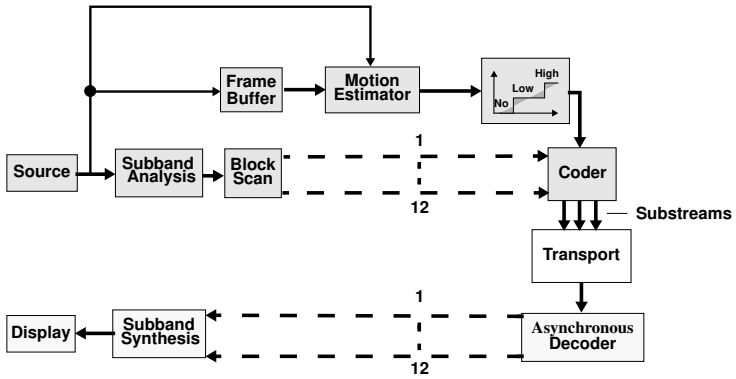

***- states labeled according to motion level associated with substream***
***- arcs labeled according to estimated amount of motion***

## Mapping of Substreams to Subbands




High-motion substream: subbands 1-3
Medium-motion substream: subbands 1-5, 9
Low-motion substream: subbands 1-12

## ASV Codec Implementation with Subband Filtering




## Simulation with Ptolemy

- **Speed?**
  - **— Sparc 20 (55 MHz)**
  - **— Frame size: 320 x 240**
  - **— Approximately one frame output per minute**
- **Domains?**
  - **— Subband analysis/synthesis in SDF**
  - **— Top-level network in DE**