

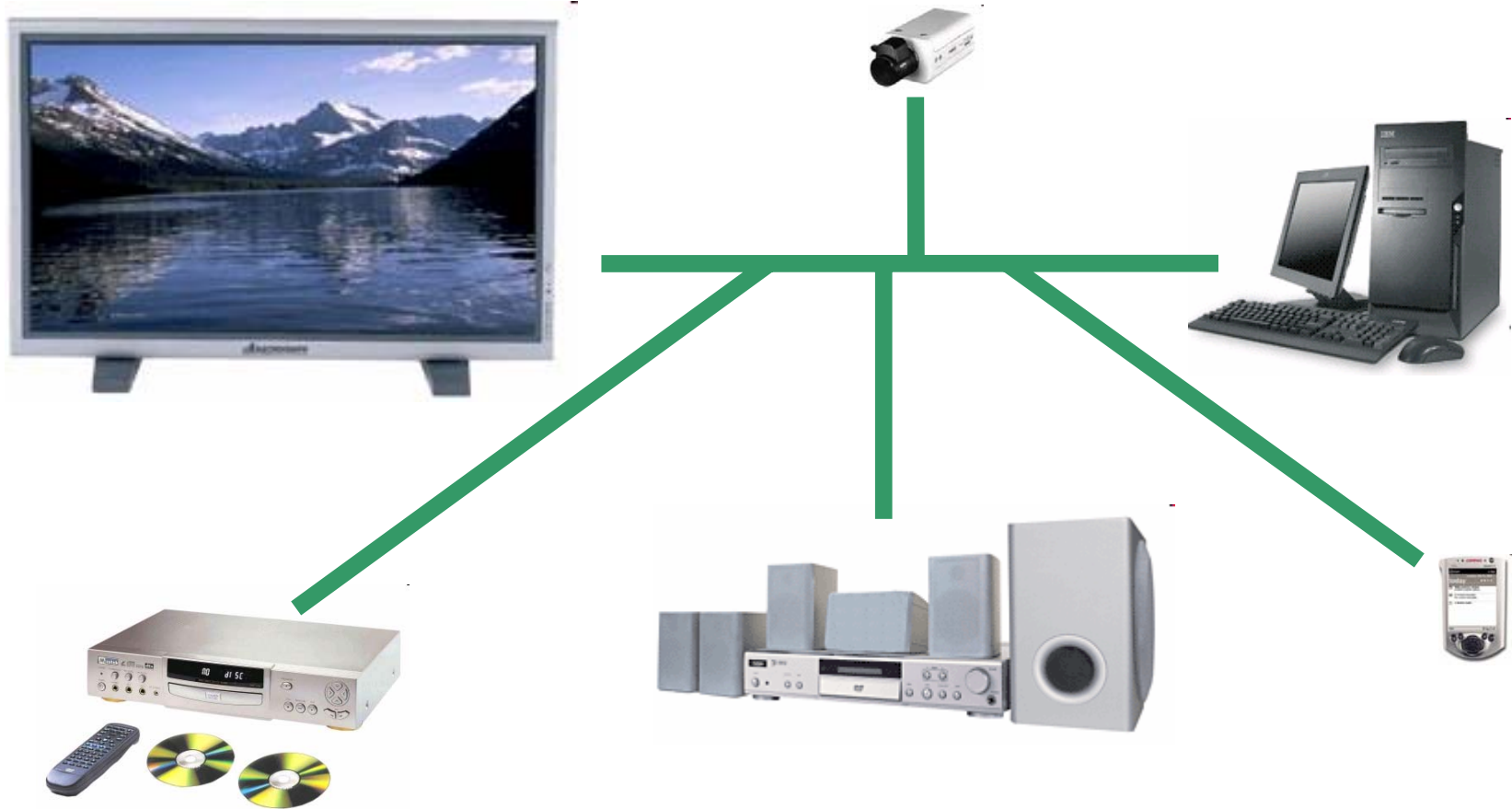
Predictive Control of Video Quality under Fluctuating Bandwidth Conditions.

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Contents

- Introduction
- Solution description
 - Scalable video technique
 - Controlling mechanism for networked terminal
- Conclusions

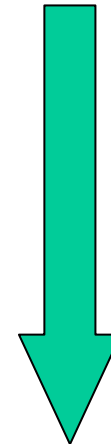
Introduction: in-home network



Objective: networked terminal



- Resource-constrained terminal : CPU
- Resource-constrained network : bandwidth
- Wireless network has fluctuations



Goal: Improve perceived quality

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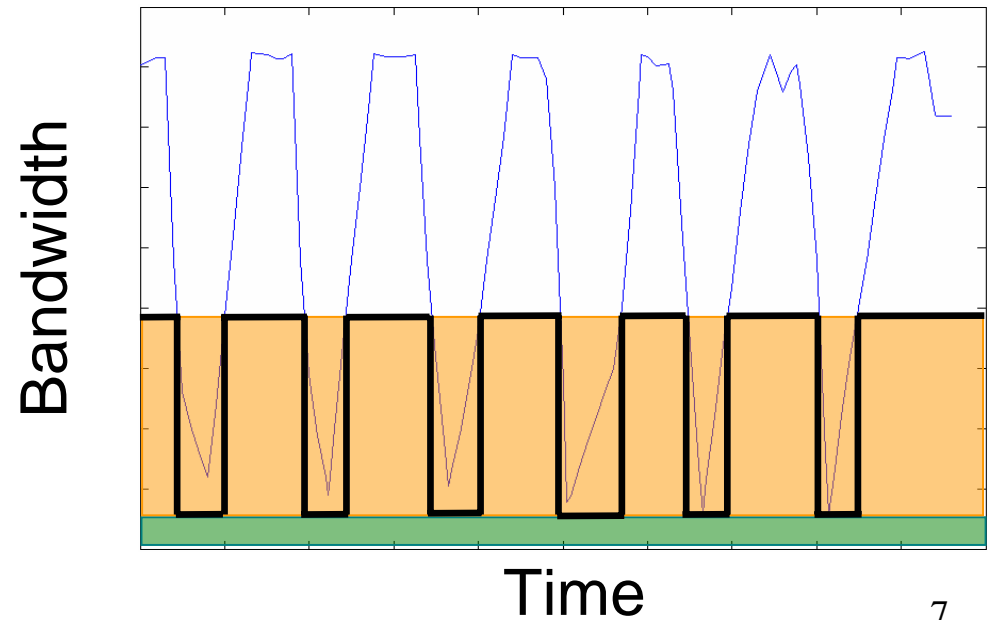
Solution approach: Scalable video

- Video stream is separated on: most important information and least important information (refinement)
- The approach allows different amount of the data to be sent and processed



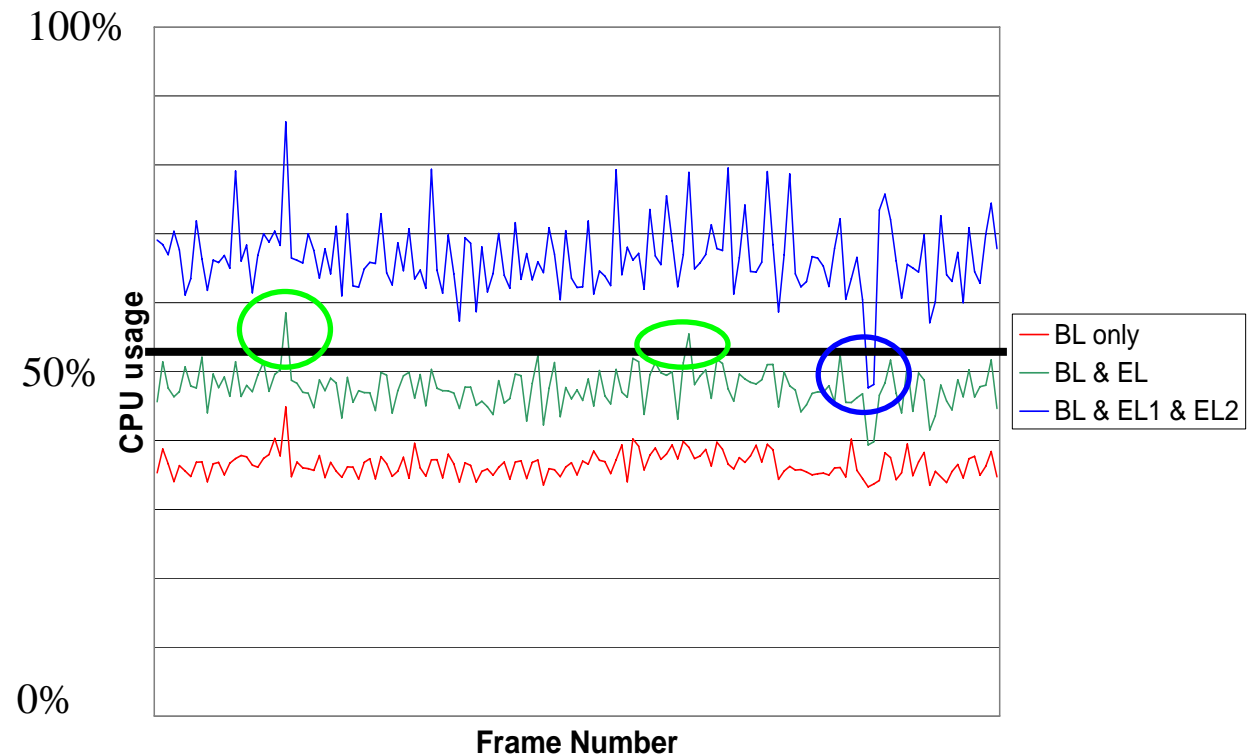
Application of scalable video : network

- Avoid missed frames
- Increase amount of “useful” data to be received



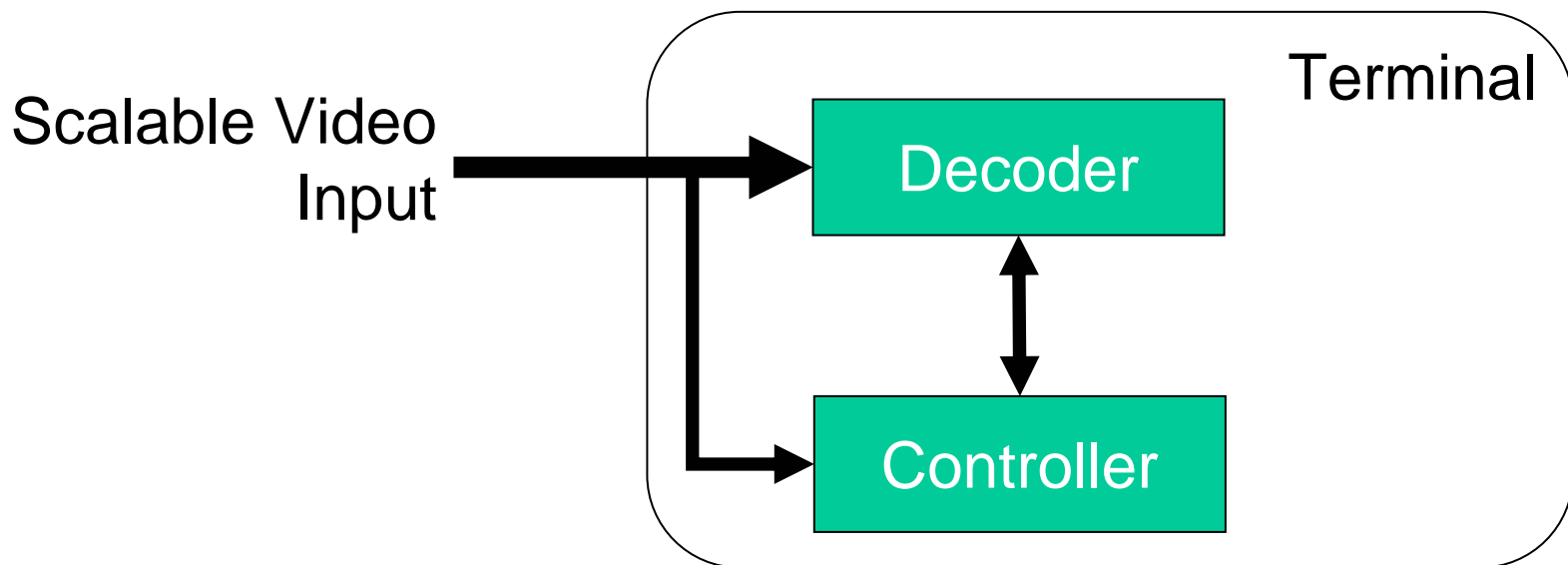
Application of scalable video : terminal

- Minimizing deadline misses due to better fit to CPU limitations



Solution approach: Controller

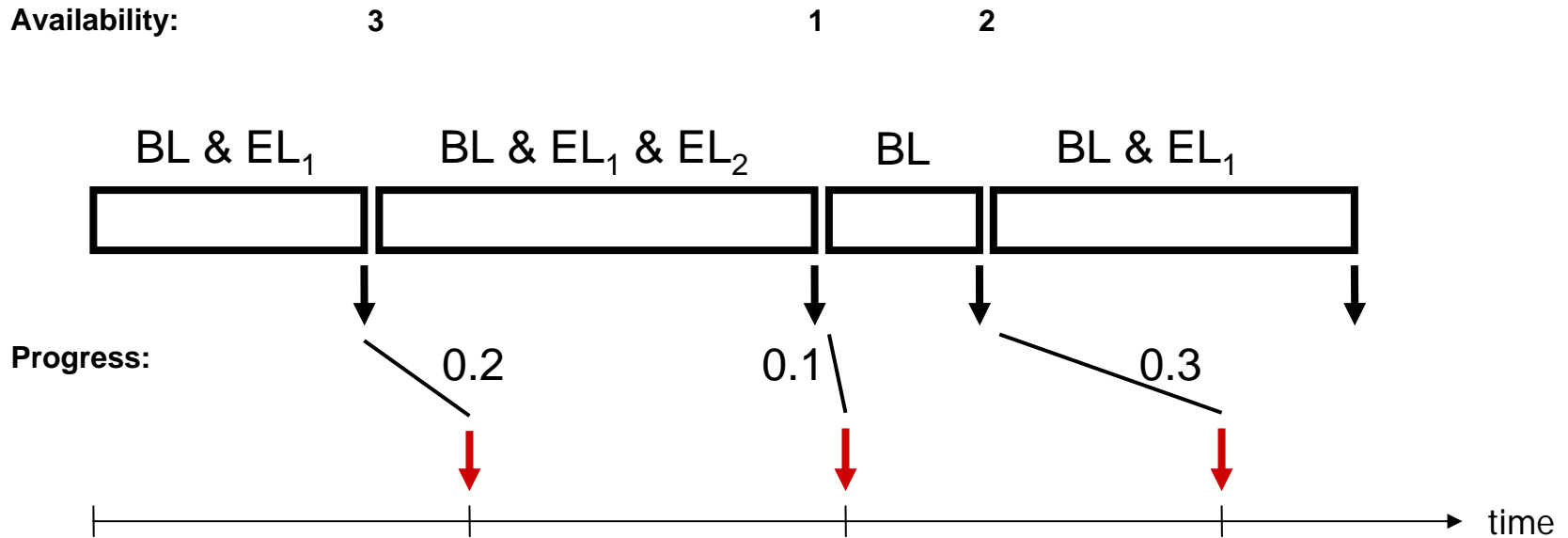
- Chooses how much video data (e.g. layers) should be processed. Takes into account:
 - amount of available resources (CPU)
 - amount of video data (e.g. how many layers have we received)The latter defines the granularity of decision making – per frame



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Decision making



- Stochastic processing times
- Choice of number of layers based on progress and availability of layers
- Objective: maximize perceived quality
 - MAX number of layers to be processed
 - MIN deadline misses
 - MIN quality changes

Markov decision process

State

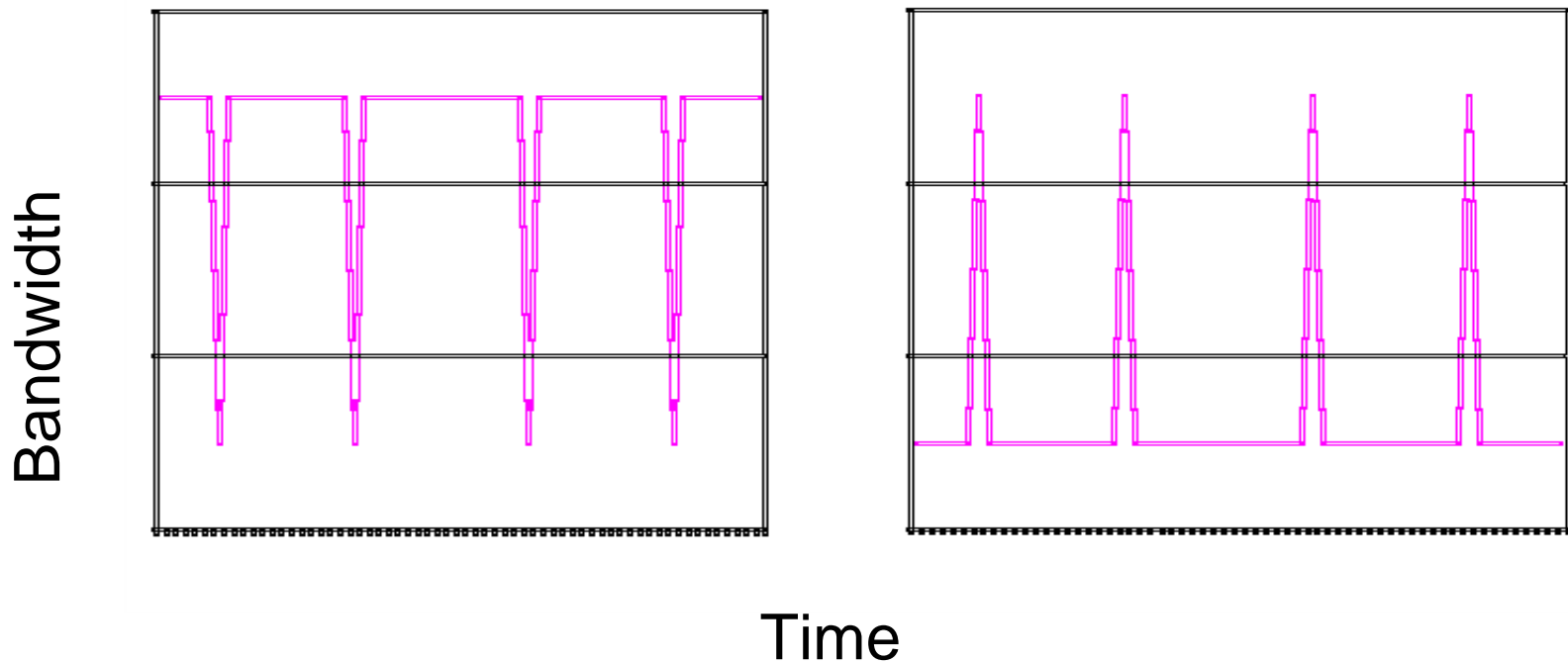
- progress w.r.t. deadline
- number of layers decoded
- maximal number of layers for the next frame

Revenue

- Reward: number of layers
- Penalty: deadline misses
- Penalty: quality change
- Penalty: quality change, caused by the network

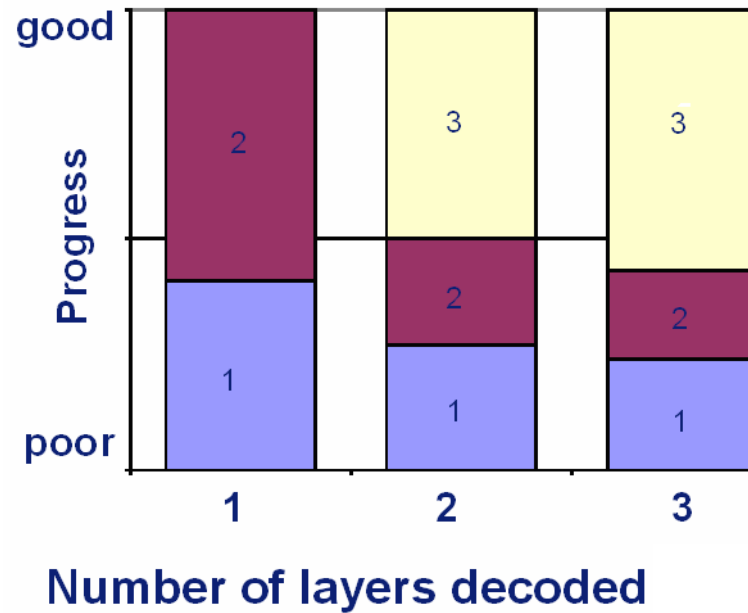
Quality change caused by the network

- The penalty for “fall down” caused by the network is 0.
- The penalty for “jumping up” after network fall is chosen based on expected network behavior .



Controlling strategy

- Computed offline
- Look-up table



Demo: Best-effort vs. Controlled decoder



Conclusions

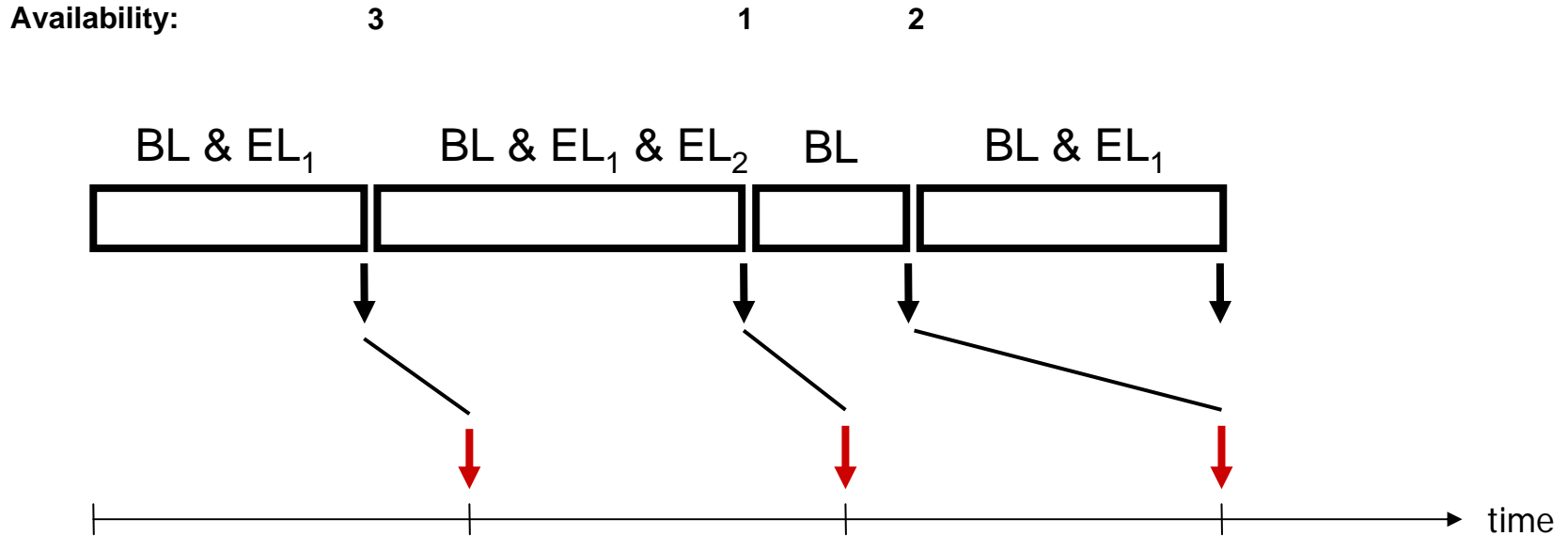
- A controller can be used to optimize perceived quality with respect to the available CPU power and amount of input data
- We developed a controller that doesn't depend on the scalability technique
- The correctness of controller behavior depends on rightness of parameters



Layers scheduling



Decision making



- Stochastic processing times
- Choice of number of layers based on progress and availability of layers
- Objective: maximize perceived quality
 - MAX number of layers to be processed
 - MIN deadline misses
 - MIN quality changes

Controlling strategy

Look-up table

Input:

- number of layers in the input buffer for the upcoming frame
- number of layers decoded for the previous frame
- current progress

Output:

- number of layers to process