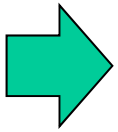
画像情報特論 (1)
Advanced Image Information (1)



Advanced Visual Communication

はじめに
Class Overview

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This Year's Schedule

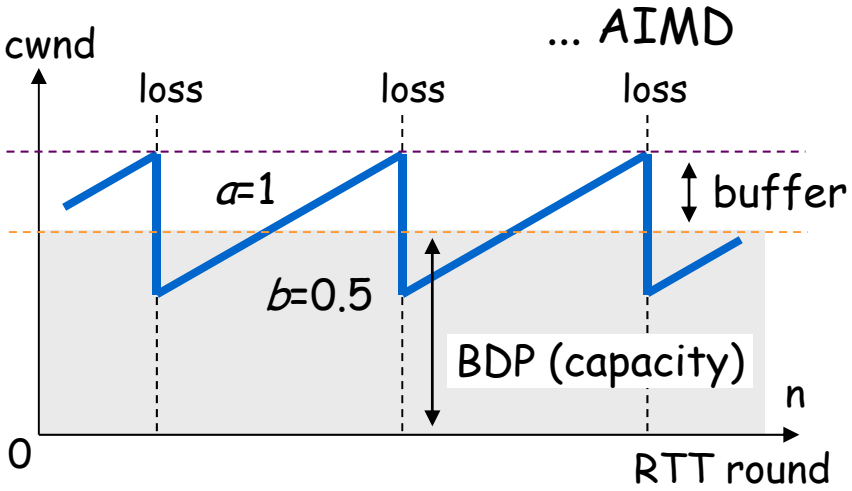
(tentative)

4/10	Class overview
4/17	Video Streaming (1) TCP variants
4/24	Video Streaming (2) TFRC, HTTP, MPEG-DASH
5/01	Video Streaming (3) Wireless
5/15	Video Streaming (4) CDN, P2P
5/22	Video Streaming (5) CCN/NDN
5/29	Video Compression (1) Basics
6/05	Video Compression (2) H.264/AVC
6/12	Video Compression (3) H.265/HEVC
6/19	Image Processing (1) Super-Resolution
6/26	Image Processing (2) Feature Extraction
7/03	Image Processing (3) Sparse Coding
7/10	Image Processing (4) TBD
7/17	Image Processing (4) TBD
TBD	Final report

Self-study on CourseN@vi, once or twice

Video streaming (1) TCP/IP

- Loss-driven

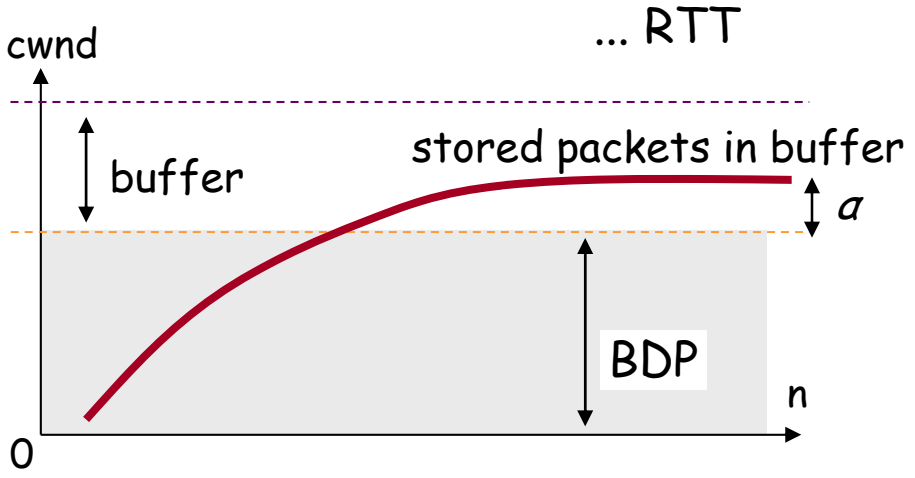


TCP-Reno, High-Speed TCP,
TCP-Westwood, CUBIC-TCP, ...

BDP/Buffer relationship

small buffer → × efficiency
large buffer → × delay

- Delay-driven



TCP-Vegas, FAST-TCP

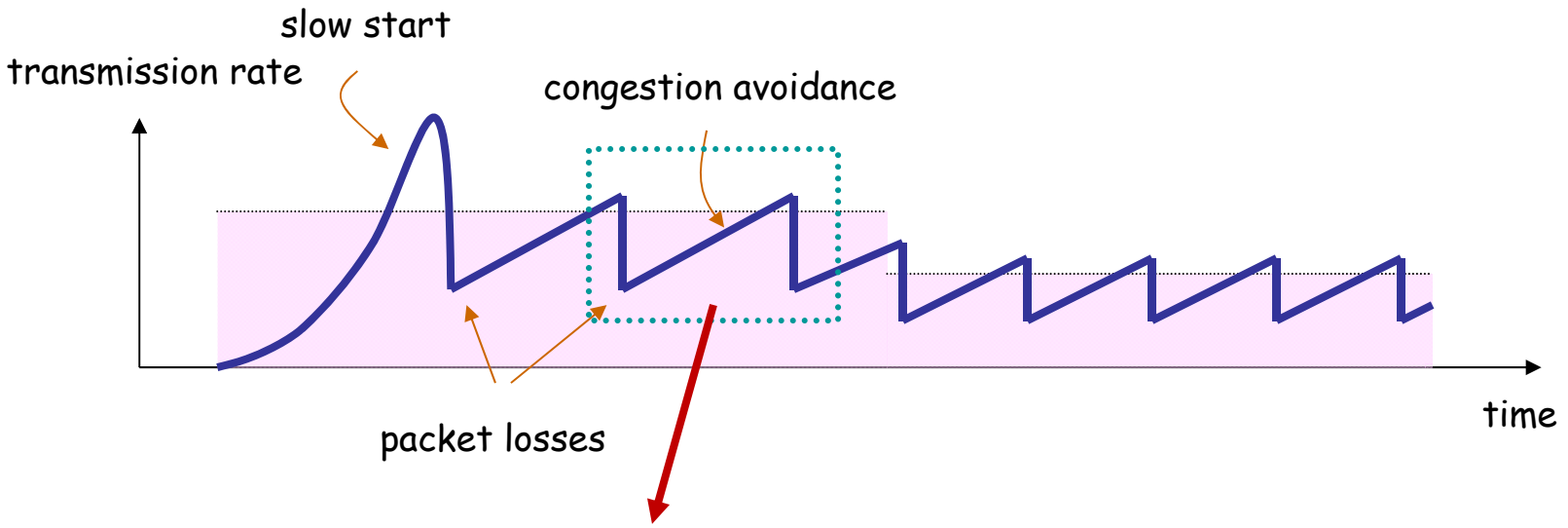
Unfairness by loss-driven TCP

× friendliness

BDP: Bandwidth-Delay Product

Video streaming (2) TFRC

- TFRC



Modeling of steady-state TCP behaviors

$$R = \frac{1}{RTT}\sqrt{\frac{3}{2p}}$$

p: packet loss rate

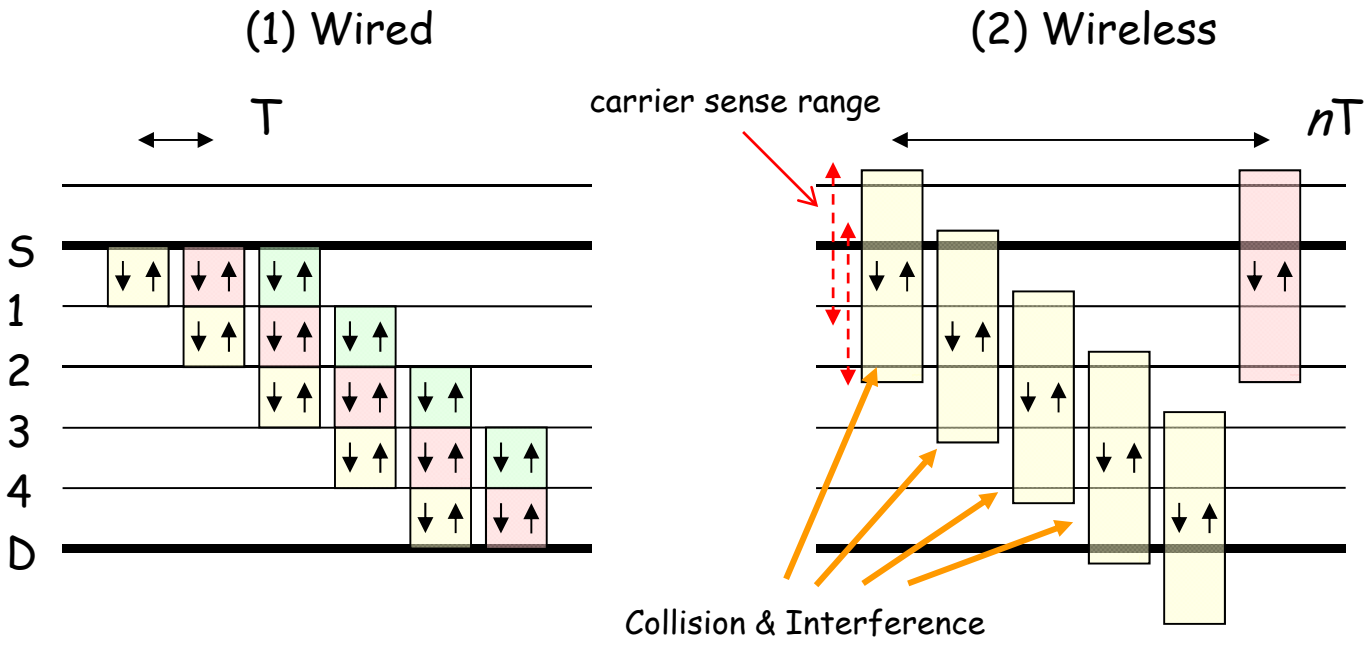
BDP/Buffer relationship

small buffer → × efficiency
large buffer → × delay

TFRC: TCP Friendly Rate Control

Video streaming (3) Wireless

- Single-Channel Multi-hop Network

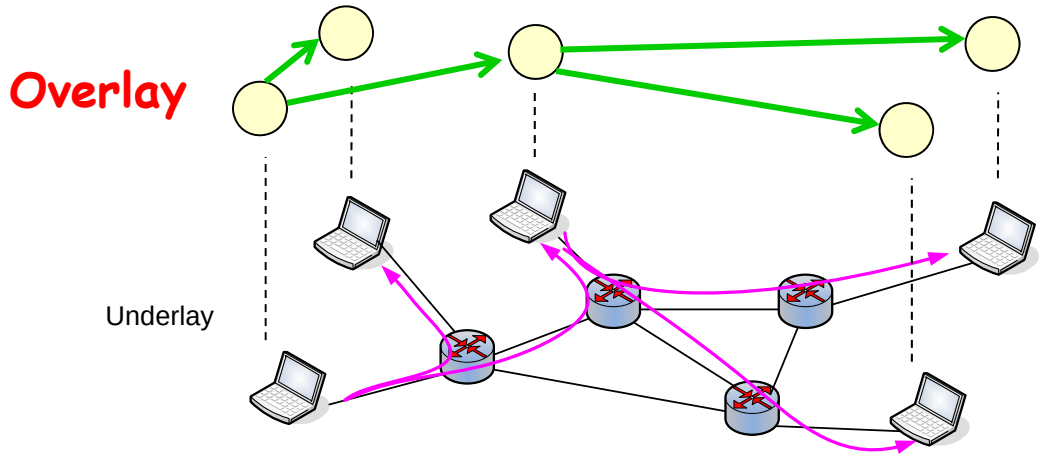


Channel Efficiency = 1

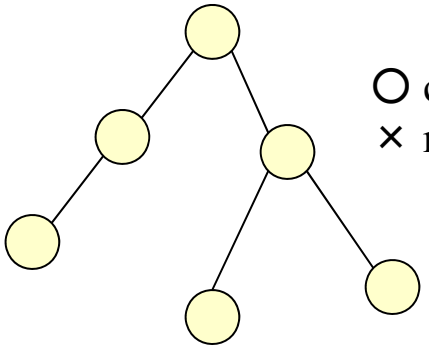
Channel Efficiency = 1/*n*
(*n* : # of multi-hops)

Video streaming (4) CDN, P2P & Cloud

- Overlay networks

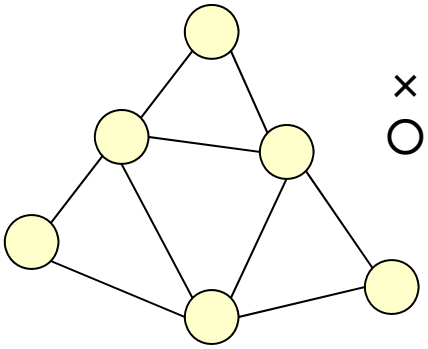


- tree



○ complexity
× robustness

- mesh

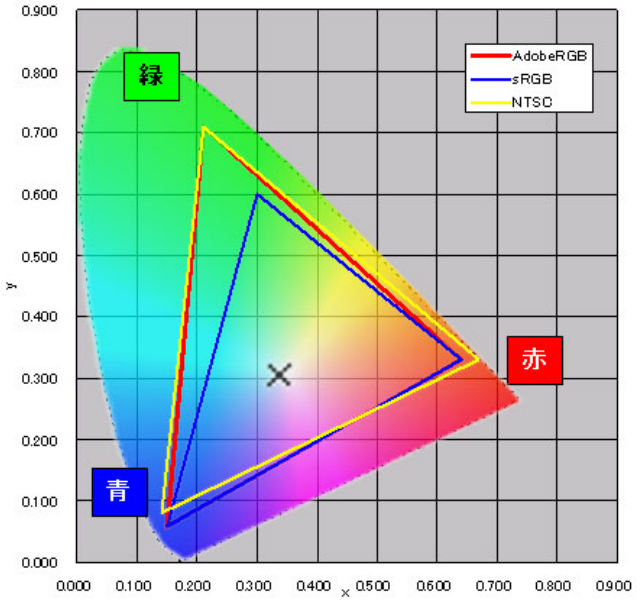


× complexity
○ robustness

Video Compression (3) H.265

- H.265/HEVC
  - HEVC: High Efficiency Video Coding
  - NGVC: Next Generation Video Coding
- Other topics
  - Higher resolution
    - spatial: U-HDTV
    - temporal: 10,000 frames
  - Gamut expansion
  - High dynamic range
  - 3D / freeviewpoint

color diagram



http://plusd.itmedia.co.jp/pcuser/articles/0805/23/news001.html

Super-resolution

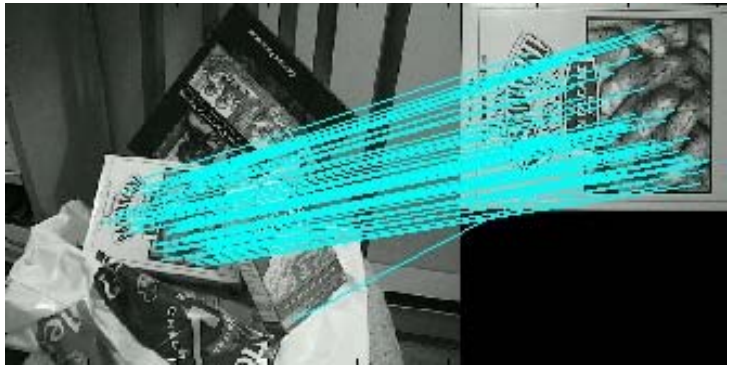
- Super-resolution
  - Missing frequency estimation (freq. domain)
  - Multiple image approach (registration)
  - Single image approach (example-based, data-base)

a: LR Frame 45 b: Data Fused Frame 45 c: Deblurred Frame 45

S.Farsiu et al.: "Advances and Challenges in Super-Resolution", IJIST, Aug.2004.

Feature Extraction

- Scale Invariant Feature Transform



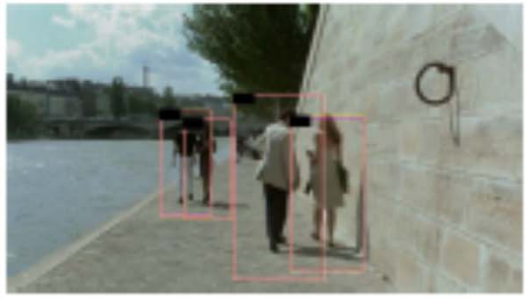
SIFT descriptors
Point correspondence

oriented gradients
in local regions

- Histogram of Oriented Gradient

Human body detection





http://www.cs.ubc.ca/~lowe/keypoints/, http://www.navneetdalal.com/

Sparse Coding

- Sparse Coding

$$\left(\hat{A}, \hat{s}\right) = \arg\min_{A,\mathbf{s}} \frac{1}{2} \sum_i \left\| \mathbf{f}_i - A\mathbf{s}_i \right\|_2^2 + \sum_i \left\| \mathbf{s}_i \right\|_1$$

Basis vector learning from sample images

Original

Noisy (12.77dB)

Denoise (29.87dB)

http://www.cs.technion.ac.il/~elad/talks/

Preparation

- Tools
  - Network Simulators (ns-2 / ns-3)
  - OpenCV
  - MATLAB (Image Processing Toolbox)