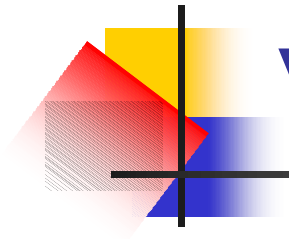
An Active Router Architecture for Multicast Video Distribution

Ralph Keller, Marcel Dasen, George Fankhauser, Bernhard Plattner @ ETHZ

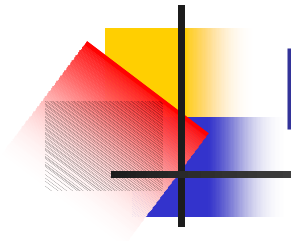
Sumi Choi, Dan Decasper @ WUSTL

(Presented by: Hemant Kumar)



Video vs Data

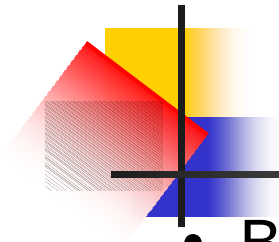
- Timely delivery is critical
- Not all bits are created equal



Problem

- Network doesn’t care (content blind)
- All packets get same treatment
- Problem for many apps : voice, video, music...real time content

How it (doesn't) work right now



- Buffering at receiver to counter jitter and packet loss

  Doesn't work with interactive media

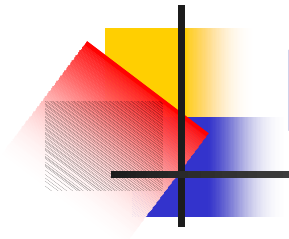
- Sender adapts rate according to receiver's feedback

  Not suited for point to multipoint

  Feedback is slow, network conditions change fast

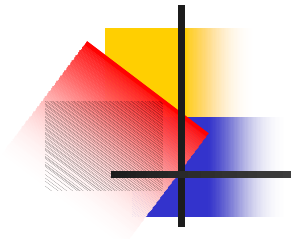
- Resource reservation

  Not widely available



Requirements

- Smart Router
- Codec with fine grained scaling
- Efficient scaling algorithm



Approach

- Use scalable wavelet based codec

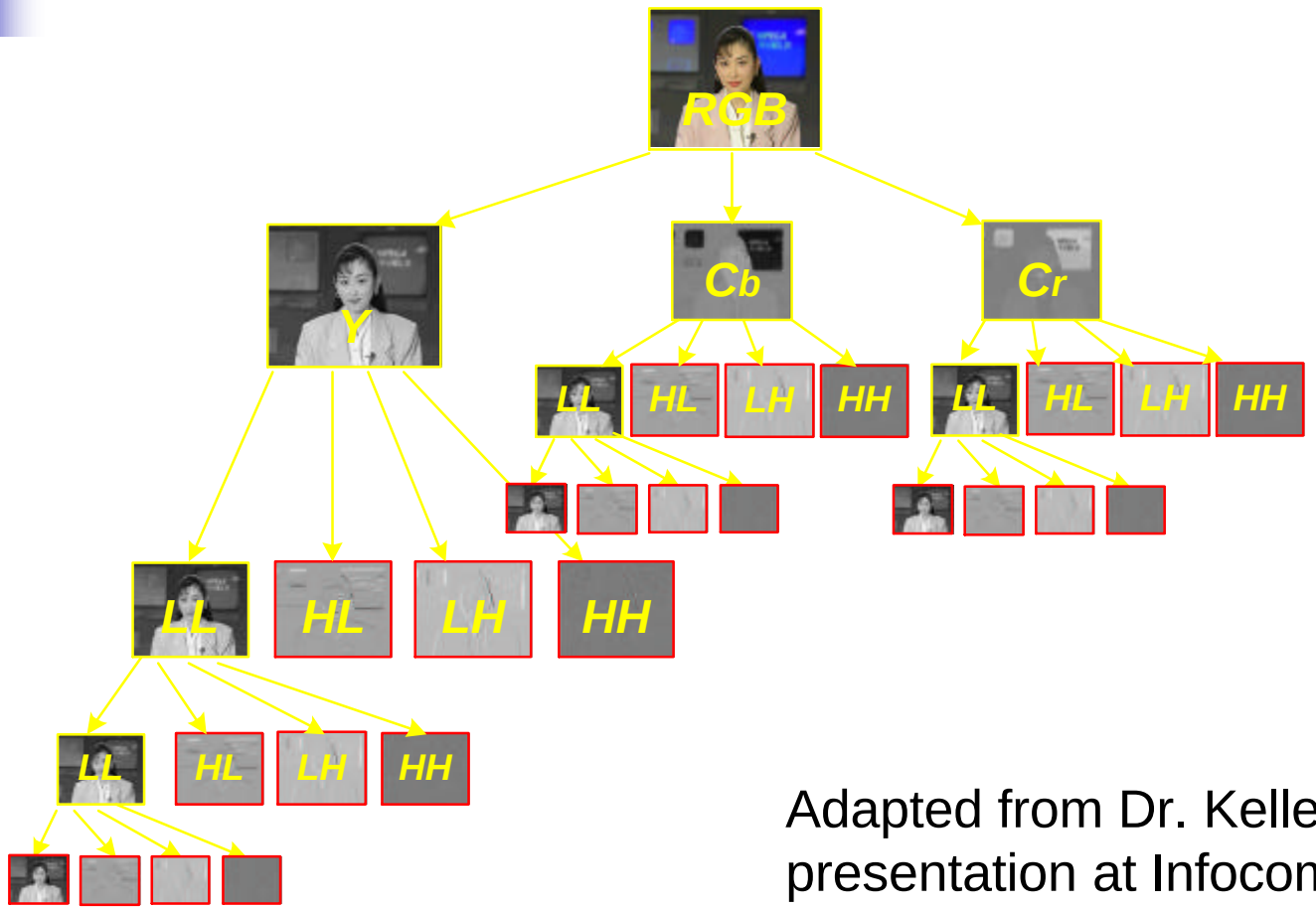
  ✓*provides fine grained scalability*

  ✓*enables a simple algorithm to make decisions about the packet*

- Plugin at router tells it how to deal with video packets

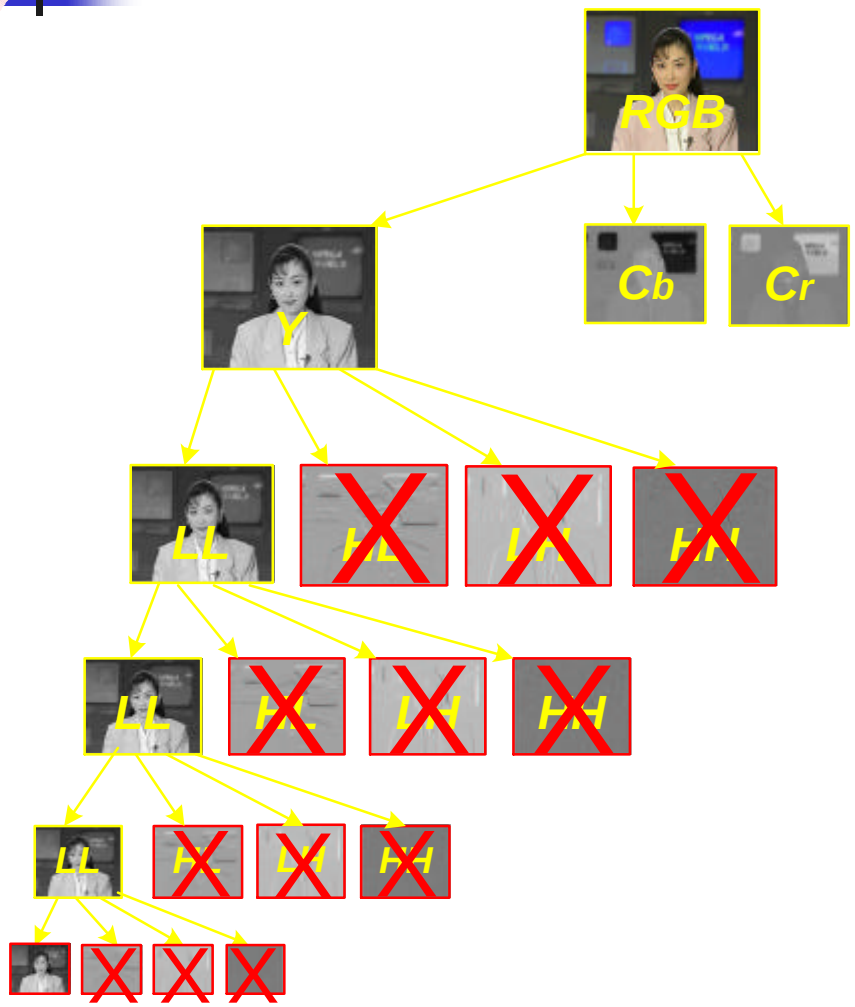
  ✓*different video formats can have different plugins*

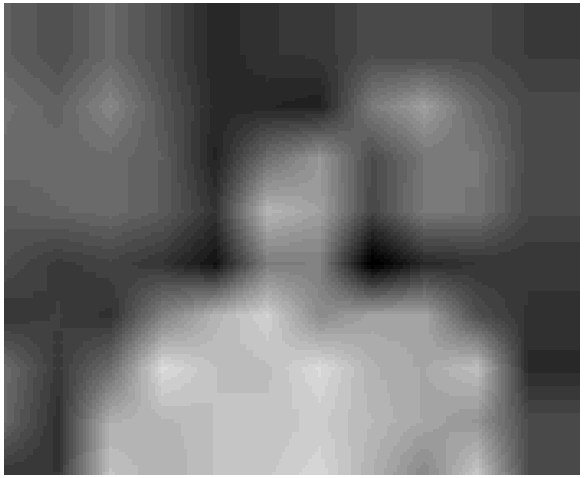
Wavevideo Encoding



Adapted from Dr. Keller's presentation at Infocom 2000

Scaling with sub bands





Decoded Image

Adapted from Dr. Keller's presentation at Infocom 2000

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Scaling with sub bands


33011 bytes (33)


25239 bytes (30)


17179 bytes (27)


9265 bytes (24)

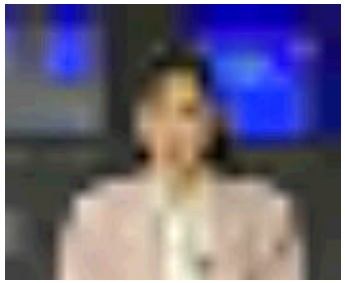

7042 bytes (21)


4819 bytes (18)


2617 bytes (15)


2006 bytes (12)

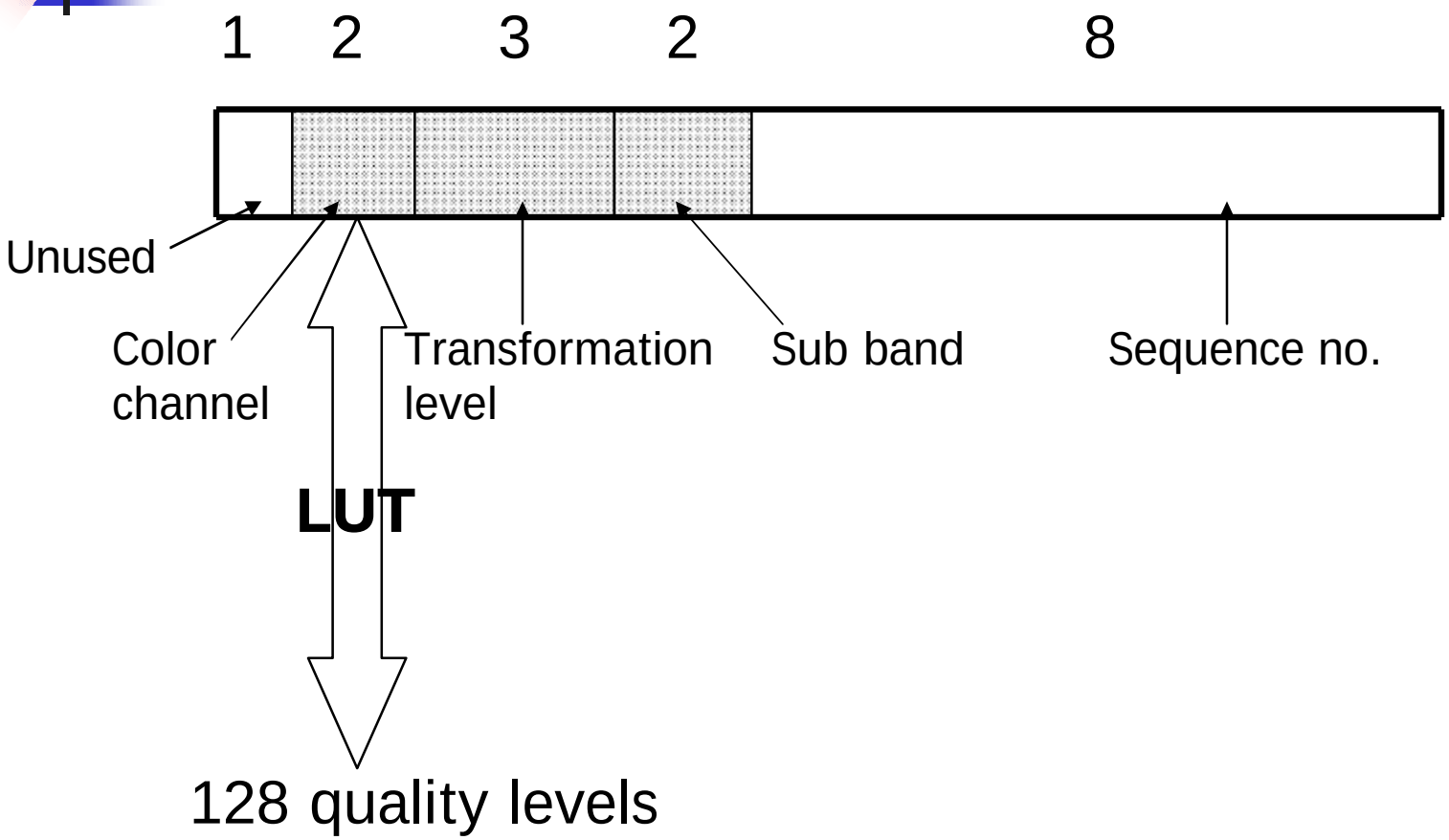

1393 bytes (9)


793 bytes (6)

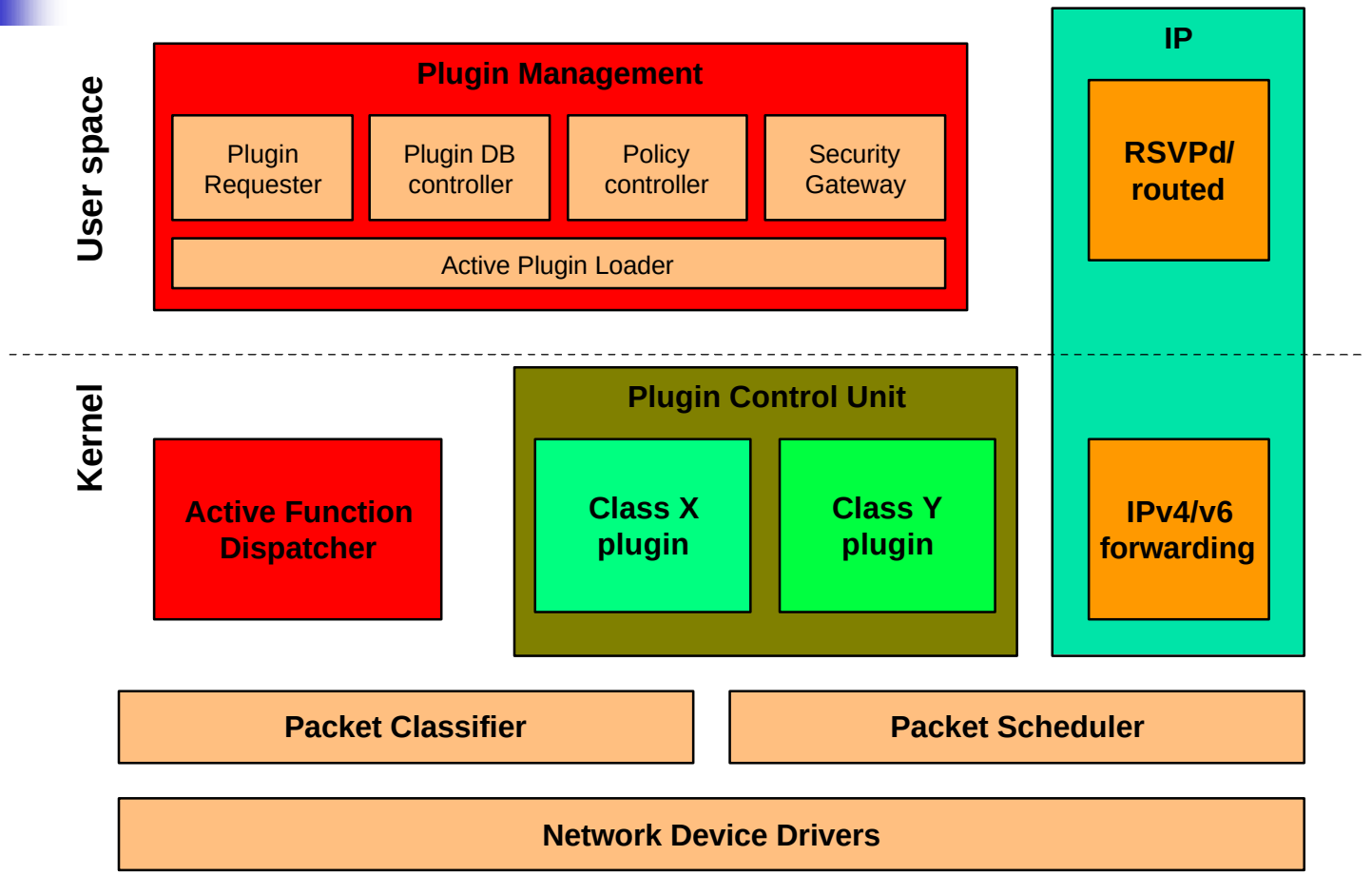

447 bytes (3)


227 bytes (1)

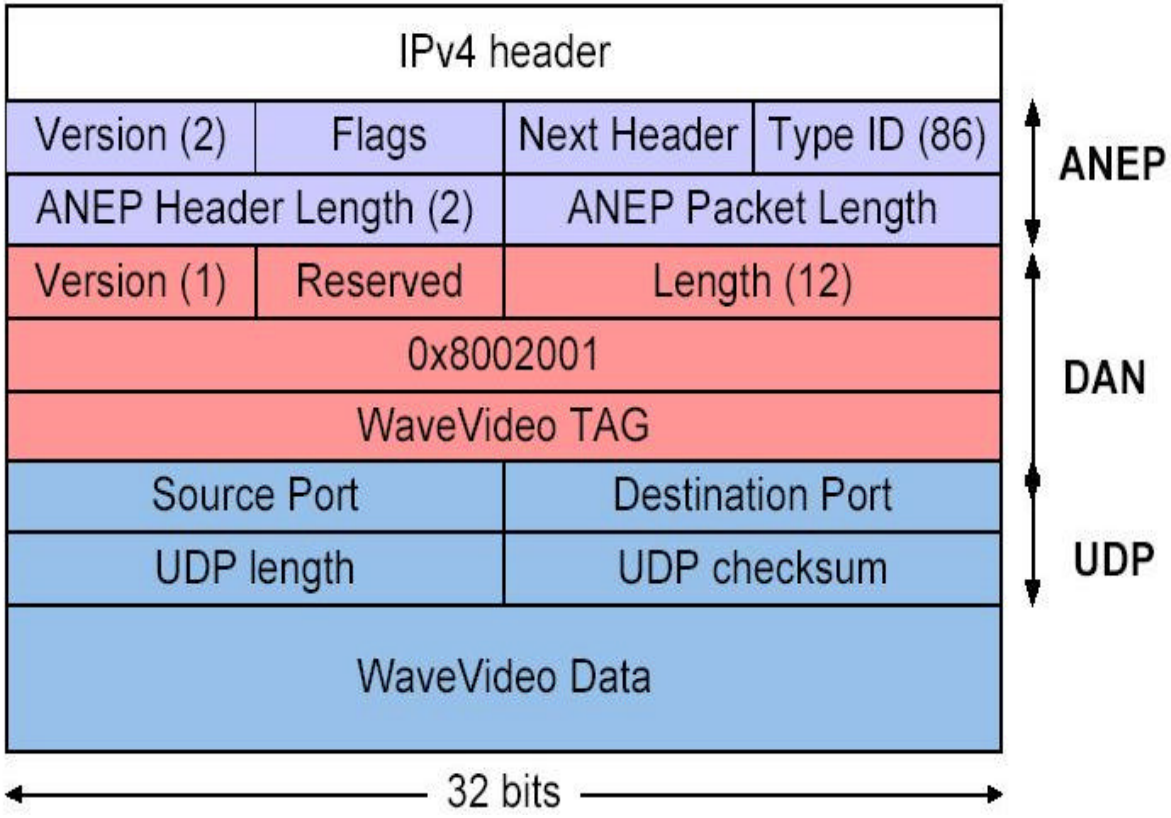
Classification of packets



Active network node

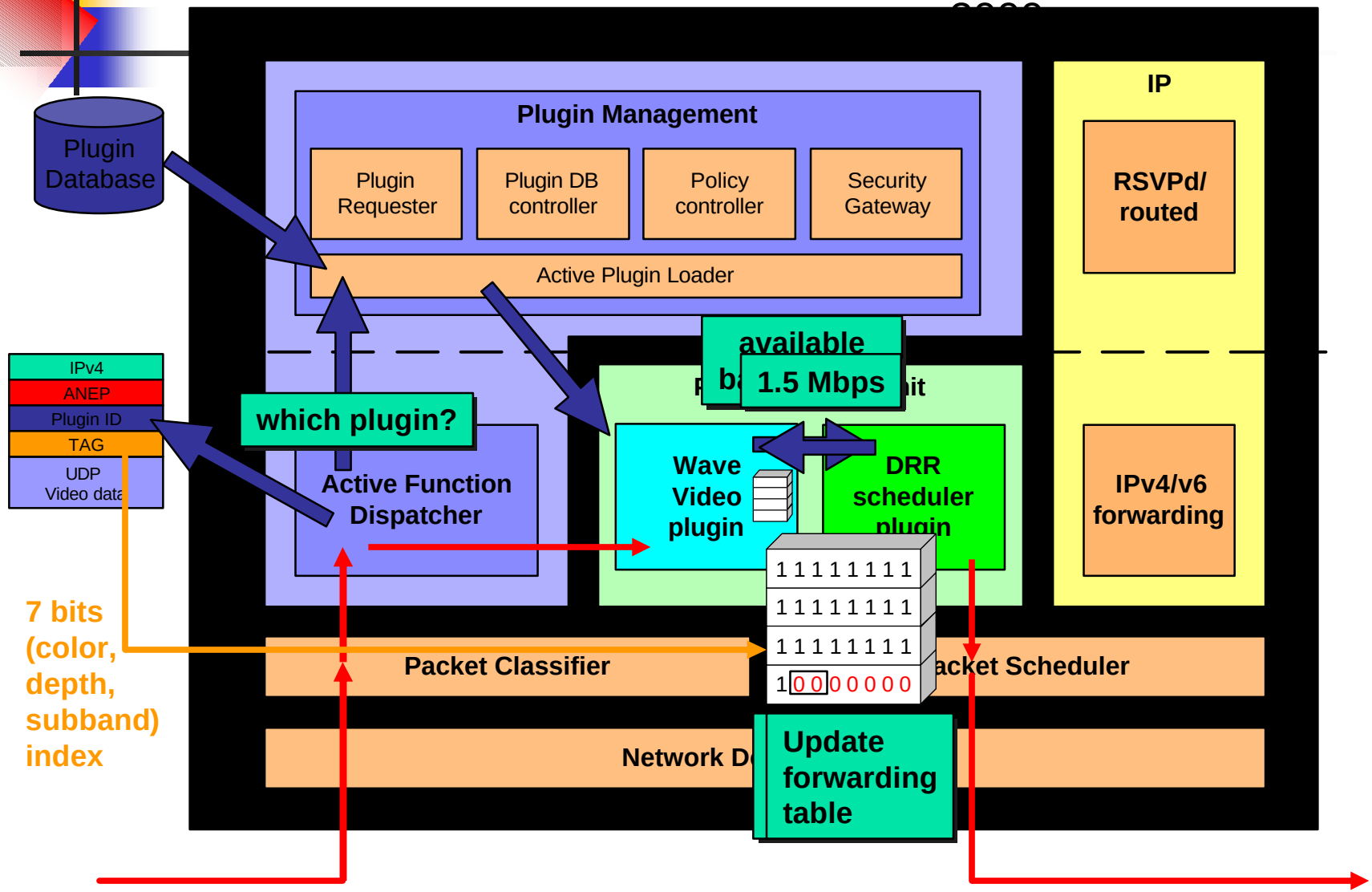


WaveVideo datagram

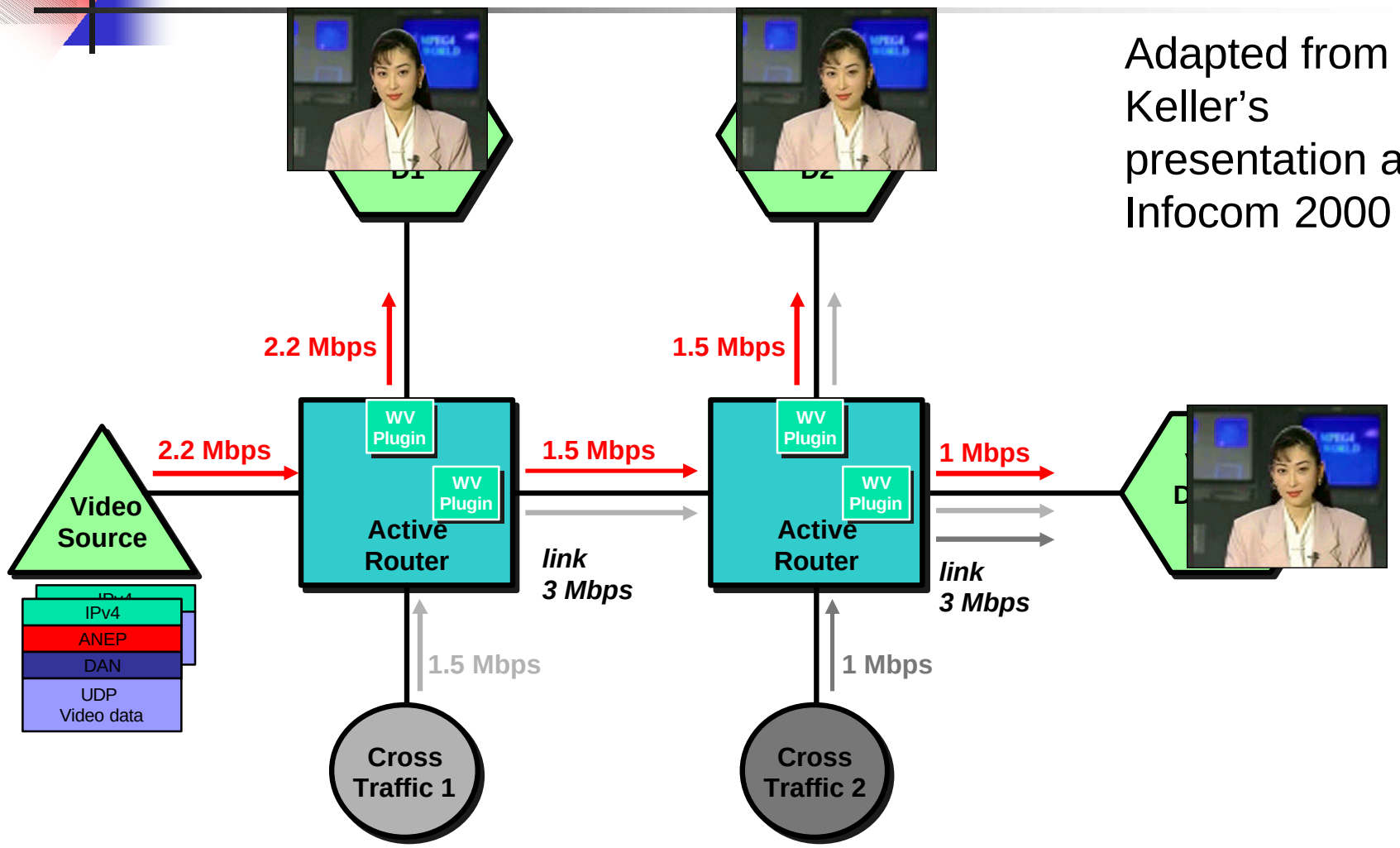


Packet processing

Adapted from Dr. Keller's presentation at Infocom

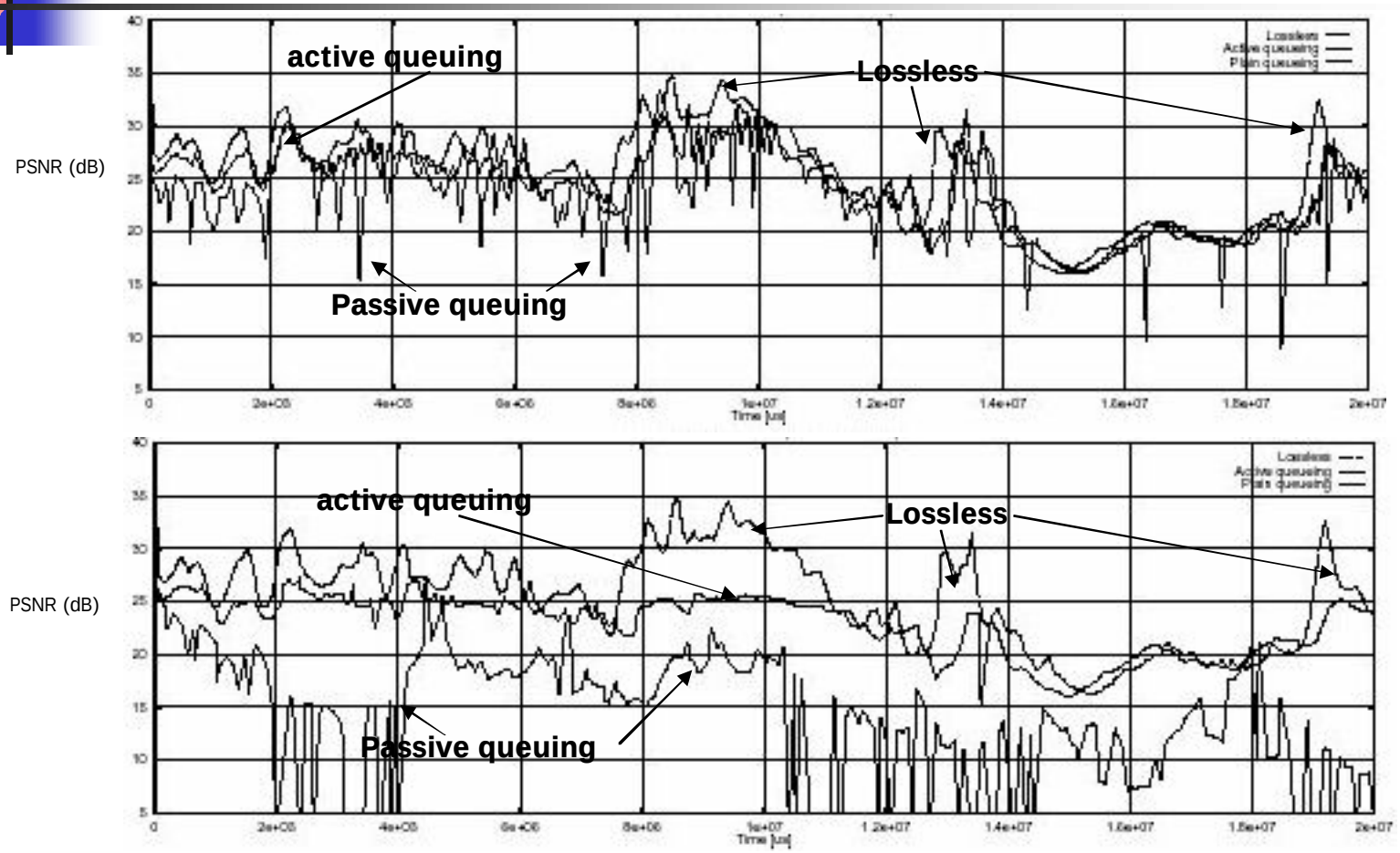


How it works



Adapted from Dr. Keller's presentation at Infocom 2000

Quality Measurements

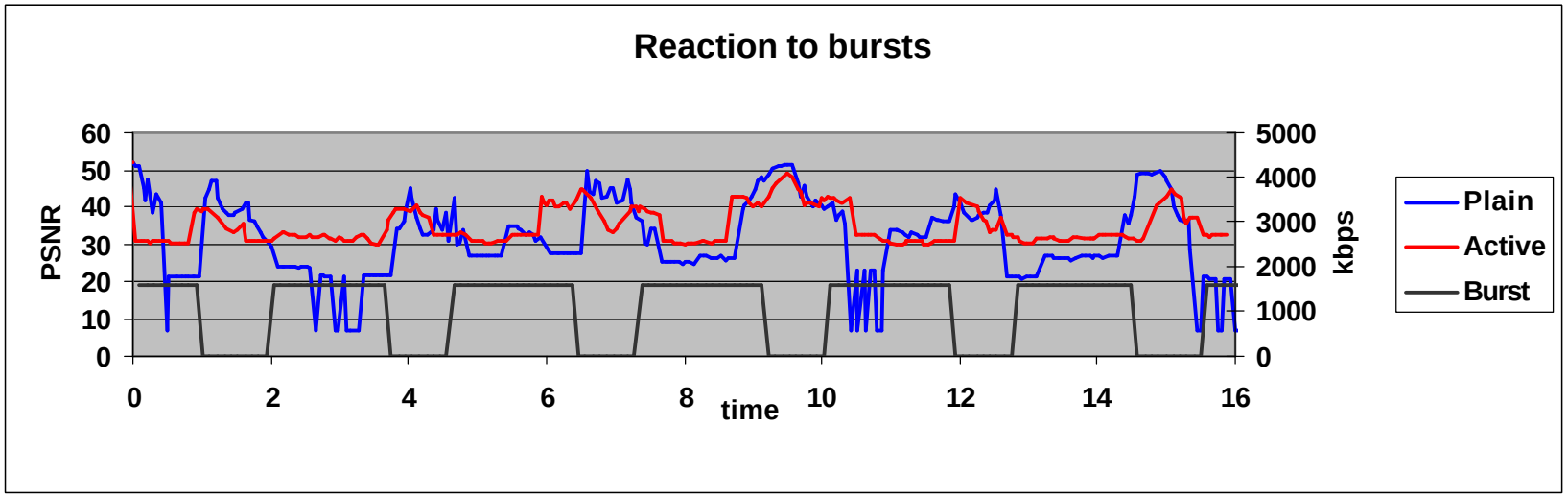


With bursty traffic

Adapted from Dr. Keller's presentation at Infocom 2000

plain queueing

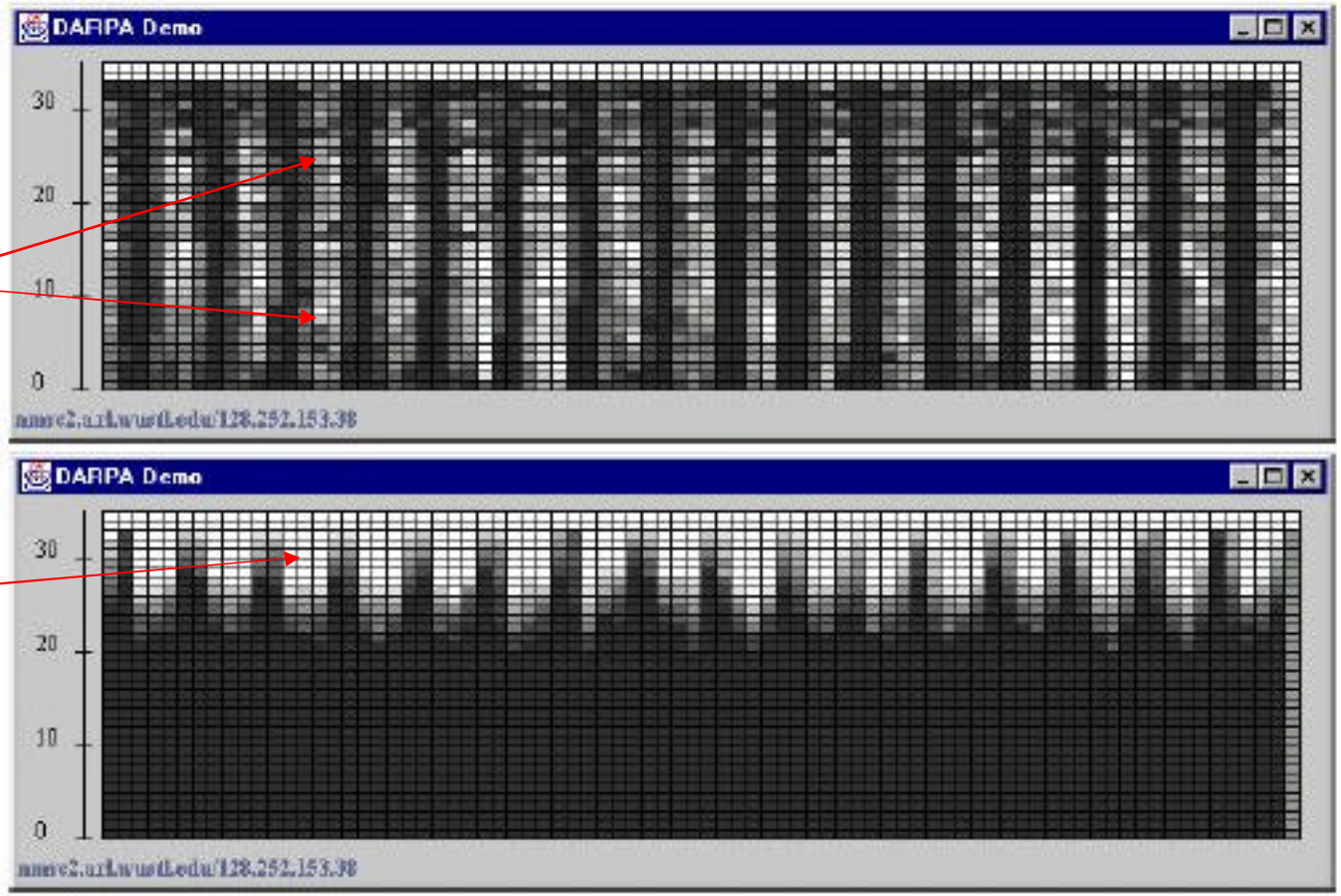
active dropping

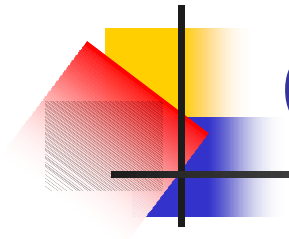


Distribution of received sub bands

Drop across all sub bands

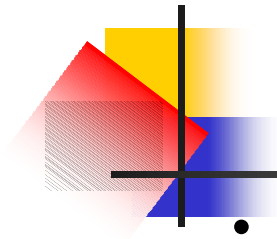
Drop occurs in high frequency sub bands





Conclusions

- Good Scalability (with a general purpose CPU, time taken is 22 μs)
- Quick Response to congestion (at most 50 ms)
- Can be implemented on any active networks environment.



Notes (- / +)

- Would be more convincing if applied to commercially available wavelet based codecs (VDONet etc.)

- Doesn’t show how effective this approach is when intermediate routers are passive

- WaveVideo will not be able to achieve compression of MPEG (because MPEG eliminates temporal redundancy also) – this is where we pay the price !

- Easily deployable solution.

- Shows efficacy of active networks approach. Even small amount of processing capability can deliver solid gains.