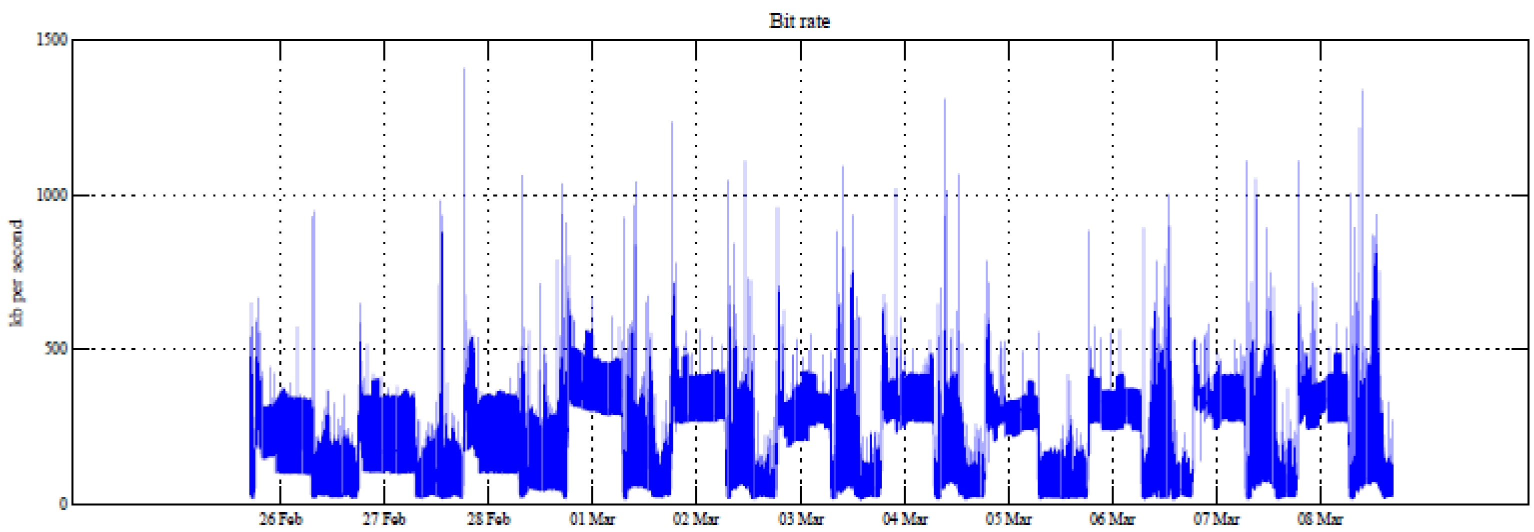
Quality of Videosurveillance Streams with Traditional Encoders and Decoders

QART Presentation– July 2013

Videosurveillance Streams Rate Time Series

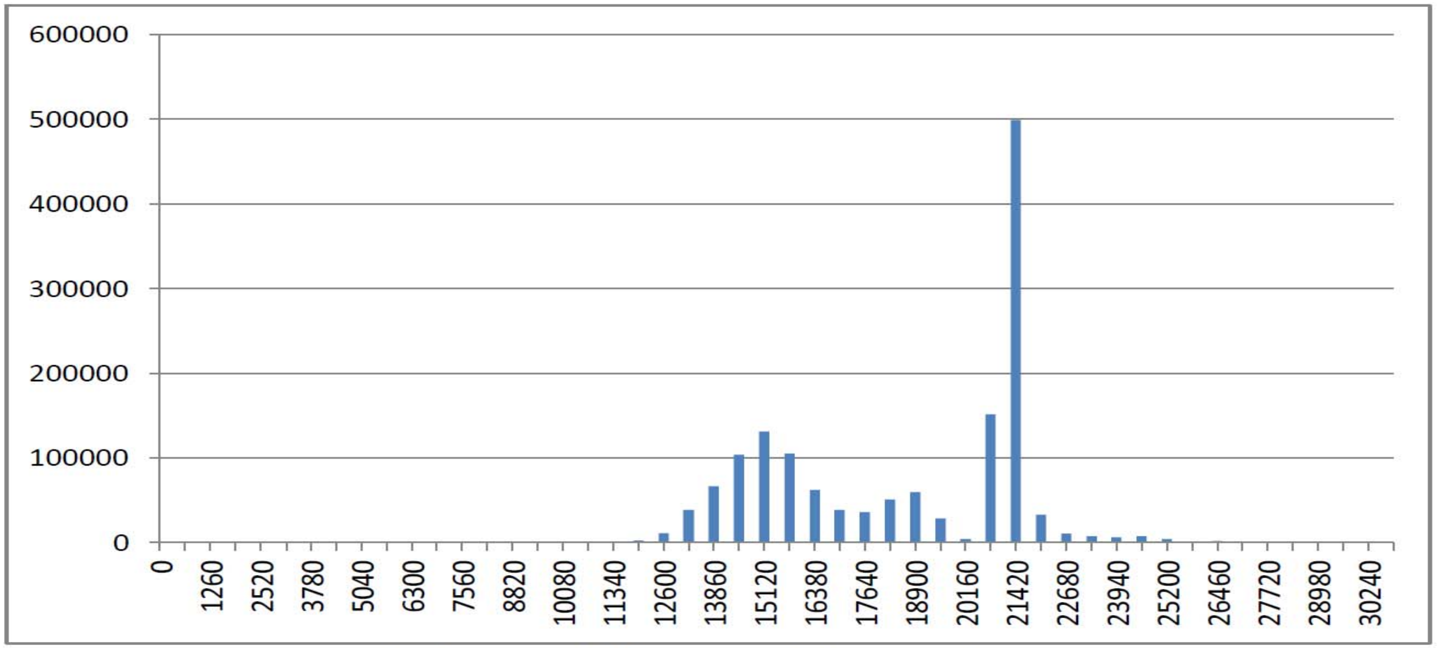
- **Videosurveillance Streams, when encoded with traditional H.264 encoders, at a given spatial resolution (HD, SD, 4CIF, CIF, other), constant frame frequency, and constant quantizer step, exhibit highly variable bit rates**

CAM7, 6.250, H264, 4CIF, QP=26 : second average



Videosurveillance Streams Rate Histograms

- **When making a rate histogram, multimodal distributions are not exceptional, especially when there are two (or more) modes of operation (day/night, week/weekend)**



Videosurveillance Streams Rate Control

- **Spectral analyses of the rate time series often contain very slow components (seasonal, weekly, daily)**
- **Uncontrollable operating parameters (weather, lighting) add to the variability and unpredictability of the rate**
- **The traditional approach to “absorb” the high variations consists in using CBR or VBR control mechanisms, that control the quantization parameter in closed loop**
  - Increasing QP to reduce the rate, when the (uncontrolled) rate tends to grow (because of noise, or motion/change content)
  - Limiting variations in VBR (often to a factor less than 2)
- **Consequence**
  - Degradation of the image quality, when one needs a good image (important when the images changes, or contains motion)
  - Waste of bandwidth when the streams contains no useful information, to achieve a CBR

Videosurveillance Streams Alternative Rate Control

- **Alternative 1: control other stream parameters (spatial resolution, frame rate) affecting the rate**
  - Acceptable in Videosurveillance, not in broadcast
- **Alternative 2: allow high rate variations, but absorb these variations in the network switches (at least at the first level) by statistical multiplexing**
  - Specially designed managed switches
- **Alternative 3: use rate control algorithms (upstream throttling) based on overall transmission channel parameters, especially congestion measures (downstream)**
  - Similar to TCP-IP, but affecting other parameters
- **Alternative 4: use rate control algorithms based on end-to-end Image Quality measures specialized for Videosurveillance Streams**

Videosurveillance Streams
Image Quality Measures for VS

- **Videosurveillance Streams are defined by (essentially) three encoder parameters**
  - Spatial resolution
  - Frame frequency
  - Q quantizer step
- **A measure of quality should be based on the following concepts (at least)**
  - Sharpness (mainly affected by spatial resolution)
  - Fluidity; this is a complex concept, brought about by
    - ✓ Frame frequency
    - ✓ Frame frequency or phase jitter (very common in “low quality” VS systems)
    - ✓ Frame dropping
  - Latency
- **All “dimensions” of the Quality Measure are affected by the encoder, the network transport mechanism, and the decoder**

Thank you for your attention!