



Brief Overview of JPEG2000

- ◆ **JPEG2000, the new still and moving image compression standard from the JPEG Committee, was designed to address the shortcoming of JPEG including:**
 - **Better image quality:**
 - ◆ **Up to 50% better Pixel SNR performance than JPEG**
 - ◆ **Compresses continuous tone and bi-level compression equally well**
 - **Scalability - dynamic bandwidth / quality control possible**
 - **Better error resilience compared to JPEG and MPEG**
 - **Content-based description and image security (encryption, copyright info, etc)**
- ◆ **JPEG2000 uses wavelet-based transform to achieve better compression**
- ◆ **DCI (Digital Cinema Initiatives) selected JPEG2000 as a standard for digital cinema development**
 - **Member of DCI: Disney / Fox / MGM / Paramount / Sony Pictures Entertainment / Universal / Warner Bros.**

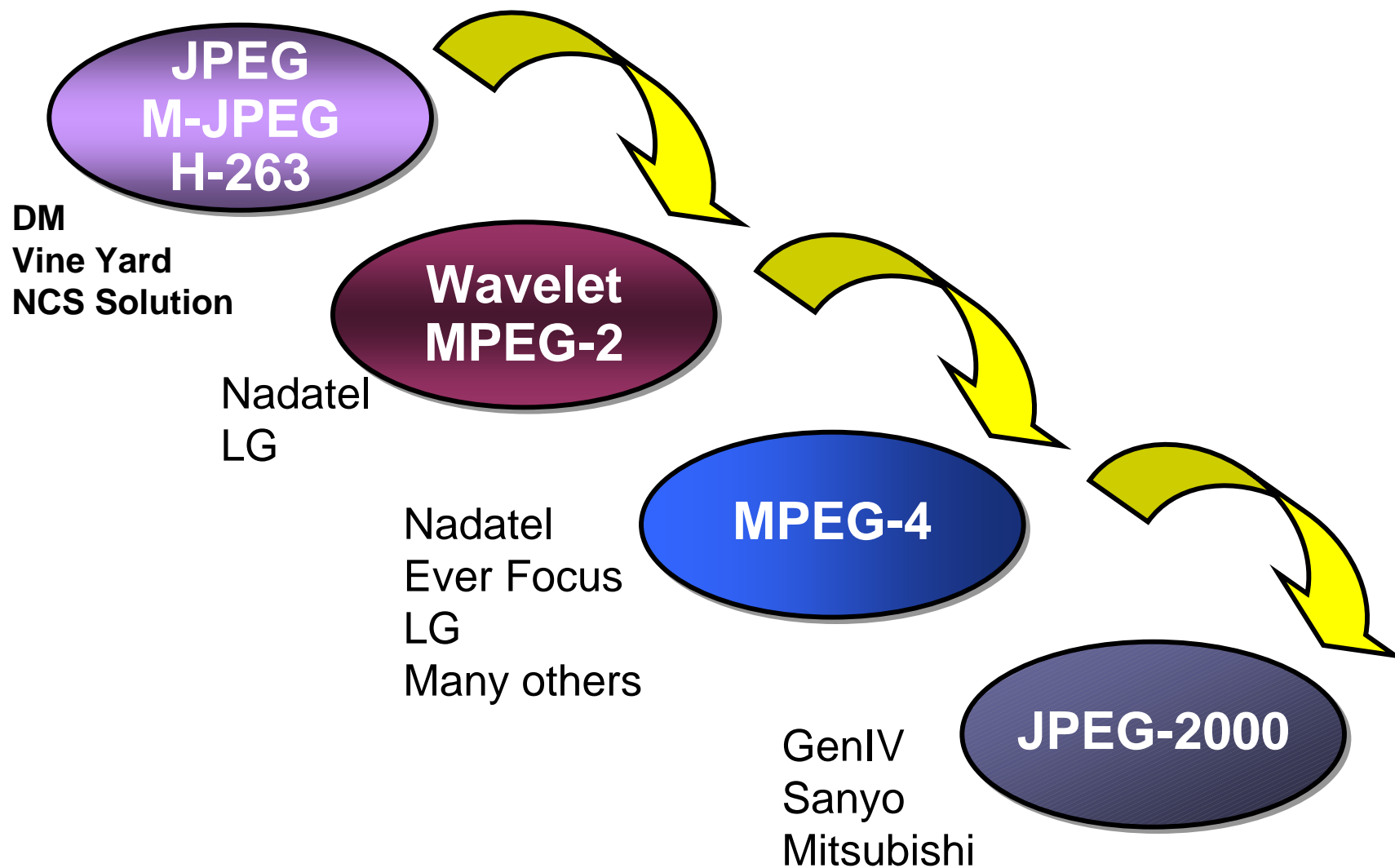


Older Video Compression Standards

◆ MPEG: Standard Video Compression Method

- **MPEG1(Moving Picture Experts Group)**
 - ◆ Completed 1992
 - ◆ Video Compression for CD-ROM with VHS quality video
- **MPEG2**
 - ◆ Completed 1994
 - ◆ Broadcast Quality Video via High-bandwidth Network for HD-TV, Digital TV, Satellite TV
 - ◆ DCI selected MPEG2 as a standard for DVD titles
- **MPEG-4**
 - ◆ Completed 1998
 - ◆ TV Quality Video via Low-bandwidth network such as Internet, LAN, Computer Network for Remote Surveillance, Conference, Storage, Education
 - ◆ Solution for communication rather than Digital Video Recorder
- **MPEG-4 AVC (H.264)**
 - ◆ Completed 1998
 - ◆ TV Quality Video via Low-bandwidth network such as Internet, LAN, Computer Network for Remote Surveillance, Conference, Storage, Education

Classification of Stand-Alone DVRs by Codec





Example: JPEG2000 and JPEG Picture (50:1)



JPEG2000



JPEG

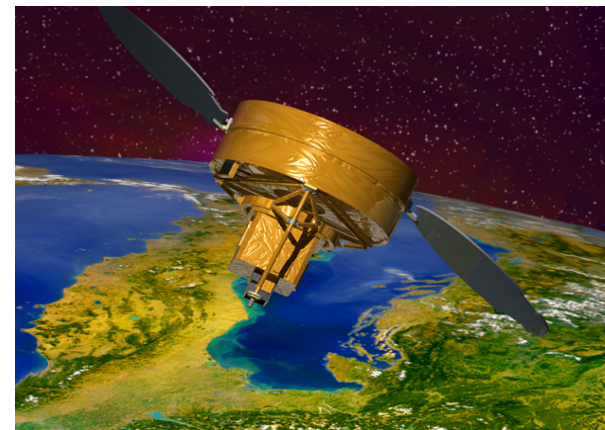
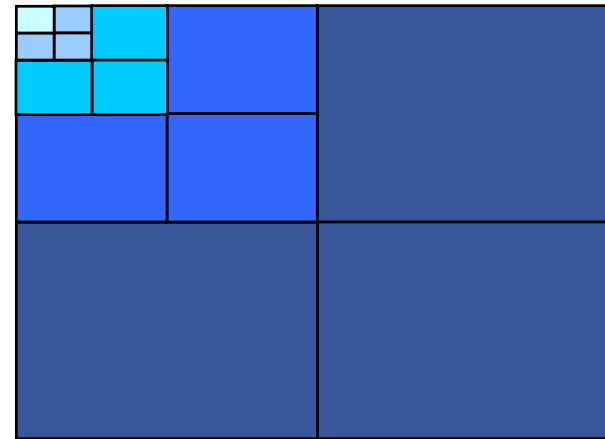
Compression JPEG2000 vs. MPEG4

Comparison	JPEG2000	MPEG4
Derives From	JPEG – Still picture algorithm	MPEG – moving picture algorithm
Image Indexing	Easy	Difficult (some limitation in operation)
Advantage for DVR Use	No mosaic effect (blocks) in playback	Sends more images via IP network
Disadvantage for DVR Use	None. Best picture quality compared to any algorithm	Small resolutions Poor playback image
Best Application	Digital Movie Stand-alone DVR System	Communications PC-Based DVR (network)

* Stand-alone DVR systems rely on focused recording and playback images with stability and reliability. Still picture algorithms allow for high resolution images and sequential image by image playback.

* MPEG4 images are only reliable when no movement occurs. Images are not stable when involved with many moving objects (ex. Images from PTZ cameras). Does not allow for high resolution, multiplexed, still pictures.

JPEG2000 Resolution Scalability (RLCP)





JPEG2000 Quality Scalability (LRCP)



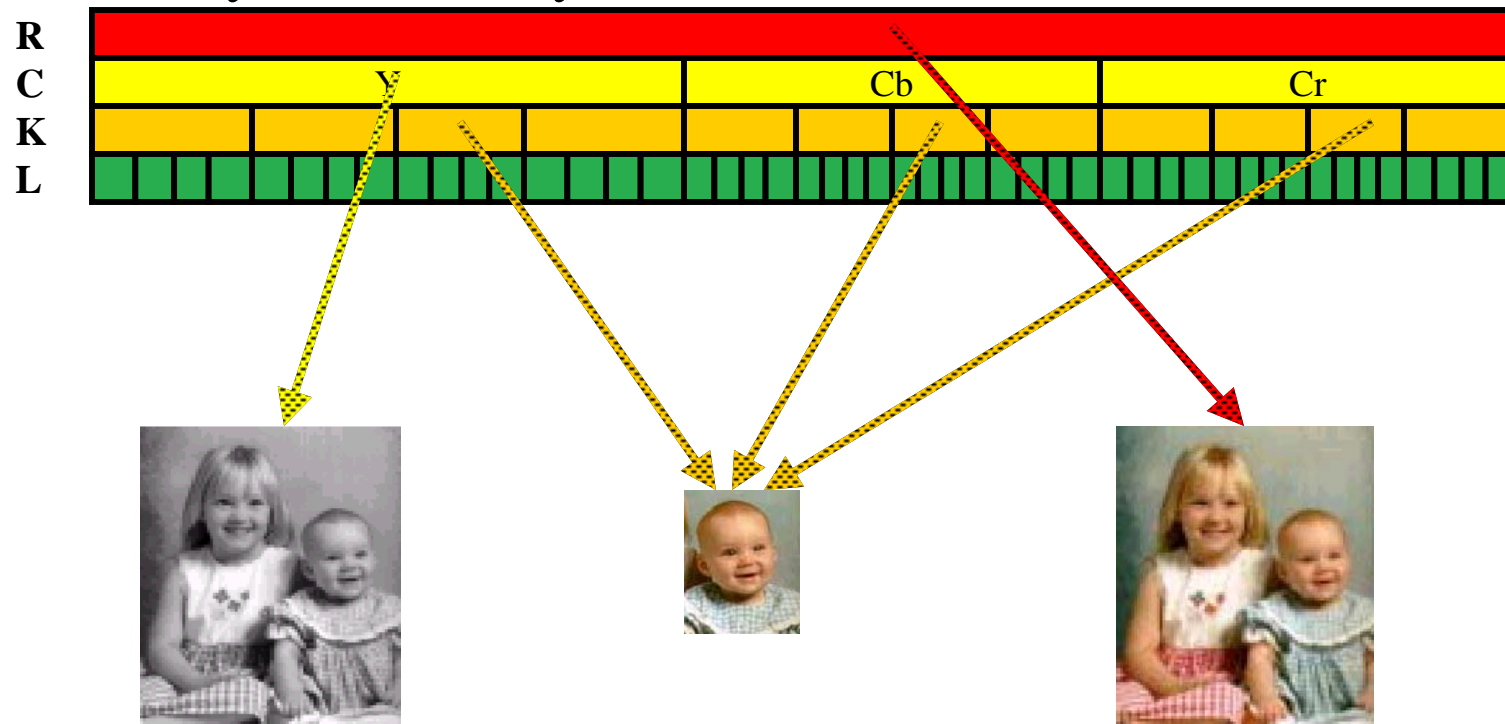
JPEG2000 PACKET PROGRESSION (For a Single Resolution)

R => Resolution

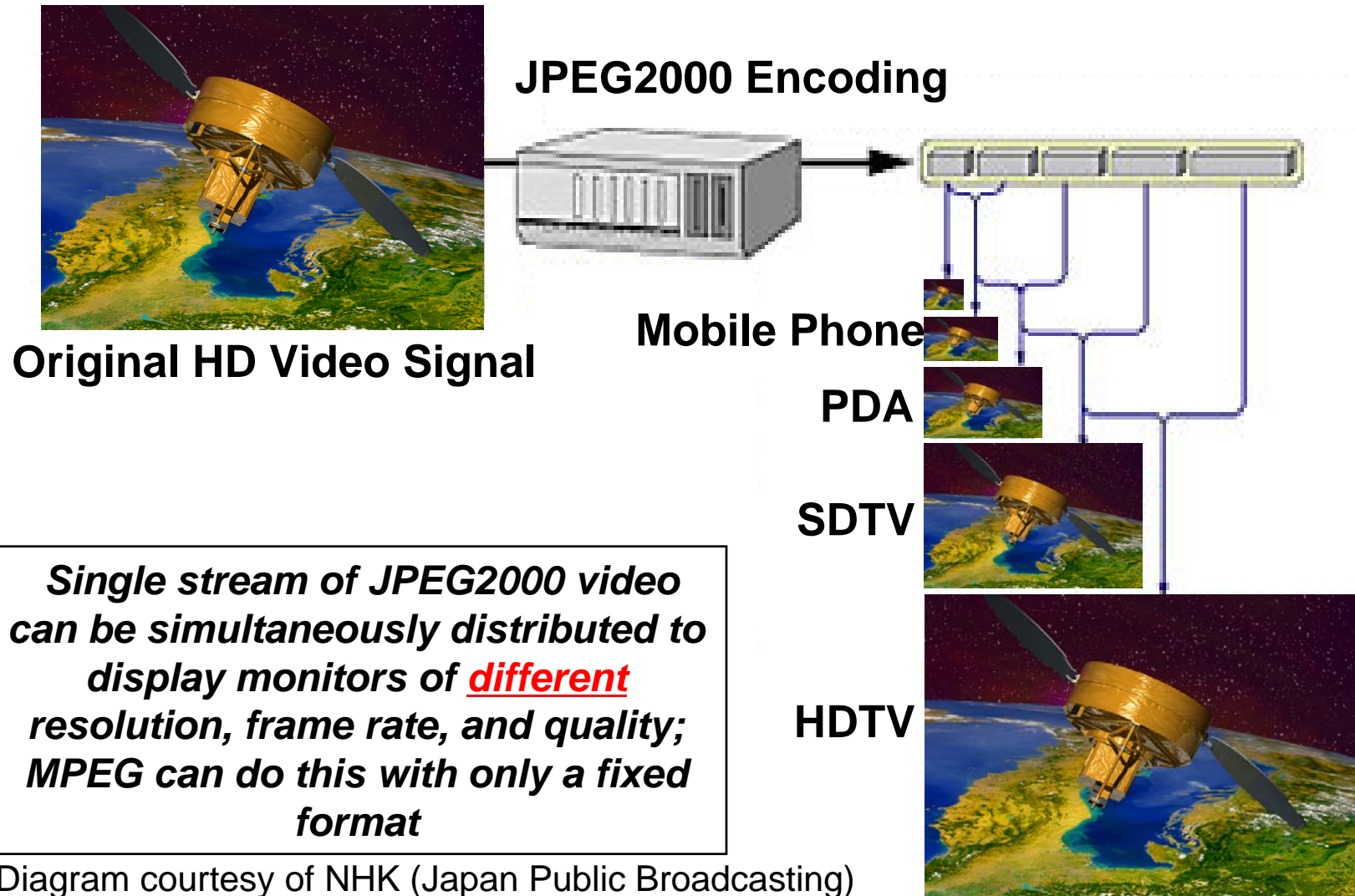
C => Component

K => Precinct

L => Layer of Quality



Scalability of Video with JPEG2000*



* - Diagram courtesy of NHK (Japan Public Broadcasting)



JPEG 2000 Handles High Bit Error Rates*

(Compression ratio of 80:1, BER of 10^{-4})



Motion-JPEG2000



Motion-JPEG



MPEG-2



MPEG-4

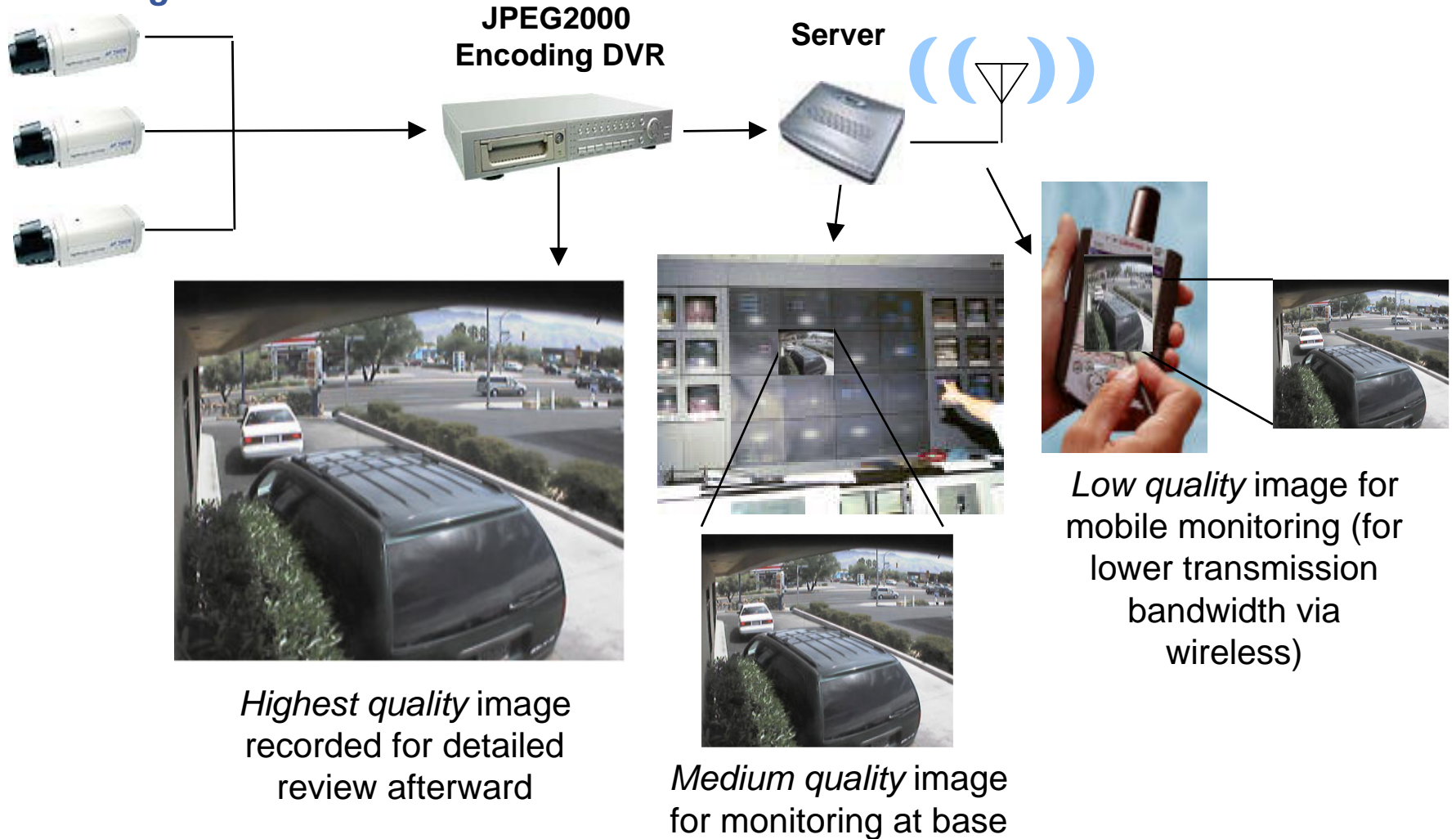
*-"Motion JPEG2000 in Video Processing," Master's Thesis, Wei Yu, Washington University July 2002

Compression Comparisons

	Advantages	Disadvantages
Motion JPEG	Most popular standard (cheapest to implement?); low process latency; used successfully in court	Least efficient compression compared to others; obvious degradation with any bit error; Unsuitable for text; no scalability
MPEG2/4, H.264	Ideal for streaming (very efficient compression, especially H.264); simpler decode process than encode; prevalent PC standard	Complicated encoding (MPEG4 / H.264); long process latency; weak error resilience (transmission errors affect multiple frames); License and user content fees for MPEG4; no still image capability (legal implications); not ideal for video editing; very limited scalability
JPEG2000	Low process latency (ADV202); better compression efficiency than JPEG; complete scalability; bit-error resilient; lossy/lossless capable; suitable for text and images;	Less compression efficient than MPEG (ex: DVD-quality- VERY rough estimate: 10-12Mbps (JPEG2000); 8-10Mbps (MPEG2); 4-6Mbps (MPEG4))

JPEG2000 in Surveillance

Simultaneously transmit different resolutions, frame rates, and quality levels with no transcoding





JPEG2000 in CCTV Applications (FAQ)

◆ **Why consider JPEG2000 when there is MPEG2/4 or H.264?**

- *More flexibility* - encode at the highest quality (for detailed viewing) but only send portions that fit lower transmission bandwidth, resolution, frame rate, etc.
 - ◆ To address HDD space concerns, the customer can reduce bit rate during scenes with no motion and increase quality when motion is detected
- *Low latency* - useful in remotely operating a camera
- *Multiplexing multiple cameras* - not possible with MPEG
- *Regions of motion can be enhanced* - not possible with MPEG
- *Higher image quality* - MPEG is not conducive toward this trend since it is 8-bits only and has no still image capability
- *Legal Issues* – Some countries (Australia) do not allow MPEG still images as legal evidence (JPEG, on the other hand, has been used in the UK courts)
- MPEG is “digital VHS” – nothing can be done with the data