



JPEG 2000 Extensions

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ISO/IEC 15444 – JPEG 2000

- o Part 1 - Core coding system
- o Part 2 - Extensions
- o Part 3 - Motion JPEG 2000
- o Part 4 - Conformance
- o Part 5 - Reference software
- o Part 6 - Compound image file format
- o Part 8 - JPSEC: Secure JPEG 2000
- o Part 9 - JPIP: Interactivity tools, APIs and protocols
- o Part 10 - JP3D: Extensions for 3D data
- o Part 11 - JPWL: Wireless
- o Part 12 - ISO Base Media File Format
- o Part 13 - An entry level JPEG 2000 encoder



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Work Plan

	CFP	WD	CD	FCD	FDIS	IS
JPSEC	02/03	02/10	04/04	04/11	05/07	05/11
JPIP	02/03	02/07	03/03	03/07	04/04	04/10
JP3D	02/03	02/10	05/07	05/11	06/03	06/07
JPWL	02/07	03/07	04/07	05/03	05/07	05/11



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JPSEC: Secure JPEG 2000

Services addressed:

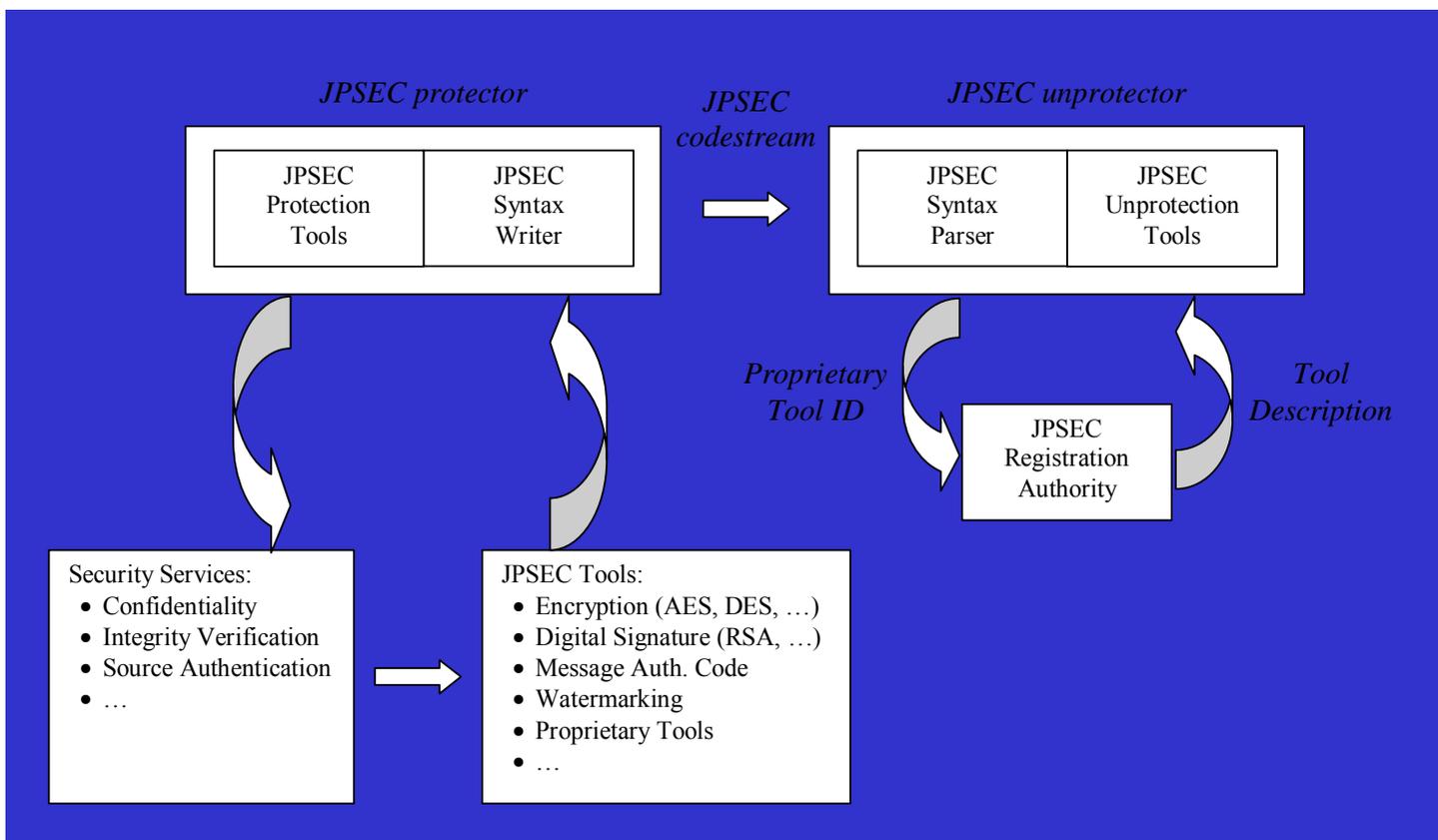
- Confidentiality
 - Encryption or ciphering to conceals original content
- Integrity verification
 - Image data integrity: bit exact verification
 - Image content integrity: perceptual meaning verification
- Source authentication
 - Identity of the party which generated the content
- Conditional access
 - Restrict access to image data or parts of it
- Secure scalable streaming and transcoding
 - Streaming and transcoding without unprotecting the content
- ...



JPSEC Framework

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Open and flexible framework

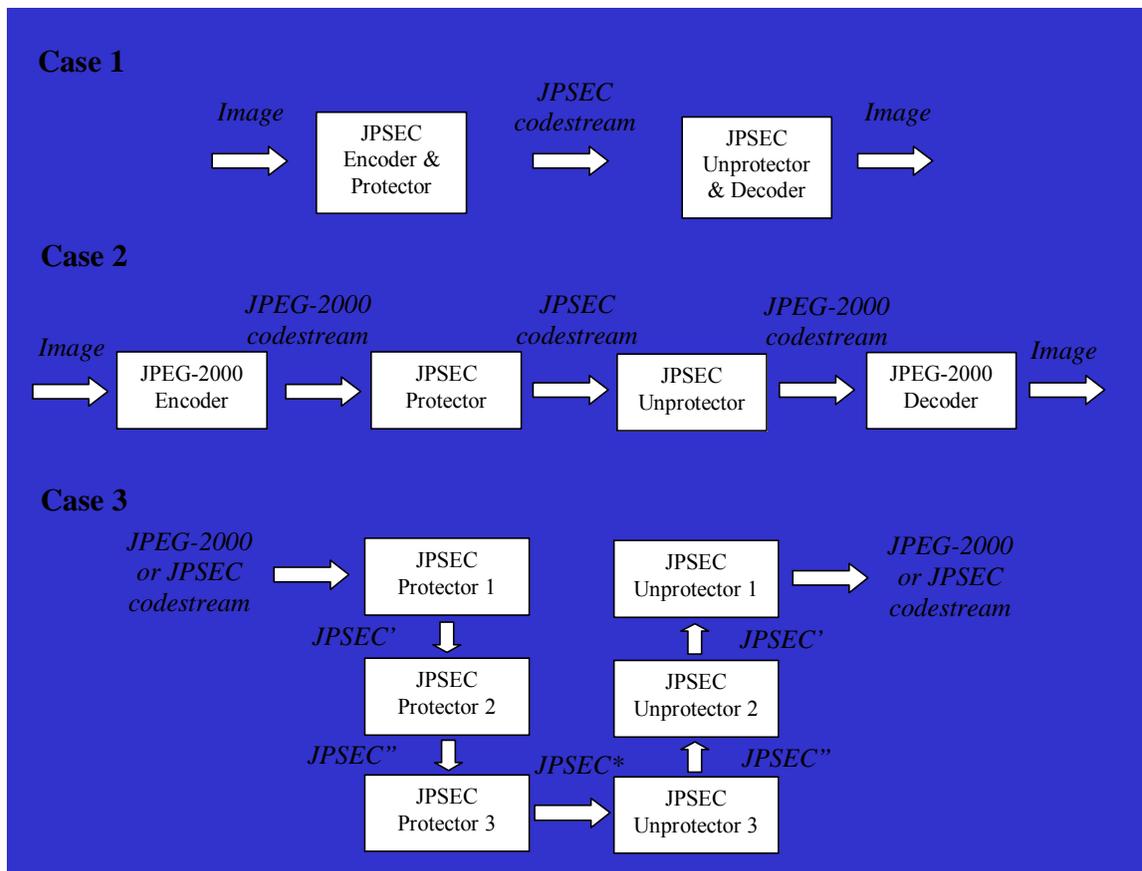




JPSEC Framework

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Creation and consumption of JPSEC content





JPSEC ROI -Scrambling

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- o Add pseudo-random noise
- o Performed in the wavelet domain
- o Based on ROI mechanisms in JPEG 2000
- o Efficient for arbitrary-shape regions
- o Adjust distortion from fuzziness to noise
- o Application
 - Video surveillance preserving privacy





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JPIP: Interactivity tools, APIs and Protocols

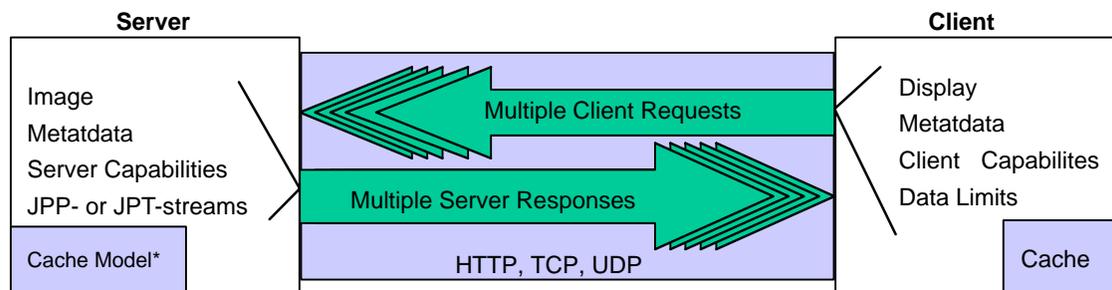
- Tools for supporting image and metadata delivery in a networked environment
- Exploit JPEG 2000 properties
 - Random access
 - Codestream reordering
 - Incremental decoding



JPIP: Interactivity tools, APIs and Protocols

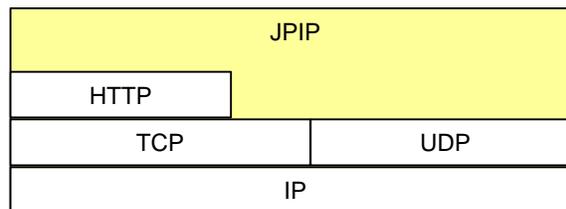
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Protocol overview



*Only if State is present

Protocol stack





JP3D: Extensions for 3D Data

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- o Extension of JPEG 2000 parts 1 and 2
- o Compress samples along all three dimensions
- o Targets applications:
 - Medical Imaging (MRI, CAT, PET scans)
 - Scientific Modeling and Simulation
 - Remote Sensing (hyperspectral imagery, geophysical/astrophysical measurements)
 - ...



JP3D: Extensions for 3D Data

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- o Extends standard JPEG 2000 technology from two to three dimensions
 - Wavelet transform
 - Quantization
 - Coefficient bit modeling
- o New technologies
 - 3D context probability models for entropy coding
 - Variable resolution sampling grids
 - Coding of floating point data



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JPWL: Wireless

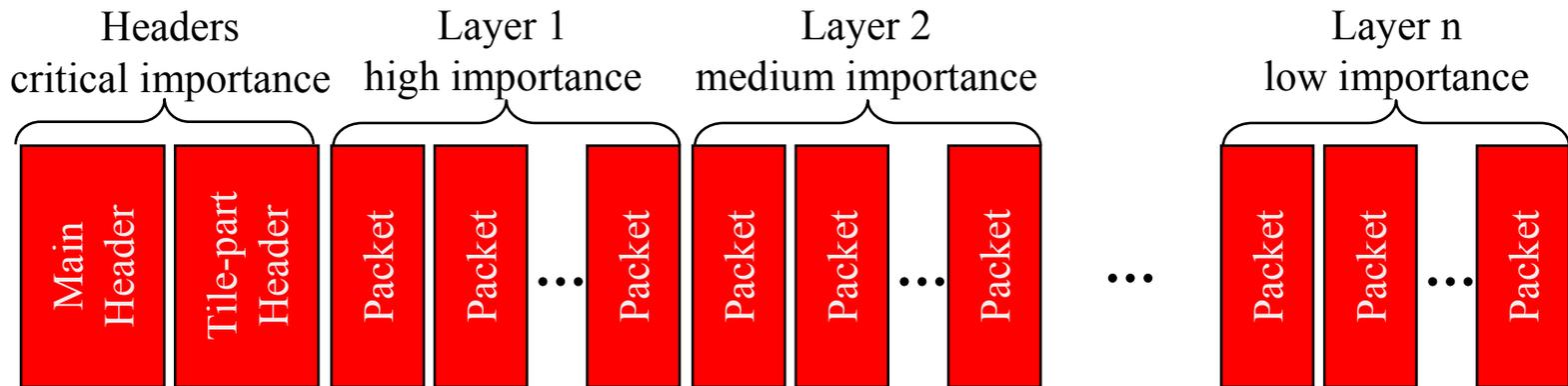
- Multimedia wireless applications are becoming ubiquitous
 - Sales of camera-equipped cell phones exceed those of standalone digital cameras
 - Importance of efficient and robust wireless imaging solutions
- JPEG 2000 is well-suited for wireless applications
 - High coding efficiency → good visual quality
 - Seamless scalability → quality of service and pricing strategies
- JPEG 2000 Wireless (JPWL)
 - Efficient transmission over error-prone networks
 - Normative and information tools for error protection and correction
 - Forward Error Correcting (FEC) codes
 - Header protection
 - Unequal Error Protection (UEP)
 - Data partitioning and interleaving
 - Robust arithmetic coding



JPWL: Wireless

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- Headers are most important part of code stream
 - FEC for strong protection of Main and Tile-part headers
 - Add redundancy bits while keeping backward compatibility
- Progressive quality transmission
 - Layered code stream: each layer contributes to improve quality
 - UEP: decreasing protection as layer importance decreases



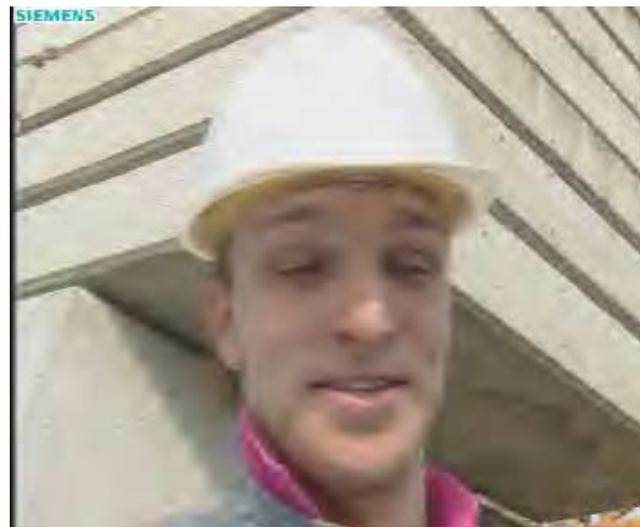


JPWL Unequal Error Protection

384 kb/s, CIF, 15 f/s, 3 quality layers
BER=10⁻³ (WCDMA error patterns)

sequence	PSNR JPEG 2000	PSNR JPWL
City	24.98	26.65
Crew	28.09	30.43
Foreman	25.73	28.07
Harbor	21.19	22.60
Mobile	17.71	18.63
Soccer	27.35	29.80
<i>average</i>	<i>24.18</i>	<i>26.03</i>

JPEG 2000



JPWL



Motion JPEG 2000 vs MPEG-4

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	Motion JPEG 2000	MPEG-4
Coding	Intra-frame Wavelet	MC DCT
Artifacts	Blur Ringing	Block Ringing
Error resilience	High	Low
Encoder complexity	Low	High
Rate control	Accurate	Inaccurate
Coding Delay	Low	High
Scalability	Efficient	Inefficient



Motion JPEG 2000 vs MPEG-4

128 kb/s, QCIF, 6 f/s

BER=10⁻⁴ (WCDMA error patterns)

	PSNR Motion JPEG2000	PSNR MPEG-4 IPP..IPP
Balloons	27.41	26.44
New York	35.06	34.25
Mobile	22.87	24.67
Animals	33.63	33.36
Letters	26.90	25.34
Waterfall	29.62	31.29
Football	32.48	30.21
Suzie	38.25	36.82
Tempest	26.69	27.75
<i>average</i>	<i>30.32</i>	<i>30.01</i>

JPEG 2000



MPEG-4

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The End !

o Questions?