



International Telecommunication Union

# The Impact of Video Surveillance Technology on Future Video Coding Standards

Dr. Michael J. Horowitz

Office of the CTO

CoVi Technologies



ITU-T

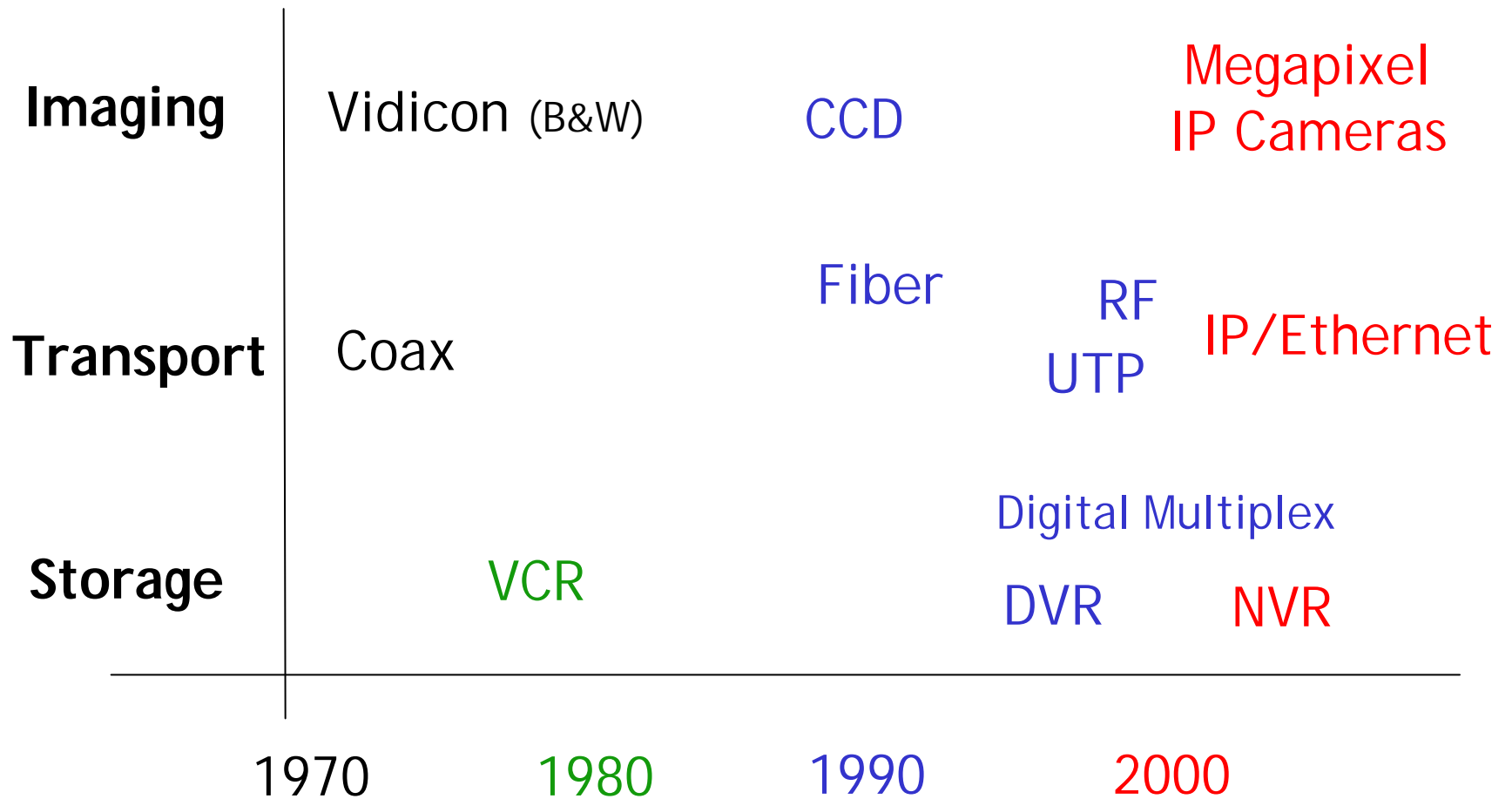
# Talk Overview

- Background
  - Evolution of video surveillance
  - System overview
  - Video coding standards in surveillance
- Video feature requirements
- System cost considerations
- Concluding remarks



ITU-T

# Evolution of Video Surveillance





ITU-T

# Evolution of Video Surveillance



Analog Video to DVR  
(NTSC with CIF Encoding)



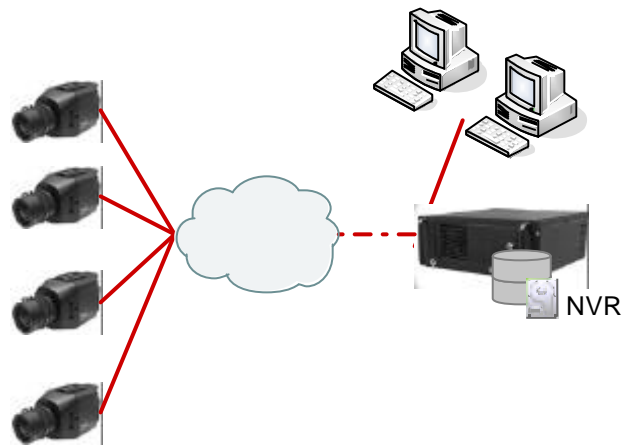
Megapixel IP Camera  
(1280x720)



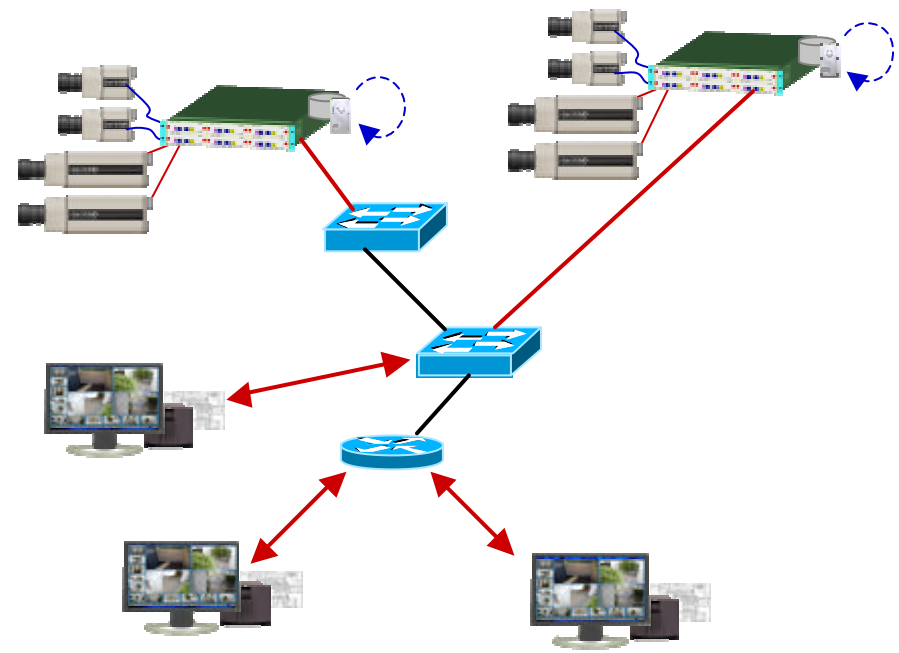
ITU-T

# Video System Overview

## Centralized IP Video



## Distributed IP Video





# Video Coding Standards in Surveillance

ITU-T

- o Simplifies exchange of video information
  - Component-to-component
  - Manufacturer-to-manufacturer
- o Compatible with feature requirements
- o Reasonable impact on system cost



ITU-T

# Video Feature Requirements

- Temporal scalability (active JVT topic)
  - Graceful degradation of archive video
  - Heterogeneous environments
    - Guard on patrol
    - Central monitoring station
    - Forensic analysis
  
- Error resilience ✓
  
- Flexible source formats ✓

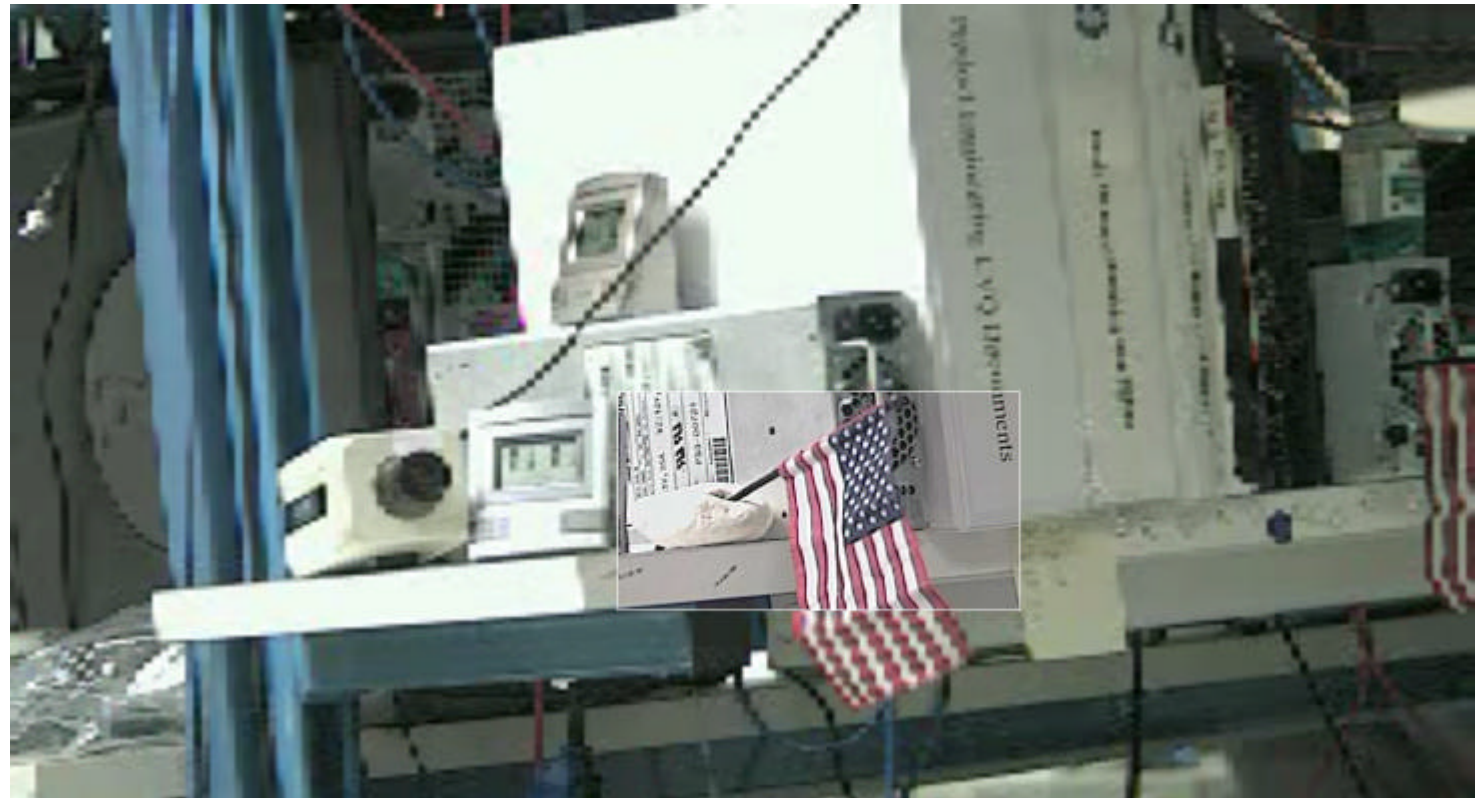




ITU-T

# Feature Requirements (continued)

- o Spatial scalability (active JVT topic)
  - Graceful degradation of archive video
  - Heterogeneous environments
  - Selectively code regions of interest



ITU-T VICA Workshop  
22-23 July 2005, ITU Headquarter, Geneva





ITU-T

## Feature Requirements (continued)

- Low latency (<350ms one-way delay) ✓
  - Real-time viewing
  - Remote camera control
  
- Trick modes for archival playback ✓
  - Intra-pictures
  - SI and SP pictures (H.264)
  
- Content retrieval from archive ✓
  - Time stamp-based
  - Alarm event-based (meta data)



ITU-T

## Feature Requirements (continued)

- o Video data integrity ↔
  - Error detection
  - Tamper resistance
  
- o Alarm events from video content ✗
  - Motion detection
  - Object tracking
  - Face recognition





ITU-T

# System Cost Considerations

- Computational complexity ✕
  - Encoding at camera
    - Hardware cost
    - Power dissipation  $\Rightarrow$  Heat
      - Increased sensor noise
      - Increased mechanical cost
  - Multiple simultaneous decoders
- Coding efficiency  $\Leftrightarrow$ 
  - Video transport: cost per kilobits / second
  - Video storage: cost per megabyte



ITU-T

# Concluding Remarks

- Existing & emerging video coding standards meet most needs
  
- Recommended future enhancements
  - Reduced computational complexity
  - Enhanced tools for video data integrity
  - Tools to facilitate video event generation
  - Improved coding efficiency