



Perfect Video over Any Network

State-of-the-art Technology for Live Video Communications



Who We Are



- Established in 2004
- Focus on the Professional Video Market
 - Over 20 years of combined experience in **Broadcast** and **Enterprise** Video over Internet Protocol (IP) products
 - Patent-Pending Error Correction & Quality of Service (QoS)
 - Proven Patient-Critical Video Telemedicine Communications
- Our Competitive Edge
 - 6 Pending US Patents
 - Leading-edge QoS technologies for live video streaming
 - Adaptable to any IP network.

Reference Customers



CNN.com



NBC

The
WALT DISNEY
Company



controlware

communicationssystems

mobity.



CBS



communications

GCS

GENESIS

NETWORKS



FRONTIERS

WORLDWIDE

KOLLMORGEN

Electro-Optical

SAIC



BAR CODE SPECIALTIES

Your Single Source for Everything Barcode and RFID

Advanced Video Transport & Interfacing



- Support for Nearly Any Video Interface:
 - Digital: ASI, SDI, Firewire™, Ethernet, WiFi, WiMax
 - Analog: S-Video, Composite, Component
- SNMP & Web System Control & Device Management
- Fast, Custom Product Design Capability
- Low-Latency Live Video Transport
- Efficient & Reliable Video-on-Demand Transport
- Emphasis on Broadcast Quality Video

Product Offerings



- Hardware Codecs
 - MPEG2 & MPEG4-SP (MPEG 2+4)
 - ProMPEG FEC & Patent-Pending ARQ Error Correction
 - Digital (SDI) & Analog Interfaces
- HD MPEG-2 4:2:2/4:2:0 Decoder with HD-SDI Output
- Firewire Gateways: HDV, DV & DVCPPro-HD
- DVB-ASI / IP Gateways w/Error Correction
- File Streamer Software
- Internet Streaming-Video QoS Replicator Servers
- HD & SD Software Decoder (StreamViewer):
 - MPEG-2, MPEG-4 (parts 2 & 10), H.264, DV, DVCPProHD

Market Addressed



- Broadcast Backhaul
 - DVB-ASI to IP Gateways
- Production
 - Firewire IP Gateway
 - HD Decoder
- Education and Corporate Communications
 - MPEG 2+4 Codecs
- Enterprise
 - Firewire Gateway
 - MPEG 2+4 Codecs
- Retail
 - File Streamer

Advantages



- IP technology Know How
 - Over 20 years experience in Video & Audio / IP transport
- ProMPEG Standards-Compliant FEC
 - Participants & compatible with industry standard for IP transport
- Qvidium Advanced FEC (patent-pending)
 - Goes beyond the capability of ProMPEG FEC
- Qvidium ARQ (patent-pending)
 - Rapid re-send no additional Overhead lower processor overhead
 - Only error correction to handle wireless & Internet connections

Streaming Video / IP Challenges



- Lost Packets
 - Network congestion
 - Poor connections
 - Overloaded routers & gateways
- Out-of-order packets
 - Dynamic routing
 - Small packet routing
 - Packet prioritization
- Stream Jitter
 - Queuing delay
 - Dynamic routing transport delay

Solutions

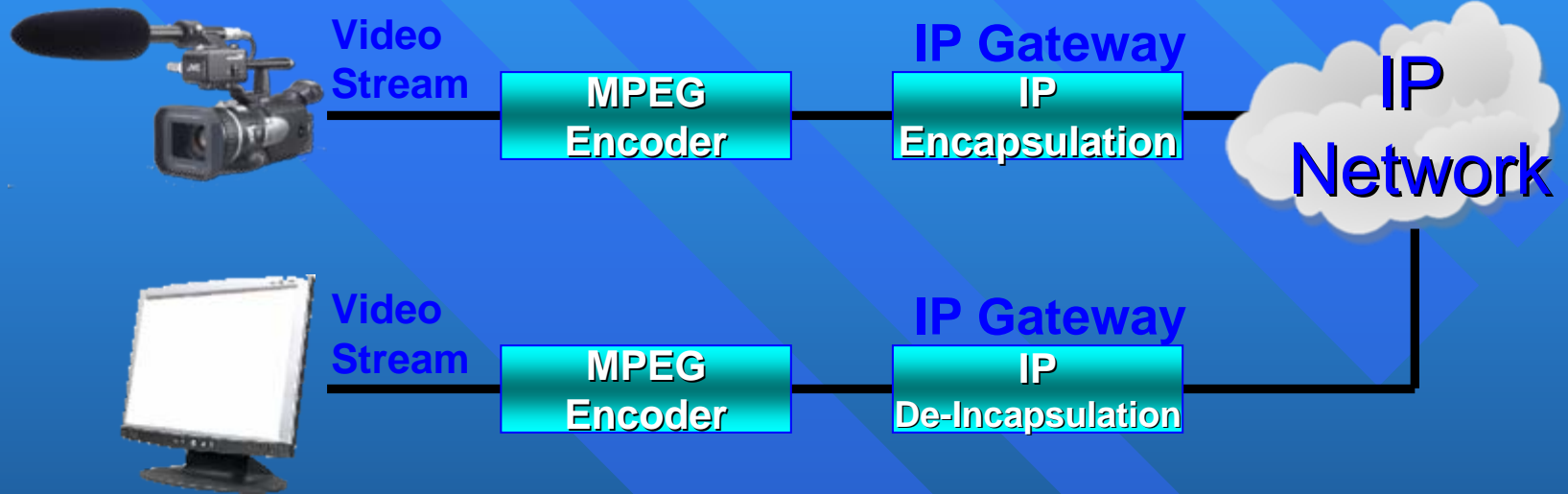


- FEC
 - Adds additional packets to re-build lost data
- ARQ
 - Intelligent, rapid re-transmission of lost data
 - Similar to TCP/IP without the disadvantages
 - Uses UDP, no rate limiting, eliminates ACKs
 - Fixed, bounded delay
 - Can be used over satellites and long links
 - Maximizes Video Throughput
 - Optimized for low delay video
 - Automatic configuration

IP Gateway Application



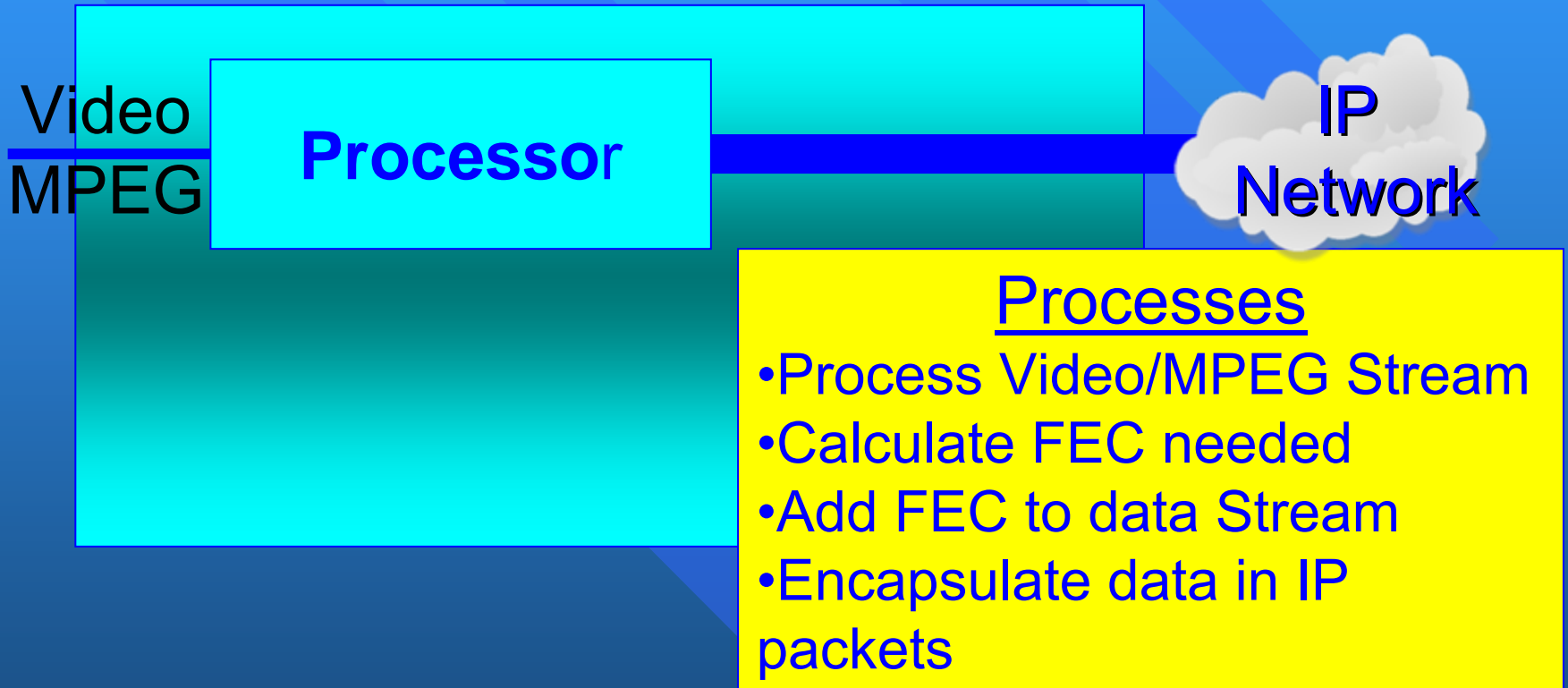
FEC





A Closer Look

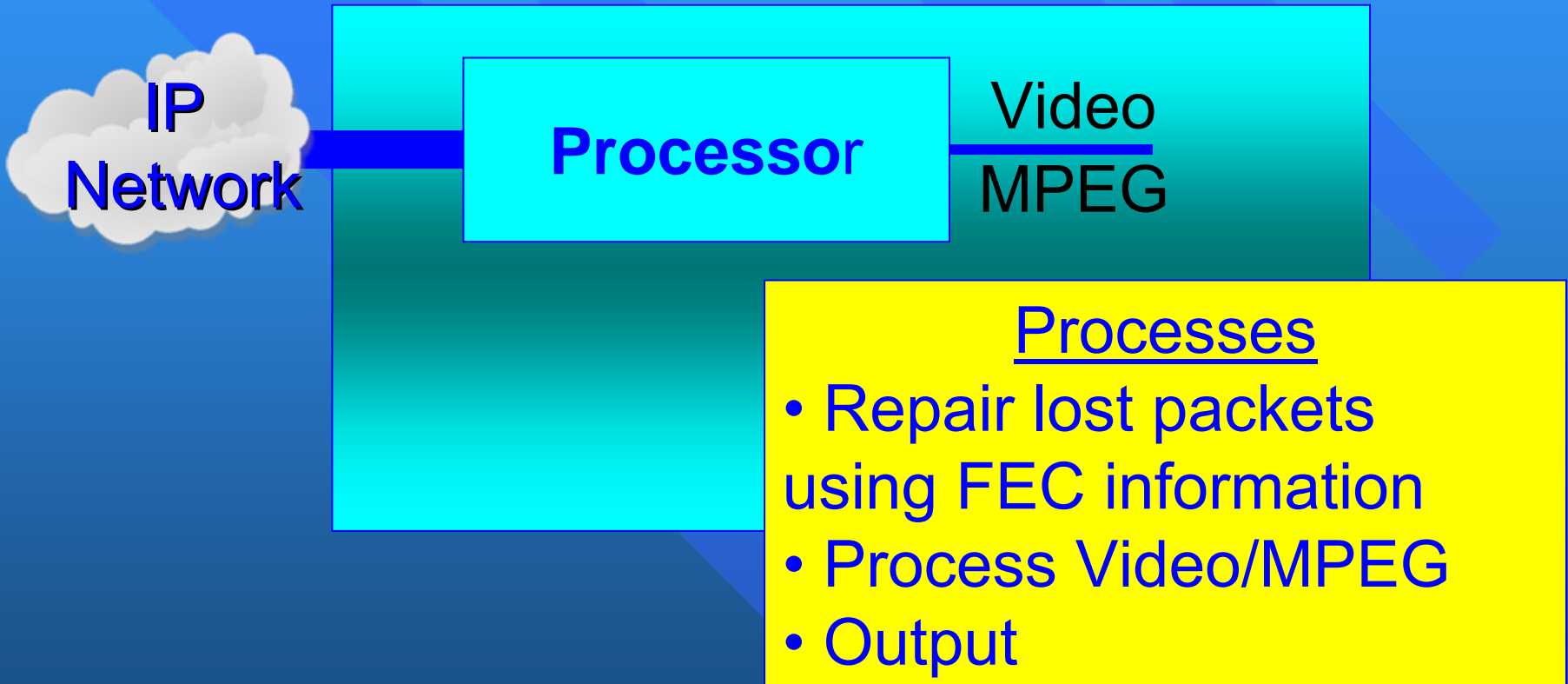
IP Gateway Sender



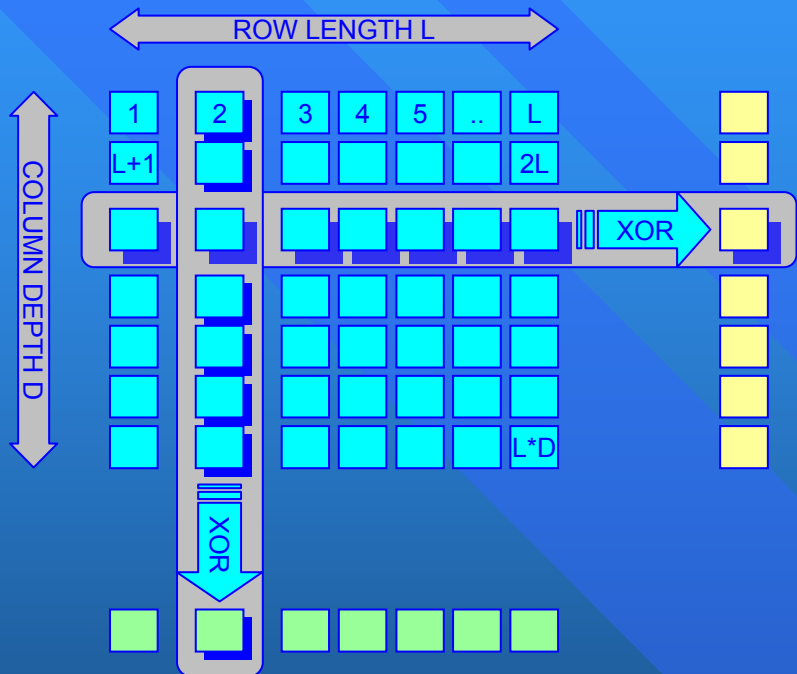
A Closer Look






IP Gateway Receiver



Row Column FEC



-  *Payload Packet*
-  *Column FEC Packet*
-  *Row FEC Packet*

Default mode: Column FEC
Typical overhead 5-10%

**Optional Mode:
Column and Row FEC**
Typical Overhead 6% - 15%

Common properties

- Burst loss up to row length correctable via data interleaving
- Max row length: 250
- Max $L \times D$: 1500
- Latency with skew matrix $\sim L \times D$

FEC Premise



- Understanding of the network conditions
- Fixed, Preset FEC Rows and Columns
- Hope you get the correct settings
- If the network condition deteriorates
 - Stop Transmission
 - Change FEC Settings
 - Re-Start Transmission
- Challenging for live transmission
 - Must find break in programming to make change to FEC settings

FEC Pros and Cons



Pros

- Can fix many problems
- Standardized

Cons

- Needs Powerful CPU
- Hard configure
- Delay for interleaving
- Not Dynamic
- Add'l BW Required
- Cannot handle large random packet loss

ARQ

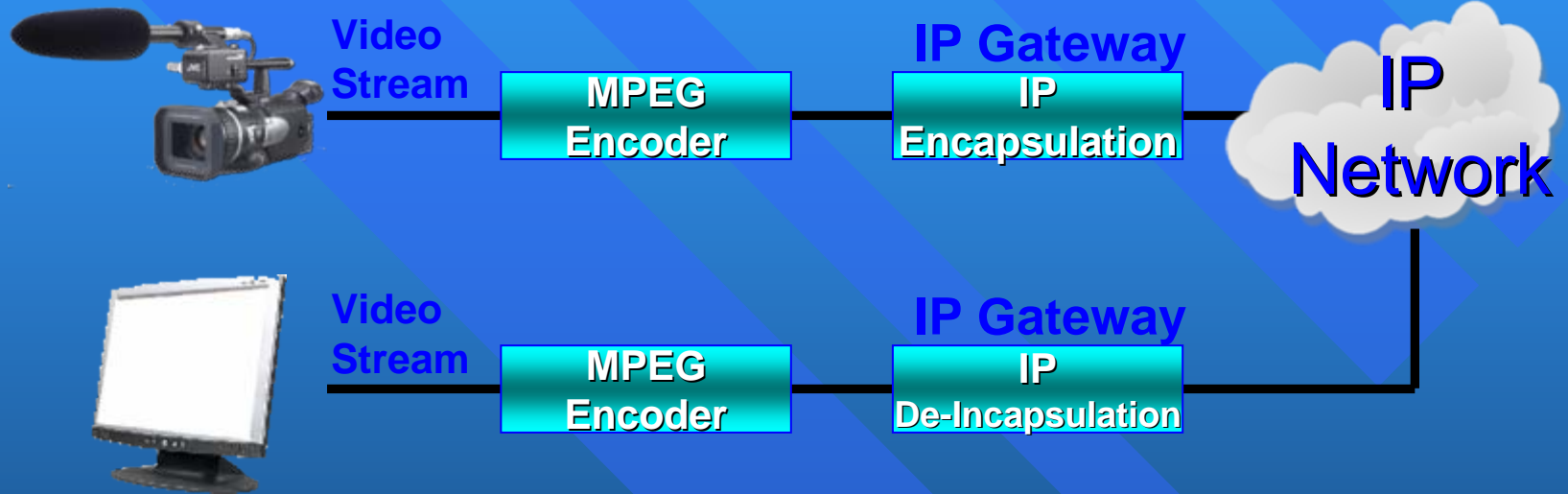


- Simple 2-step process:
 - Step 1: Transmit the DATA
 - Step 2: If there is trouble on the line re-transmit only the missing data
- Adds small fixed delay at receiver
 - Can repeat as time allows
 - Multiple retries → nearly zero loss
- Auto measurement & configuration
- Ideal for wireless connections & Internet

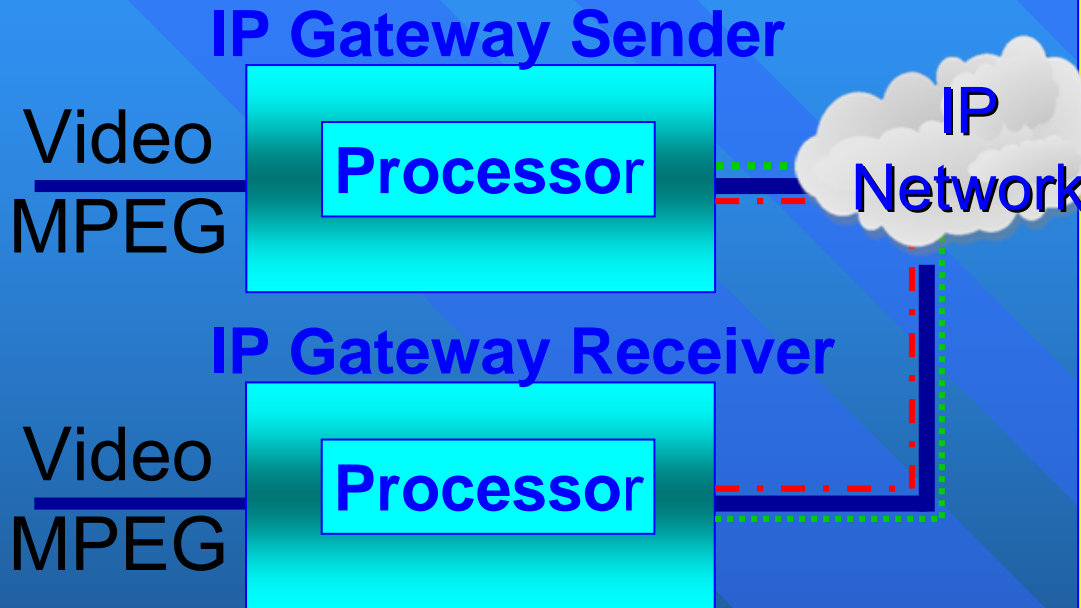
IP Gateway Application



ARQ



A High-level Look at ARQ



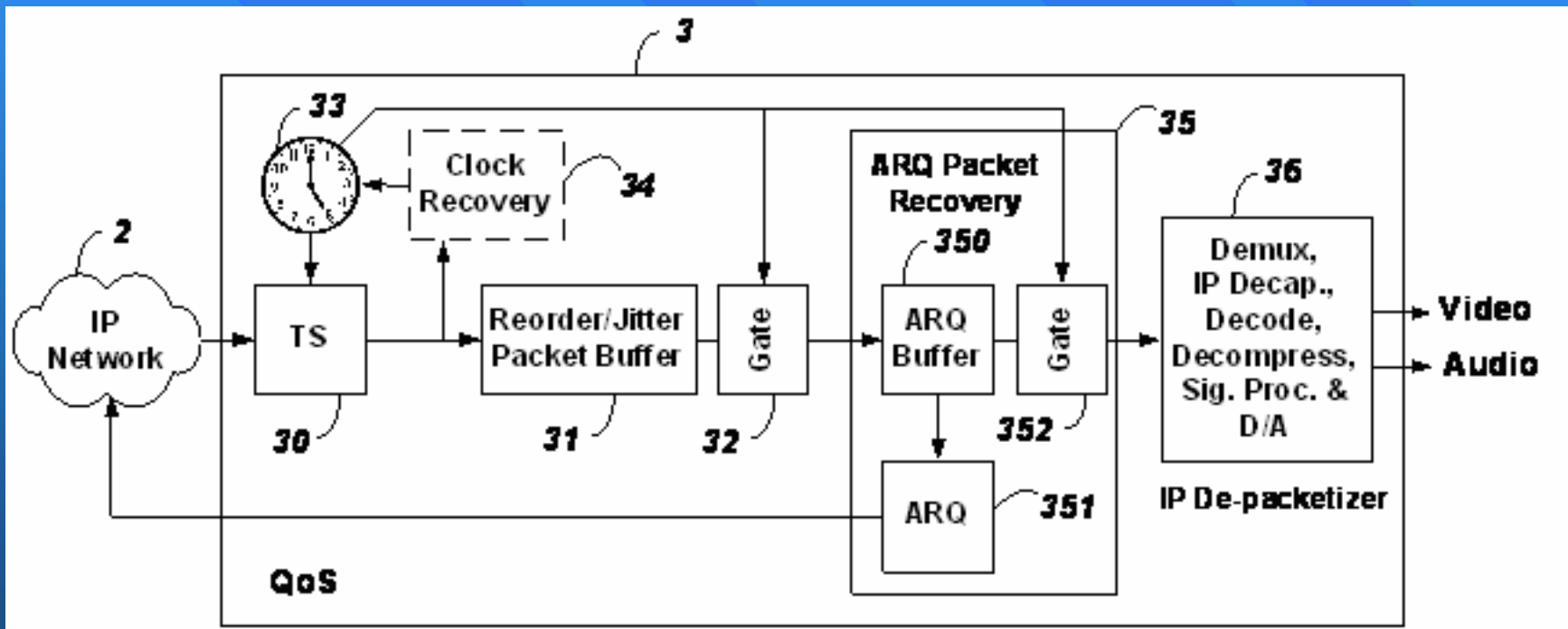
Processes

- Process Video/MPEG Stream
- Encapsulate data in IP packets
- Send Packets out
- If data is lost request for re-send is sent from Receiver

A Detailed Look at ARQ



Patent for Low-Latency Automatic Repeat Request Packet Recovery Mechanism for Media Streams

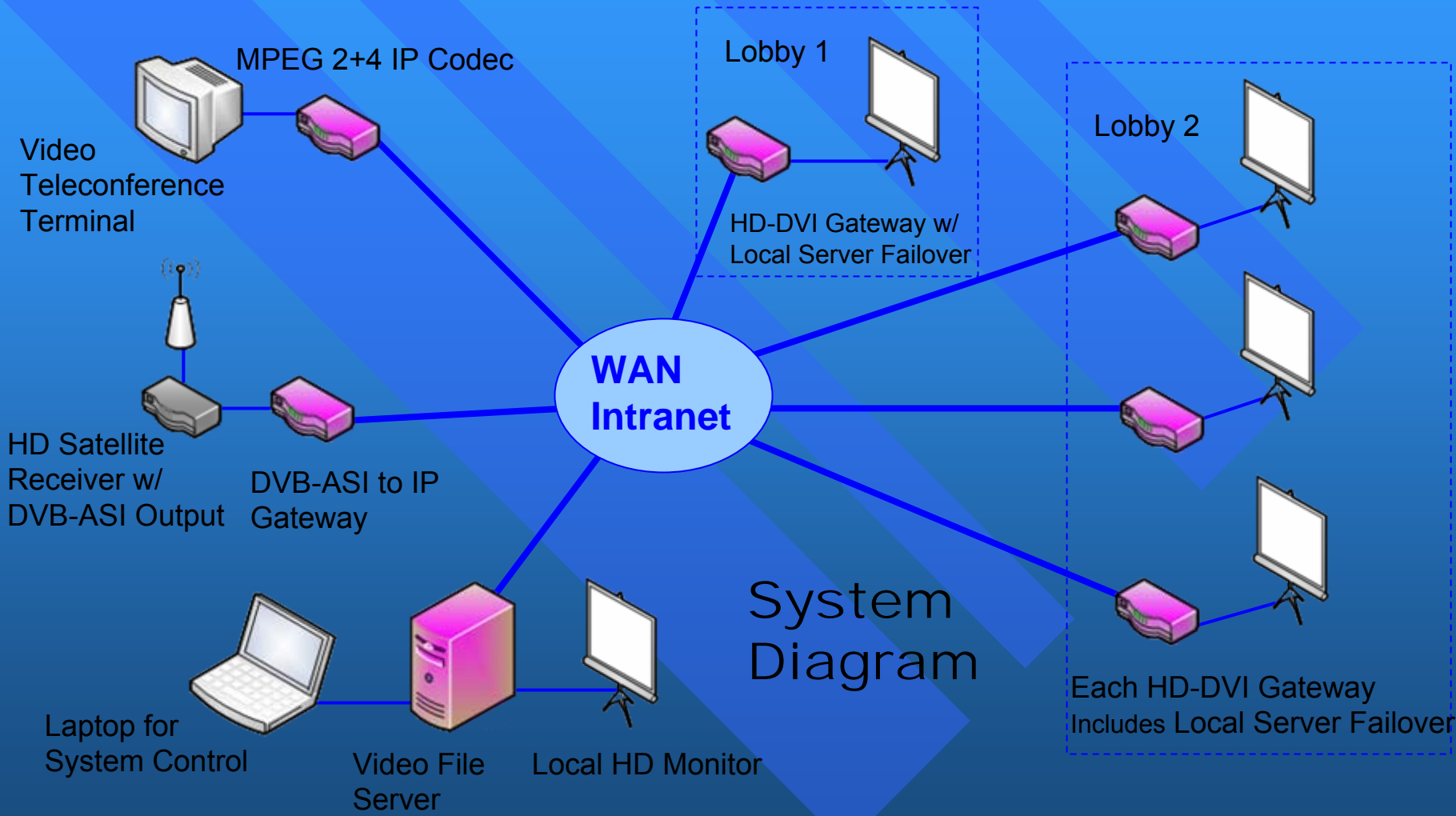


Advanced Microsoft Video Technology Integration



- Windows Media 9 video encoding
- Windows DirectShow
 - Network Send and Receive QoS and Error Correction Filters
- Video and Audio multiplexing
- Patent Pending Galois Field FEC
 - Protects Windows Media 9 I,B,P video frames independently
 - Protects audio frames optimally
- Synchronized pipeline for low latency playback
 - Patent pending network clock synchronization
 - Patent pending network de-jitter buffer
 - Patent pending ARQ and FEC Error Correction
 - Audio and Video DirectShow Rendering

Deployed Video / IP System Example



System Diagram