Opportunities for Data Broadcasting in Digital TV

Presenter: Dinkar Bhat

Triveni Digital

Copyright © 2005 Triveni Digital, Inc. All rights reserved.

DTV Broadcast Stream

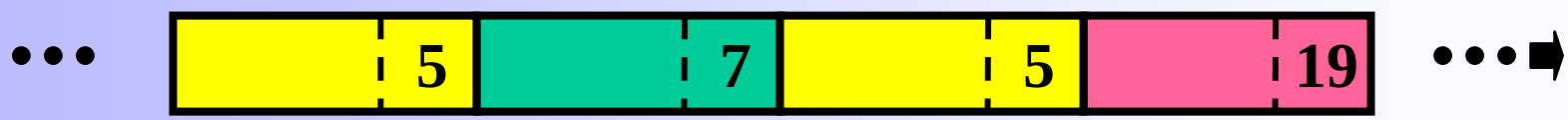
- Based on ***MPEG-2 transport stream***

- May contain multiple ***virtual channels***:
  - Video channels, each with a video stream, one or more audio streams, and possibly one or more data streams.
  - Audio channels, each with one or more audio streams and possibly one or more data streams.
  - Data-only channels, each with one or more data streams.

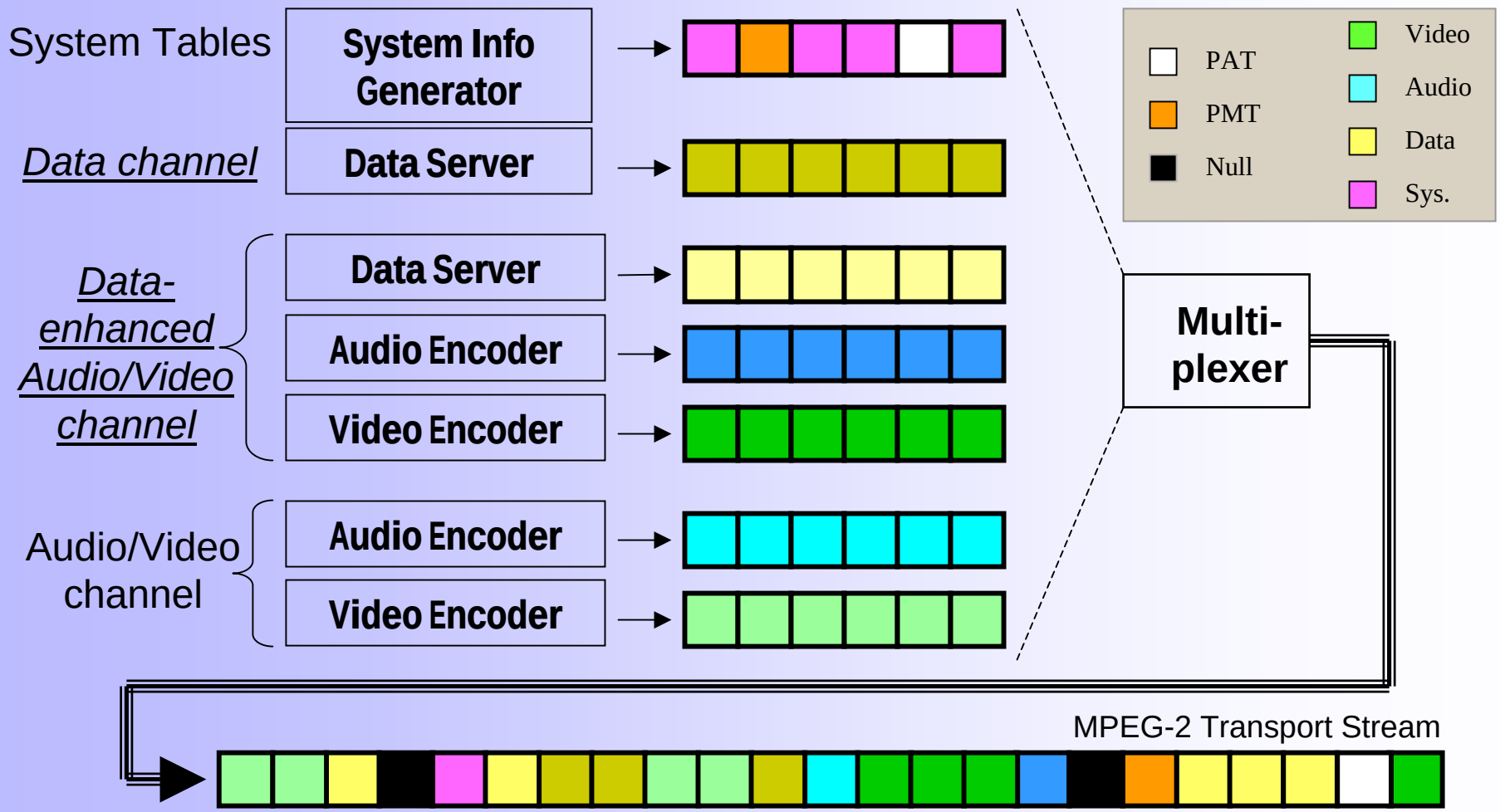
- Data can be anything - files, directories, streams!!

MPEG-2 Transport Stream

- Consists of 188-byte ***transport packets***; 4 byte header, 184 byte payload in each
- Conveys interleaved ***program elements*** and system streams -- audio, video, data, PSI, ...
- ***Packet id*** (*PID*) in packet header identifies the program element or system stream.

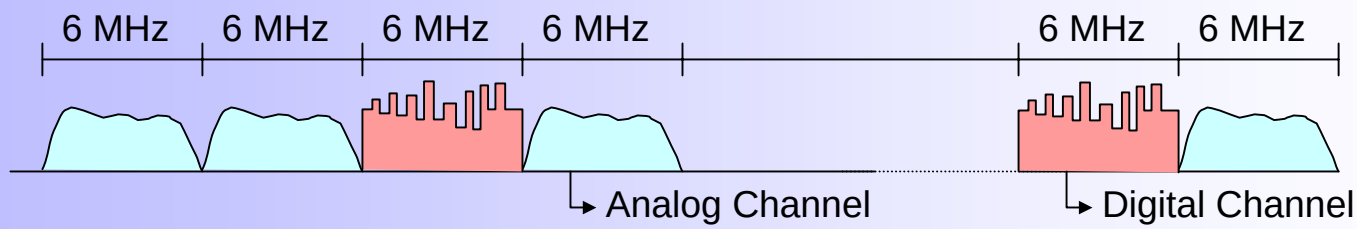


Transport Stream Encoding

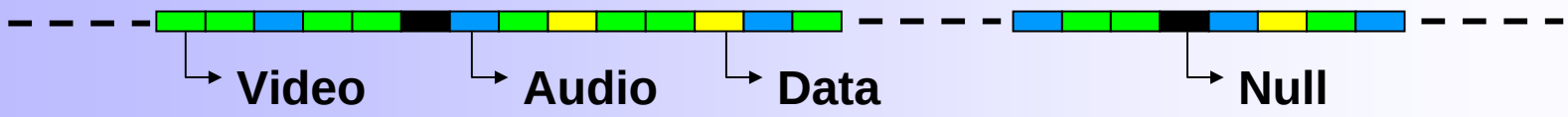


Bandwidth for Datacasting

6 MHz DTV broadcast band



Provides 19.4 Mbits/sec digital bandwidth w/ 8VSB



HDTV: 15 - 18 Mbits/sec for one virtual channel
SDTV: 3 - 5 Mbits/sec for one virtual channel
Leaves 1.4 - 16.4 Mbits/sec for data
(1.4 Mbps ~ T1 line; 16.4 Mbps ~ 1/3 T3 line.)

Examples of Applications

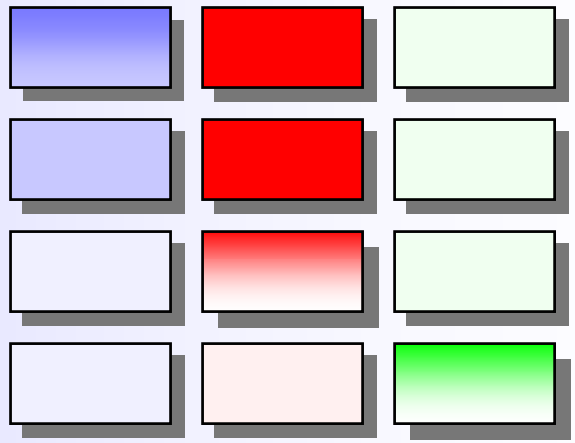
- Interactive sports statistics
- Supplemental TV program information
- E-commerce music, software, etc.
- Interactive news, weather, traffic.
- Information kiosks
- Distance learning
- Interactive advertising

Application Classification

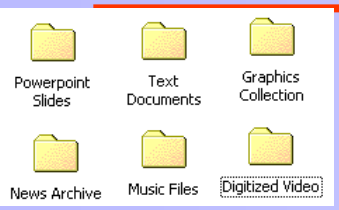
Three semi-independent axes:

Tightly Bound to TV Program	Business to Consumer	Streaming Media
Unbound	Business to Business	Discrete Data

- Interactive sports statistics
- TV program supplementary info
- E-commerce fulfillment
- Corporate communications



Data Distribution

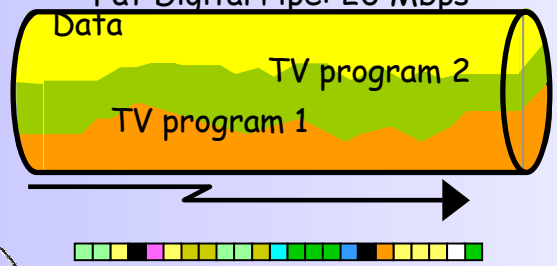


Content Packages

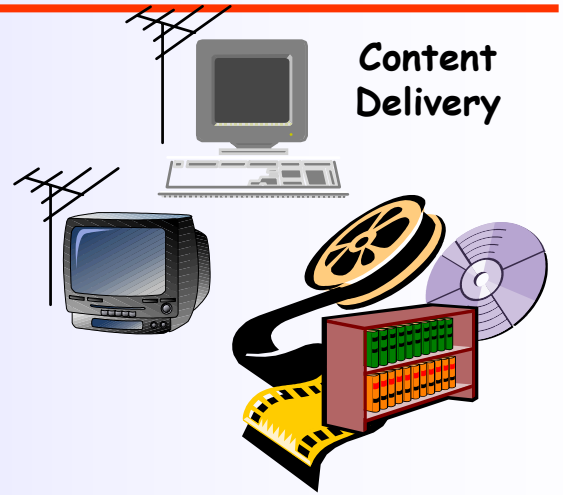
Digitized Rich Media

Internet

Cable Headend

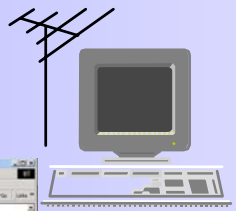


Digital Packets:
Video, Audio, Data

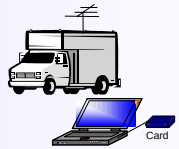


Content Delivery

Emergency Response Data



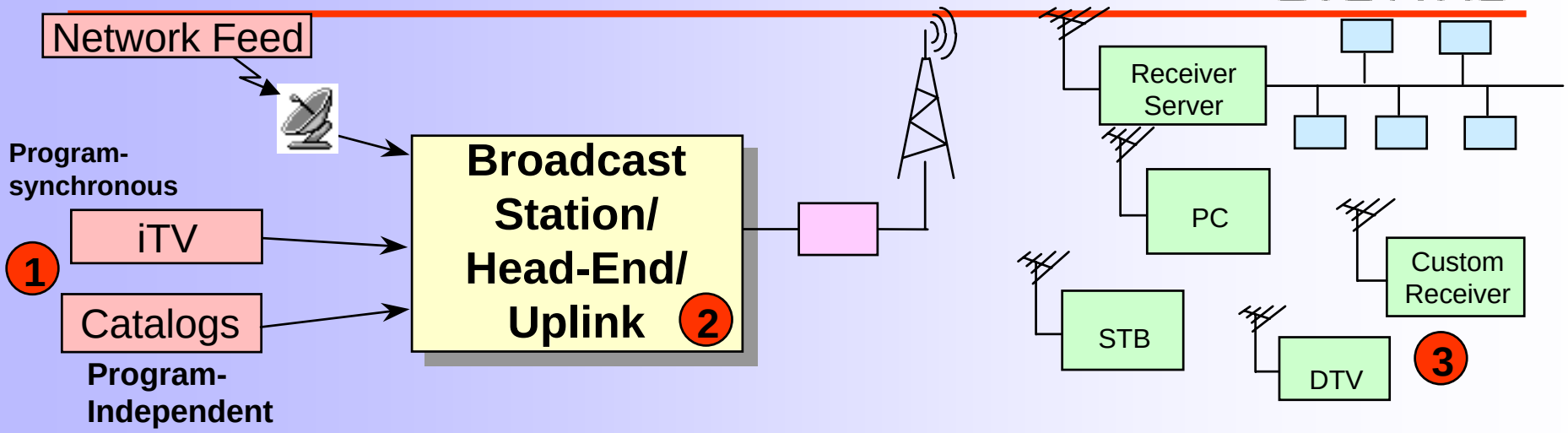
Internet Acceleration

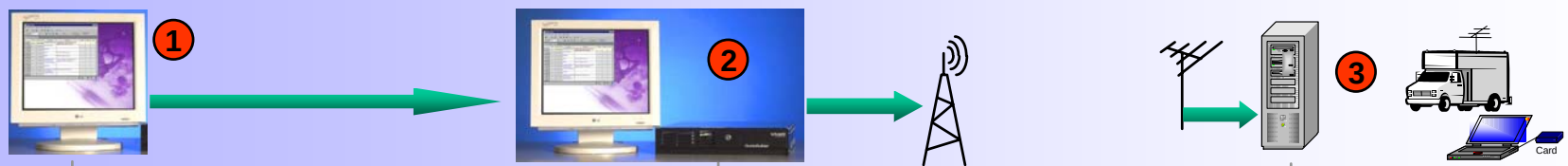


Education/Training packages

Schools, Libraries, etc

Three Component Architecture





DATA SPECIFIER

- Specify content
- Specify schedule
- Prioritize: guarantee/best effort
- Encrypt - customer access
- Generate catalogs

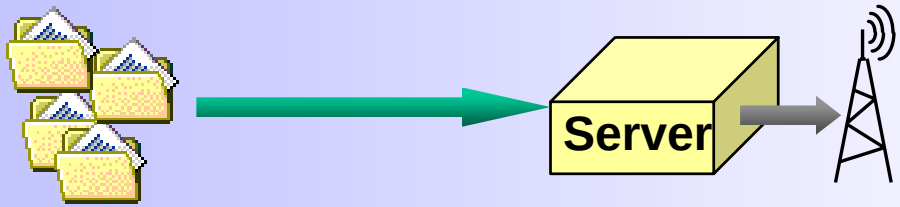
DATA SERVER

- Enforce Contract
- Allocate/control/optimize bandwidth
- Meter bandwidth usage
- Bill based on tiered rates
- Activate, deactivate new accounts

DATA RECEIVER

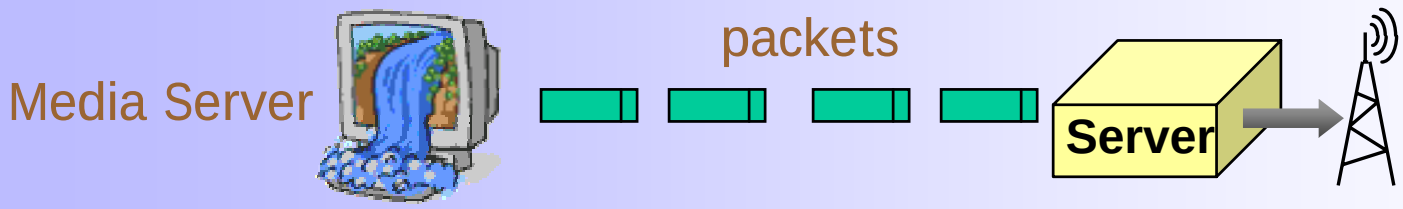
- Tune to channel, (view A/V)
- Present catalog, select data stream
- Extract data from stream
- Render / launch players
- Clean up local cache

Applications - 1



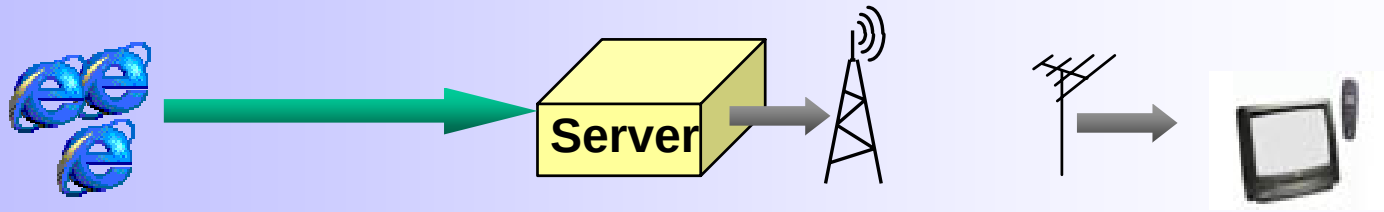
- Broadcasting “Uncoupled” File Content
  - Carried in data-only virtual channels
- Schedule Parameters:
  - Carousel count, interval between transmissions,
  - Bitrate to be allocated,
  - Content-location,
  - Mime-types for files

Applications - 2



- Broadcasting Streaming Content
  - Media server provides IP packets to the data server.
- Schedule Parameters:
  - IP addresses for receiving packets,
  - Time periods when packets will arrive at Data Server,
  - Bitrate at which packets will arrive at Data Server.
- No carousel counts or transmission intervals.

Applications - 3



- Broadcasting Interactive Content
  - Tightly coupled to the program it enhances,
- Schedule Parameters:
  - Precise timing for sending triggers,
  - Complex schedules for inserting content,
  - Additional metadata like announcements.

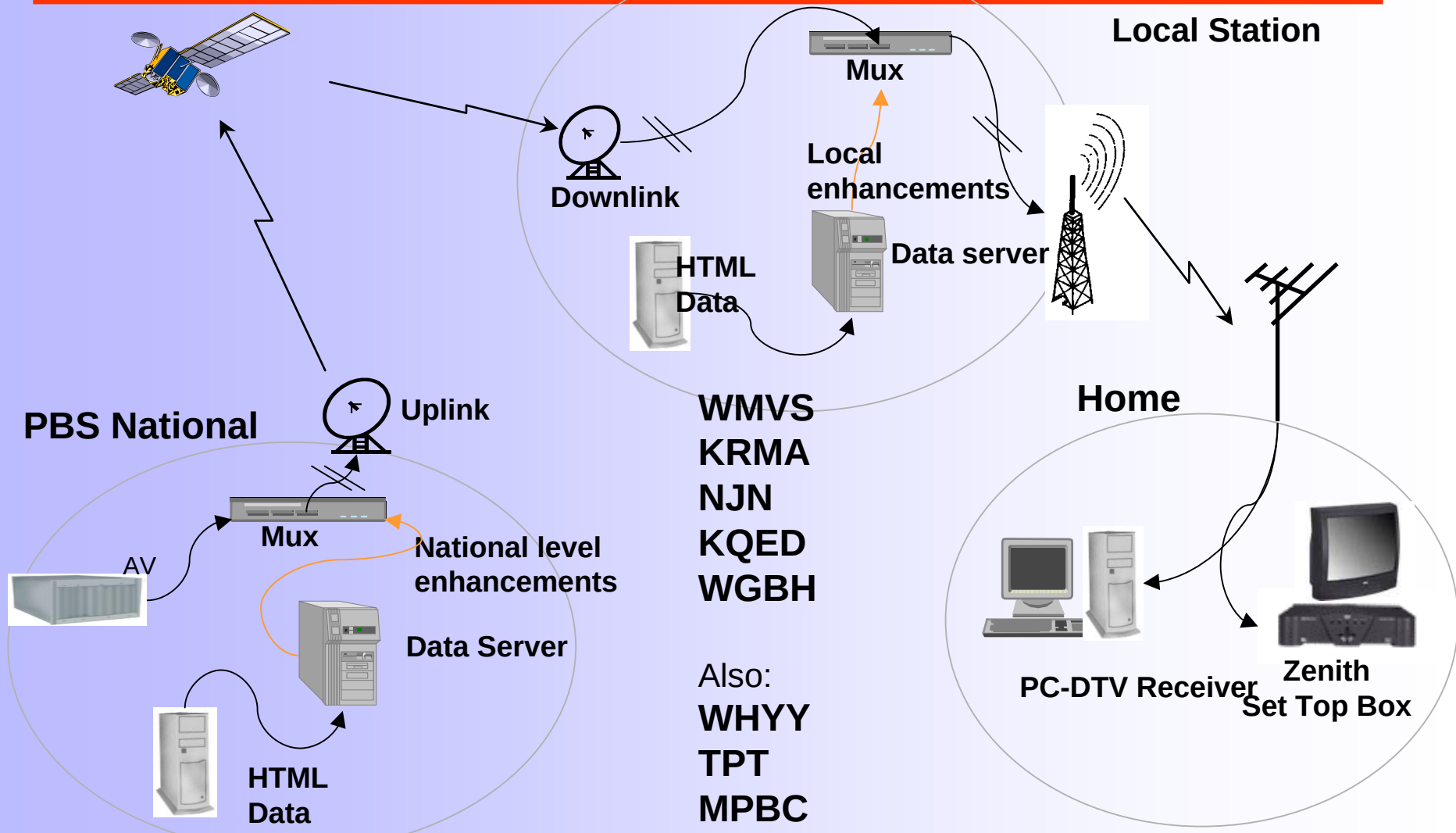
Case Studies

- Enhanced TV
  - Television program experience enriched using HTML pages
- Distance learning
  - Delivery of training material to schools.

Enhanced TV

- Sending enhancements to set-top boxes and PC-based receivers:
  - Procedural applications - Java based.
  - Declarative applications - HTML pages with CSS etc.
- Standards-based vs. Proprietary methods
  - Emerging standards - OCAP, ACAP, MHP.
- Nationwide PBS trials held in 2001

System Architecture



Sample Enhancements

Sample Enhancements (Contd.)

Sample Enhancements(Contd.)

Enhanced Content Delivery

Data components:

Carried as IP multicast data in MPEG2 transport packets:

- **Announcements:**
  Tells receiver where/how to find content & triggers
  (IETF standard for IP multicast services SAP, SDP)
- **Content:**
  HTML, graphics, etc that are to be rendered
  (HTML 4.0, PNG, JPG, CSS1, ECMAScript, DOM-T)
- **Triggers:**
  Tells receiver when to display specific graphics
  (URLs, Named vs Script, Automatic vs User-Invoked)

Technical Issues

- Tools for content development.
- Automated test environments.
  - For application developers
  - For middleware developers
- Delivery of interactive content and system information.
- Interoperability between receivers in early deployments.

Distance Learning

- Current trends in education & training
  - Increasing use of video and other multimedia content
  - Increasing stress on relevant, up-to-date materials
  - Distributed learning environments
  - Asynchronous learning (self-study) as well as classroom

- Challenges posed by these trends
  - Delivering large volumes of educational materials to many sites
  - Updating these materials frequently
  - Doing all this efficiently, reliability and economically

Internet Limitations

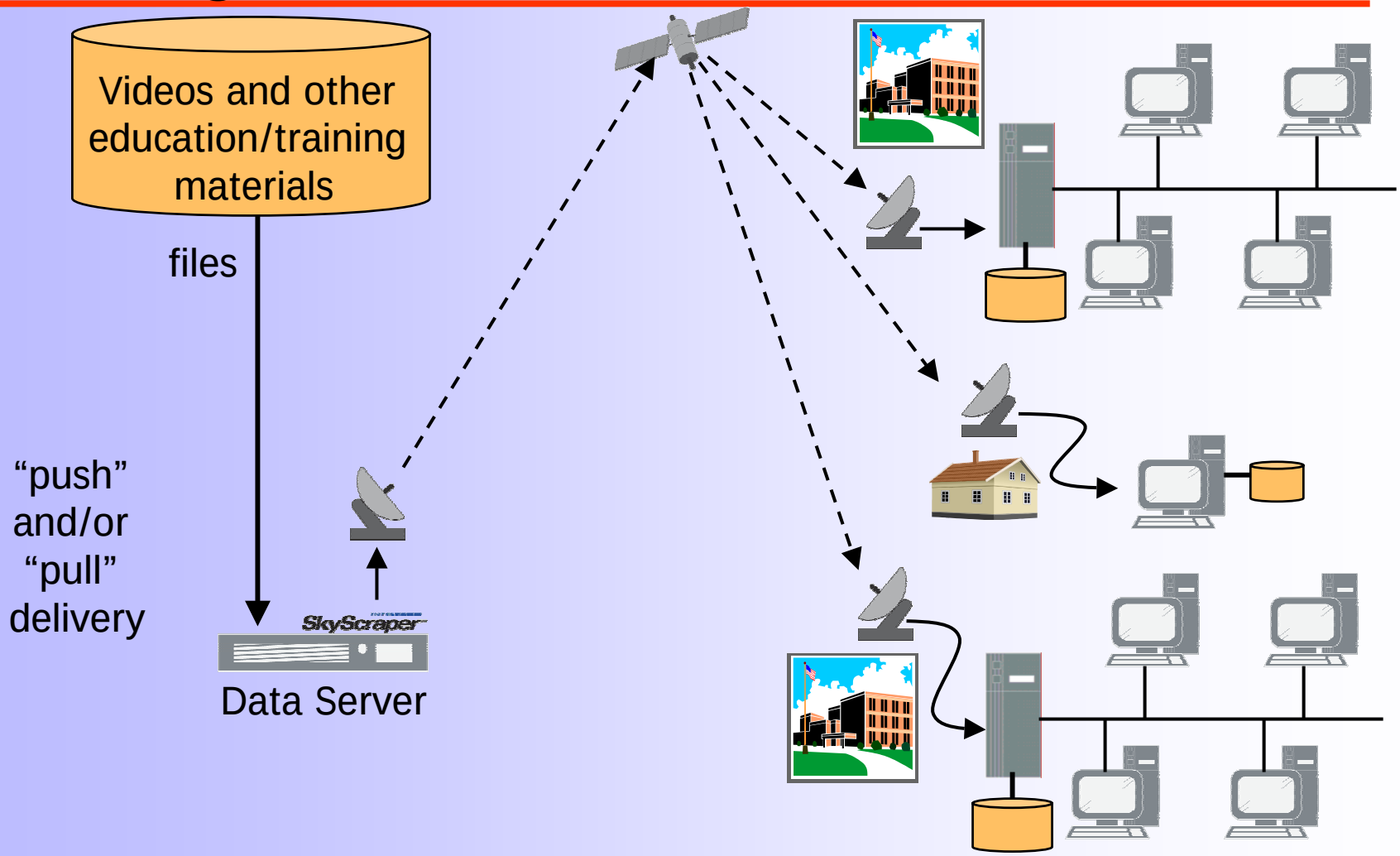
- For high quality streaming media delivery:
  - Hopeless with low bitrate Internet connection
  - Shaky even with pretty good Internet connection

- For high volume file delivery
  - Poor for education/training centers with limited Internet access
    - Rural areas
    - Many homes (self-study)
    - Military units in the field (including ships at sea)
    - Developing countries, etc.
  - Poor for pushing out updates to large numbers of sites

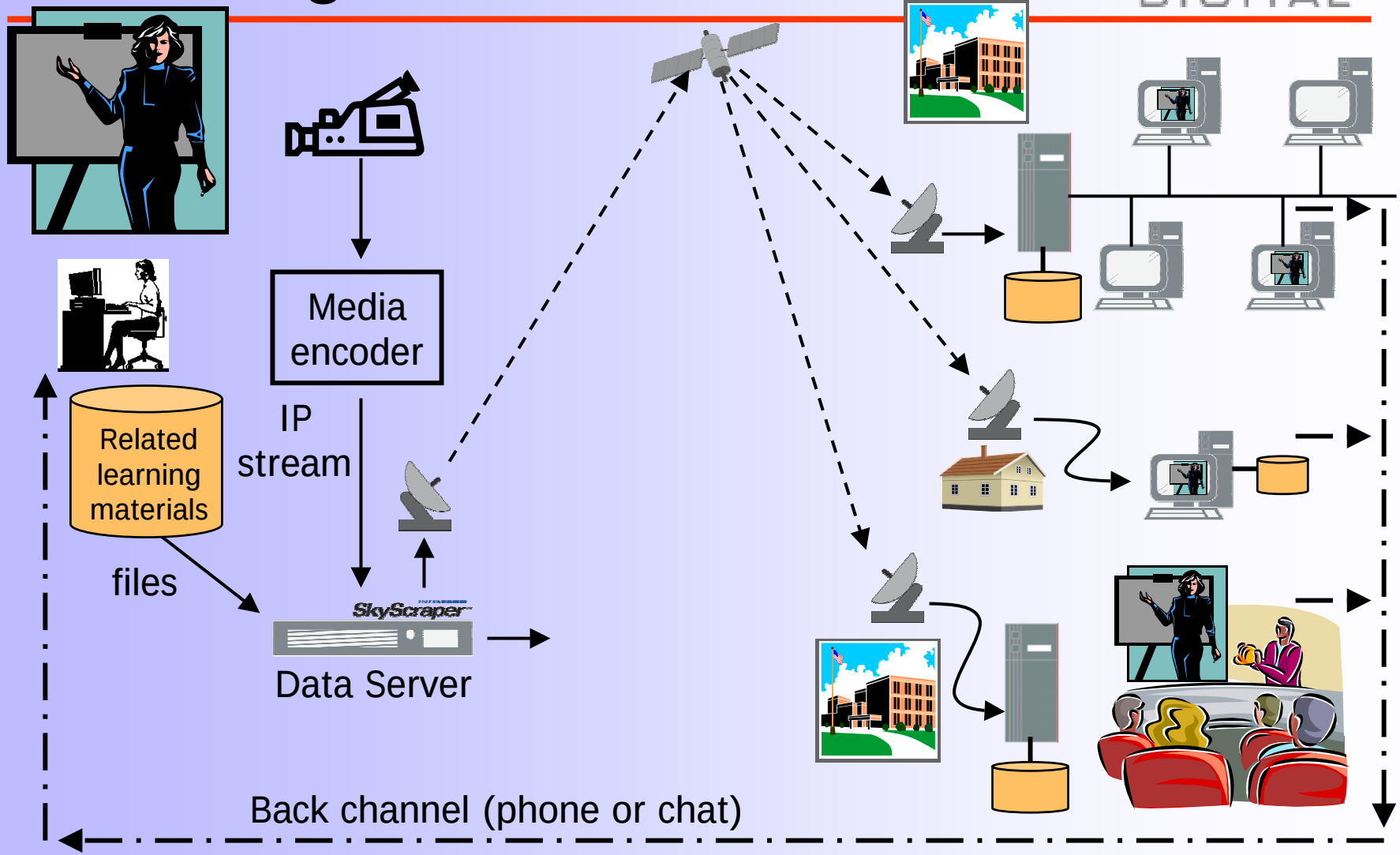
Datacasting Strengths

- Delivering high quality media streams
- Delivering large files
  (e.g., high quality, multimedia content)
- Updating content frequently
- Delivering content to many sites simultaneously
- Delivering to sites with poor Internet connections

Asynchronous Distance Learning



Interactive Distance Learning



Summary

- Data broadcasting in DTV enables different kinds of applications.
  - Provides new revenue opportunities.
- Applicable in different delivery mechanisms.
  - Delivery to hand-held devices is an emerging trend (DVB-H).
- Appropriate architecture is *crucial.*
  - Many technical challenges : loss of packets, bandwidth management, encryption, targeting.