

Implementation of IP Multicast via Satellite Network



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Table of Contents

- ❑ IP Multicast : General Overview
- ❑ The Challenge : Multicast over Internet
- ❑ IP Multicast over Satellite
- ❑ DVB/MPEG2 Standard
- ❑ System Implementation (Case Study)
- ❑ Receiver Type and Network Configuration

IP Multicast Overview

- ❑ A one to many transmission
- ❑ Receiver Oriented Packet Delivery Management
 - Sender don't need to know receiver
 - Receiver can decide to join or leave the group
- ❑ Basically Best Effort and Non-Guaranteed Transmission
- ❑ An extension to the standard IP network level protocol. (RFC 1112)
- ❑ Application :
 - Video & Audio Distribution
 - Replicated DB Update
 - Software and File Distribution
 - and many other Point To Multi Point communication.

Basic Glossary Understanding : Multicast

- ❑ Unicast, Multicast and Broadcast
- ❑ IP Multicast Addresses and Host Group Management
 - Class D IP address
 - 224.0.0.0 to 239.255.255.255
 - Multicast Packet Start with 1 1 1 0
 - IGMP (Internet Group Management Protocol)
- ❑ IP multicast routing protocols
 - Distance Vector Multicast Routing Protocol (DVMRP)
 - Multicast Open Shortest Path First (MOSPF)
 - Protocol-Independent Multicast. PIM Dense Mode (PIM-DM) and PIM Sparse Mode (PIM-SM)
 - Core Based Trees
 - Real-Time Streaming Protocol (RTSP)
 - Real-Time Transport Protocol (RTP)
 - ReSerVation Protocol (RSVP)
- ❑ MBONE

Multicast IP Address

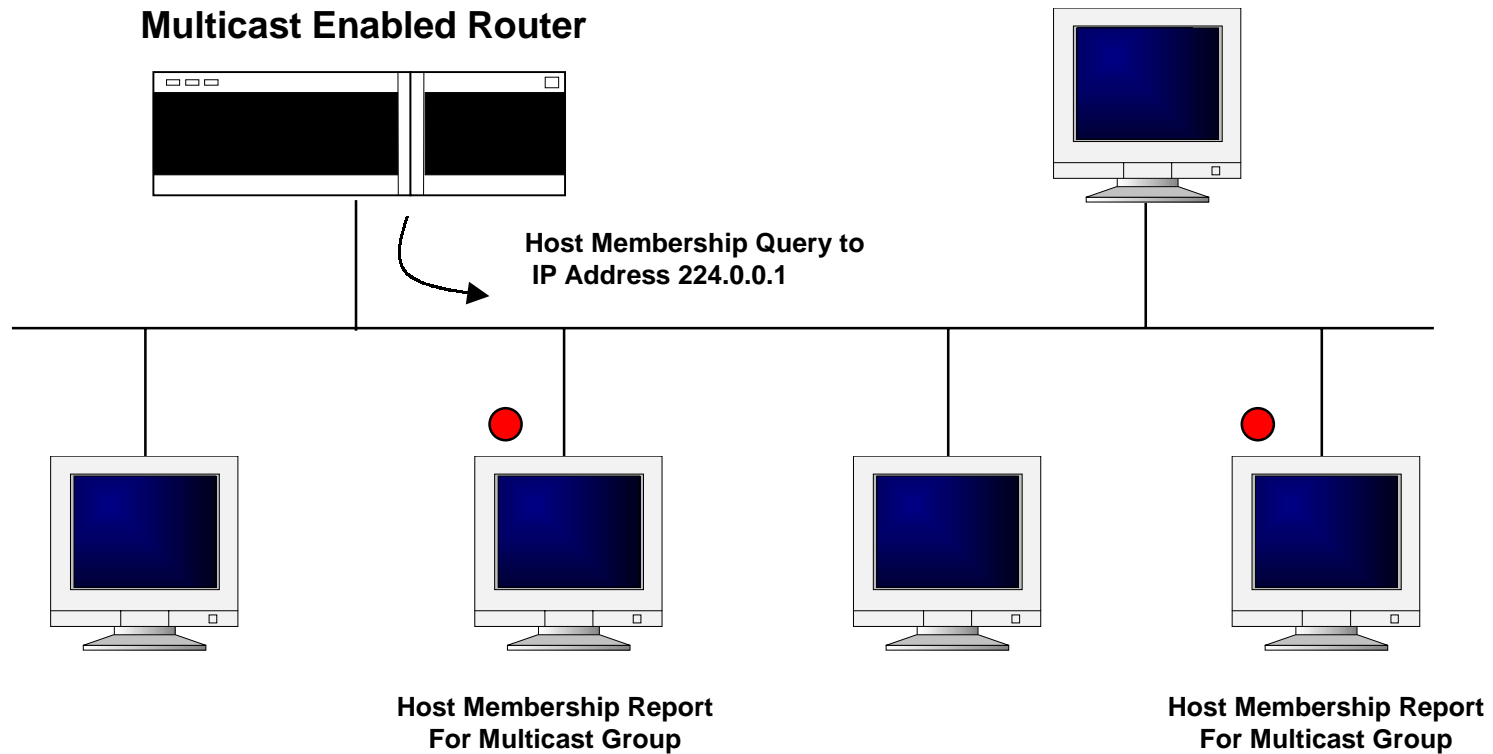
- ❑ Class-D IP Address : 224.0.0.0 to 239.255.255.255
- ❑ Unique Identifier for the multicast packet

1	1	1	0	Multicast Group ID (28bits)
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Internet Group Management Protocol (IGMP)

- ❑ Used by Multicast routers to learn the existence of host group members on their directly attached subnets.
- ❑ Multicast router send query to all host group (224.0.0.1)
- ❑ TTL (Time To Live) is used, so the query will not transmitted outside of subnet.
- ❑ Membership can be dynamically changed and updated

IP Multicast Addresses and Host Group Management

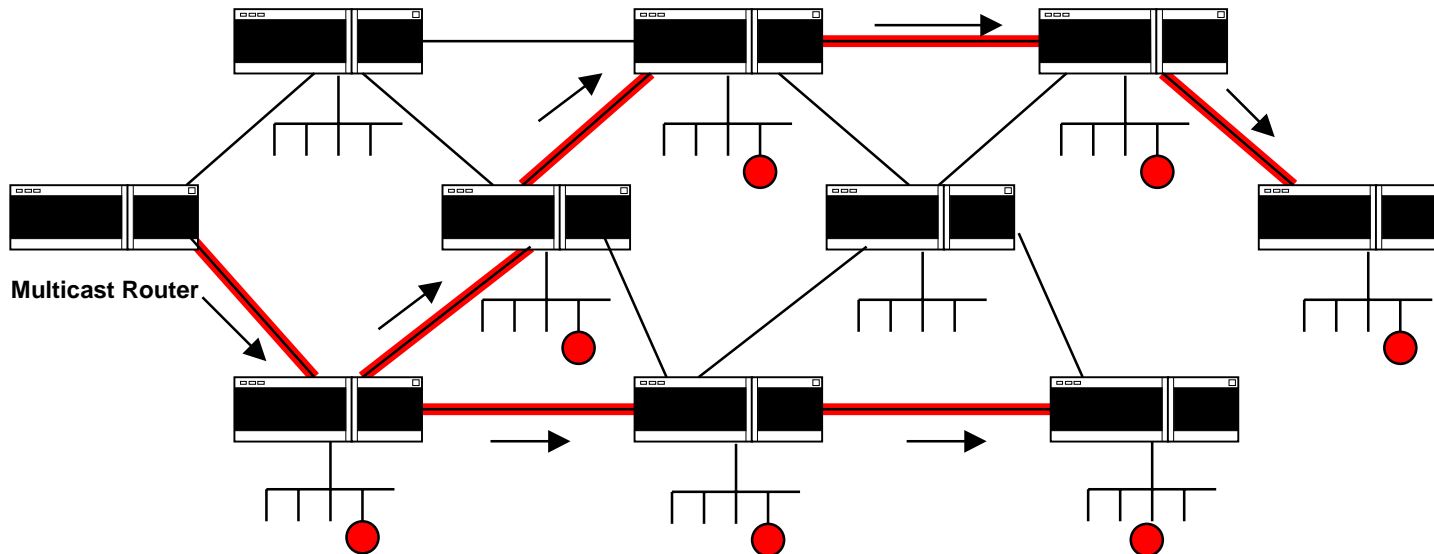


Spanning Tree

- ❑ Used for IP Multicast Routing
- ❑ Connects All the members of IP Multicast Group
- ❑ To Generate Minimize Numbers of Copies on the Network
- ❑ Based on Network Layer Address

Actual Network Configuration

Spanning Tree Configuration



IP multicast routing protocols

❑ Dense Mode Assumption

- Distance Vector Multicast Routing Protocol (DVMRP) : based on RIP
- Multicast Open Shortest Path First (MOSPF) : based on OSPF
- Protocol-Independent Multicast. PIM Dense Mode (PIM-DM)

❑ Sparse Mode Assumption

- PIM Sparse Mode (PIM-SM)
- Core Based Trees

❑ Other Protocol

- Real-Time Streaming Protocol (RTSP)
- Real-Time Transport Protocol (RTP)
- ReSerVation Protocol (RSVP)

❑ MBONE (Multicast BackBONE)

- Virtual network layered on the top of the physical Internet to support IP Multicast Packet

The Challenge : Multicast over Internet

❑ Reliability

- Non-Guaranteed : Nature of Internet
- Limited Bandwidth
- Level of Reliability
 - Best Effort : Video, Audio
 - Fully Reliable : Data File
- Recovery :
 - Local Recovery
 - Retransmission Request

❑ Scalability

- Well suited for LAN or Closed Sub-Network Environment
- Need to maintain Multicast enabled Router between network
- Or need to maintain virtual network tunnel based on Unicast.
- High Network Overhead Cost for WAN environment

Heterogeneity

- ❑ Different Receiver Environment
 - Network Capacity and Reliability
 - Distance from Sender
 - Crying Baby syndrome

Satellite Can Be Optimum Solution for IP Multicast

□ Reliability

- Reliable Network Capacity and Bandwidth from End to End
- Simple control for over all network
- No congestion is expected for end to end communication
- Can support interactive mode using terrestrial network or VSAT

□ Scalability

- Wide Coverage (ie. Asiasat 3S covers 2/3 of global population)
- High Speed Internet Support up to 45Mbps
- No need for intermediate Multicast enabled router.
- No additional burden to the existing Internet network backbone

□ Homogeneity

- Homogeneous Network for whole receiver host group

General Satellite Multimedia System Configuration

❑ Data Broadcast Module

- IP-DVB Encapsulation
- VPN Server
- Cache Server
- Billing Server
- Data Encryption
- Usage Statistics
- Server Applications : MFTS, IP Streaming, Web Casting etc..

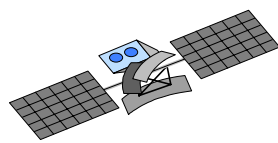
❑ Satellite Uplink Module

- QPSK Modulator, Up Converter, Uplink Antenna

❑ Receiver Module

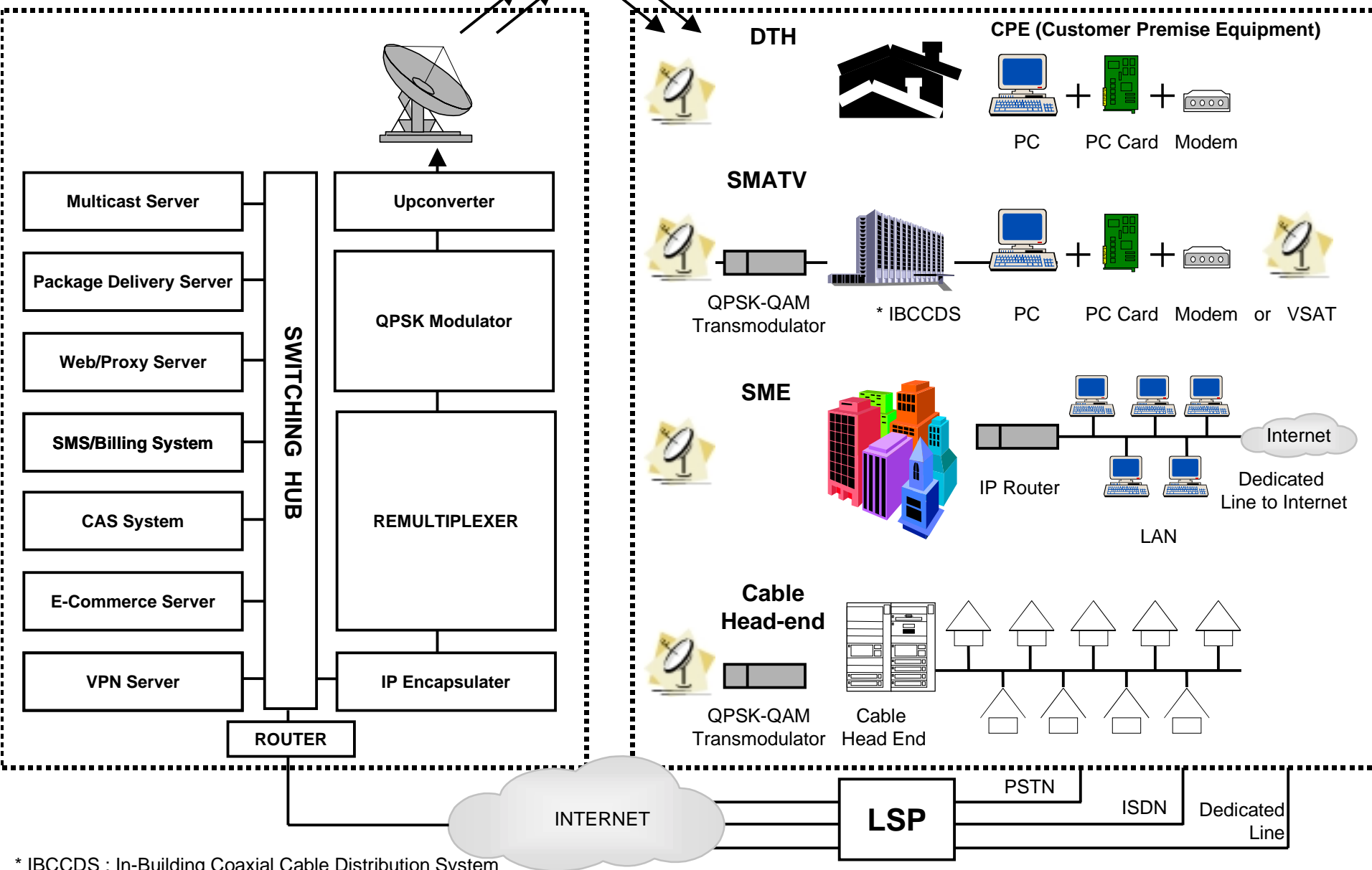
- Receiver DVB Module
- Winsock DLL
- Client Applications

Service Provider Network Center



AsiaSat 3S

Receiving Site Examples



* IBCCDS : In-Building Coaxial Cable Distribution System

DVB (Digital Video Broadcast) Standard

❑ Open

- Available for anybody and anywhere
- License Free
- Developed through consensus in the working groups

❑ Interoperable

- Non Manufacturer Dependant
- Based on the common MPEG-2 coding system,
- Effortlessly carried from one medium to another (ie. Satellite to Cable or Cable to Terrestrial)

❑ Flexible

- Support Data, TV(PAL, NTSC, SECAM), HDTV etc...

❑ Market-led

- Not a regulator- or government-driven (top-down) initiative
- Working to tight timescales and strict market requirements
- Feedback from broadcasters, manufacturers and service providers

DVB/MPEG2 Standard

Why Standard is so important?

❑ For Service Providers

- Flexibility
- Scalability
- Cost Effective

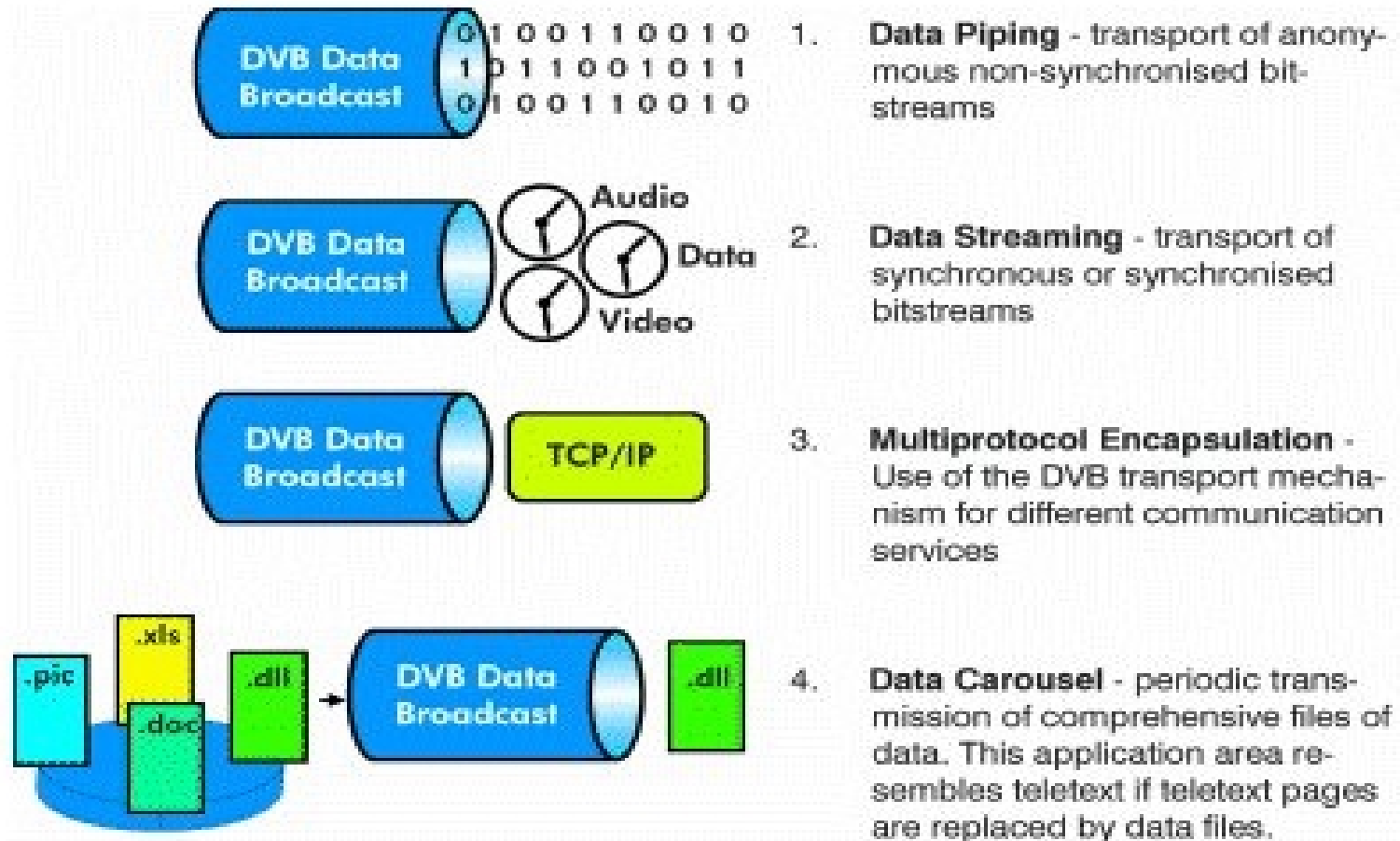
❑ Equipment Manufacturer

- Bigger Market
- Better Focus

❑ End User

- Variety of Applications
- Cheaper Service
- Better Service

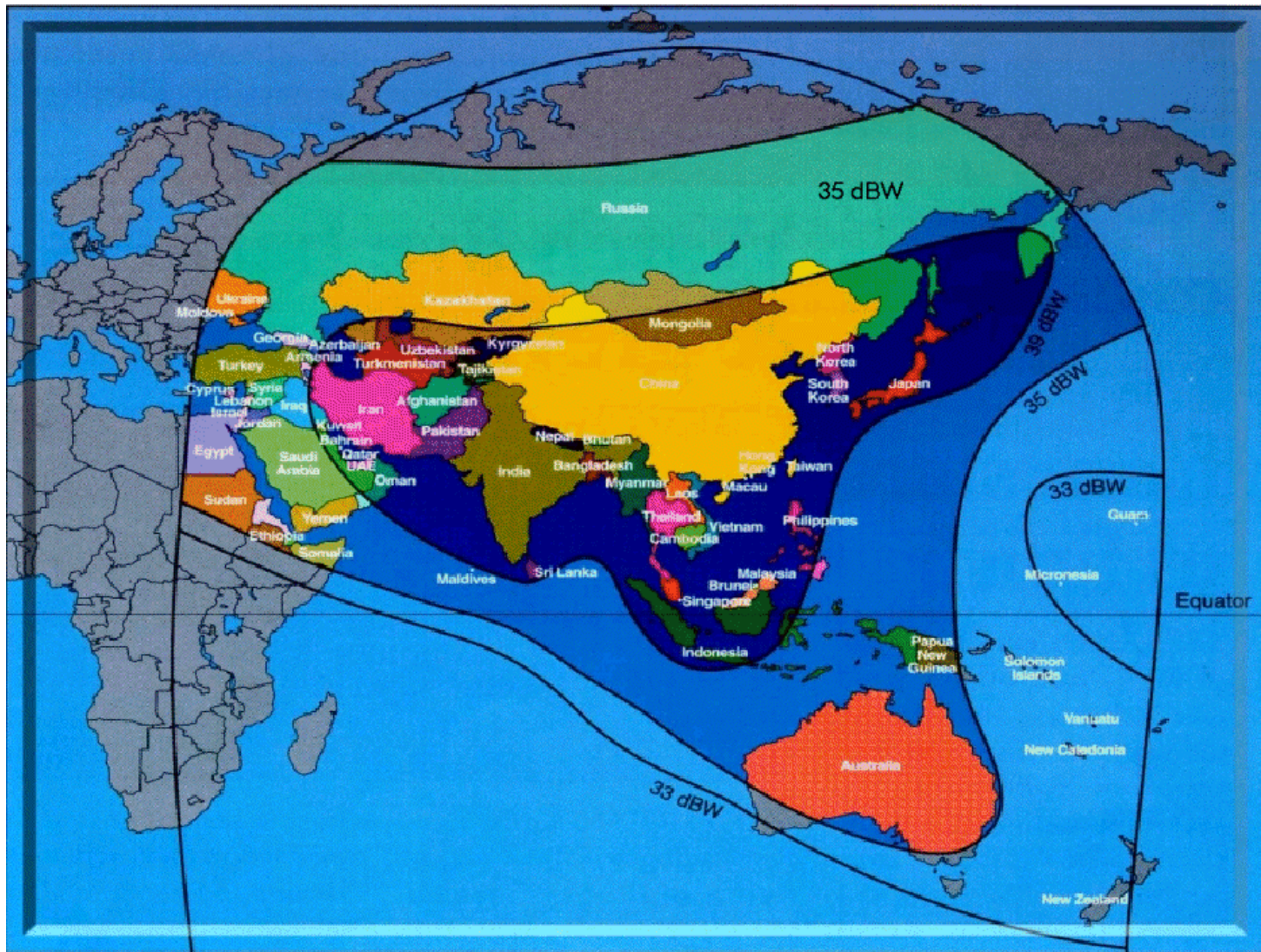
DVB-Data Standard - ETSI EN 301 192



System Implementation Case Study

- ☐ Service Coverage
- ☐ High Speed Internet
- ☐ Multicast File Transfer
- ☐ IP Streaming
- ☐ Web Casting
- ☐ etc...

Service Coverage (C-Band)





PhoenixNet : Data Package Delivery

- ❑ Optimum solution for point-to-multipoint large file transfer.
 - For example, it is not possible to distribute 600MB file to 100 regional branches over the normal terrestrial Internet. Surecast must be the best solution except Fedex delivery on CD-ROM media.
- ❑ Support `Best Effort` and `Fully Reliable` Mode
 - File delivery is guaranteed by a variety of acknowledgements, using a terrestrial return path.
- ❑ Based on UDP Multicast Protocol
- ❑ No mandatory requirement for return channel
- ❑ Support Grouping of Receivers
- ❑ Client Software for Automatic File Reception and Filtering

More Advantage of Satellite Package Delivery

- ❑ High-speed (only limited by PC performance)
- ❑ Concurrent transmissions available
- ❑ Support Encrypted transmissions
- ❑ Web based interface for transmission control by Contents Provider
 - Package File Management : Add, Remove etc..
 - Delivery Start Time
 - Delivery Frequency (How many times?)
 - Receiver Group Definition
 - Encrypted or Free to Air
 - Best Effort or Fully Reliable
 - Transmission Speed
 - PUSH or Requestable
 - etc...

SureCast : Client Software (MFTS : Multimedia File Transfer System)

❑ Client Features

- Receive files in multicast
 - Install and configure a DVB receiver to listen to the right PID.
- Request Files
- Request retransmissions through a terrestrial line
- Manage concurrent file receptions

❑ Client Applications

- SureCast Engine
 - Protocol implementation, Software component
- SureCast Progress
 - Display the status of incoming transmissions
- SureCast Monitor
 - Control the MFTS Engine and Progress

How to achieve reliable file transmission in Multicast

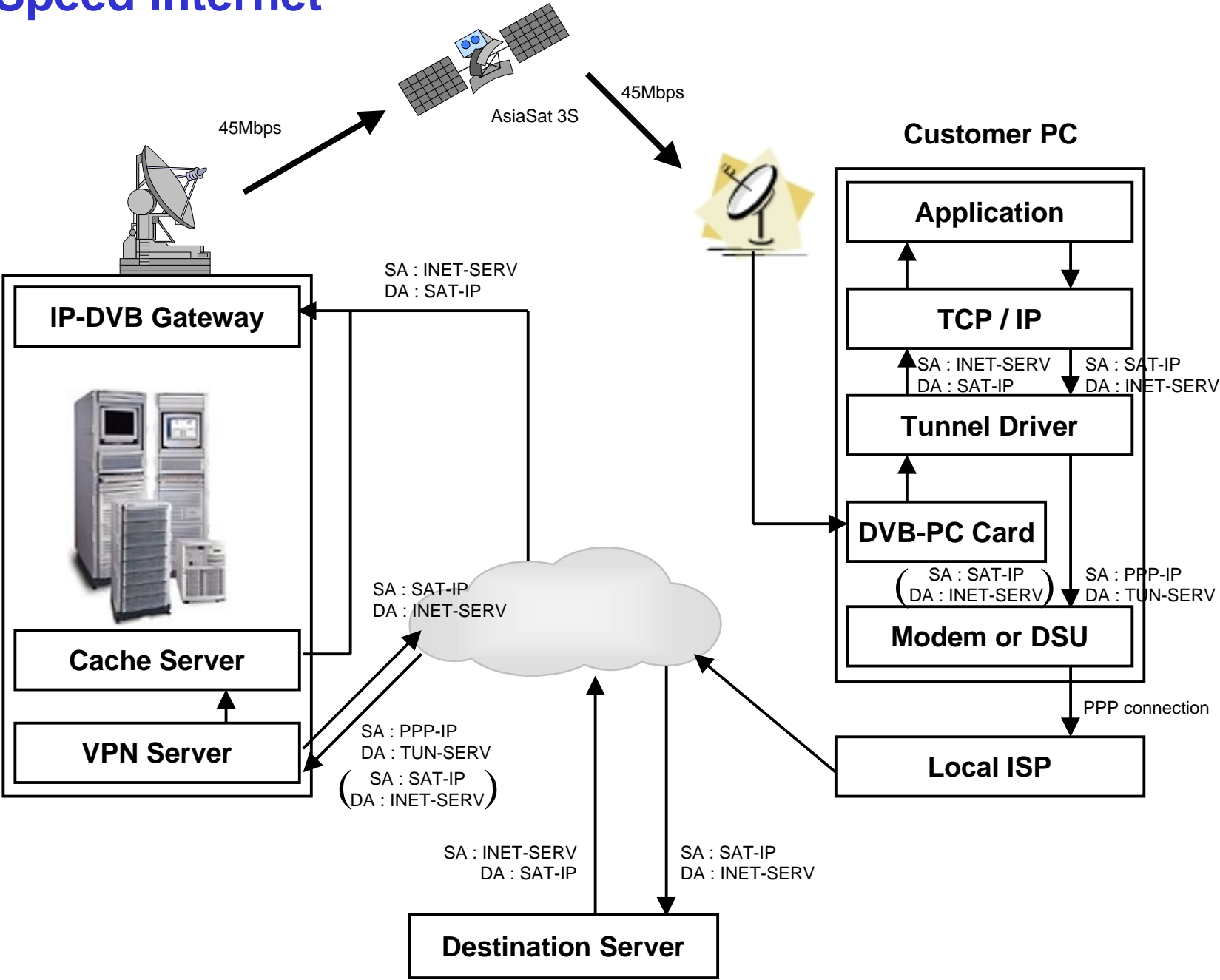
❑ Best Effort Mode

- No need for return channel
- Multiple Transmission
- Lost Packet will be filled in whenever there is successful transmission
- Example : Three consecutive failure due to different packet loss will result in successful file transmission after reassembling each of lost packet at client side.

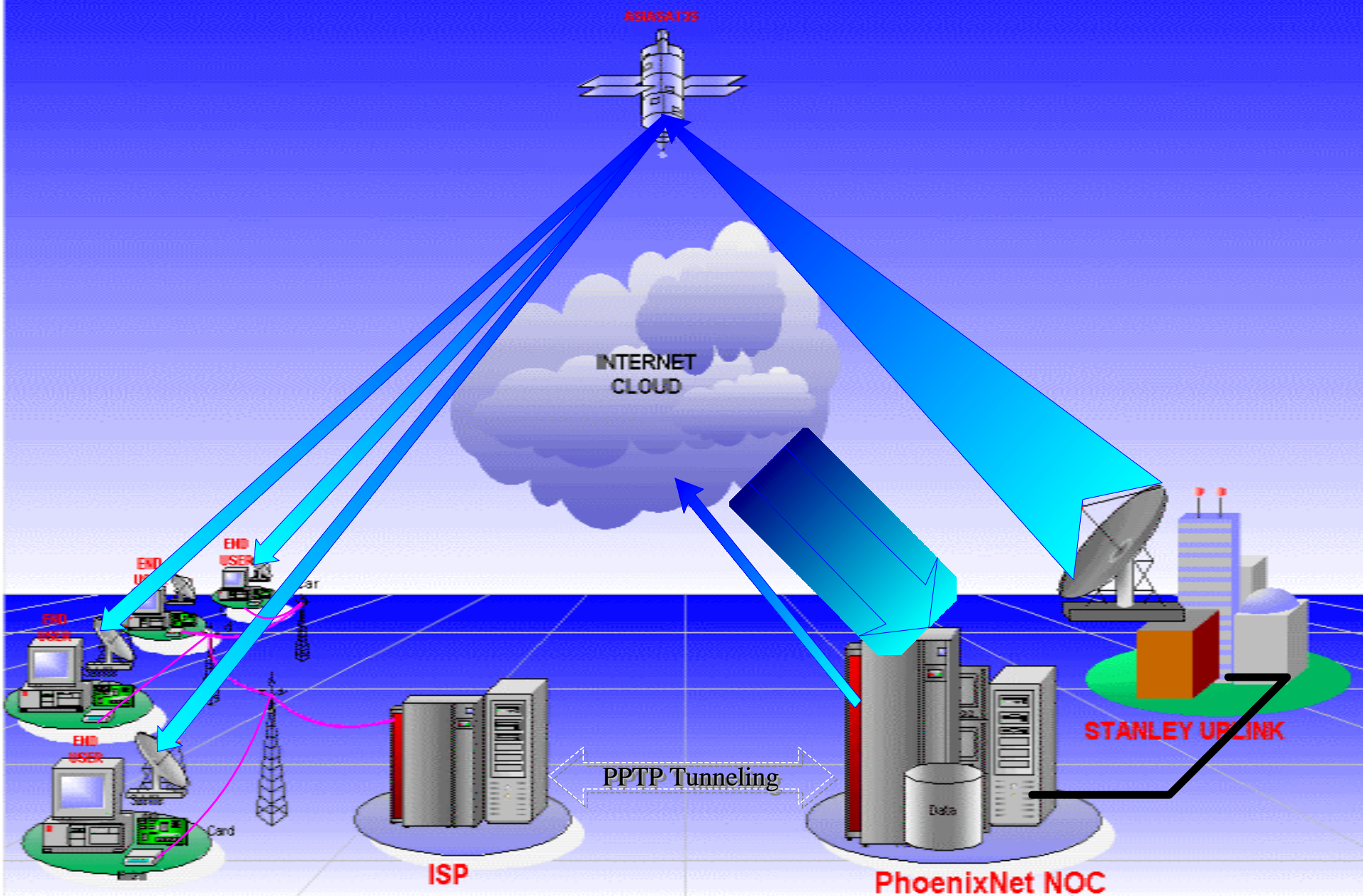
❑ Fully Reliable Mode

- MFTS client monitor lost packet, and automatically generate feedback to MFTS server after the whole transmission.
- MFTS server assemble all the packet loss information from multiple clients, and retransmit lost packet's. This process can be repeated until end user have successful result.

High Speed Internet



High Speed Internet

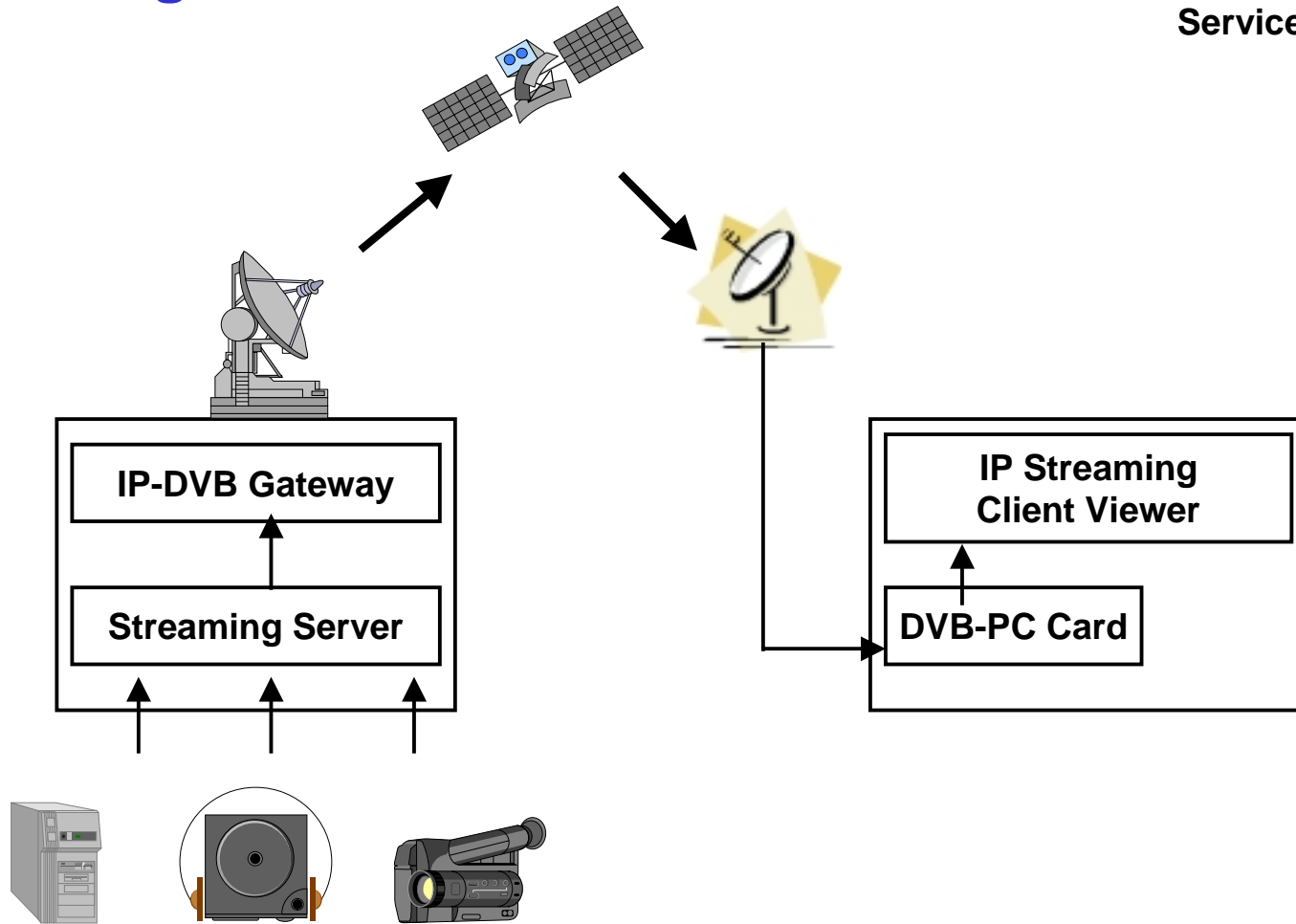


SpeedCast : High Speed Internet

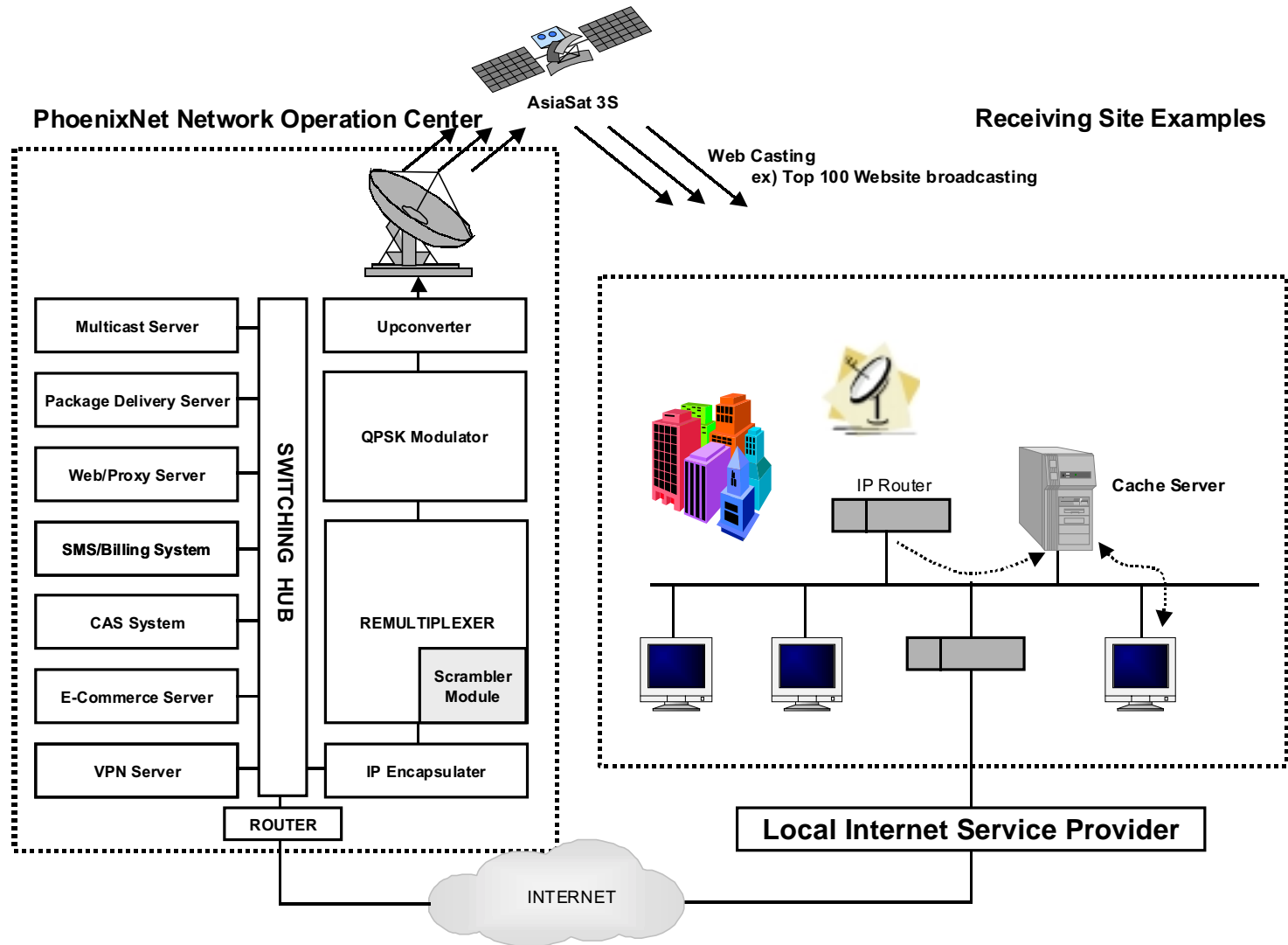
- ❑ ISP compatible and transparent
- ❑ High TCP Throughput
- ❑ Ability to access any Internet host
- ❑ Application Protocol independent (HTTP, FTP, ...)
- ❑ Require no specific client Windows software
- ❑ Scalable system
- ❑ Return Path based on PPTP
- ❑ Protocol Enhancing with a Proxy or Cache

IP Streaming

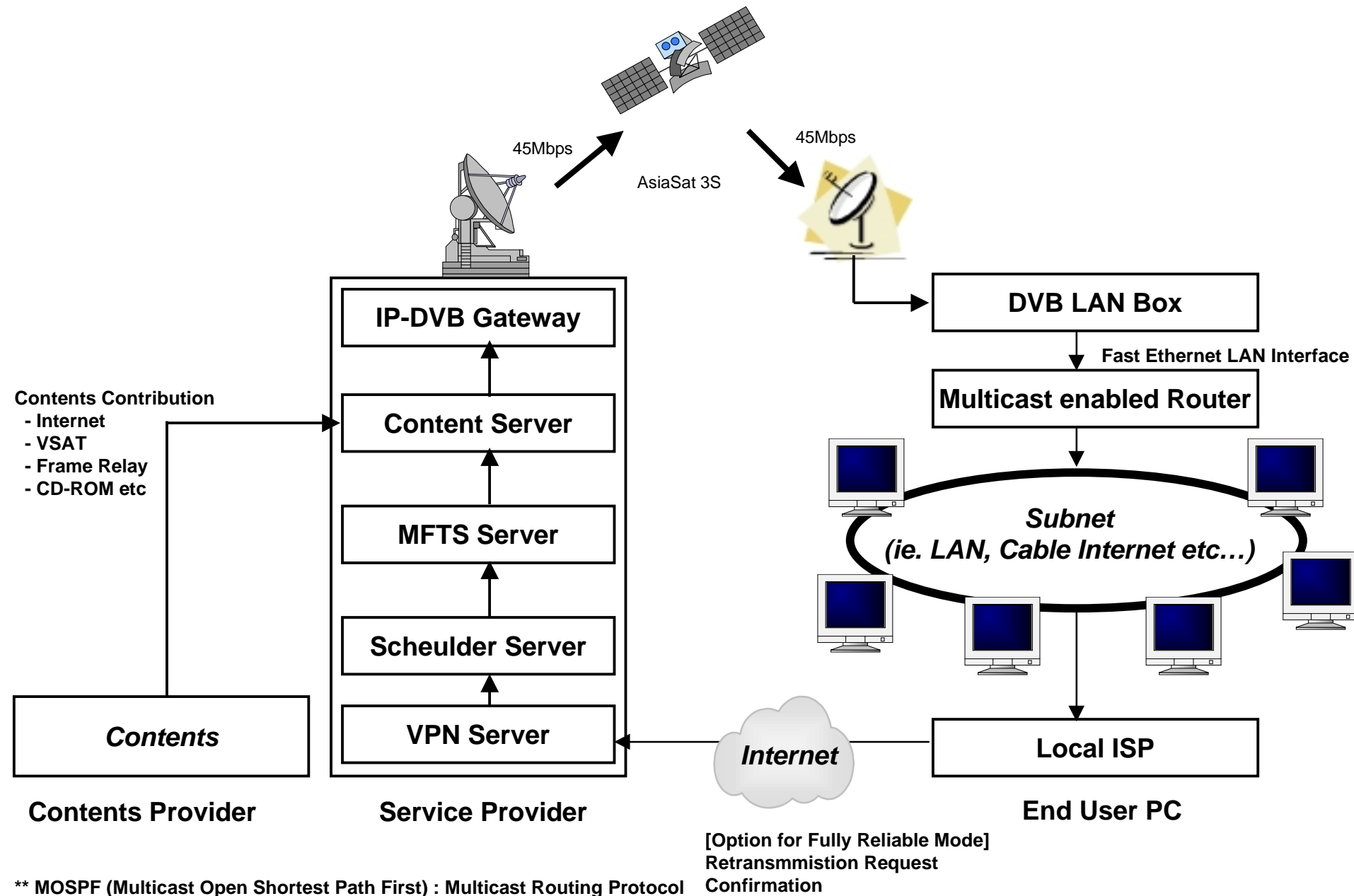
Service Provider



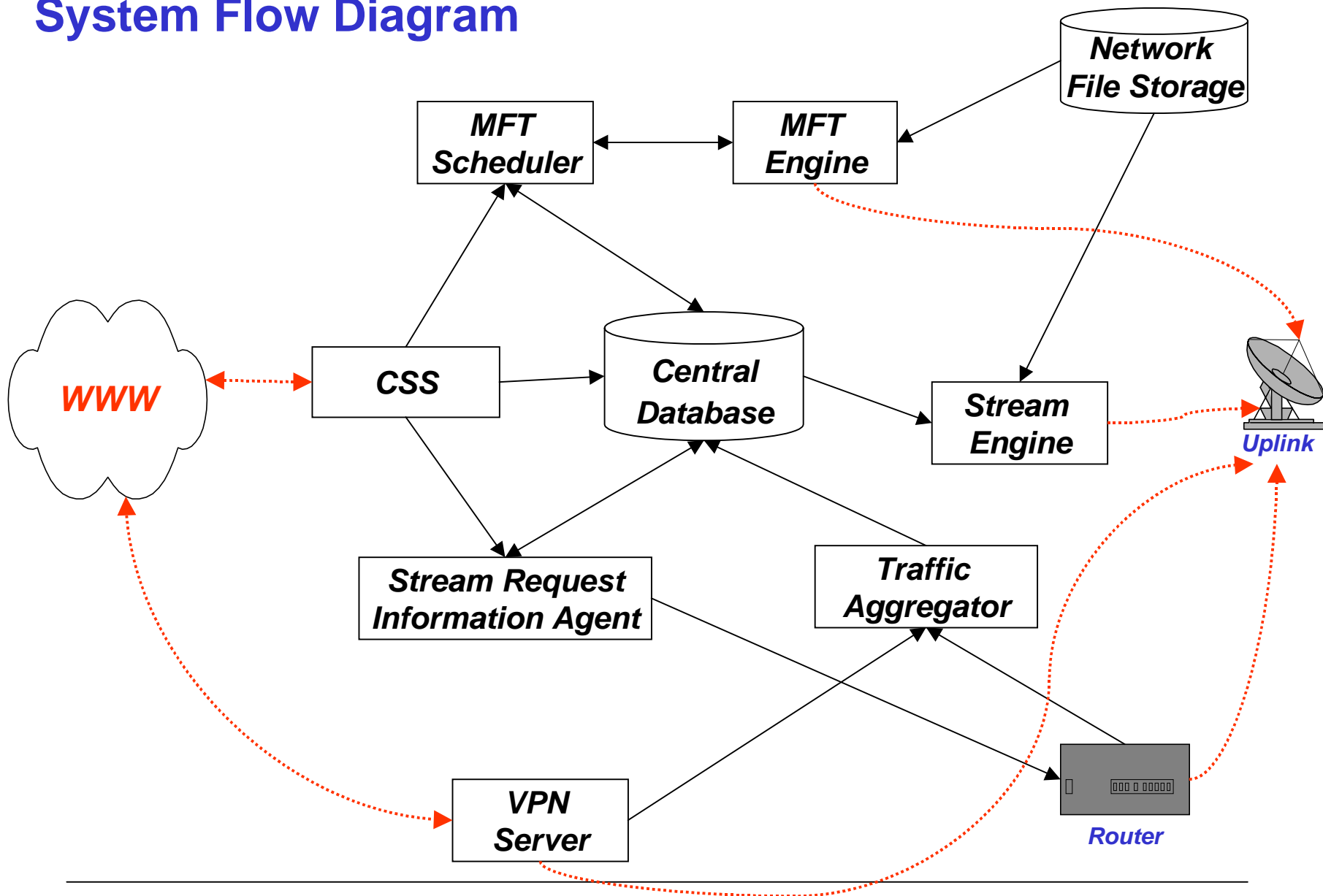
Web Casting Example Configuration



Interface with Terrestrial IP Multicast Network (Example)



System Flow Diagram



Receiver Type and Network Configuration

❑ Satellite DVB IRD (QPSK)

- Satellite DVB PCI Card (Data Service)
- Satellite DVB PCI Card (Data + TV Service)
- Satellite DVB Box with USB port
- Satellite DVB Router with Ethernet Port

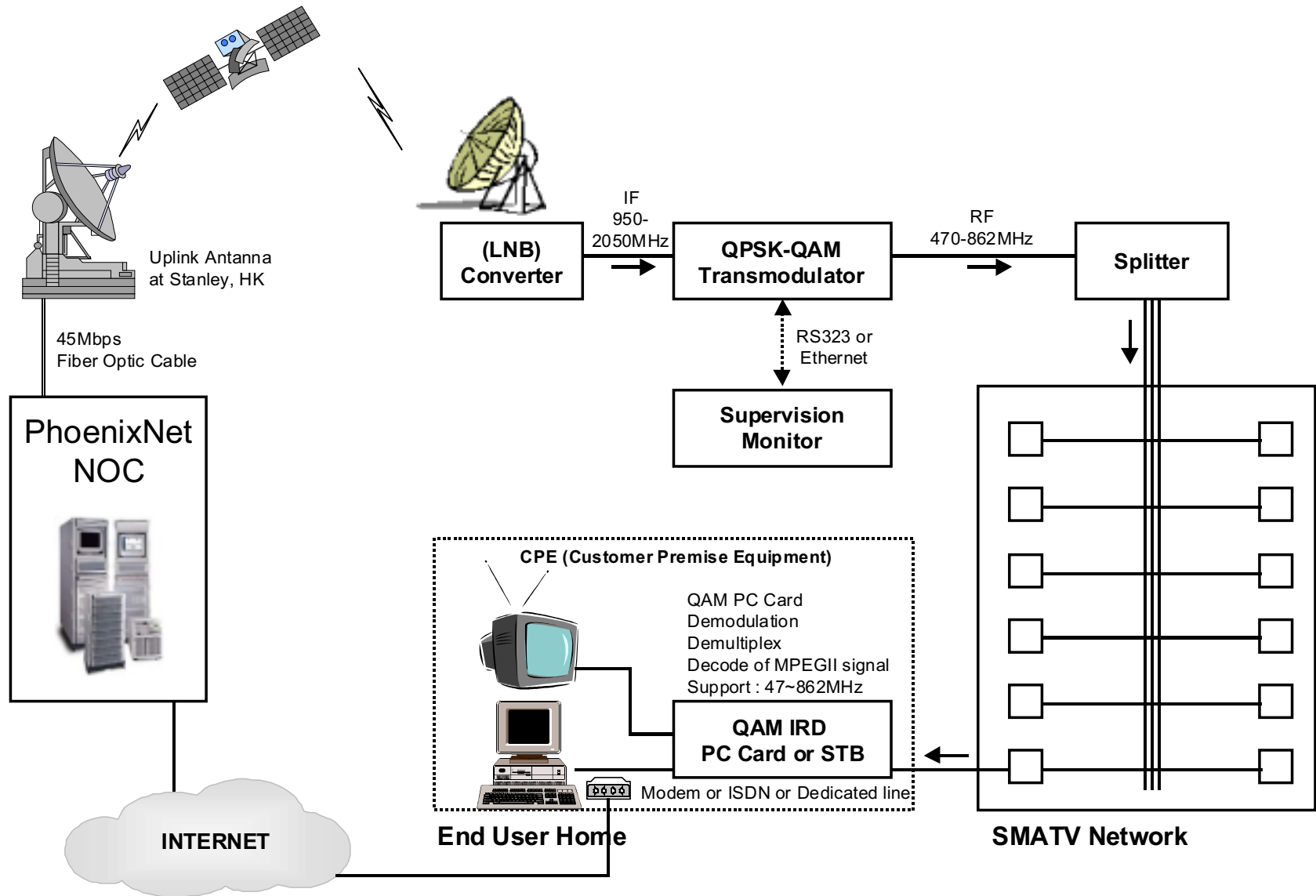
❑ Cable DVB IRD (QAM)

- Cable DVB PC Card (Data Service)
- Cable DVB PCI Card (Data + TV Service)
- Cable DVB Box with USB port
- Cable DVB Router with Ethernet Port

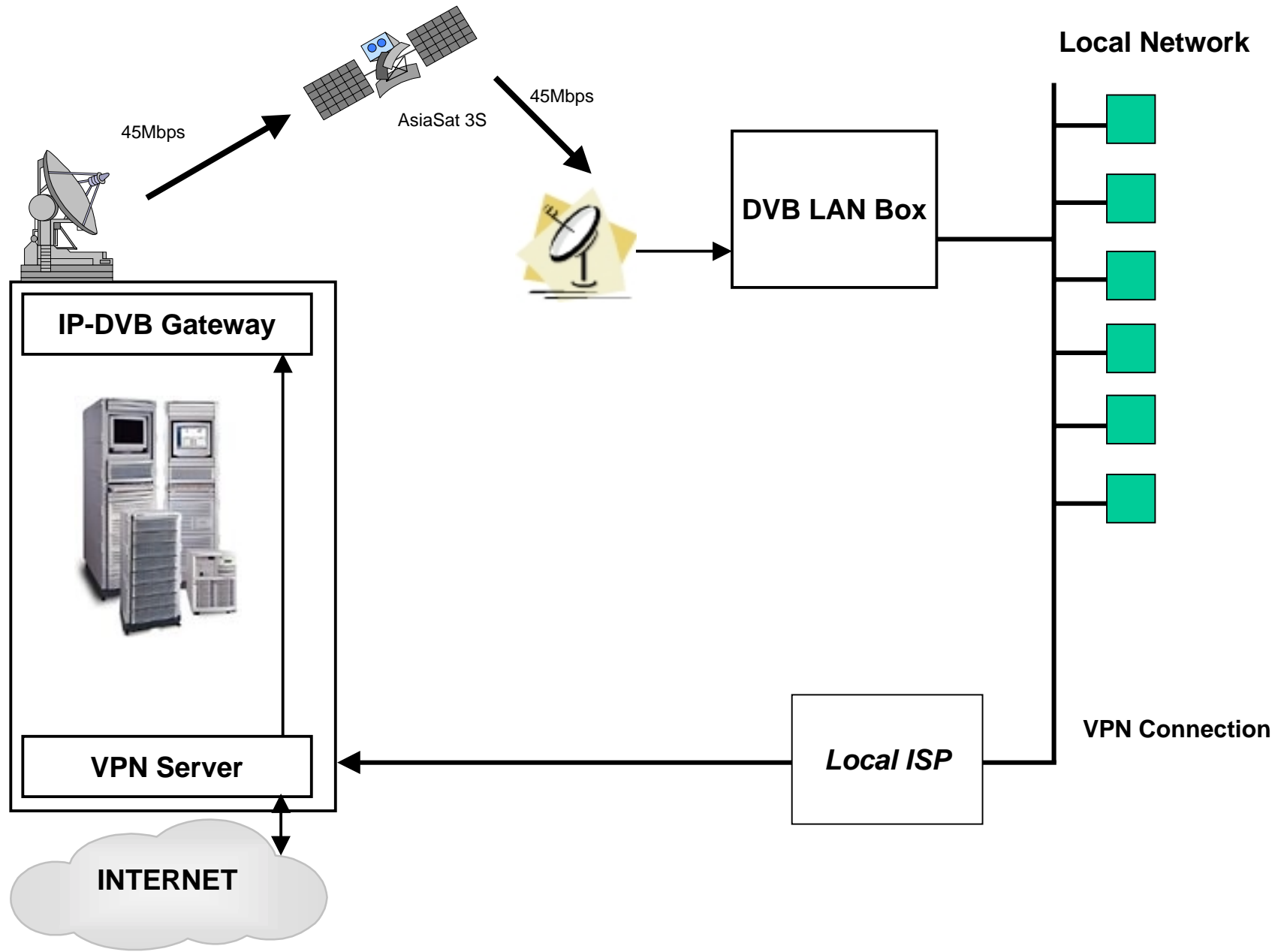
❑ QPSK ? QAM Trans Modulator

❑ VSAT System

Cable System Example (SMATV : Satellite master antenna television)



SME Solution Example (DVB LAN Box)



Question & Answer