

Lecture 5:

Delivery of Multimedia Services

7COM1030 – Multicast and Multimedia Networking

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Characteristics of Multicast Services

- ▶ Group communications
 - Many receivers at the same time
 - Cooperation & interaction between users
- ▶ Multicast delivery is essential for
 - Efficient utilization of network bandwidth (resource)
 - Compared to multiple unicast connections
- ▶ Technological challenges for multicast
 - Reliable Multicast, QoS management, group management, etc

Examples of Multicast Services

- ▶ One-to-many multicast
 - Internet TV, webcasting
 - Webcasting of broadband streaming media
 - Remote education
 - Distribution of financial data: stock-ticker
- ▶ Many-to-many multicast
 - Teleconferencing
 - Whiteboard
- ▶ Current trend
 - Most of commercial services are based on
 - One-to-many multicast services
 - Most of ISPs focus on one-to-many services

Multicast Applications

- ▶ Classification of multicast applications
 - Collaborative: teleconferencing
 - Message streaming: streaming media player
 - Bulk data transfer: multicast file dissemination

Application Type	Latency Req.	Reliability	Scalability
Collaborative	Low	Semi/Strict	<100
Message Str.	Low/Medium	Semi/Strict	to Millions
Bulk Data	Not Real Time	Strict	to Millions

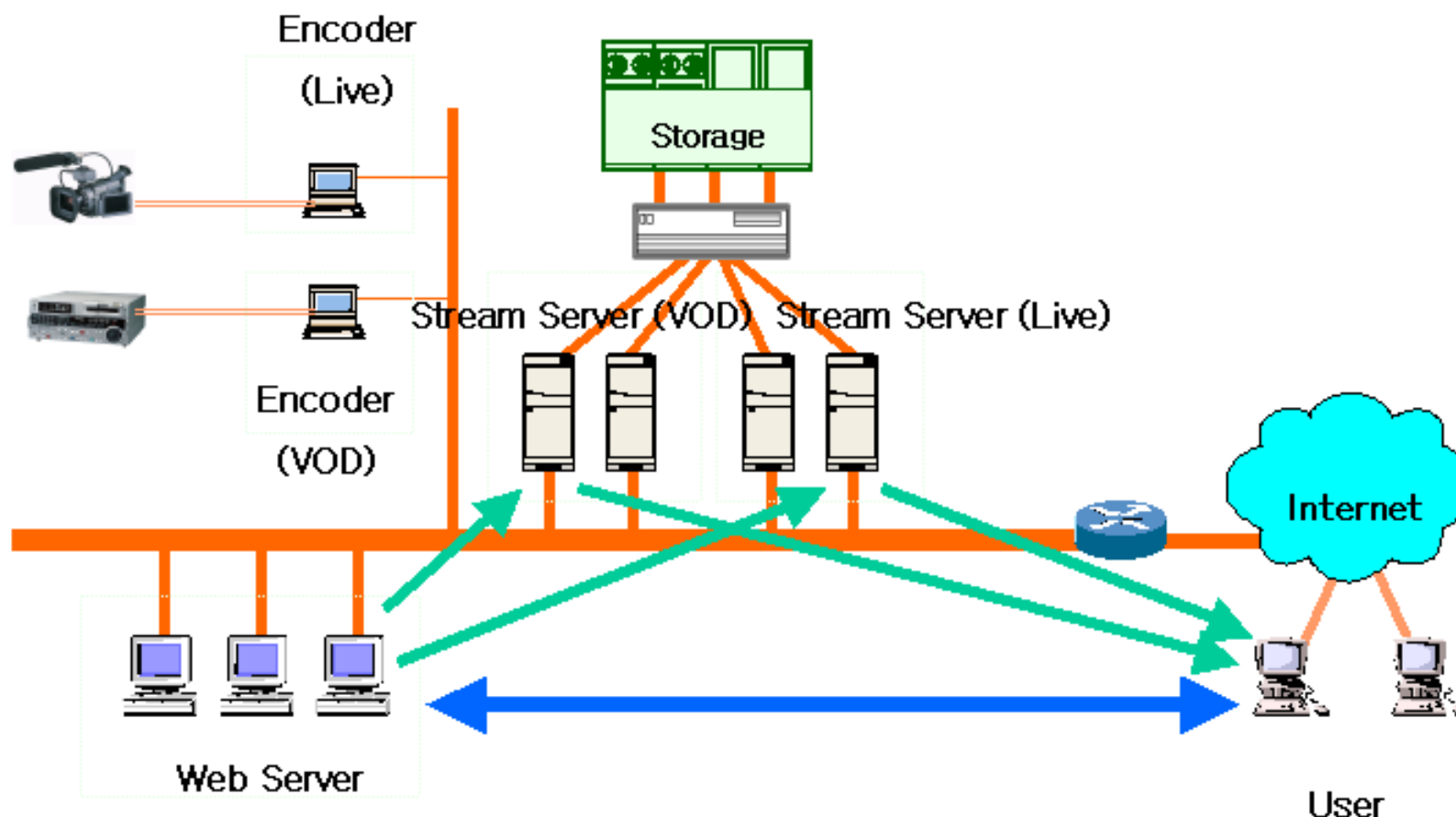
Broadband Multimedia Services

- ▶ Broadband: up to 1-2 Mbps per session
 - Bandwidth (resource) consuming
- ▶ Multimedia: audio/voice, video, data
- ▶ Real-time and live broadcasting: time-critical

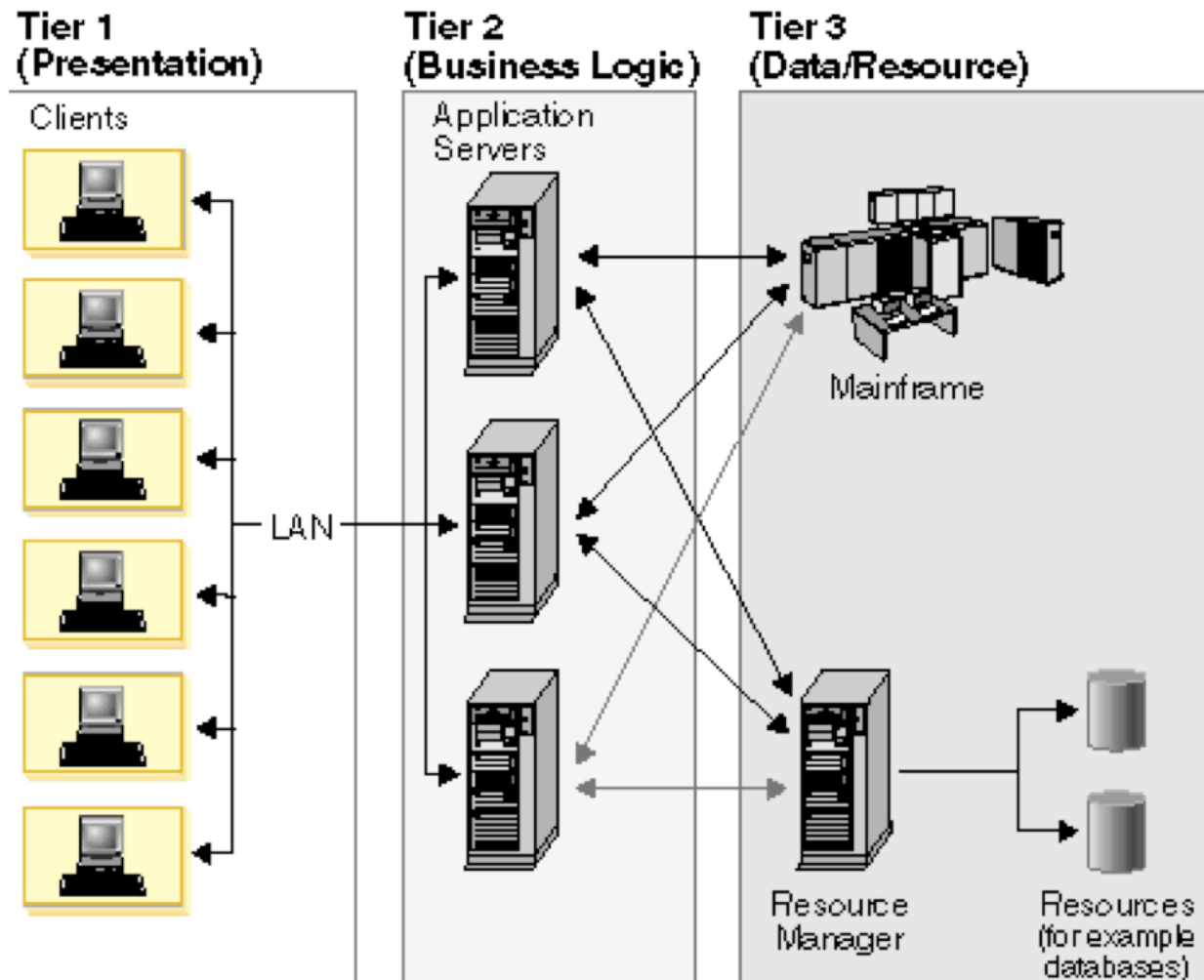
Webcasting of Broadband Multimedia

► Typical webcasting system

Example: YouTube



Three Tier Client/Server Architecture



Tier 1: User interface
Tier 2: Logical process
Tier 3: Data storage

Application servers are used to service data requests between clients and database.

a.k.a.
Multi-tier Architecture

Possible Delivery Schemes

▶ **Replicated unicast**

- TCP/IP unicast connection to each receiver
- Multiple unicast connections for a session

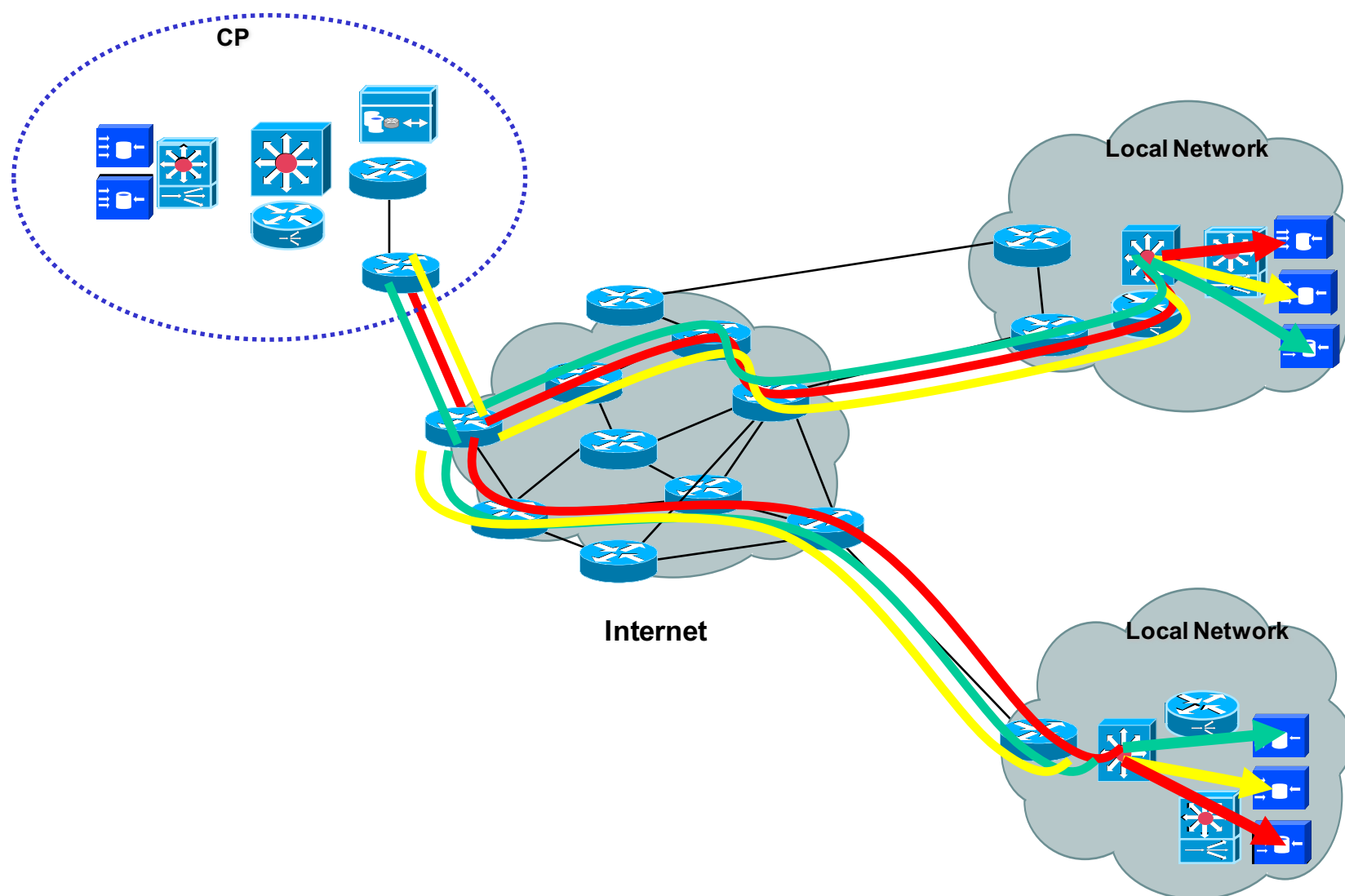
▶ **Native IP multicast**

- Within multicast-enabled networks
- Multicast forwarding tree between multicast Routers
- IGMP between router and hosts

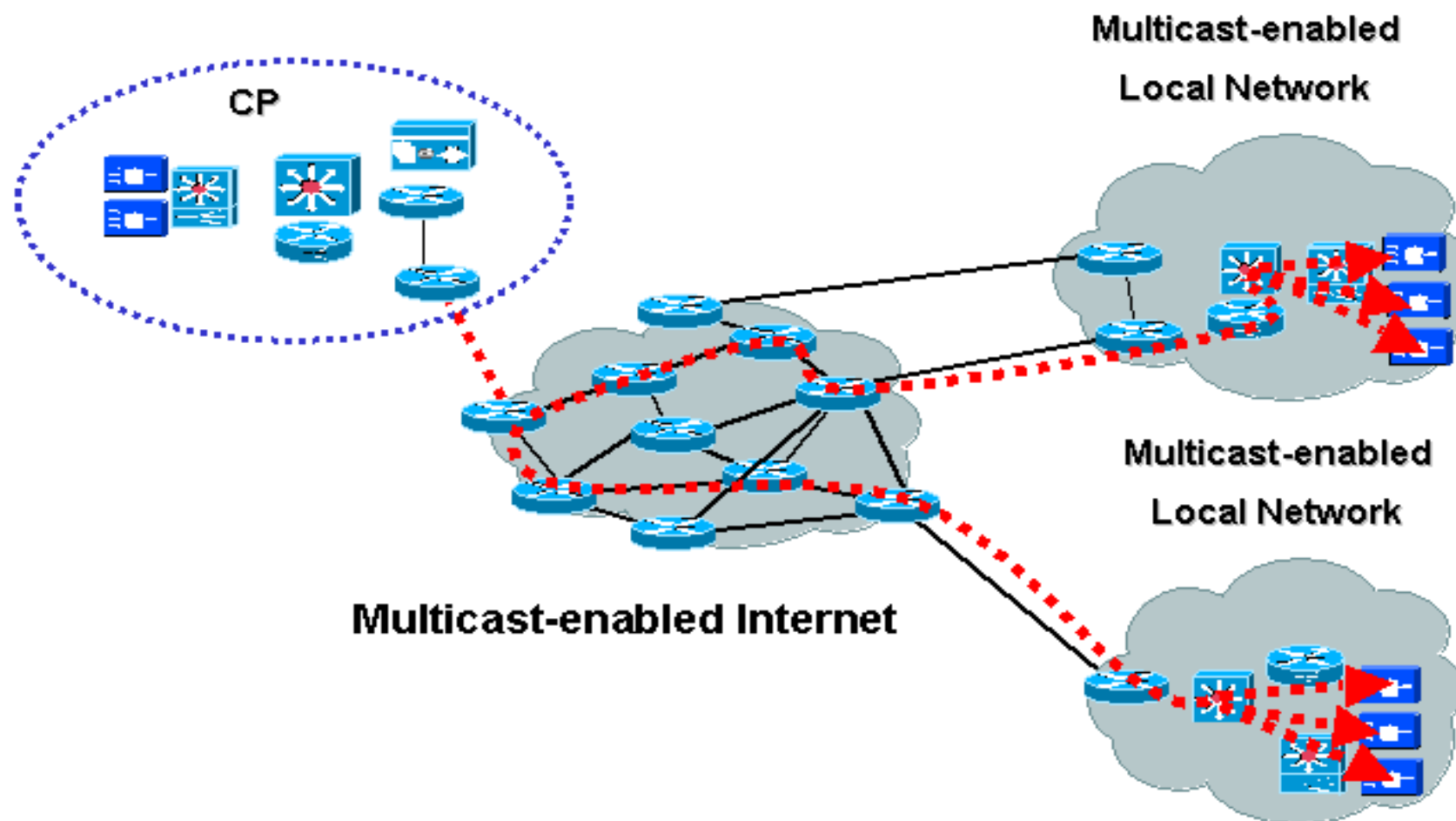
▶ **Hybrid of unicast and multicast**

- Unicast from Sender and Relay Server:
 - Over unicast networks
- Multicast from Relay Server to Recipients
 - Within the multicast-enabled networks

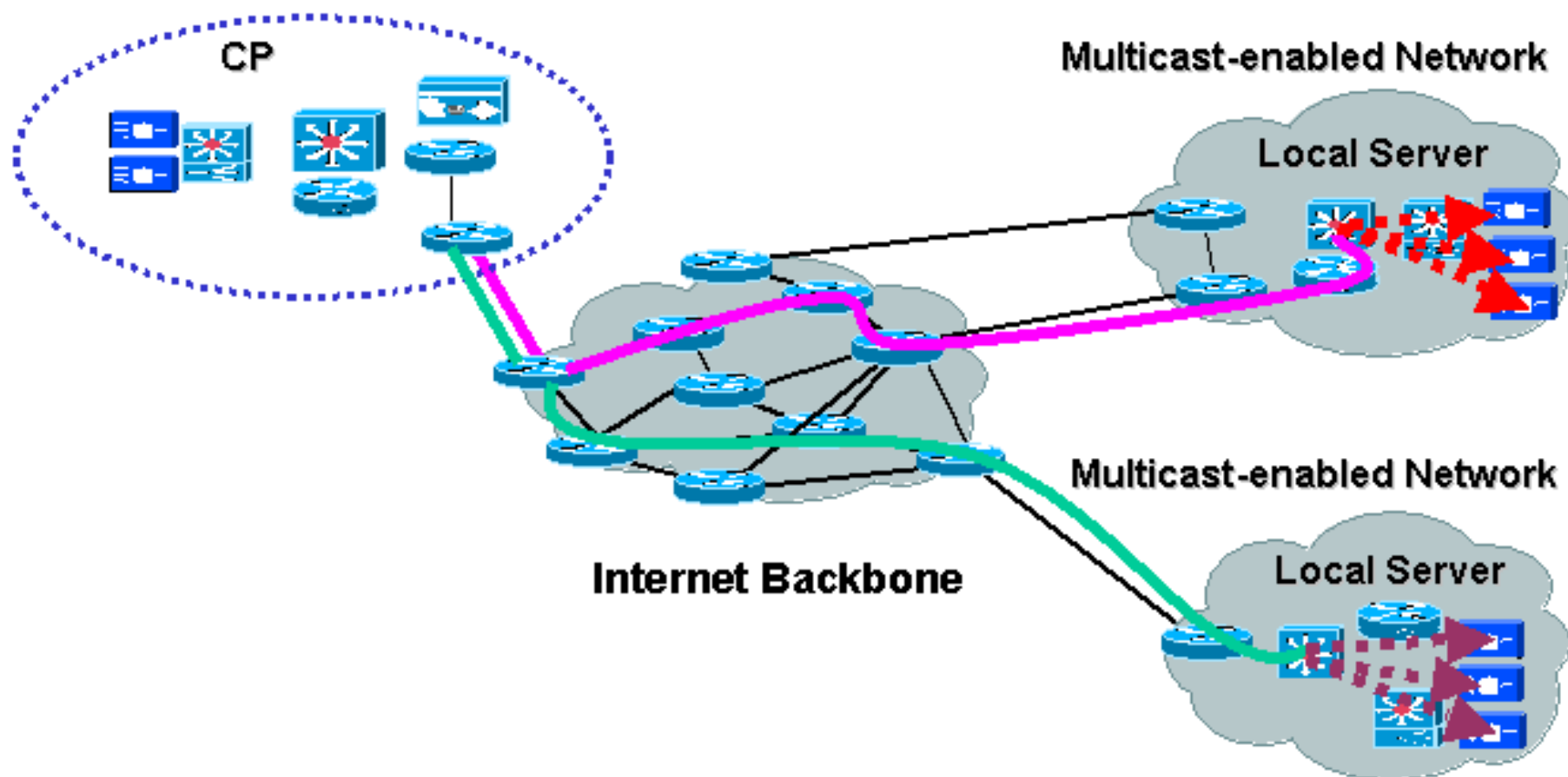
Unicast Delivery for Multimedia



Multicast Delivery for Multimedia

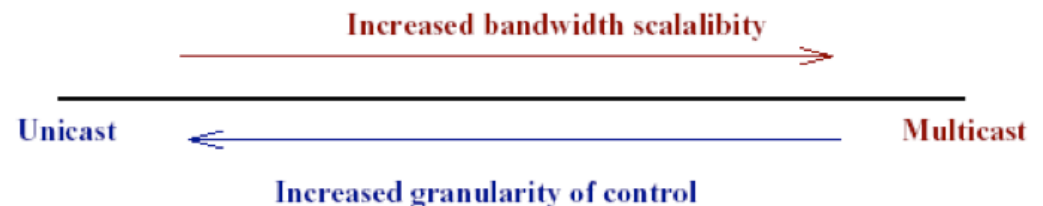


Hybrid Delivery of Unicast and Multicast



Comparison of Delivery Schemes

- ▶ Replicated unicasts (**current & most**)
 - Easy to employ, but
 - Bandwidth Consuming in the network
 - Traffic bottleneck at the sender (contents provider)
- ▶ IP multicast (**ideal & best**)
 - Most efficient in terms of utilization of network resources
 - But, still much technical challenges to solve
 - Not fully deployed in commercial Internet
- ▶ Hybrid of unicast and multicast (**realistic alternative**)
 - An realistic alternative delivery scheme
 - For migration to IP multicast
 - Based on unicast and multicast



Multicast Technologies for Multimedia

- ▶ Multicast group management
 - **Application-level** group management
 - Session management & membership management
- ▶ End-to-end multicast transport
 - **Layer 4** multicast management
 - Reliable multicast & QoS management
 - ECTP, IETF RMT, etc
- ▶ Multicast routing in networks
 - **Layer 3** forwarding by routers
 - Multicast routing protocols
 - DVMRP, PIM, CBT, etc

Application
Transport
Network
Access

End-to-End Multicast Transport

- ▶ Reliable multicast
 - Issues: scalability concerns (error/congestion control)
 - IETF RMT WG
 - TRACK (Tree-based ACK) protocol
 - ALC (Asynchronous Layered Coding) protocol
 - NORM (NACK Oriented Reliable Multicast) protocol
 - ITU-T Q.8/17
 - ECTP (Enhanced Communications Transport Protocol)
- ▶ QoS management
 - QoS negotiations/monitoring/maintenance issues
 - Working in ITU-T Q.8/17 (ECTP)

Group Management Protocol

- ▶ Session management
 - Session creation/enrollment
 - User registration/authentication
- ▶ Membership management
 - Active membership monitoring and report
 - Support of billing/charging model
- ▶ Status
 - IETF: SDP/SAP, SIP
 - ITU-T Q.8/17: GMP (working)

Questions?

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