Architectural Considerations for Providing Carrier Class Telephony Services Utilizing SIP...

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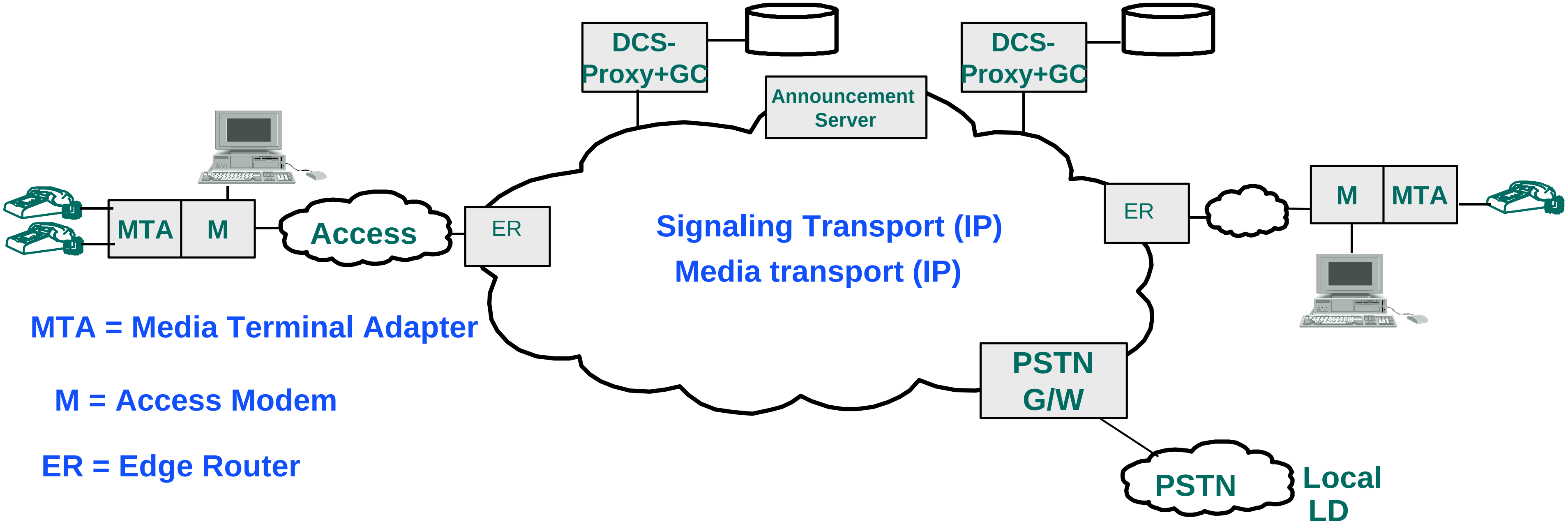
Requirements from a Service Provider’s Perspective

- Need for differentiated quality-of-service is fundamental
  - must support resource reservation and admission control, where needed
  - hope SIP enables lots of new services; also desire to meet needs of current users
- Allow for authentication and authorization on a call-by-call basis
- **Can’t trust** CPE to transmit accurate information or keep it private
- Need to guarantee privacy and accuracy of feature information
  - e.g., Caller ID, Caller ID-block, Calling Name, Called Party
    - privacy may also imply keeping IP addresses private
- Protect the network from fraud and theft of service
  - critical, given the incentive to bypass network controls
- We must be able to operate in large scale, cost-effectively
  - don’t keep state for stable calls in proxies; end-points can keep state associated with their own calls

Distributed Call Signaling Framework



DCS-Proxy+GC

DCS-Proxy+GC

Announcement Server

MTA

M

Access

ER

Signaling Transport (IP)

Media transport (IP)

ER

M

MTA

PSTN G/W

PSTN

Local LD

MTA = Media Terminal Adapter

M = Access Modem

ER = Edge Router

- Designed as a complete end-to-end signaling architecture for PacketCable
  - Philosophy: encourage features and services in intelligent end-points, wherever technically and economically feasible
  - “DCS-Proxy” designed to be scalable transaction server
  - Resource management protocol provides necessary semantics for telephony
  - “Gates” (packet classifiers) at network edge allow us to avoid theft of service

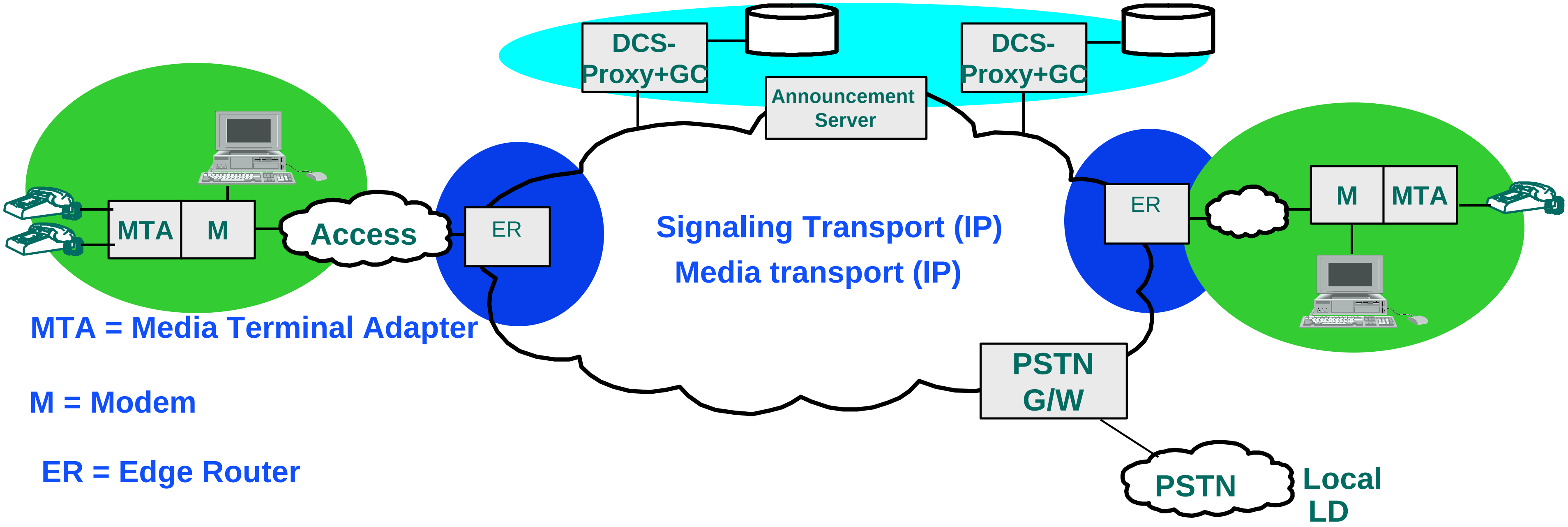
DCS Architecture

- Enhances SIP With Carrier Class Features
  - Resource Management
  - Privacy
  - Authorization and Theft of Service issues
- Tight Coupling Between Call Signaling And QoS Control
  - Prevent Call Defects: don’t ring the phone if resources are unavailable
  - Prevent Theft Of Service: associate usage recording and resource allocation, ensuring non-repudiation
    - » provide the ability to bill for usage, without trusting end-points
    - » ensure quality requirements for service are met (e.g., don’t clip “Hello”)
- Care taken to ensure untrusted end-points behave as desired
- Privacy mechanisms built into architecture

DCS Architecture

- Makes use of end-point intelligence
  - useful from the point of view of new feature creation
- Distribution of state
  - Clients keep Call State
  - Edge Routers keep Connection State
  - DCS-Proxy only keeps Transaction State
- Failure model minimizes service impacts due to component outages

DCS Architecture



MTA = Media Terminal Adapter

M = Modem

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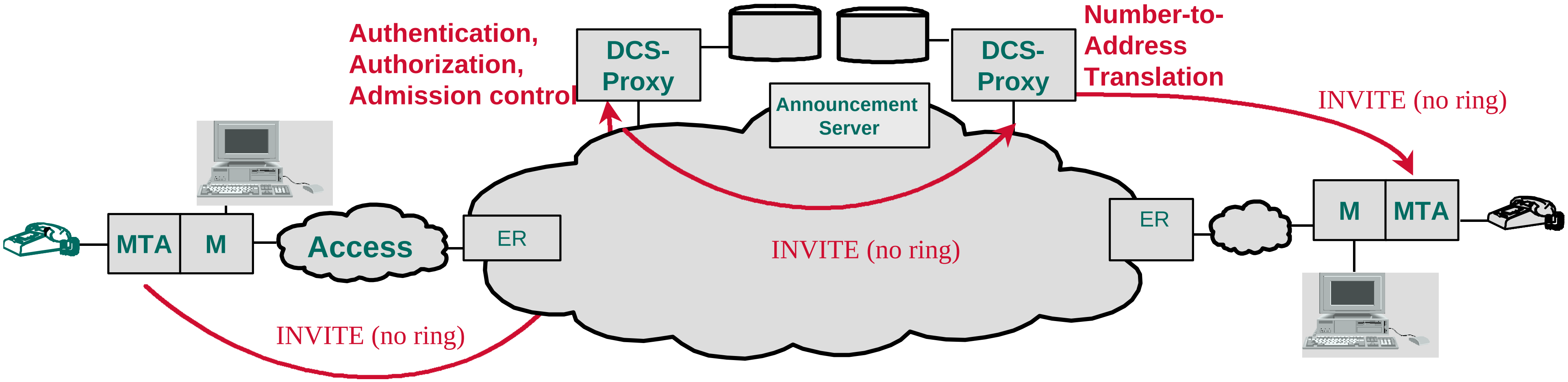
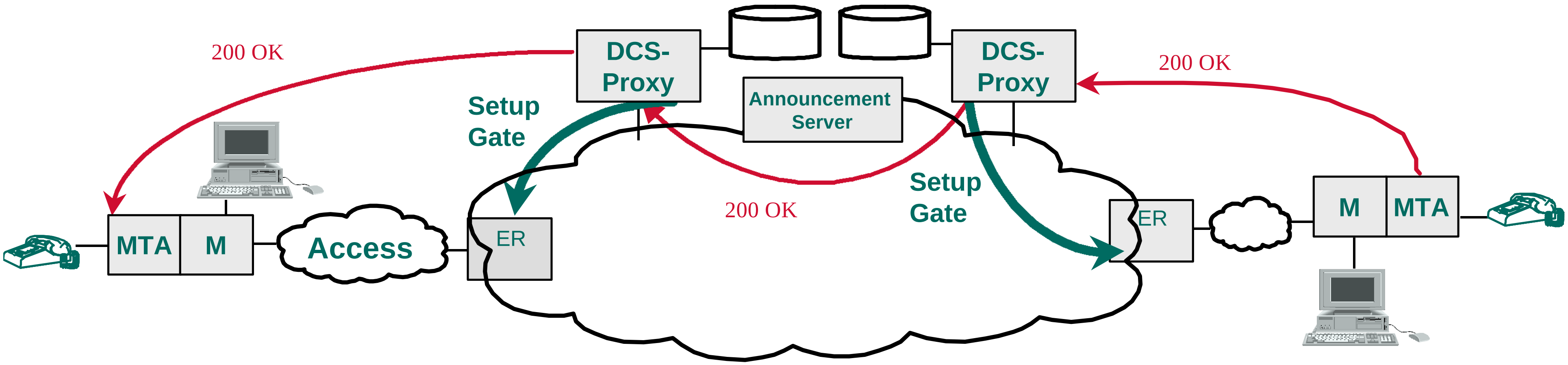
Call State **Connection State** **Transaction State**

Example Call Flow



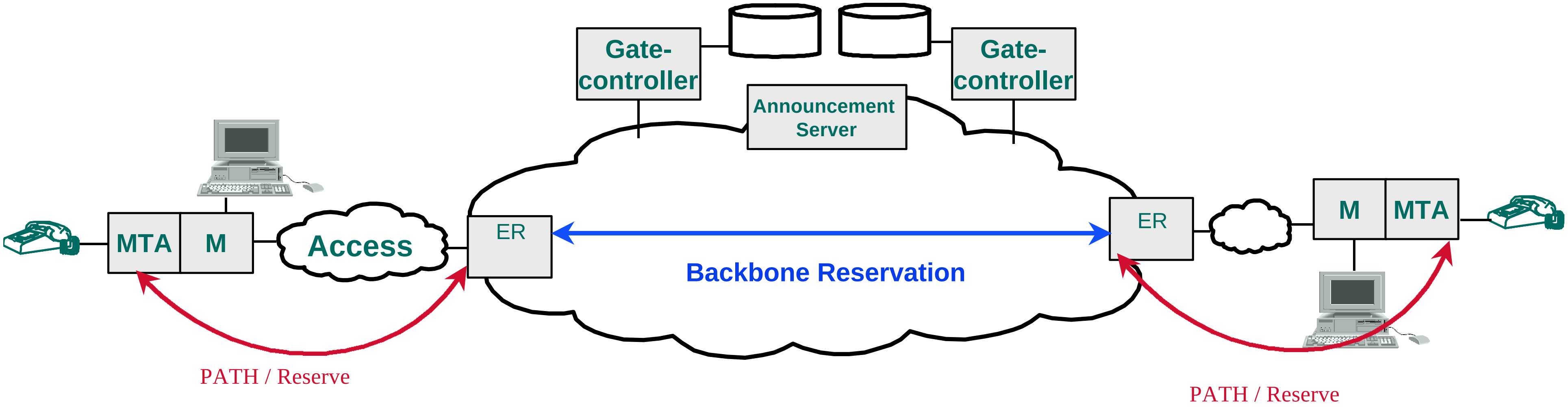
- ◆ MTA issues an INVITE to destination E.164 (or other) address
  - – don’t know yet “what” resources are needed to “where”
  - – provider may choose to block a call if resources are unavailable
    - » but P(blocking) may be ≥ P(call defect)
      - ➪ call defect: when the call fails after the parties are notified
- ◆ Originating DCS-proxy performs authentication and authorization
- ◆ Terminating DCS-proxy translates dest. number to local IP address

Example Call Flow (contd…)



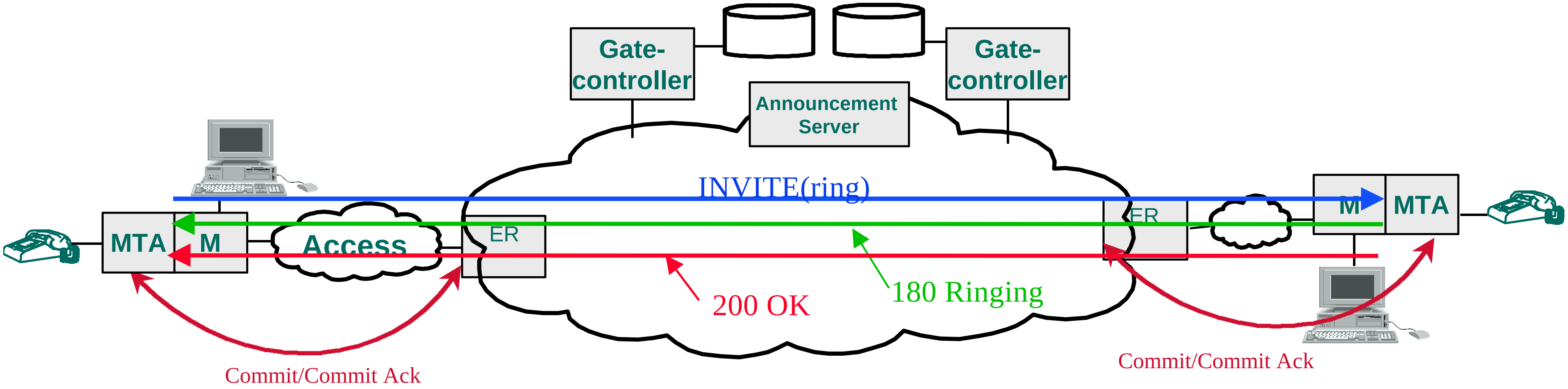
- 200 OK communicates call parameters and gate identity to MTA
- Gate controllers setup “gates” at edge routers as part of call setup
  - gate is described as an “envelope” of possible reservations issued by MTA
  - gate permits reservation for this call to be admitted
- Policy may be exercised either at Gate controller or associated policy server

Resource Management: 1st Phase



- MTA initiates resource reservation
  - access resources are “reserved” after an admission control check
    - » this insures that resources are available when terminating MTA rings
  - backbone resources are “reserved” (e.g., explicit reservation or “packet marking”)
- Originating MTA starts end-to-end handshake with terminating MTA
  - originating MTA sends INVITE(ring), terminating MTA sends 180 RINGING, 200 OK

Resource Management: 2nd Phase



- MTA knows voice path is established when it receives a 200 OK
- MTAs initiate resource "commitment"
  - resources "committed" over access channel
    - CMTS starts sending unsolicited grants; usage recording is started
  - commitment deferred until far end pick up, to prevent theft of service; allow efficient use of constrained resources in access network
- Commit opens the "gate" for this flow

Signaling Performance Requirements

- Short post-dial delay
  - no perceptible difference in post-dial delay compared to circuit-switched network
- Short post-pickup delay
  - delay from when the user picks up a ringing phone and the voice path being cut-through should be small
    - called party's "hello" must not be clipped
    - calling party's response to hearing the "hello" must also not be clipped
- Probability of Blocking: a metric to which provider may engineer net
- Probability of Call Defect (i.e., call that has both parties invited to and then fails) due to lack of resources needs to be much smaller
  - target rates not necessarily under the control of the provider
- Flexibility in deployment of DCS-Proxy: start small.

DCS: Profile With Extensions

- 6 Internet Drafts have been submitted:
- Architectural Overview
  - » draft-dcsgroup-mmusic-arch-00.txt
- Resource Management And Call Authorization
  - » draft-dcsgroup-mmusic-resource-00.txt
  - » draft-dcsgroup-mmusic-call-auth-00.txt
- Privacy
  - » draft-dcsgroup-mmusic-privacy-00.txt
- Proxy-to-Proxy Communications
  - » draft-dcsgroup-mmusic-proxy-proxy-00.txt
- Distributed Call State
  - » draft-dcsgroup-mmusic-state-00.txt