Internet Multicast: It's still a thing!
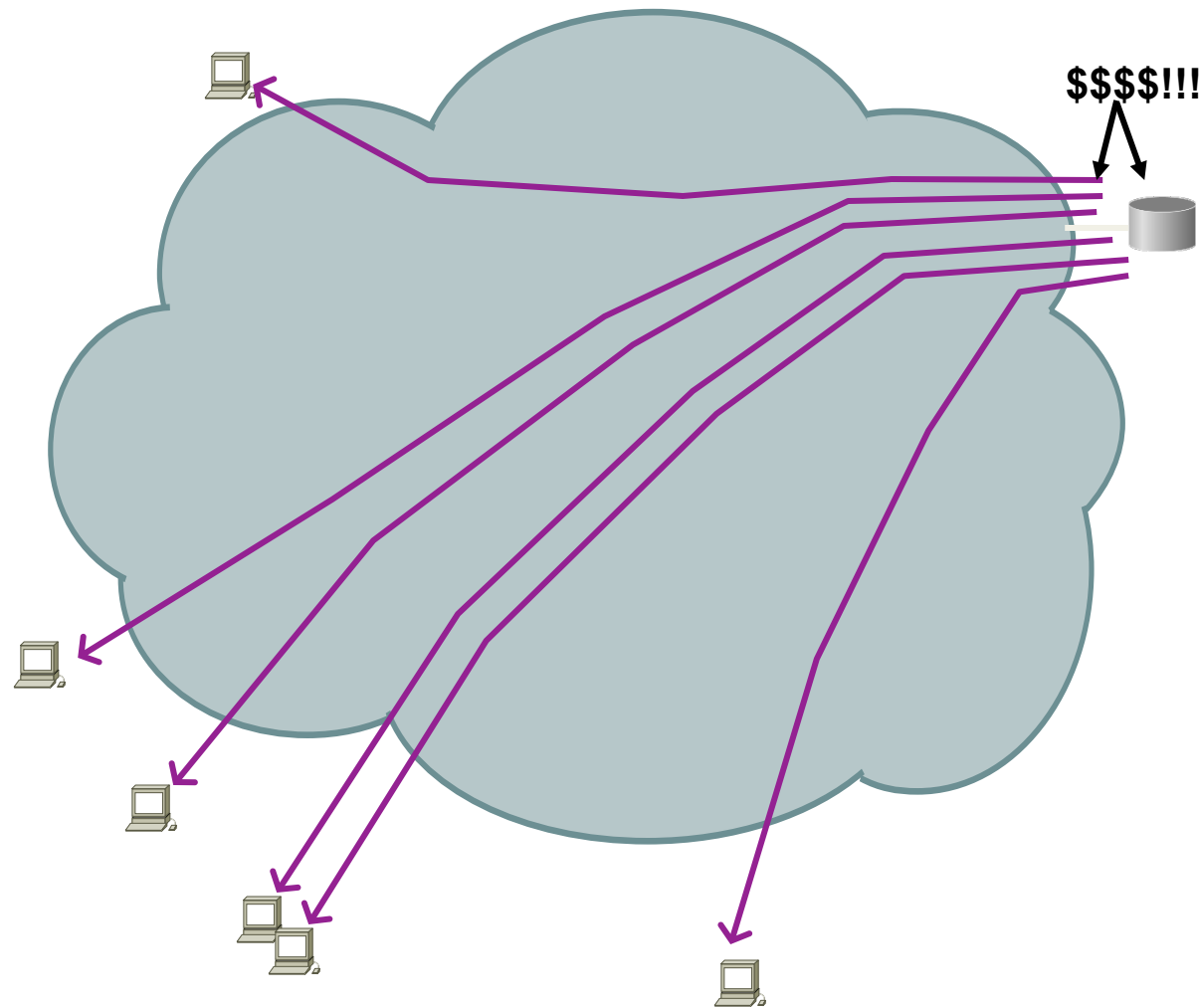
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State Of Multicast Today

- Multicast has been a modest success overall
  - Vital in some places (Financials, MVPN, video distribution)
    - Walled-garden deployments
- Internet Multicast has been more … disappointing
  - Interest is as low as ever…
  - Need is as high as ever…
  - Components for success exist
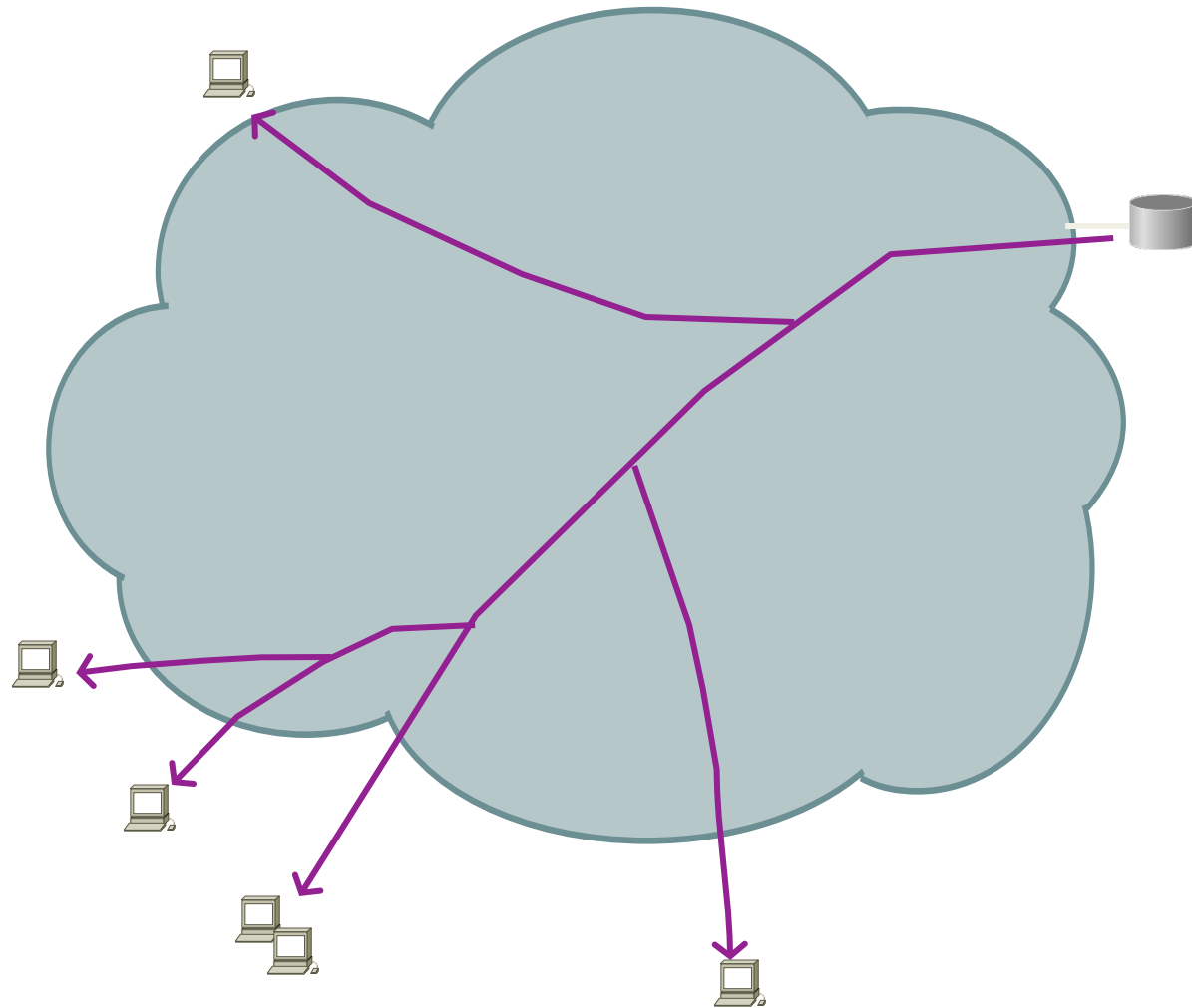 - You may already be using it!

Internet Multicast: What went wrong?

- Internet Multicast (MBONE) status
  - ~25k BGP routes, ~450 ASNs are multicast enabled
  - Necessity for Internet applications: ubiquity
  - Anything less than ~100% deployment might as well not exist
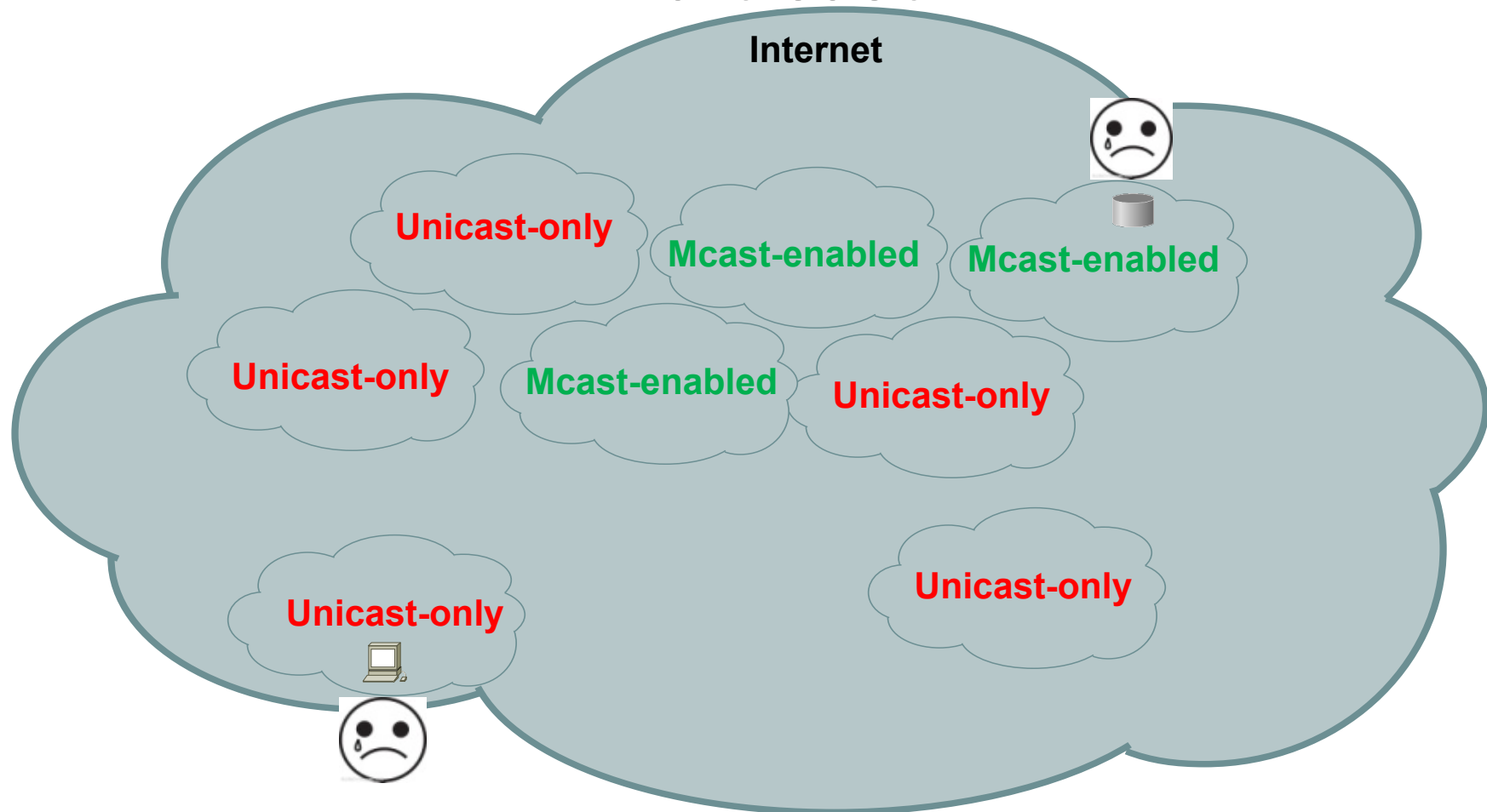 - Chicken and egg

In the beginning, there was unicast…

...then came Multicast

But, there was a problem with multicast...

Internet

Unicast-only   Mcast-enabled   Mcast-enabled

Unicast-only   Mcast-enabled   Unicast-only

Unicast-only

Unicast-only
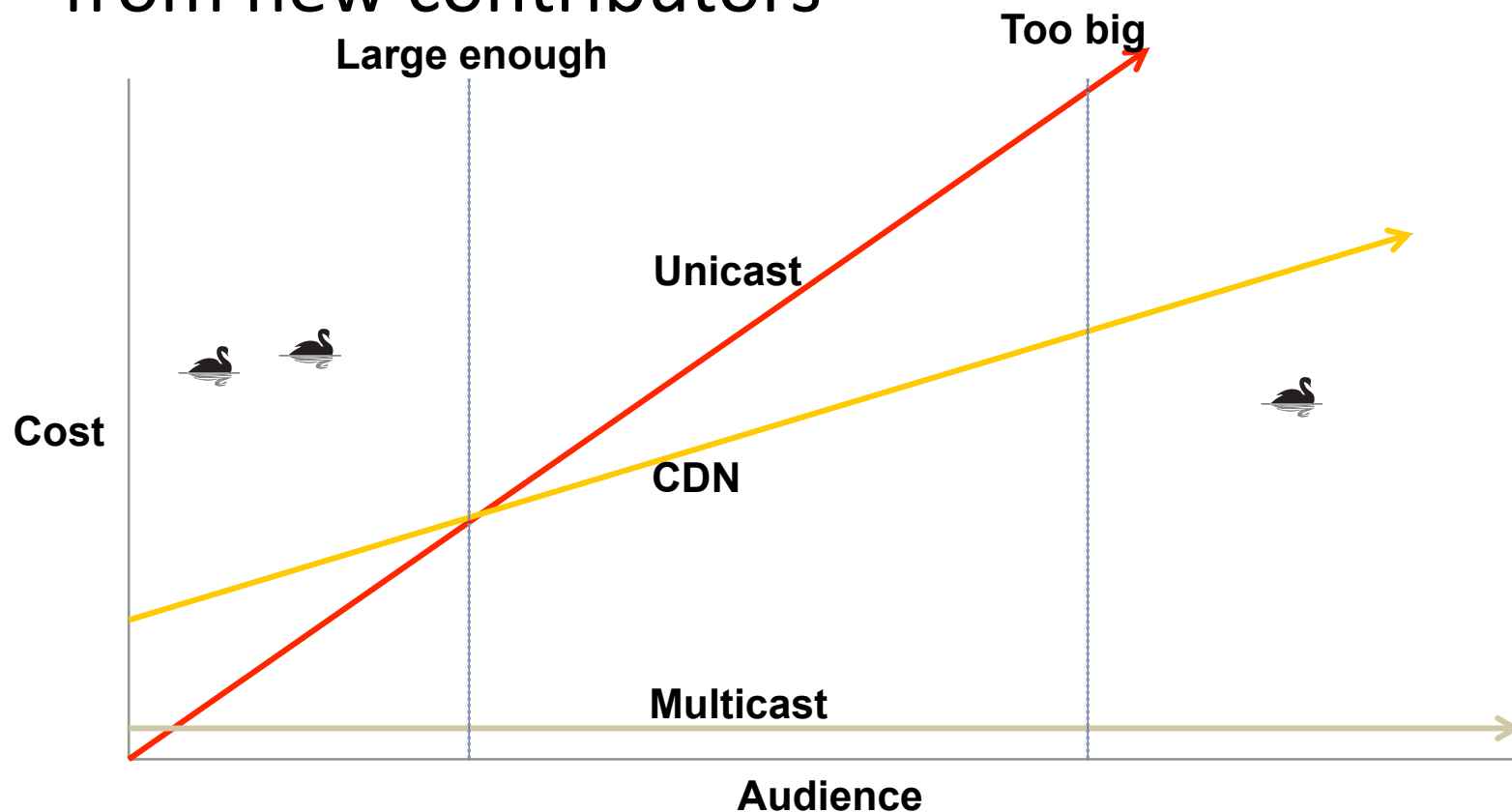
- The "All or Nothing" problem

What to do? CDNs!

- Content Delivery Networks become popular
  - Almost as good as multicast, and it just works!
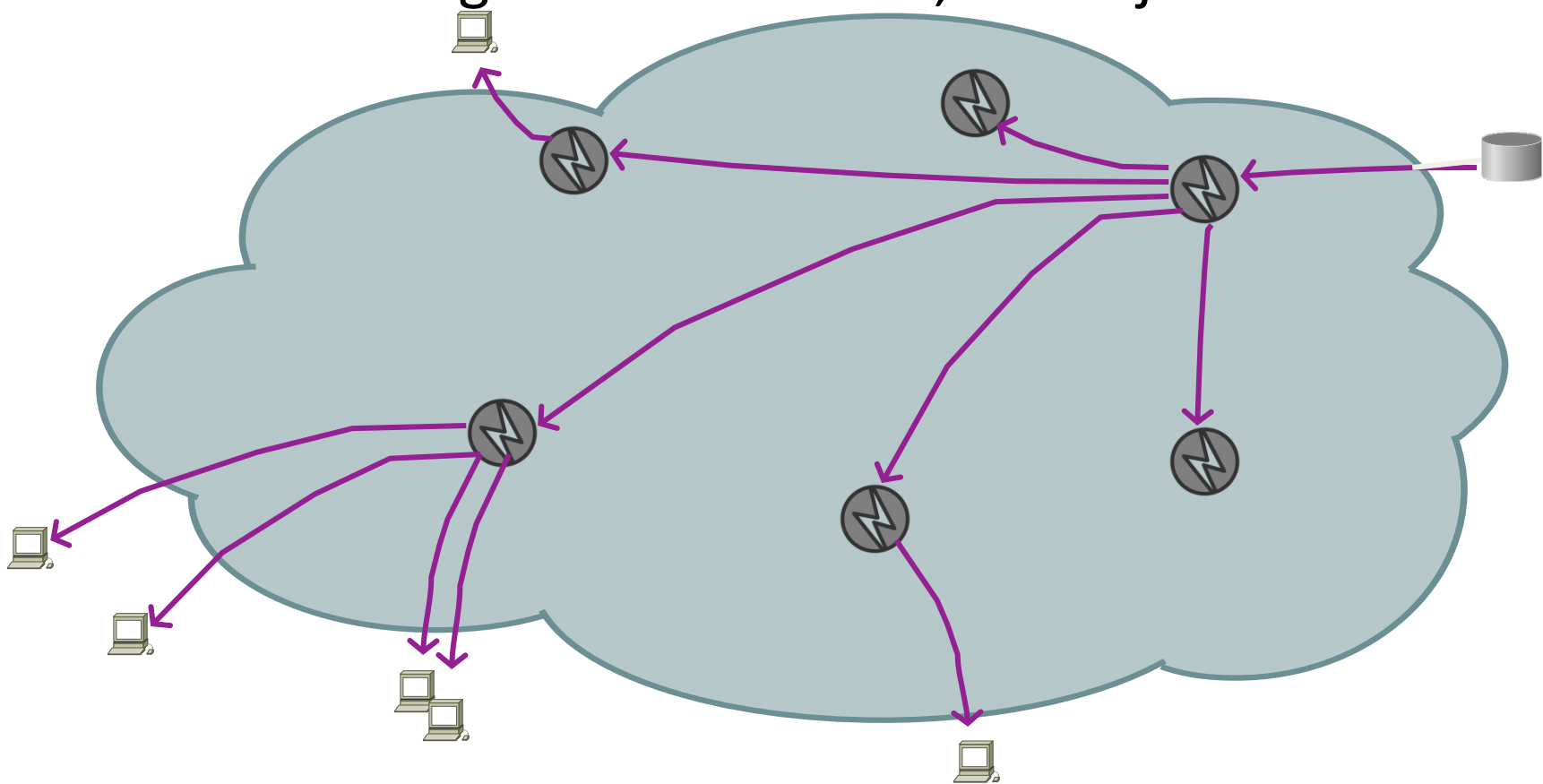
Comparison: Unicast, CDN and Multicast

- Middle is where you find convenience- old content in new places

- Tails are where you find disruption- new content from new contributors

Early uses of Disruptive technologies

- First Websites (1991):
  - Gopher Search Engine
  - CERN, WWW Digital Library (TBL's web catalog at CERN)
  - Digital Picture Archive on the 17th Floor of Delft Univ
  - Stanford Linear Accelerator Center
  - …later would lead to Amazon, eBay, Google, Wikipedia
- First Webcam (1993):
  - Trojan Room coffee pot of Cambridge Univ
  - …later would lead to Skype, YouTube
- Lesson: don't judge a technology by the content available now, but rather by what becomes possible
  - Thought experiment: imagine what would become possible with a multicast-enabled Internet

"Think Ecology, not Economics*"

- **Diversity: different species take advantages of different niches, providing opportunities for specialized growth and success**
- **What does this mean?**
  - **NEW Content from NEW contributors**
  - **Next Generation of TV (NGTV)**
  - **Sporting events (big and small), foreign TV content, drones, ????**

[*] John Naughton, *From Gutenberg to Zuckerberg*

So What's New?

- Internet Multicast has been around since the 90's and hasn't gained much traction

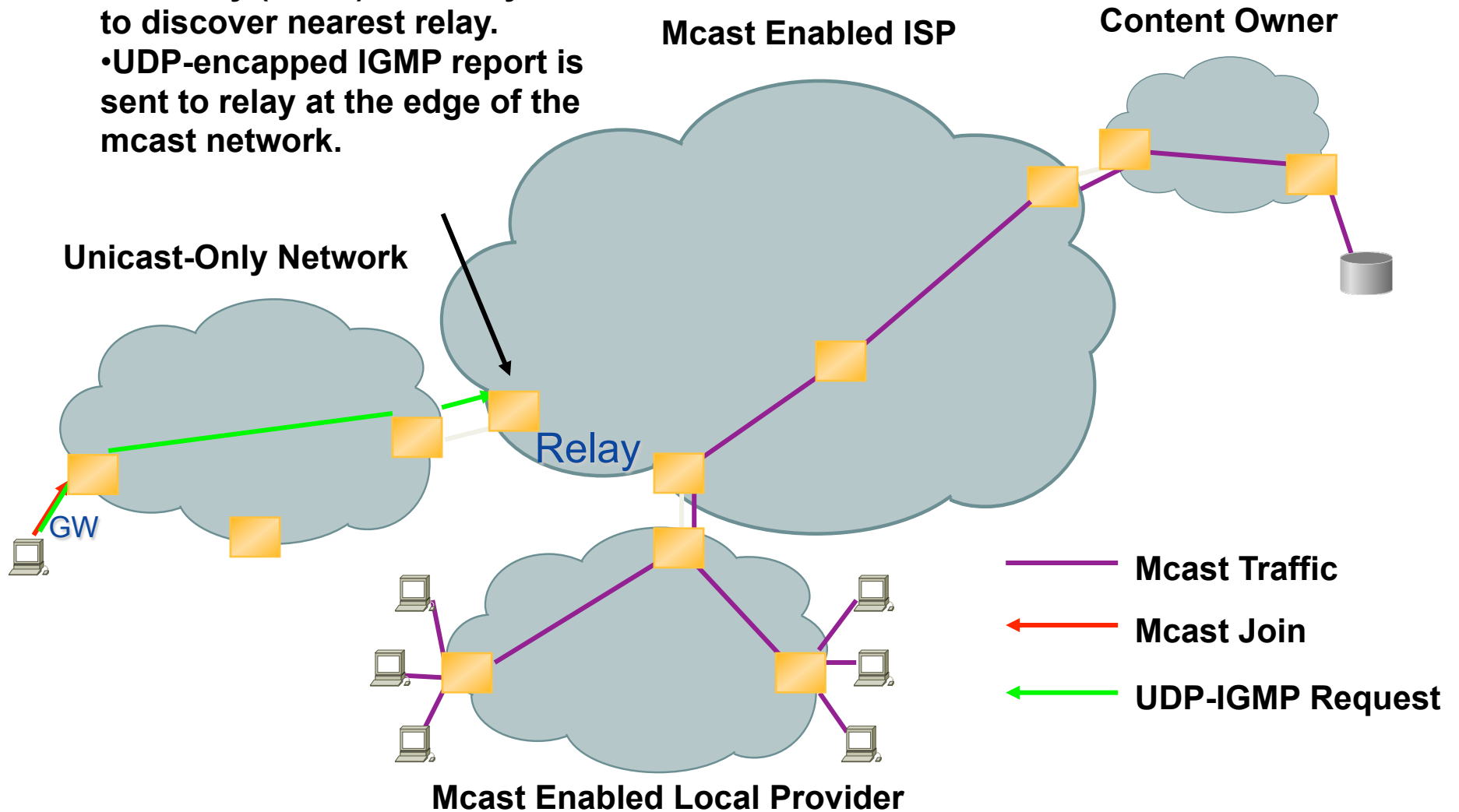# Internet Mcast Game Changer: AMT

- Automatic Multicast Tunnels
- Addresses fundamental "all or nothing" problem
  - Treats issue as a transition problem
    - Rather than trying to get mcast enabled everywhere, make mcast available everywhere
    - Dynamically tunnel from mcast-enabled islands to end users in unicast-only abyss
  - End users no longer dependant on their local provider to receive mcast

Solution Requirements

- Must be simple (grandmother-proof)
- Must work with any application (Flash, Real, QT, etc)
- Must work with any access technology (DSL, Cable, mobile, VPN, etc)
- Content providers must enjoy the benefits of multicast
  - Otherwise they won't be providing content for long

AMT- How it works

- Gateway (client) uses Anycast to discover nearest relay.
- UDP-encapped IGMP report is sent to relay at the edge of the mcast network.

Unicast-Only Network

Mcast Enabled ISP

Content Owner

Relay

GW

Mcast Enabled Local Provider

—— **Mcast Traffic**

—— **Mcast Join**

—— **UDP-IGMP Request**

AMT – Unicast Edge Network

Mcast Enabled ISP

Content Owner

Mcast join is sent by relay on behalf of the unicast receiver.

Unicast-Only Network

Relay

GW

Mcast Enabled Local Provider

Mcast Traffic

Mcast Join

UDP-IGMP Request

AMT – Unicast Edge Network

Mcast Enabled ISP

Content Owner

Mcast stream is replicated and encapped in UDP to the unicast receiver.

Unicast-Only Network

Relay

GW

Mcast Enabled Local Provider

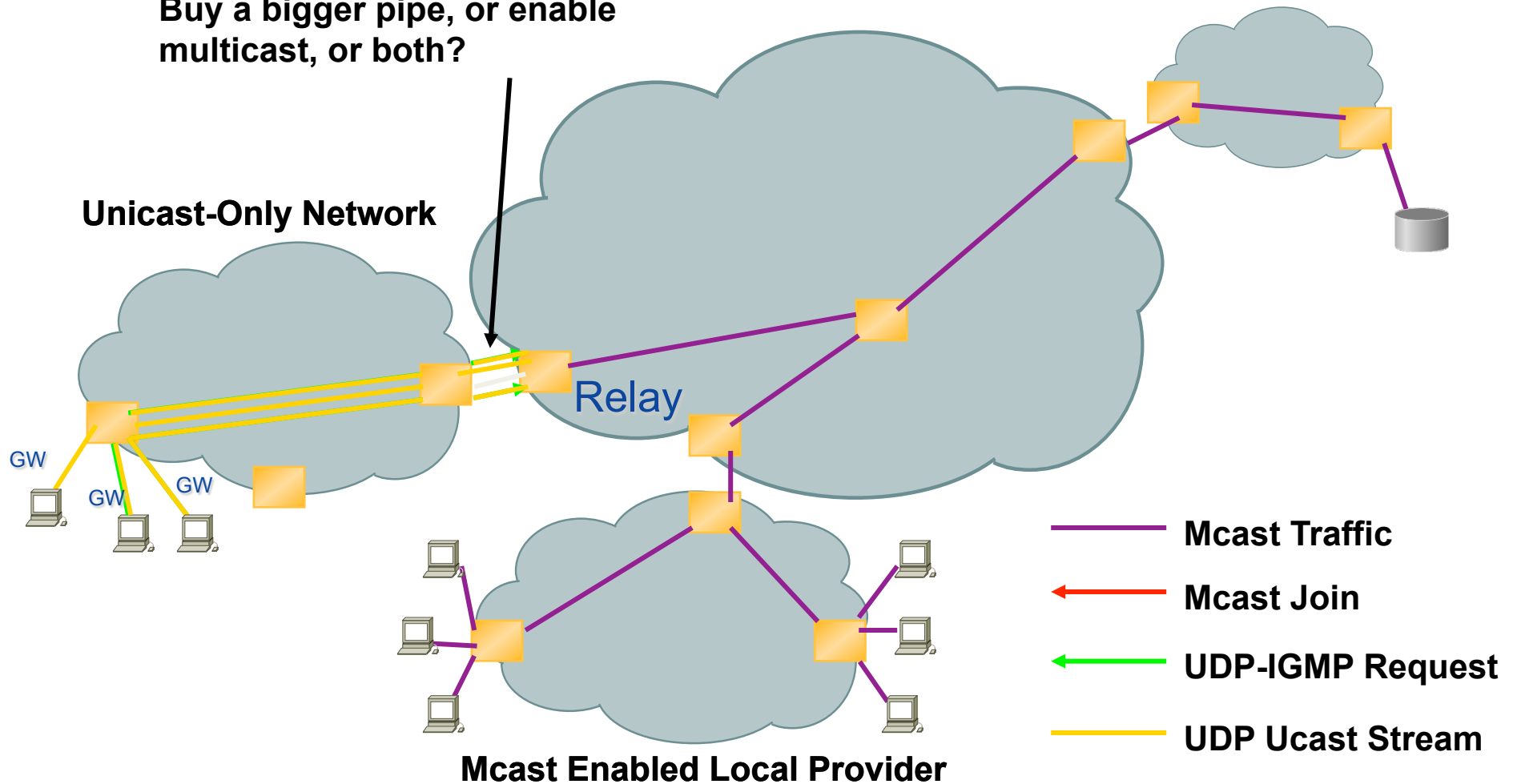|	
———	**Mcast Traffic**
⟵	**Mcast Join**
⟵	**UDP-IGMP Request**
———	**UDP Ucast Stream**

AMT – Unicast Edge Network

Mcast Enabled ISP

Content Owner

Buy a bigger pipe, or enable multicast, or both?

Unicast-Only Network

Relay

GW

GW   GW

Mcast Enabled Local Provider

——— **Mcast Traffic**

◄——— **Mcast Join**

◄——— **UDP-IGMP Request**

——— **UDP Ucast Stream**

AMT Overview

- Provides a transition strategy for unicast-> multicast networks
  - Builds dynamic tunnels to hosts
- Any application (Flash, Real, QT) can sit on top of AMT
- Uses UDP so no kernel level changes
  - Unlike IGMPv3, can be a simple plug-in
  - UDP allows NAT/firewall transversal

AMT Details

- 3-way handshake to join groups from unicast receivers to prevent spoofing and DOS attacks
- Replication server (relay) joins multicast group and translates into multiple unicast streams
- Anycast discovery allows for closest topological relay
- Client (gateway) can be a host or join on behalf of local receivers
- Only ~1 line of config enables a native deployment to reach any host on the Internet

AMT Spec Status

- Multivendor proposal- Microsoft, Cisco, Alcatel, Juniper
  - draft-ietf-mboned-auto-multicast
  - Status: IESG Evaluation
  - All DISCUSS issues appear to be resolved now
    - Congestion control, security model
  - Very close to advancement to RFC
- A number of implementations exist
  - Deployed on the Internet for years

Internet Mcast and IPv6: Technological Cousins

- Any argument for/against IPv6 applies just as well to Internet Mcast
  - It's not needed: NAT, CDN
  - It is needed: v4 address exhaustion, missing long tail of TV
- Both suffer the "all or nothing" problem
- Both require new protocols/extensions of old ones
- Both born in the 90s, struggled through adolescence
- Both require faith in the unseen
  - Both do accomplish little on their own, but enable big things

Will it really happen?

- Internet is the dominant transport for nearly all forms of media, information, entertainment and commerce
  - Newspapers, magazines, books, music, etc
    - Everything except TV!
- Television remains a notable holdout
  - Seems inevitable that they will eventually (truly) merge
- Brute-force unicast is really co$$$tly
  - Bandwidth is cheap and plentiful... but not free or infinite
- AMT is the first step towards NGTV
- It's happening today!
  - AT&T/Octoshape Internet Mcast collaboration using AMT
  - CNN.com, Eurovision Song Contest, French Open

Still Not Convinced?

AMT is a...

Cloud-based
Virtualizable
Service-Chainable
SDN solution!

What's Next

- Reviving PAIX MIX
  - Public AMT Relays
  - Send email to lenny@juniper.net if interested
- World Multicast Day?
- Other ideas??

Further Reading on AMT

- AMT Spec
  - http://datatracker.ietf.org/doc/draft-ietf-mboned-auto-multicast/
- AT&T-Octoshape Internet Mcast Collaboration:
  - *http://www.attinnovationspace.com/innovation/story/a7658924*
  - *http://www.nanog.org/meetings/nanog52/abstracts.php?pt=MTc5OSZuYW5vZzUy&nm=nanog52*
- Next generation TV over the Internet: This revolution will be televised
  - http://www.networkworld.com/news/tech/2011/010511-tech-update-next-gen-tv.html

When the World Deploys Multicast