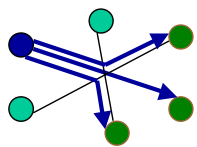


# A Profitable Multicast Business Model

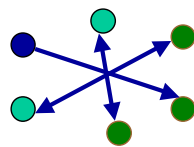
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## Why Multicast ?

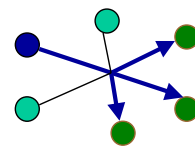
one sender three receivers



multiple unicast



broadcast



multicast

## Multicast Deployment

- impediment: lack of good business model
- **question:** how to distribute benefits of multicast among all parties (sender, receivers, ISPs) involved?

## Overview

- business model
- profit analysis
- numerical examples
- deployability
- conclusions

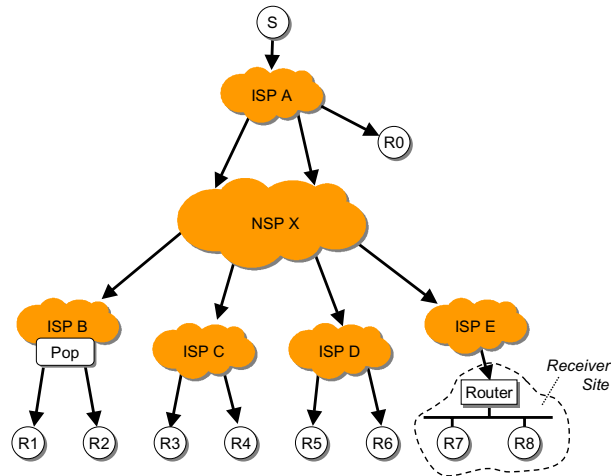
## Business Model

- sender
  - pays for multicast bandwidth to I SP
  - might charge receivers for content
- receivers
  - should not pay extra for receiving multicast over unicast
  - could be charged for content
- I SP(s) charge sender for resources used in network for multicast

## Profitability Expectation

- sender
  - pays less for multicast to  $N$  ( $> 1$ ) receivers in comparison to  $N$  unicasts to I SP
  - profit grows as  $N$  increases, some of which offered as higher discount to receivers
- receivers
  - receive content at discounted price
- I SP(s)
  - charge much more than single unicast but less than  $N$  unicasts
  - support more streams

## Network Model



## Profit Analysis

sender profit

$$\underbrace{(Nx_m - C)}_{\text{multicast profit}} - \underbrace{N(x_u - b_u)}_{\text{unicast profit}}$$

receiver profit

$$x_u - x_m$$

$N$  = #receivers

$x_u$  = content cost when unicast

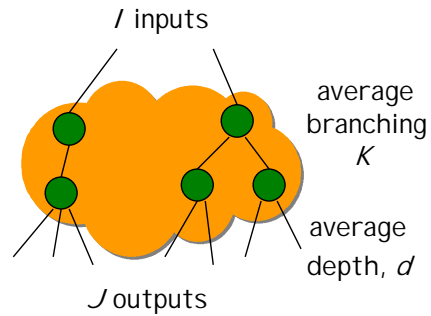
$x_m$  = content cost when multicast

$b_u$  = unicast bandwidth cost

$C$  = ISP(s) charge

## I SP Profit

- find  $L_m$ , #links in multicast subtrees
- $C_i = L_m * c_u / d$   
 $c_u$  = unicast cost
- I SP charges  $(1+\delta) * C_i$
- profit =  $C_i * \delta$



$$L_m = \text{ceil} (K * (J-1) / (K-1))$$

## Total I SP Charge

- aggregate charges by all I SPs bottom up
- total charge paid by sender,

$$C = (1+\delta) * \sum_i C_i$$

## Numerical Example

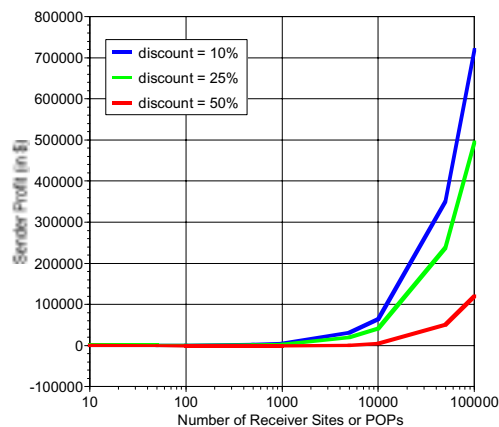
- single ISP case only

$$c_u = b_u$$

- use Chuang-Sirbu law
  - (links in multicast tree from sender to  $n$  receiver sites / average depth) =  $n^{0.8}$
  - $Lm/d = n^{0.8}$
  - assuming  $N = n$ ,  $C = (1+\delta) * n^{0.8} * b_u$
- exploit  $n^{0.8}$  --  $n$  region for profit, choose  $\delta$  such that for  $(1+\delta) = n^\epsilon$ ,  $\epsilon$  lies in  $(0, 0.2)$

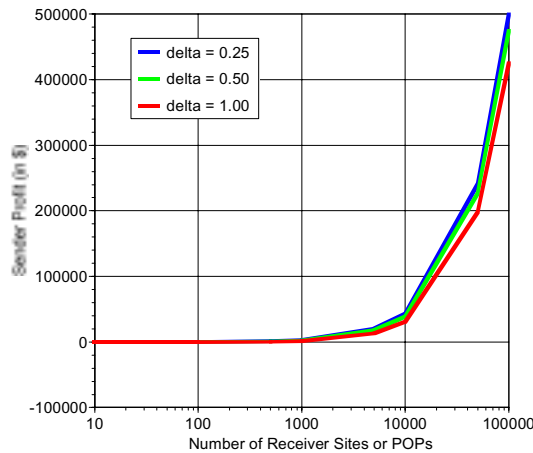
## Numerical Example (contd.)

- ISP profit,  $\delta = 30\%$
- content cost when unicast = \$15
- unicast cost = \$10
- profit increases with receiver sites as expected



## Numerical Example (contd.)

- receiver discount = 25%
- content cost when unicast = \$15
- unicast cost = \$10
- profit increases with receiver sites as expected



## Deployment

- I SPs calculate their share based on local view
  - ingress, egress links; average branching  $K$ , depth  $d$ , profit margin ( $\delta$ )
  - use practical experience for dimensioning
  - $K$ ,  $d$  part of bilateral agreement
- bottom-up charging
- sender could perform sanity check
  - knows #receivers in case of paid content

## Summary

- business model simple, profitable to all parties involved
- our study considers single, multiple I SP case
- new breed of content delivery services possible

## Open Issues

- multiple I SP case: profit sharing, trust model
- implementation (*mpriced??*)
- other models, scenarios with free content?
- consider other players (e.g., content delivery providers)
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