Network Effects Mean Others Matter

- Metcalfe’s Law is the most famous of many formulations
  - Suited to pair-wise connections, e.g., telephones
  - You need other people to call
  - …so the value of the network is proportional to the square of the number of people in the network (\( \propto n^2 \))
- Other “Laws” correct for structure and type of network
  - Broadcast=linear, groups=exponential, real-world=logarithmic, etc.
How Do We Measure Disparity?

- All network values show increasing total value with network growth
  - What about excluded *individuals*?
- ALL previous Network Laws are based on membership in the network
- Conventional wisdom
  - Disparity is value inside (membership) vs. those outside (assumed zero)
- But surely disparity depends on the number of people OUTSIDE the network?

Exclusion-based Framing

- The number of people inside the network matter
  - The included network may be inherently superior (broadband, immunized, etc.)
  - Included send signals to complementary networks
    - Content, OS, software, etc.
    - E.g., webpages are getting bigger with more people on broadband
      - Dial-up users suffer even if the number of people on dial-up weren’t to decrease
- Proposed exclusion-based framing captures both of these effects
Exclusion Really Matters as Networks Grow: Metcalfe’s Law Disparity Example

Exclusion has Societal Costs as well

- Those excluded from a network often resort to parallel/alternative networks
  - Such networks and their interconnections are poorly studied or even captured
- The costs of exclusion are borne not only by the excluded but by society overall
  - Factors include overhead, subsidy requirements, need to maintain alternative/parallel networks, externalities etc.
    - Classic example is Emergency Rooms and the uninsured
    - In broadband/telephony, examples include pulse/touchtone dialing, unpatched older software being responsible for many Internet attacks, etc.
Here’s a Ranking…

INFANT MORTALITY

US is ~43rd!

Mostly 2005 estimates; CIA World Factbook

Rahul Tongia, Ph.D.
Rethinking the “Normal” Distribution: Healthcare and Broadband in the US

Average numbers appear to mask a *bimodal* distribution

- Healthcare is really good or really bad
  - US Broadband ranking is perhaps 25th (19th in OECD)

Implications

- Waiting for solutions to “trickle down” will either fail or take a really long time
- Might need specialized solutions for the underserved
  - How did poorer countries manage superior infant mortality?
    - Specialized in-home visits by paramedics/midwives for every expectant mother
  - We might do the same for rural or underserved areas
    - Technology – Increase wireless emission limits, use white spaces, etc.
    - Policy – Open Access, Rights of Way, Sharing, etc.