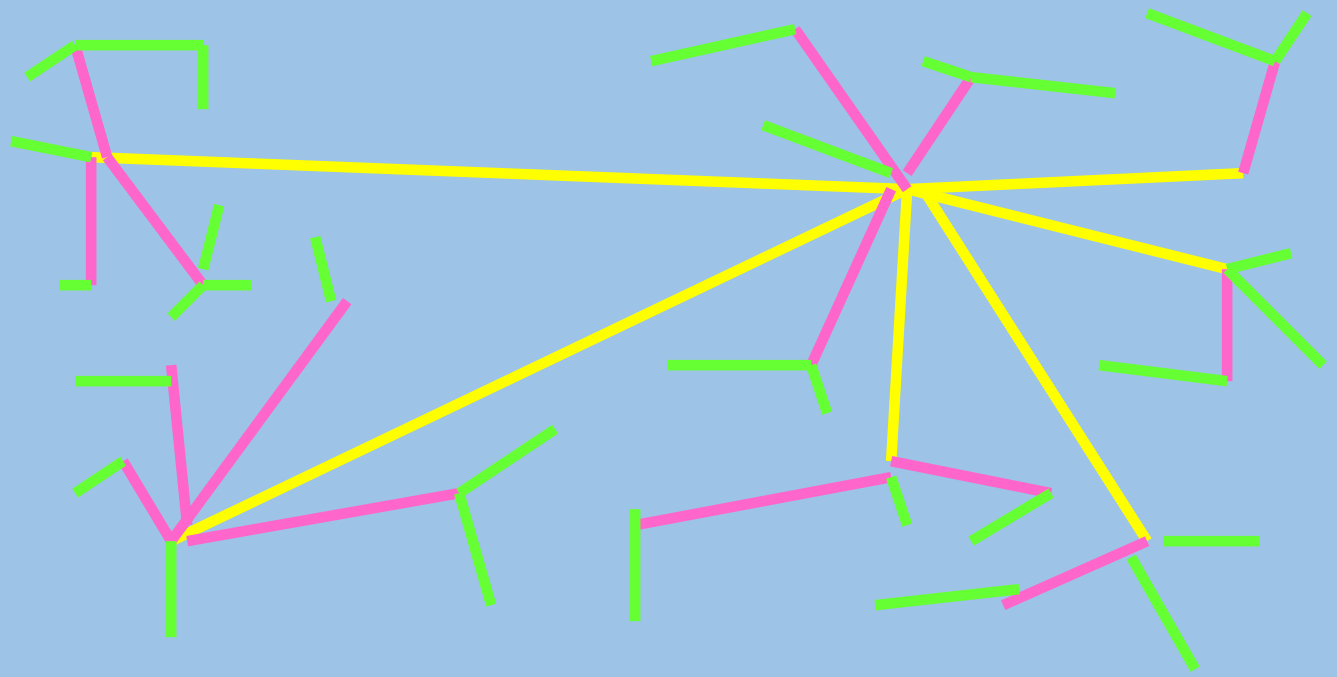
Micah Albert, USA, Redux Images. 2012, Nairobi, Kenya

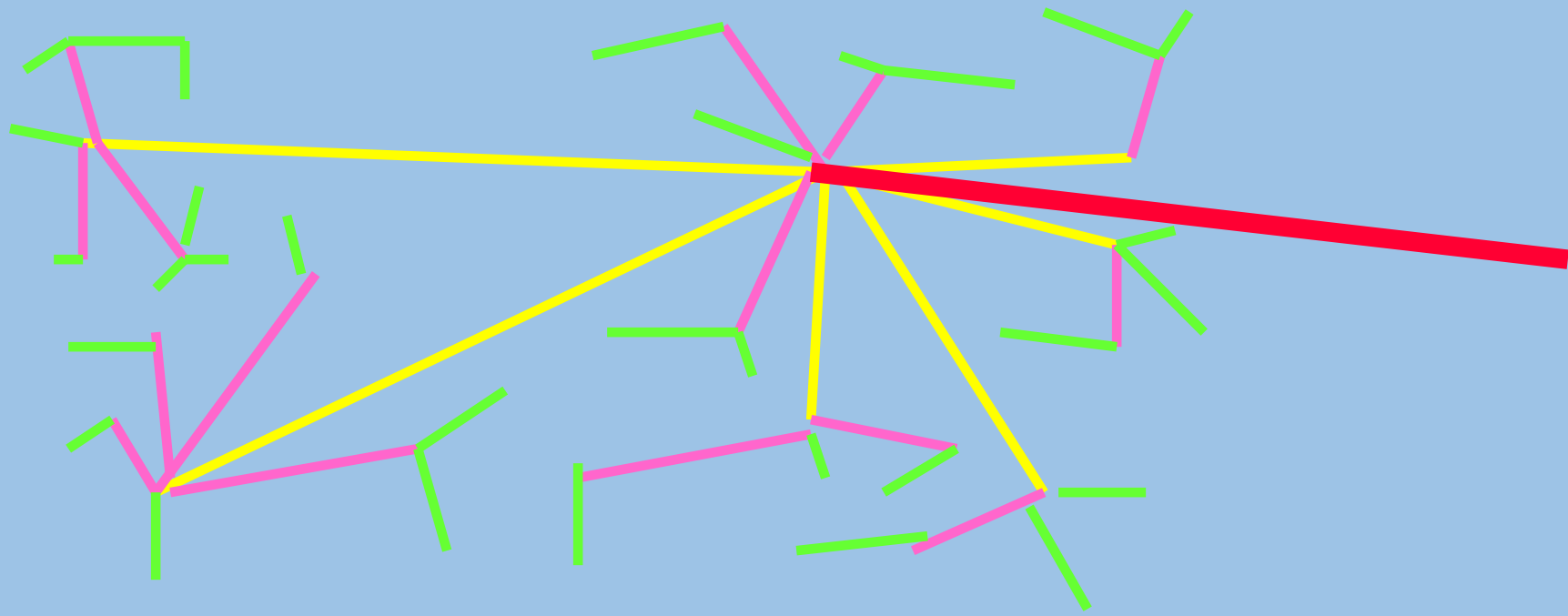
In Praise of the Intranet:

Bandwidth, bandwidth management, and the eGranary Digital Library

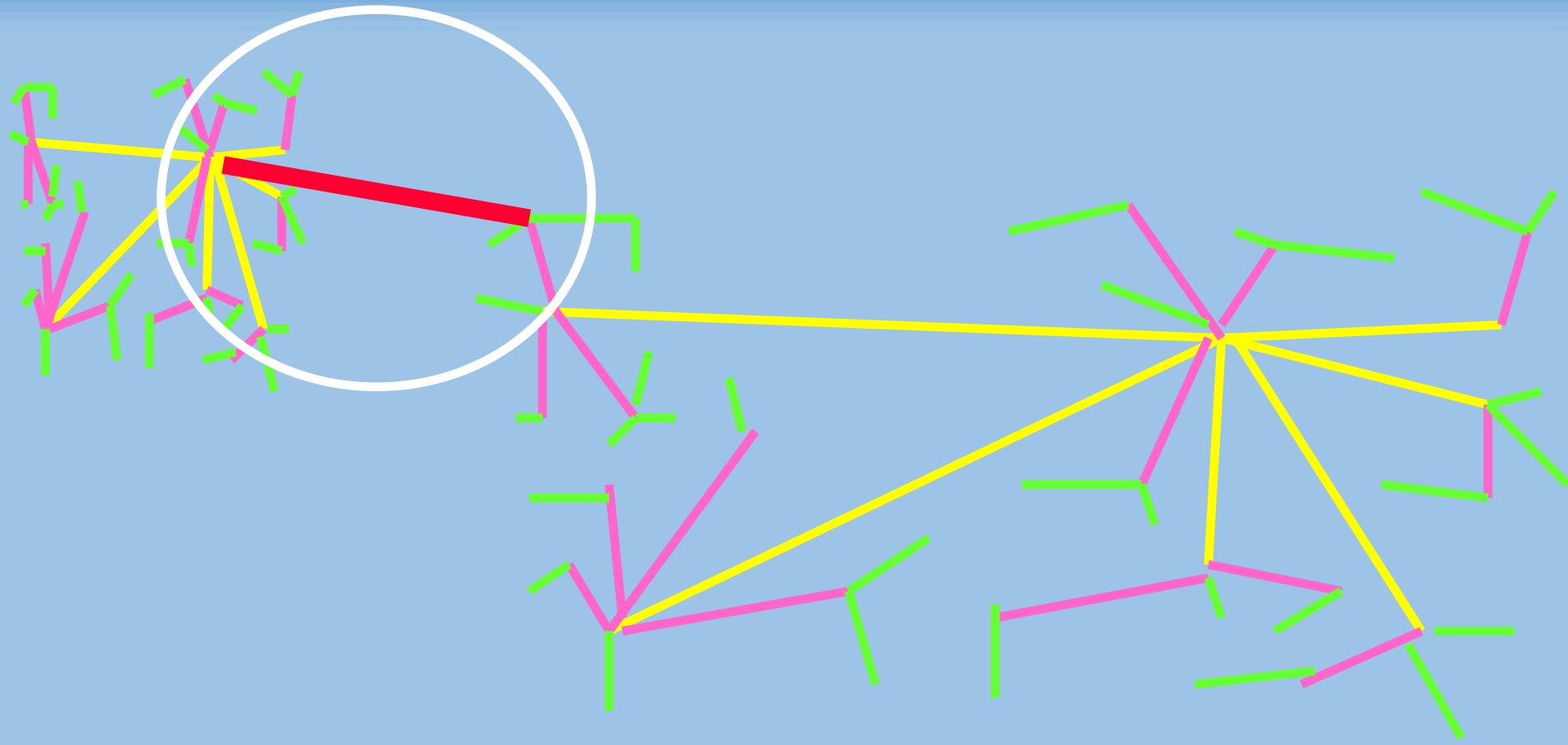
LAN: every computer and sharable device is connected



Then a connection to the Internet comes along...

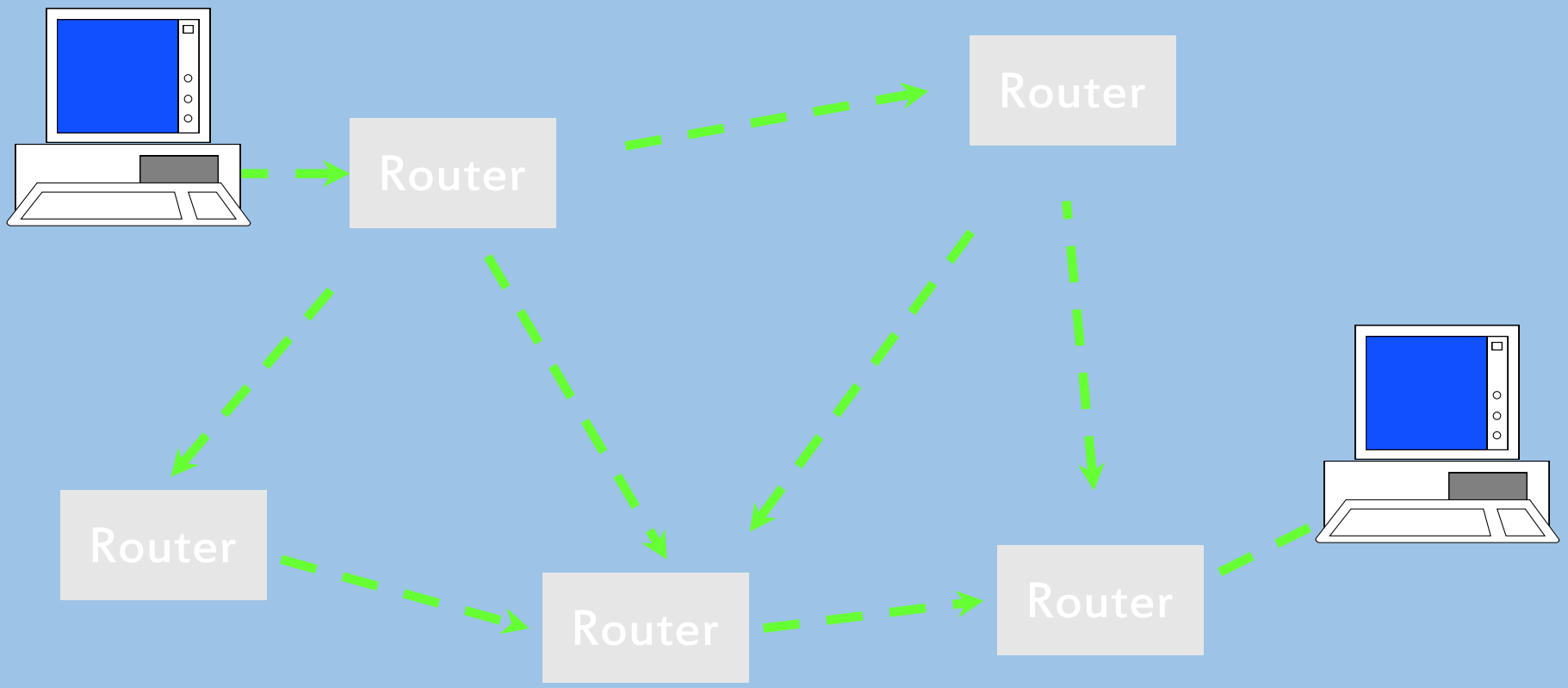


This is the key: a single connection gives all on the local network access to the entire Internet

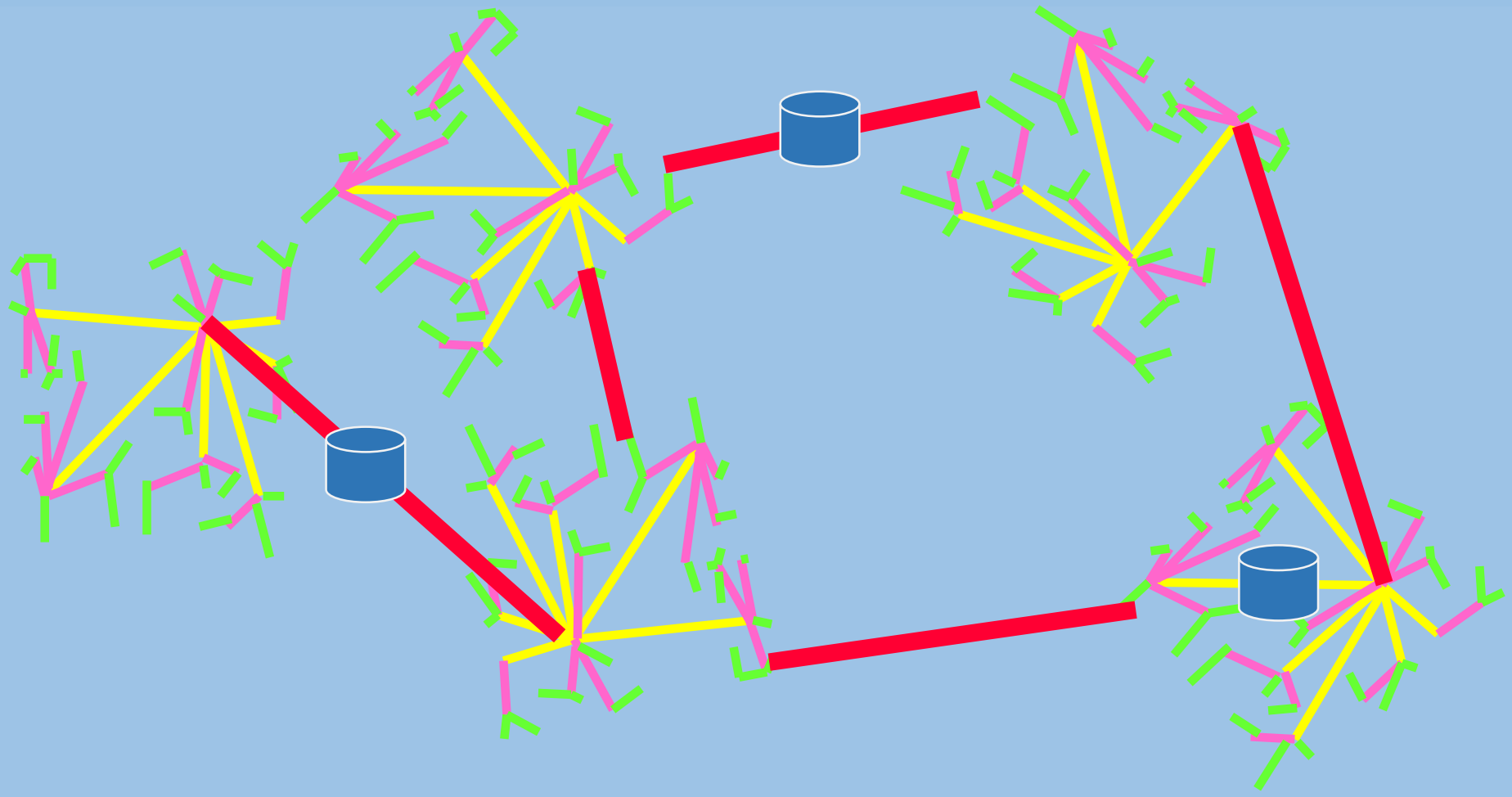


The Internet is simply a conglomeration of networks with wires running between them

Routing Packets

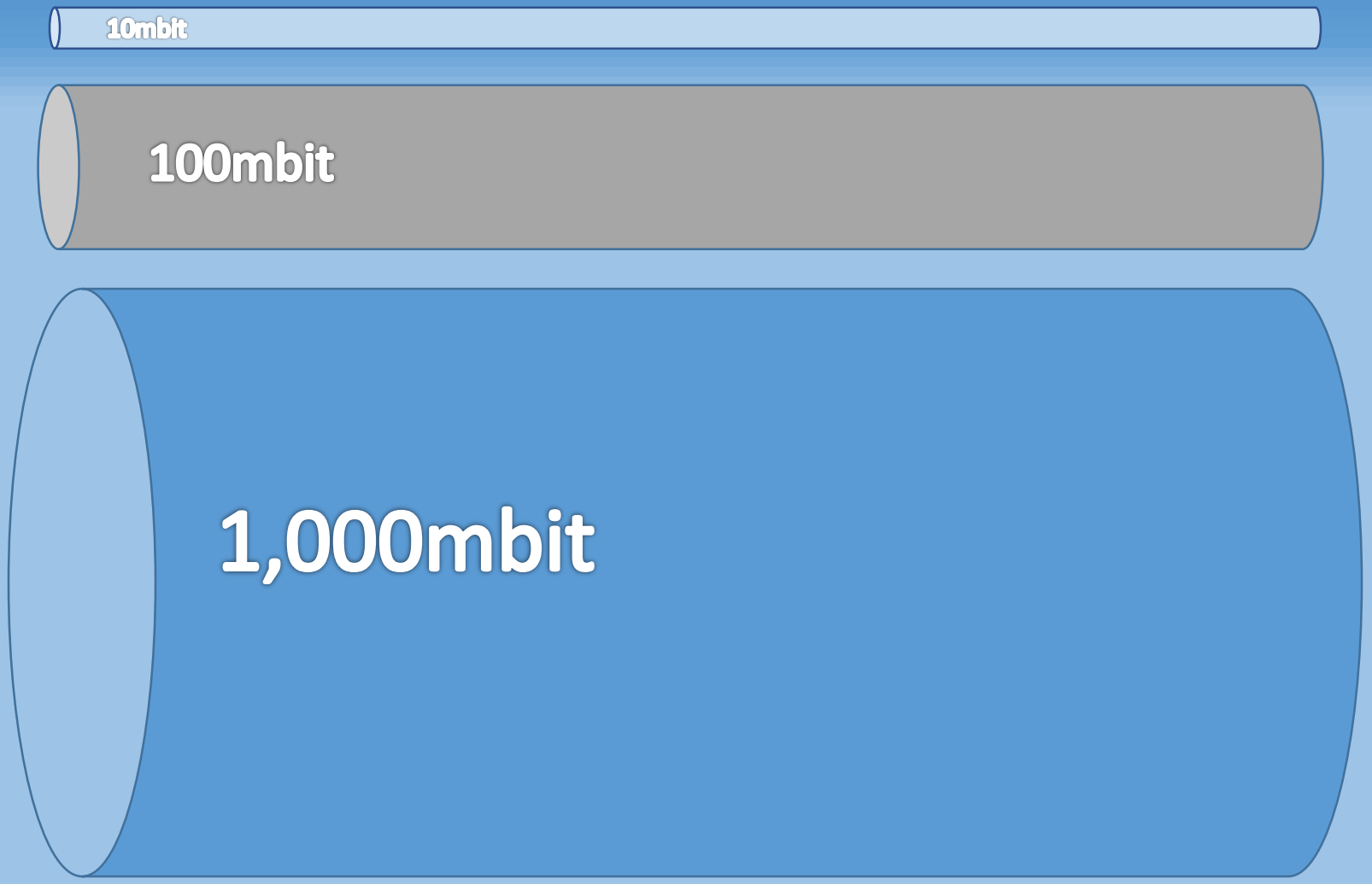


Edge Technologies: caches (Akami)



What's the Prof Up To?

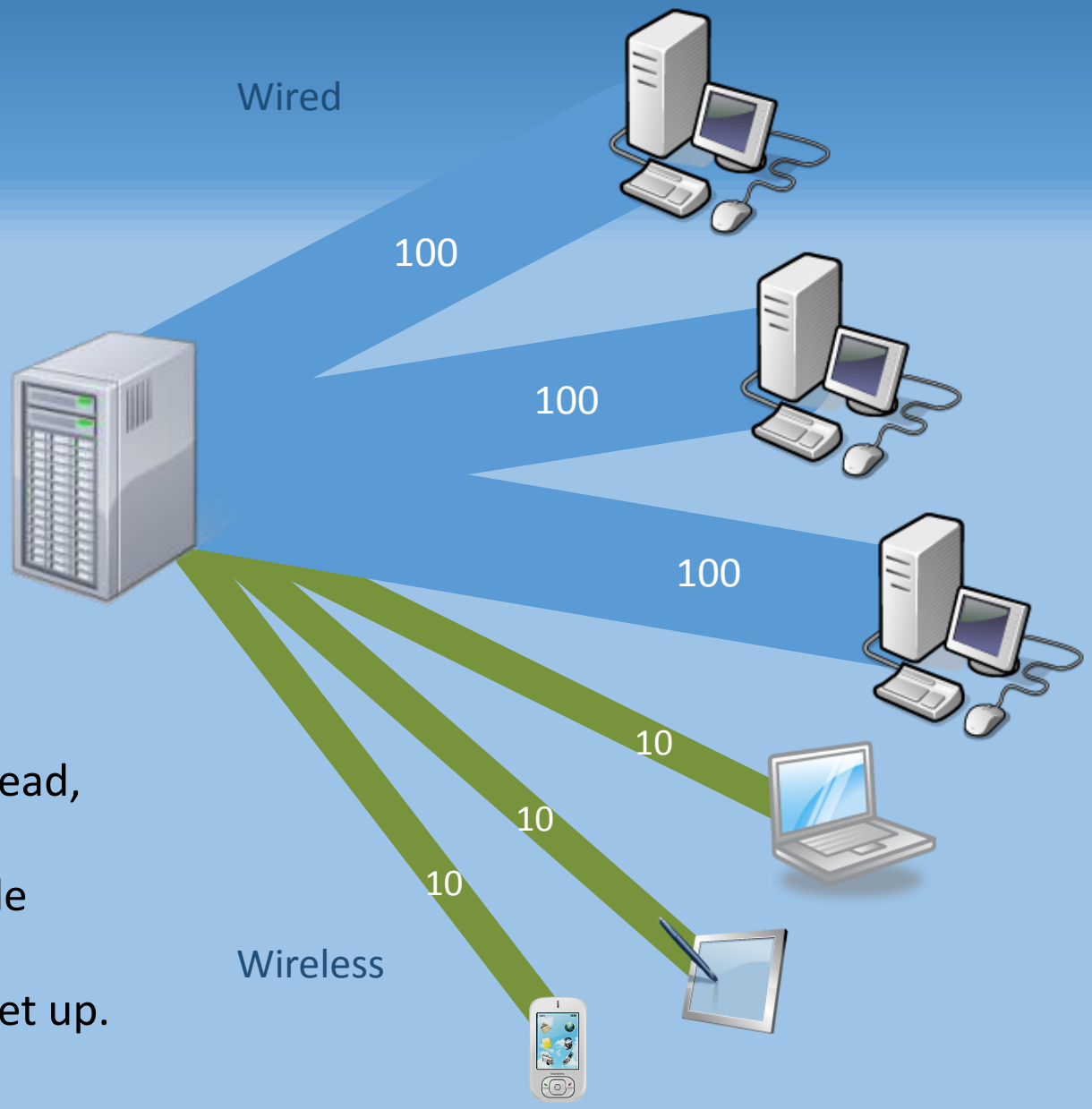
Network Pipes



Intranet

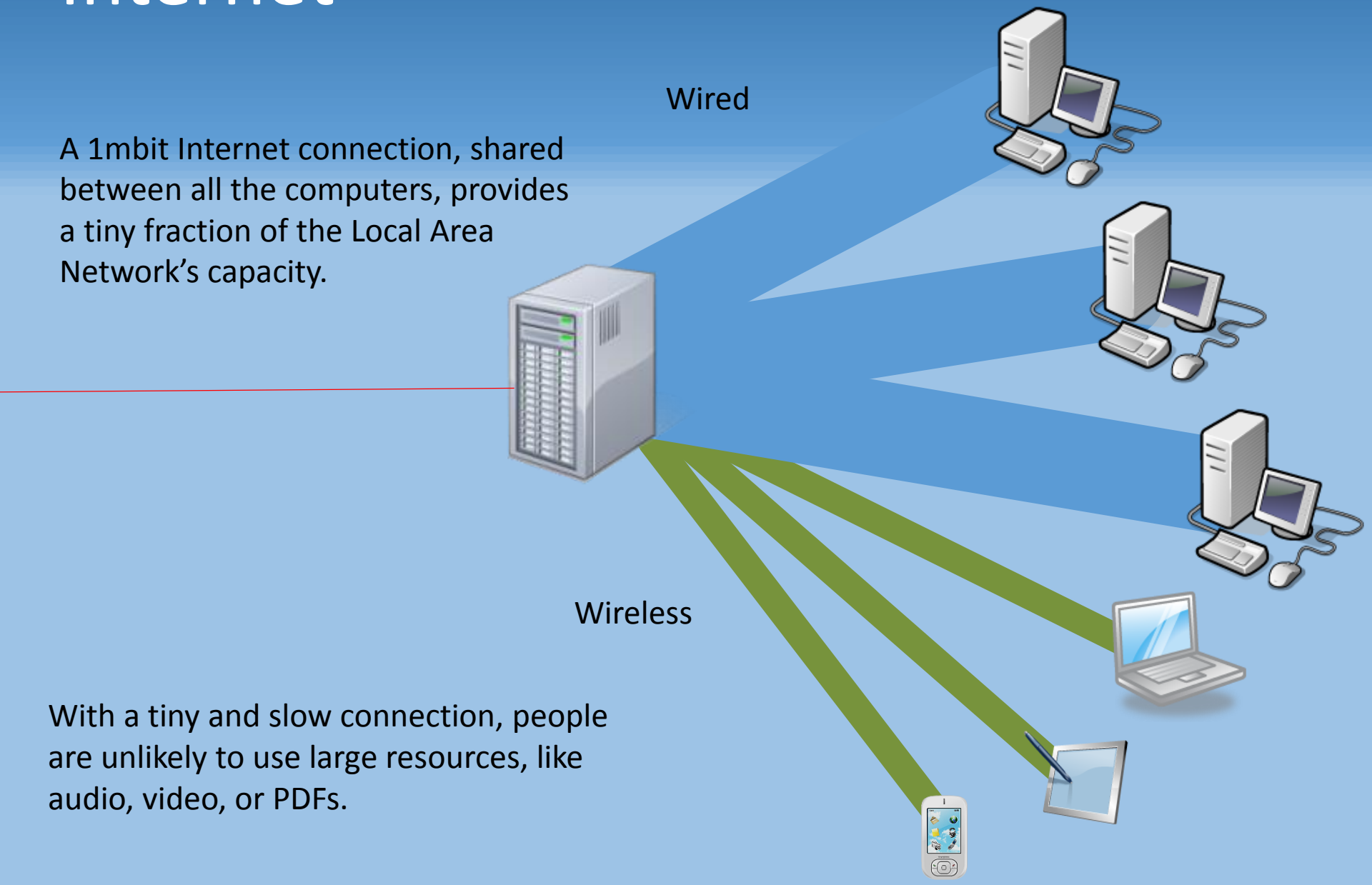
The typical wired computer has a very fast 100mbit connection… each one! Wired networks provide the best bandwidth, some go 1,000mbit and as fast as 10,000mbit.

Wireless computers share bandwidth with high overhead, hence actual speeds are a fraction of advertised. While slower, this is the most convenient connection to set up.



Internet

A 1mbit Internet connection, shared between all the computers, provides a tiny fraction of the Local Area Network's capacity.



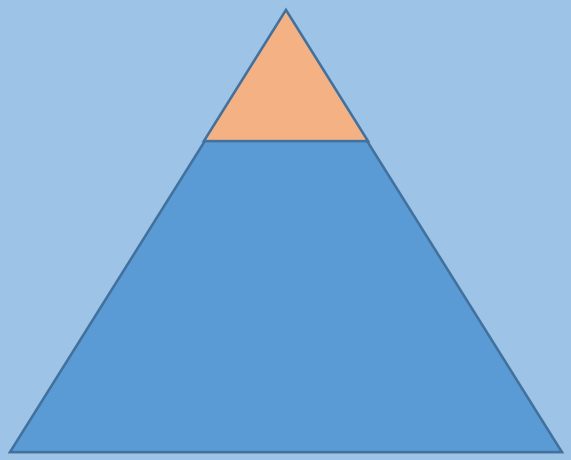
With a tiny and slow connection, people are unlikely to use large resources, like audio, video, or PDFs.

Scale

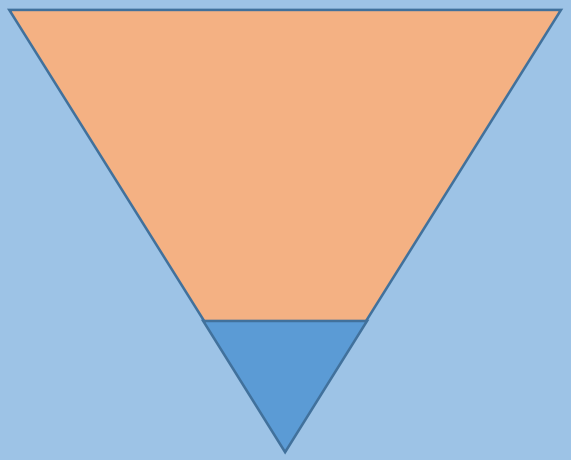
- How many will be expected to use the system simultaneously? Hundreds?
- What sorts of content? Video, audio, and PDF files are gigantic compared to email and Web pages.
- Typical speeds:
  - U.S. homes = 4-12mbit
  - Cell phone 4G = 2-10mbit (sort of)
  - Universities generally have >1,000mbit connections.
- A long-term recurring expense that may or may not be sustainable by many institutions
- Single point of failure
- Measure connectivity costs in # full-time teachers

Intranets are Key

- Most organizations have an intranet-first strategy
  - Internets are their public facing “brochures”
- UNC has 500 servers, 600 staff, and terabytes of bandwidth providing intranet services to the campus.
  - Intranet services = $124,000,000 a year
  - Internet connectivity = $200,000 a year

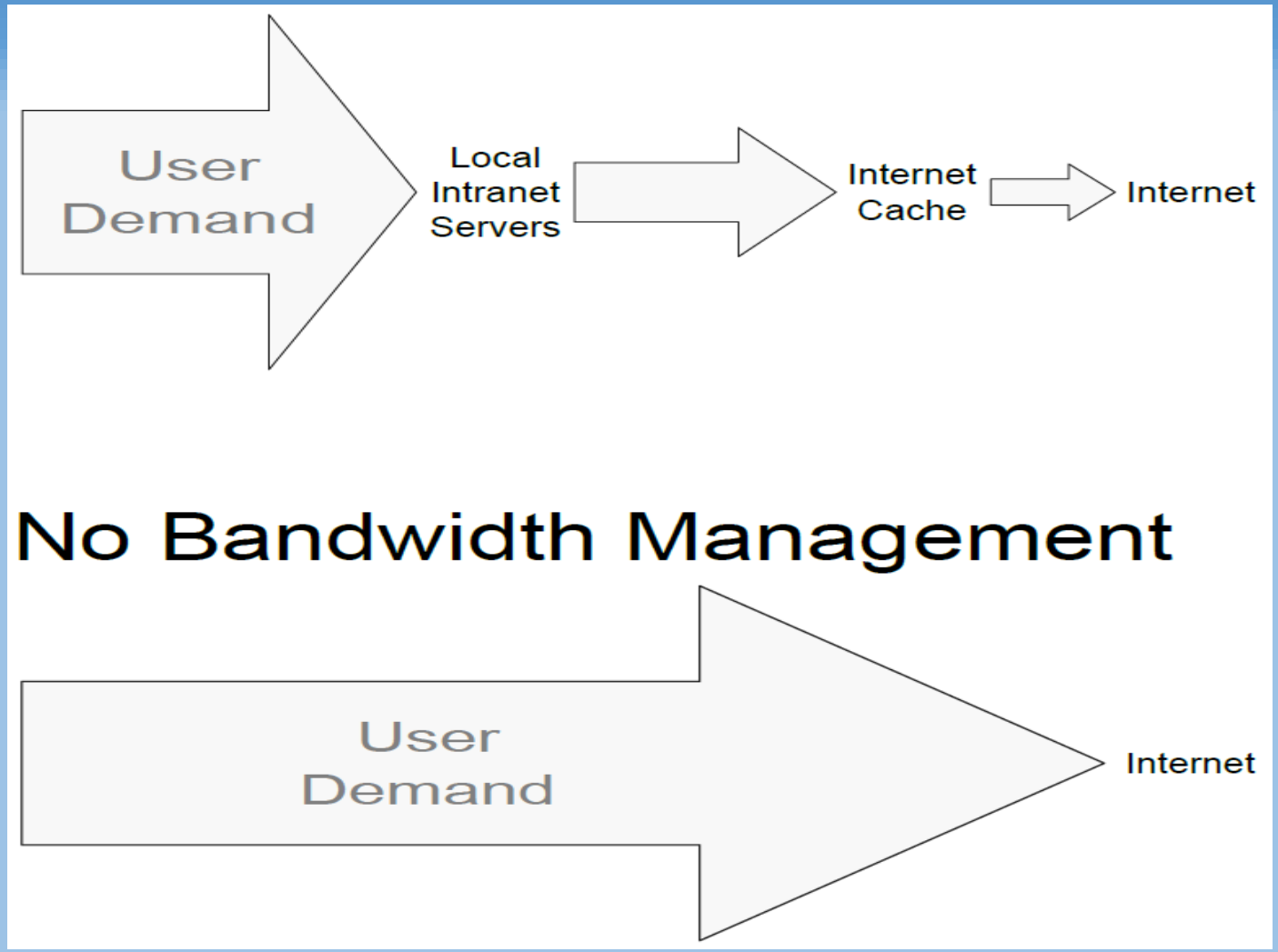


Traditional Intranet



“Cloud” Strategy

Internet Bandwidth Management



Traffic Characterization and Internet Usage in Rural Africa

Johnson, Pejovic, Belding, and van Stam. Web for Emerging Regions, 2011

- "…rural networks need to be treated as a special class of network due to their unique set of challenges."
- Dominance of web-based vs. peer-to-peer (LAN) traffic
- Online social networks are the most popular apps
- Round trip times… sometimes over 10 seconds
- Large portion of cache-able traffic from CDNs (Content Delivery Networks) is not cached
- Majority of bandwidth is large OS updates
- Significant malware traffic

Traffic Characterization and Internet Usage in Rural Africa

"As the average web page size continues to grow, and as Internet applications become increasingly more interactive and demand real- or near-real-time performance, the digital divide will widen unless innovative networking techniques that mitigate these increasing bandwidth demands are employed."

Creative Connectivity

Rather than investing to bring the entire Internet to every individual in poor, underserved areas, it is more efficient and effective to craft hybrid solutions that deliver targeted resources at a cost significantly less than an Internet-centric, one-size-fits-all solution.

Two Phenomena

- The digitization of communication and information
  - CD-ROMs
  - Databases
  - Spreadsheets
  - Images and audio 
- The Internet: computers exchanging data
- An apt marriage; no blood relation
- Seemingly inseparable

SneakerNet

"Never underestimate the bandwidth of a station wagon full of magnetic tape."