What Would One Do with 1 Gbps?

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What Kind of a Gigabit?

• Shared vs dedicated
  - Is the entire capacity "guaranteed" available to me?
• Wired vs wireless
  - Do I have to be/stay in a particular place to use it?
• Local area vs last-hop vs Internet-wide
  - Is there likely to be another bottleneck somewhere beyond?
• Interface restrictions
  - Does provider add "acceptable use" constraints?
• Downstream-only vs symmetric?
  - Can I be a producer as well as a consumer?
The Present Picture
(wired)

The Present Picture
(wireless)
Bottleneck ≥ 1 Gbps: System Consequences

- Memory bandwidth may be a constraint for high-throughput applications requiring significant software processing

Required memory/network BW ratio: 7
Bottleneck ≥ 1 Gbps: System Consequences

• Memory bandwidth is a consideration for high-throughput applications requiring significant software processing
  - but big, fast caches help avoid problems caused by layered abstractions in the mid-90's

• Protocol Bottlenecks
  - TCP congestion control algorithms waste BW on startup by sending very few packets/round-trip

• Trading bandwidth for latency
  - Instead of waiting a round-trip-time to learn which of several possible events occurred, send all possible reactions + policy for choosing
  - Example: distributed games
Bottleneck ≥ 1 Gbps: System Consequences

- **Trading bandwidth for latency**
  - Instead of waiting a round-trip-time to learn which of several possible events occurred, send all possible reactions + policy for choosing
  - Example: distributed games
- **Potential new bottlenecks:**
  - **Local distribution**
    - Most homes not wired for gigabit speeds
  - **Gateway/Router**

Bottleneck ≥ 1 Gbps: Content Implications

- Not enough for baseband HDTV @ 1080p ~4.6 Gbps
- But plenty for multiple coded HDTV
- Interactive immersive environments
  - Immersive SecondLife?
  - 3-D conferencing?
  - Latency is the main issue
Application Trend: VESA Display Interfaces

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VESDA Display Interfaces

A Gigabit-enabled Paradigm Shift?

- Assume a ubiquitously-available, local-area gigabit wireless channel (a la Bluetooth @ 1Gbps)
- The vision: Separate computing devices from input/output devices via an open, networked interface
  - Protocols for dynamically discovering and establishing secure associations with such networked human interface devices
A (wireless) Gigabit-enabled Paradigm Shift?

• Assume a ubiquitously-available, local-area gigabit wireless channel (Bluetooth @ 1Gbps)
• The vision: Separate computing devices from input/output devices via an open, networked interface
  - Protocols for dynamically discovering and establishing secure associations with such networked human interface devices
• Advantages:
  - Each can evolve independently
    • Computing devices have one interface to the outside world
    • I/O devices can remain human-sized
• Disadvantages:
  - Disruptive (chicken and egg problem)

The Vision: Belt-top Computing

• Permanent, personal, mobile computer
• Internal storage
• Single input/output channel
  - Wired/wireless interfaces
  - Peripherals connected via network
• Adapted/customized to its owner
  - Through constant use
  - Over a period of years
The Vision: I/O Infrastructure

- **Human-sized User-interface devices**
  - Large-screen displays
  - Touchpads
  - Keyboards
- **Part of the environment**
  - Provide access anywhere in the home (or elsewhere)
  - Shared by multiple computing devices
- **Controlled via network**
  - Compare VESA's Net2Display initiative

Conclusions

- No major system architectural changes due to Gigabit pipe
  - Home WLAN, gateway likely new bottlenecks
- Immersive content a possibility
- **Separable User Interface Computing**: a different personal computing model
  - Enabled by high-bandwidth wireless local network
  - Has been prototyped using OTS technologies