Peer-to-peer Technologies lightening the Internet

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Peer-to-peer …

A definition:
A node may act as both
a client and a server

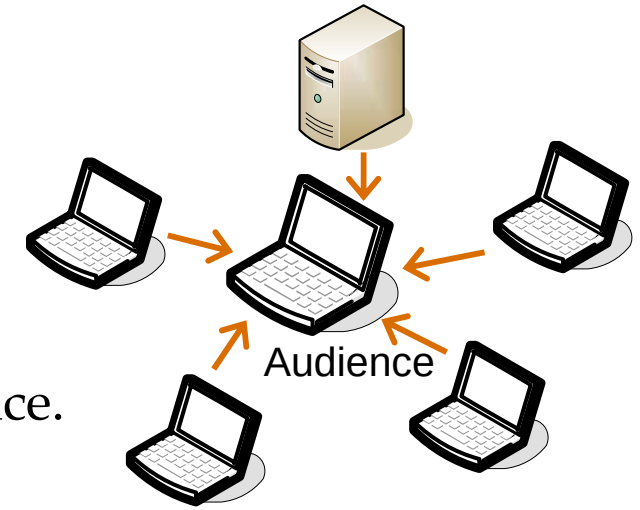
- P2P content delivery
- P2P groupware
  - Ariel products, ifreestyle, Groove, …
- P2P bulletin board
  - Shingetsu, Winny 2, …
- P2P instant messenger
- P2P phone
- …

- The subject of this P2P industry association
  - Content:
    Video, voice, music …,
    and other kinds of files.
    Software package, patch and others.

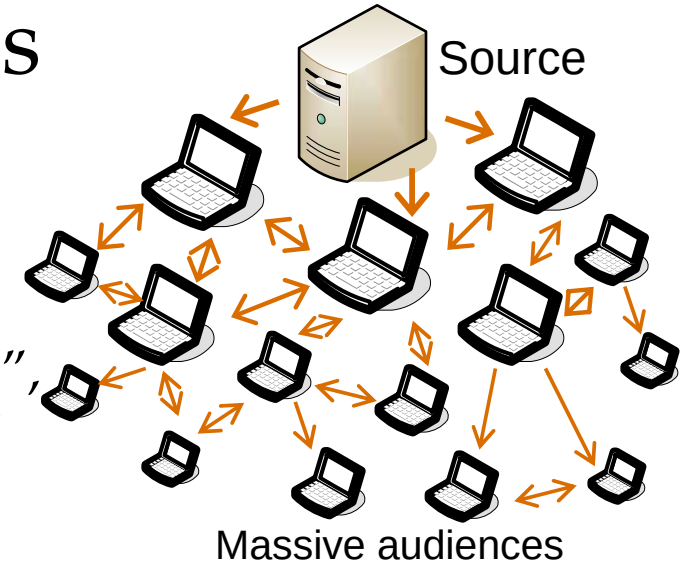
- Kinds of delivery tech
  - Download
  - On-demand streaming
  - (Live) streaming

P2P Content Delivery

- Gathering technologies
  - Download
  - On-demand streaming
    - Playing while downloading.
  - Gather parts of contents replicated in advance.
  - "Swarming"



- Disseminating technologies
  - (Live) streaming
  - Deliver content to massive number of audiences in a short time.
  - "Application-{level, layer} Multicast (ALM)", "Overlay Multicast", "Endsystem multicast (ESM)"



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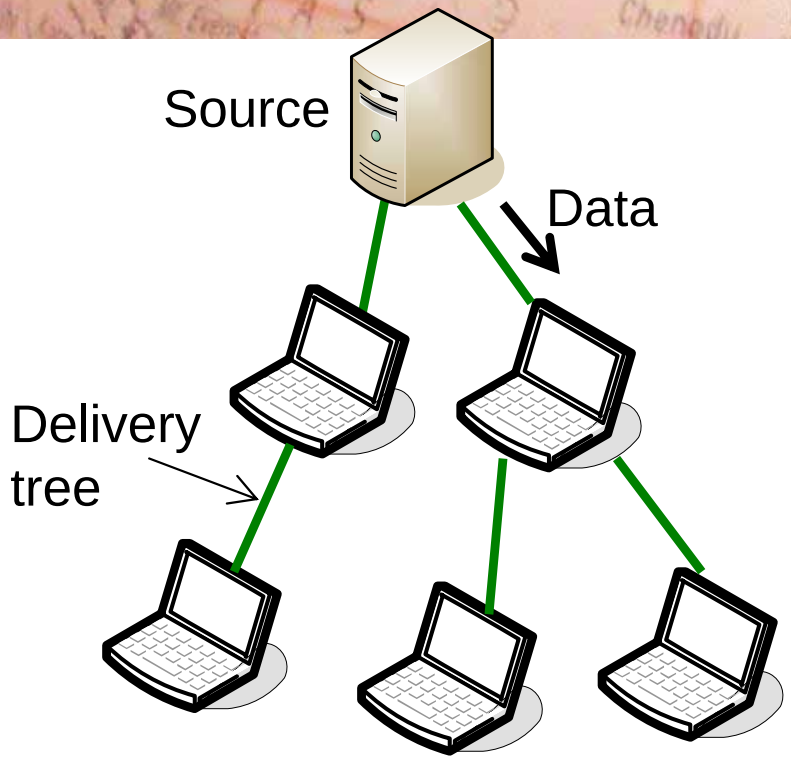
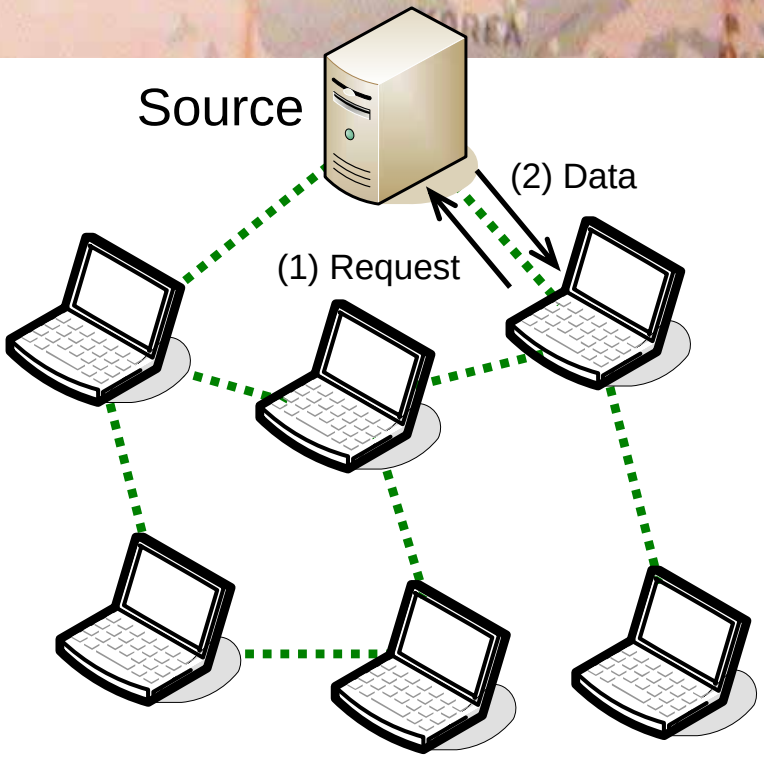
Dissemination: ALM, OM, ESM
Tree-based vs. Mesh-based





- Tree-based
  - Data flow along the delivery tree constructed explicitly.
  - Push from the root toward leaves.
  - △ Requires quick repair in node failure
  - ○ Data reach all ends, with low latency.
  - Exploits broadband links.
- Mesh-based
  - Keeps loose relationships with neighbors.
  - Pull data from neighbors.
  - ○ Robust to node failure by nature
  - △ Delivery to ends not guaranteed. To be compensated.
  - Exploits narrowband links.

Effects of P2P content delivery

- Traffic reduction around the source
  - From 50 % to 9X %
    - Supports large number of audiences with the same facilities.
  - Massive content delivery with little resources
    - → "All publishing" society ?

Following slides show

- Examples
  - Swarming experiments
  - On-demand delivery
  - (Live) streaming
- Who benefits from it?

- Others (left out here)
  - Adaption to network situations
  - Fault tolerance
  - Lower management and operation cost

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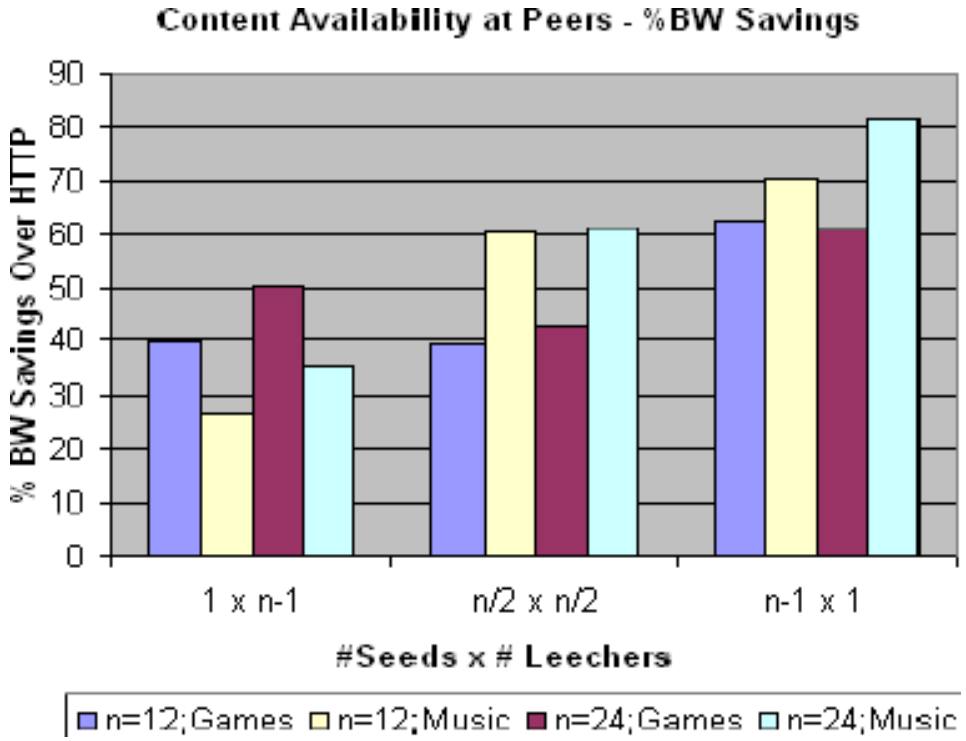
Swarming experiments

- Conditions
  - On-demand delivery with BitTorrent protocol
  - 24 peers on a LAN
  - Traffic reduction up to 80 % or more

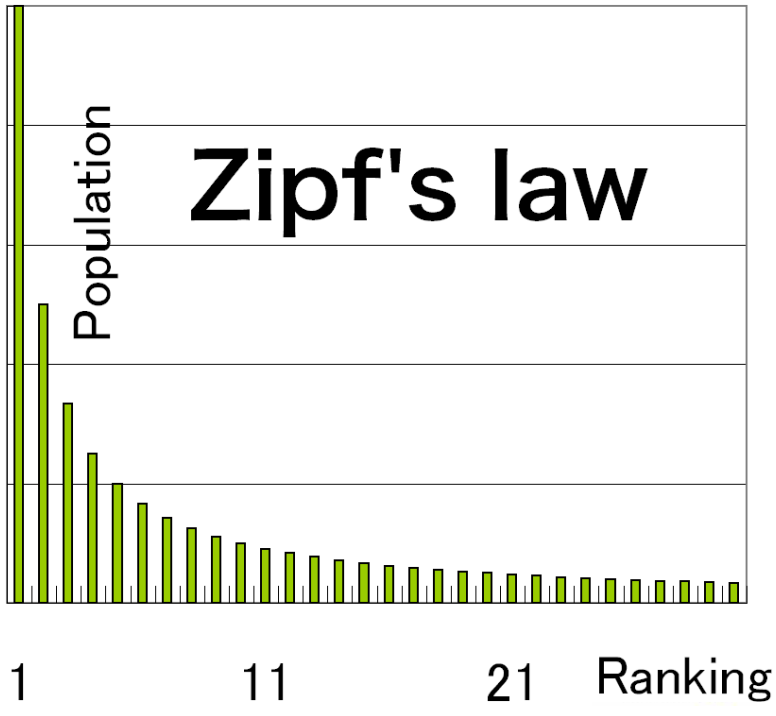


From a talk by Aaron Colwell (RealNetworks, Inc.) in a panel in NOSSDAV 2007

On-demand delivery

- "39 % from origin server, 61 % from peers"
  - In case of an on-demand video delivery service in US in 2005.

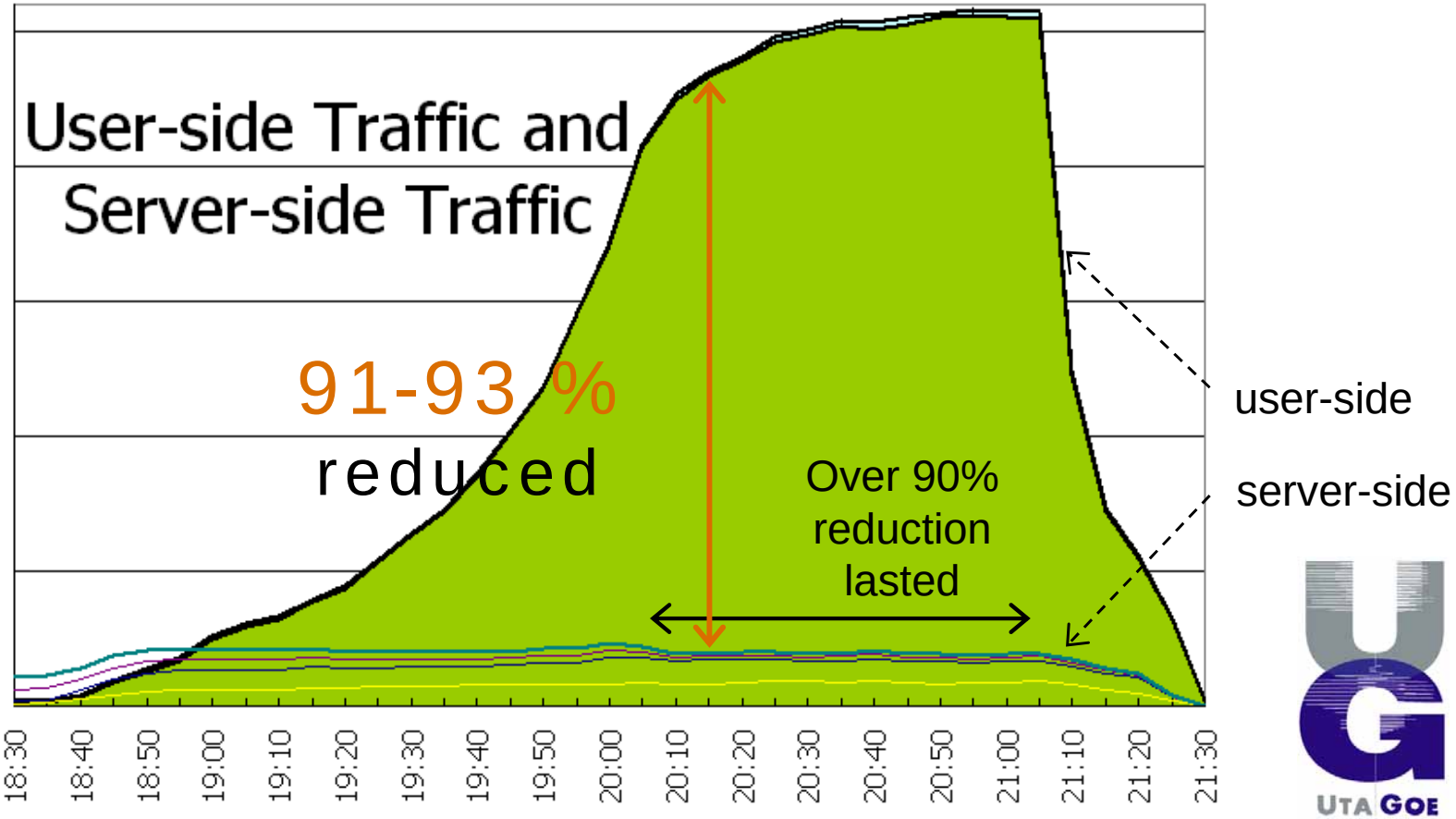
- In case of pure on-demand delivery, Number of requests for each content is long tail.
  - Modeled with the Zipf's law: 1st n, 2nd n/2, 3rd n/3, …
- Higher population yields higher efficiency of P2P.
  The opposite is also true.
- Being improved. (mentioned later)



(Live) streaming

- From 90 to 95 % of traffic reduced around the source
  - With Utagoe's UG Live software

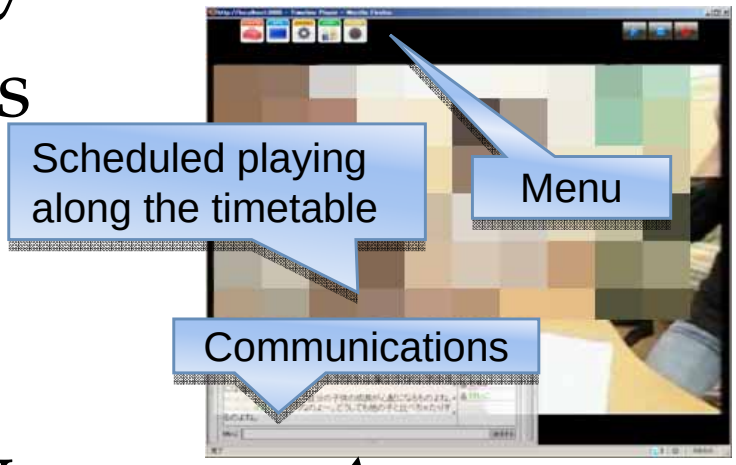
On Nov 26, 2007,
"access talk-about live"
by J-Stream,
Castella (www.castella.jp),
and Utagoe



Implications of delivery-style in efficiency

Higher efficiency

- (Pure) on-demand delivery
  - A large number of examples
- Channel
  - Joost
- Program-directed delivery
  - Utagoe's P2P IPTV, codenamed Lycaon.
    TV experience + Net/Web strengths
- (Live) streaming
  - BB Broadcast (Roxbeam (China) and TV Bank),
    ShareCast2 (ANCL and bitmedia),
    UG Live (Utagoe)



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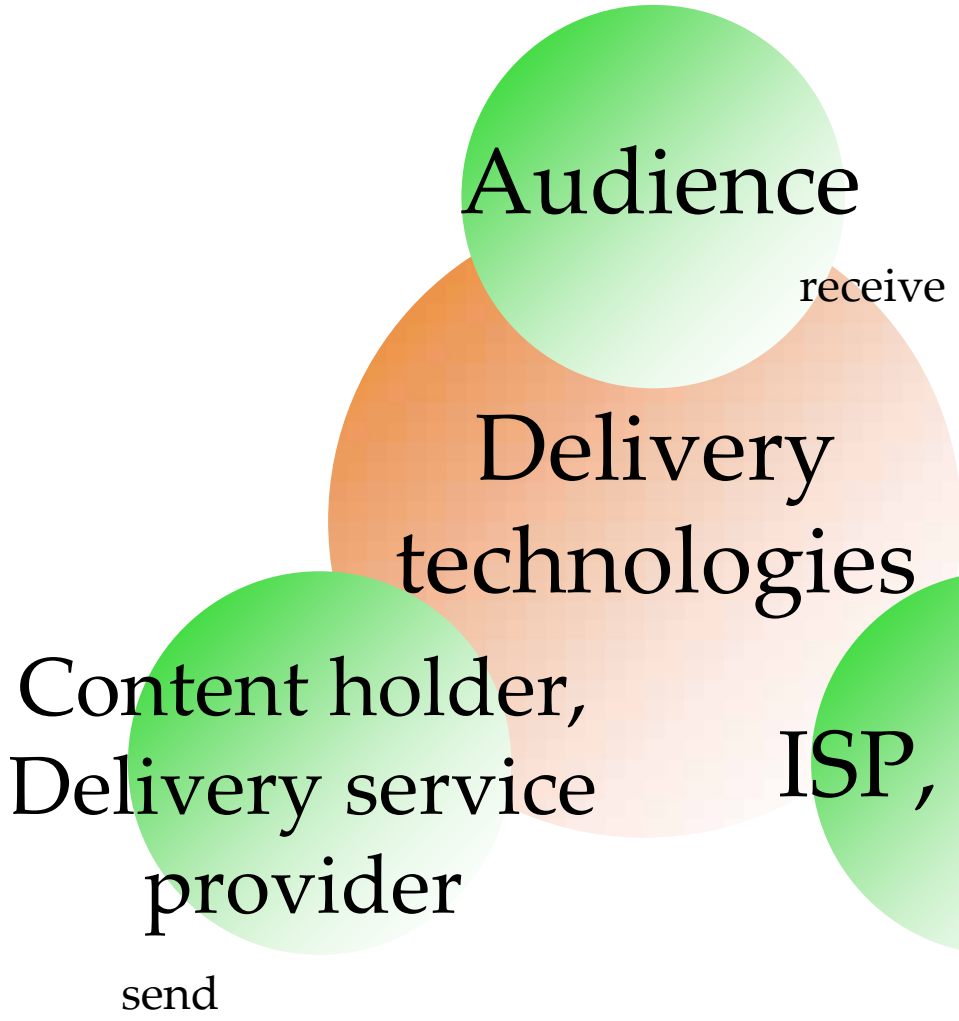
Who benefits from it?



- Audience
  - "It's OK as long as I can see."
- Content holder, Delivery service provider
  - Benefits from traffic reduction
- ISP, Carrier
  - ???

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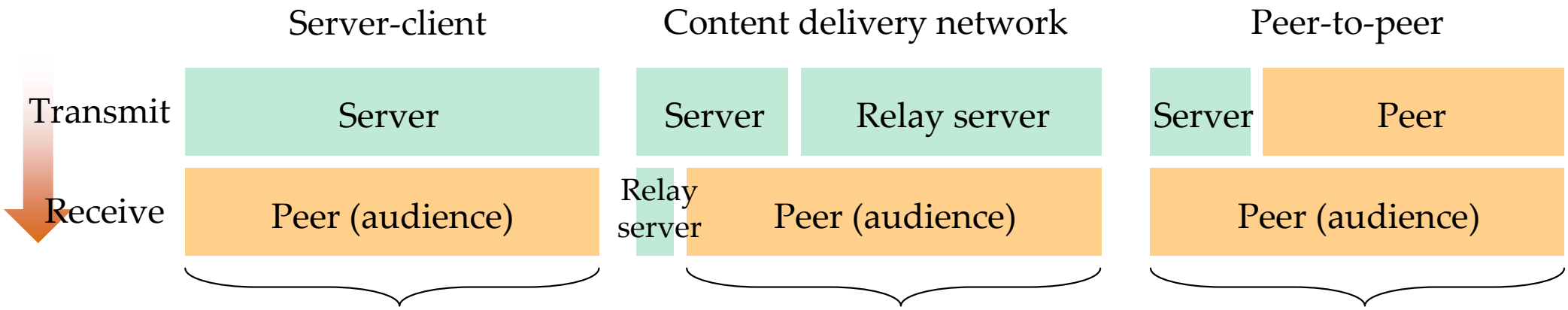
Amount of delivered data does not depend



Amount of delivered data is constant

e.g. In case 1,000 nodes each receive 1 Mbps, 1,000 Mbps = 1 Gbps

- Note
  - CDN increases the amount by relay servers receiving but not playing. Here ignored.
  - Peer-to-peer increases the amount by control messages. It is usually several percent.
    - e.g. Peers communicate with a tracker in BitTorrent protocol.

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Traffic reduction is …

- ISPs and carriers deliver the same amount of data, whichever delivery technology used.
- ”Traffic reduction” is an effect for content holders and delivery service providers.
- But, ISPs and carriers can benefit from it.
  - Local production for local consumption

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Local production for local consumption

- Peer-to-peer enables us to get contents from "near" peers.
  - CDNs are still effective, but relay servers are deployed at limited number of ISPs.
  - Results:
    - Traffic to/from higher level of ISPs and transit fee reduced.
    - Traffic on the Internet backbone and IXes reduced.
    - …
- Most P2P software has such features:
  - A node selects peers to which it requests/sends data according to throughput and/or latency.
    - Utagoe's UG Live: based on throughput
  - according to peer's IP address and AS number.

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Open problems

- Are techniques to select “near” peers consistent with ISPs and carriers’ interests?
  - e.g. Throughput over the backbone can be higher than local one.
  - Today, it is the only way for P2P software to measure throughput or latency.
  - ISPs and delivery service providers can cooperate with each other.
    - e.g. CRNF’s activities: exploits address assignment information
    - e.g. Verizon and Pando’s activities in P4P WG in DCIA
- Is the currently deployed techniques effective?
  - This P2P industry association is expected to show it.
- Do Internet operators still have difficulties in traffic engineering with peer-to-peer-style all-to-all traffic?
  - Discussion required.

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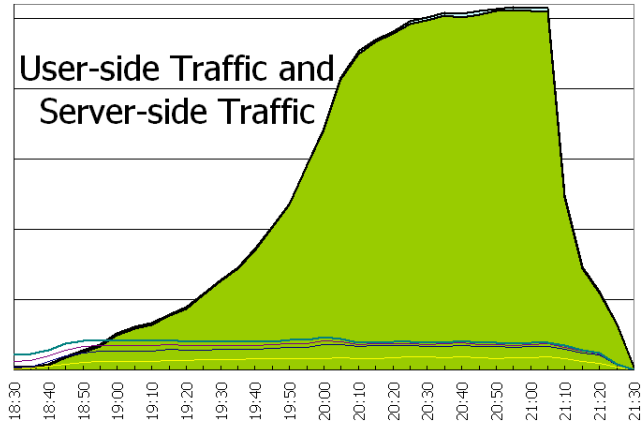
Summary

- Traffic reduction effect by peer-to-peer technologies has been proven.



- ISPs and carriers can benefit from it.
  - Local production for local consumption

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