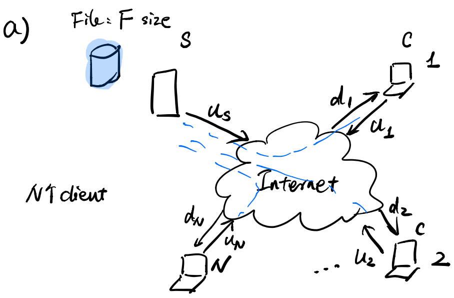
a)



① $\frac{F}{u_s}$: time for server upload one copy of the file

② $\frac{F}{d_{min}}$: d_{min} is the minumun download speed, so F/d_{min} is the slowest download time

③ $\frac{NF}{u_s + \sum_{i=0}^{N} u_i}$: Time for cooperating peers+ server to upload a copy of the file to all peers (N copies)

④ $\frac{NF}{u_s}$: time for server to upload file to all clients.

(CNA 2015 1 (a))

In CS mode: client dont upload file into Internet

b). $D_{p2p} = \max\left\{ \frac{F}{u_s}, \frac{F}{d_{min}}, \frac{NF}{u_s + \sum_{i=0}^{N} u_i} \right\}$

$D_{cs} = \max\left\{ \frac{NF}{u_s}, \frac{F}{d_{min}} \right\}$

最重要的条件

$\frac{NF}{u_s + \sum_{i=0}^{N} u_i} \leq \frac{NF}{u_s}$

$\frac{F}{u_s} \leq \frac{NF}{u_s}$ ($N \geq 1$)

① $\frac{F}{d_{min}} > \frac{NF}{u_s}$. ✓ $D_{p2p} = D_{cs}$

$D_{p2p} = \frac{F}{d_{min}}$, $D_{cs} = \frac{F}{d_{min}}$

② $\frac{F}{d_{min}} < \frac{NF}{u_s}$ $D_{cs} = \frac{NF}{u_s}$

$D_{p2p} \leq \frac{NF}{u_s}$, ✓ $D_{p2p} \leq D_{cs}$ ∴ speed faster or the same.

③ $\frac{F}{d_{min}} = \frac{NF}{u_s}$, $D_{cs} = \frac{NF}{u_s}$ or $\frac{F}{d_{min}}$

$D_{p2p} = \frac{F}{d_{min}}$ ∴ $D_{p2p} = D_{cs}$

e