Consume Local

Towards Carbon-free Content Delivery

Aravindh Raman

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Works before Brexit

- **Take-away TV: Recharging Work Commutes with Greedy and Predictive Preload… of TV Content**
  Dmytro Karamshuk, Nishanth Sastry, Mustafa al-Bassam, Andy Secker, Jigna Chan…
  In IEEE Journal on Selected Areas in Communications (J-SAC) 2016.
- **SCORE: Exploiting global broadcasts to create offlin… access**
  Gianfranco Nencioni, Nishanth Sastry, Gareth Tyso… Jigna Chan… roft.
  In IEEE/ACM Transactions on Networking 2…
- **Video-on-Demand Strea… -friendly Peer-assisted Conte…**
  Dmytro Karamshuk, Ni… handaria
  IEEE INFOCOM 2015
- **On Factors Affecting t… doption of a Nation-wide TV Streaming Service**
  Dmytro Karamshuk, Nisha… stry, Andrew Secker and Jigna Chandaria
  IEEE INFOCOM 2015
- **Understanding and decreasing the network footprint of over-the-top on-demand delivery of TV content**
  Gianfranco Nencioni, Nishanth Sastry, Jigna Chandaria and Jon Crowcroft
  22nd International World Wide Web Conference (WWW), 2013

Content caching and sharing at the edge works like a charm!

During Brexit (’16 - present)

- **[Honourable Mention] Facebook (A)Live? Are live soci… *broad*casts?**
  Aravindh Raman, Gareth Tyson and Nishanth S…
  WWW 2018
- **[Best Paper Award] Wi-Sti… …ged Edge Networks**
  Aravindh Raman, N… …ian, Jigna Chandar…
  ACM SIGCO… …Communications 2017
- **Consume Loc… …on Free Content Delivery**
  Aravindh Rama… …tro Karamshuk, Nishanth Sastry, Andrew Secker…
  Chandaria
  IEEE ICDCS 2018

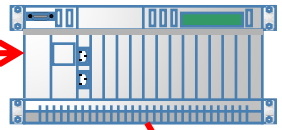
Good to cache and share at the edge!
What for the Edge?

Why would users participate?

Consume Local: Towards Carbon Free Content Delivery
Aravindh Raman, Dmytro Karamshuk, Nishanth Sastry, Andrew Secker and Jigna Chandaria.
In 38th IEEE International Conference on Distributed Computing Systems (ICDCS), Austria (2018)

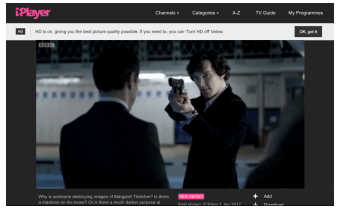
Peer-assisted Content delivery

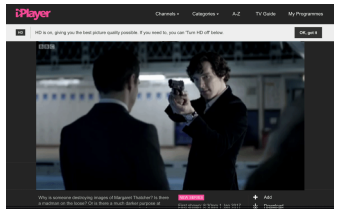
Core Router

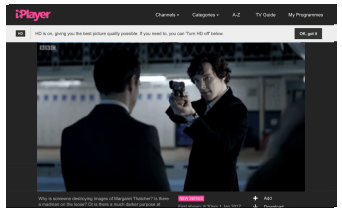


ExP

PoP





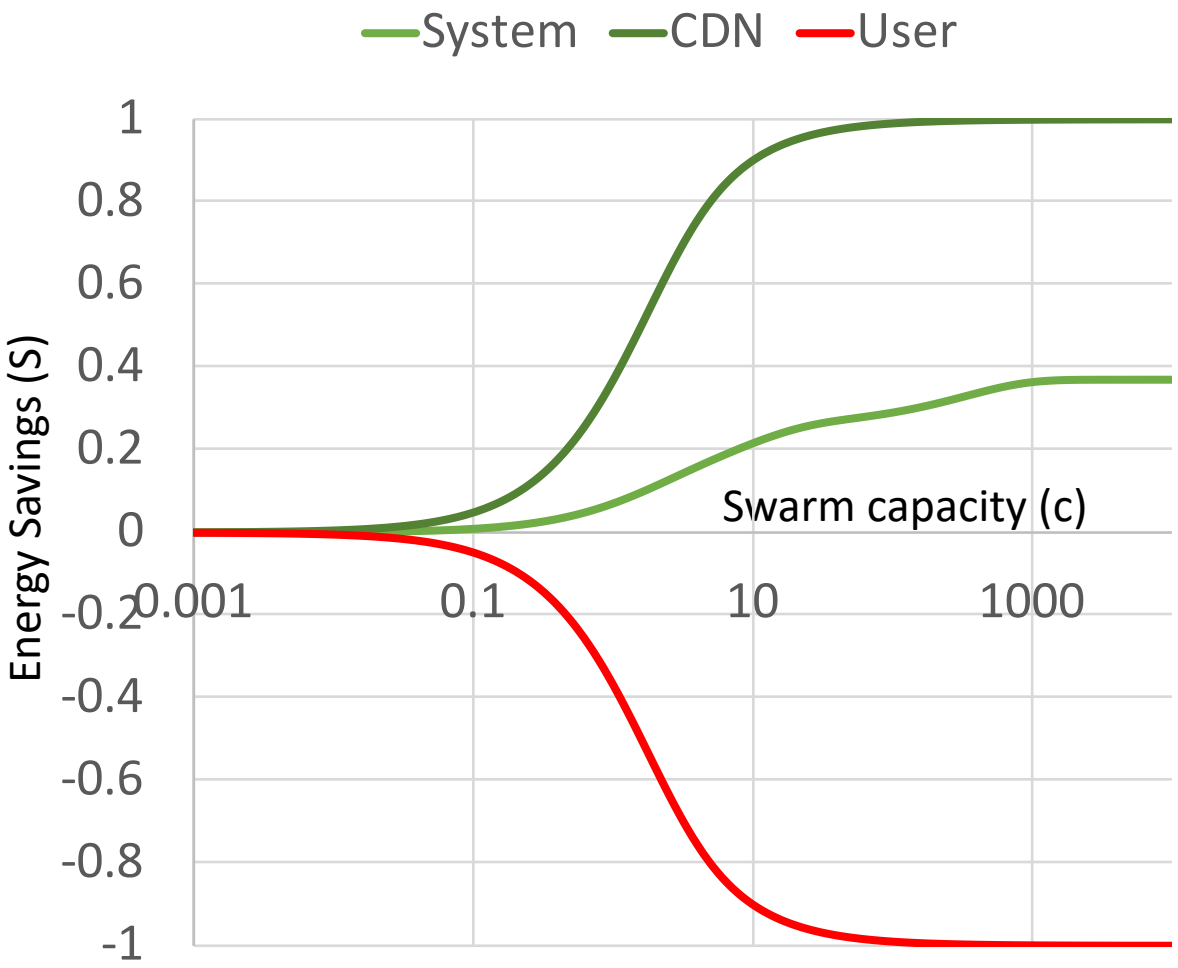


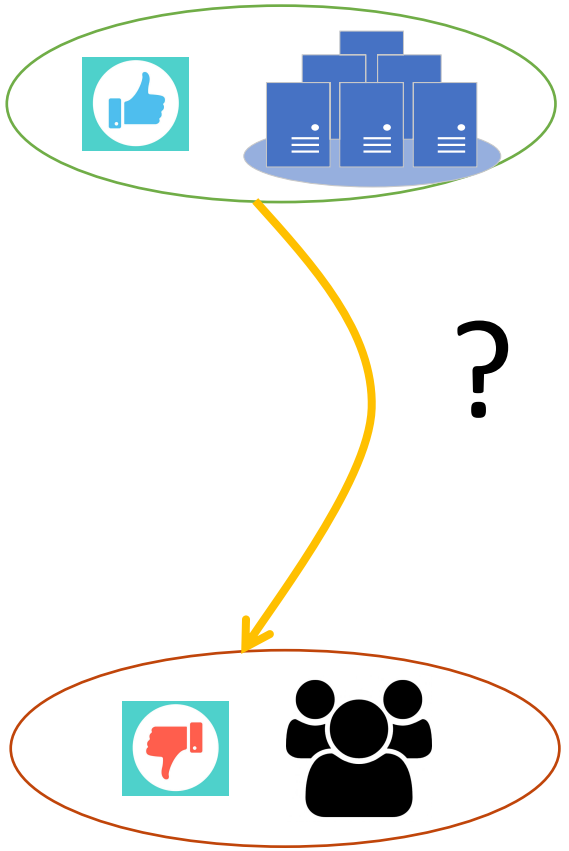
CDN

ISP

Users

Savings at System level





Energy savings

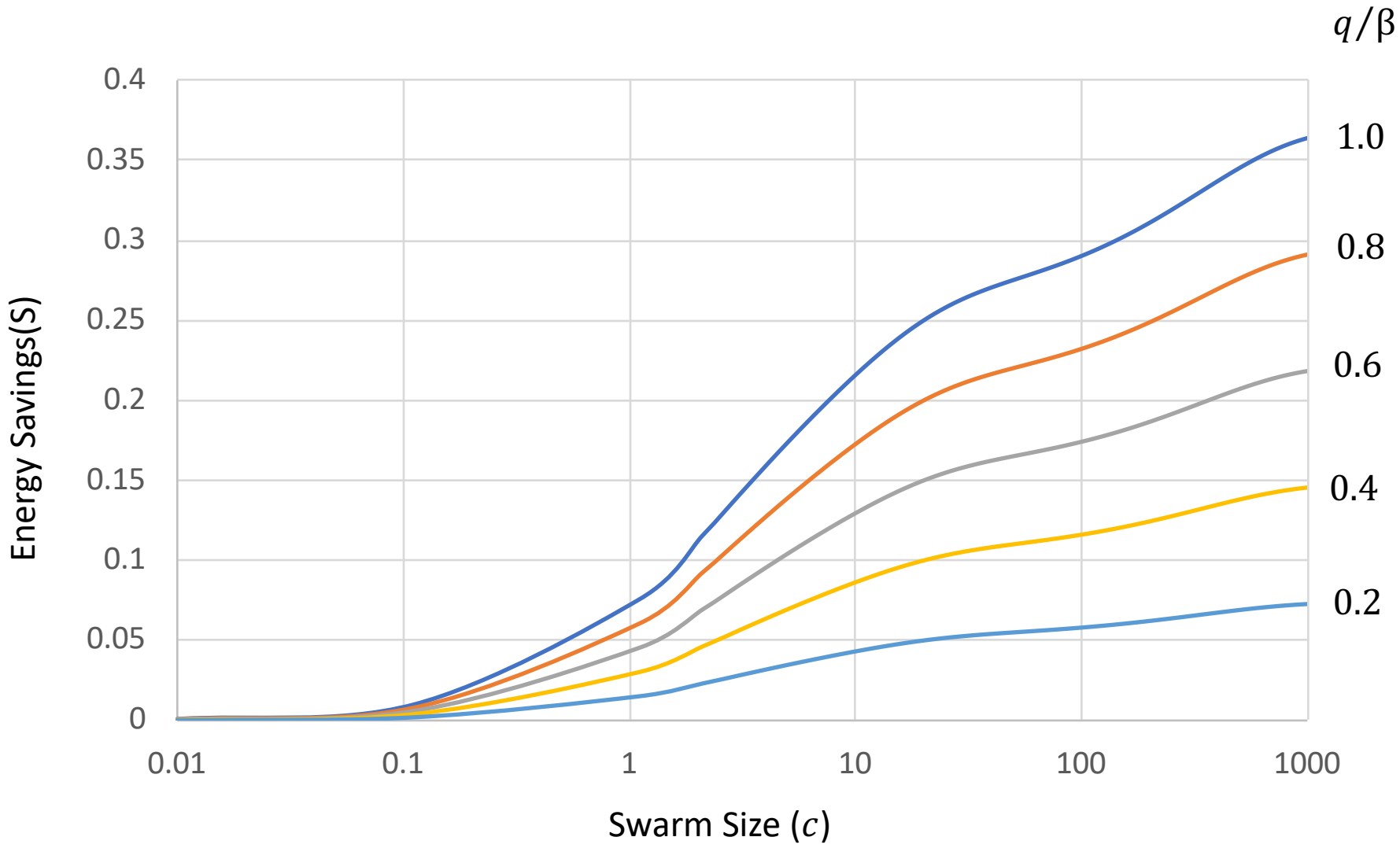
Modelling

Energy consumed = Energy consumed by user traffic thru' (traditional CDN + peer-assisted)

$$\text{Energy Savings (S)} = 1 - \frac{\psi_s\left((1-G) * T_U\right) + \psi_p\left(G * T_U\right)}{\psi_s\left(T_U\right)}$$

$$S = \frac{q(c + e^{-c} - 1)(\psi_s - \psi_p^m)}{\beta c \psi_s} - \frac{q\ X\ PUE}{\beta c \psi_s} X \left[(\Upsilon_{PoP} - \Upsilon_{ExP}) f(p_{ExP}, c) + (\Upsilon_{core} - \Upsilon_{PoP}) f(p_{PoP}\ c) + (\Upsilon_{core}) f(p_{core}, c) \right]$$

Theoretical Savings



Dataset

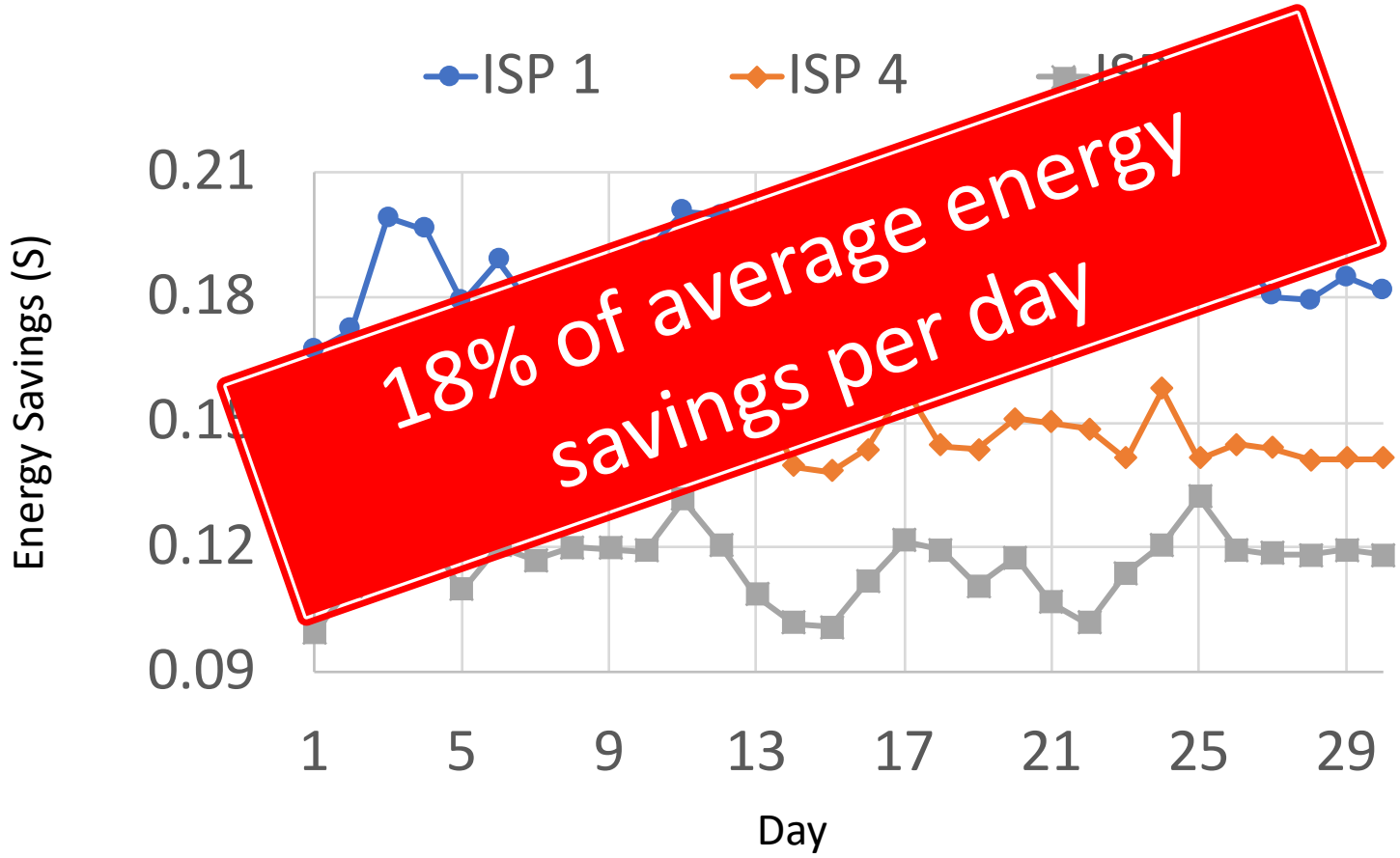
Population: **8M**

3M users/month

1.5M IPs/month

23.5M sessions/month

Actual Savings



Converting Savings to Incentivise Users

Carbon Credits

Your flight:

From: New York (US), JFK to: Frankfurt (DE), FRA, Roundtrip, Business Class, ca. 12,400 km, 1 traveler

CO_2 amount: 1.8 t

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The Gold Standard

Portfolio: lufthansa

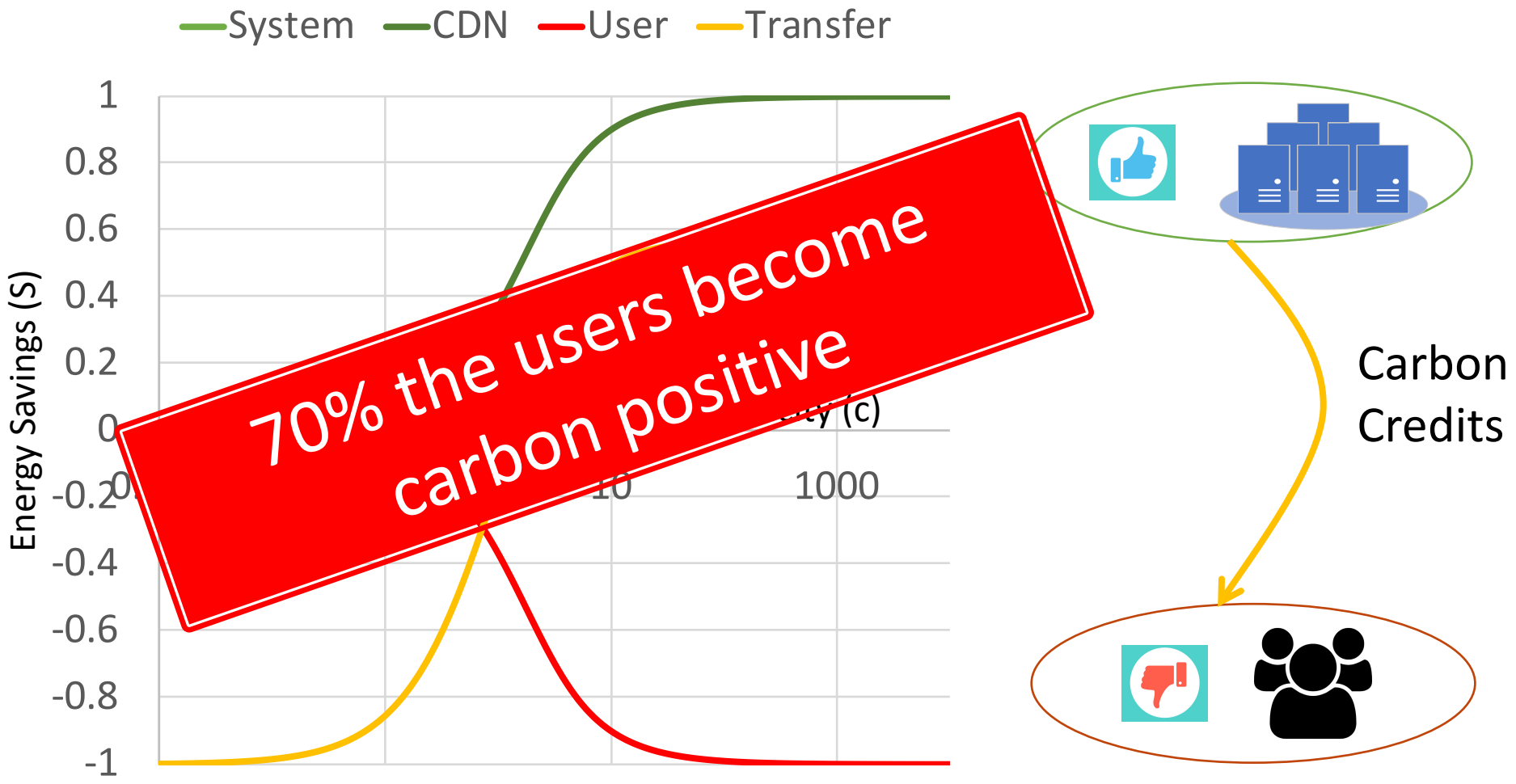
Your contribution to carbon offsetting: USD 46.00

This will support the two climate protection projects "Solar Lighting in rural Ethiopia" and "Energy-efficient Cook Stoves for Siaya Communities, Kenya".

Carbon Credit Transfers

$$CCT = \frac{PUE \ * (\Upsilon_s * \mathrm{G}) - l\,\Upsilon_m\,(1 + \mathrm{G})}{l\,\Upsilon_m\,(1 + \mathrm{G})}$$

Incentivizing Users at System level



Upto 30% of energy savings

Go Green and carbon-free

https://nms.kcl.ac.uk/netsys/~aravindh

aravindh.raman@kcl.ac.uk

Future Works (Post Brexit?)

- Federated Application(s) at the edge
  - Inference
  - Learning
  - Social network
  - Broadcasts
  - AR/VR