

# A Simulation Package for Energy Consumption of Content Delivery Networks (CDNs)

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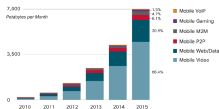
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# Motivations

- The Internet accounts for a non-negligible share of energy consumption worldwide
  - ▶ content delivery is a major factor (the main culprit!)
- CDNs are an integral part of the future generation Internet.
- CDNs were originally designed to save bandwidth by offloading traffic from network core
- There is a trending research campaign on energy efficient CDNs
  - ▶ numerous models/techniques, but there is not a holistic view about energy consumption behaviour
- Simulation is an affordable way to make such a holistic view
  - ▶ by putting together the existing models or designing new ones

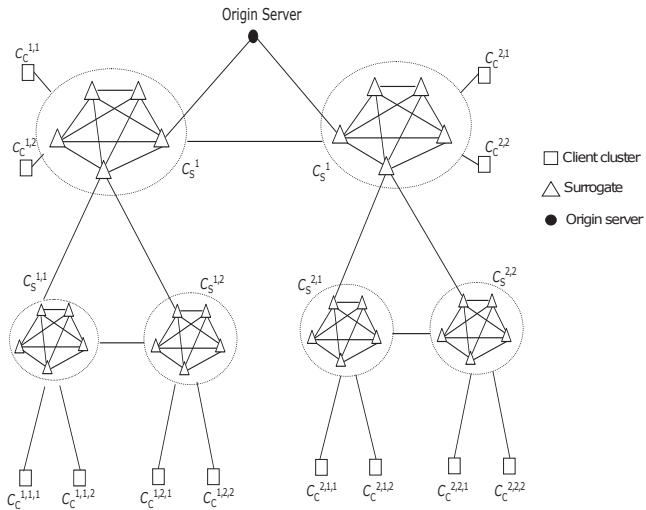


VoIP calls, assumed to be 0.1% of all mobile data calls in 2015.  
Source: Cisco VNI World, 2011

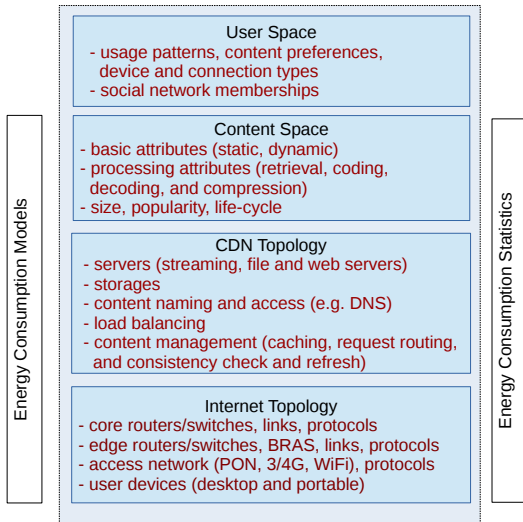
Around the globe, in one hour:

- 685 million sms messages
- 128 million Google searches
- 9 million tweets
- 1.2 million mobile apps downloaded
- 2880 hours of YouTube videos uploaded
- 50,000 smart phones activated

# Reference CDN Architecture



# Proposed Simulation Package



# Energy Consumption Models: State-Of-The-Art

- Transmission  $\Rightarrow$  macroscopic (end-to-end) models
  - ▶ focused on network core and edge (routers, switches, WDM links)
  - ▶ energy consumption is modelled for full capacity of the devices
    - must be augmented with load dependent CPU power consumption models
  - ▶ rich models for wired/optical access networks
    - WiFi/LTE  $\Rightarrow$  few existing models, new ones are emerging (hot topic!)
- CDN  $\Rightarrow$  rich models for energy consumption of storage devices, few generic server models
  - ▶ the existing models can be augmented by load-dependent power consumption models with/without load balancing and server switch-off
- Content Related Models  $\Rightarrow$  mostly focused on time complexity
  - ▶ video processing models exist, but mapping to energy consumption is required

# Thank You!