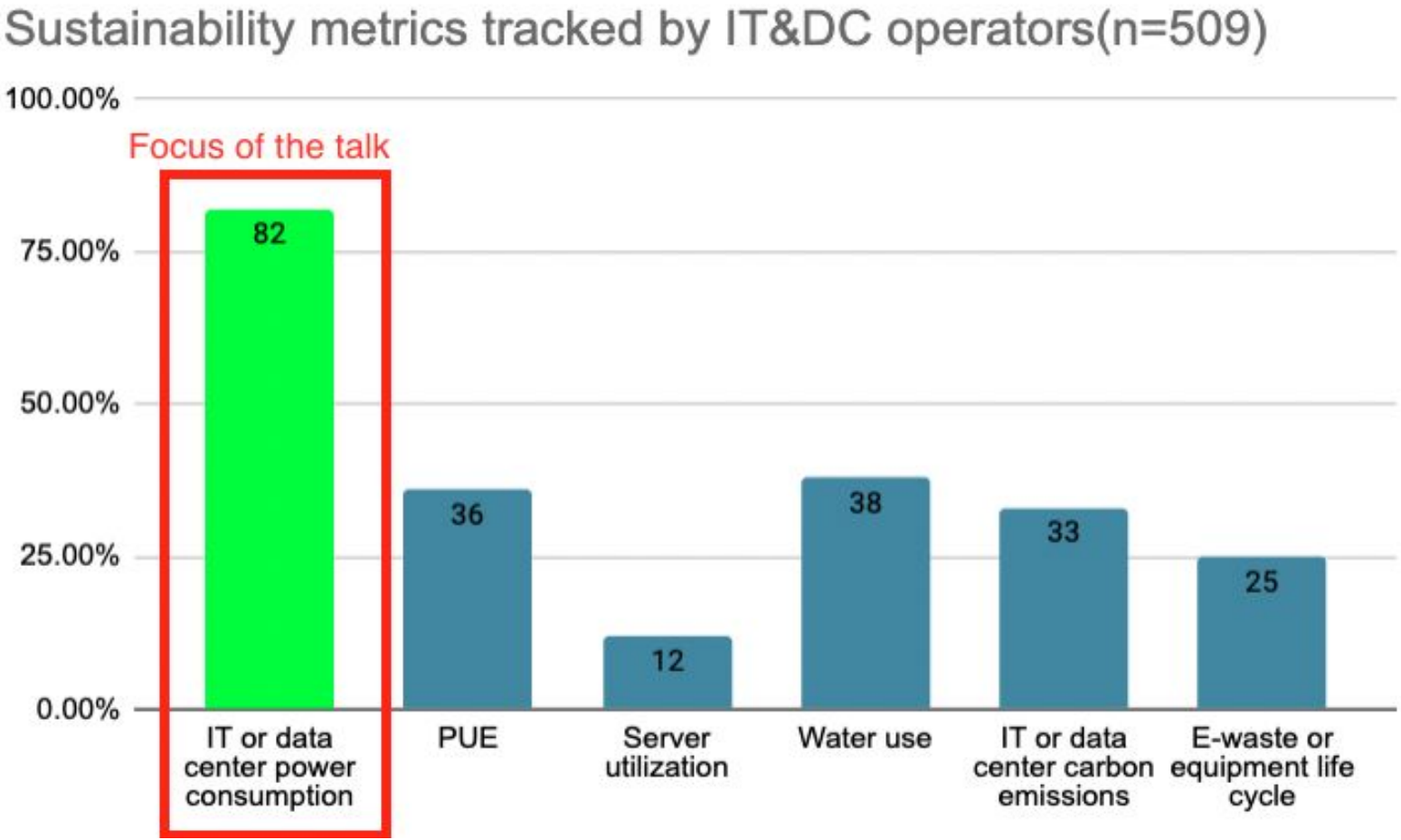
Techniques to reduce network power consumption

Peter Ehiwe, May 2023 @RIPE86



[0]

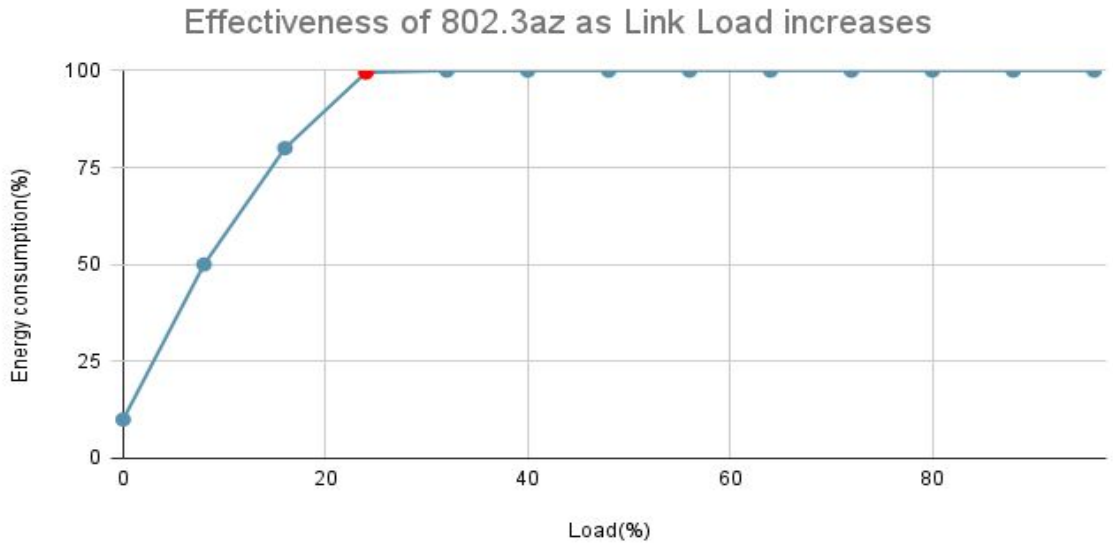
[0] survey from the uptime institute

Two Main Buckets

- Sleep mode techniques
  - IEEE802.3az
  - Wireless access points
  - Port LEDs
- Rate adaptation techniques

IEEE 802.3az

- Saves power by turning off parts of TX circuitry when there little or no traffic on the link.
- Works for ethernet(xBASE-T) over copper transmission. (x=100, 1G, 10G)



[1]

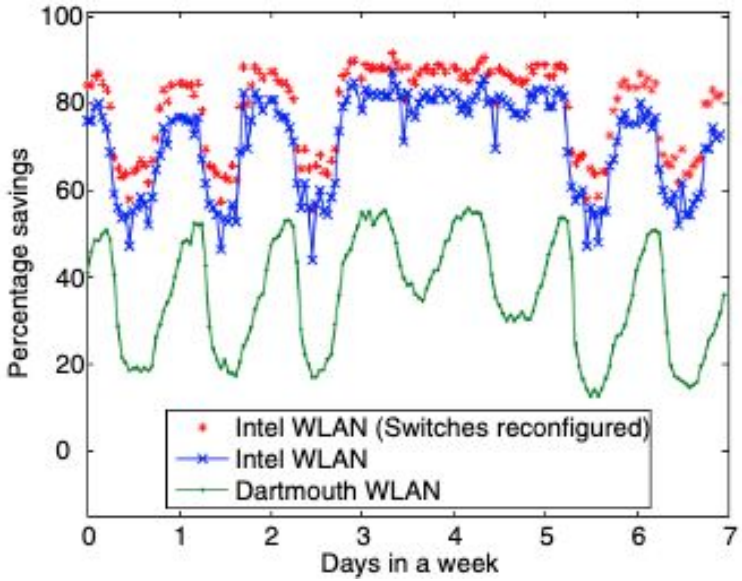
[1] Augmenting the Energy-Saving Impact of IEEE 802.3az via the Control Plane - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/The-energy-consumption-with-IEEE-8023az-increases-sharply-as-the-link-load-increases_fig1_281747018 [accessed 22 Feb, 2023]

IEEE 802.3az enhancements

- Determining cable length and adjusting TX power accordingly.

Wireless Access Points

- Do you need to run all APs at all times?
- Do you need to run all access points at off peak hours? (i.e after 7pm? Or weekends?)
- Can you develop an algorithm for your network that dynamically powers AP to meet user load?



[2]

Percentage energy savings in the Dartmouth and Intel WLANs. (Image created by **Papagiannaki**,2007)

[2] https://www.researchgate.net/publication/4294400_Towards_an_Energy-Star_WLAN_Infrastructure

Port LEDs

- Do we need link LEDs on network devices flashing 100% of the time with no one looking at it 99% of the time?
- What if we could turn off link LEDs by default and turn them on(in an automated fashion) only when a maintenance needs to be done?
- The energy & cost savings impact to a hyperscaler with 100k network switches and an average of 20 cables per switch can be estimated as follows:

Port LEDs

- 1 LED indicator uses up to 15mW of power.
- 100k switch & avg of 20 cables per switch, means 4,000,000 LEDs.
- If LEDs are run 24*7 & 365 a year, yearly power consumption will be 4,000,000*15*365*24 = 525600000000mWH or 525600kWH.
- Yearly cost savings = 525600 * $0.165(world avg price per kWh) = $86,400/year.
- Electricity saved can be used to power 130 Irish homes for a year!

Rate adaptation

- When network load is low, we can negotiate a lower link rate, this allows voltage to be scaled down thus reducing power consumption. [3]
- (Ethernet links dissipate between 2-4W when operating between 100Mbps-1Gbps compared to 10-20W at 10Gbps.)
- Rate adaptation concept can be applied to other network components such as (the switch fabric and route processor).
- Not many commercial implementations (but a few successful prototypes).

[3] https://www.usenix.org/legacy/events/nsdi08/tech/full_papers/nedevschi/nedevschi_html/index.html

Discussion

- What “green” network initiatives are you working on?
- Any questions?