

# Can Cloud Computing and Optical Networking Save the Planet?

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# Cloud Computing

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What do the following have in common?

- Happiness
- Love
- Marketing Hype
- Recession
- Cloud Computing

They all mean different things to different people



# Summary

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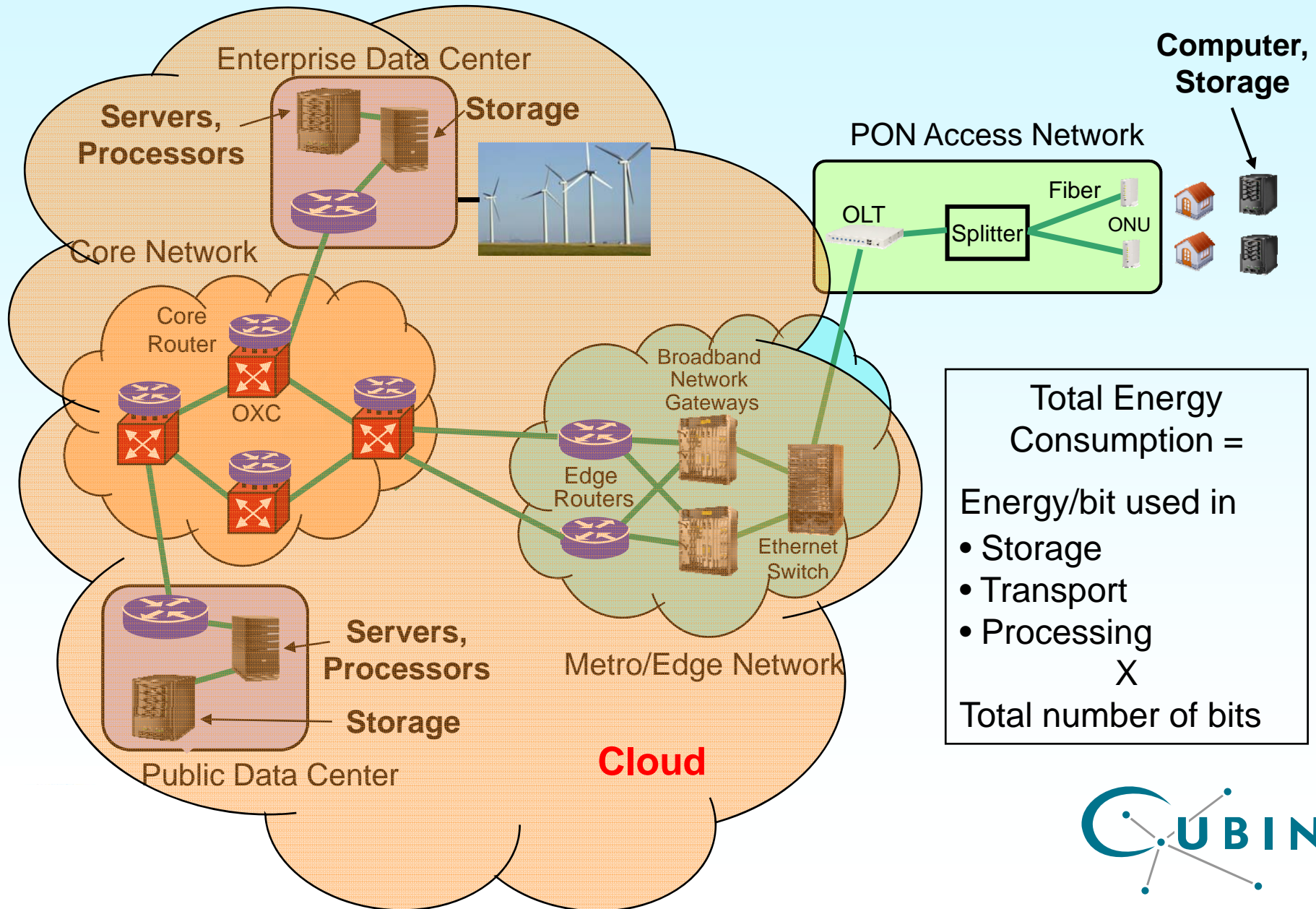
## Cloud Computing as a Logistics Problem

Key elements of logistics

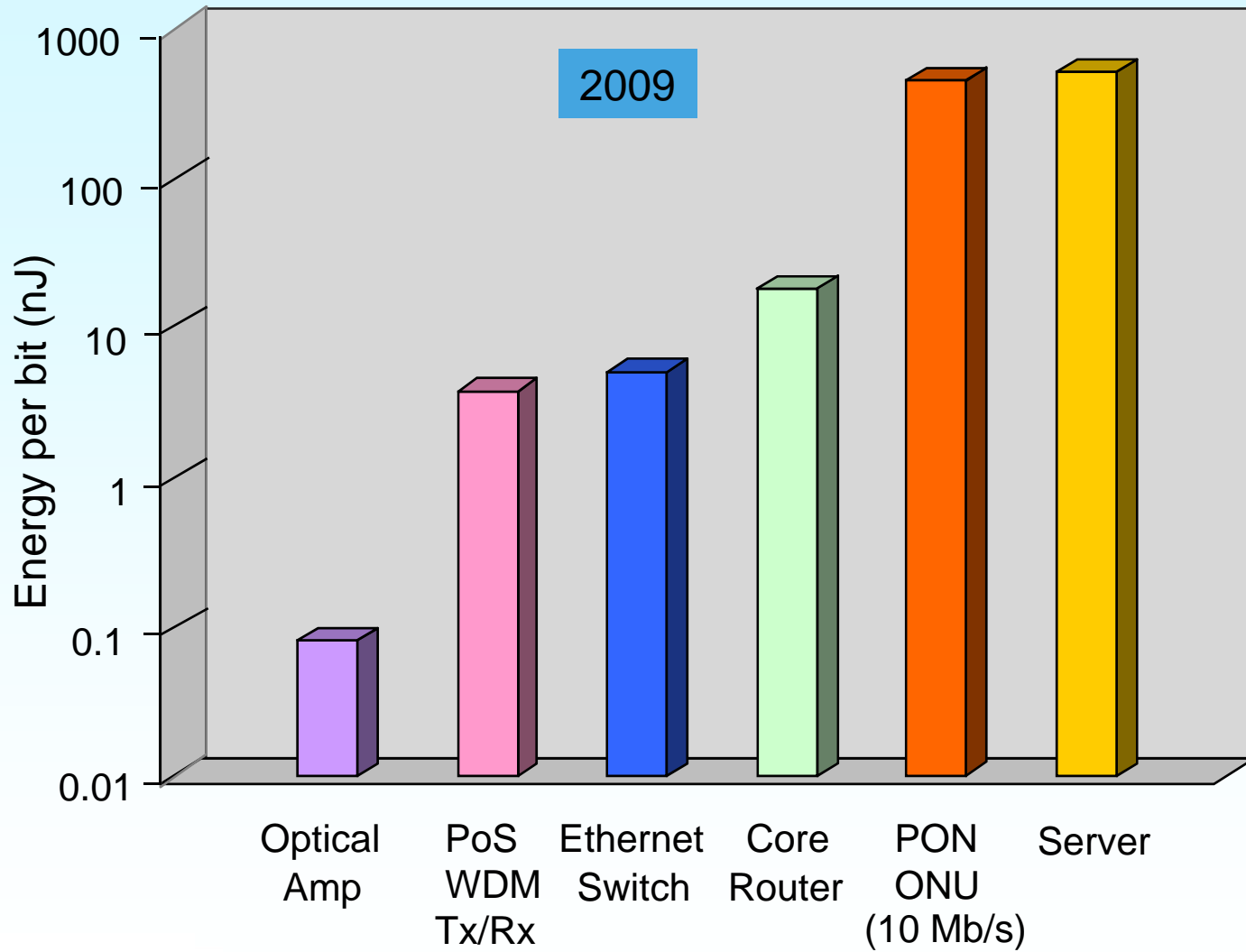
- Processing
  - Storage
  - Transport
- } Energy costs



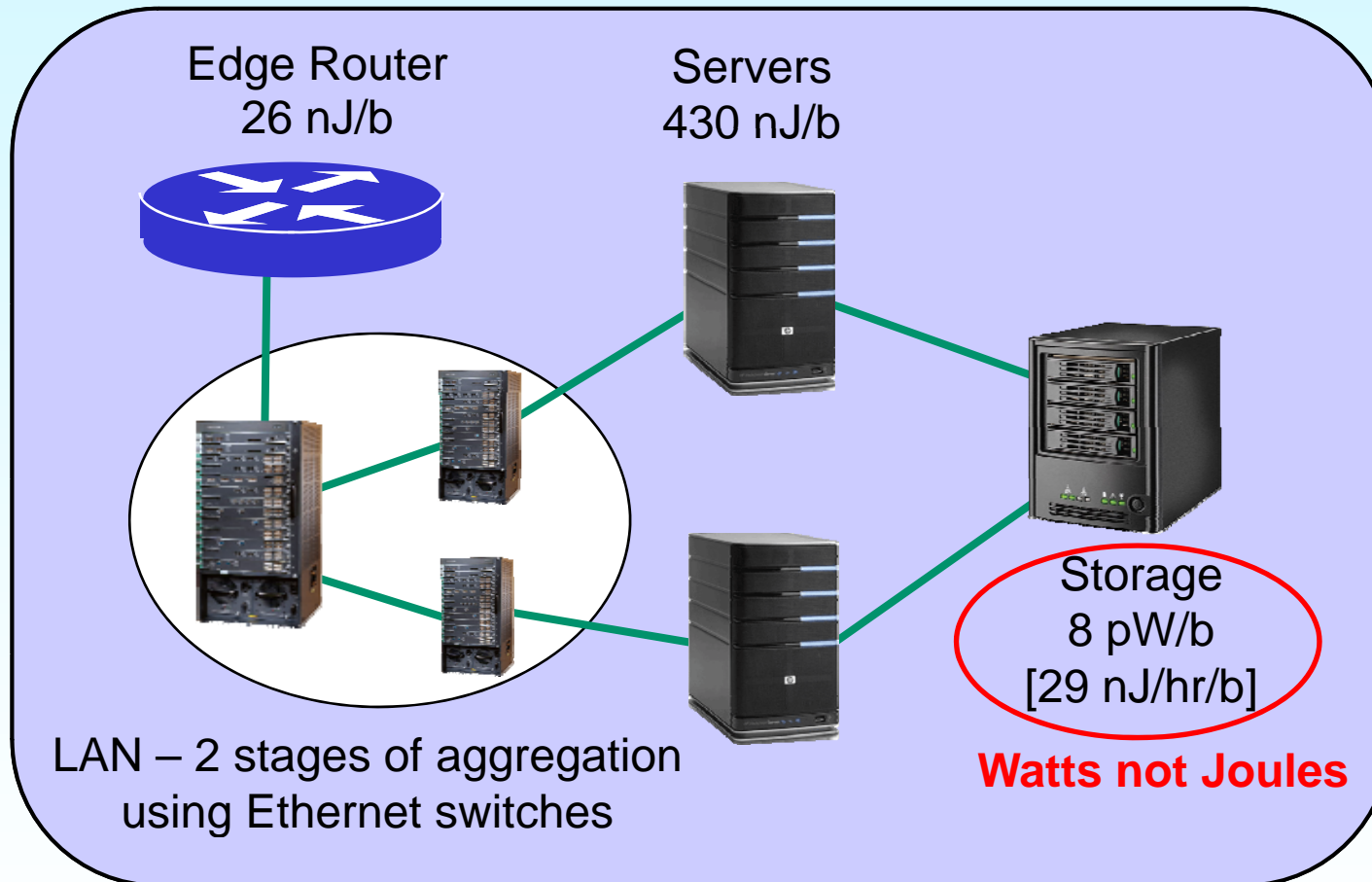
# Cloud Computing Energy Model



# Network Energy Model



# Data Centre Energy Model



# User Hardware Energy Model

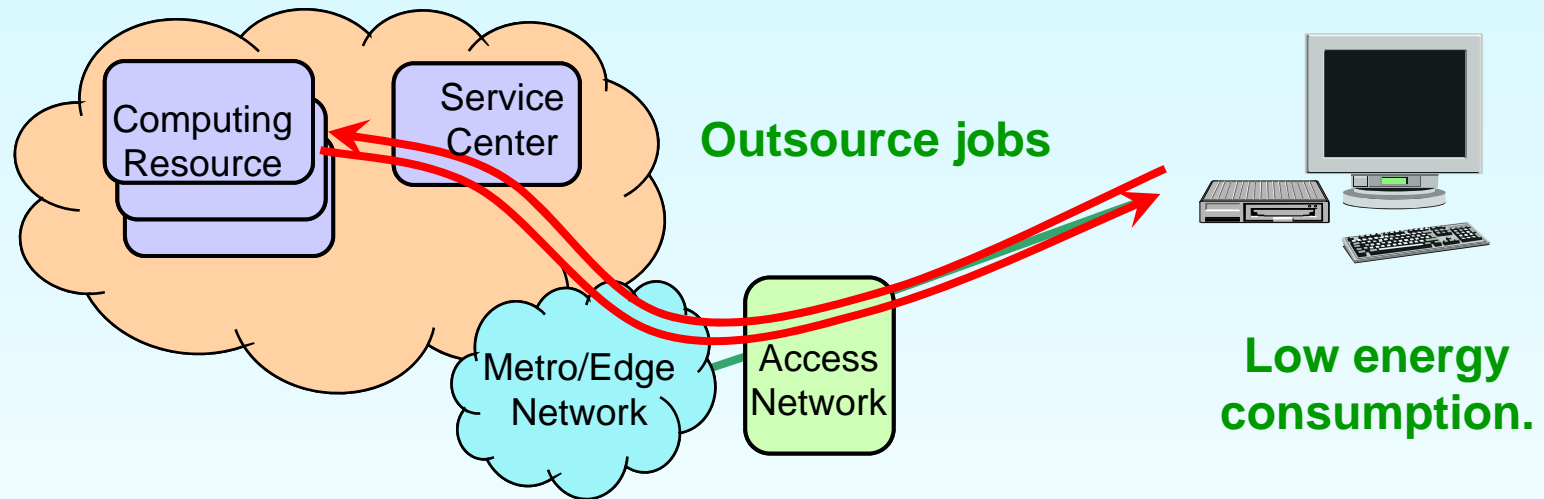
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- **End user computer:**
  - **High Energy Use Desktop 140 Watts**
    - Eg. Intel Quad-core, or older P4, mid-range graphics
  - **Modern mid-range Desktop 70 Watts**
    - Eg. Intel Core Duo 2.5 GHz, 2 GB RAM, mid-range graphics
  - **Low-end Desktop/Thin Client 18 Watts**
    - Eg. Intel Atom 1.6 GHz, 2 GB RAM, chipset-based graphics
  - **Ignore monitor (LCD/CRT) energy consumption**
    - This will be similar in all our comparisons



# Outsource to Cloud or Oversize Computer?

Should I use a low-end Computer & Outsource Jobs



- OR -



Use a high-end computer that can handle any of my jobs

But high energy consumption even for light jobs



# Consider Three Scenarios

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## 1. Software-as-a-Service

- **Stored on user's computer with updates downloaded regularly**
  - Eg current anti-virus software model extended to mainstream applications, MS Update (weekly patch) model

## 2. Service Bureau

- **Most tasks done on lower end user machine, outsource the “big” jobs**

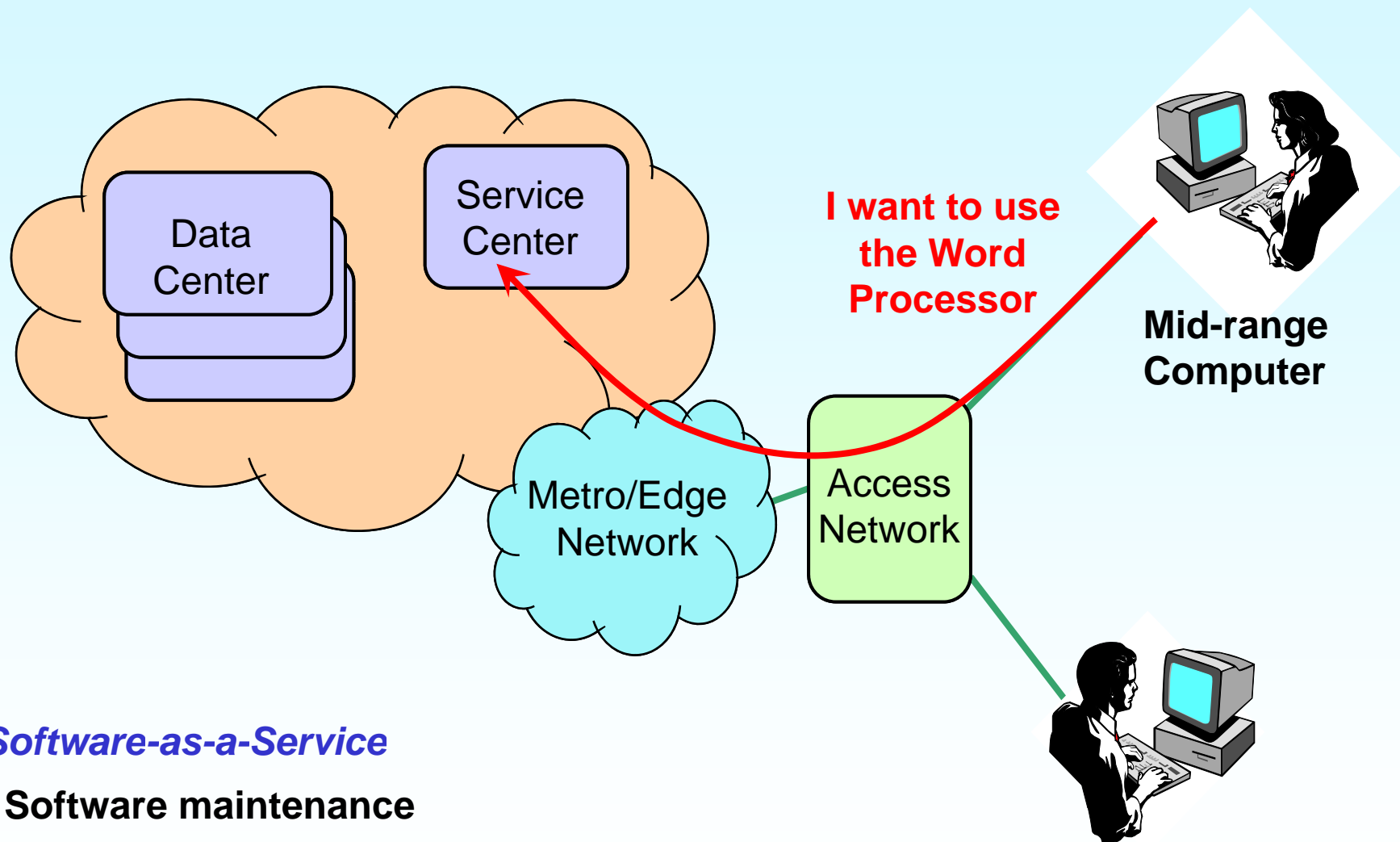
## 3. Computing-as-a-Service

- **Hosted and run on provider's computer “farm” with data initially uploaded from user**
  - User data may be hosted or locally stored
  - Like enterprise “Thin Client” model

**Can cloud computing save energy ?**



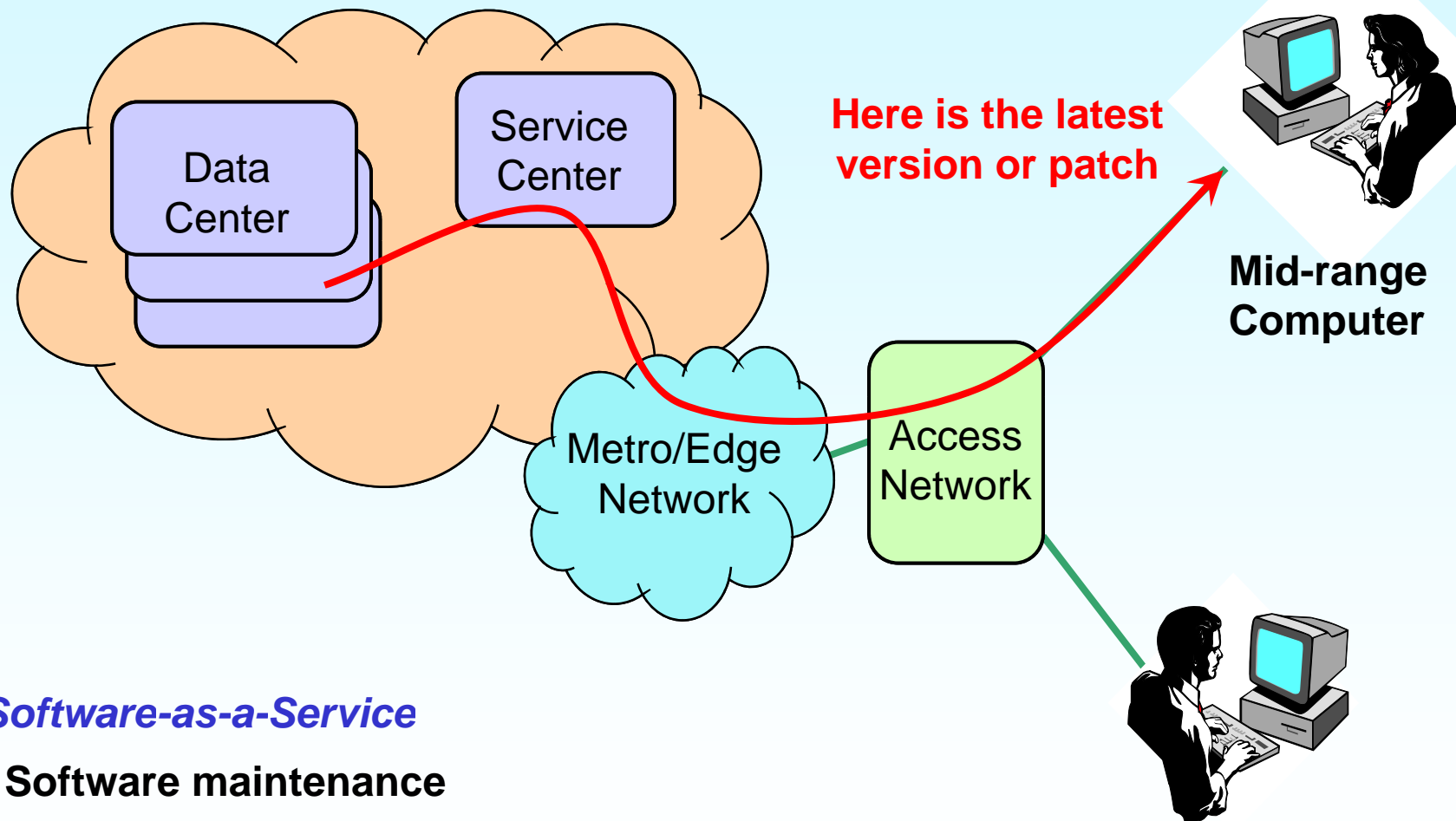
# 1. Software-as-a-Service



## *Software-as-a-Service*

- **Software maintenance**

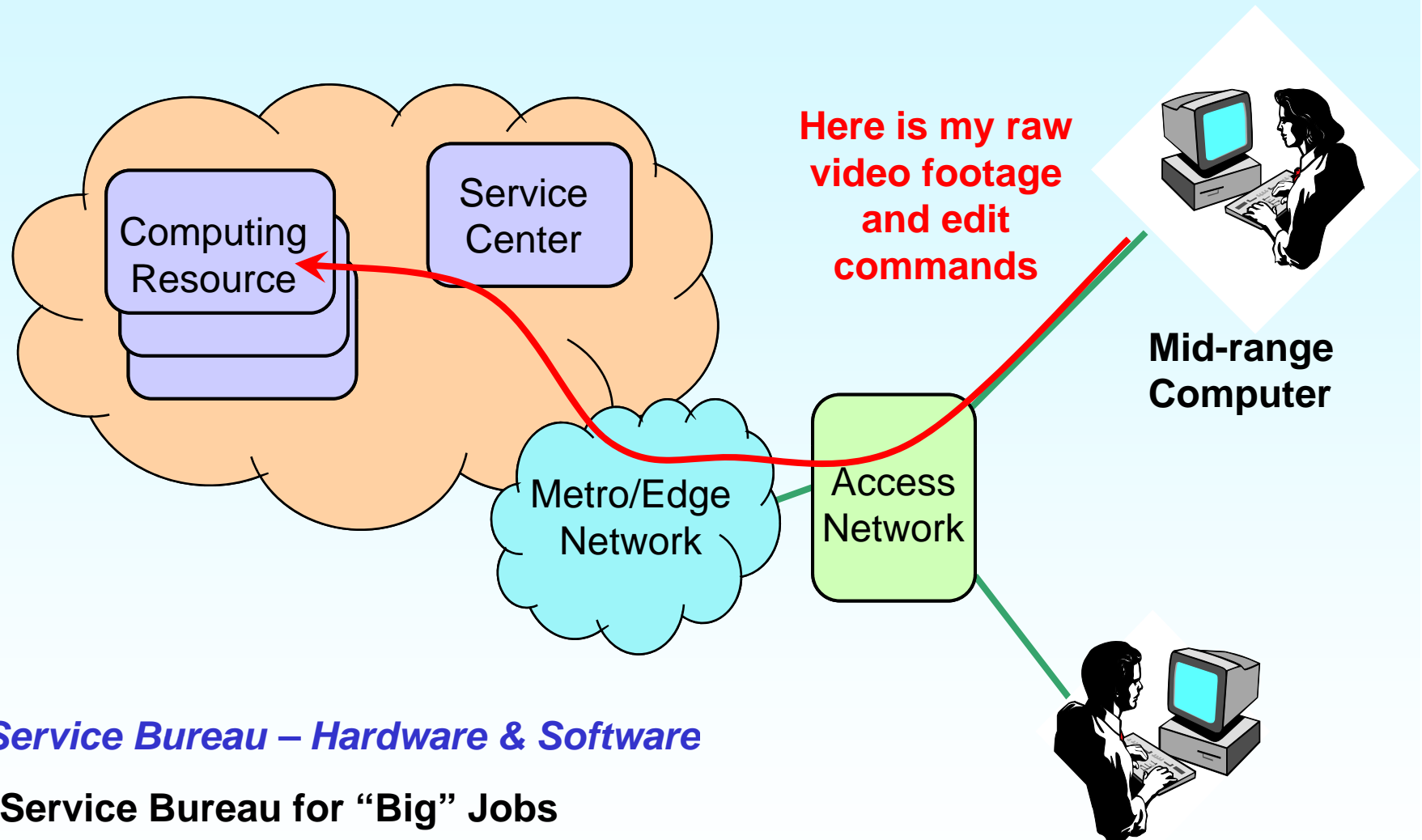
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## *Software-as-a-Service*

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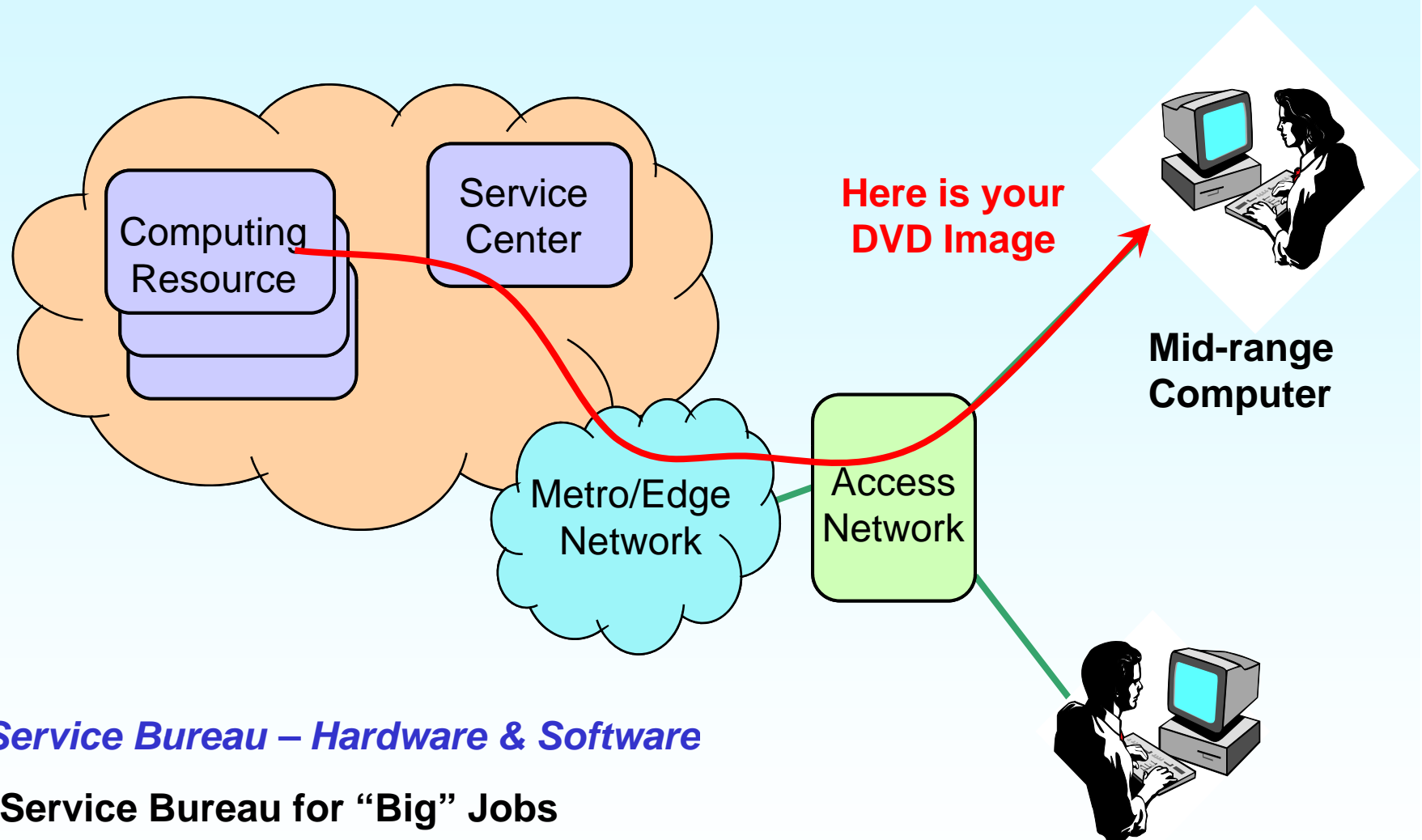
## 2. Service Bureau



*Service Bureau – Hardware & Software*

- Service Bureau for “Big” Jobs

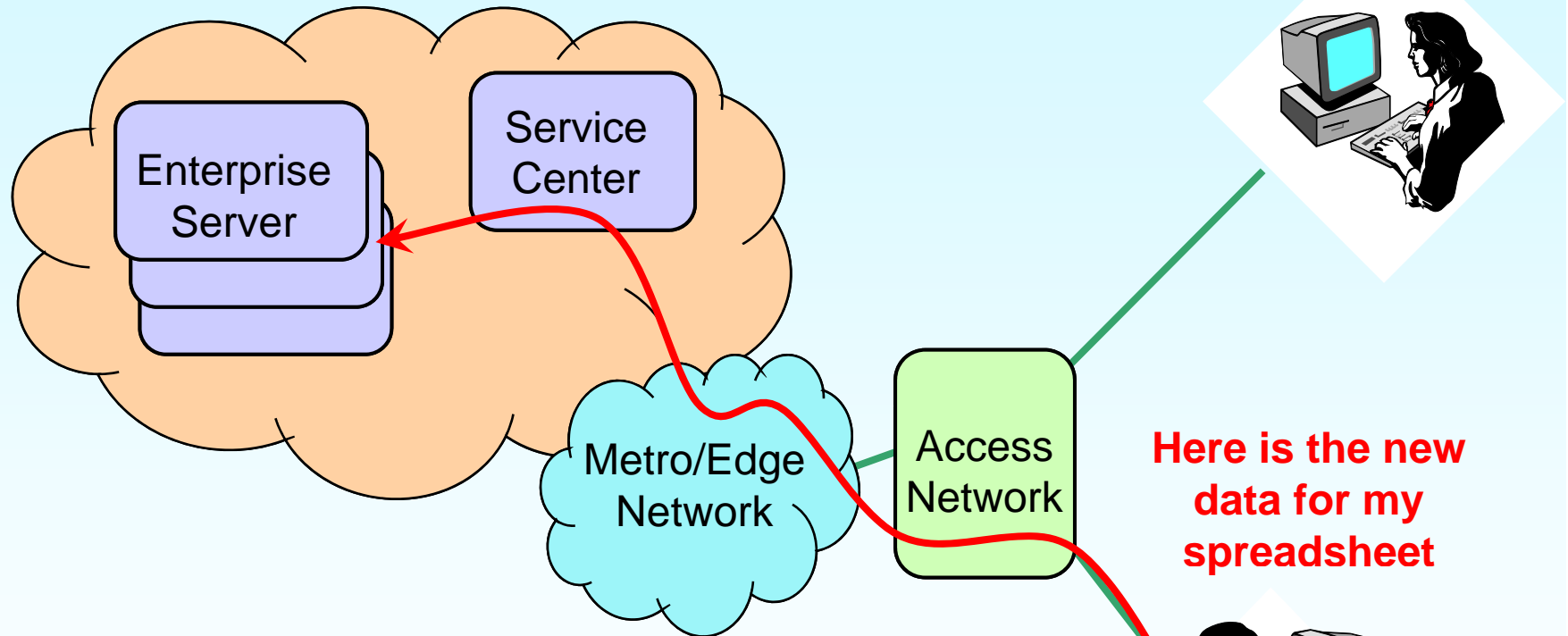
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# 3. Computing-as-a-Service



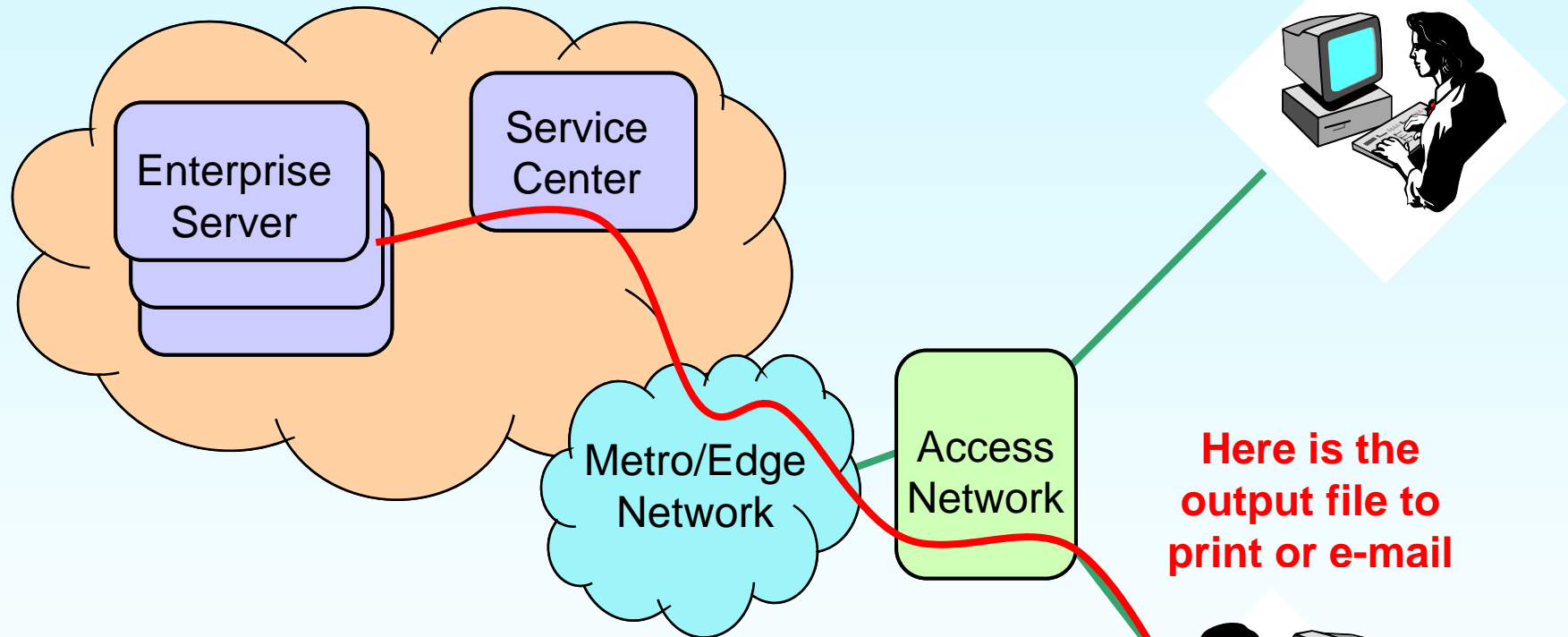
*Computing (Hardware and Software-as-a-Service)*

- Centralised Storage and Processing

Low-end or  
“Thin Client”  
Computer



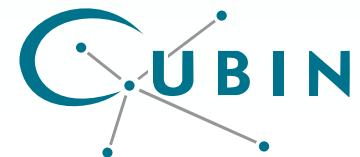
# 3. Computing-as-a-Service



*Computing (Hardware and Software-as-a-Service)*

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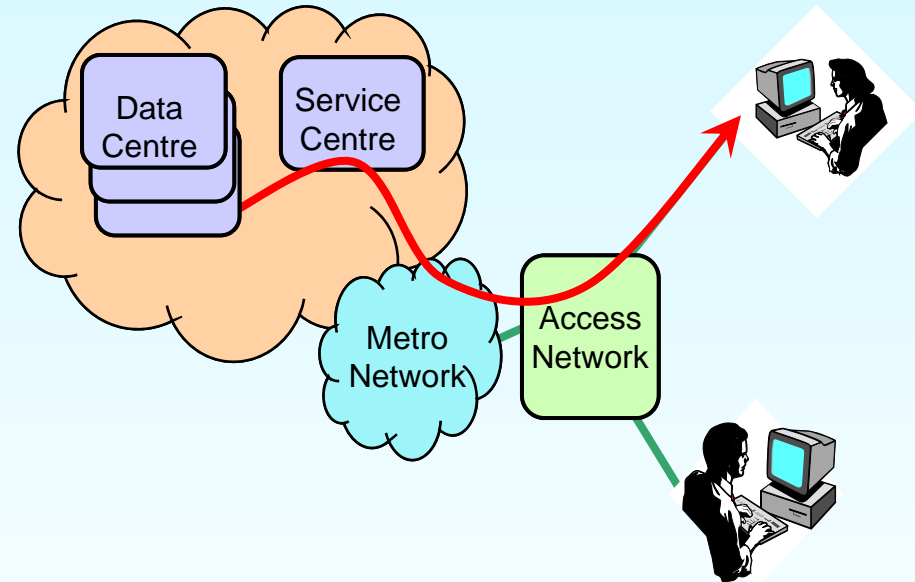
Low-end or  
"Thin Client"  
Computer



# 1. Software-as-a-Service Example

## Store on Local Disk or in the Cloud?

- Energy impact of the “Software as a Service” & “Storage as a Service” models
- Compare the energy cost to store & transport 50 MB blocks to the user, cf. store on local drive

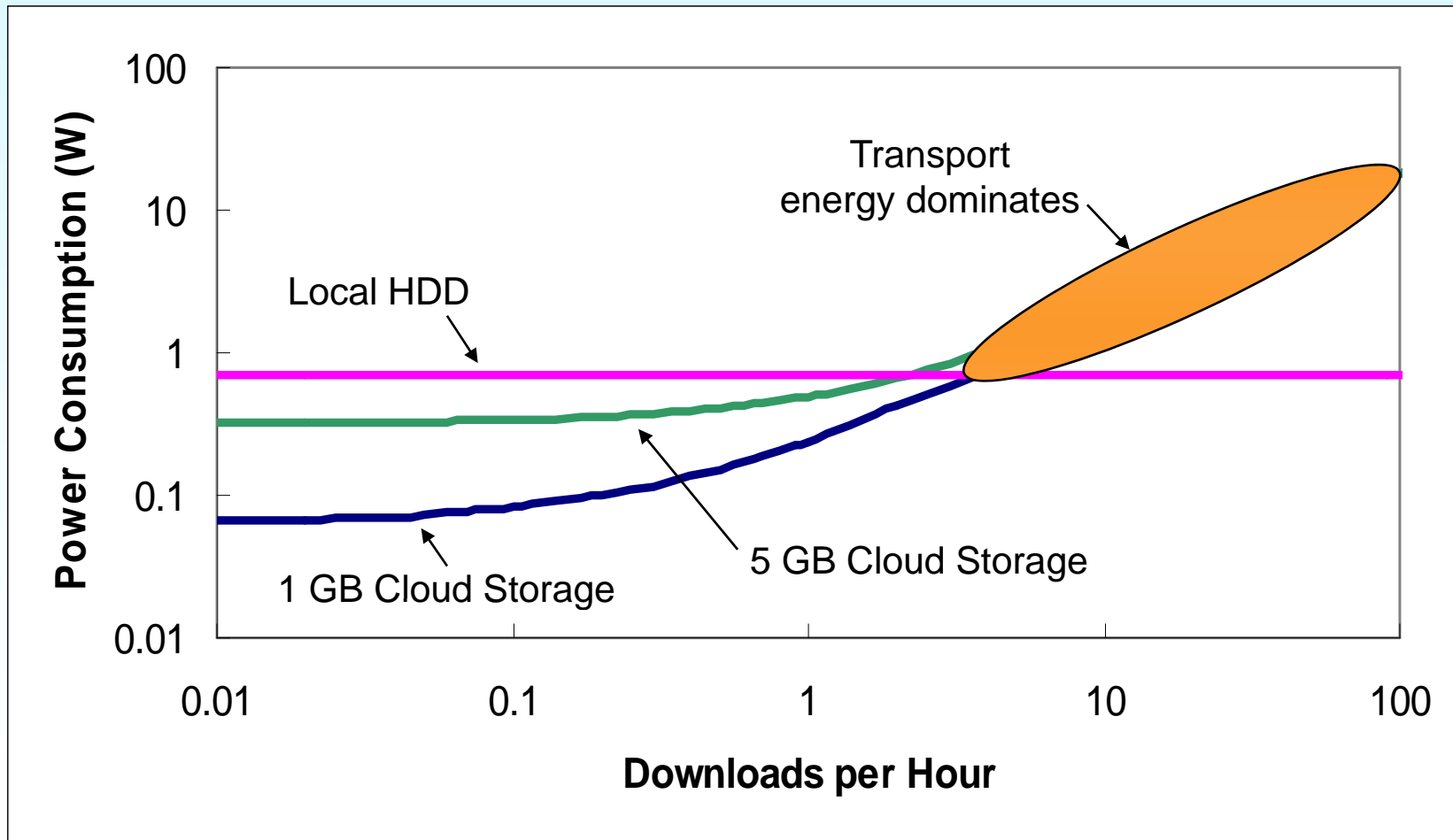


- Users require 1GB and 5GB “cloud” storage

# 1. Software-as-a-Service Example

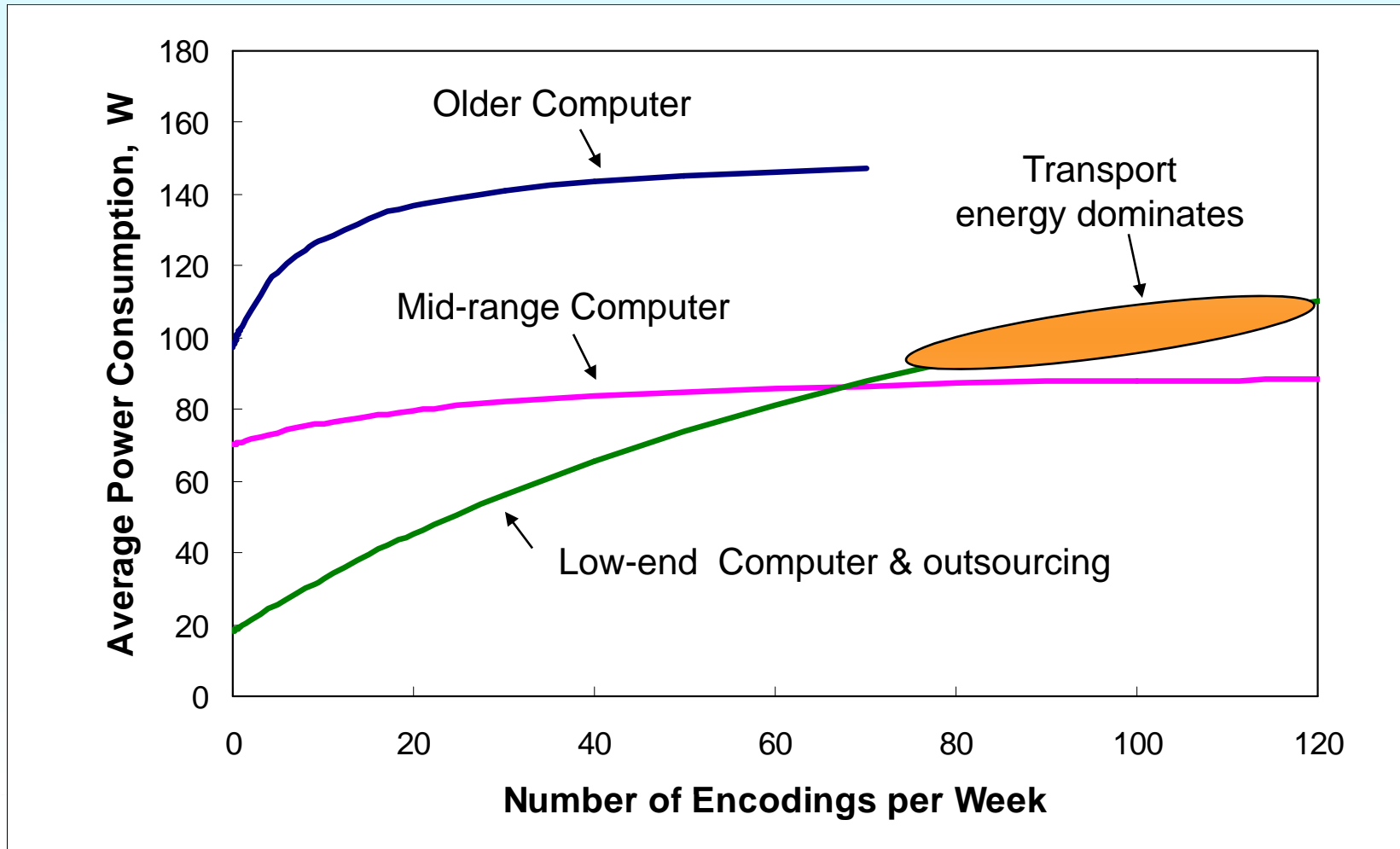
## Store on Local Disk or in the Cloud?

Storage of application & data “in the cloud” compared with storing on a local disk. 50 MBytes per download. Modern laptop-style HDD 20% read/write and 80% idle.



## 2. Service Bureau Example

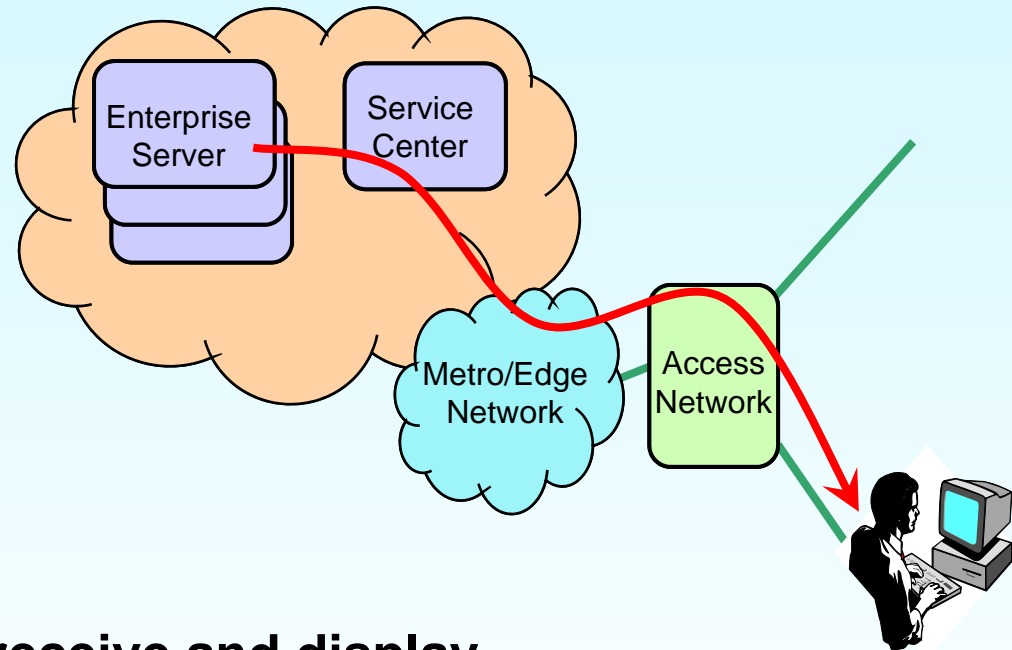
Computer used for 20 hrs/week, plus some video encoding of ½ hour videos



# 3. Computing-as-a-Service Example

## Thin Client or Small PC in Office?

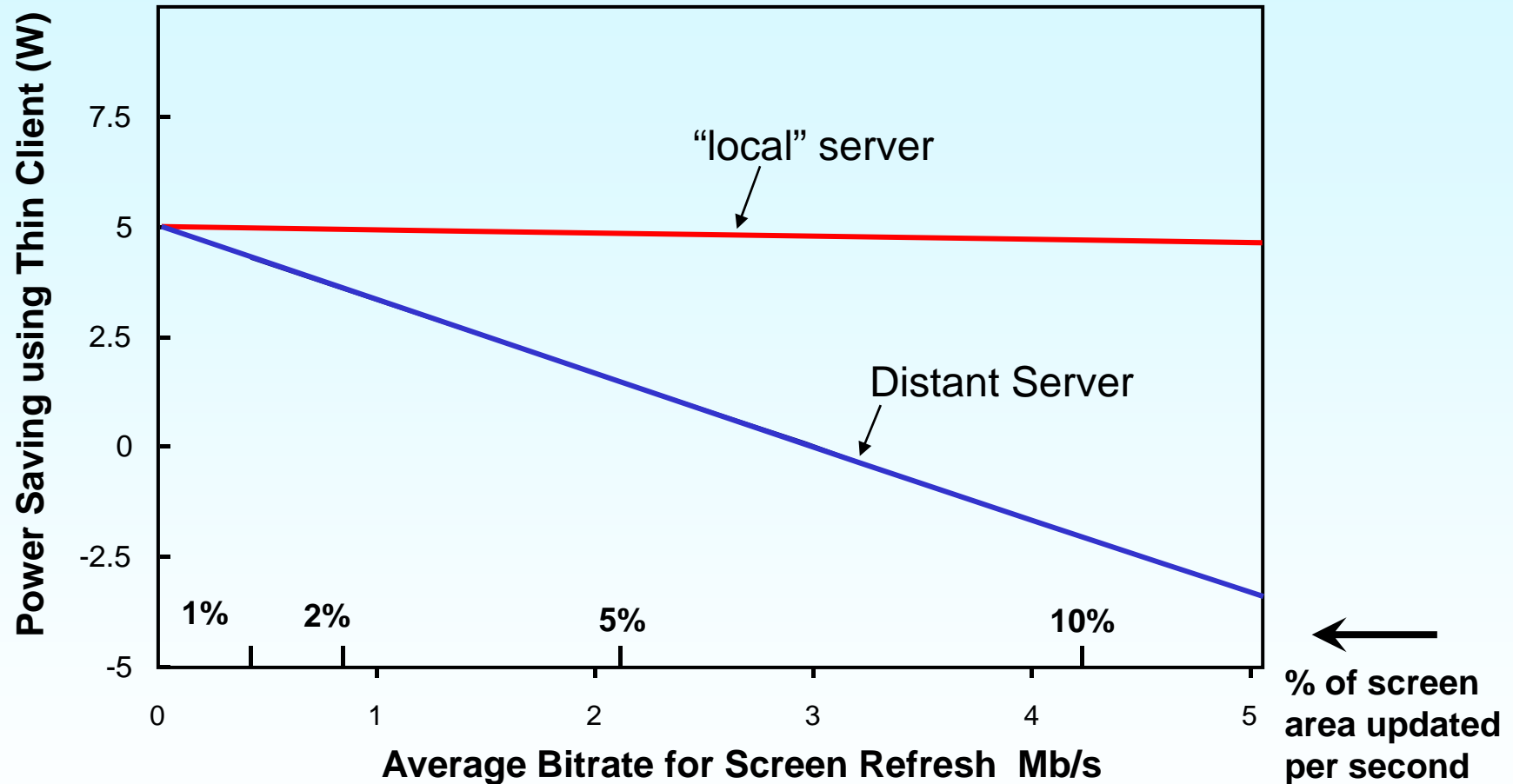
- **Office situation**
  - non-intensive tasks,
- **Should this office deploy:**
  - a low-end machine per user  
OR “dumb, thin clients”?



- **Commonly, thin client would receive and display HTML formatted data from the server**
- **Thin client capability may be limited to displaying bitmaps developed from its server**

# 3. Computing-as-a-Service Example

Thin Client compared to Small PC in Office



Thin client solution "green" only when the server is local

# Summary

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- **Cloud Storage and Cloud Computing can provide energy savings**
  - More so for less-demanding users
  - For handling the occasional intensive task
- **But...**
  - Advantages may be lost when data transfer is large
  - This is where optical networking needs to come to the rescue
- **Cloud Computing may not save the planet....**
  - But if used appropriately, it could help to mitigate the growth in energy consumption in our industry
  - A classical Logistics problem

