



CSCI 101

Connecting with Computer Science

Cloud Computing I



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2020 Fall Semester (S3)

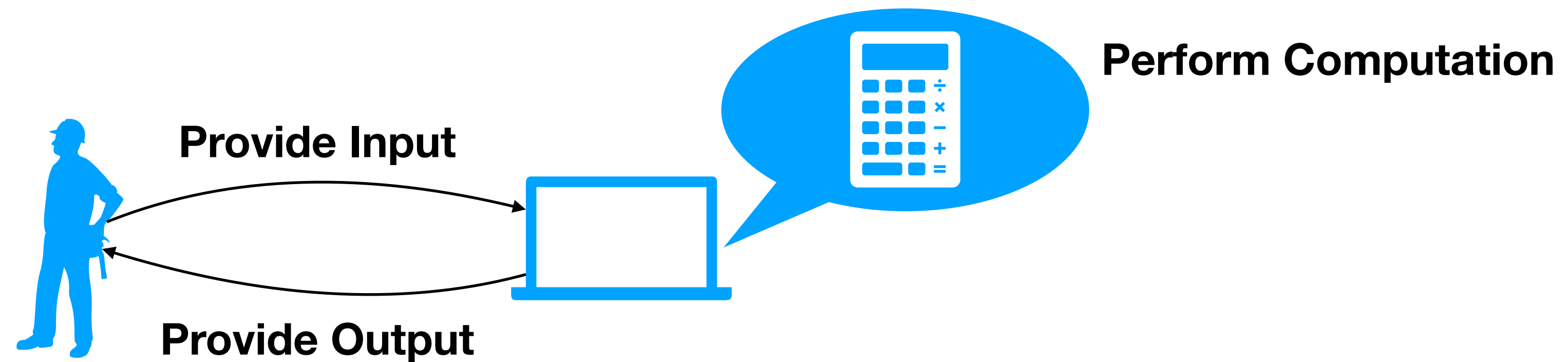
Overview

- Focus: Massive Data Solution
- Readings: R8, R9
- Core Ideas:
 1. Definition of Cloud Computing
 2. Questions about Cloud Computing

What is Cloud Computing?

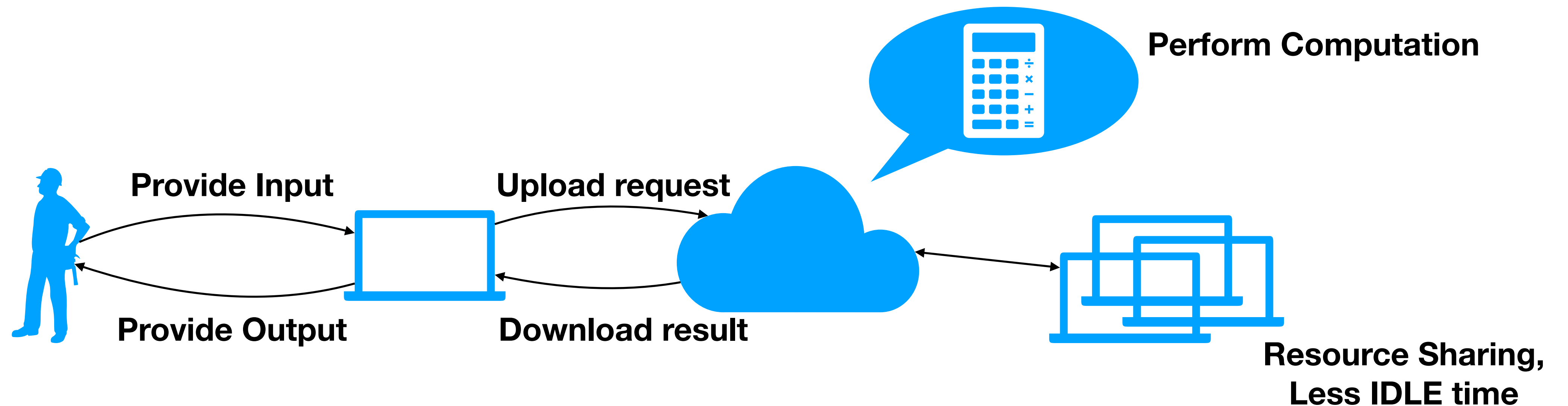
It's actually not that complicated

Conventional Workflow



- Local Computation
- Efficiency: only as fast as your local machine
- Resources: idle for 90% time

Cloud Workflow



- Cloud Computation
 - Efficiency: cloud platforms can have much better resources (e.g. super computer, huge clusters of high-performance, etc.)
 - Resources-sharing: always serving

Comparison

- Local computation
 - 99% of the time, you don't need 50 CPUs and 4 RTX Titans
 - Cost of building a 50 CPU machine with 4 RTX Titans is very expensive
 - Maintenance/Upgrading of such machines are also expensive
- Cloud computation
 - 99% of the time, you work on your own computer. 1% of the time, you rent the cloud to do stuff for you
 - Rental cost is relatively low, comparing to purchasing
 - Maintenance/Upgrading done by service providing companies, you don't waste anytime!

Different Cloud Service Models

- SaaS (Software-as-a-Service)
 - Entire software is cloud based. All computations done remotely.
- PaaS (Platform-as-a-Service)
 - The platform is cloud-based. You build your software on these platforms. Computations are done remotely, but gives you more customisability.
- IaaS (Infrastructure-as-a-Service)
 - The infrastructure is cloud-based. Just like having your own computer/cluster.
- Others: Serverless computing, FaaS (Function-as-a-Service)

Examples

- Adobe Creative Cloud, Apple iCloud (macOS, iOS, iPadOS)
- Google Docs, Apple iCloud (Web)
- Wordpress
- Linode, VMWare cloud
- AWS, Google Cloud, Microsoft Azure

Technical Aspect

- What does the Cloud provide?
 - Data Storage
 - Computation
 - Service Providing

Data Storage Examples

- Apple iCloud, Google Cloud, Dropbox
- Why?
 - 1 TB of storage can be a few dollars per month, can be accessed anywhere with internet
 - Easy sharing/collaboration
 - No maintenance headaches: hard drives do eventually die.

Cloud Computation Examples

- Google Cloud, Nvidia, AWS, Compute Canada
- Why?
 - Not every institution can afford a super computer worth millions of dollars for just a few jobs
 - Compute Canada: Canada's 4 most powerful super computers
 - Niagara: University of Toronto
 - Cedar: Simon Fraser University
 - Arbutus: University of Victoria
 - Graham: University of Waterloo

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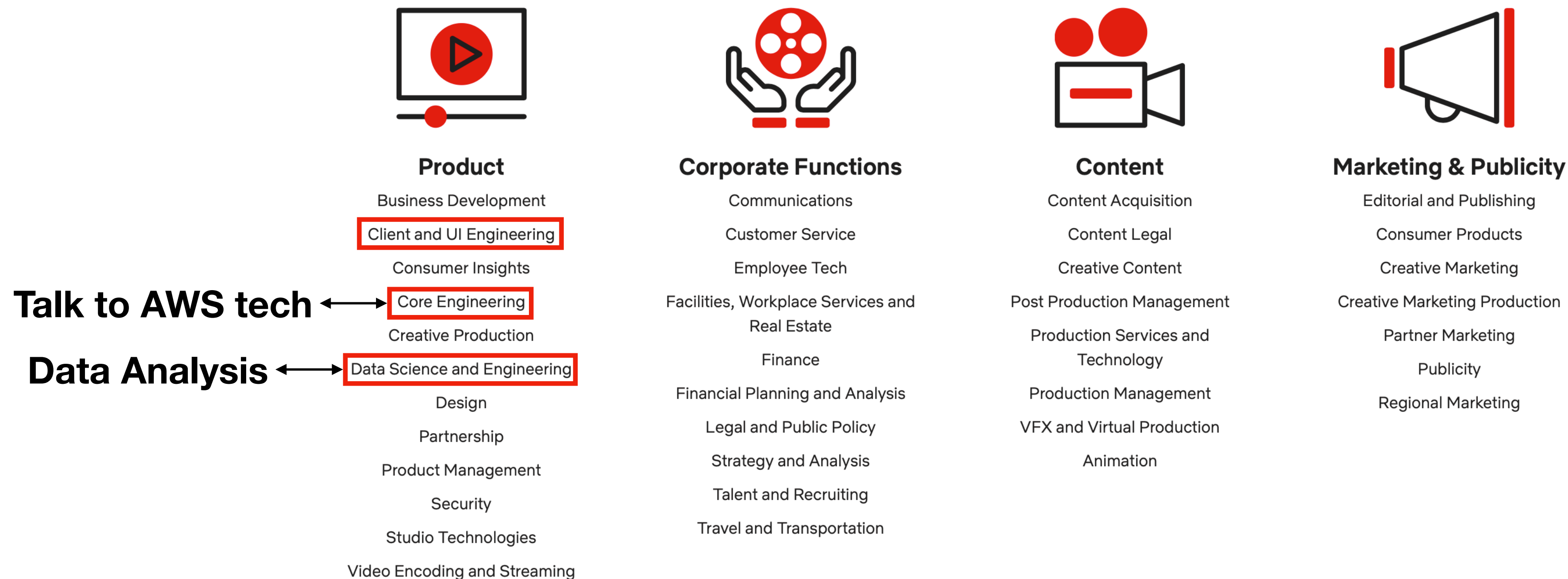
- Machine Translation Research
 - Google: 32 RTS Titan GPUs, 1TB of GPU memory, run for a month
 - Electricity bill: Tens of Thousands of dollars
- Why?
 - Terabytes of training data, Billions of parameters, Training takes time, resources, and golden cash
 - My latest papers: 200k data, few million parameters, trains in 2 days with 2 x 1080Ti worth about 1500 dollars, less than their electricity bill
 - My colleague's paper (on a different topic): uses Compute Canada (Cedar), for Free!
 - Trains massive models within days, got published

Service Example: Netflix

- Netflix
 - Netflix doesn't own a single server. They are using Amazon's AWS.
 - Ironic: Direct competitor to Amazon's own Prime
 - Massive content distribution network infrastructure: all provided by AWS
 - Need more servers? AWS can provide by simply pushing a button
And add more money to Netflix's bill of course.
 - Scaling your business? So easy, press the button and it's done

Service Example: Netflix

Join Your Dream Team



- Netflix has NO server/network maintenance team, Amazon has em all covered!

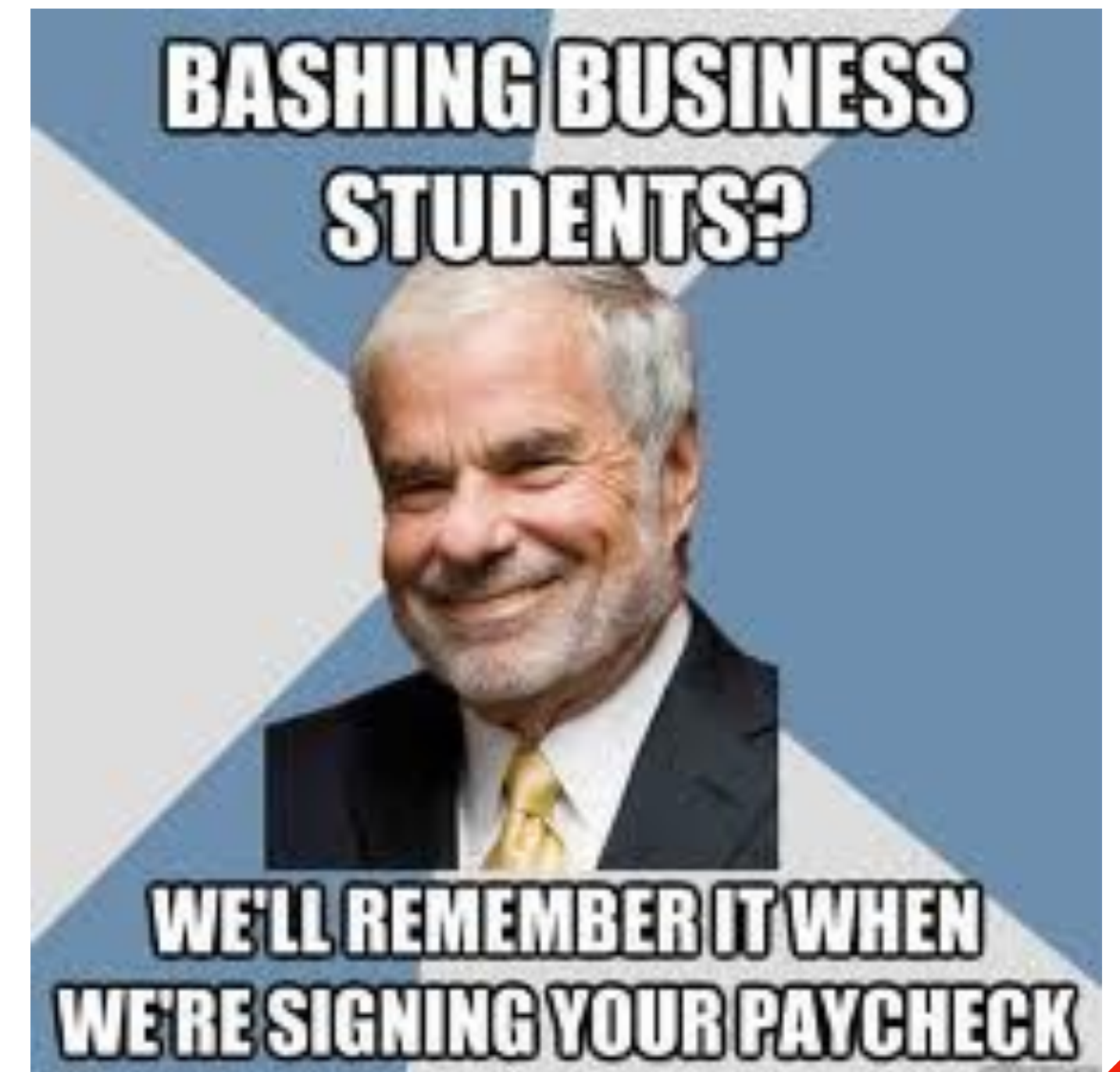
Examples

Questions about Cloud Computing

Ah, now is the fun part

Q1: Cloud Computing is NEW?

- A: Wrong.
 - As early as 1996, or beyond (Remote control)
 - Popularised by Business students yelling 'Big Data!'
 - Cloud computing is primarily a **business product**
 - Real reason why it's "suddenly" popular: **cost**
 - **PC are cheap** enough now
 - **Storage is cheap** enough now
 - Network **bandwidth is good** enough now, with 3G and beyond



Q2: What is the difference between Cloud and Web-service?

- A: Web-service can be **static**, or dynamic but computationally **simple**
- Cloud computing is designed for **massive** storage capability, or **massive** computation capability, or **massive** user-base service providing capability
- Ordinary users are usually **Oblivious** to the Cloud (except for storage)
- Most websites are using Google Cloud / Amazon AWS , M\$ Azure, etc. You cannot avoid it.

Q3: How do I work professionally with the Cloud?

- A: Usually, you have three options¹
 - First Party: Work for **Cloud-Solution providing companies**, like Google, Amazon, M\$, etc.
 - Second Party: Work for a smaller **company that uses Cloud Solutions**.
 - Third-Party: Work for a third-party **company that helps other companies with Cloud Solutions**.

QX: Other Questions?

- Ask me now plz.