

CSC4200/5200 – COMPUTER NETWORKING

Instructor: Susmit Shannigrahi
SOFTWARE DEFINED NETWORKING AND
NAMED DATA NETWORKING
sshannigrahi@tntech.edu



Data VS Control Plane

Data plane is (mostly) in the hardware -

- Forward packets

Control plane

- How do we tell routers how to forward packets?
- BGP?
- How do you change something when network changes?

Data and Control Plane together

Problems?

- No separate channel
- Expensive
- Hard to change

What is SDN?

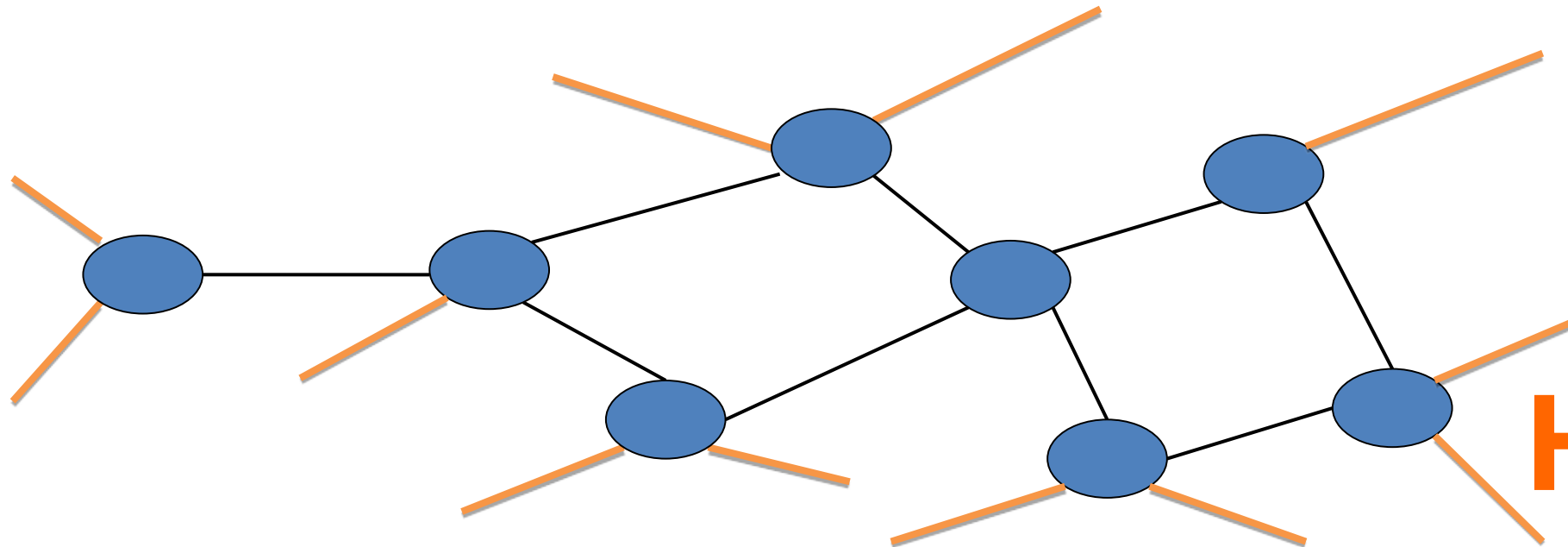
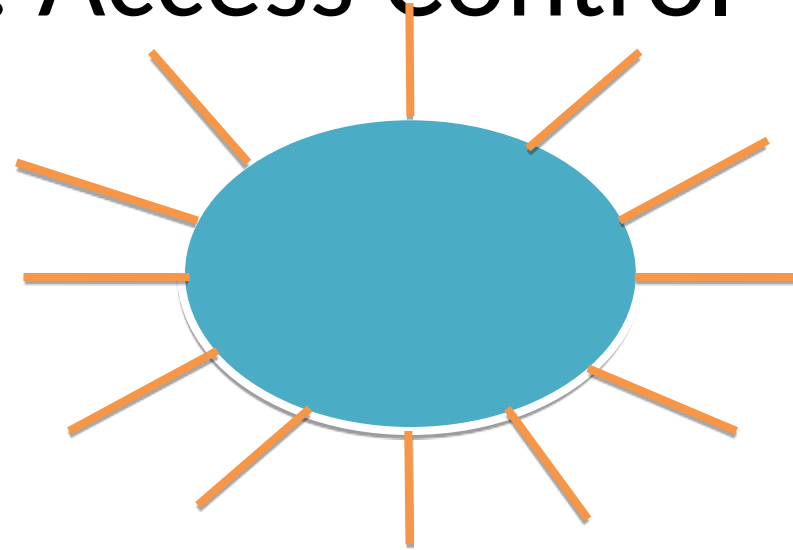
- Software-defined networking (SDN) provides abstraction for
 - Configuration, security, and forwarding
- SDN makes the network
 - Directly programmable
 - Agile: administrator can change the network
 - Centrally managed: network management is logically centralized.
 - Vendor-neutral

Simple Example: Access Control

Source: Scott Shenker, UC Berkeley

What

Abstract Network Model



Global Network View

How

Software Defined Networks

Source: Scott Shenker, UC Berkeley

Specifies
behavior



Control Program

Abstract Network Model

Compiles to
topology



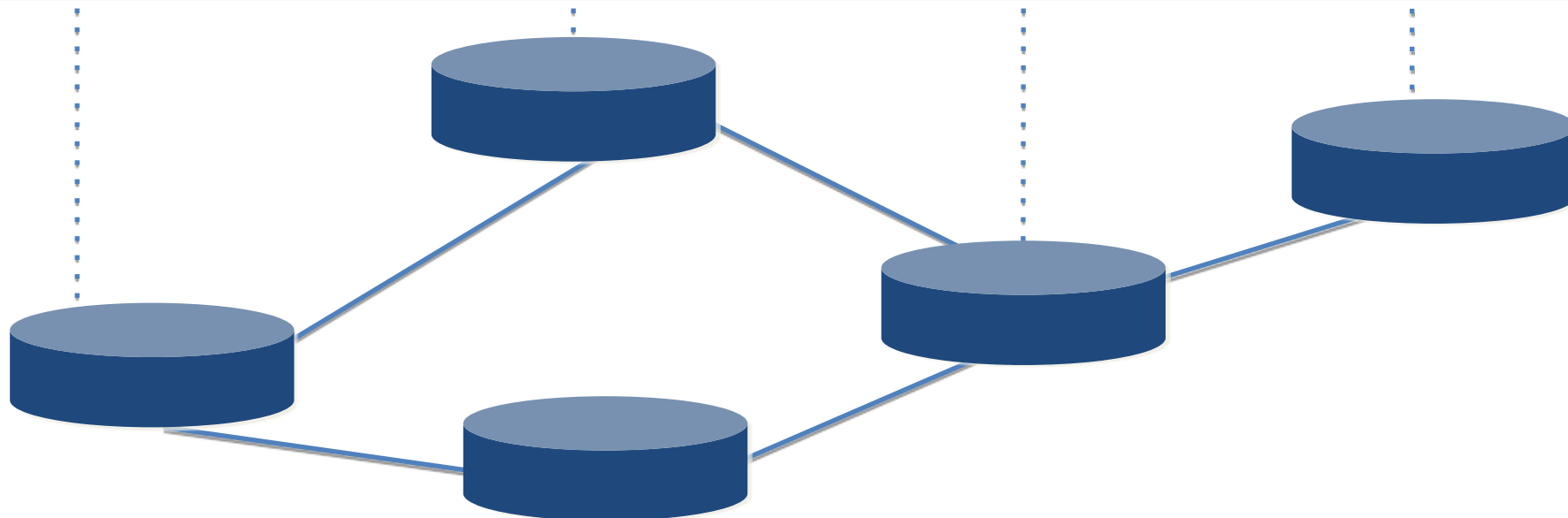
Network Virtualization

Global Network View

Transmits to
switches



Network OS



What Does This Picture Mean?

Source: Scott Shenker, UC Berkeley

- Write a simple program to configure a simple model
 - Configuration merely a way to specify what you want
- Examples
 - ACLs: who can talk to who
 - Isolation: who can hear my broadcasts
 - Routing: only specify routing to the degree you care
 - Some flows over satellite, others over landline
 - TE: specify in terms of quality of service, not routes
- Virtualization layer “compiles” these requirements
 - Produces suitable configuration of actual network devices
- NOS then transmits these settings to physical boxes

What is SDN?

Very high queuing delay

Control Plane

Control Plane

Control Plane



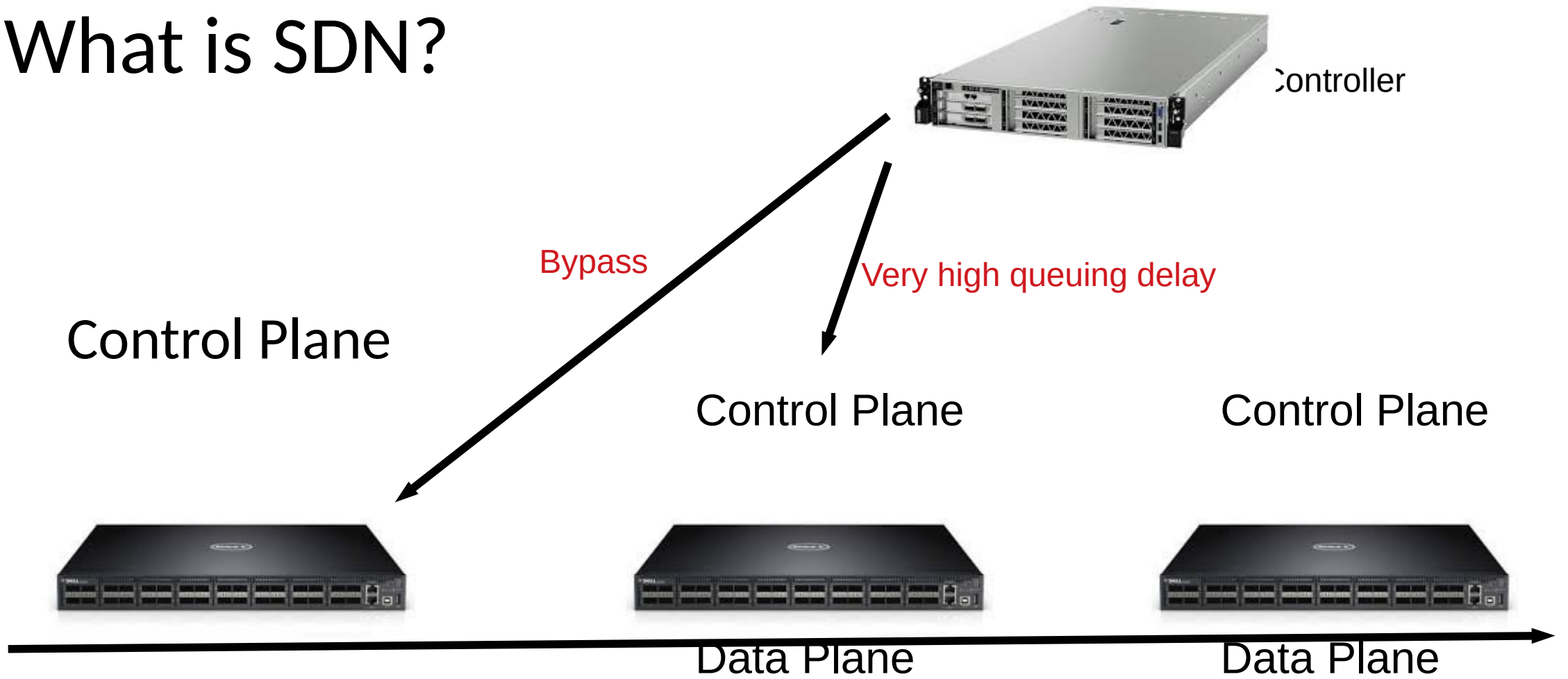
Data Plane

Data Plane

Data Plane



What is SDN?



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NAMED DATA NETWORKING

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Today's Internet

- To find content in the network
- ..you have to learn where the content is
- ..and then ask the network to take you there
- ..so you can tell the server what you want

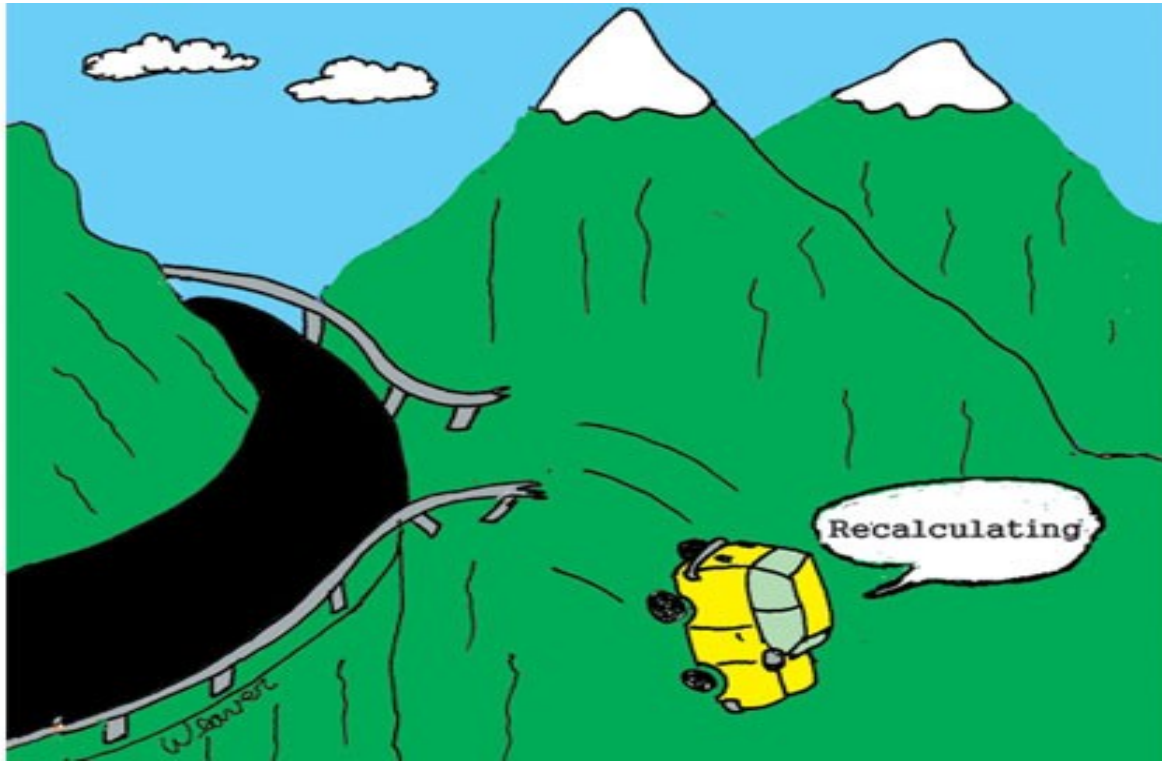
- In other words, the Internet is like an **old GPS!**



Latitude:26.212424°
Longitude:127.680932°

But Things Often Fail

Often the content is not there..



..or the path is too congested!



What if the Network was Smarter

And you could tell it what you want!

- Instead of taking you where you **think** the content is..
- ..the network could **get** the content for you!
- ..in the most efficient way!

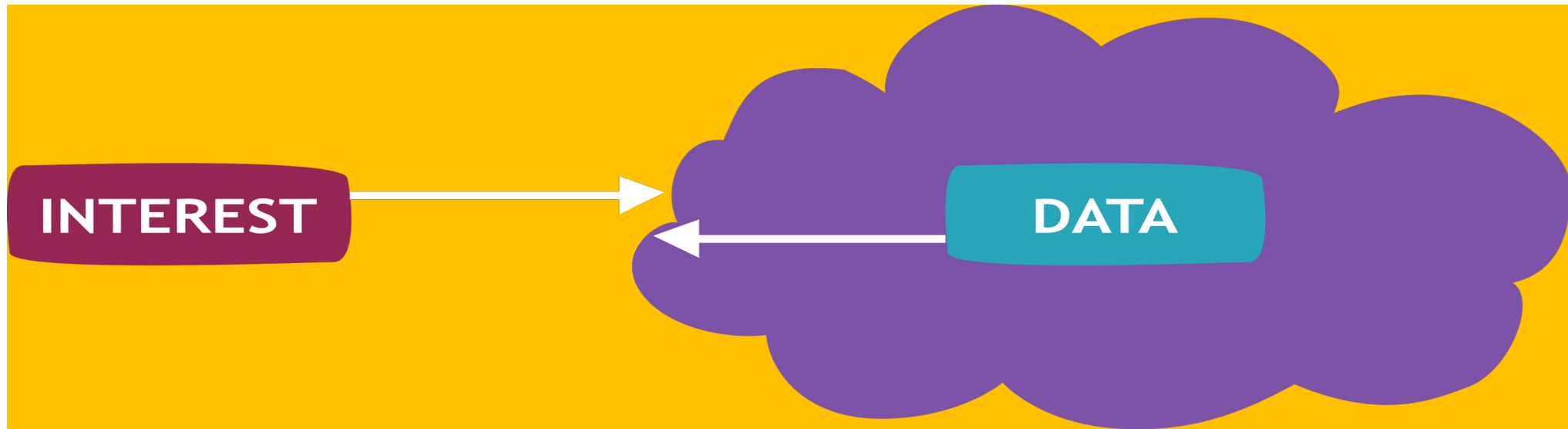
How do we make the network smarter?

Ask what you want by its name, not address



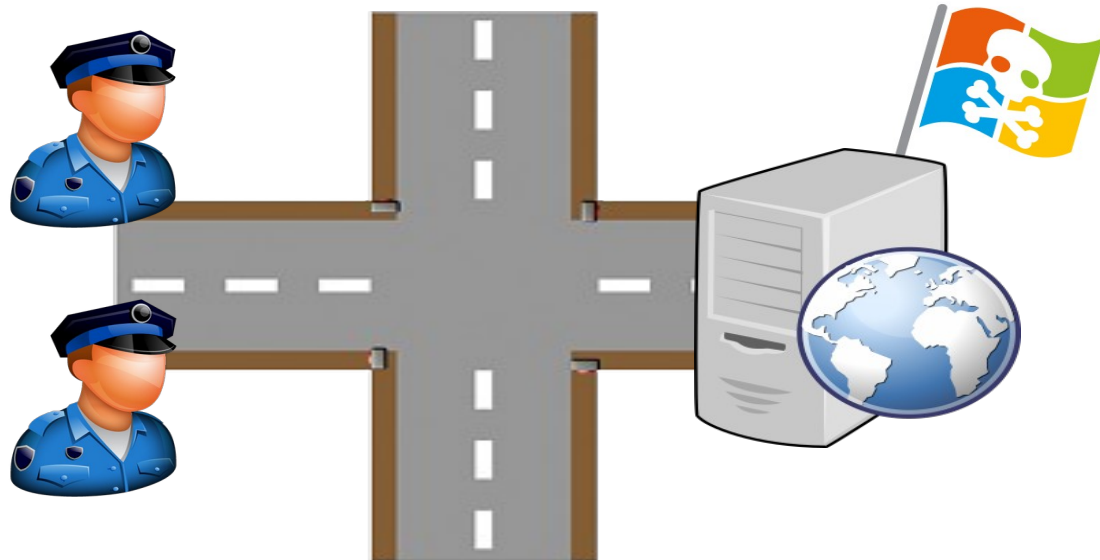
Named Data Network (NDN)

- The new idea: **Name the data, not the hosts!**
- ..so you can ask the network directly for the data!



Named Data is Easy to Secure

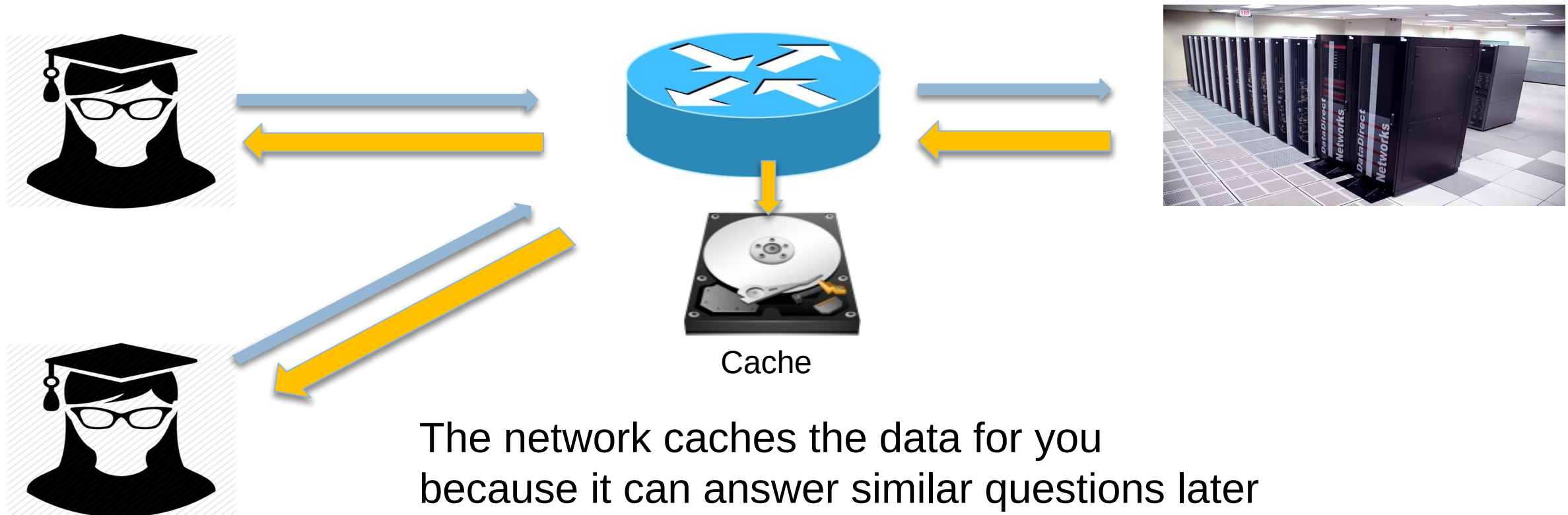
- In the Internet you secure your path..
- ..but the server may still be hacked!



- In NDN you **sign** the data with a **digital signature**..
- ..so the users know when they get bad data!

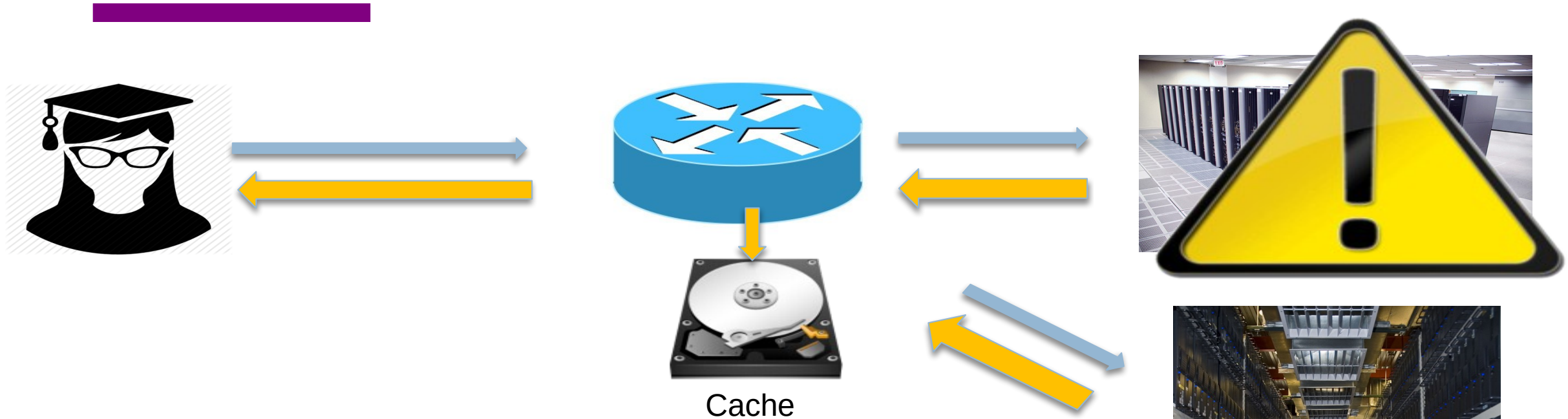


Named Data Can be Cached

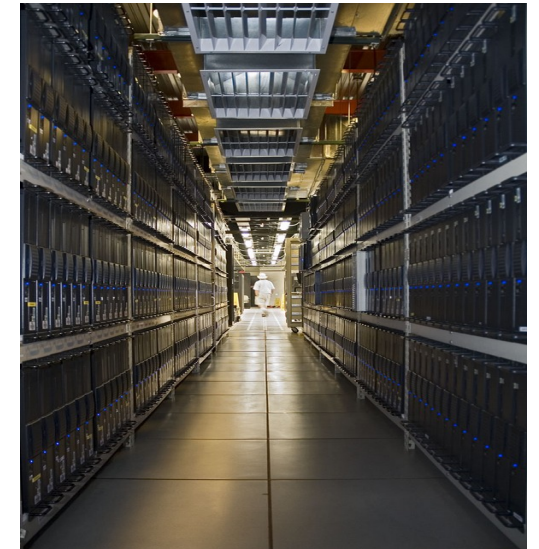


The network caches the data for you because it can answer similar questions later
Data is naturally cached to locations of high demand
Caching becomes the network operator's problem!

Robustness to Site Failure



Failover in a named data network happens **automatically** without application involvement



This Sounds Awfully Complex..

It's not! It's actually quite simple:

- First, name your datasets with a hierarchical, community agreed name:
 - */ google / index.html*
- Then, advertise the *prefix* to the network:
 - I can answer any questions starting with:
 - */ google*
- Finally, let users issue interests with the appropriate name or name prefix
 - */ google / index.html*

Final things

- Idea Evaluation:

<https://tntech.campuslabs.com/eval-home/>

OR

<https://tntech.campuslabs.com/eval-home/direct/9663543>

- Left in the semester
 - Final Exam: **Tuesday, May 03, 3:30 – 5:30 PM**
- **Summer REU opportunity**