Software Defined Networking

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In this course, you will learn about software defined networking and how it is changing the way communications networks are managed, maintained, and secured.

Module 8.2: The (Near) Future of SDN

- ◎ Two Lessons
  - A Broader Vision of SDN
  - **Open Problems and Challenges**

- ◎ Quiz

Caveat...

- Too many open problems to discuss in a short lecture!

- Will simply recap highlights from some of the course interviews.

- This list also reflects my bias.

Open Problem Areas in SDN

- ◎ Northbound API and Applications
  - Wide-area networking, interdomain routing
  - Programming and debugging SDNs
- ◎ Control
  - Security, data-leak prevention
  - Combining big data with network management
  - Orchestration
- ◎ Data Plane
  - Moving beyond match/action

New Applications and Services

- We studied the use of SDN in various contexts and for various applications
- **SDN is just a tool. It does not specify the killer application.**
- **Still needed:** What is the compelling application that ISPs and operators want that needs SDN?

Wide-Area Networking

- Interdomain routing is brittle
  - Mechanisms are indirect
  - Policies only based on destination prefix
  - Can only influence direct neighbor
- We explored a way of introducing disruptive change at an IXP (SDX).
- Future: New protocols, business models, applications

Programming and Debugging

- Programming applications for SDNs is getting easier with new high-level languages, but it is still difficult.

- Coupling and composing heterogeneous control programs is not always possible.

- Debugging is very challenging.

- **Future:** Heterogeneous components and control, debugging.

Security

- Current Internet architecture has no accountability built in

- Security properties are extremely difficult to verify and enforce

- Data leaks are incredibly common

- **Future:** Can SDN control traffic flows according to formal security policy?

SDN Meets Big Data

- We have seen how SDN makes certain network management tasks easier.

- No existing technology takes advantage of the huge amount of data about the network
  - Regular traffic patterns, prediction, etc.

- **Needed:** Means of mining configuration, traffic demands, etc. to enable intelligent management.

Orchestration & Beyond Match/Action

- SDN is more than just match/action. It is logically centralized control of multiple network devices.

- We have seen several extensions
  - OF Chip, Middleboxes, Programmable substrates

- **Still needed:** Unifying control framework for orchestration.

Summary

- Many open problems in SDN in many areas
  - **Northbound API:** Programming, New applications
  - **Control plane:** Orchestration
  - **Data plane:** Moving beyond match/action

- With this course as a starting point, you are now equipped to solve the next set of SDN problems!