SDN: What We’ve Learned

Martin Casado
Outline

• SDN : a History
• SDN : a Definition
• SDN : What I’ve Learned
Networking in Theory
Networking in Practice

- Distributed Forwarding State
- Manual configuration State

Switch/Router

Packet In

- L2 table + VLAN
- L3 table
- ACL+ QoS
- VRF Context
- Port groups

Packet Out

A

B

C
The Problems ...

• Humans suck at state management

• No well defined APIs for datapath state

• No general distributed algorithms for all datapath state
The Problem Statement

"How to programmatically manage all of the datapath state in the network"
Issue #1: Poor Hardware Abstractions

- Fixed function
- Often expose implementation details
- Non-standard
Solution: Generalize Dataplane

OpenFlow

Switch/Router

Packet In

Flow table
Flow table
Flow table

Packet Out

A
B
C
Issue #2: Distributed Computing is Hard
Solution: Decouple Distribution Model from Topology

Software control

Forwarding Hardware

OpenFlow

Forwarding Hardware

OpenFlow

Forwarding Hardware

OpenFlow

Forwarding Hardware

OpenFlow
SDN: An Evolution

• Switch state, not flow state
• Multiple tables
• Generality vs. practicality
• Configuration vs forwarding
• Distributed, not centralized
• Hybrid switch integration
• ....
SDN: A Definition (of sorts ..)

- Programmatic interface to the forwarding plane
- Generalized forwarding model to allow evolution through software changes
- Decouple the distribution model of the dataplane and control plane
Things I’ve Learned ...
Networking really is an $N^2$ problem
Changing network abstractions can be more difficult than changing network architecture.
There probably won’t be an SDN “app store”
Some of SDN’s greatest advantages really do come from software
Ironically, networking can be networking’s worst enemy
SDN community still coming to terms with open source
SDN is a tool, not an outcome
SDN Reality Check

• Signs that we may be in an SDN Bubble
  – Everyone is doing it, has to have an “SDN Strategy”
  – Many claim to have been doing it since before the term was coined
  – No-one can agree what it means
  – Definitions getting so broad as to be meaningless

• But SDN is a tool, not an outcome
  – Getting excited about SDN is like being excited about a programming language
  – The right question: does SDN solve a problem I care about?
Historical Parallel: Cloud backlash

“It's stupidity. It's worse than stupidity: it's a marketing hype campaign... Somebody is saying this is inevitable – and whenever you hear somebody saying that, it's very likely to be a set of businesses campaigning to make it true.”
– Richard Stallman

“The interesting thing about cloud computing is that we've redefined cloud computing to include everything that we already do...Maybe I'm an idiot, but I have no idea what anyone is talking about. What is it? It's complete gibberish. It's insane. When is this idiocy going to stop?”
– Larry Ellison, Oracle

“A lot of people are jumping on the bandwagon of cloud, but I have not heard two people say the same thing about it”
– Andy Isherwood, HP
Parting Comments

• There’s something great going on ...
• Let’s try not to oversell it
• Let’s try not to let others dilute it

• And in the meantime, let’s build cool stuff
Thank You