Software-Defined Networking Workshop: Motivations and preliminary findings

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ON*Vector
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Motivation
SDN in simple terms...

...but operational networking is more than this

![Diagram showing SDN components](image-url)
Identified as the ‘SDN operational gap’
From conversations to position paper to workshop directive
Three Goals

1. Identify the ‘operational’ gap
   - architecture, tools and policies
2. Deploy and operate **securely** multi-layer, multi-domain SDN networks
   - Interwork with the current set of Internet technologies
3. Identify research, development and technologies needed to support new, innovative users and applications
What does that help achieve?

- Build an ecosystem of security-savvy, operational SDN experts with government and academic networks leading the way
- Rapid prototypes with open-source tools, engage the open-source or startup community
- Share experiences, build knowledge
- Engage operational knowledge with academia, open-source enthusiasts and industry at a larger scale
Workshop
Workshop Organizers

Sponsors
- Grant Miller
- Vince Dattoria
- Bryan Lyles

Organizers

Workshop PI
- Inder Monga

Organizing Committee
- Chip Elliott
- Ron Hutchins
- Roy
- Eric Boyd
- Bill Snow

Steering Committee
Vince Dattoria (DOE), Bryan Lyles (NSF), Robert Bonneau (AFRL), Matthew Goodman (DARPA), Kevin Thompson (NSF), Bob Walter (DARPA)

NSF PIs
Joe Evans and Sean Peisert

Lawrence Berkeley National Laboratory
Workshop Structure

Keynotes - https://www.ora.gov/sdnpr2013/

Breakout groups

• Brainstorming

• Three broad areas
  – Users and Applications (UAM)
  – Technology and Operational Deployment (TOD)
  – Security

Readouts and Discussion

Workshop Report (in progress)
It is about *running* networks (not just about network *research*)

Develop, deploy and (inter)operate a prototype multi-domain SDN network

http://www.computerhistory.org/internet_history/full_size_images/1969_4-node_map.gif

Future of intersite networking, LBL, 1986
Interoperate with existing IP networks as base capability

Build multiple, community supported Software-Defined eXchanges (SDX)

- Tackling exchanging IP data is table-stakes for a larger deployment

TreeHouse Setup Overview [7/24/2013]

Collaboration with Josh Bailey, Google

Nick Feamster, Georgia Tech
Network is important component of the larger application picture

Software-Defined Networking should transition to Software-Defined ‘Instrument’ (SDI)

• Include compute, storage along with network
• Break the networking black box
Standardize APIs and Application ‘plugin’ processes

Open the SDN app-store

• Leveraging applications within a community will benefit all
• Support both ‘open’ and ‘closed’ source
• Will require a set of standard APIs
Manageability goes hand-in-hand with Programmability

Community focus needed to bridge network management and service manageability gap

• no common debugging statistics?

• What are the ‘ping’ and ‘traceroute’ equivalents for SDN?
  • Simple tools to debug connectivity, and when it does not work.

• Need a northbound API for debugging, not just for applications
  • Query network state
  • Interoperable across vendors and controllers
Community is an important element of successful transformation

Community best practices for building SDN networks
  • Architecture for the control plane, sizing the control plane etc.

Network Bootstrapping

Education (Unlearning and learning, obsolescence to relevance)
Network virtualization is the killer app, but how does it work?

Managing underlays and overlays – network virtualization
- Techniques not well understood, research topic

Profiles for various applications, so vendors/software developers can build to these profiles (supports the app-store idea)
- Don’t know how to make that happen, but a strong desire to have since SDN means so many things
Security, still time to bake it in and do more!

Still a nascent topic, lots of definitions and discussions

Uses of SDN for Security

- Secure updates for applications
- Flexible intrusion detection
- Flexible Reaction/Provisioning

Making SDN secure

- Trust Model
- Correlation of complex network issues
- Policies (AAA, resource management, admission control etc.)
- Consistency model (valid vs invalid network state)
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My inspiration and recommendation:
Draw upon principles of ‘Maker Movement’ when thinking about SDN
– this could be ‘our’ DIY project!

• If it can be imagined, it can be made.
• The first step in making a thing, even a non-physical thing, is visualizing it.
• A most effective step in refining/developing a thing is collaborating with others on it.
• Begin with the end in mind.
• Making things always combines form with function.
• The art of making should be appreciated and celebrated.

Credit to wikipedia for principles