Challenges of supporting SDN in production

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OESS / FSFW / AL2S

- What we have in production today
- OESS - Open Exchange Software Stack
  - Point-to-Point / Multi-Point VLAN provisioning Service 100% openflow
- FSFW - FlowSpace Firewall
  - OpenFlow Network Slicer - Network hypervisor allowing multiple controllers to talk to a single set of switches without letting any one controller effect a change that will affect another.

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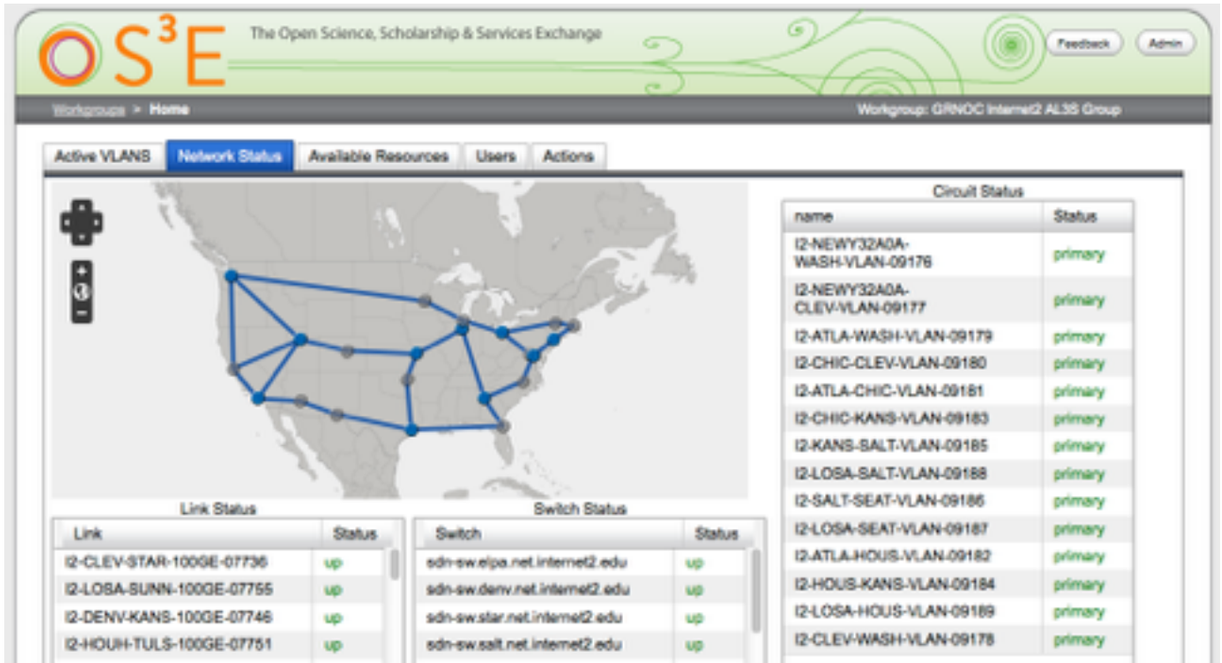
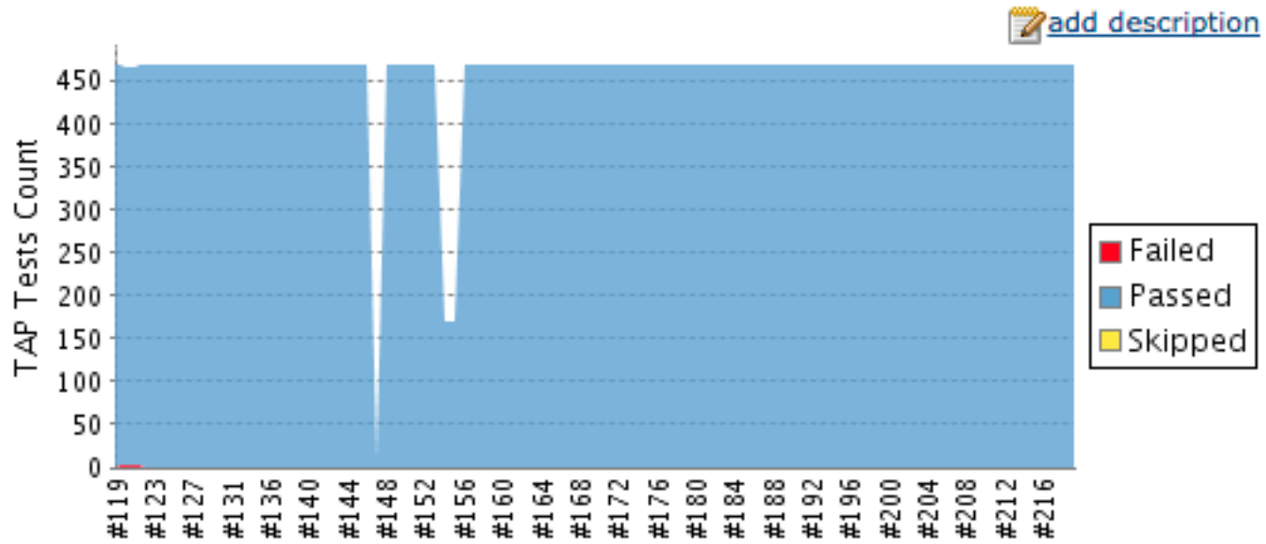
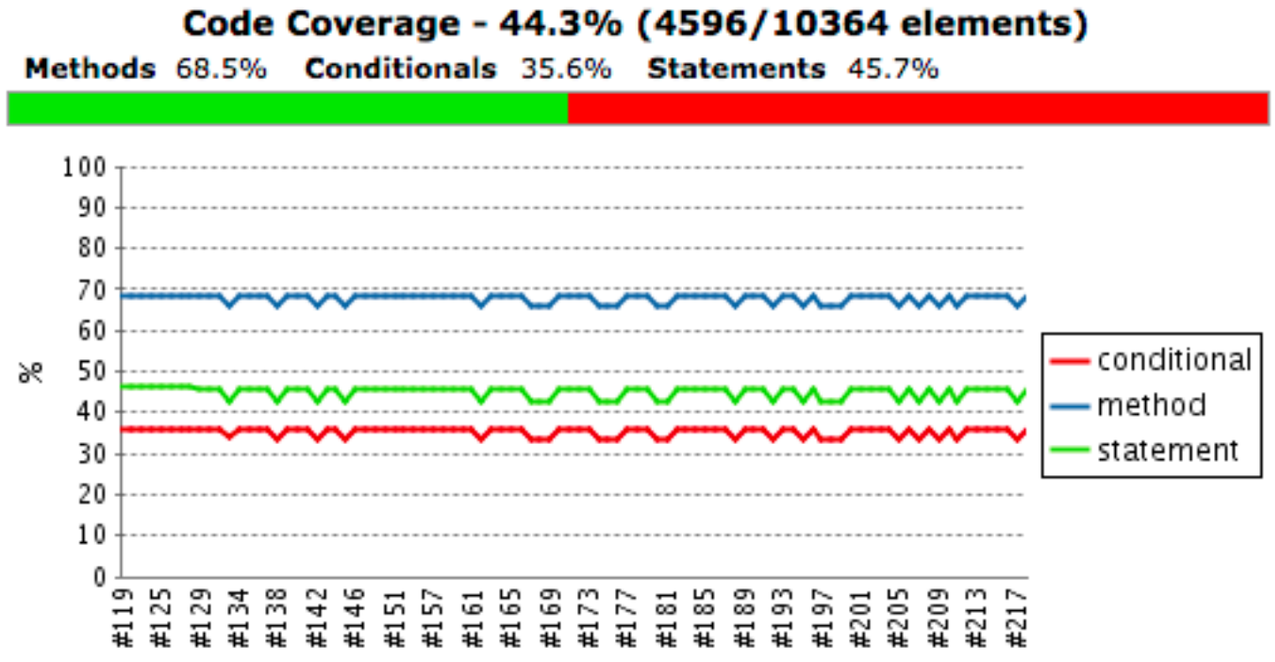


Writing custom controllers

- You are now writing Routing Engine Code
  - Automated Unit testing
  - Automated Systems testing
  - Automated Build Process
  - Scale testing
- Code Coverage Analysis
- Strict release workflow
- Code Review (not by the developers)





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Running custom controllers

- Operational workflow changes
  - software developers, systems engineers, and network engineers need to work closely together to troubleshoot issues
  - Determining the source of the problem can be difficult:
    - Controller / Application
    - Device Hardware
    - Device Software
- Postmortems after incidents
  - Bugs/Problems are going to happen
  - Review changes in policies to reduce down time
  - Add policies to prevent similar issues from occurring

Running custom controllers

- Network Operator is now the System Integrator
  - Easy to underestimate the amount of time to test vendor code changes
  - People (Software Developers) who are not used to dealing with devices must learn to work with them
- Build Once and deploy is un-realistic
  - every vendor update requires re-testing agains the current released version
  - changing any part of the stack requires re-testing the entire stack
- Need additional troubleshooting tools
  - TCPDump of the control channel (your vendors are going to expect it)
  - additional vendor commands to see flows as programmed in hardware

Process Improvements

- Every time there is an issue ask these questions
  - What was the issue
  - What was affected
  - How did it get past testing
  - How did the issue get introduced
  - What could we do to prevent this in future
- Implement any changes that would have prevented it in the future
  - Eg. Instead of adding unit tests for a missed feature, add policy for unit tests for ALL new features

Troubleshooting Outages

- New untrusted technology always gets the blame (rightfully so)
  - controllers need to provide a list of flows they expect on the system
  - training of Network Engineers / System Engineers / Software Engineers for troubleshooting is very important
    - Must have experience running the entire stack in test before in production
      - provides experience troubleshooting issues
      - enhances troubleshooting capabilities
      - will drive future development to aid operations
    - Its not always the new technology!
      - it is possible to spend lots of time troubleshooting an issue that is thought to be in the SDN stack but the problem is in a traditional network

Troubleshooting Outages

- Roles get blurred
  - Software Engineers need access to run commands on devices to see what the device is doing
  - Network Engineers need access to logs from the controller to determine what it is attempting to do
  - Improved communications between groups is needed
    - must speak the same language
    - must listen to each other
  - Over time these roles might become more converged
- Need more troubleshooting tools from vendors (not hidden commands)

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Controller/App Vendors

- Lots of people are writing controllers/apps… but
  - Where is the long term maintenance release
  - Where/How do you get support
  - Where is the documentation?
  - not many are thinking about operations (packaging, logging, troubleshooting)
  - Mininet != a sufficient testing platform for production controllers
    - does not account for subtle differences between vendors implementations
    - DPIDs don’t look the same
    - Port IDs are different
- Where is the RedHat/CentOS/Ubuntu of controllers

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Controller/App Vendor

- Added change management process to control risk
  - Testing
    - Mininet + device testing
      - Testing in a stage environment with an almost exact copy of the network
      - Testing takes 2-3 weeks to complete
  - Time to deploy a new controller is slow
- Constrains nimbleness (us and vendor)
- Constrains pace of innovation (us and vendor)
- This is not as good as we hoped with the initial vision of OpenFlow

Complexity and Vagueness

- OpenFlow is not the universal language (or at least not treated that way)
  - In many cases the Spec if vague leaving it up to vendors on how to implement
  - People are adding layers of abstraction to manage this
  - Making the controller the commonality instead of the protocol
- We are not seeing OF 1.3 fix this
  - Vendors are not implementing (at least not quickly)
  - Still missing many of the required features
  - not even thinking about optional features

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Security with SDN

- Proper software / systems architecture will protect against many attack possibilities
  - Separation of privileges
    - Eg. public web-service should be different process than what talks OpenFlow
- Control plane inaccessible from public internet
- It took years to develop trust with the core routing today
  - what is the right way to gain the same assurance for SDN
- FSFW - resource protection difficult to perform
  - Valid but different messages can trip up vendor hardware
  - volumetric attacks are interesting and difficult to protect against

Security with SDN

- Plenty of opportunities to apply SDN towards Security problems
  - SciPass - OpenFlow load balancer and ScienceDMZ
  - Remote Triggered black hole
  - Dynamic Honeypot