



*Owen DeLong*

# Switches and Routers and Stickers Oh My!

A brief tour of how we automated the configuration and documentation of the SCaLE Network Infrastructure

# Introduction

## About the Author /Presenter:

- ❖ Have been officially leading the tech team for 4 years.
- ❖ Unofficially since SCaLE 15x, so this is my 7th SCaLE leading the Tech team.
- ❖ First got involved with SCaLE as a speaker (SCaLE 8x) and been at every SCaLE since.
- ❖ Usual \$DAYJOB = Network Architect
- ❖ Currently between jobs, so see me after this if you are looking for a senior network architect.





# Introduction

About the team:

- ❖ Usually 20+ volunteers involved in the network each year
- ❖ This is a picture of most of the team from SCaLE 19x (Hilton, 2 years ago)
- ❖ Yes, that's Vint Cerf (Keynote Speaker that year) in the front left. No, Ilan doesn't work on the network team.
- ❖ Most of the people in this picture have been active for 3+ years.
- ❖ It's a great team and they do a fantastic and difficult job — They make me look good.
- ❖ If you're enjoying the show network, please thank these guys when you see them.





## What will this talk cover?

- ❖ The overall structure of the network
- ❖ The automation tools we use to run the core network infrastructure (See Rob Hernandez' talk from SCaLE 20x for information about the WiFi tools)
- ❖ Stickers? What do stickers have to do with this?
- ❖ Q&A
- ❖ Optional: A brief walking tour of some of the network infrastructure (after the talk and not in the room — Limit 15 people)



“The reason we say that humans have free will is because we can't predict what they will do. Only time(whatever that may be) will tell. The increase of disorder or entropy is what distinguishes the past from the future, giving a direction to time.

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–*Stephen Hawking — A Brief History of Time*

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# A Brief History of the SCaLE Network

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- ❖ From the beginning through the second year at Pasadena Convention Center, SCaLE network consisted of an assortment of HP ProCurve switches and Netgear WAPs and was arranged as a single flat network infrastructure segmented into VLANs, but every VLAN was present on every switch with no failure isolation.
- ❖ Third year at PCC we migrated to Juniper EX4200-48P switches, added 3 Juniper SRX-300 routers, and put Layer 3 separation in between the buildings with a 3-tiered hierarchy (Internet/Border Router->Conference/Expo Routers->Switches).
- ❖ This year, we are still using many of the Netgear WAPs but also starting to roll out newer WiFi-6 capable Belkin/Linksys WAPs. Still using OpenWRT to run the WAPs.



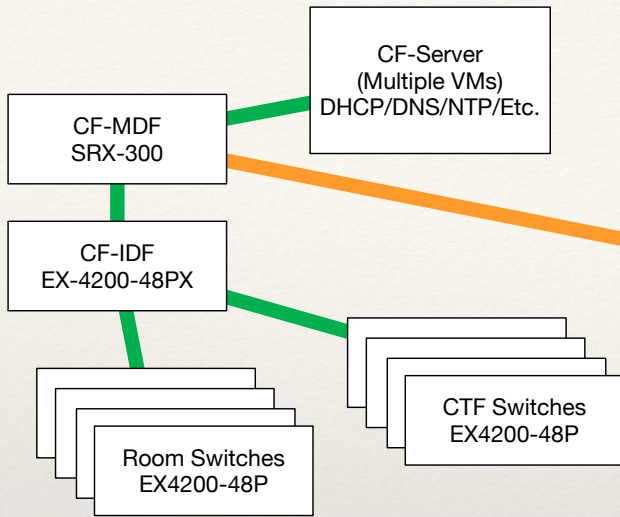
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# Structure of the Current Network

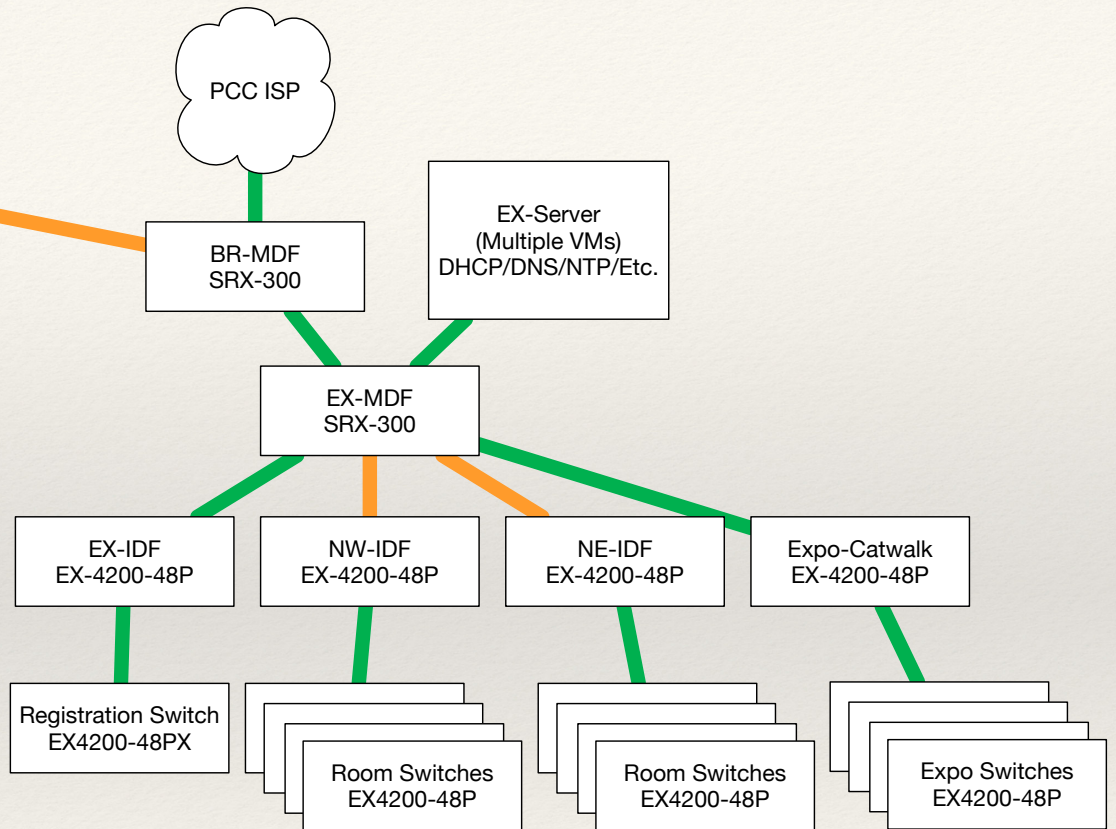
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- ❖ 3 Juniper Routers (SRX-300)
  - ❖ 1 Core/Border Router
  - ❖ 1 Edge Router for Conference Building
  - ❖ 1 Edge Router for Expo Building
- ❖ 25 Juniper (Mix of EX-4200-48P and EX4200-48PX) switches
  - ❖ 1 Per meeting/presentation room
  - ❖ Grid of switches deployed in Exhibit Hall (number varies year to year by hall layout and hall layout isn't known in time to adapt this talk)
  - ❖ 1 for the registration area
  - ❖ 1 in each of the Intermediate Distribution Frames (wiring closets) (5 total)
- ❖ 2 physical servers
  - ❖ VMs for DHCP, DNS, RAdvD, etc.)
- ❖ 120± Wired Access Points (no details in this talk)
- ❖ Multimode Fiber between MDF and some 3 IDF's (Conference, Northwest Expo, and Northeast Expo)
- ❖ More than 3 miles of ethernet cable deployed each year.

# Conference Building



# Expo Building





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# Meaningless Statistics About the Automation

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- ❖ (as of December, 2023)
- ❖ 695 Lines of configuration input data in Tab Delimited Files
- ❖ 39,213 Lines of switch configuration output generated from those
- ❖ 10,137 lines of PostScript output generated from those (Stickers)
- ❖ 2,997 lines of PERL and BASH code and 51 lines of README.md
- ❖ Code and Input files are publicly visible in public GitHub repo ([socallinuxexpo/scale-network](https://github.com/socallinuxexpo/scale-network)).

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# Why Automation?

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❖ Two primary reasons:

❖ 1:

❖ 695 Lines of configuration input data in Tab Delimited Files

vs:

❖ 39,213 Lines of switch configuration output generated from those

❖ 10,137 lines of PostScript output generated from those (Stickers)

❖ 2:

❖ We have a lot more team members that understand Tab Delimited Files than understand JunOS.



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# Ideals and Tradeoffs

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- ❖ The code is written in PERL — PERL was still popular when it started and I find Python annoying
  - ❖ The original code started under fire during SCaLE 15x
  - ❖ It has continued to evolve and improve since then.
  - ❖ Improvements this year:
    - ❖ Better trunk color coding on stickers
    - ❖ A unified configuration loading utility for switches
      - ❖ Now based on Expect.pm instead of spray and pray
      - ❖ Still room for improvement in error checking and exception handling
      - ❖ Handles load via SSH over network, SSH to management port, or Serial Console
  - ❖ Better PoE handling
  - ❖ Improved documentation



# Mass Loading Switches

Every year, we load fresh configurations onto the switches.

Mostly we are able to do this using the management ethernet port in the days just before the show.

Sometimes we have to load a minimal config via serial to make that possible.

We also have the ability to deploy updated generated configurations to the switches over the network during the show.

Whenever possible, we avoid manual configuration of the switches and any manual configs are lost at the next automated load.

Photo credit: Rob Hernandez — SCaLE 19x, Owen DeLong left and Steve Bibayoff right mass-loading switch configurations.





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# Let's Walk through Some of the Configs

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(And some of the resulting Output)

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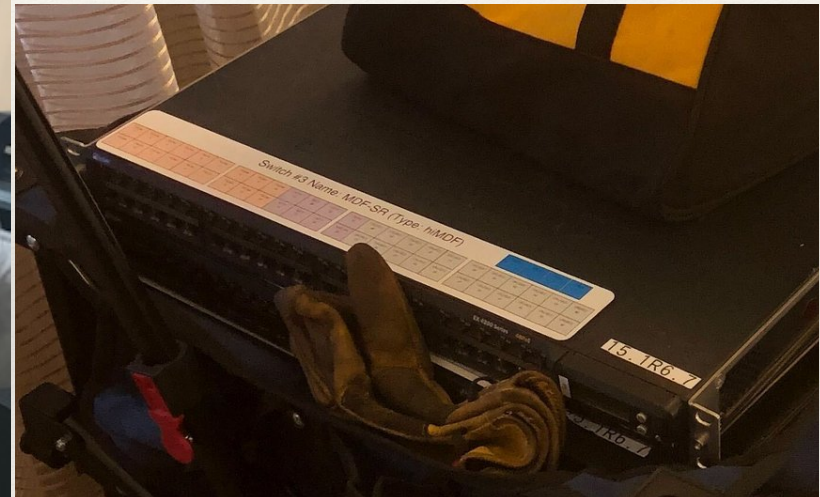
# Let's not Walk through the Code

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- ❖ It's kind of ugly and grew very organically, mostly under fire.
- ❖ It's not super interesting, TBH.
- ❖ Stickers are more fun!! (sort of)
- ❖ If you really want to look under the hood, it's visible in the GitHub Repo:  
`socalllinuxexpo / scale-network`



# Stickers? Why? What?



# RELIABLE Switch Port Identification

Switch #40 Name: Rm105 (Type: cfRoom)

|         |          |          |          |         |          |          |          |          |          |          |          |          |          |          |              |           |           |           |           |              |              |              |              |
|---------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|
| TRUNK 0 | UNUSED 2 | UNUSED 4 | UNUSED 5 | TRUNK 8 | TRUNK 10 | TRUNK 12 | TRUNK 14 | TRUNK 15 | vSigs 18 | vSigs 20 | vFLAN 22 | vFLAN 24 | vFLAN 25 | vSigs 28 | vCTP 30      | vSched 32 | vSched 34 | vSched 36 | vSched 38 | SCALE-FAB 40 | SCALE-FAB 42 | SCALE-FAB 44 | SCALE-FAB 46 |
| TRUNK 1 | UNUSED 3 | UNUSED 6 | UNUSED 7 | TRUNK 9 | TRUNK 11 | TRUNK 13 | TRUNK 16 | TRUNK 17 | vSigs 19 | vSigs 21 | vFLAN 23 | vFLAN 26 | vFLAN 27 | vSigs 29 | RAM_PROCS 31 | vSched 33 | vSched 35 | vSched 37 | vSched 39 | SCALE-FAB 41 | SCALE-FAB 43 | SCALE-FAB 45 | SCALE-FAB 47 |

Switch #39 Name: ExpoB4 (Type: Booth)

|         |          |          |          |         |          |          |          |          |           |           |           |             |             |             |             |             |             |             |             |           |           |           |           |
|---------|----------|----------|----------|---------|----------|----------|----------|----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------|-----------|-----------|-----------|
| TRUNK 0 | UNUSED 2 | UNUSED 4 | UNUSED 5 | TRUNK 8 | TRUNK 10 | TRUNK 12 | TRUNK 14 | TRUNK 15 | UNUSED 18 | UNUSED 20 | UNUSED 22 | Port_244 24 | Port_245 25 | Port_246 26 | Port_249 29 | Port_250 30 | Port_254 34 | Port_255 35 | Port_256 36 | UNUSED 40 | UNUSED 42 | UNUSED 44 | UNUSED 46 |
| TRUNK 1 | UNUSED 3 | UNUSED 6 | UNUSED 7 | TRUNK 9 | TRUNK 11 | TRUNK 13 | TRUNK 16 | TRUNK 17 | UNUSED 19 | UNUSED 21 | UNUSED 23 | Port_248 28 | Port_247 27 | Port_249 29 | Port_251 31 | Port_253 33 | Port_253 35 | Port_257 37 | Port_259 39 | UNUSED 41 | UNUSED 43 | UNUSED 45 | UNUSED 47 |

Switch #4 Name: BallroomC (Type: exRoom)

|         |          |          |          |         |          |          |          |          |          |          |          |          |          |          |           |           |           |           |           |           |           |           |           |
|---------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| TRUNK 0 | UNUSED 2 | UNUSED 4 | UNUSED 5 | TRUNK 8 | TRUNK 10 | TRUNK 12 | TRUNK 14 | TRUNK 15 | vSigs 18 | vSigs 20 | vFLAN 22 | vFLAN 24 | vFLAN 25 | vSigs 28 | UNUSED 30 | UNUSED 32 | UNUSED 34 | UNUSED 36 | UNUSED 38 | UNUSED 40 | UNUSED 42 | UNUSED 44 | UNUSED 46 |
| TRUNK 1 | UNUSED 3 | UNUSED 6 | UNUSED 7 | TRUNK 9 | TRUNK 11 | TRUNK 13 | TRUNK 16 | TRUNK 17 | vSigs 19 | vSigs 21 | vFLAN 23 | vFLAN 26 | vFLAN 27 | vSigs 29 | UNUSED 31 | UNUSED 33 | UNUSED 35 | UNUSED 37 | UNUSED 39 | UNUSED 41 | UNUSED 43 | UNUSED 45 | UNUSED 47 |

Switch #3 Name: NE-IDF (Type: exIDF)

|         |         |         |         |         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |           |           |           |           |
|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| TRUNK 0 | TRUNK 2 | TRUNK 4 | TRUNK 5 | TRUNK 8 | TRUNK 10 | TRUNK 12 | TRUNK 14 | TRUNK 15 | TRUNK 16 | TRUNK 18 | TRUNK 20 | TRUNK 24 | TRUNK 26 | TRUNK 28 | TRUNK 30 | TRUNK 32 | TRUNK 34 | vSigs 36 | vSigs 38 | UNUSED 40 | UNUSED 42 | UNUSED 44 | UNUSED 46 |
| TRUNK 1 | TRUNK 3 | TRUNK 6 | TRUNK 7 | TRUNK 9 | TRUNK 11 | TRUNK 13 | TRUNK 17 | TRUNK 19 | TRUNK 21 | TRUNK 23 | TRUNK 25 | TRUNK 27 | TRUNK 29 | TRUNK 31 | TRUNK 33 | TRUNK 35 | TRUNK 37 | vSigs 39 | vSigs 41 | UNUSED 43 | UNUSED 45 | UNUSED 47 | UNUSED 49 |

Switch #32 Name: RegDesk (Type: registration)

|         |          |          |          |         |          |          |          |          |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |
|---------|----------|----------|----------|---------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| TRUNK 0 | UNUSED 2 | UNUSED 4 | UNUSED 5 | TRUNK 8 | TRUNK 10 | TRUNK 12 | TRUNK 14 | TRUNK 15 | UNUSED 18 | vSched 20 | vSched 22 | vSched 24 | vSched 25 | vSched 28 | vSched 30 | vSched 32 | vSched 34 | vSched 36 | vSched 38 | UNUSED 40 | UNUSED 42 | UNUSED 44 | UNUSED 46 |
| TRUNK 1 | UNUSED 3 | UNUSED 6 | UNUSED 7 | TRUNK 9 | TRUNK 11 | TRUNK 13 | TRUNK 16 | TRUNK 17 | UNUSED 19 | vSched 21 | vSched 23 | vSched 26 | vSched 27 | vSched 29 | vSched 31 | vSched 33 | vSched 35 | vSched 37 | vSched 39 | UNUSED 41 | UNUSED 43 | UNUSED 45 | UNUSED 47 |

Switch #31 Name: Rm107 (Type: cfRoom)

|         |          |          |          |         |          |          |          |          |          |          |          |          |          |          |              |           |           |           |           |              |              |              |              |
|---------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|
| TRUNK 0 | UNUSED 2 | UNUSED 4 | UNUSED 5 | TRUNK 8 | TRUNK 10 | TRUNK 12 | TRUNK 14 | TRUNK 15 | vSigs 18 | vSigs 20 | vFLAN 22 | vFLAN 24 | vFLAN 25 | vSigs 28 | vCTP 30      | vSched 32 | vSched 34 | vSched 36 | vSched 38 | SCALE-FAB 40 | SCALE-FAB 42 | SCALE-FAB 44 | SCALE-FAB 46 |
| TRUNK 1 | UNUSED 3 | UNUSED 6 | UNUSED 7 | TRUNK 9 | TRUNK 11 | TRUNK 13 | TRUNK 16 | TRUNK 17 | vSigs 19 | vSigs 21 | vFLAN 23 | vFLAN 26 | vFLAN 27 | vSigs 29 | RAM_PROCS 31 | vSched 33 | vSched 35 | vSched 37 | vSched 39 | SCALE-FAB 41 | SCALE-FAB 43 | SCALE-FAB 45 | SCALE-FAB 47 |



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# Stickers

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- ❖ 1:1 physical size correspondence to ports on front of switch
- ❖ Color Coded for Port Type (Trunk, Vendor, VLAN, WAP, etc.)
- ❖ Seemingly illegible Text identifies more detailed port information (e.g. Which VLAN, etc.) (you can actually read it on the real thing, though it is tiny text)
- ❖ Printed vertical, 10 labels wide on 24" Adhesive Vinyl Roll Stock (OraCAL 631) — ~16" of roll stock per cut sheet, 6 cut sheets. About 2 hours to print.

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*Any Burning Questions?*

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