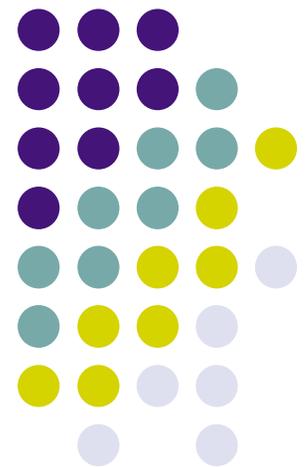
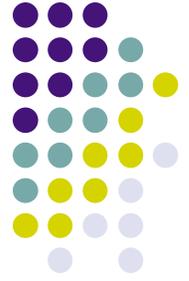


# Coherent Naming Schemes: A Case Study

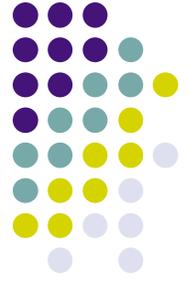
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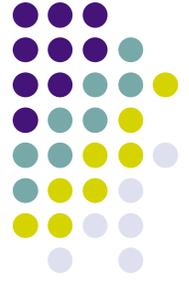
# Overview

- In early 2004, the Tufts NOC recognized the need for a standardized network equipment naming scheme to support:
  - Routers as both entities, and interfaces.
  - Switches
  - Wireless APs
  - Security devices (firewalls, gateways, etc.)
  - Future needs.



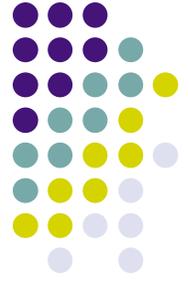
# The Problem

- 3 campuses, 15 routers, 400+ switches, and many different existing name formats.
- Previously there was no standard for device naming.
- Names were chosen in an attempt to convey useful information, but a lack of standards had deleterious effects on productivity, complicating troubleshooting, equipment deployment, documentation, and automation efforts.



# What didn't work: (part 1)

- Inconsistent nomenclature for buildings
  - Postal addresses mixed with building common names and University building ID numbers.
  - Location information by floor or nearby departments rather than room number.
- Inconsistent data in name
  - TAB-DC-15K-A1
  - TAB-BI
  - Research-2-FI8K
- Arbitrary interface names
  - sack-rtr-5
  - tufts-pri-border



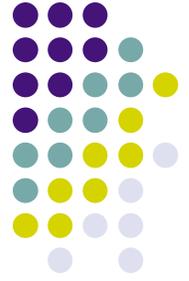
## What didn't work: (part 2)

- Relying on institutional memory
  - “Everyone knows that the switch for Cousens Gym is actually in Halligan Hall in that room that doesn't have a number on the door.”
- Names based on device hardware
  - Sackler-7507
- The myth of “naming security”
  - Obscuring the names of network devices in the name of security isn't as important as being able to do effective troubleshooting and documentation.
  - Sufficiently dedicated attacker etc. etc.



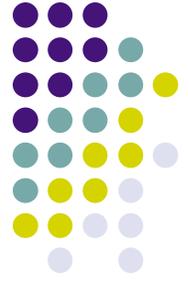
## What we needed:

- Comprehensible – Human readable with immediate meaning.
- Extensible – Must accommodate future device types.
- Derivable – Formulaic. Completely predictable names given a set of parameters.
- Self-Documenting – Names defined by role. i.e. Traceroute output should make sense.
- Unique – One name => One Device.



# Some Counterexamples

- Using TelCo codes to name locations
  - cmbrmaks, somrmats (??)
  - May not have the resolution or information you need, and **will** become inconsistent with whoever you patterned yourself on.
- Compression artifacts
  - Everyone abbreviates differently, names become unpredictable and underivable.
- Avoid using equipment types in names
  - Equipment is replaced or upgraded, should the name also need to be replaced?
  - The name should reflect a location and role, not a specific piece of hardware. This keeps name churn to a minimum.



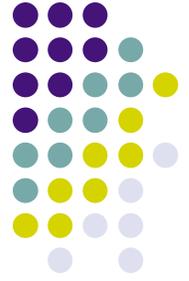
# Methodology

- Use authoritative naming sources
  - Space planning dept. for building names.
  - Building and Grounds Dept. for actual room numbers.
- Formal grammar
  - Enforce a strict structure to names.
  - Human parsing now, but computer parsing in the near future.
- List assumptions about the network
  - Combined L2/L3 core with MAN/WAN links to other campuses
  - Three basic kinds of links
  - What are you optimizing for?



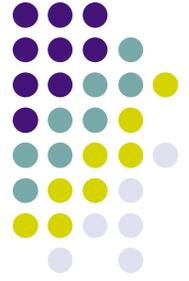
## Methodology (part 2)

- Informative is more important than brief
  - Want brief? Use a CNAME.
  - People will type in long names if the names:
    - Make sense.
    - Can be derived correctly on the first try.
- DNS is not for asset management
  - Never use vendor type, make, or model.



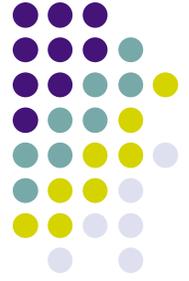
# The Specifics

- Two syntaxes: multi-homed devices (routers) and single-homed devices (switches, APs, etc.)
- Routers
  - Three types of links
    - b = border (i.e. administrative handoff)
    - x = transit (i.e. interim hop, usually no clients)
    - t = terminus (i.e. last hop, usually a client network or loopback)
  - Router names: (role)-priority
    - E.g.: sackler-rtr-pri, grafton-rtr-pri, border-sec
  - Why pri and sec? Why not 01 and 02?
    - Devices are actually primary and secondary.



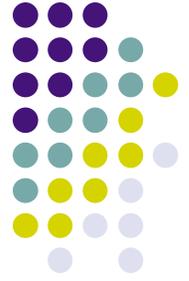
## The Specifics (part 2)

- Name L3 links from origin point, forward
  - E.g. the L3 interface of the Sackler router connecting to the Grafton router is:
    - sackler-rtr-pri-x-grafton-rtr-pri
  - Likewise the L3 interface of the Grafton router at the other end of the same link is:
    - grafton-rtr-pri-x-sackler-rtr-pri
  - i/f Vlan80 (a leaf subnet) on the Anderson hub router:
    - anderson-rtr-pri-t-vlan80
  - Handoff to the standalone EECS dept. network, from the Anderson router:
    - anderson-rtr-pri-b-eeecs



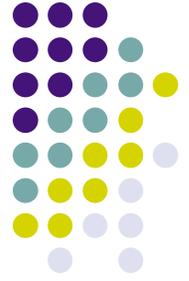
# The Specifics (part 3)

- Switches and other single-homed devices (i.e. WAPs)
  - Single “interface”, simpler name
  - <building name>-rm<room number>-<type><instance>
  - The first switch in room 124 of the 4 Colby St. building is:
    - 4colby-st-rm124-unit0
  - The first WAP in the ceiling of room 168 in Paige Hall is:
    - paige-hl-rmc168-ap0



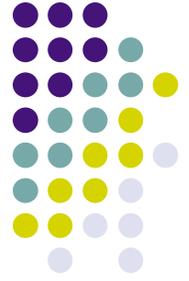
# Implementation

- Several days of planning, and pre-generating the names beforehand
- No concessions were made at runtime
  - If it's hard to use, we had to know immediately.
- Daytime changes
  - In-group coordination only, in order to change over monitoring systems where necessary.
- Backward compatibility
  - CNAMEs were put in place for names already in use by “finger macros”.



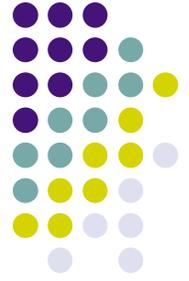
# The Results: Success!

- A consistent, derivable, and self-documenting naming scheme.
- Faster network debugging times.
- Faster security response times.
- Faster turnaround on addition of new devices.
- People **did** adjust quickly and didn't mind typing in longer names.
  - Typing a longer name is still faster than needing to look it up in an outside reference.



# Lessons Learned

- You'll always have to make assumptions about network topology
  - E.g. more meaningful to name a point-to-point as its endpoints than as "t" interface
  - "universal" is hard, and rarely as useful as it sounds (q.v. X.500)
- Name everything first
  - Pre-deriving all current names was the best test we could really do of the naming scheme's flexibility



# Acknowledgements

- From the NOC Group at tufts.edu
  - Marc Jimenez, Robin Garner, Bob Moran
  - Joel Gridley, Linda Van Horn
  - Peter Radcliffe
- Others
  - Nicolai Plum, Cat Okita, Aaron Block