A Power Steering Portal

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The Status Quo

• Network operators engineer networks with sufficient capacity to support peak loads
  • Redundant capacity to be used in case of failure
• Power consumption is constant
• Most networks exhibit predictable utilization patterns
Money Flying Out The Window
Three Case Studies: Potential Savings

• Tier 1 European ISP
  • 106 nodes, 1144 links
  • Savings of 195KW out of an initial 265KW
  • 73.5% of PFE & link power

• Another European Tier 1 ISP
  • 192 nodes, 2691 links
  • Savings of 379KW out of an initial 491KW
  • 77.2% of PFE & link power

• An access network in a US Tier 1 ISP
  • 85 nodes, 1500 links
  • Savings of 58KW out of 207KW
  • 28.0% of PFE & link power
Goal: Power Savings
The Solution

• Consolidate traffic to facilitate power savings
• Power down unused network components when they are not needed
• Component granularity maximizes savings
Component Granularity

• Depends on your router architecture
• A component can be:
  • The entire router
  • A chassis or a Field Replaceable Unit (FRU)
    • Power supply, fan tray, switching interface board, line card, pluggable line card optics
  • An ASIC on an FRU
Which Components Consume Power

• Big Consumers
  • Line card ASICs (@250W)
  • Switching interface board ASICs (@150W)

• Lesser Consumers
  • Route processors (@100W)
  • Line card optics (@20)

❖ Your results can vary depending on router architecture
❖ HVAC and fans also consume significant amounts of power
New Feature: Component Power Status

- Network elements contain components
- Each component has a power status
  - Up, Down
- The power status of each component can be changed independently
  - An operator can power down one line card without powering down another
  - An operator can power down a port without powering down another
- Containment matters
  - If an operator powers down a line card, they also power down every port that the line card contains
Operational Impact

• A typical network has thousands of network components
• Managing their power status can be labor intensive and error prone
• Some network events will require immediate power status actions
  • A backhoe cuts a link, driving the network into congestion. The best way to eliminate congestion is to power up a line card that is currently powered down
Introducing the Power Steering Portal

• Provides network visualization (maps)
  • Operational and utilization views
  • Power consumption and power efficiency views

• Displays weekly trends
  • Utilization, power consumption and power efficiency

• Proposes power savings policy
  • Which components can be powered up and down
  • When can they be powered up and down

• Deploys power savings policy
Power Steering Portal Status

• Under development, science project status
• Soliciting co-innovators
  • Need input from those with operational experience
  • Need operators to test drive the code
The Ask

• Interested in contributing to the project?
• Contact rbonica@juniper.net or tli@juniper.net
Security Considerations

• Like any network management function, the Power Management Portal must operate in a secure environment

• Like any network management protocol, the protocols that connect the Power Management Portal to its network elements must be secure

• If the Power Management Portal or its communications are compromised, an attacker can power down the network.
Why Only Two Power States

• Currently, the only the widely supported power states are Up and Down
• There is no consensus regarding what a third state should be
  • Standby? Low-speed?
• Implementation of a third power state may not be cost effective
  • Can components transition from Down to Up quickly enough, without a standby mode?
  • Will the low-speed mode save enough power to make it cost effective?
• Implementation and deployment of networking equipment that supports three modes will take years
Questions?