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vCRIB: Virtualized Rule Management in the Cloud

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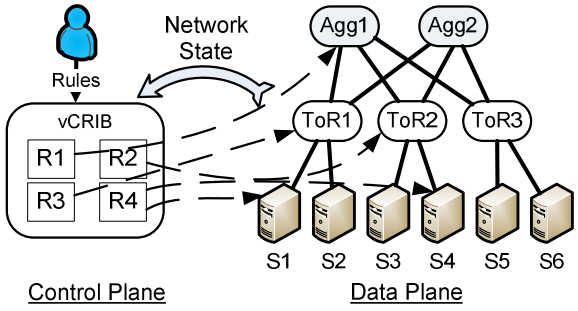
Motivation: Cloud rule management is hard

- Many fine-grained rules for various management tasks (e.g., access control, customized routing)
- Need to manage rules at both switches and hosts

Position	Positive	Negative
Hypervisor	Complex rules Knowledge of VMs	CPU usage → decrease revenue
Switch	Optimized HW Knowledge of network	Limited TCAM size

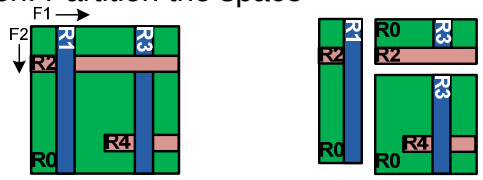


Our solution: a virtualized rule information base for the cloud

Overlapping Rules

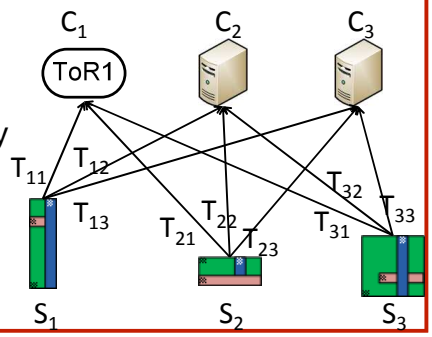
S1: SrcIP=10.0.0.0/16, DstIP=10.0.0.0/16, Rate limit
S2: SrcIP=10.0.0.0/8, DstIP=10.0.0.0/8, Deny

- Loading/removal dependency of overlapping rules
- Solution: Partition the space



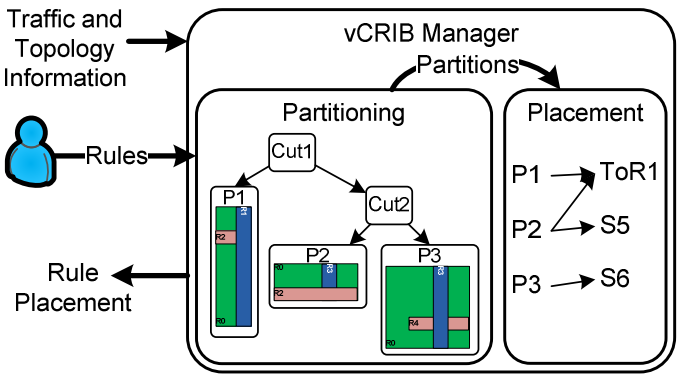
Resource Assignment

- Constraints
  - CPU
  - Memory
  - Functionality
- Goal
  - Traffic
  - Cost



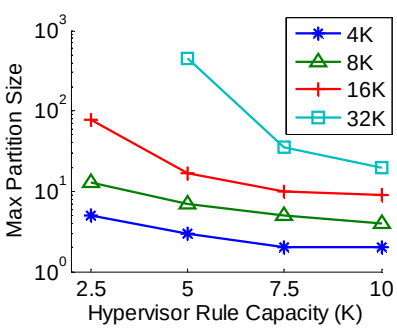
Partition and Placement

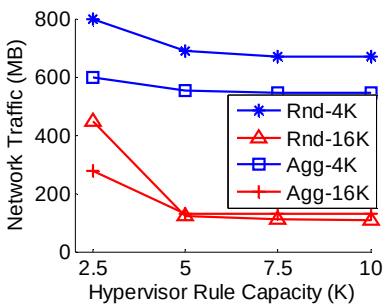
- Handling overlapping rules with partitions
  - BSP Tree:
    - Recursively cut the space and create the tree
    - Stop when the number of rules reach the total network memory
    - Trade-off between balance and split rules for the position of cut: $F=\alpha\times\max_p S(p) + (1-\alpha)\times N$.
- Placing partitions with resource constraints
  - DFS Branch and Bound: Place the largest unassigned partition on the position with minimum traffic overhead



Evaluation Results

- VCRIB is efficient in placing rules using provided resources
  - Larger network capacity → Smaller partitions
  - Smaller partitions → more flexibility in placement → less traffic overhead
  - Aggregatable source IP addresses for VMs on each hypervisor (Agg setting) → less traffic overhead





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