Arosa: testbed resource allocation using late-binding and constraints

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PROBLEM STATEMENT
- Current network testbeds early-bind resources to requests, and return explicit commitments to the clients
- Problem: poor utilization of expensive infrastructure; clients are exposed to failures between allocation and use
- Solution: represent commitments as constraints and late-bind resources

CURRENT SOLUTION: EARLY COMMITMENT

CREATE REQUESTS

REQUEST1
num(Hosts) = 4
REQUEST2
num(Hosts) = 3

CREATE TICKETS
TICKET1
num(Hosts) = 4
TICKET2
num(Hosts) = 3

BIND RESOURCES
LEASE1
S1
H1 H2 H3 H4
TICKET1
S1
H5 H6 H7 H8
TICKET2
S2
H9 H10 H11 H12

DESIGN OPTIONS
- Incremental assignment of each new request
- Complete reassignment of all unbound tickets
- Arosa: a middle ground
  - Internally maintains a concrete assignment
  - Reconsiders only some unbound tickets

RESULTS

OUR APPROACH: LATE-BINDING
- Describe requests and reservations (tickets) as constraints
- Bind concrete resources to tickets late

CONCLUSION
- Provides flexibility via resource reallocation
- Achieves higher testbed resource utilization
- Can mask physical network failures
- Supports multi-stage resource negotiation

Resource negotiation process

Arosa achieves higher utilization

Subsequent reassignment hides many node failures