

Robust, Secure, and Efficient Routing

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<http://www.ece.ucdavis.edu/rubinet/rose.html>

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Project Goals

- Improve fault-resilience and stability of Internet routing.
- Achieve finer-grained traffic engineering while maintaining simplicity and elegance of legacy IP forwarding.

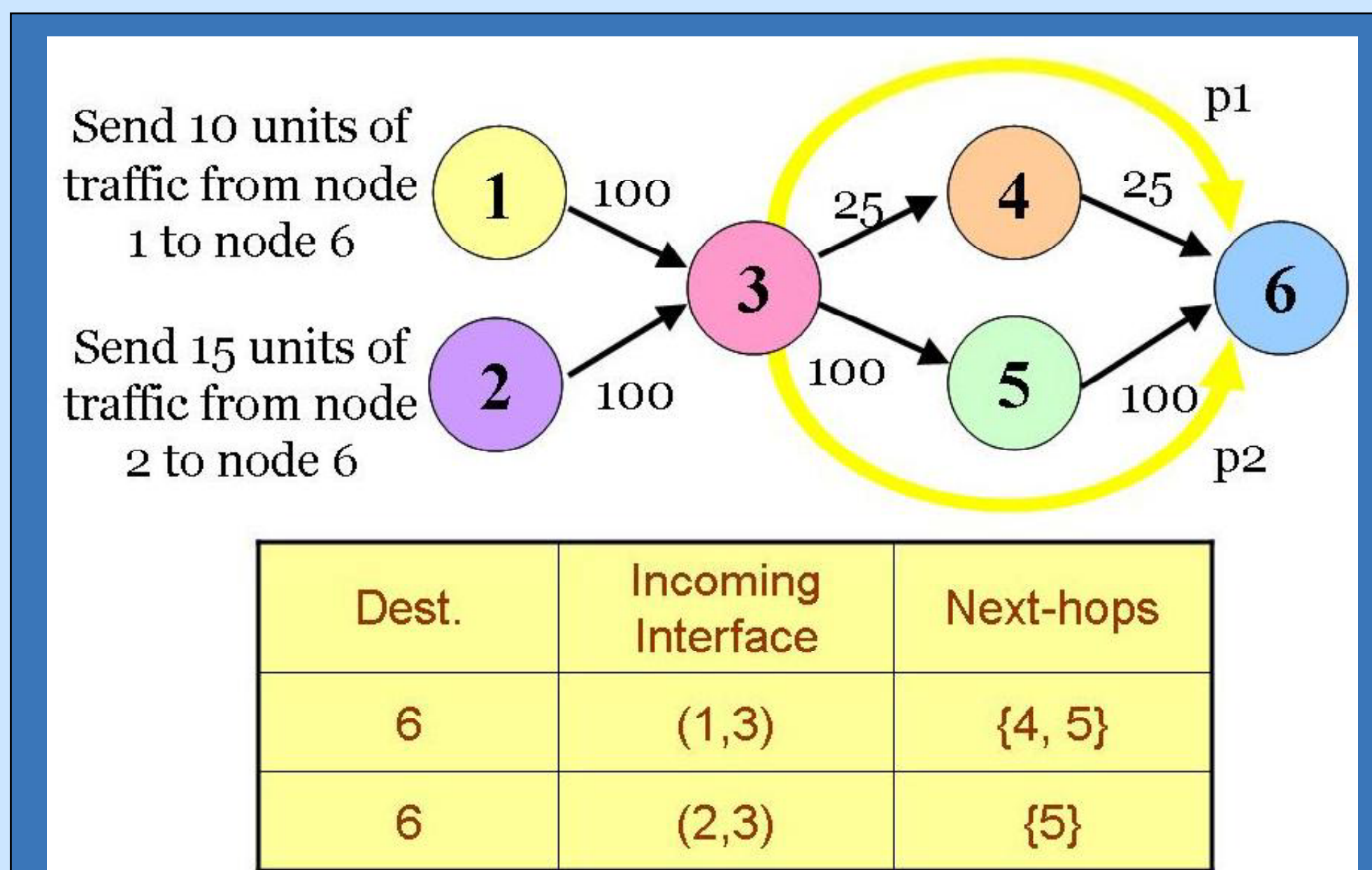
Current Routing Paradigm

- Shortest path constraint
- Equal cost path constraint

Our Approach

Interface-Specific Forwarding

Independent path selection, i.e.,
'Destination-IP to NextHop mapping'
at different incoming interface



With Interface Specific Forwarding, packets destined for node 6 that arrive at node 3 can follow two different paths via node 4 and 5, respectively.

Approach and Impact

New approach

- Interface-specific forwarding tables
- Multiple link-weights per link

Research Impact

- Achieve finer-grained traffic engineering
- Achieve performance close to optimal routing

Technical Discussion

Default IP-routing observes the Equal-Cost Multipath Constraint (ECMP) and optimizes the link weights (one 'cost' per link) to minimize maximum link congestion.

We **modify ECMP constraint** such that: *if at an interface i at a node x , there are k adjacent hops that correspond to a shortest path to a destination d , then all traffic to the destination d must be uniformly distributed across the k hops*"

Interface-Specific Routing (ISR)

- Requires separate forwarding table per interface
- Statically configure multiple link weights per link

Each interface sees a different network map with different set of link weights and runs Dijkstra's algorithm to determine the optimal path/next-hop. The multiple link weights are flooded to the entire network using default mechanism.

Results

- ISR achieves lower worst-case link congestion
- Performance is closer to optimal routing compared to default routing (reduces the gap by 50%)
- In the worst case, ISR performs as good as default IP routing

