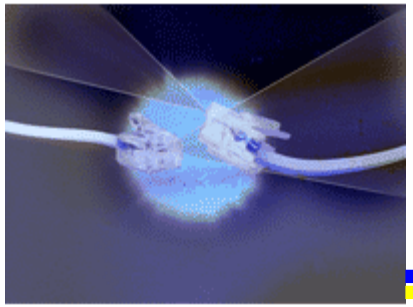
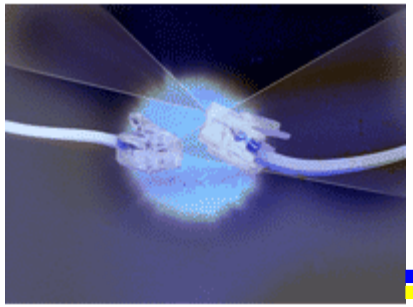


Link Metrics or Costs

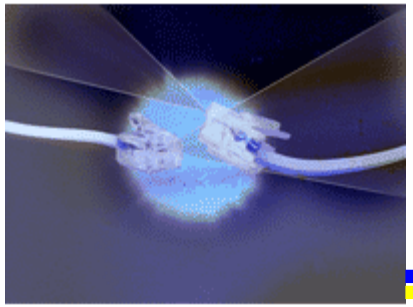
- Need to compute values to use in routing algorithms
- Simplest technique – each link costs 1
  - Generates route with least # of hops
  - Ignores latency of links; i.e. satellite
  - Ignores capacity of links – 19.2 k dialup considered as good as a T3
  - Ignores loading conditions on links



Link Metric Determination

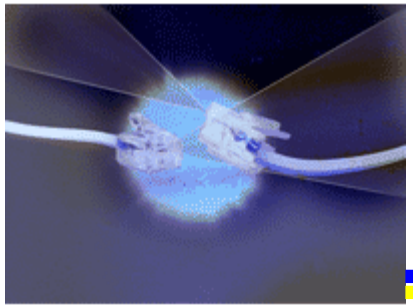
- Original ARPANet mechanism counted packets queued for link
  - Just moves packets to shorter lines, like hopping lines at grocery store
  - Still ignored bandwidth and latency
- Second approach used delay and BW
  - Timestamp each packet's arrival & departure
  - Compute delay when ACK received

    Delay = (Depart – Arrive)+Transmit+Latency



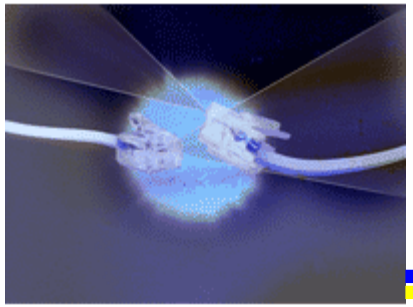
Link Metrics (cont.)

  - Retransmits update Depart, so unreliable links get higher cost
  - Weight was average delay
- Problem – under heavy load, cost would go way up, then immediately drop back down as nodes routed packets in other directions
- Also generated too wide a range of values



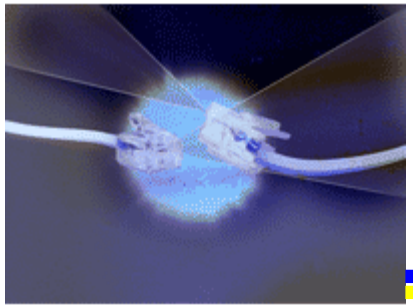
Link Metrics (cont.)

- Next revision compressed range of values, considered type of link, smoothed variation over time
  - Delay changed to utilization, and was averaged with recently reported values
  - Hard limit on how fast value could change
  - Compressed range using sigmoid function with different curves for different link types



Dynamic Cost Adjustment

- Advantages
  - Highly loaded link never costs more than 3 times same link when it is idle
  - Most expensive link is only 7 times more expensive than cheapest link
  - High-speed satellite link more attractive than slow terrestrial link
  - Cost function of link utilization only at medium to high load



Updating Link Metrics

- Values are calculated continuously, but averaged over time
- Changes are only advertised if delta is larger than a threshold