Network Algorithms

* Algorithms – speed abstractions in ALL systems (not just network)
  + Virtual Memory
  + Relational Databases
* 1990s: web exploding, traffic and address doubling
* Problem: TCP (connected queues) + IP (datagram) slow ~ routers & servers
* Network Algorithmics – restore speed of abstractions

Confluence

* Main + Impacting -> New Stream
  + Inflection Point – motivation to have this confluence
  + Milieu Change – abstraction to move/adapting the infecting stream
  + Transformed
* Examples
  + Realistic Painting + Psychology -> Photography + Canvas + Thin to thick strokes -> Impressionism
  + Algorithms + Probability -> Crypto + Sometimes Correct + Eratosthenes to Miller-Rabin algorithm -> Randomized Algorithm
  + Distributed Algorithm (alg + network -> popularity of internet + asynchrony/ partial failure)
  + Computational Economics (economics + cs -> internet auctions -> large scale + small latency)
* Confluences
  + Separate trends from fads
  + NOT ALL interdisciplinary work
    - Networking + Learning Theory – Large network data + distributed data? + changed concept? -> Network Learning
* Network Algorithmics
  + Prefix Lookup
    - Route sends message via a forwarding table
    - Storing of prefixes – avoid large amount of address
    - Reduces router memory – now has to match longer prefix match in billions of pockets per second
    - Linear search – N amount (2^#)
    - Order by alphabets + starting from mid-point (log N)
  + IP Lookup
    - Networking + Algorithms + Traffic, IP v6 + Msec to usec + binary search to on lengths -> algorithmics
      * IP v6 (32 -> 128 bits)
      * CS 118 (Computer Network)
  + Collision – add markers
* 2000s: fast routers (Cisco Cat 6k, GSR, Juniper M40)
  + Reasonable hardware for all problems (switching, lookups, ACLs, scheduling)
  + Solutions scaled with link speeds
  + Now, algorithmics – measurement & security + flexible routers (P4)
* UCLA CS
  + CS 31 + 32 -> Algorithms
* Conclusion:
  + Confluences: inflection point + new milieu before focusing on the change
  + Network Algorithmics – different measures & models compare to algorithms
  + Differences (RDMA) – sacrifice insertion time for fast search (msec ->nsec)