What we were doing in 1988

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24/6/2025

SIGCOMM 1988 – 32 papers

- Compare with SIGCOMM 2023 (72 papers) https://conferences.sigcomm.org/sigcomm/2023/list-accepted.html
- Not with NeurIPS 2024 (3584 papers)

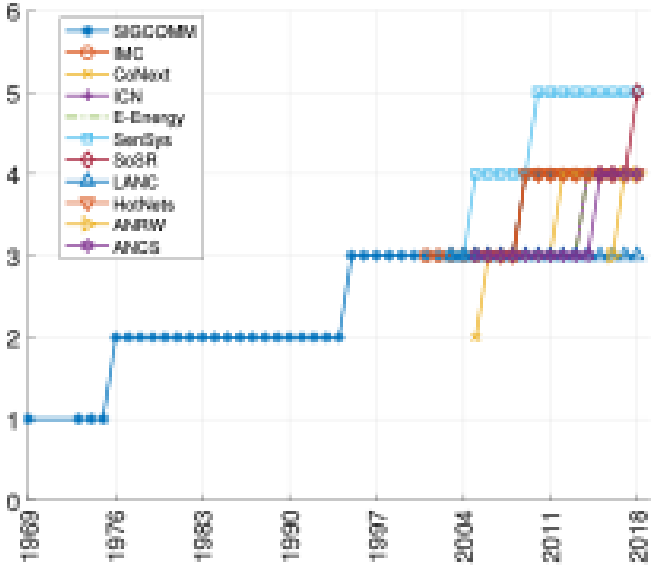

Figure 3: Median number of authors during 1969–2018 in SIGCOMM venues. *Collaborative authorship is becoming*

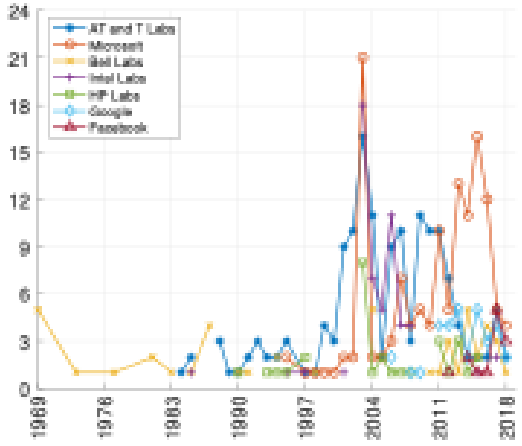

Figure 9: Top research institutes in all SIGCOMM venues based on publication count during 1969–2018 and their temporal development. Note that the line breaks where data is not available. *AT&T is a major player in SIGCOMM venues and remaines the overall top contributor, but other research institutes (e.g., HP, Intel, Microsoft) have emerged as rising stars. Note that y-axis represents the number of publications of a research lab published across all venues from our dataset.*

Topology, Routing, Interconnect, Resource

- Topological analysis of local-area internetworks
- Dynamic bandwidth allocation in a network
- Optical interconnection using ShuffleNet
- The landmark hierarchy: a new hierarchy for routing in very large networks
- Pitfalls in the design of distributed routing algorithms
- Multicast routing in inter networks and extended LANs

Computing Science! OS, PL, Arch

- Design of the x-kernel
- Exploiting recursion to simplify RPC communication architectures
- Service specification and protocol construction for the transport layer
- A network management language for OSI networks
- The design philosophy of the DARPA internet protocols
- The fuzzball
- Development of the domain name system

Hardware & Speed

- Optimizing bulk data transfer performance: a packet train model
- A mesh/token ring hybrid-architecture LAN
- Tree LANs with collision avoidance: protocol, switch architecture, and simulated performance
- An analysis of Memnet—an experiment in high-speed shared-memory local networking
- The VMP network adapter board (NAB): high-performance network communication for multiprocessors
- Circuit switching in multi-hop lightwave networks

Measurement&Methodologies

- A pseudo-machine for packet monitoring and statistics
- Knowledge-based monitoring and control: an approach to understanding behavior of TCP/IP network protocols
- Measured capacity of an Ethernet: myths and reality
- Distributed testing and measurement across the Atlantic packet satellite network(SATNET)
- Experience with test generation for real protocols
- Performance models for Noahnet

Protocols Protocols Protocols

- A multicast transport protocol
- A high performance broadcast file transfer protocol
- Specification and verification of collusion-free broadcast networks
- Delivery and discrimination: the Seine protocol
- A binary feedback scheme for congestion avoidance in computer networks with a connectionless network layer
- Congestion avoidance and control
- A protocol to maintain a minimum spanning tree in a dynamic topology

Where did we go from there…

Table 6: Yearly top keywords in SIGCOMM venues

Year	Keywords
2018	Smart Power Grids, Embedded Systems, Multimedia Systems, Convolutional Codes, Internet Of Things
2017	Embedded Systems, Energy Efficiency, Smart Power Grids, Internet Of Things, Convolutional Codes
2016	Convolutional Codes, Embedded Systems, QOS, TCP, QoS
2015	Energy Efficiency, Smart Power Grids, Energy Utilization, Complex Networks, Wireless Sensor Networks
2014	Embedded Systems, Software-defined Networking, Complex Networks, Social Networking (online), Energy Utilization
2013	Wireless Sensor Networks, Complex Networks, SDN, Openflow, Optimization
2012	Network Architectures, Energy Efficiency, Data Centers, Social Networking (online), Openflow
2011	Wireless Sensor Networks, Embedded Systems, Energy Efficiency, Optimization, Distributed Computer Systems
2010	Embedded Systems, Wireless Sensor Networks, Network Protocols, Electric Network Topology, Computer Operating Systems
2009	Embedded Systems, Wireless Sensor Networks, Network Security, Social Networking (online), Peer To Peer Networks
2008	Embedded Systems, Convolutional Codes, Wireless Sensor Networks, Game Theory, Social Networks
2007	Wireless Sensor Networks, Internet Measurements, Semiconducting Intermetallics, Distributed Computer Systems, Web Services
2006	Wireless Sensor Networks, Distributed Computer Systems, Algorithms, Virtual Reality, Availability
2005	Wireless Telecommunication Systems, Wireless Sensor Networks, Distributed Computer Systems, Relay Telecast Networks, Testbeds
2004	Network Protocols, Telecommunication Traffic, Servers, Bandwidth, Mathematical Models
2003	Mathematical Models, Bandwidth, Telecommunication Traffic, QOS, Congestion Control (communications)
2002	Telecommunication Traffic, Digital Watermarking, Security Of Data, Topology, Servers
2001	Quality Of Service, Multimedia Systems, Algorithms, Bandwidth, Multicasting
2000	Multimedia Systems, Algorithms, Network Protocols, Telecommunication Services, User Interfaces
1999	Congestion Control (communications), Telecommunication Traffic, Mathematical Models, Multicasting, Algorithms
1998	Multimedia Systems, QOS, Semantics, Information Retrieval, Internet Protocols
1997	Multimedia Systems, Digital Storage, Indexing of Information, Bandwidth, Content-based Retrieval
1996	Performance, Mobile Telecommunication Systems, Optimization, Congestion Control (communications), Asynchronous Transfer Mode
1995	Audio Systems, Computer Graphics, Bandwidth, Information Services, Telecommunication Services
1994	Memory Architecture, Network Routing, Topology, Address Space, Credit-based Flow Control
1993	Multimedia Computing, Video Signal Processing, Data Handling, Information Retrieval Systems, Synchronization
1992	Packet Switching, Telecommunication Control, Communication Protocols, High Speed Networks, Congestion Control
1991	Asynchronous Transfer Mode, Service Disciplines, Traffic Congestion, Graph Theory, Propagation Delays
1990	Packet Switching, Broadband Networks, Design Principles, Fixed Rate Gateways (computer Networks)
1989	EDN, Graph Theory, Asynchronous Transfer Mode, Data Transmission, Open Systems Interconnection
1988	Topology, Bandwidth, Local Area Networks, Optical Communication, Congestion Avoidance
1987	Distributed Computer Systems, Natural Resources Management, Resource Allocation, Supercomputers, Back-bone Network
1986	Distributed Systems, Transport Protocols, Local Area Networks, Access Control, Application Programs
1985	Distributed Systems, Transport Protocols, Back-bone Networks, Congestion Avoidance, Data Transmission
1984	Data Sets, Data Transfer, Local Area Networks, Open Systems Interconnection, Reference Modeling
1983	Packet Switching, Access Control, Data Transfer, Gateways (computer Networks), Interconnection Networks (circuit Switching)
1982	Queueing Network Model, Data Link Control, Flow Control, Information Management, Performance Analysis
1981	Network Performance, Queueing Network Model, Complex Networks, Data Link Control, Flow Control
1980	Convolutional Codes, Packet Switching, Open Systems Interconnections, Reference Modeling, Authentication
1979	Data Handling, Information Management, Interconnection Networks (circuit Switching), Electronic Data Interchange, Gateways (computer Networks)
1978	Switching Networks, Available, Antenna Arrays, Asynchronous Data, Automatic Repeat Request
1977	Airport, Operating System Design, Queueing Theory, Satellite Broadcast, Shared Adder
1976	Average Delay, Band-width Utilization, Centralized Networks, Closed Loop Control Systems, Common Carriers
1975	Convolutional Codes, Data Communication Systems, Packet Switching, Packet Networks, Switching Networks
1974	Convolutional Codes, Switching Networks, Distributed Computer Systems, Digital Storage, Multiplexing Techniques
1973	Packet-switched, Adaptive Routing, Batch Data Processing, Branch Bound Method, Buffer Management
1969	Convolutional Codes, Switching Networks, Distributed Computer Systems, Digital Storage, Multiplexing Techniques

Thanks to Gareth et al for work on the 5 Decades of SIGCOMM biblio paper (where the graphs/tables come from)!

Why should you care #1?

- The UK has been a leader in networking since the start
  - The University and National support is a major factor
- Much of our science is a beneficiary
  - Data and code and seminars/classes on the net
  - E.g. LHC/CERN, Genome, dare I say AI
- Operational networks deploy in cycles
  - Having extreme demands ahead of extreme dependency is helpful
  - Viz video conferencing from 1988, meant we were ready!

Why should you care #2?

- Long term relevance (optical!) +
- Long term irrelevance (multicast) -
- Very long lead time (ipng -> IPv6) +
- Very long lead time (multicast for training AI in data centers)+

- Techtransfer:today's data center as big as whole internet 20 years ago
- Power management (aggressive sleeping) from phone->backbone

- AI….

Where are we headed?

- Scale of network/cloud leads to big teams with ‘industry’ partners
  - Universities send students as interns to do innovative part
  - Looks like high energy physics or genomics (50 authors!)
  - Longitudinal (eg Perfsona) programs for decades (c.f. ipv6)
  - Academics still do new stuff (multipath tcp, quic, iot, security)

- AI both good and bad
  - Cross section bandwidth in data centers innovate+ but energy-
  - Bitcoin on steroids (should be banned☺)
- AI for nets 90% nonsense
  - but causal inference/bayes for fault diagnosis
  - And PhiML for TE looks promising
  - Decouple time scales too…