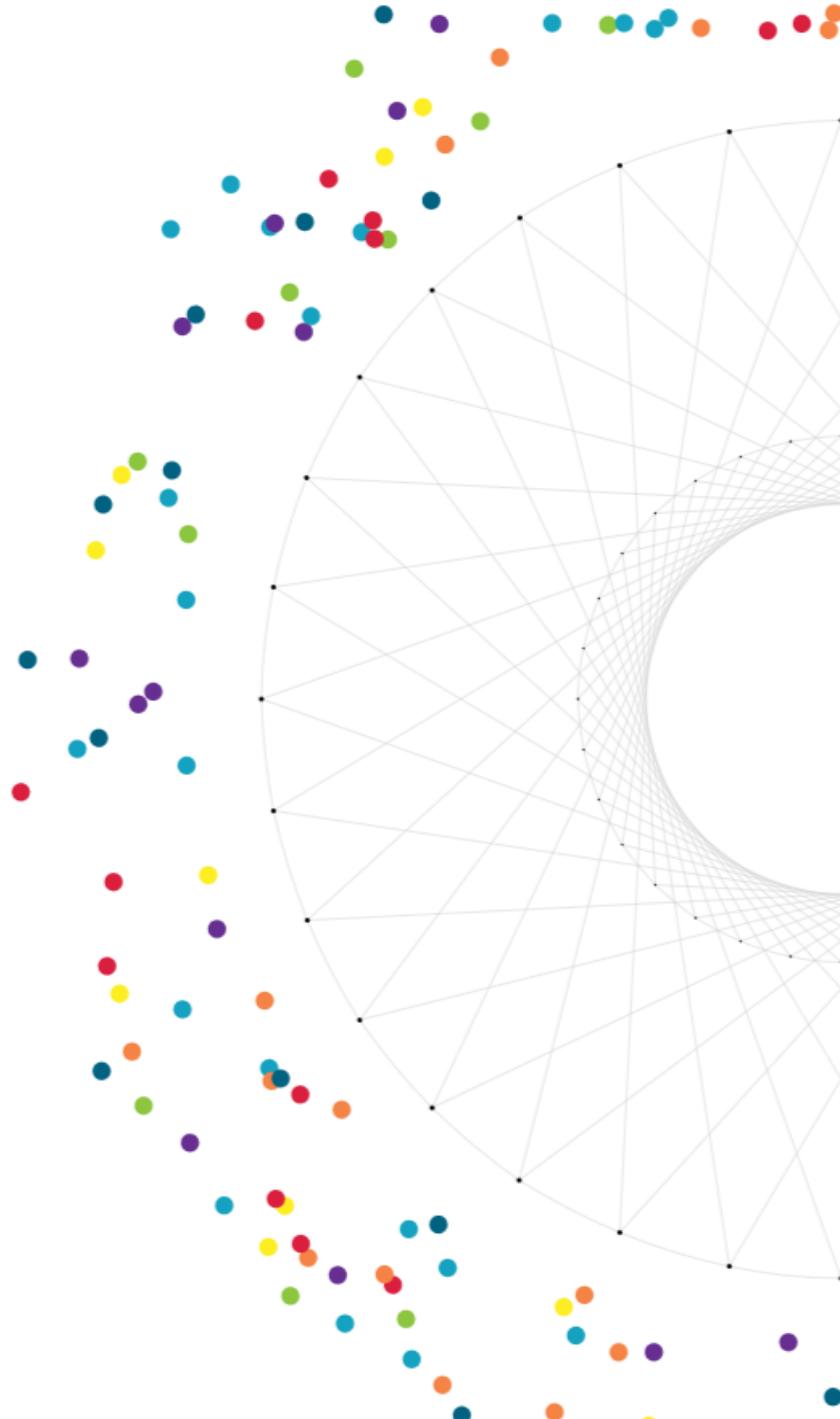
The Design Philosophy of the DARPA Internet Protocols

Speaker : 09014231 潘东元
Partner ：09014222 王铎

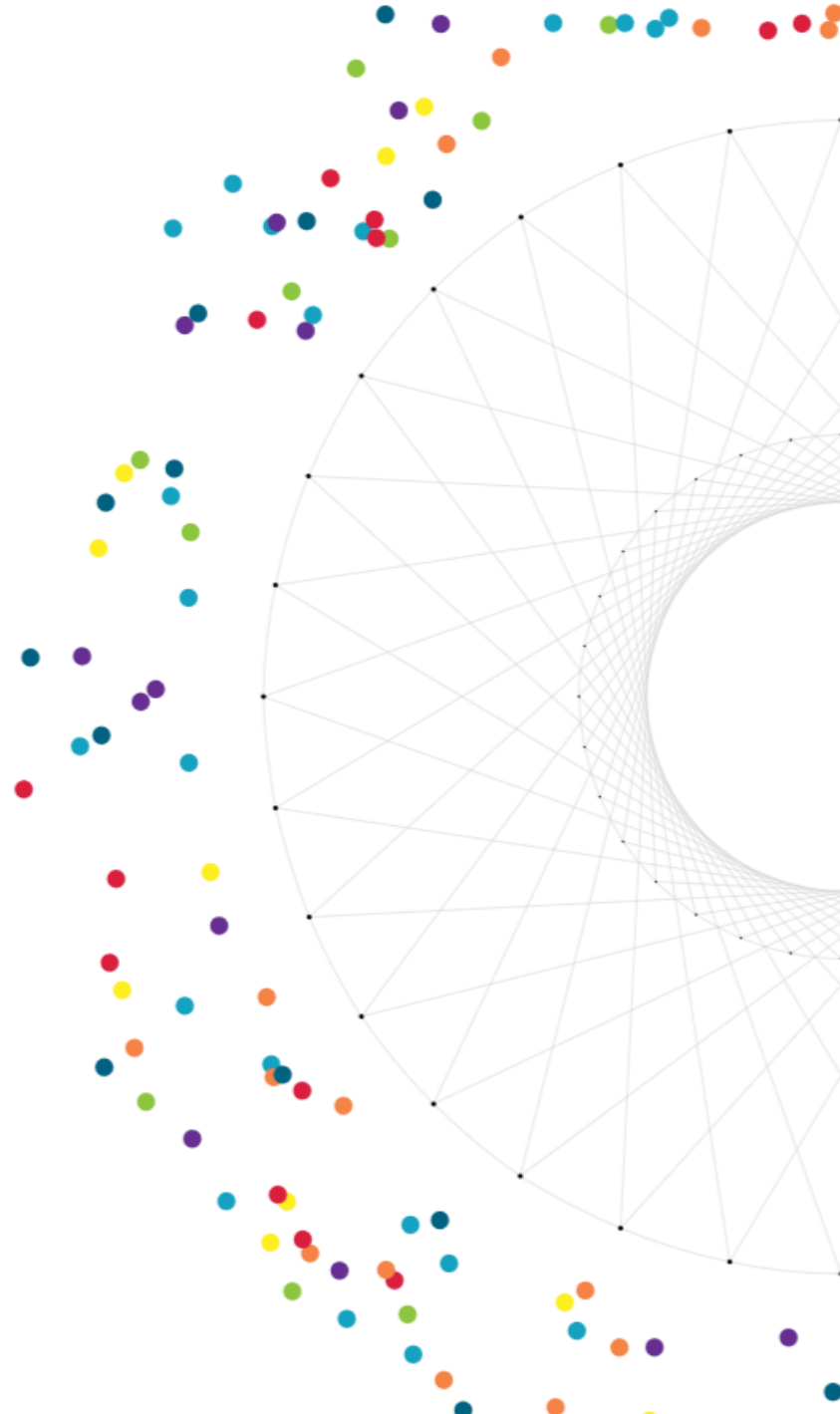
Purpose of the paper

- Original objectives of the Internet architecture
- Relation between goals and features of the protocols



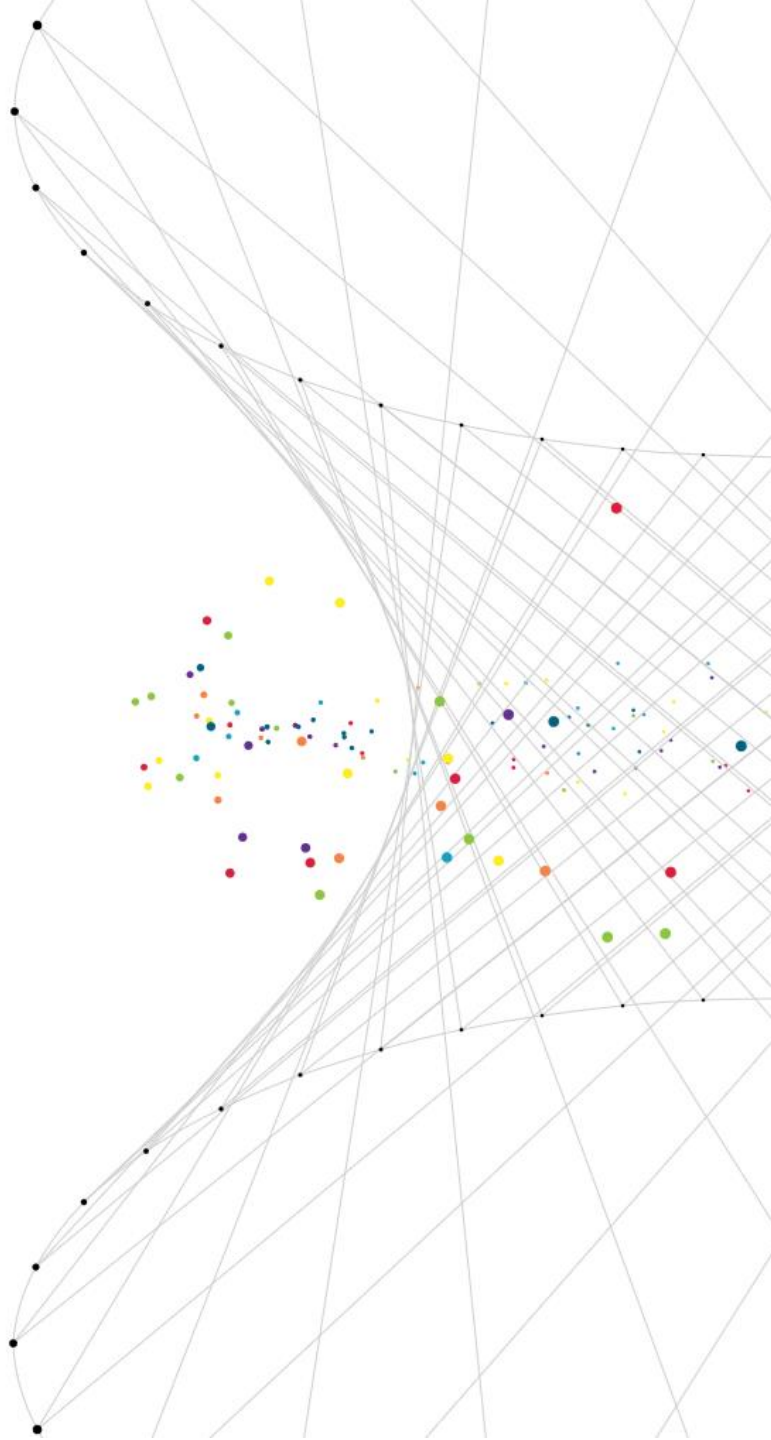
Basic Concept

- IP (Internet Protocol)
- TCP (Transmission Control Protocol)



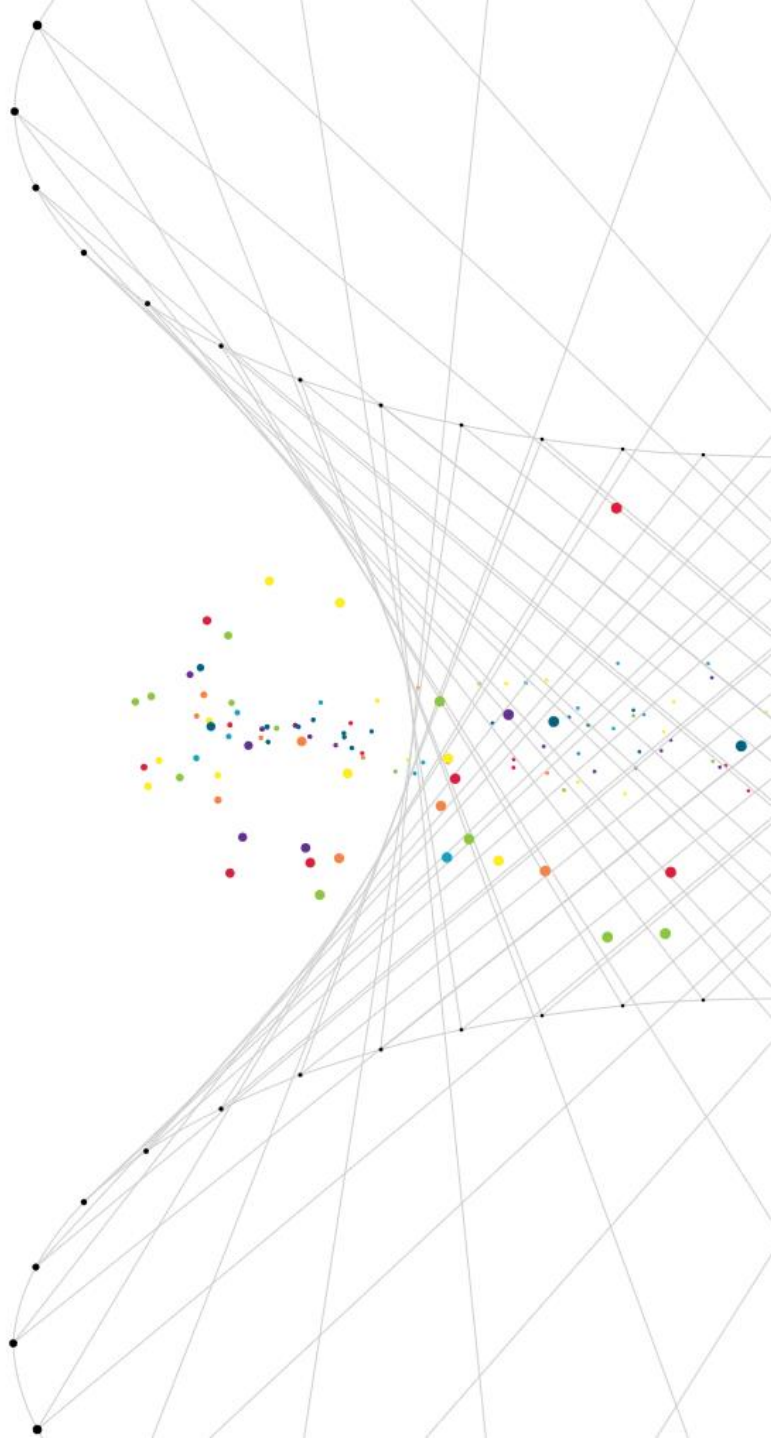
Fundamental Goal

- Develop an effective technique for multiplexed utilization of existing interconnected networks
- Design a unified system incorporating a variety of different transmission media
- The assumption of the particular technique for interconnecting these networks -> gateways(网关)



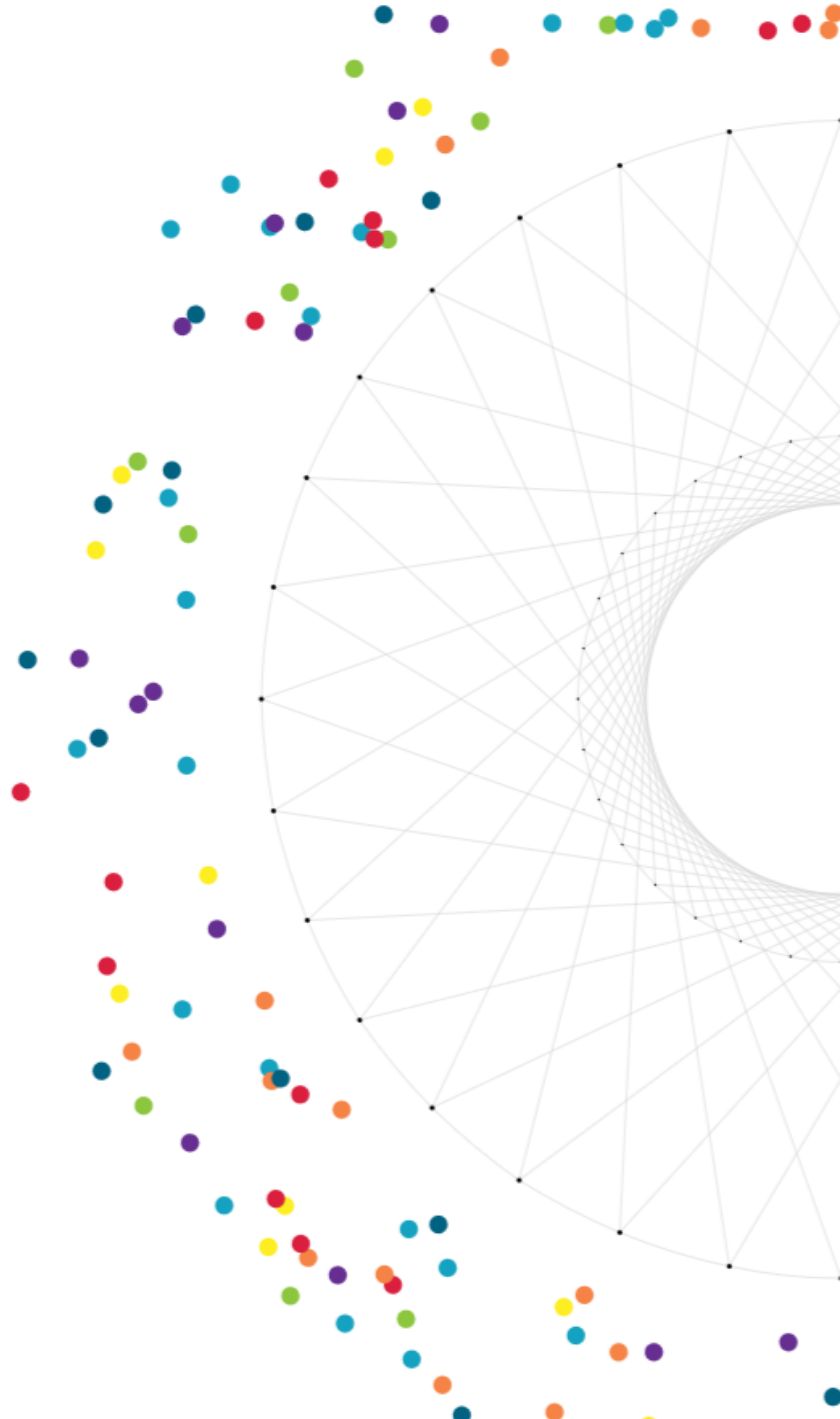
Fundamental Structure of the Internet

- A packet switched communications facility (switcher)
- A number of distinguishable networks connected together (gateways)
- Store and forward packet forwarding (algorithm)



Second Level Goals

1. Internet communication must continue despite loss of networks or gateways
2. The Internet must support multiple types of communications service
3. The Internet architecture must accommodate a variety of networks
4. The Internet architecture must permit distributed management of its resources

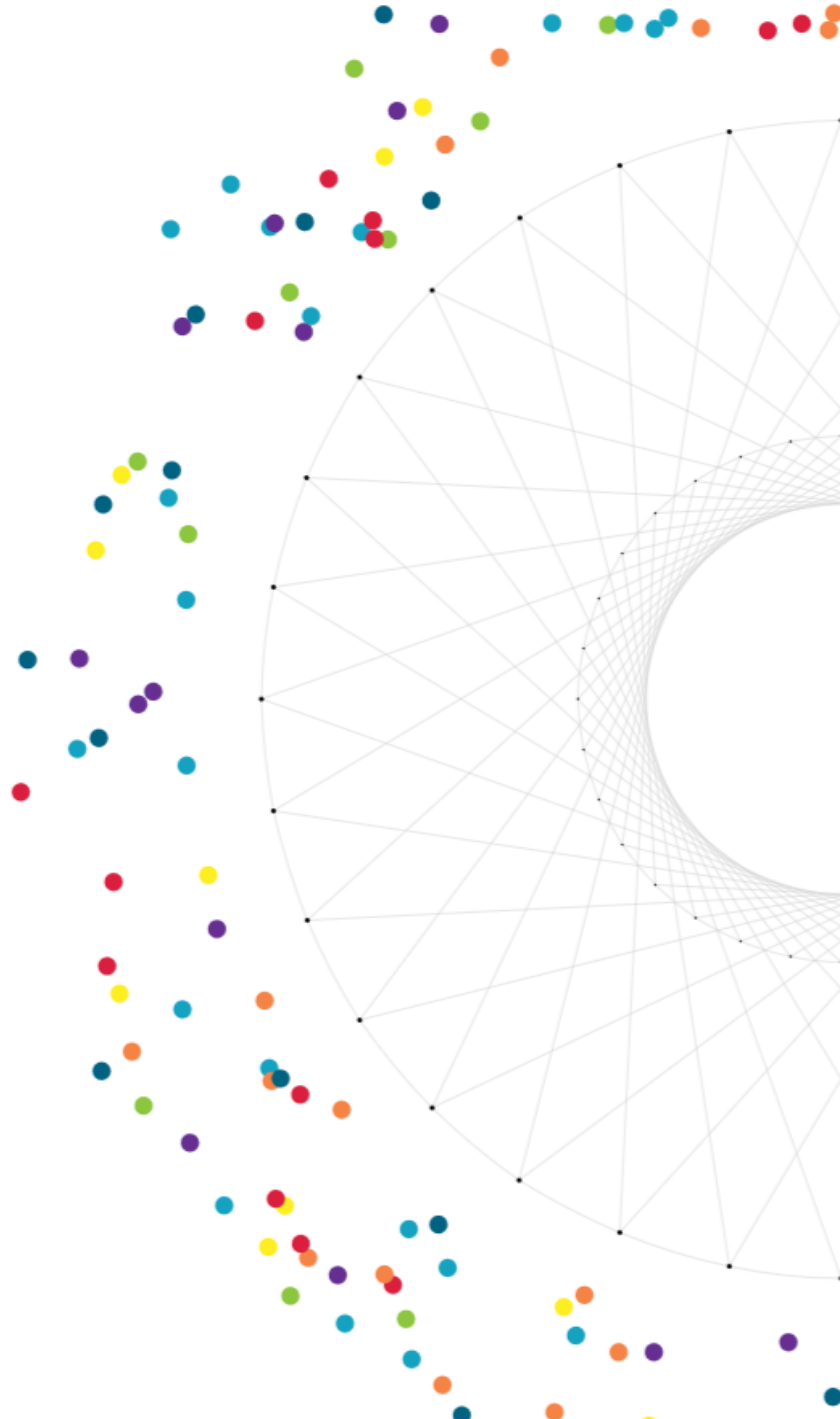


Second Level Goals

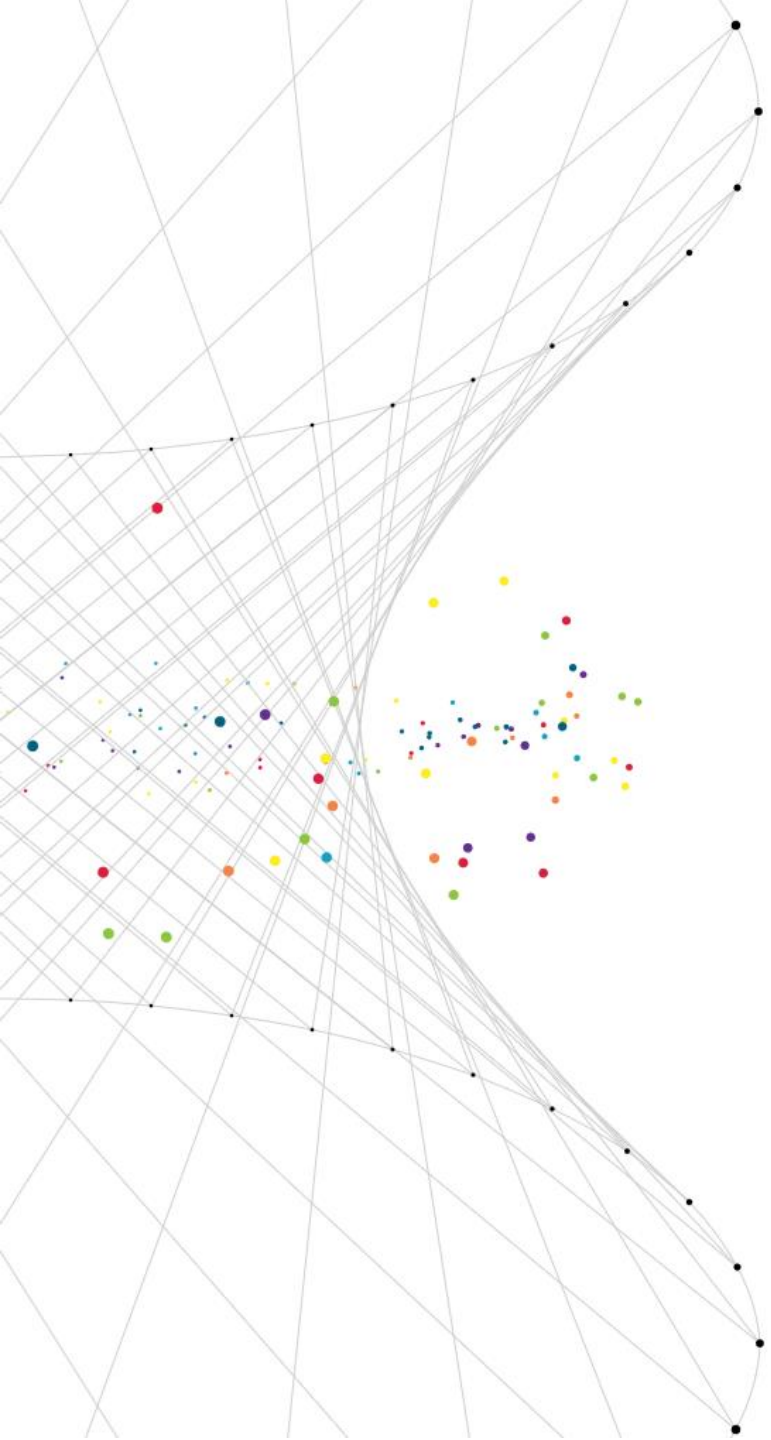
5. The Internet architecture must be cost effective
6. The Internet architecture must permit host attachment with a low level of effort
7. The resources used in the internet architecture must be accountable

! order changed =>

entirely different network architecture



Survivability in the Face of Failure



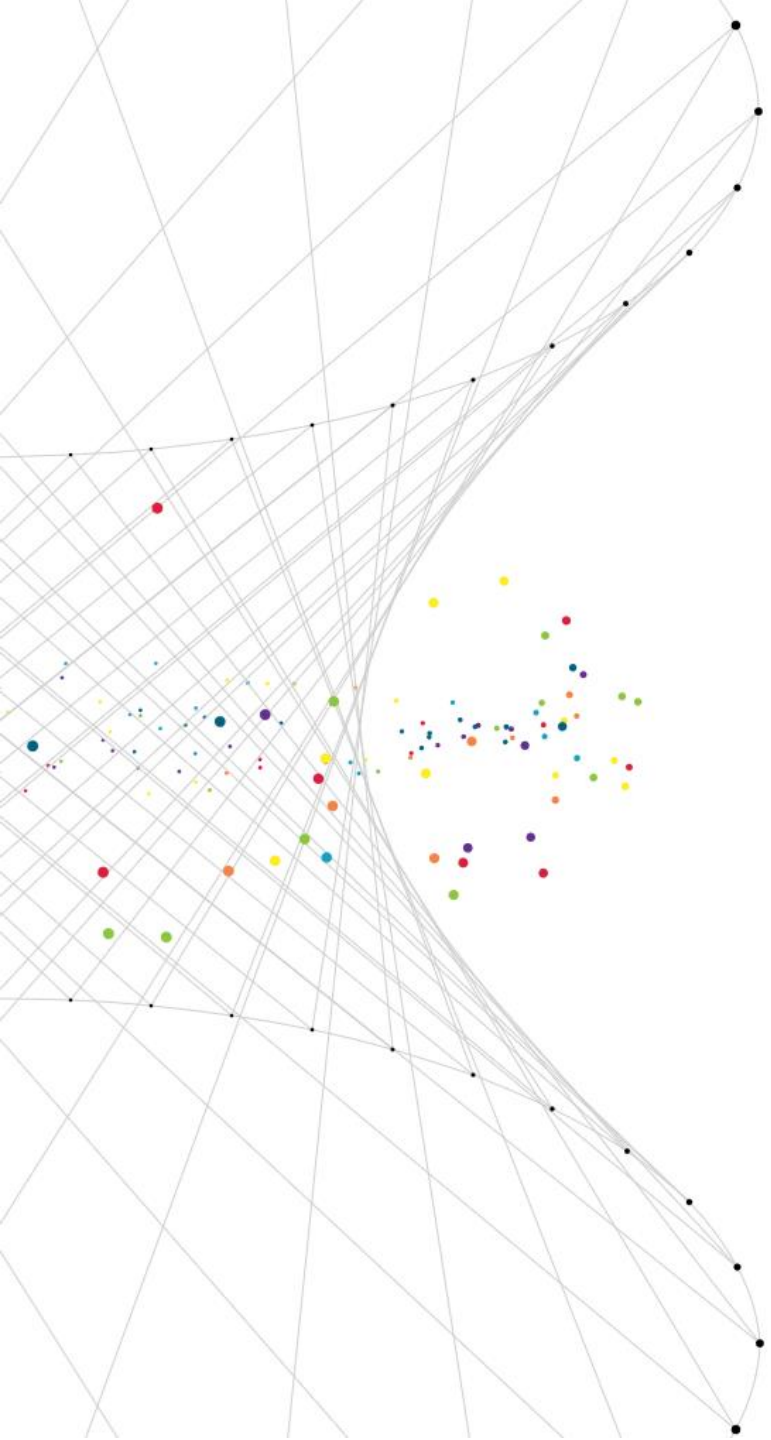
- Synchronization
- Protection
  on-going conversation state information
- Mask
  transient failure

Two methods

1. Store-and-replicate State
   in intermediate packet switching nodes

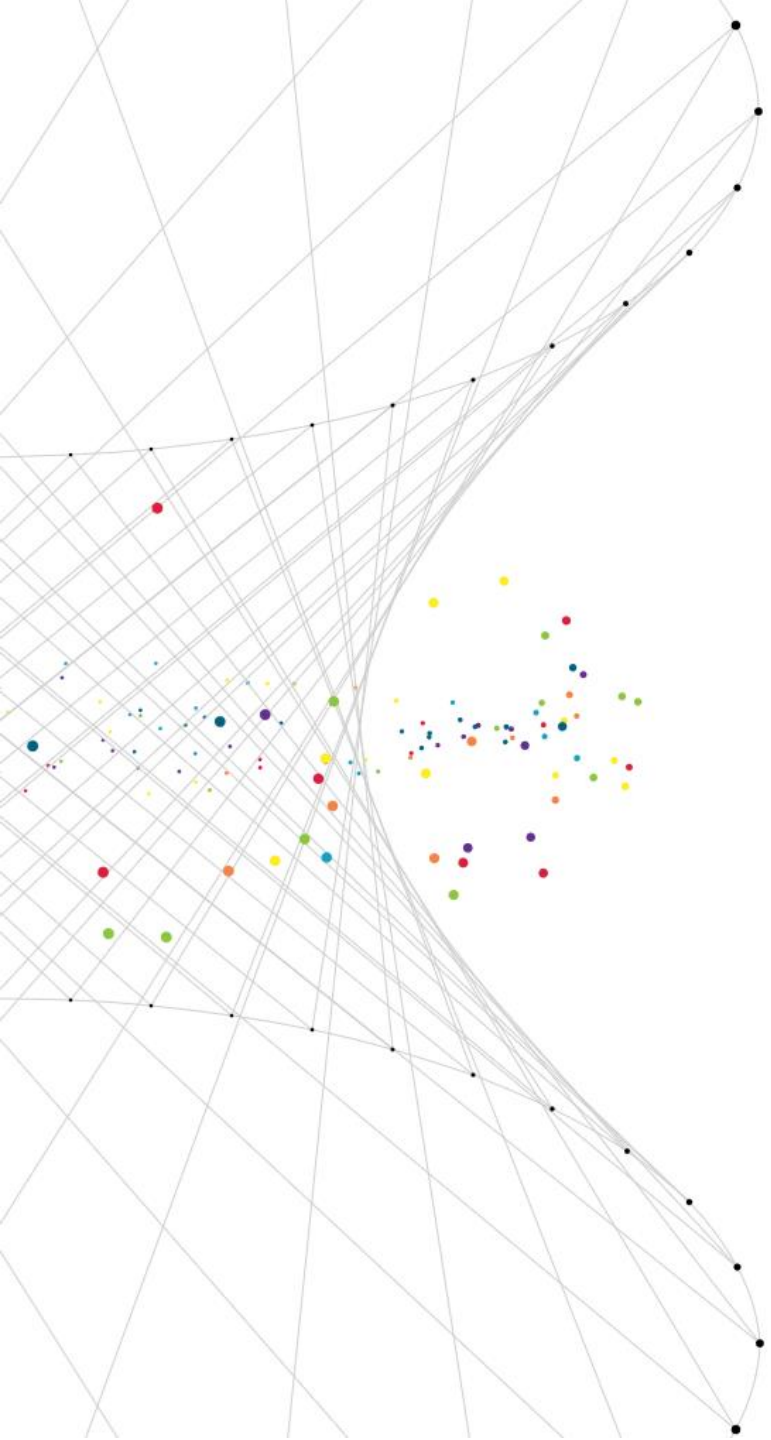
2. Gather Information
   at the endpoint of the net

fate-sharing



Advantages to fate-sharing over replication

- Protects data against more intermediate failures
- Be easier to engineer than replication



Consequences

- Gateways without any essential state information about on-going connections

- Host with too heavy trust compared with ensuring reliable delivery of data

first goal is survivability
but second to the top level goal of interconnection of existing networks

Types of Service

- Distinguished by requirements
  e.g. speed, latency and reliability

- "virtual circuit" service
  ---first service provided in the Internet architecture
- Out of TCP service :
  XNET : little reliability
  Real time delivery : low delay & low speed

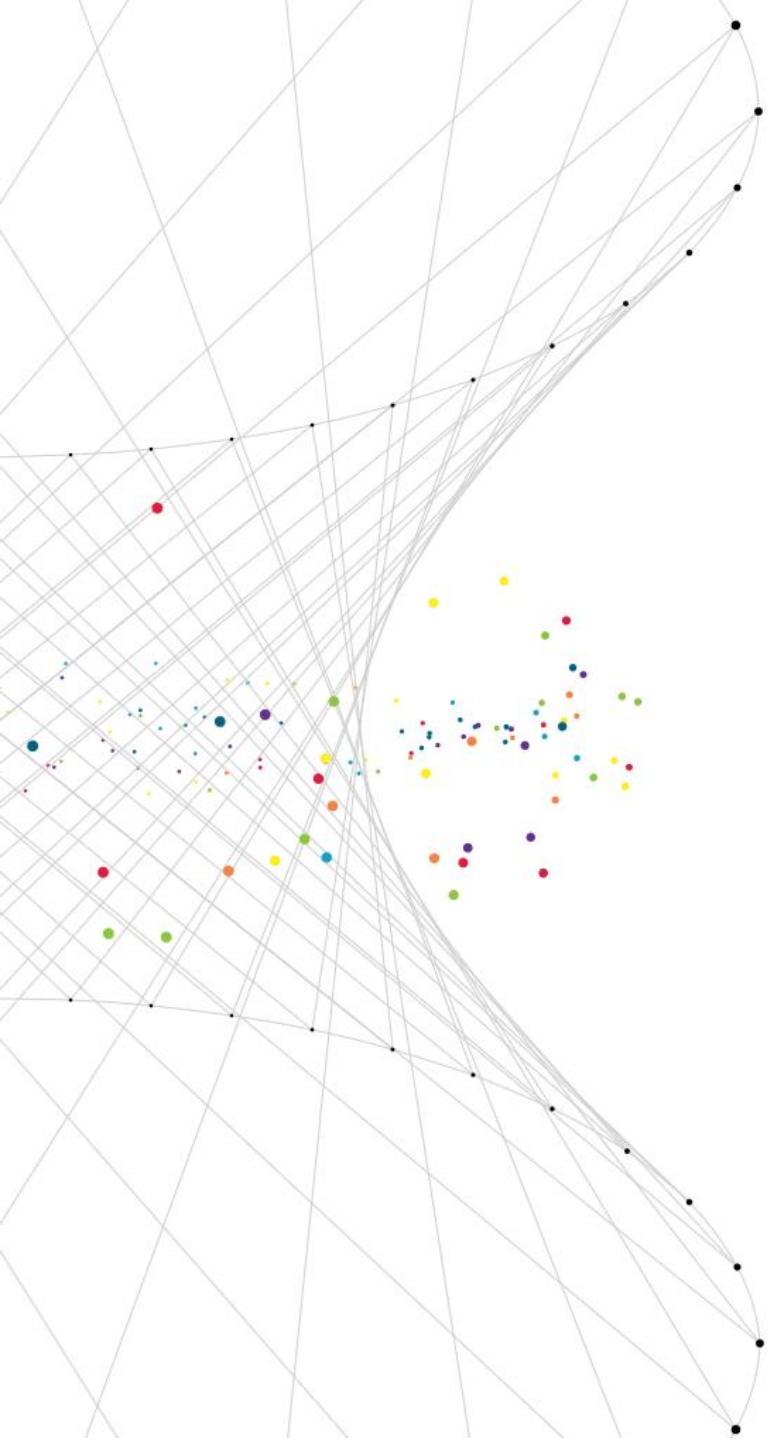
- TCP : the reliable sequenced data stream
- IP : basic building block (datagram)

Types of Service

- User Datagram Protocol (UDP)
  to provide a application-level interface to the basic datagram service of Internet.

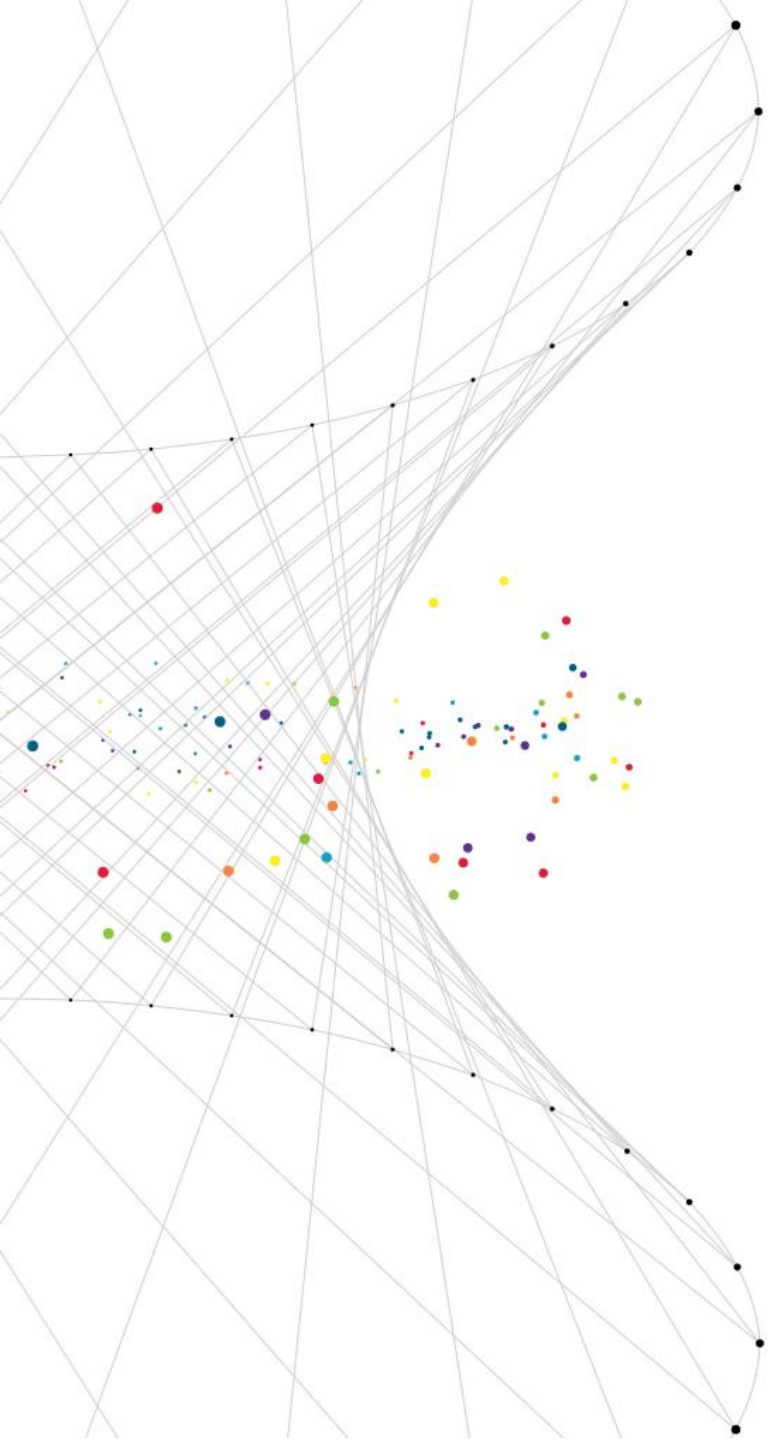
- Multiple types of service
  constructed out of the basic datagram building block algorithms within the host and the gateway.

Varieties of Networks



- Internet architecture
  incorporate and utilize a wide variety of network technologies

- Not assumed explicit service
  1. network support
  2. reengineer & reimplement host



Other Goals

- Distributed management permit
  multiple agencies
- Cost effective architecture
  overhead of packets
  retransition of lost packets
- Effective host attachment permit
  implementation & mechanism
- Accountable resources
  packet flows

Architecture and Implementation

- Realization

  a particular set of networks, gateways and hosts connected together in the context of the Internet architecture

- Major **struggles**

  ---guidance to the designer of a realization

- Guidance would relate the engineering of the realization to the types of service

Architecture and Implementation

- Protocol verifiers
- simulator

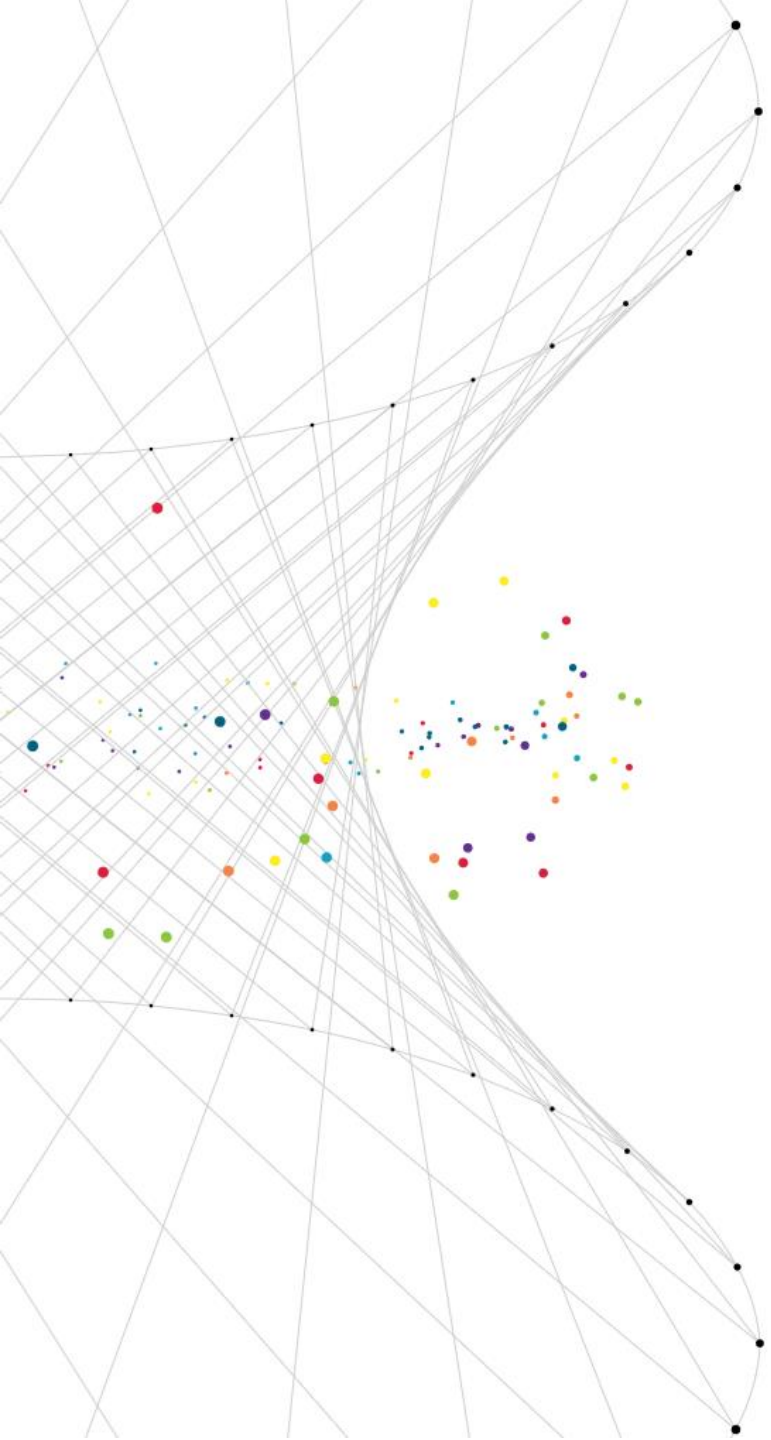
⇒ helpless to struggles

- The relationship between architecture and performance

⇓ difficult to improve performance
specification documents to produce

extremely challenging

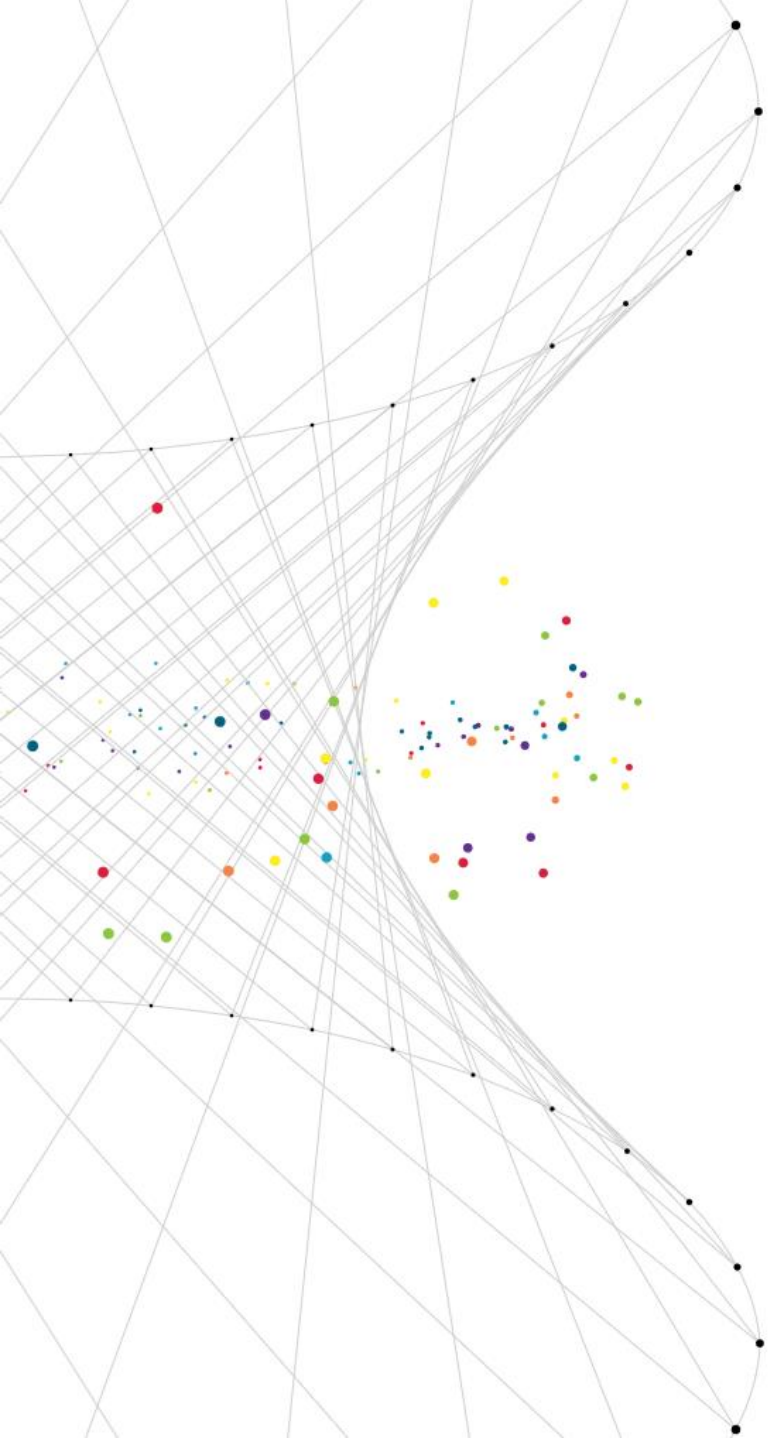
Datagrams



- Fundamental architectural feature

- **Reasons why important**

I. Eliminate the need for connection state within the intermediate switching nodes
II. Provide a basic building block out of which a variety of types of service can be implemented
III. Represents the minimum network service assumption

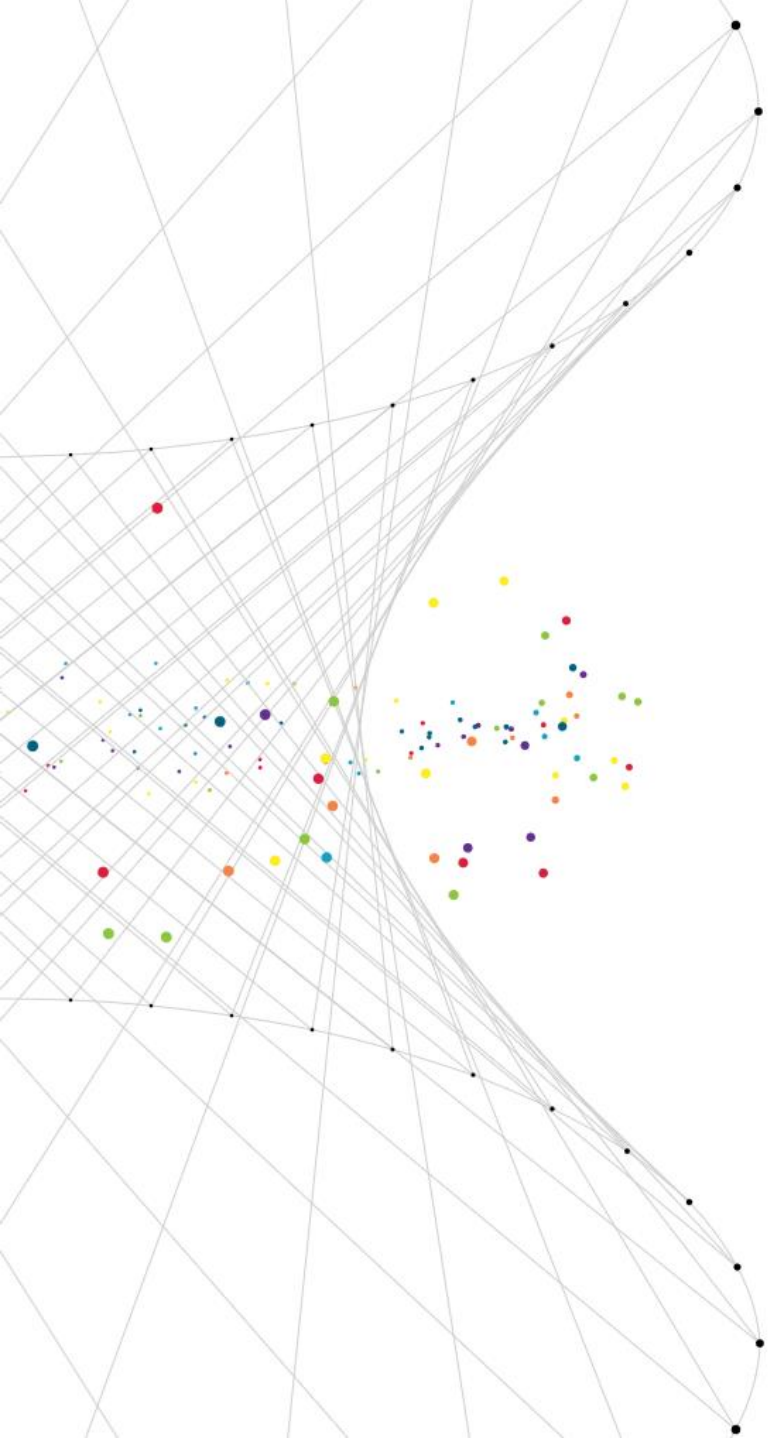


TCP

- Sufficient with only one form of regulation

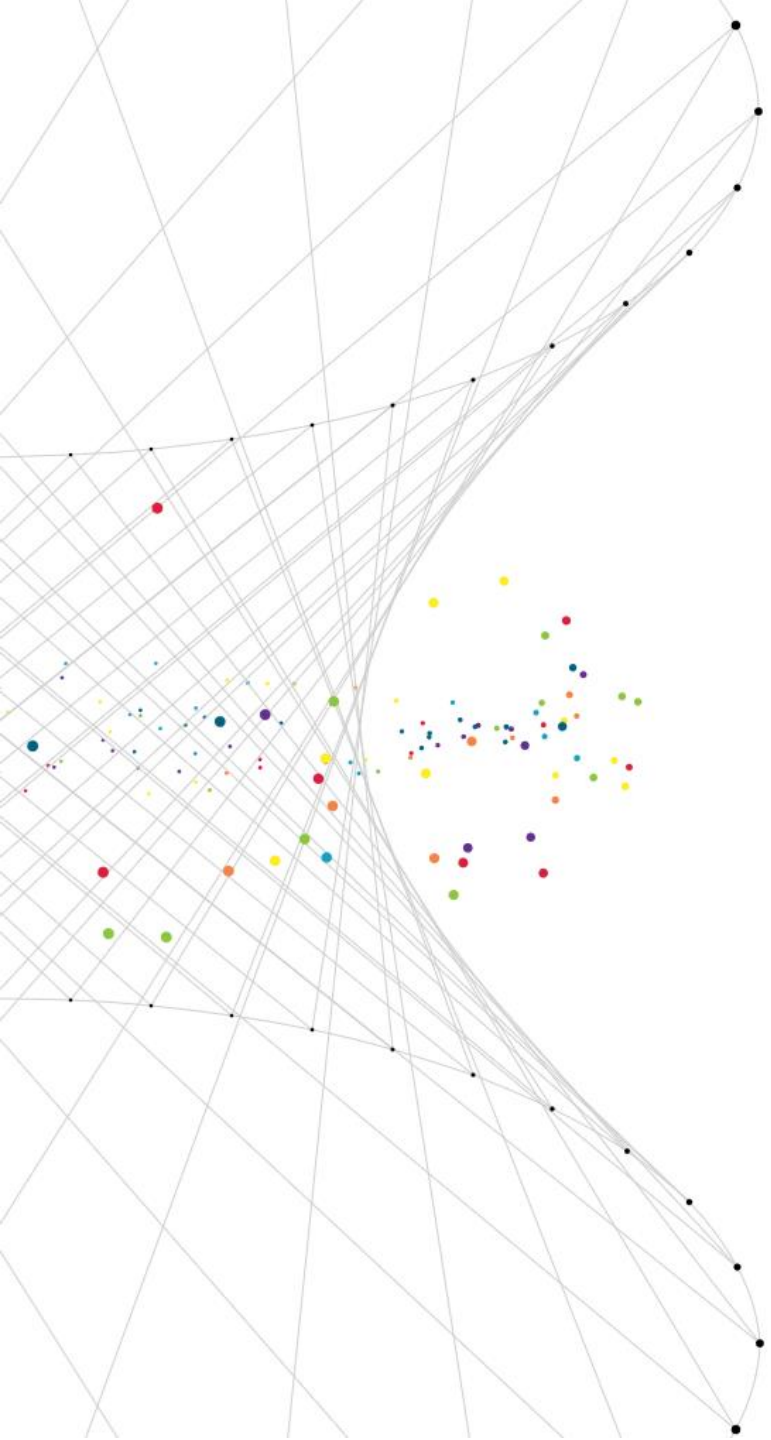
- Regulate the delivery of bytes, rather than packets

I. the insertion of control information into sequence space of bytes
II. the TCP packet to be broken up into smaller packets(put into IP)
III. small packets to be gathered together into one larger packet(retransmission)



EOL

- End-Of-Letter flag ---replaced by the Push flag
- tool for mapping the byte stream to the buffer management of the host
- In retrospect, should be incorporated into TCP



Conclusion

- priorities of the designers do not match the needs of the actual users
- datagram has served very well in solving the most important goals of the Internet
- there may be a better building block than the datagram for the next generation of architecture

Thanks