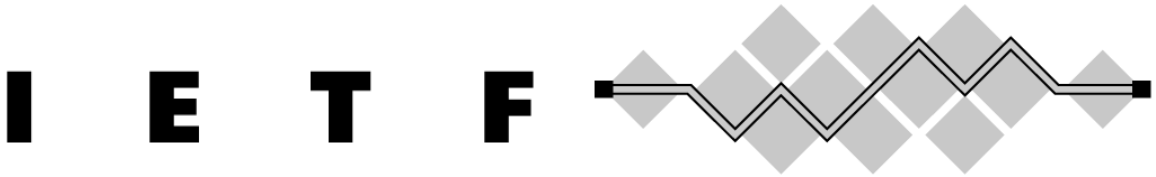
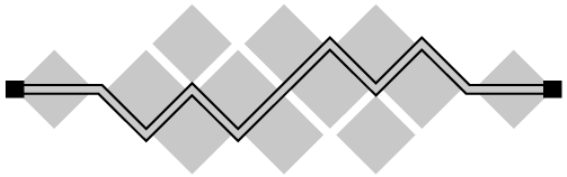


The Search for Internet Architectural Principles

(Internet 2000)

pvm@home.net

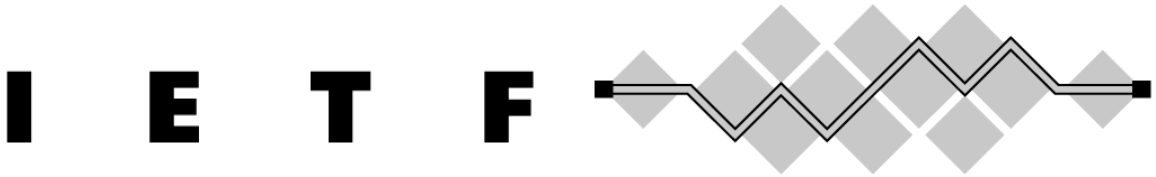
I E T F



What is the Internet?

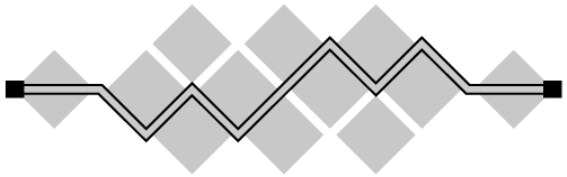
... the current state of network evolution

Era:	1969 ARPANET	1983 Internet	1994 Internet	1996? Future
Backbone speed (000s)	56	56	45,000	9,600,000
Host interface speed (000s)	56	10,000	10,000	1,000,000
Computers	4	200	4,500,000	10,000,000
Managers	1	64	40,000	100,000



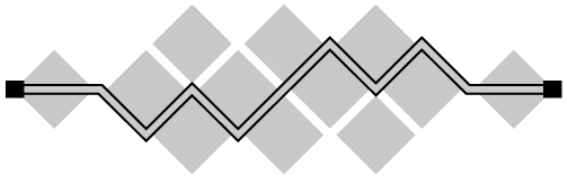
What are the characteristics of Architectural principles?

- Time Dependent
- Method to create cooperation, i.e. common standards
- “Most significant bits” of the standards
- A small “spanning set” of rules that generates a varied space

I E T F 

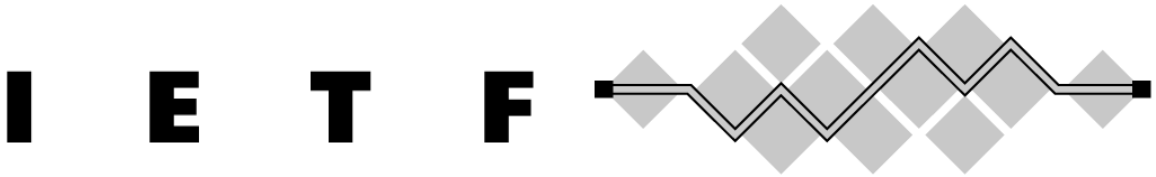
IPng = IP the Next Generation

- IP is running out of gas (or at least class B addresses).
- We can make it better than before.
- The IETF can do it best.
- One protocol to bind them all.
- The internet of the future needs new capabilities.

I E T F 

Gigabit Principles

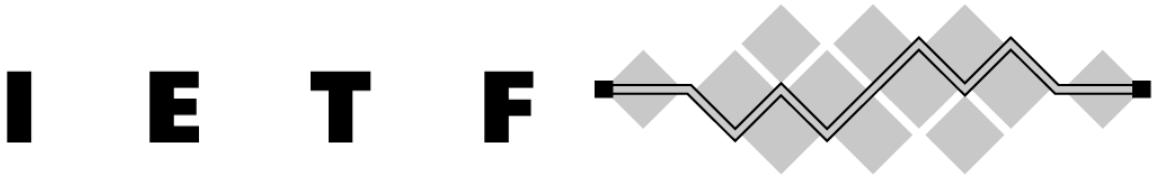
- We can’t do things the old way.
- We need to explore far out speeds, not the next speed.
- Gigabit problems are different.
- Gigabits enable new services.



The Old Way (some say the Internet way)

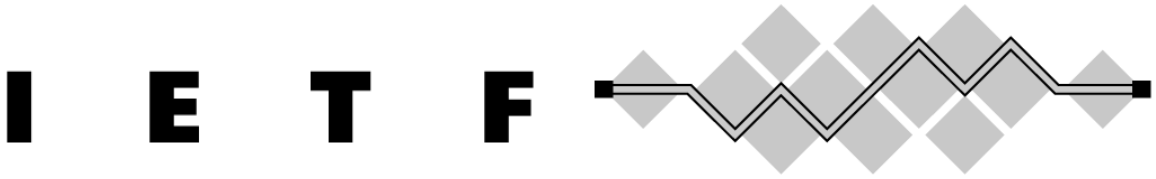
The REK Six Commandments

- No Connections
- All packets are treated equally
- Rapid adaptation to topology changes
- Minimal first-packet delay
- Fixed length addresses
- Be unlike the phone system



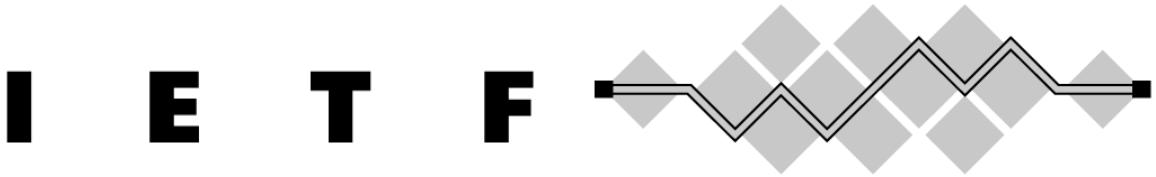
The Deering addendum

- Unicast is just as important as multicast
- No usage-sensitive billing



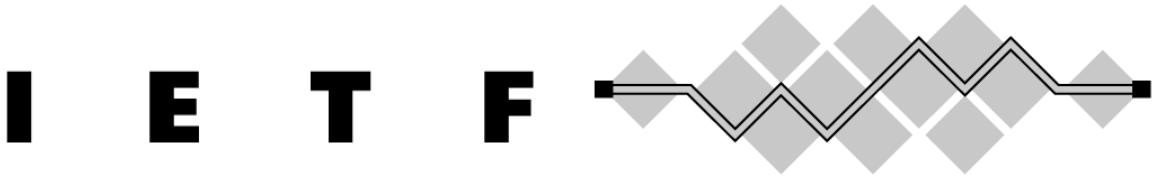
The New PC Way

- Telecommunications and computation merge
- Network research and Telcos work together
- SONET base
- HIPPI/ATM popular



Design Principles - Dave Clark 88

- **Goal: effective technique for multiplexed utilization of existing interconnected networks**
- **Prioritized second level goals:**
  - Communications must continue despite loss of networks & gateways
  - Must support multiple TOS
  - Must accommodate a variety of networks
  - Must permit distributed management of resources
  - Must be cost effective
  - Must permit host attachment with a low level of effort
  - Must be accountable
- **Features: Datagrams, IP/TCP split**



Other Examples of Expert Forecasting

EXPERT	FORECAST
Lord Kelvin (1895)	***Heavier-than-Air Flying Machines are impossible.***
Albert Einstein (1932)	***There is not the slightest indication that [Nuclear] Energy will ever be obtainable.***
Thomas J. Watson (1943)	***I think there is a world model for about five computers.***
Kenneth Olsen (1977)	***There is no reason for an individual to have a computer in the home.***

Source: Christopher Cerf and Victor Navasky, *The Experts Speak* (New York; Pantheon Books, 1984).