Changing Assumptions

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Assumptions (1)

- Processing power, storage and bandwidth all keep growing
  - Moore's Law
  - Storage grows even faster
  - Bandwidth grows, but in big leaps (capital expense)

- Connectivity
  - Dialup, ISDN, DSL, Cable, 802.11b, T1, T3, STS-3, OC-12, ...
    - At least 3 orders of magnitude difference in regular use
  - Previously "mostly disconnected"
  - Now "mostly connected"
  - Offline capability is still important

- But extreme interactivity will always be difficult
  - The latency problem remains

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Latency: the universal constant

```
>ping rtfm.mit.edu

(1991)
Pinging 18.181.0.29 with 32 bytes of data:
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230

(2001)
Pinging 18.181.0.29 with 32 bytes of data:
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
Reply from 18.181.0.29: bytes=32 time=120ms TTL=230
```

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Assumptions (2)

- Firewalls are here to stay, but they get in the way of real work
- The network is fundamentally broken
  - My IP address changes daily
  - Your IP address changes daily
  - I can't ping you, or vice versa
  - Proxies even change the network protocol on the way through
  - WAP, 3G, walled gardens

- This was not always the case
- IPv6 won't fix it any time soon
- Napster fixed parts of it, though
  - Another addressing scheme, not DNS
  - Cross-firewall traffic
  - Client = Server

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Assumptions (3)

- Centralised systems are capital expenditure

    – Change is slow
    – Change is expensive

- Personal systems (at the "edge" of the network) are not

    – Cheaper
    – More disposable
    – Therefore more "churn"
        - = more innovation, flexibility, growth

- Multiple users per device; multiple devices per user

Assumptions (4)

- Network "option value"
    – Broadcast
        - How many potential receivers? ("Sarnoff's Law")
        - **O(N)**
    – Point-to-Point
        - How many potential 1-on-1 conversations? ("Metcalfe's Law")
        - **O(N^2)**
    – Grouping
        - How many potential groups? ("Reed's Law")
        - **O(2^N)**

- Of course not all these options are exercised
    – But the network value = the option value

- Group-forming-networks become the dominant value form with increasing numbers N

Implications for platforms

- Latency & network unpredictability
  - Asynchronous comms (message queues) not synchronous (RPCs)

- Offline use
  - Local data, distributed databases, synchronisation

- Evolvability
  - Component architectures not layered architectures

- Symmetry
  - Universal resource identifiers, protocol flexibility, public rendezvous points

- Friction vs. Option Value
  - Open standards, low "connectivity friction"

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"so far, a head"

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