Why are all architectural problems from 2000 still unsolved?

How would we know we had solved socio-economic problems anyway?

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you can't have your dessert until you've eaten your vegetables

- careful not to invent problems to fit the research we want to do

- research agenda since DARPA NewArch (2000) all still unsolved
    - 'solved' = rough consensus and deployable code (ideally all solutions coherent)

- routing, naming, addressing (n)
    - policy controls on inter-provider routing
    - robustness & availability, inc mobility
    - reachability through middleboxes

- resource control (0)*
    - highly time-variable resources
    - capacity allocation
    - extremely long propagation delays

- management (0)
    - policy-driven auto-configuration
    - failure management

- security (n)
    - attack resilience
    - traceability

- heterogeneity   –   cross-cutting agenda
    - enabling conflicting socio-economic outcomes (0)
   - enabling a variety of technical outcomes (n)

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* resource control:
0 projects in NSF NeTS FIND
1 retrospective paper in SIGCOMM'06

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networks research – enduring tensions

commercial viability

secure responsibility

scalability simple

freedom evolvable

design for tussle

between outcomes in this space

- not just self-supply (p2p, ad hoc)
    - but co-existence of ad hoc and managed services
- not just endpoint control
    - but co-existence of end control and edge (middlebox) control
- not just individual security / privacy
    - but co-existence of individual freedom and social/corporate control

- balance between approaches determined by natural selection
    - market or social (e.g. government) control
    - society & the economy: shaping the Internet and shaped by the Internet
    - requires multidisciplinary research teams

- imposing your political values through your design
    - just means your design will get distorted (if it's ever deployed)

- fine in theory, but where's the practice? [3] [4]
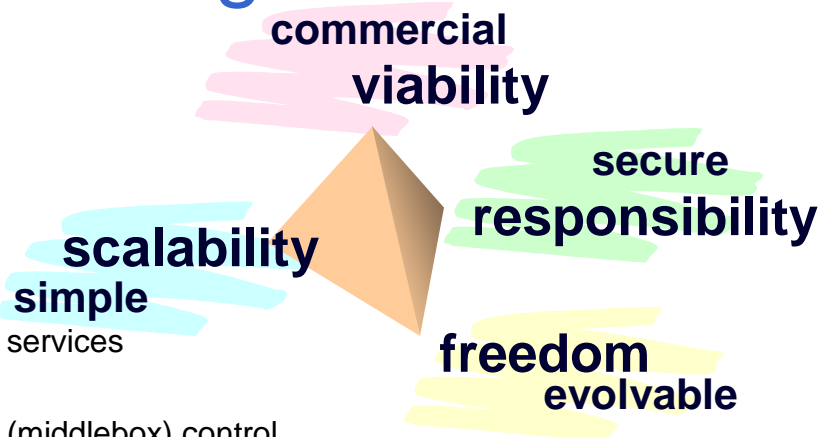
[3] Briscoe "Designing for tussle; case studies in control over control " (2004)
http://www.cs.ucl.ac.uk/staff/B.Briscoe/present.html#0406pgnet
[4] Communications Futures Programme & Communications Research Network
<http://cfp.mit.edu/> <http://www.communicationsresearch.net/>

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heterogeneity = multiple architectures?
heroic tussle or pathetic indecision?

- yes, at architecture design time

- yes for testbeds

- but, a spin-off from testbeds for real-life run-time? Please, no!

partitioned architectures

app written to
multiple APIs

architecture gateway
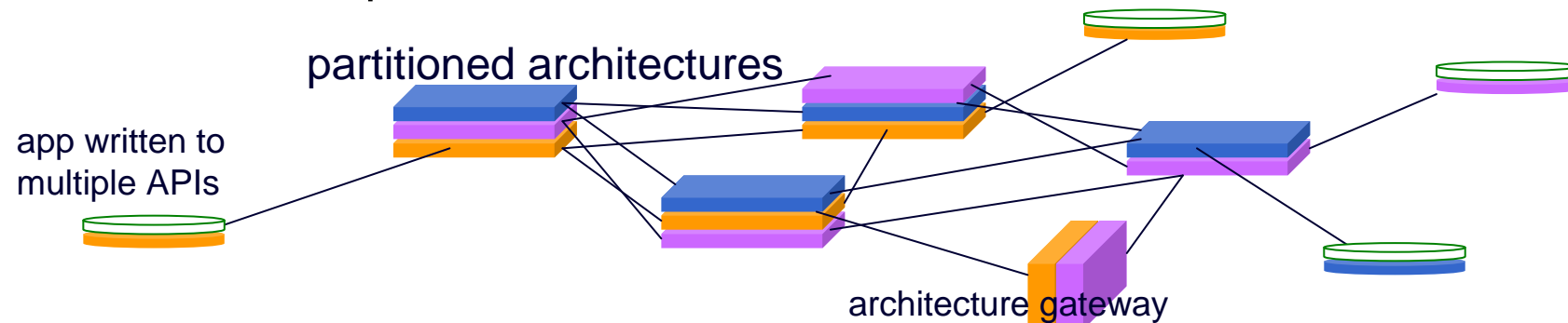
- for connected internetwork flows and routes must traverse all architectures

- inter-architecture resource control? routing?

- can't even solve these problems for one inter-domain architecture

- do we hear end-customers & app developers saying
  "If only we had multiple architectures"?

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implications for testbed design

- overlays not useful for e2e resource control expts

  - fine if focusing purely on naming, addressing, routing

  - care! architecture research will eventually need to be integrated

- traditional view of infrastructure testbed problem

  - need real applications, real users

- the fault in the Internet is the fault in our expts

  - our assumptions about operators, businesses, info svcs depts

  - we need real operators, real businesses, real info svcs depts

    - set policies with their own reputations and resources at stake

- the prize is true convergence, 3GPP/IMS, mesh, ISPs, NGNs

  - varying outcomes at the same time: 'design for tussle'

spare slide
my research agenda

Q&A

rebalancing research agenda priorities

- global scale asynchronous event messaging
  - short co-ordination /control messages (discovery, notification, synch, config)
  - control/co-ordination for lower layers (config, routing, failures) as well as apps
  - connecting the physical world to the information world – the Internet of things
  - overlay multicast not panacea for state scaling & many other problems [1]

- resource allocation / congestion control / fairness
  - longest lasting architectural vacuum – becoming acute
  - flow equality goal (TCP) root cause of many problems [2]
    - solutions [3] have been obscured by this dogma
  - hi acceleration for hi-speed short flows

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[1] Briscoe "The Implications of Pervasive Computing on Network Design" (2006)

[2] Briscoe "Flow rate fairness: Dismantling a religion" (Oct 2006)

[3] Briscoe et al "Re-feedback and re-ECN"

   <http://www.cs.ucl.ac.uk/staff/B.Briscoe/pubs.html>

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in summary

- eat your vegetables then you can have your dessert
  - have as much spice as you want on your vegetables
  - classic distributed computing problems to solve

- avoid sexy research fashions
  - active networks, multihop wireless, p2p overlays
  - *unless* treated as exemplars of the classic problems

- instead sex up the classic problems with some tussle

<www.cs.ucl.ac.uk/staff/B.Briscoe/>