FALLACIES IN DISTRIBUTED COMPUTING

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The network is reliable

- Servers may experience software failures
- Routers may drop packets due to buffer exhaustion
- Infrastructure: need hardware and software redundancy
- Software: deal with message loss
  - WS-ReliableMessaging: not persistent through node failures

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Latency is zero

- Okay on a LAN, not on a WAN
- More problematic than bandwidth
  - 30ms to send ping from Europe to US and back
- Minimize packet size
  - Want other side to start processing data quickly
  - Pipeline parallelism, need a LARGE window
- Can kill an AJAX application (backend latency)

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Bandwidth is infinite

- VOIP, video, IPTV pushing demands
- Packet loss limits bandwidth
  - Ex: NY/LA rtt = 40ms, say packet loss is 0.1%
  - Suppose MTU = 1500, throughput $\leq$ 6.5 Mbps
  - Suppose MTU = 9000, throughput $\leq$ 40 Mbps
  - Constraint is time to recover from packet loss
- Conclusion: maximize packet size!

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The Network is Secure

- Many defenses stop at the perimeter (firewall)
- Defense in depth:
  - Enclaves within enterprise network
  - Services should always validate inputs
  - Secure internal communications
    - Network level: IPsec virtual networks
    - Transport level: SSL/TLS

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Topology doesn't change

- Authentication & authorization:
  - Single sign-on, authorization server infrastructure
- Naming: Reference services by DNS name rather than IP address
  - But what if DNS name changes?
- Routing:
  - IP makes routing decisions on per-hop basis
  - WS-Addressing adopts same idea
  - Message broker/enterprise service bus
    - Publish-subscribe semantics

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There is one administrator

- Within an enterprise:
  - Database, web server, network, Linux, Windows, mainframe administrators
- Across enterprise boundaries:
  - Example: The cloud!
  - Something breaks, and you need to work with outside administrators to diagnose and fix
  - Upgrades and version compatibility

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Transport cost is zero

- Overhead of communication stack
  - Time to marshal/unmarshall
- Any network deployment requires cost-benefit analysis
  - Benefits of infrastructure
  - Costs of purchase, running, maintenance

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The network is homogeneous

- The motivation for CORBA
  - …and then SOAP-based Web services
  - …but Java EE and WCF Web services are not interoperable…
- Heterogeneity is inevitable with IT economics
  - Which technology would you like to be locked into today?

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Broad comments on RPC

- RPC is not very transparent
- Failure handling not evident
  - What to do with timeout?
- Performance work:
  - from 75ms RPC to RPC over InfiniBand with 75usec round-trip (later)

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