

E2E YATA

Joe Touch

Proj. Leader / Res. Asst. Prof.

Computer Networks Division

USC/ISI

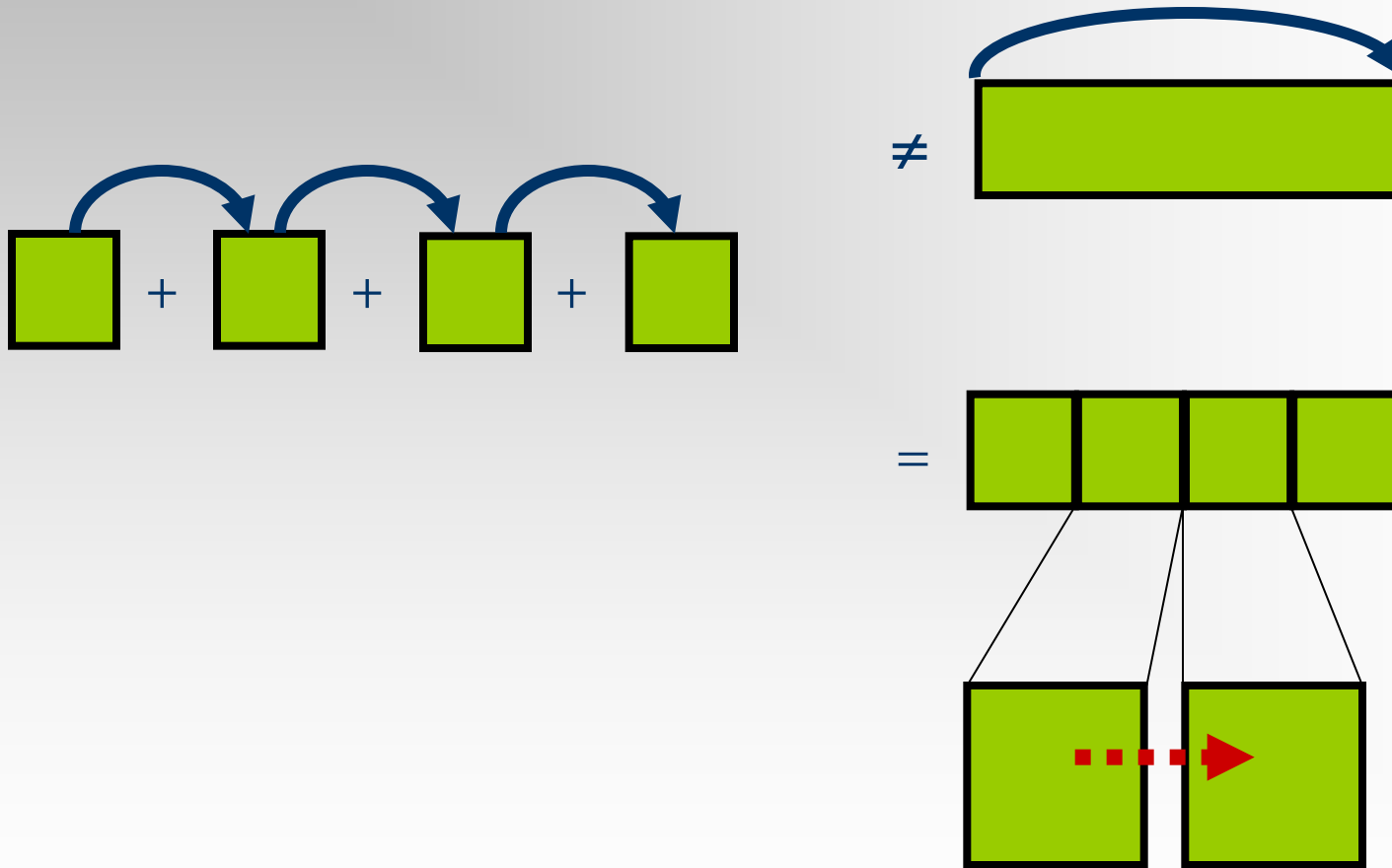
E2E Rules

- **E2E Principle:** End-to-end services cannot be provided solely by the composition of hop-by-hop services.
- **E2E Corollary:** Hop-by-hop services may be useful for performance, but they enhance, rather than replace, the corresponding end-to-end service.

E2E Misconceptions

- **E2E Only:** Do not replicate end-to-end services or features at the hop-by-hop level.
- **Everything E2E:** Implement all services or features end-to-end wherever possible.
 - Internet Architecture principle, I.e., “dumb core, smart edge”, simpler, more reliable core

The Gap



Benefits at each level

- E2E
 - Agility and flexibility of deployment
 - Simplicity and reliability of core
 - “Completeness” (avoids composition)
- HBH
 - Fewer connections (e.g., email)
 - Higher cache sharing (e.g., web)

Define “inside” router

- Topological
 - *At* the router
 - Storage – e.g., caching
 - Computation – e.g., transcoding, network management
- Functional
 - *In* the network layer
 - Network protocols – e.g., multicast, anycast
 - Forwarding, queuing algs. – e.g., RED

Why *IN* the network?

- Bandwidth
 - Don't have capacity to push function to the edge
 - E.g., multicast, caching, transcoding
- Latency
 - Don't have time to push function to the edge
 - E.g., application-specific routing, caching, transcoding, network management

Conclusions

- GOOD use
 - Correlates service with location properties
 - Is not particularly user or price related
- BAD (misuse)
 - As a blind rule against core services
 - As a blind rule which new applications or services violate to validate being ‘advanced’