



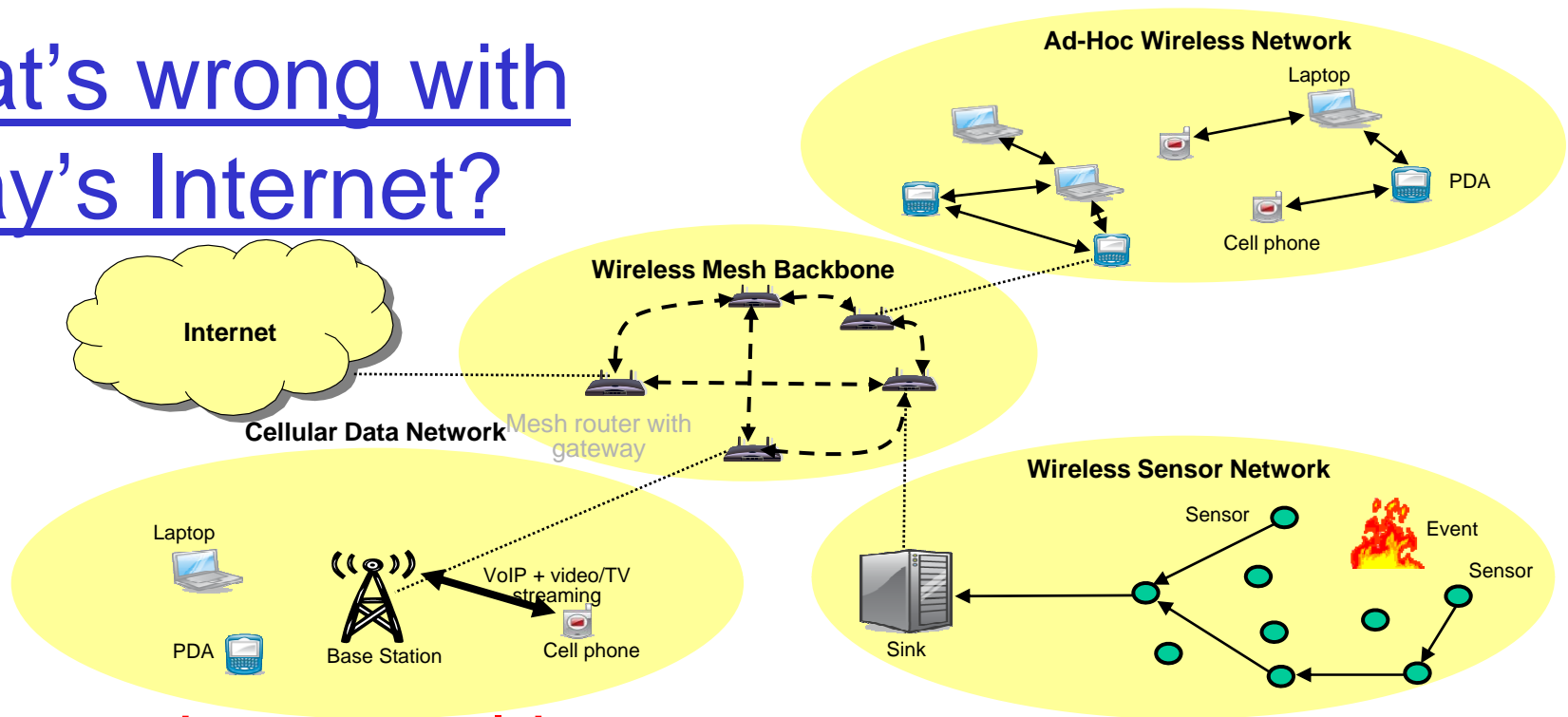
Recursive InterNetwork Architecture



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CS Seminar on Faculty Projects

What's wrong with today's Internet?



❑ The **new brave world**


- Larger scale, **more diverse** technologies
- **New services:** content-driven, context-aware, mobile, socially-driven, secure, profitable, ...

❑ Custom **point-solutions:** No or little “science”

- ❑ Lots of problems: Denial-of-service attacks, bad performance, hard to manage, ...

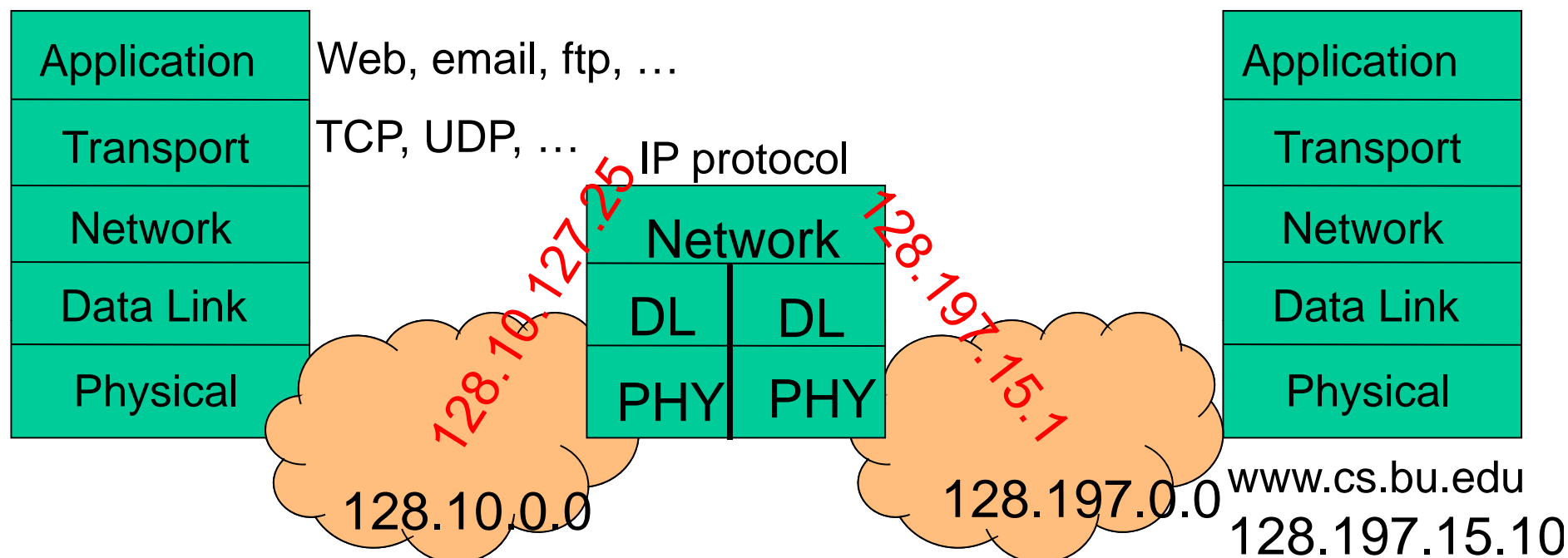
Questions?

- ❑ Is the Internet's architecture fundamentally broken that we need to “clean slate”?
 - Yes

- ❑ Can we find a new architecture that is complete, yet minimal? If so, what it is?
 - RINA? 

- ❑ Can we transition to it without requiring everyone to adopt it?
 - Yes

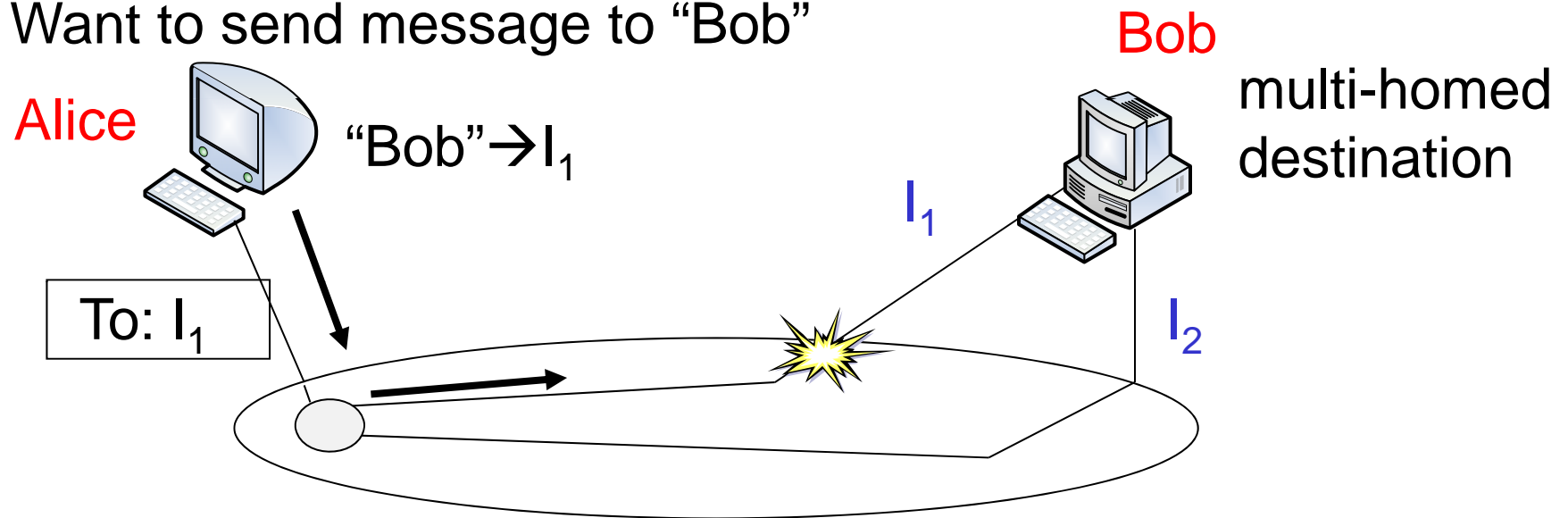
Internet's view: one big, flat, open net



- ❑ There's **no building block**
- ❑ The “hour-glass” model imposed a least common denominator
- ❑ We named and addressed the wrong things
- ❑ We exposed addresses to applications

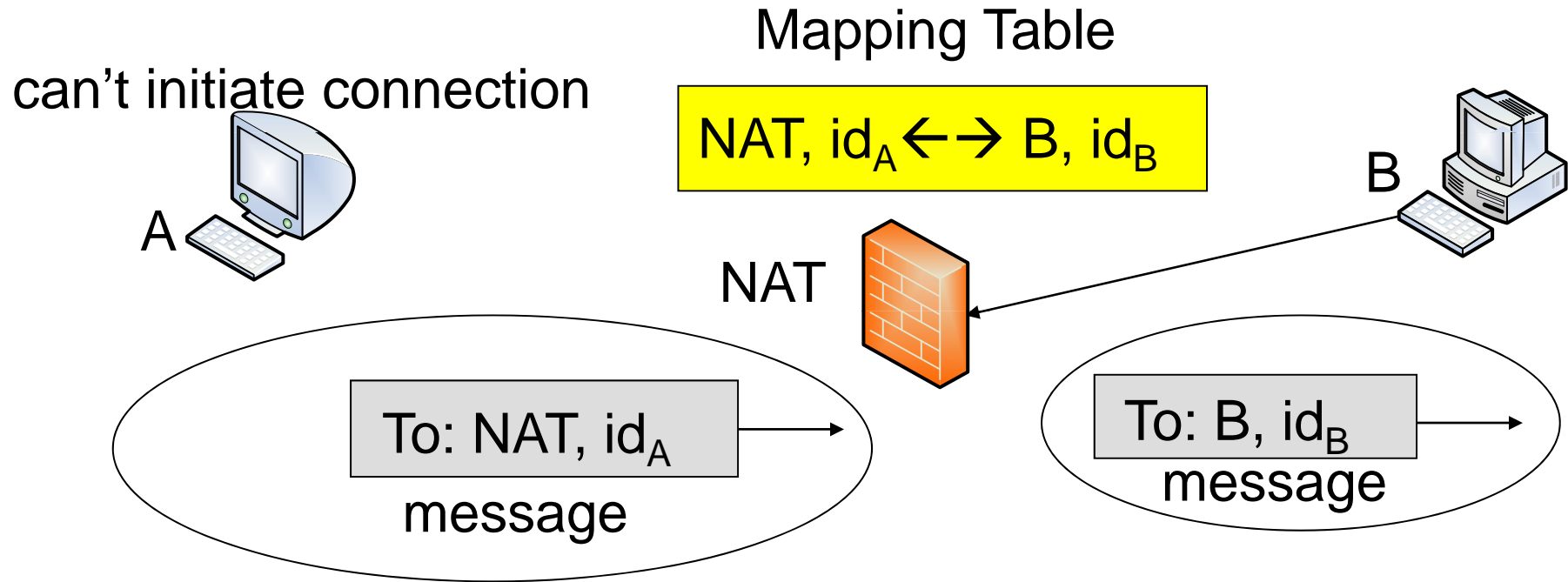
Ex1: Bad Addressing & Routing

Want to send message to “Bob”



- ❑ Naming “interfaces” – i.e., binding objects to their attributes (Point-of-Attachment addresses) – makes it hard to deal with multihoming and mobility
- ❑ Destination application process identified by a well-known (static) port number

Ex2: Ad hoc Scalability & Security

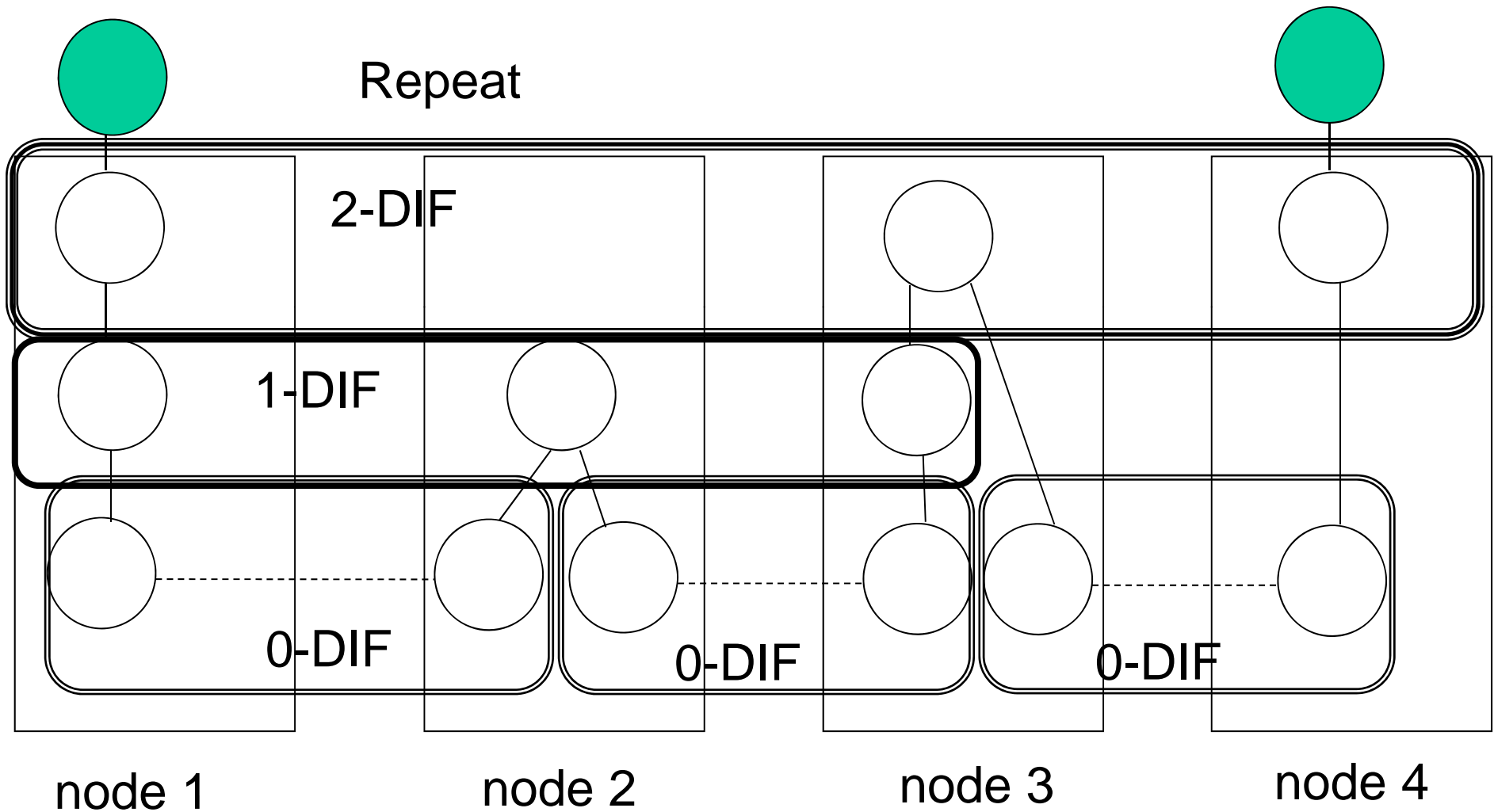


- ❑ Network Address Translator aggregates **private** addresses
- ❑ NAT acts as **firewall**
 - preventing attacks on **private** addresses & ports
- ❑ But, **hard to coordinate communication** across domains when we want to

Our Solution: divide-and-conquer

- ❑ Application processes communicate over (distributed) IPC facility
- ❑ How IPC managed is hidden → better security
- ❑ IPC processes are application processes of lower IPC facilities
- ❑ Recurse as needed
 - better management & scalability
- ❑ Well-defined interfaces → predictable service

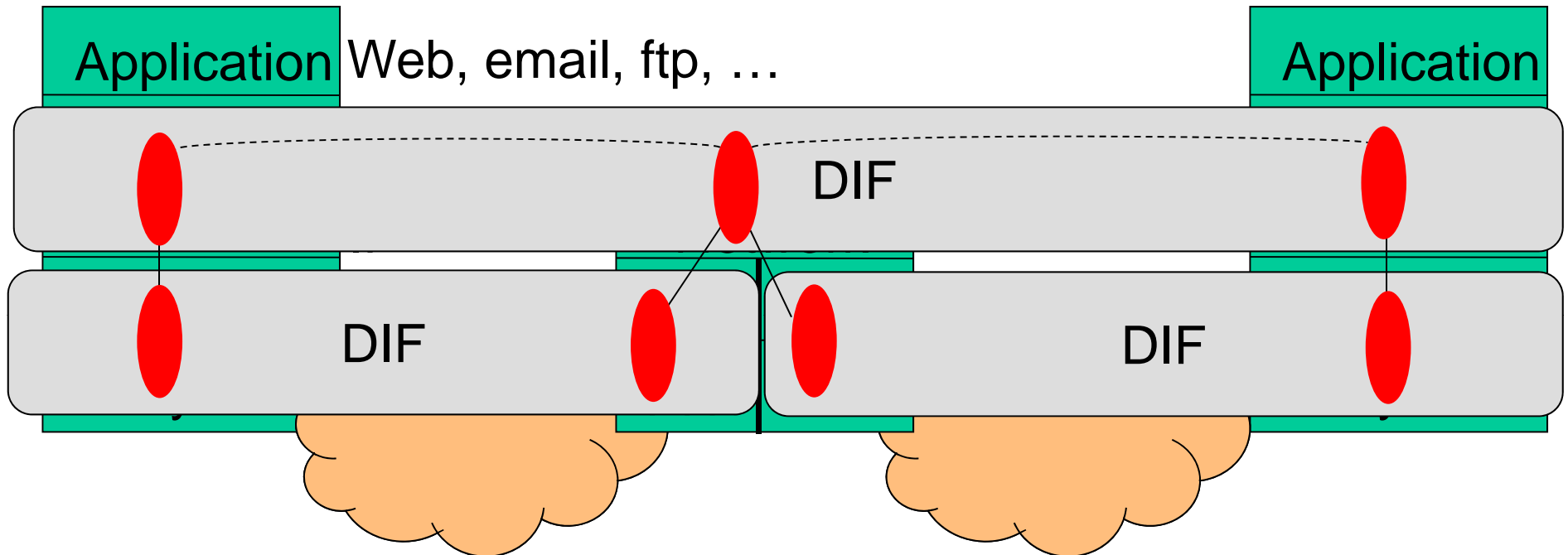
Recursive Architecture based on IPC



DIF = Distributed IPC Facility (locus of shared state=scope)

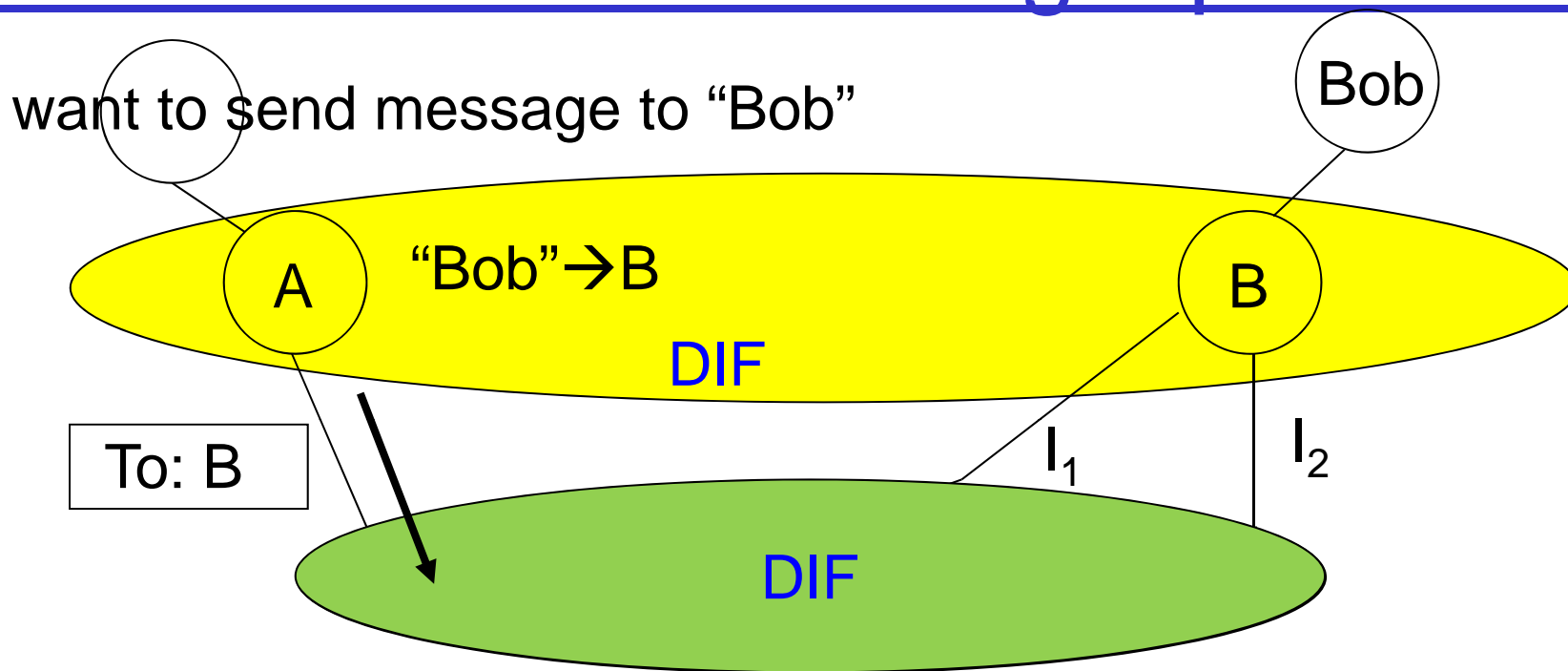
Policies are tailored to scope of DIF

RINA allows scoping of services



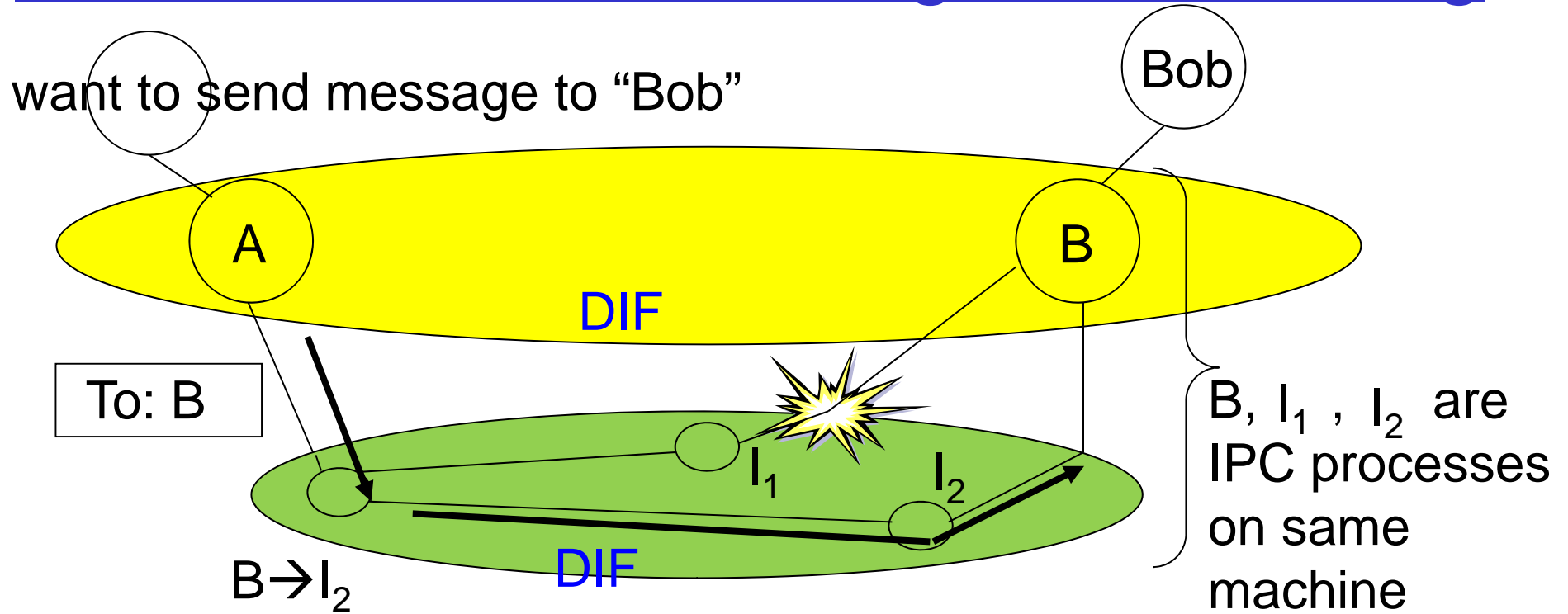
- ❑ The **DIF is the building block and can be composed**
- ❑ E2E (end-to-end principle) is not relevant
 - Each DIF layer provides service / QoS over its scope
- ❑ IPv6 is/was a waste of time!
 - We can have many layers / levels and not need too many addresses within a DIF layer

RINA: Good Addressing – private mgmt



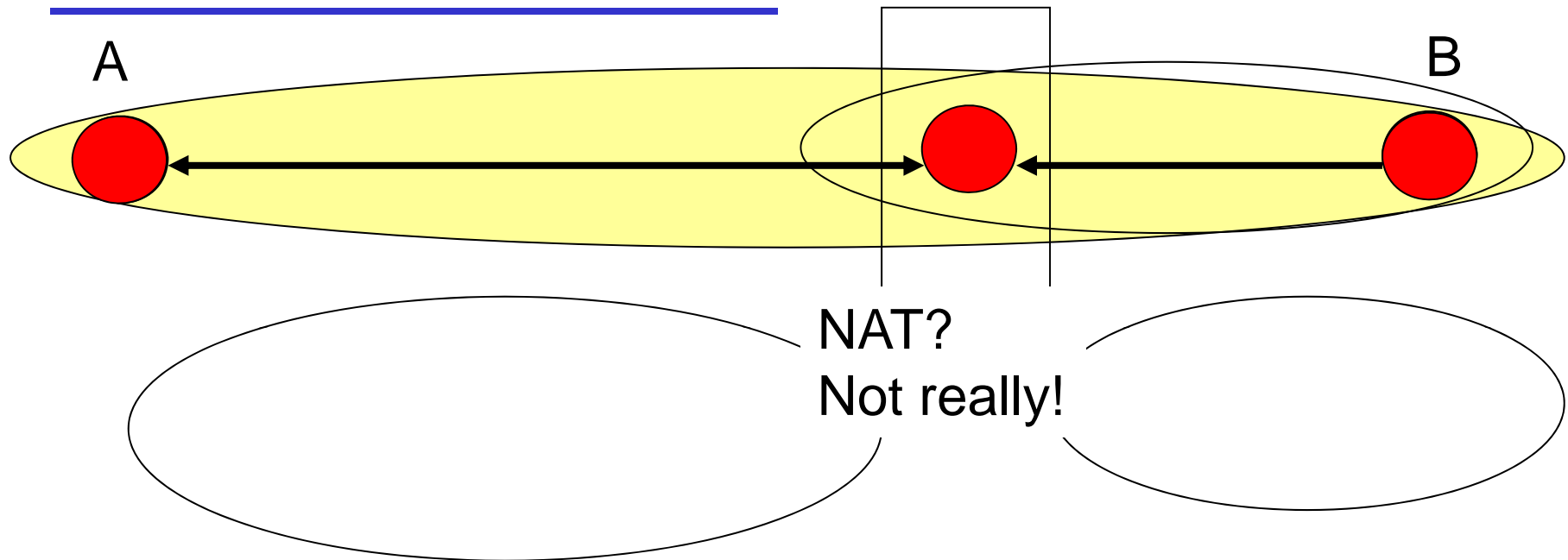
- ❑ Destination application is identified by “name”
- ❑ **App name** mapped to **node name (address)**
- ❑ Node addresses are **private** within IPC layer
 - Need a global namespace, but not address space
 - Destination application process is assigned a port number **dynamically**

RINA: Good Addressing - late binding



- ❑ Late binding of **node name** to **PoA (point-of-attachment)** address
- ❑ PoA address is "name" at the lower DIF level
- ❑ Node subscribes to different DIF layers

RINA: Better Scalability & Security – secure containers



- Nothing more than applications establishing communication
 - Authenticating that A is a valid member of the DIF
 - Initializing it with current DIF information
 - Assigning it an internal address for use in coordinating IPC
 - This is **enrollment**

Current / Future Work

- ❑ Complete specification of IPC mechanism (data transfer & control) and management (routing, security, resource allocation, ...)

- ❑ Prototyping and evaluation
 - Local testbed
 - Wide-area testbed: PlanetLab, GENI
 - Support for mobility, multihoming, service composition, ...

- ❑ Experiment with new services
 - E.g., EaaS (Enclave as a Service)

Collaborators

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More @
<http://csr.bu.edu/rina>