ICON:
Intelligent Container Overlays

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Motivation: Edge Computing

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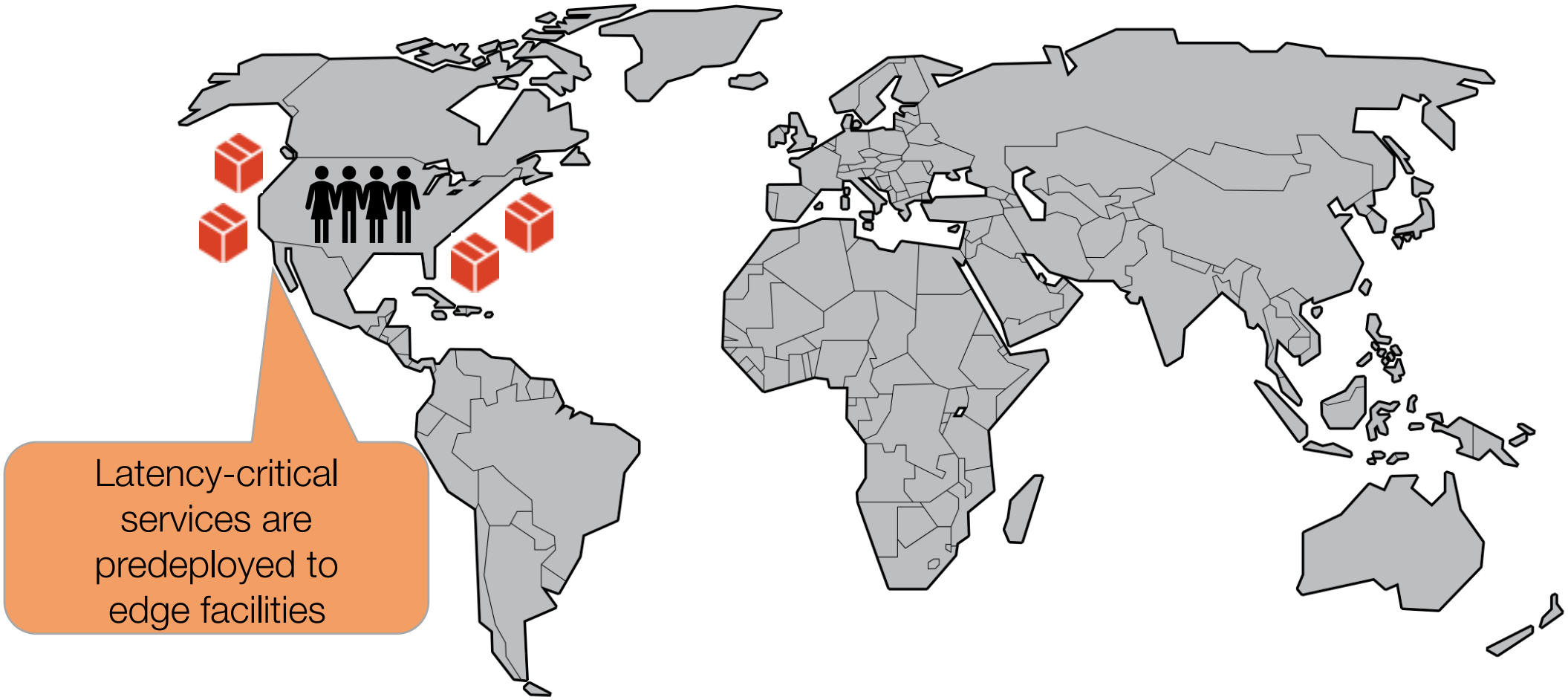

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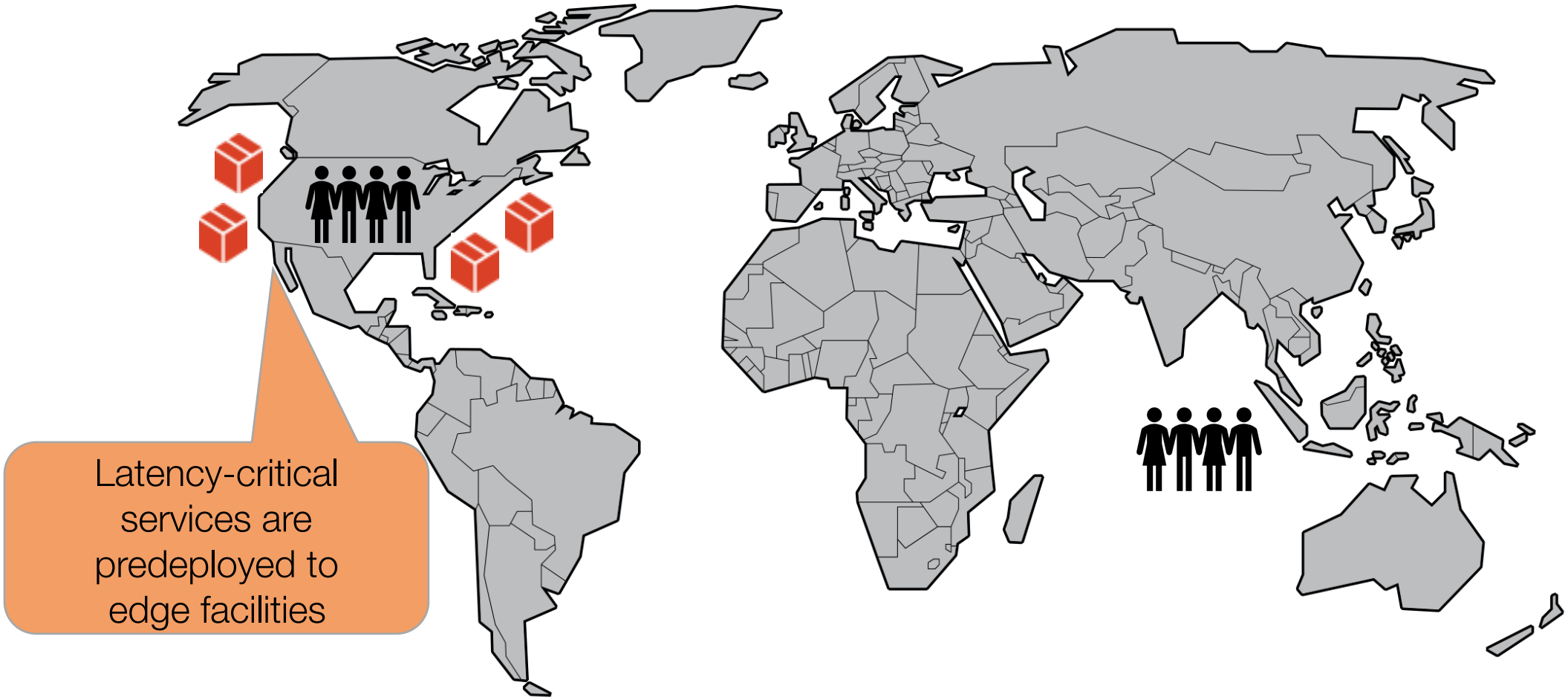

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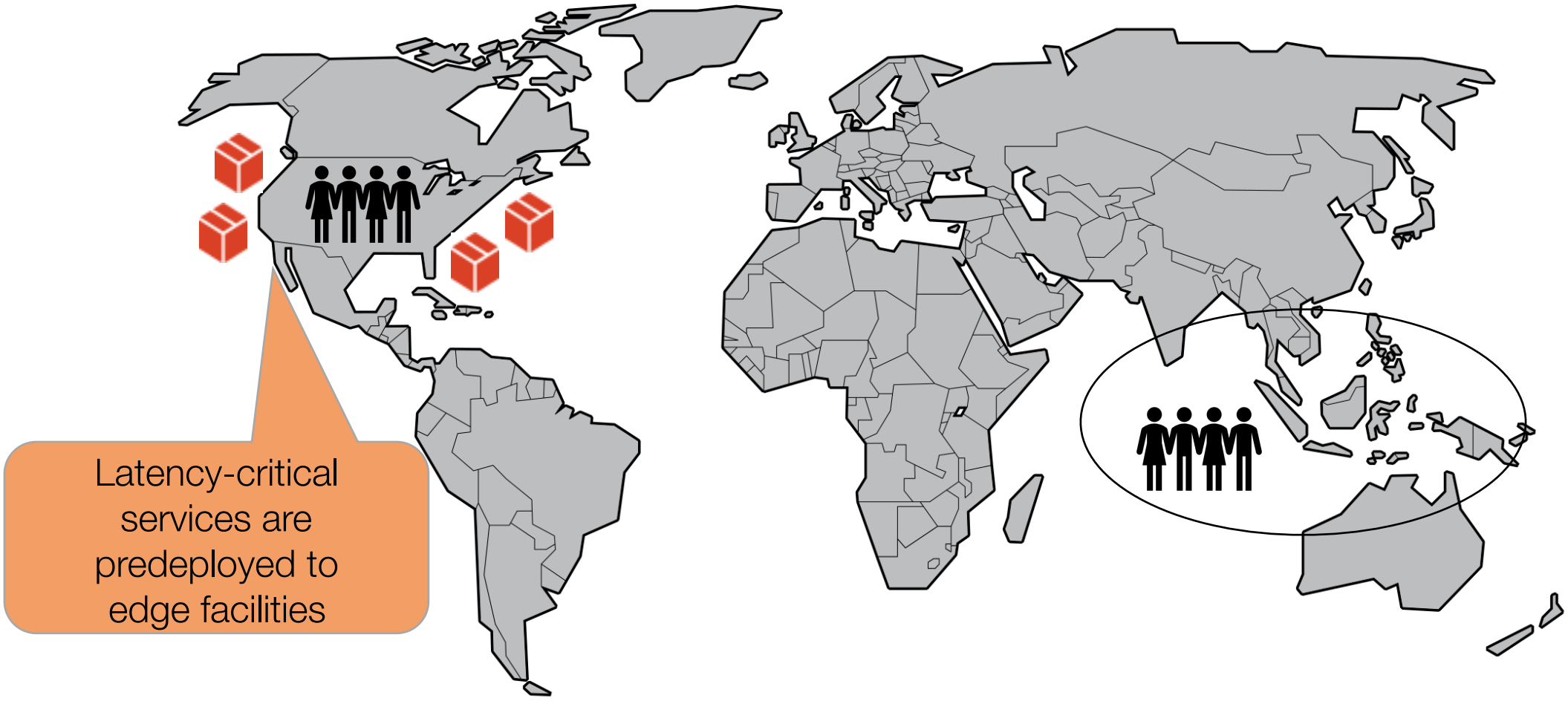

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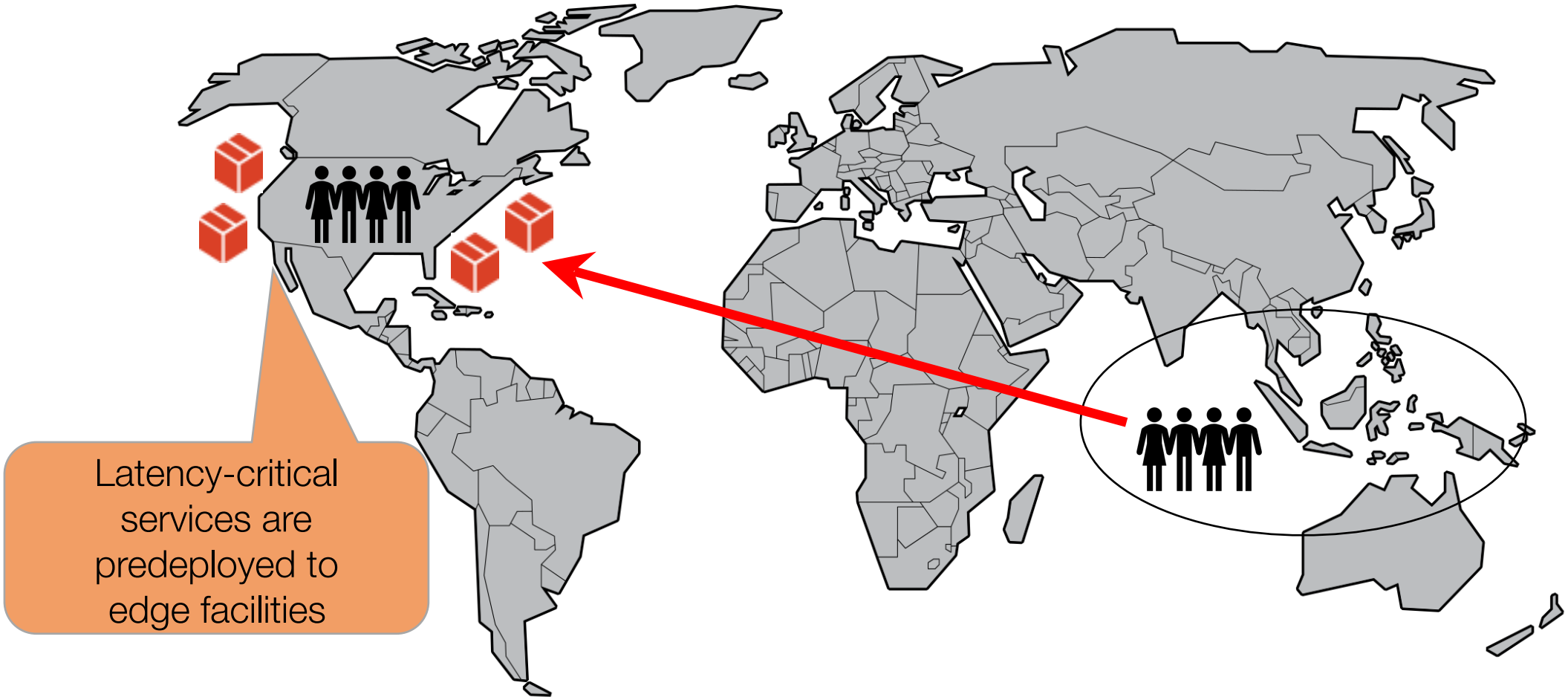

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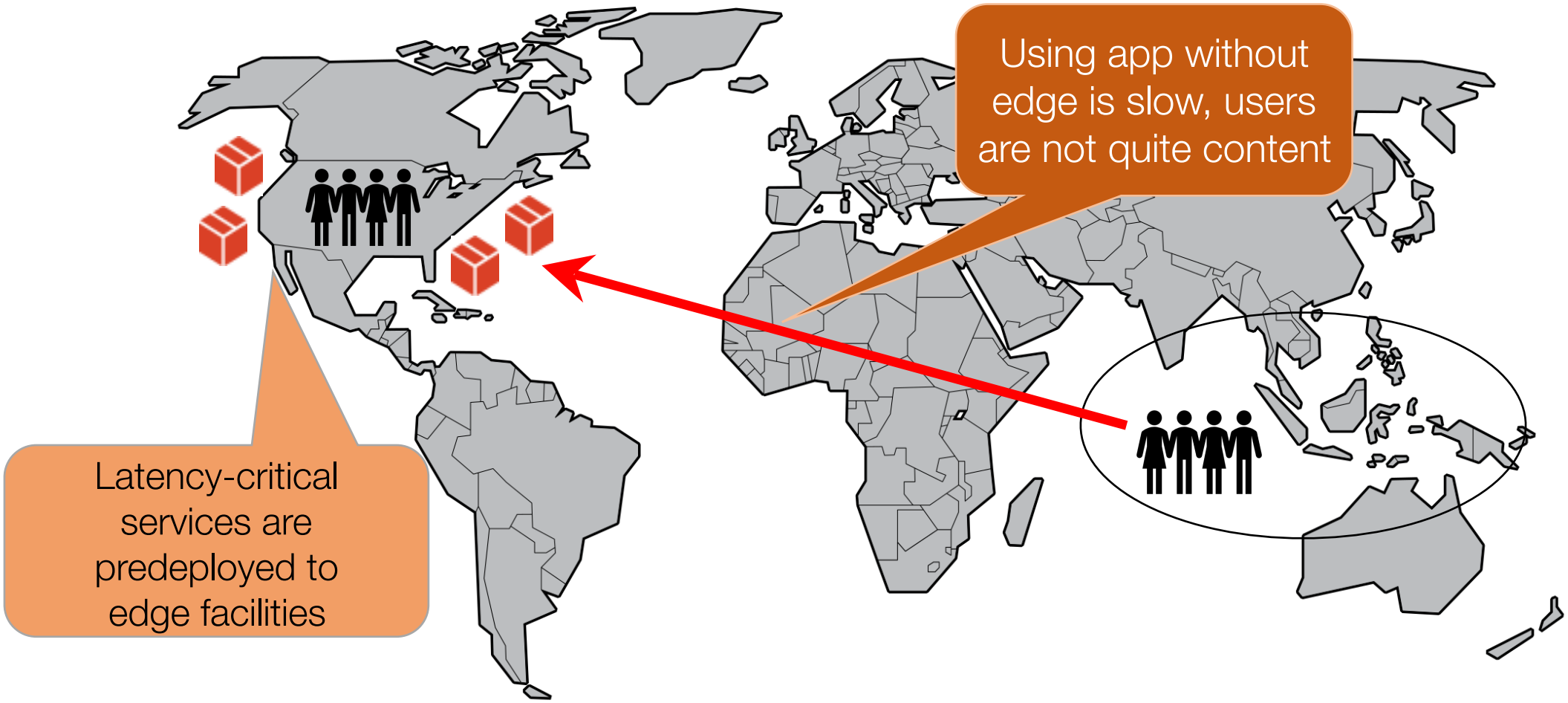

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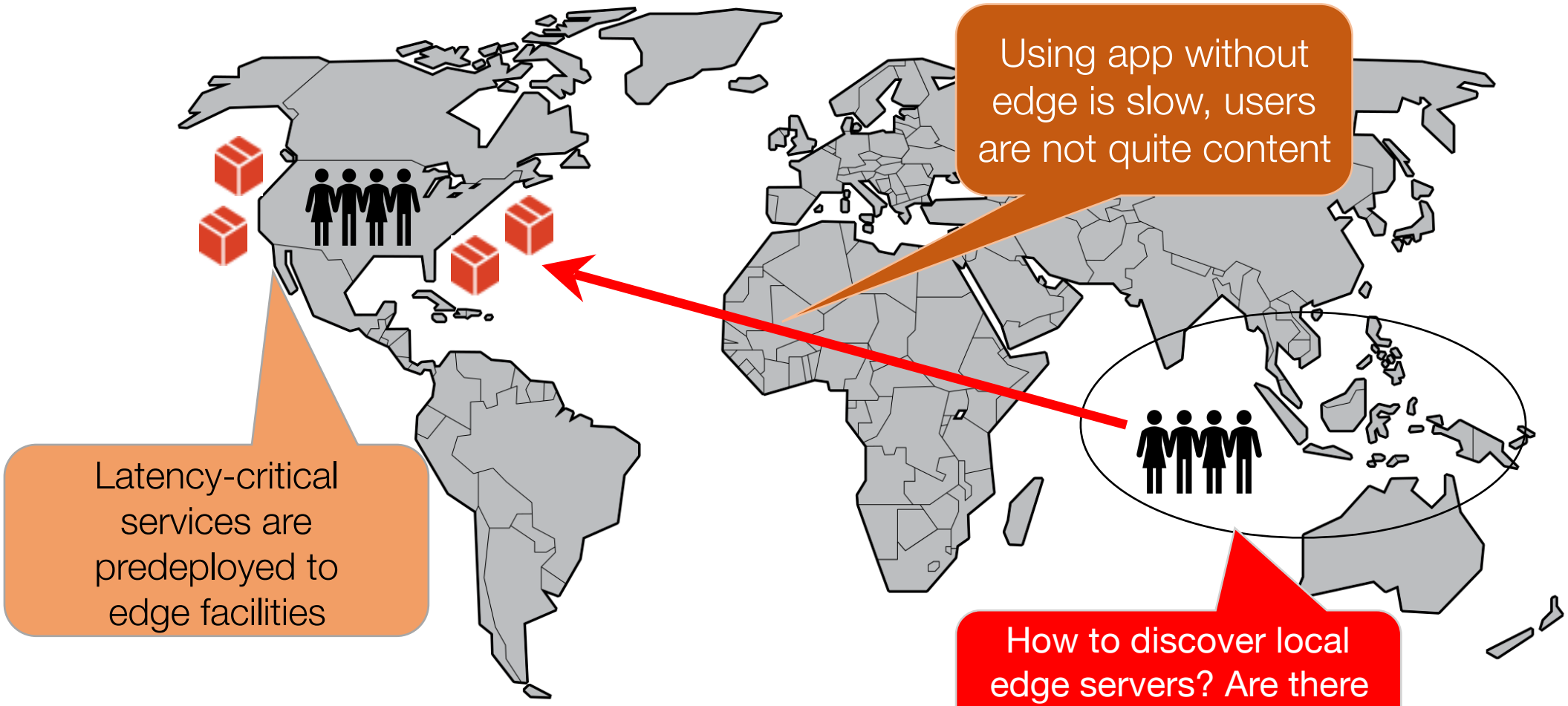

CDN for Services?

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NO!

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Open Standards

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Decentralized Solution

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Something like the Internet!

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- **Towards common standards of self-organized service provisioning on global scale**
- **Not only about the edge!**

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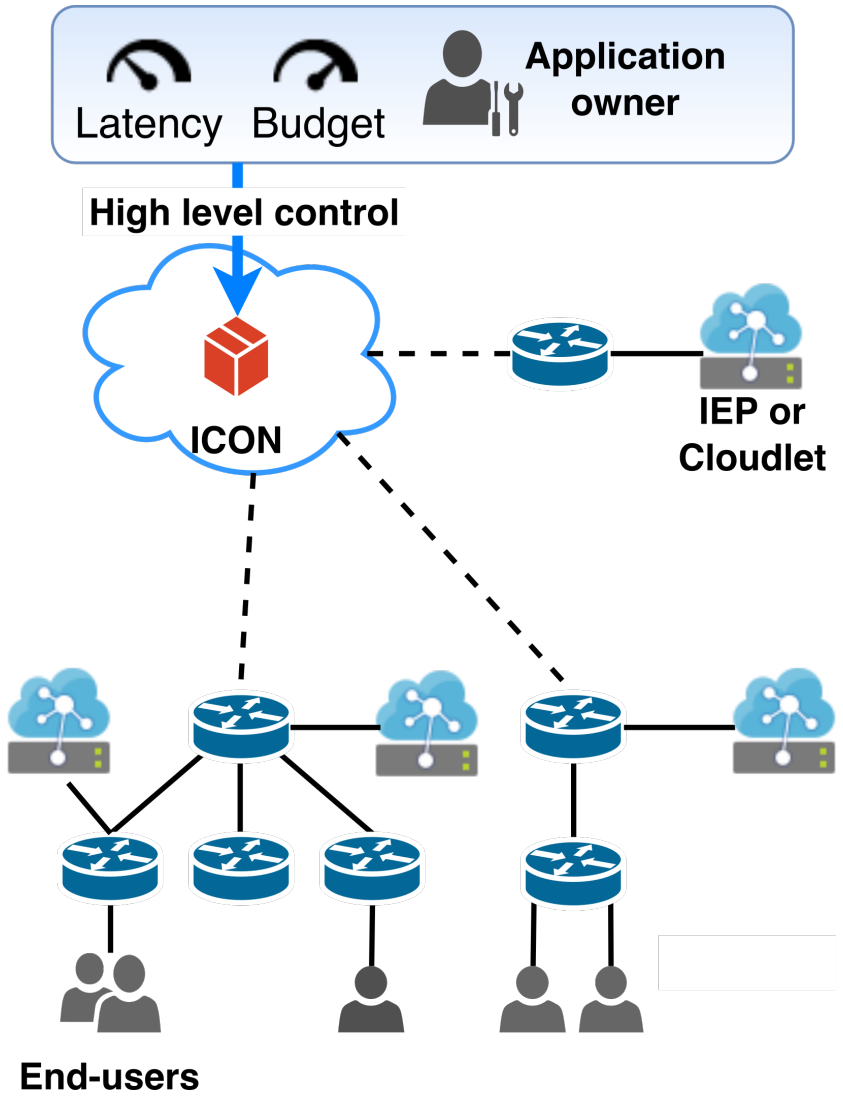
- **Capable of taking decisions and acting autonomously**
  - Migrates or replicates closer to end-users to satisfy, e.g., latency objectives
  - Terminates if utility falls below predefined threshold

Operation of ICON

- **Initially, ICON is in the cloud**
  - One or multiple origination points



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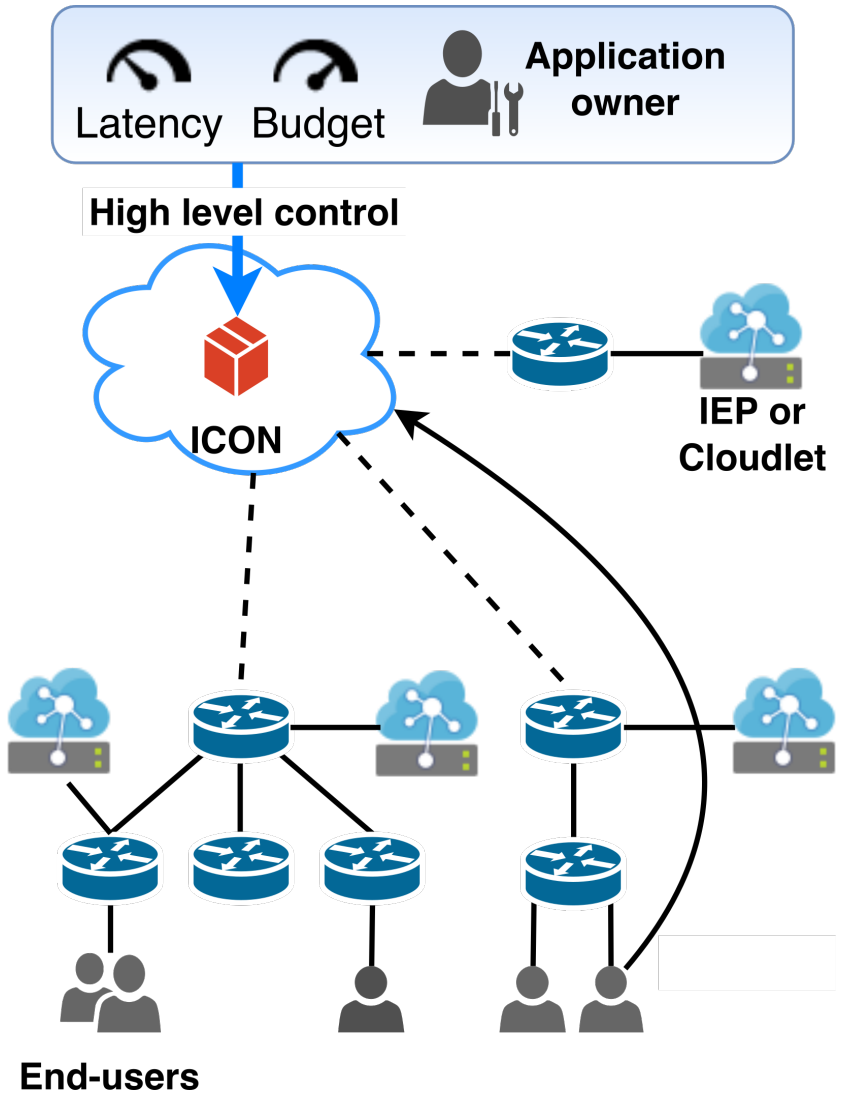

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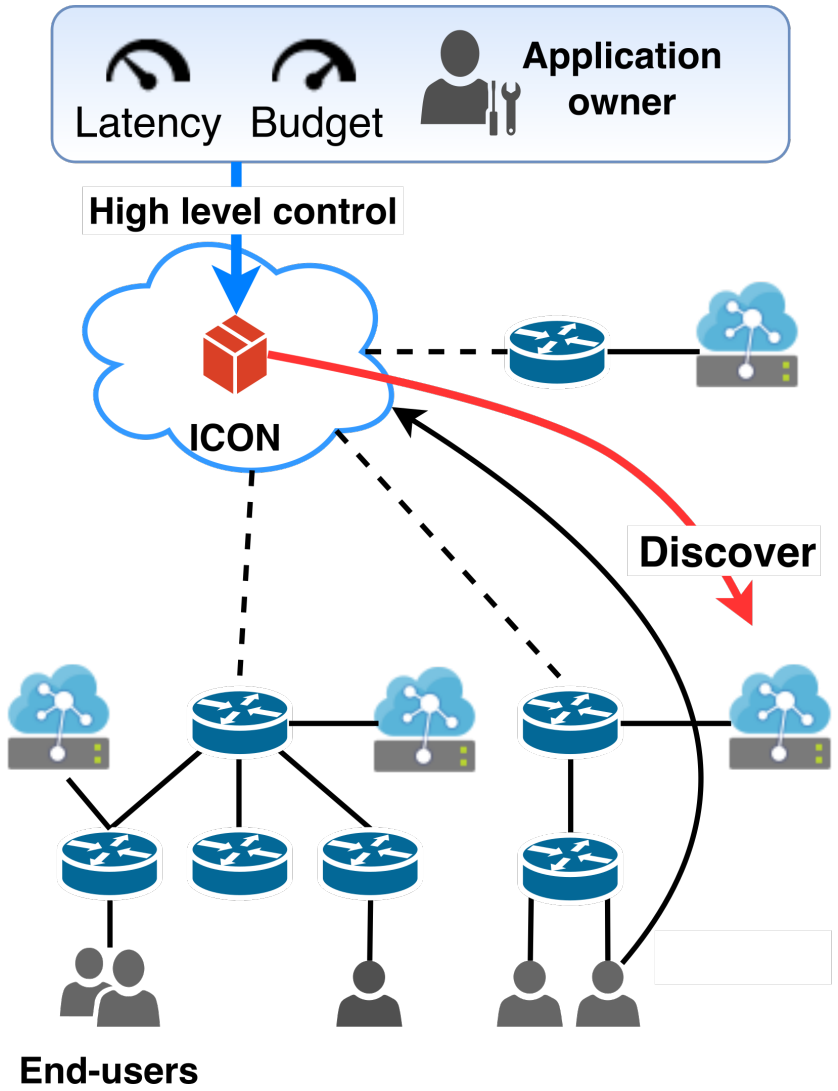

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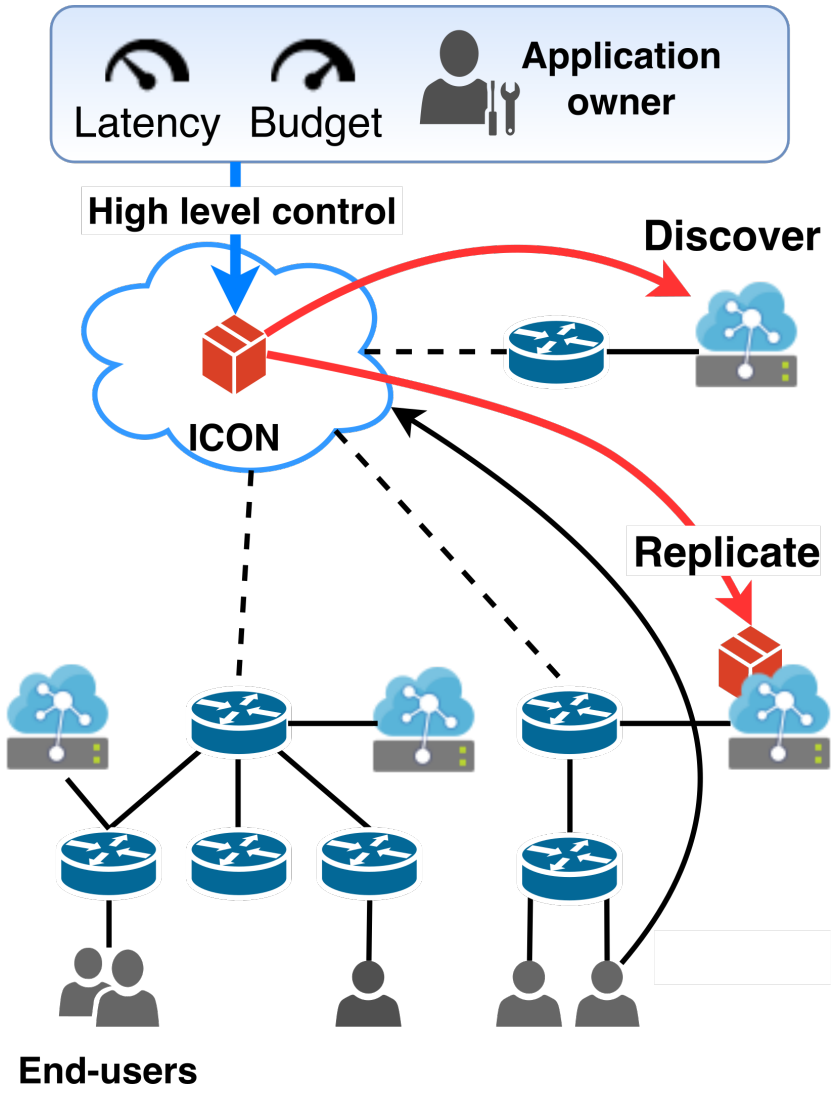

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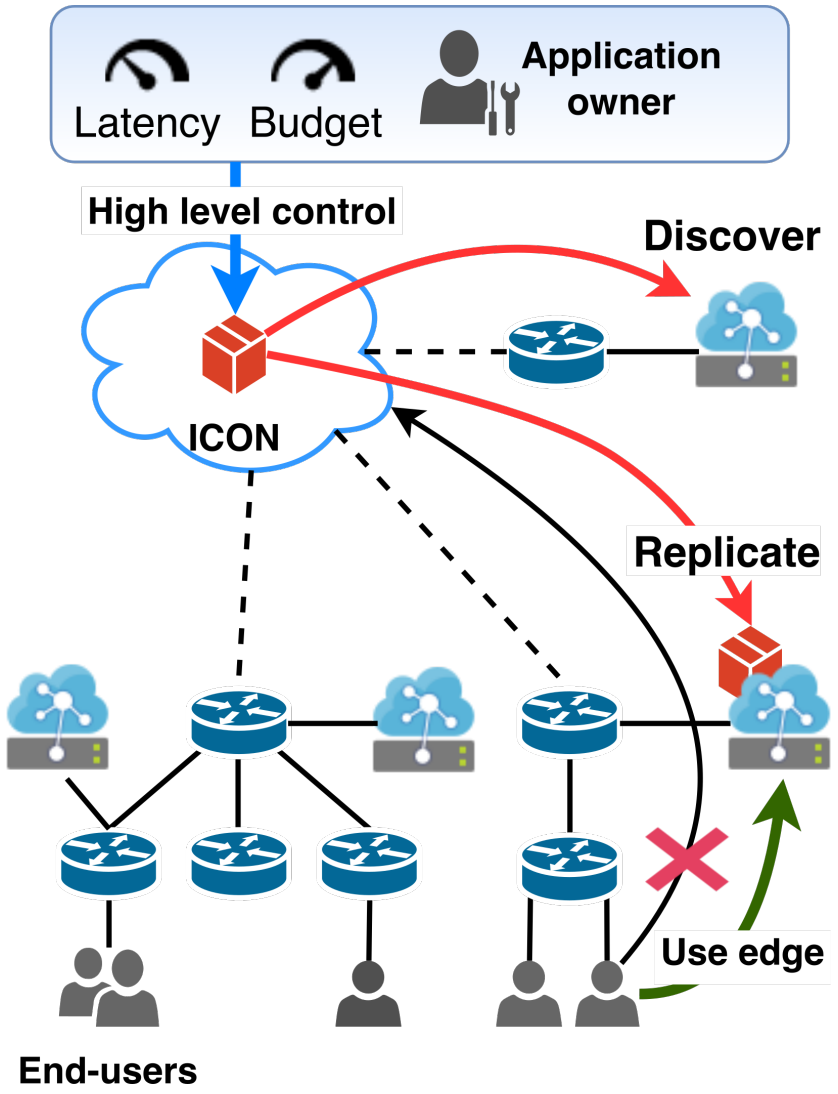

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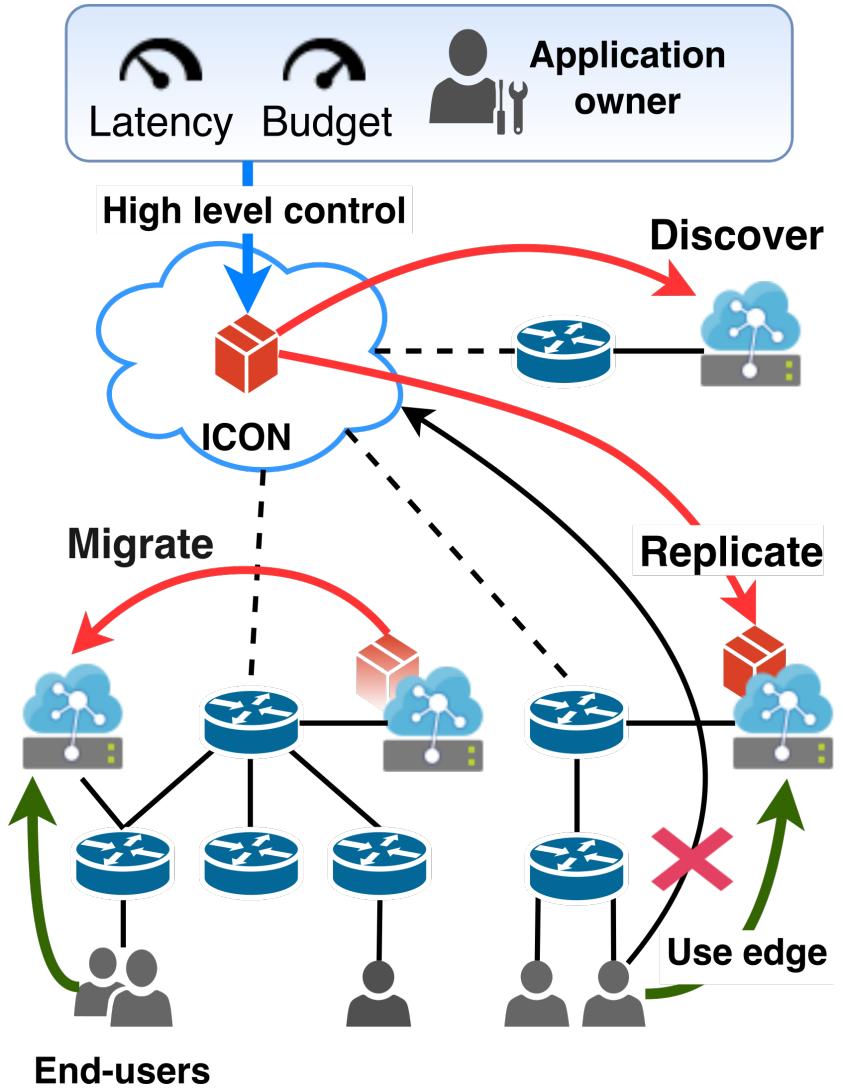
  - **Migrate closer to the end-users**



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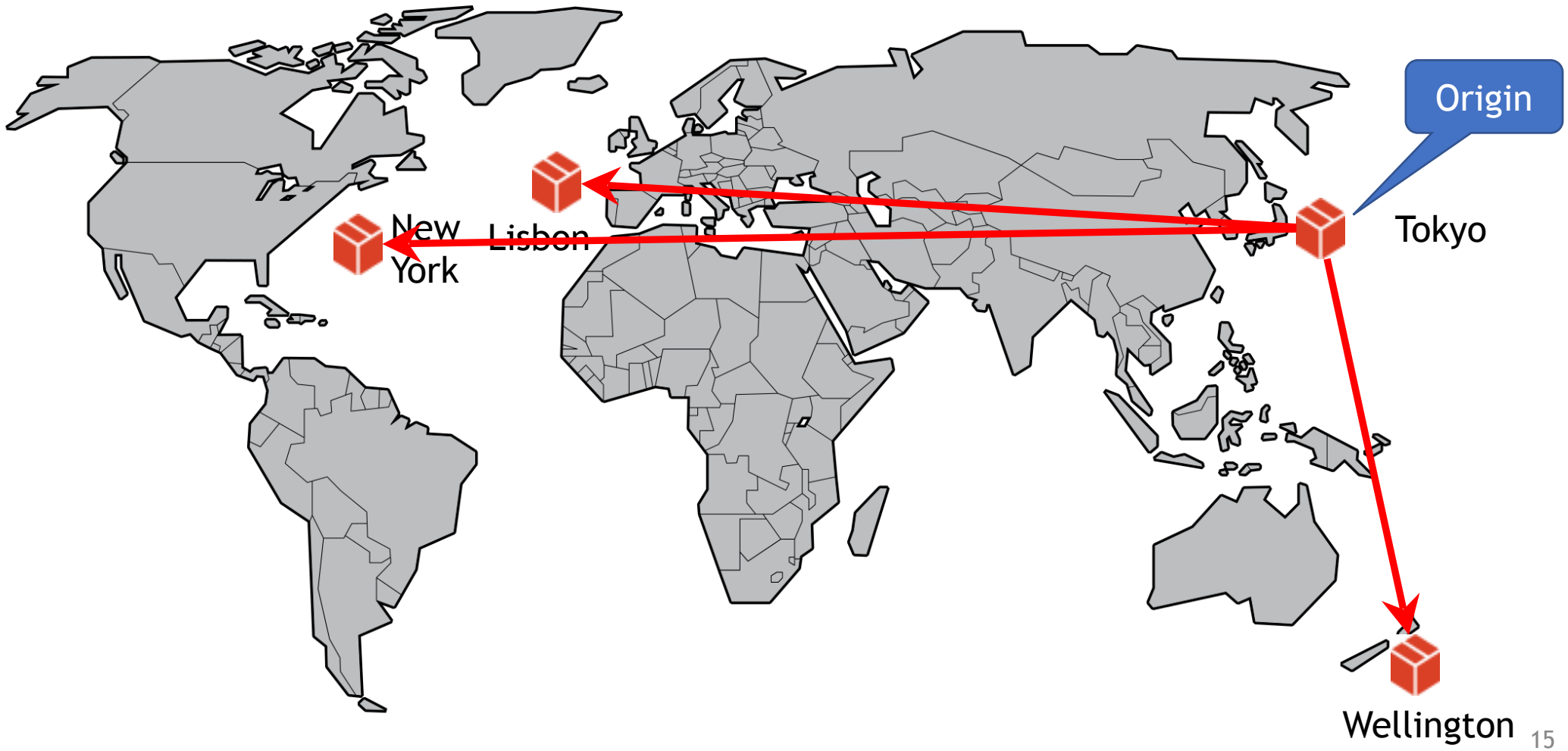

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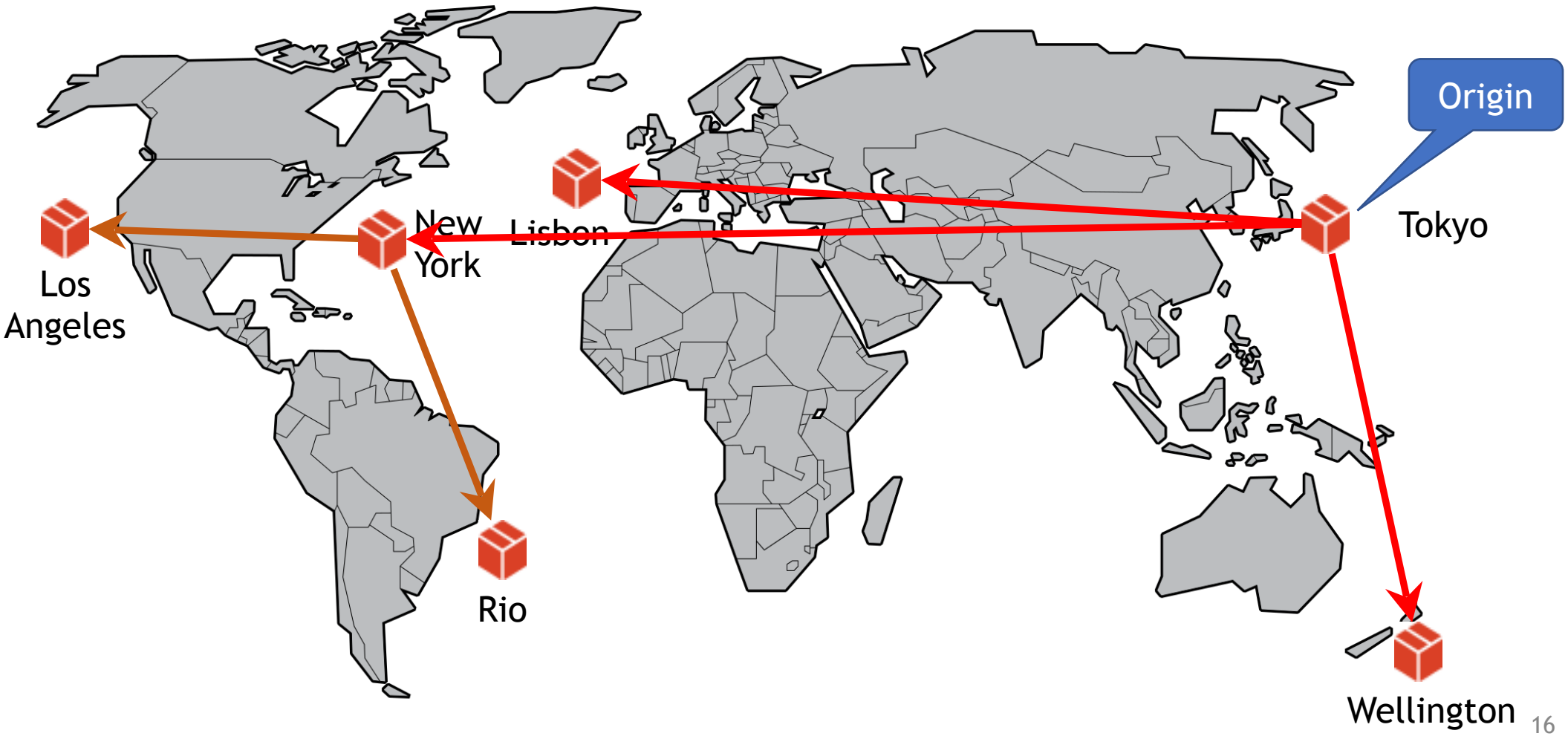
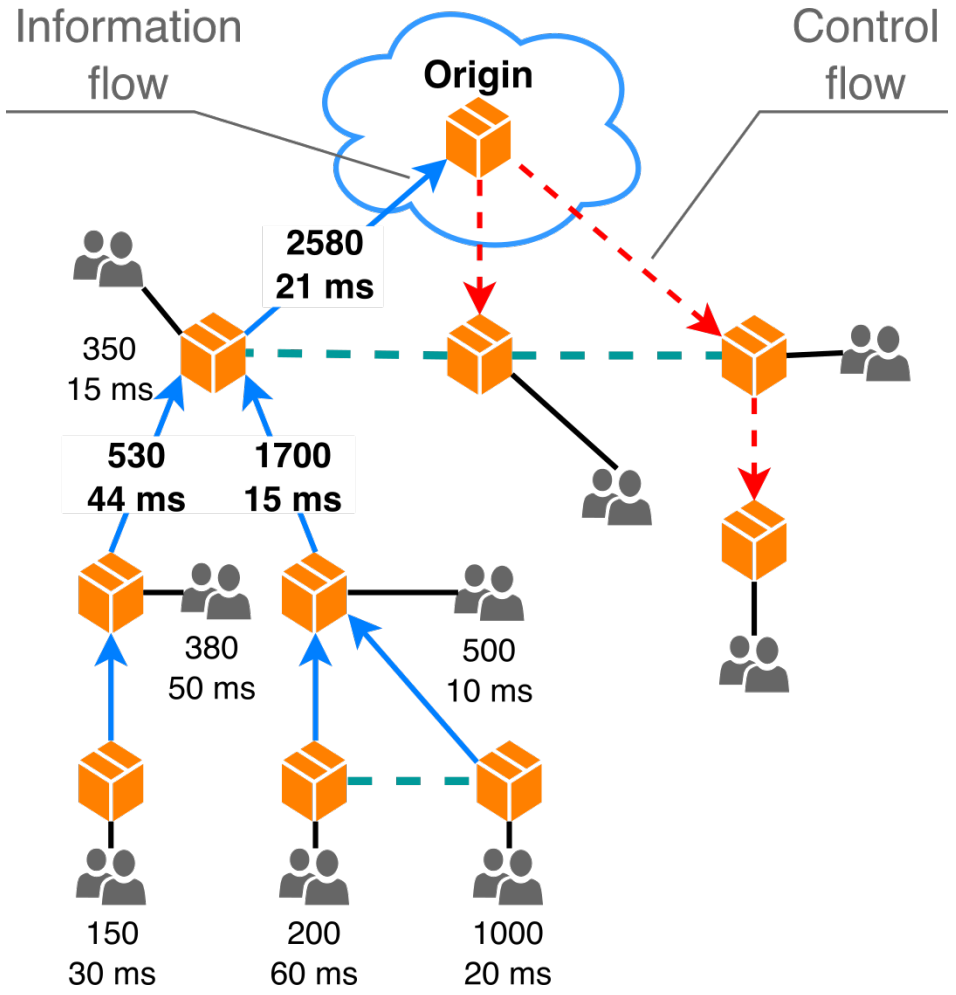


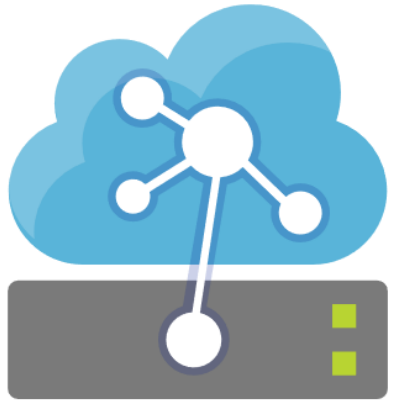
Overlay of ICONs

- Tree is formed organically as ICONs deploy replicas of themselves
  - Efficient for information propagation
- Coordination
- Control
- Other topologies are possible (e.g., swarm)



Independent Edge Providers (IEPs)

- Facility where ICON can deploy itself
- Can be:
  - Facility operated by a cloud provider (e.g., Cloudfront, Azure Stack)
  - Telco edge server (MEC)
  - Crowdsourced: iExec, Golem, etc.?
- Runs ***container yard*** application
  - Built on top of e.g., Kubernetes, Mesos or Docker Swarm
  - ICON negotiates with the yard on deployment timeslot, hardware resources, price, etc.
- Contractual agreements and transactions
  - Smart contracts are possible option



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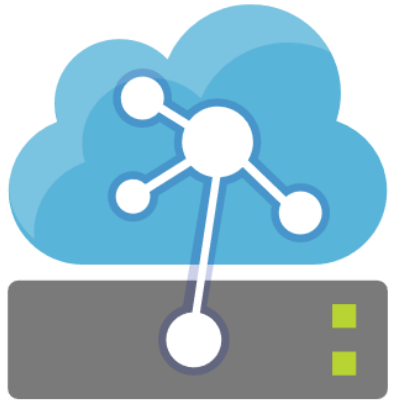

Anyone can establish an IEP

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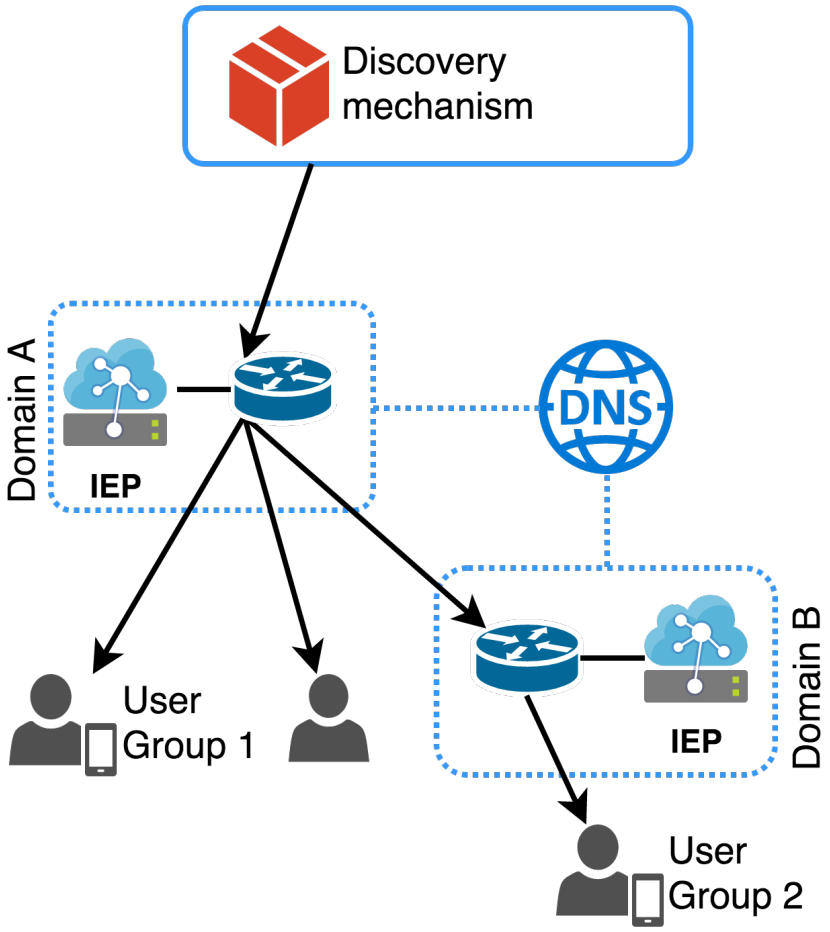
- Assumption: IEPs add **edge** SRV records to authoritative DNS servers of their domains



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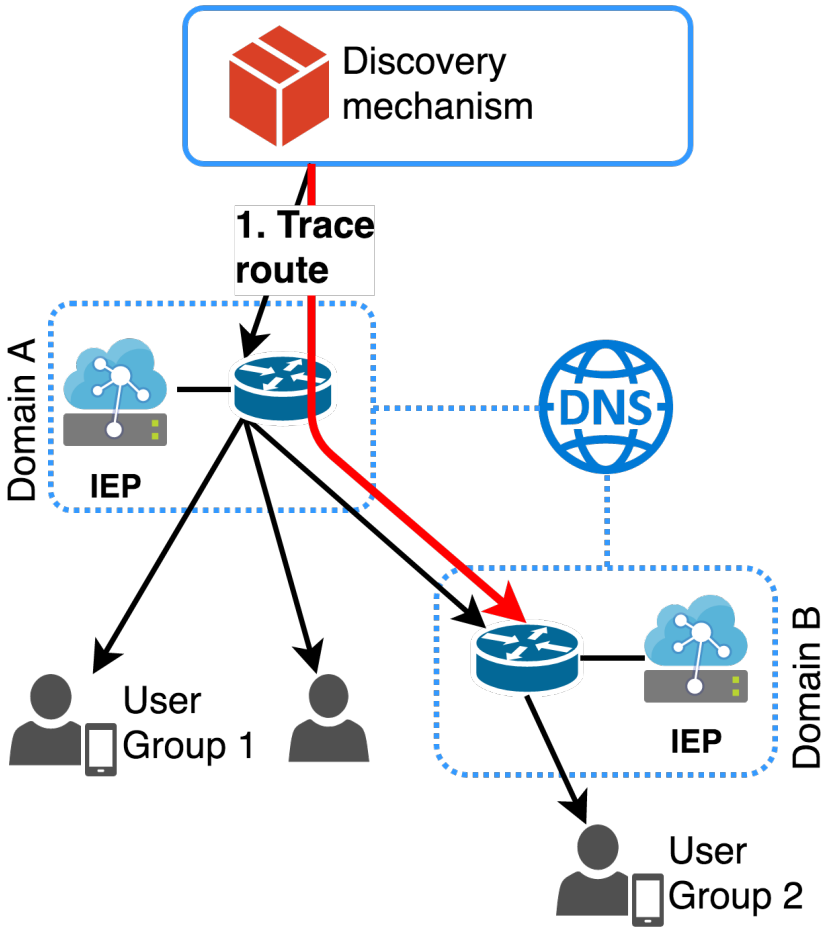

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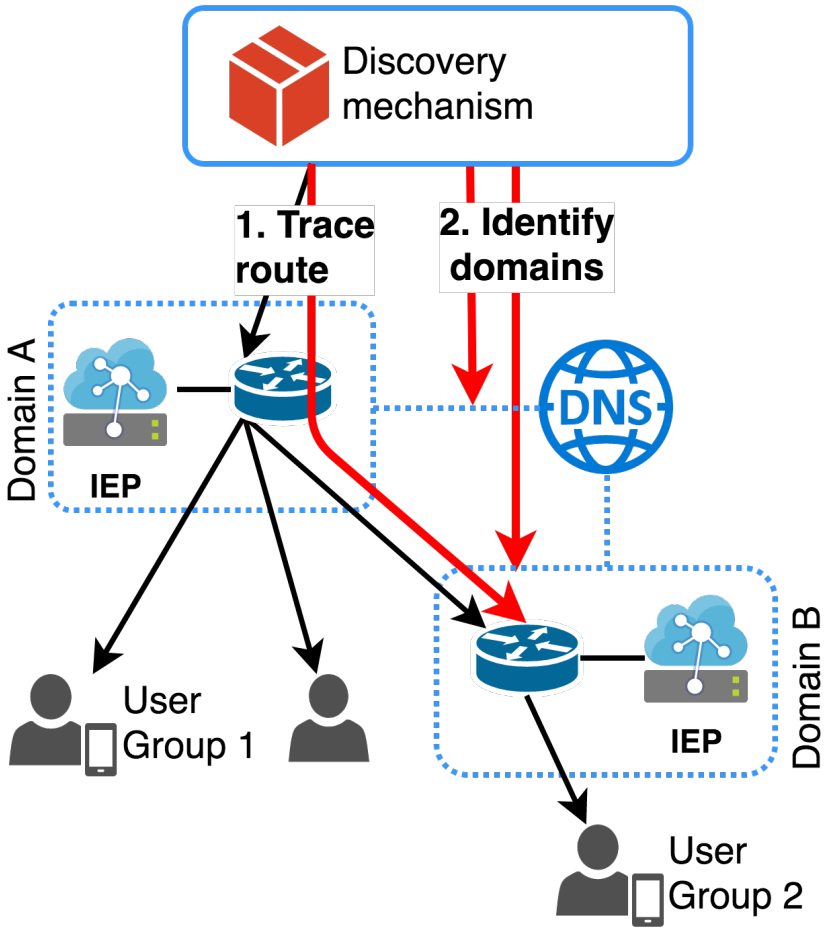

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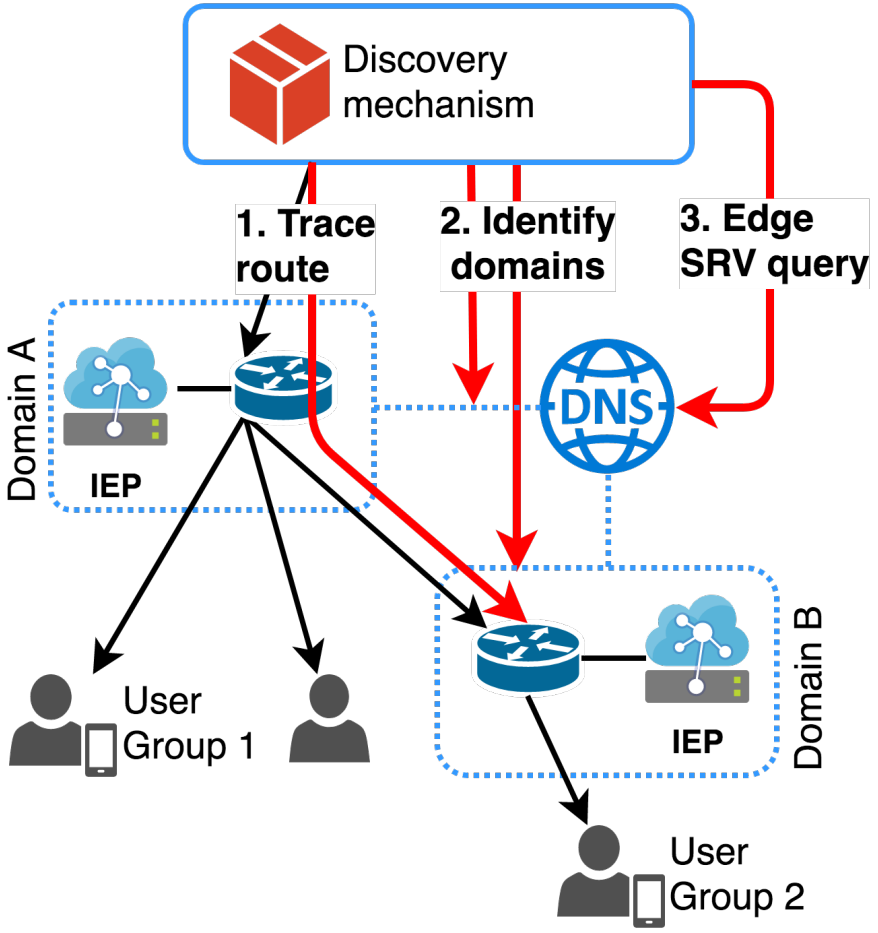

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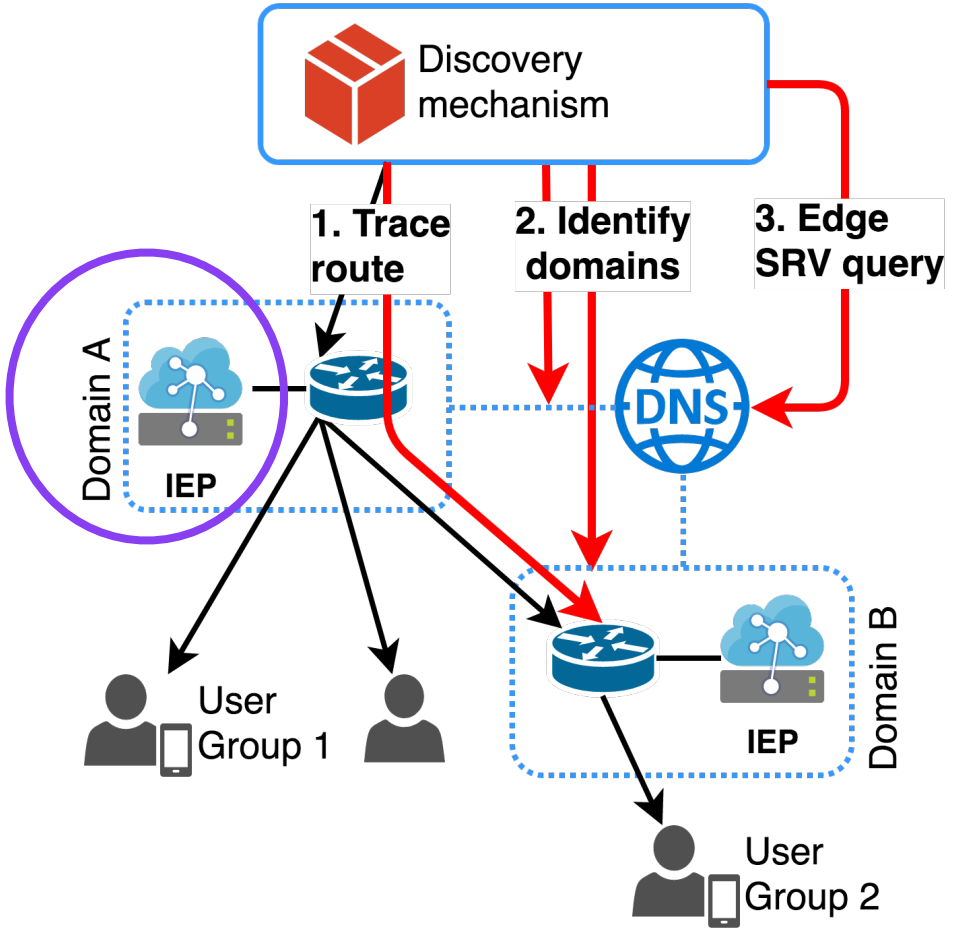

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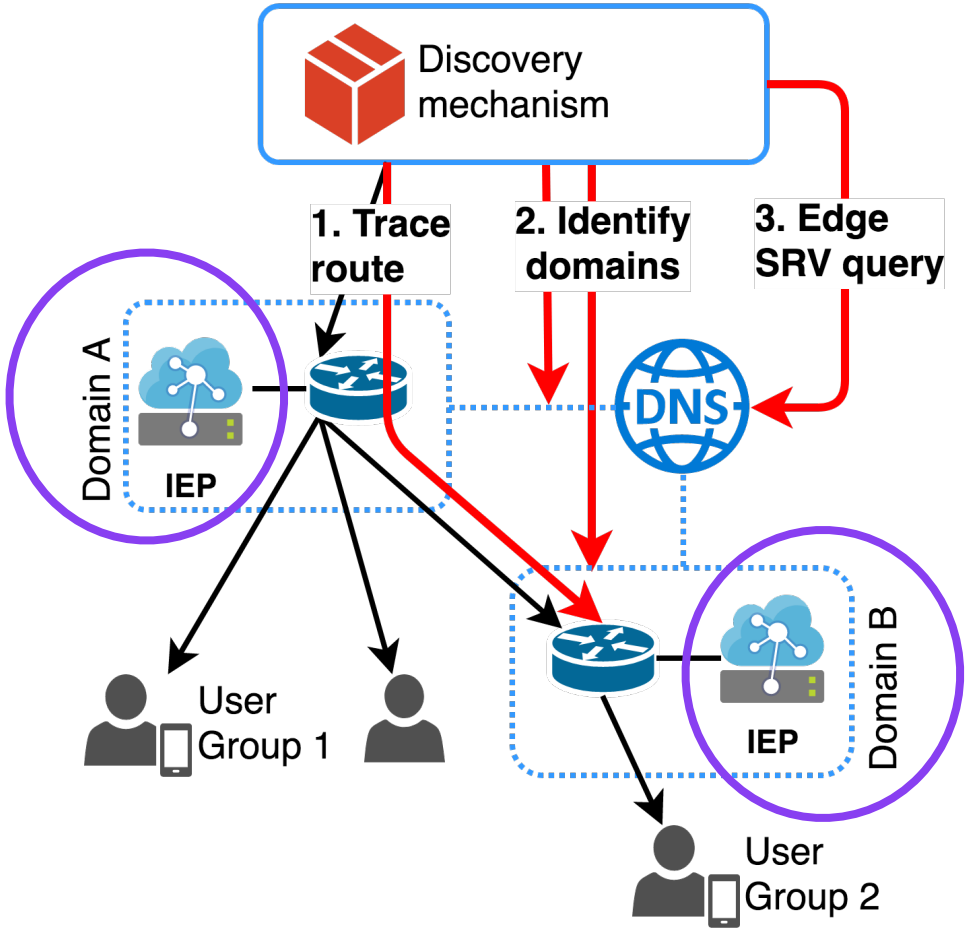

Intelligence of ICONs

- Easy version: Governed by utility function
  - Weights are “control knobs”, e.g., budget vs. latency
  - Application owner can also “hotswap” the entire utility function
- Thresholds: When expected utility of an action exceeds certain boundary value:
  - Replicate
  - Migrate
  - Terminate
- More complex version: Overlay forms a picture of the world and adapts the network as a whole

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- Contractual agreement between ICON and independent edge providers
  - Are smart contracts the best option?

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- Specialized ICONs forming chains of services, and multitier apps
  - Not limited to edge, e.g., a database may also be packed as ICON
  - How to coordinate?

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