



Layers and levels

Models of analysis

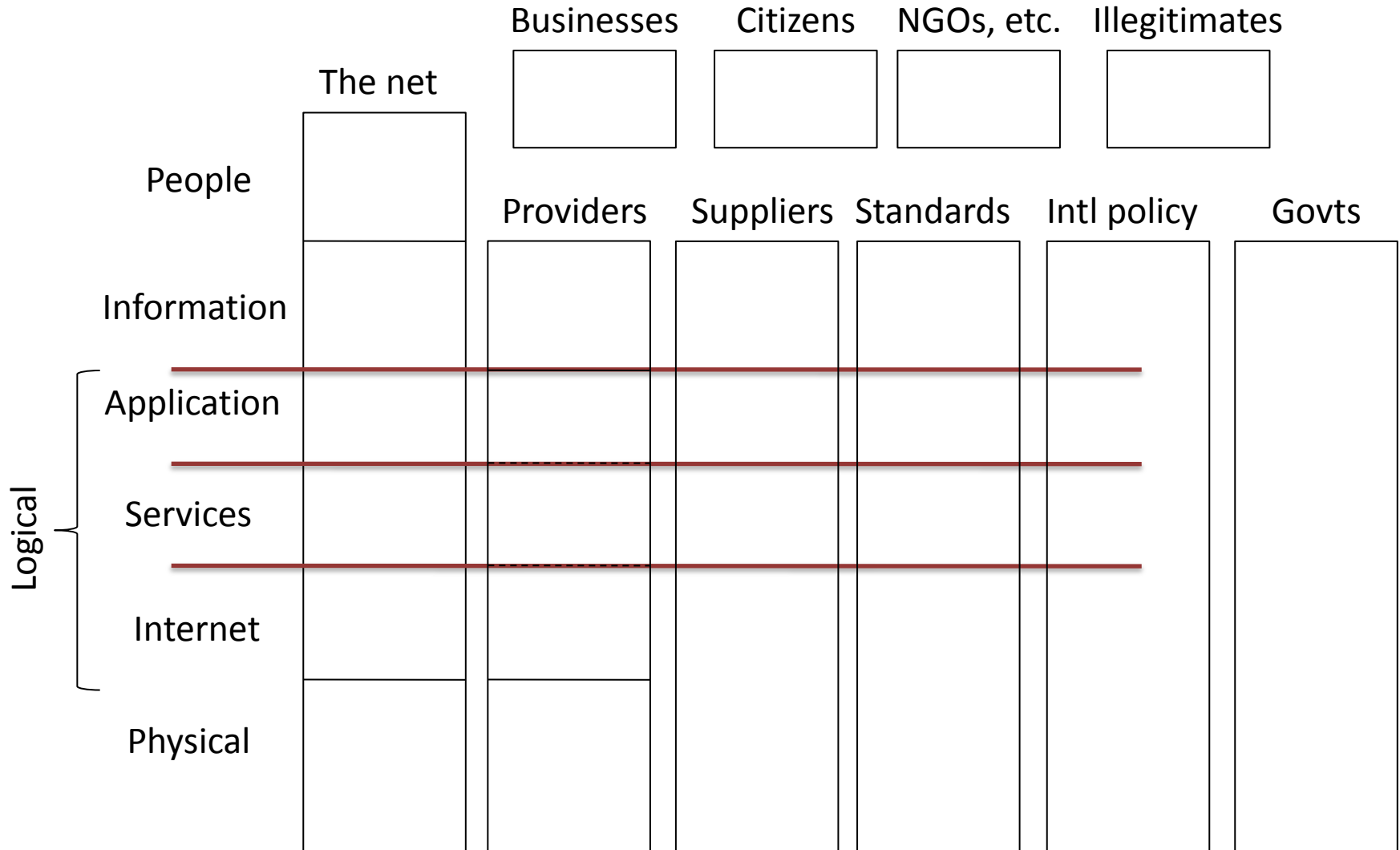
17.447/17.448

Fall, 2011

Review

- In our last meetings we have presented two tools of analysis for our work.
 - A layered model of cyberspace
 - A model familiar to computer science.
 - Levels of analysis
 - A model familiar to political science.
- The goals today
 - Elaborate these models.
 - Link them together.

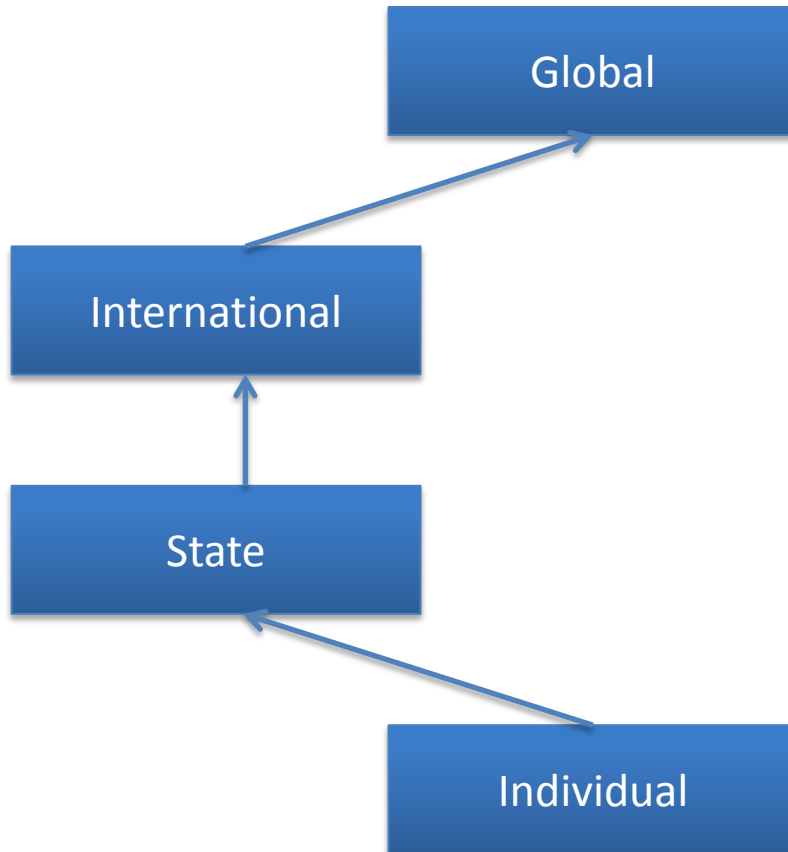
Layers model from last week



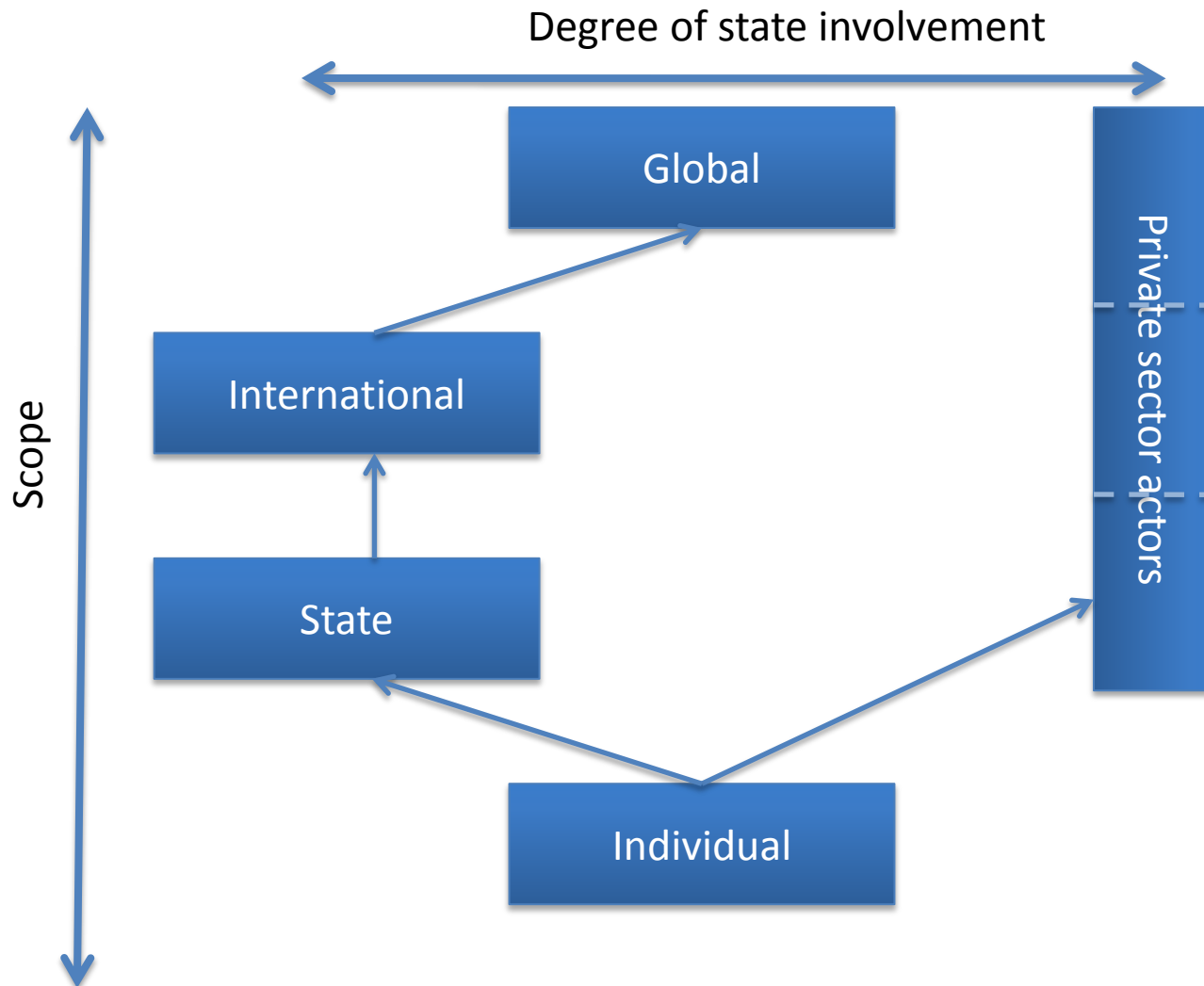
Levels of analysis

- The other tool, familiar to political science.
 - But extended in fundamental ways.

IR levels of analysis



Adding in private actors



Collective actors come with many scopes:

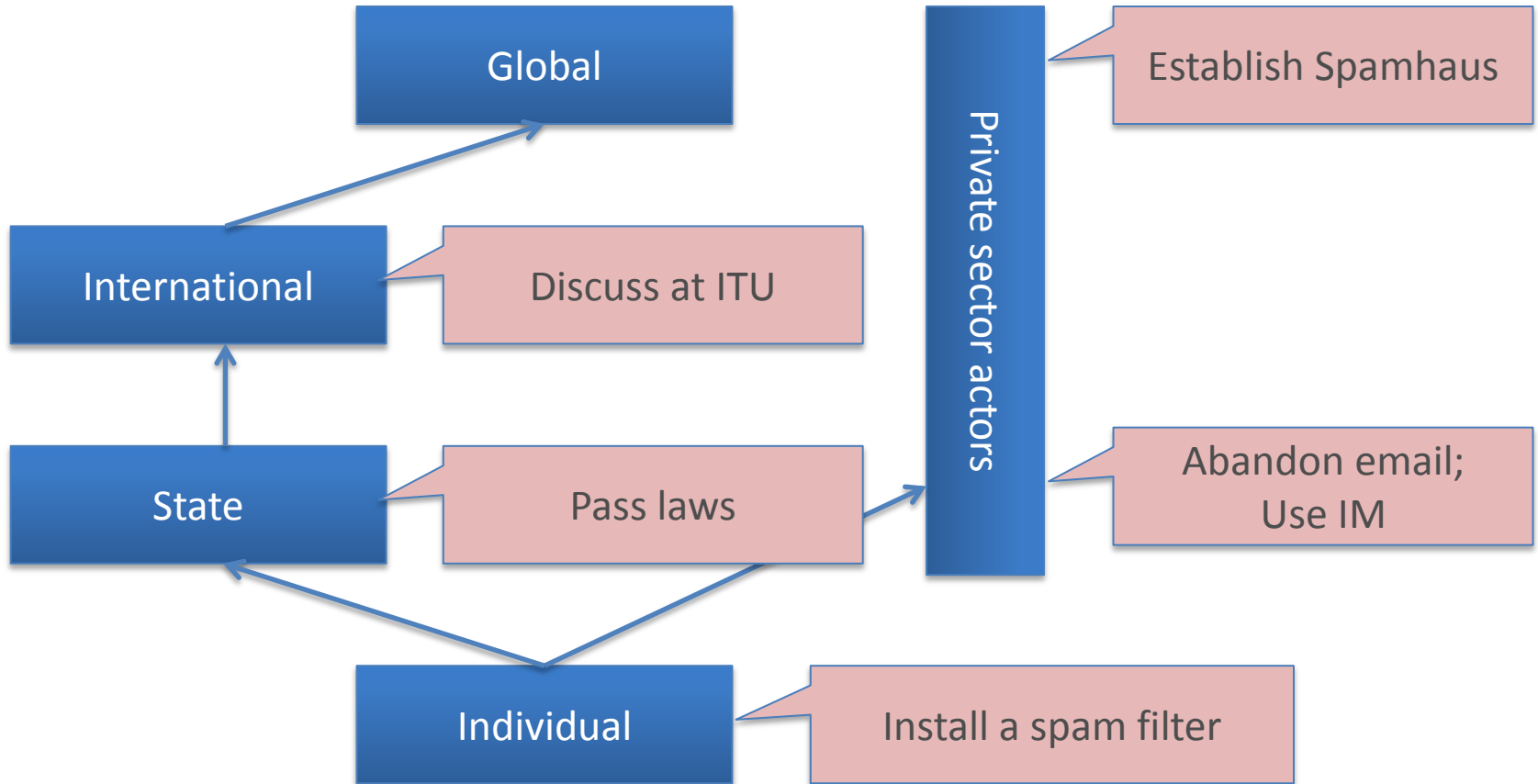
- Local to a state
- Trans-national
- “Going for Global”

The “belongs to” arrows do not strongly apply to collective private actors.

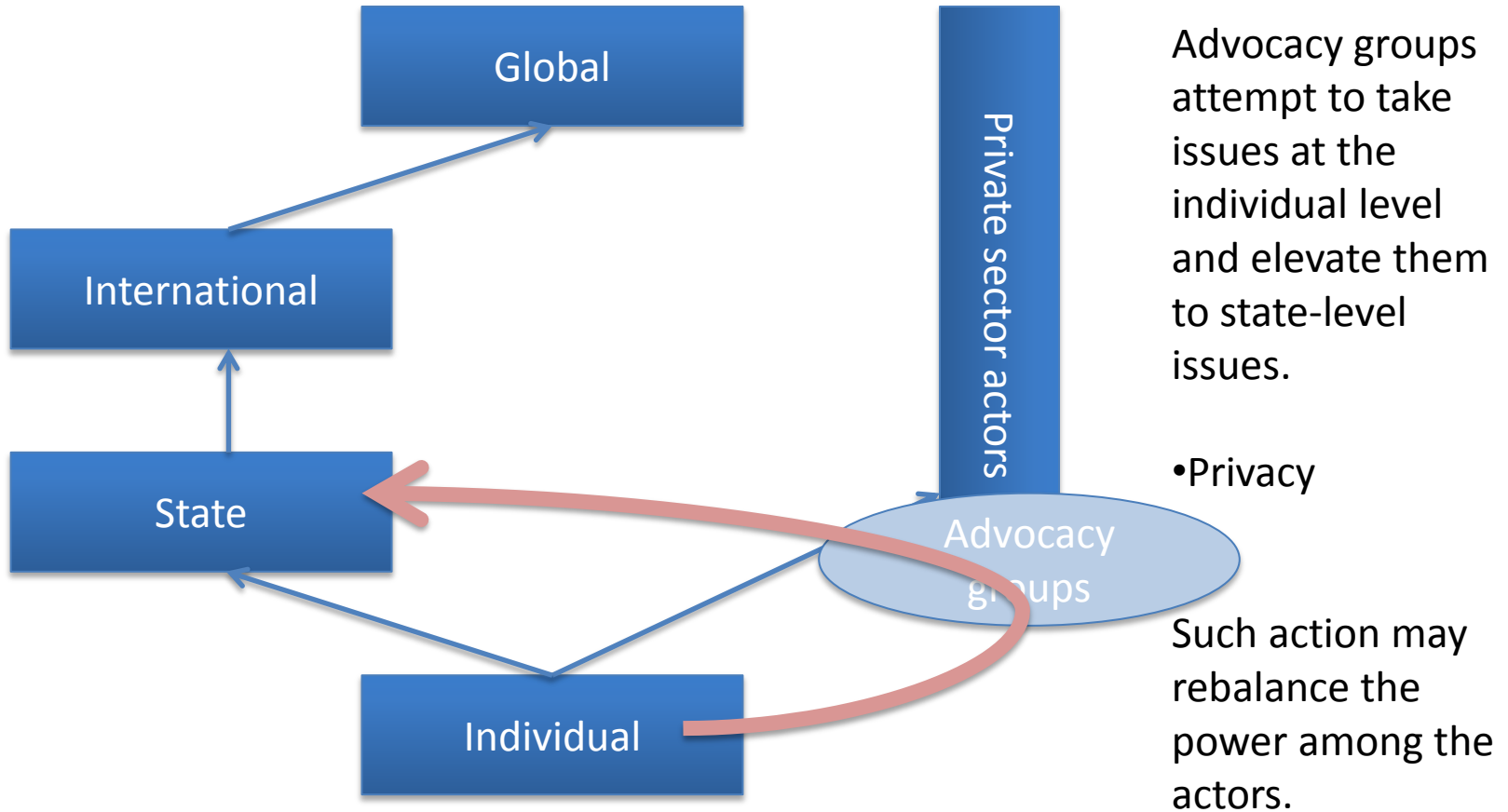
Using this model

- This model can be a tool of analysis to characterize problems:
 - Causes of war, nature of spam, climate change.
 - Some problems may suggest a framing at multiple levels, some (like climate change) seem to have a natural level where their analysis must necessarily go.
- This model can also be a tool to explore the space of solutions.
 - A proposed solution that is at a different level than the “natural” level of the problem may not be effective.

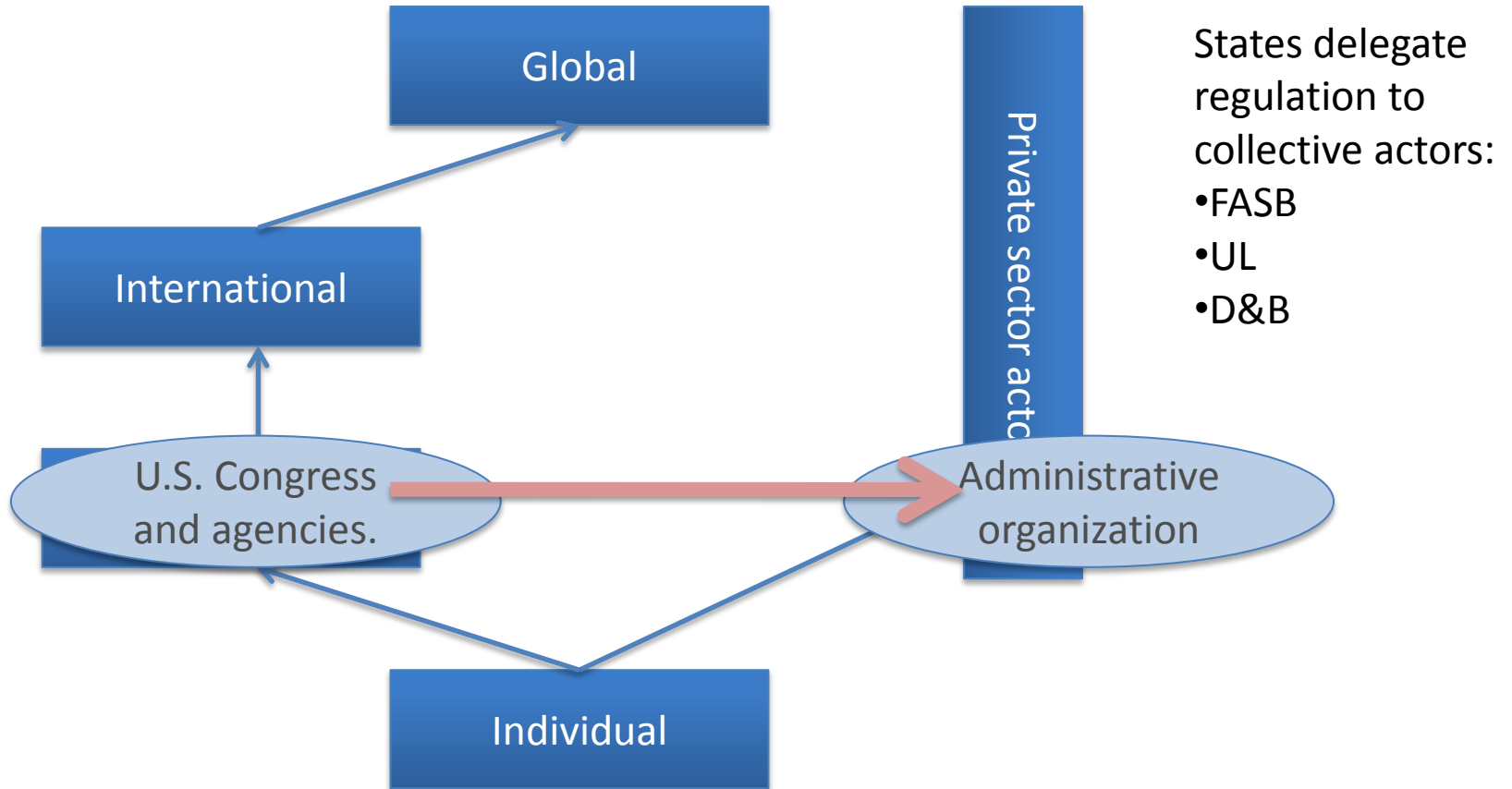
Curing spam



Some actors move the locus



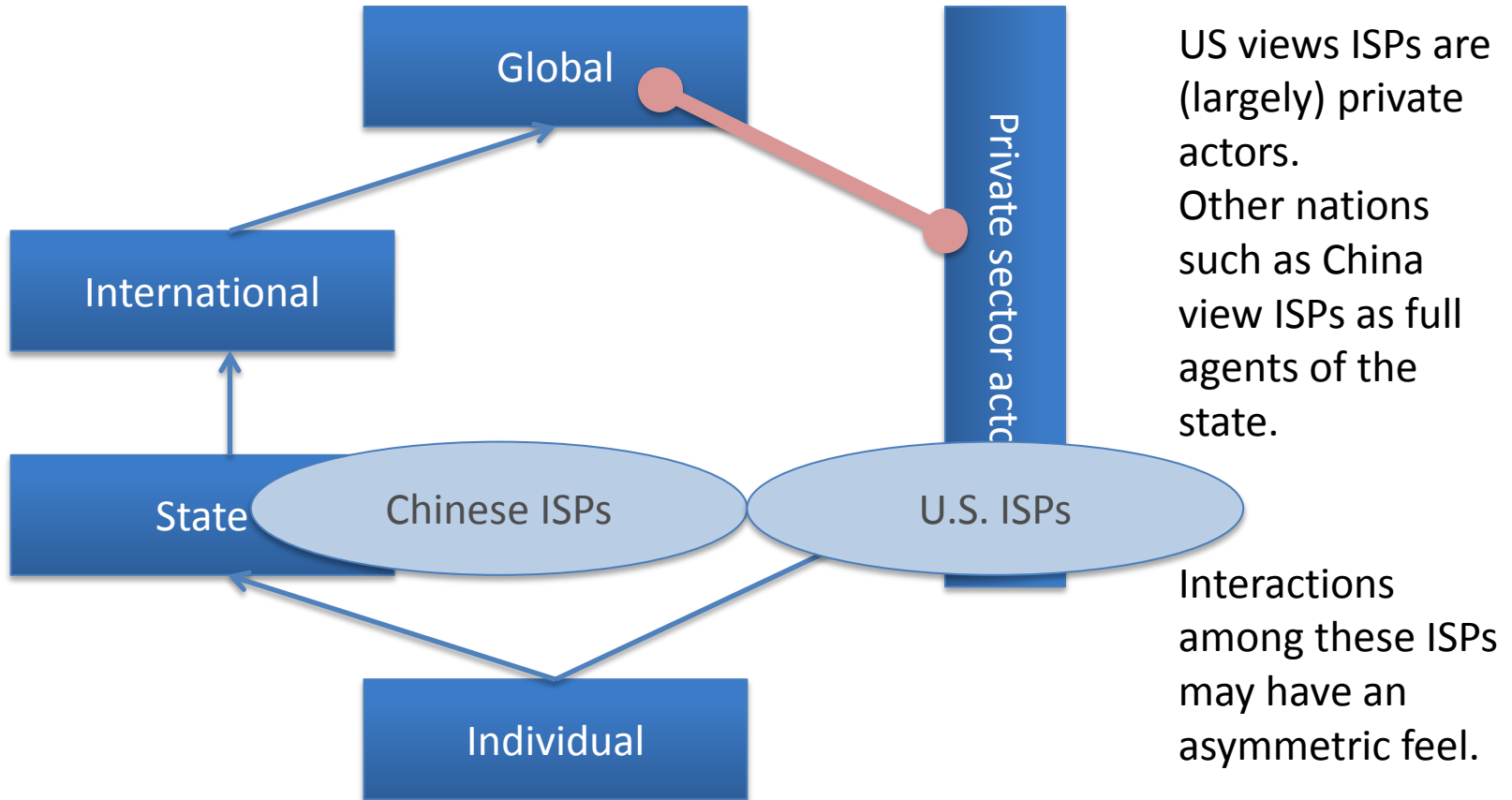
Private order



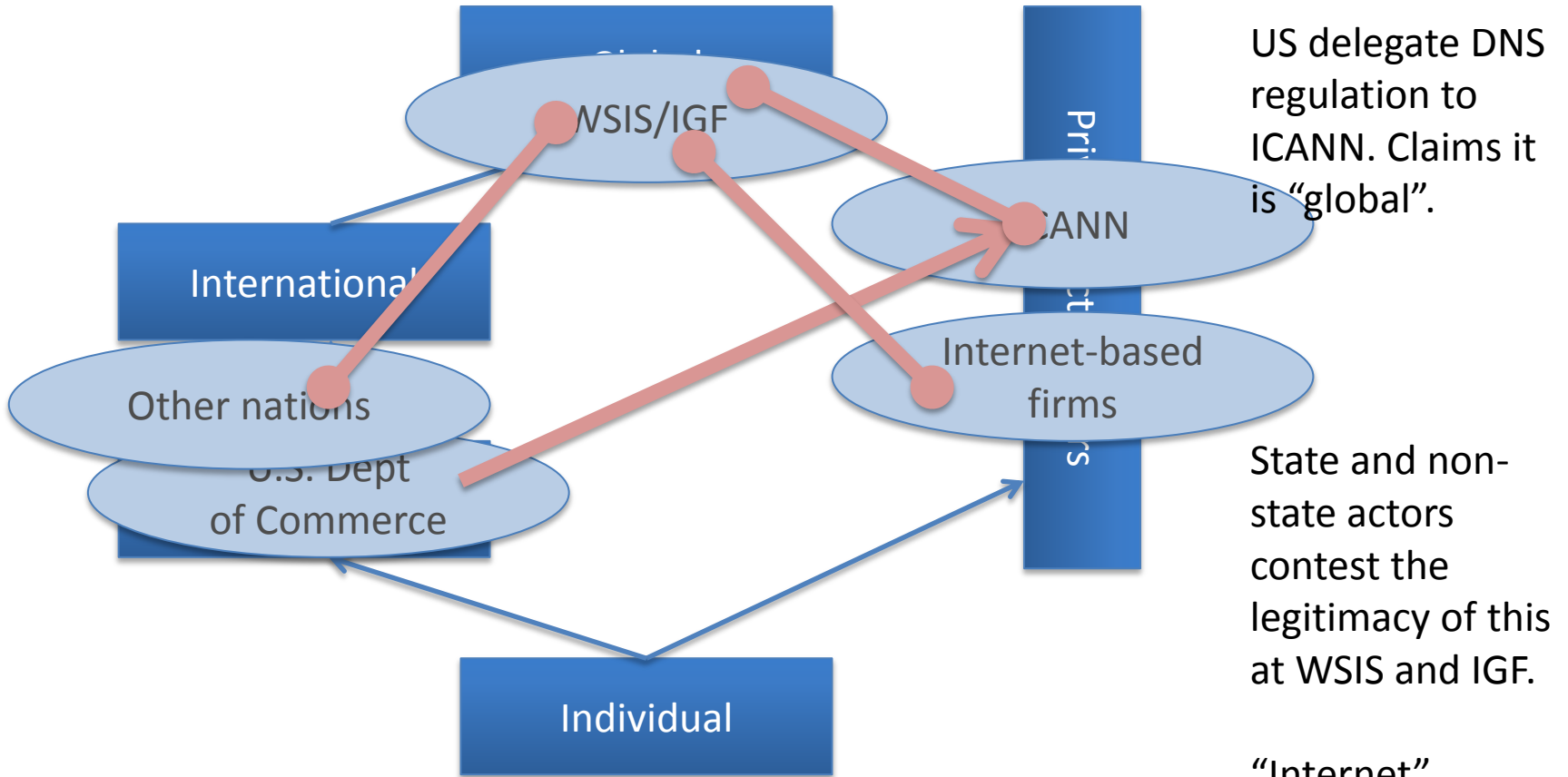
Asymmetric contention

- When actors of different sorts contend, they use different tools, leading to asymmetric contention.
 - States pass laws and enter into contracts.
 - U.N. organizations convene summits and pass resolutions. States use tools of diplomacy, such as consensus building and stalling.
 - Companies lobby, form larger collectives for clout, fund preferred outcomes.
 - Advocacy groups protest.

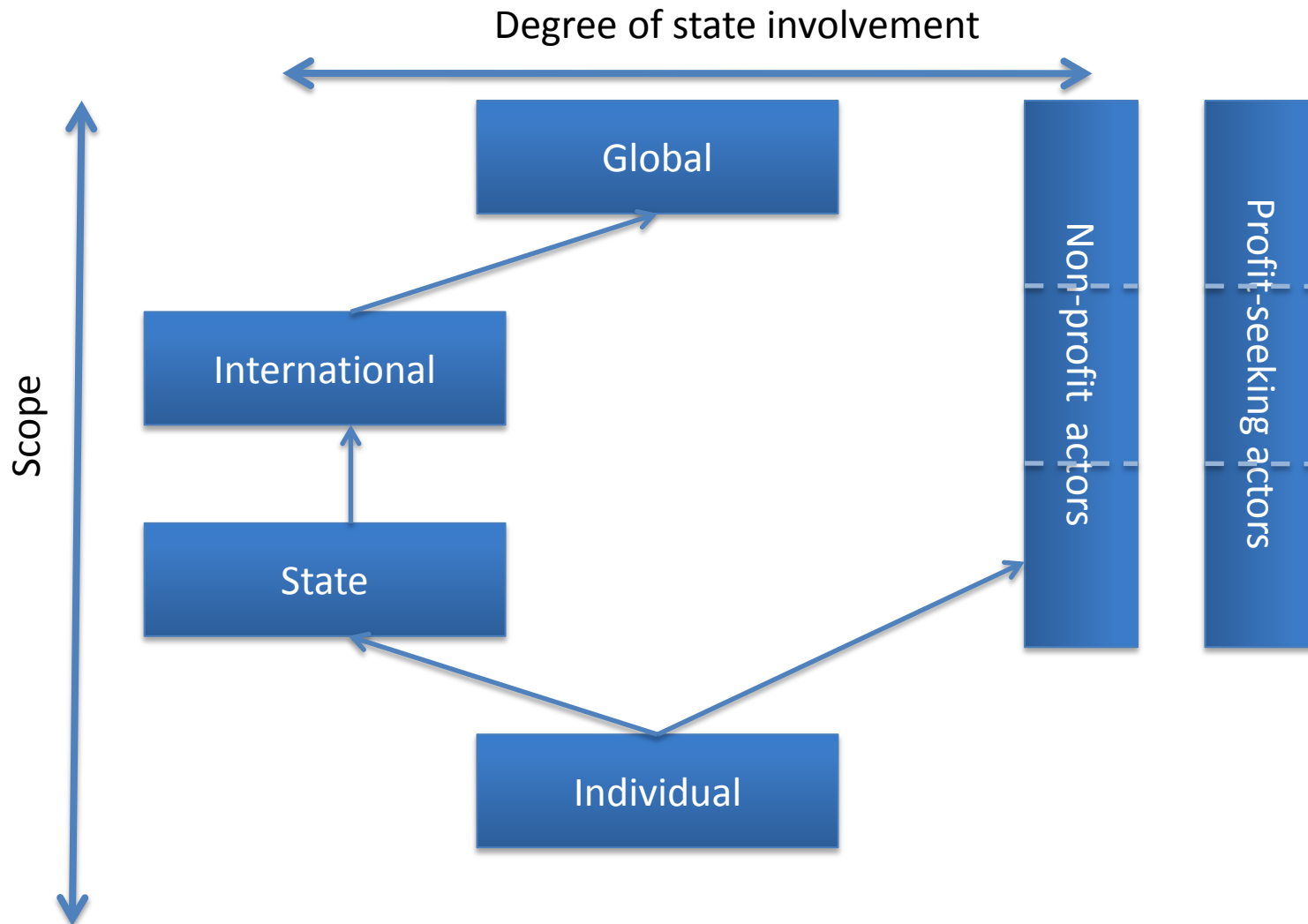
States differ in their control



Contention over DNS



A potentially useful elaboration



Combining the models

- Actors can be positioned within both models
 - As can “issues” and “solutions”.

The matrix

	Individual	State	International	Global	Non-profits	Profit-seeking
Logical	Applications					
	Services					
	Internet					
	Physical					

Examples of issues

	Individual	State	International	Global	Non-profits	Profit-seeking
Logical	People		Digital divide		Developing world	
	Information	Privacy; Peer production	Censorship	Takedown; IPR,	Spam; Wikileaks	
	Applications	Peer production	Lawful intercept			
	Services		Blocking DNS		Governance of DNS	
	Internet	Home network mgt.	Network neutrality		Allocation of IP addresses	
	Physical	Home wiring	Facilities unbundling	Satellite orbit spectrum		

Controlling spam

Logical

	Individual	State	International	Global	Non-profits	Profit-seeking
People						
Information	Filter	Pass laws; authorize private action	Discuss		Spamhaus	Filter; Certified emailers
Applications						Block ports
Services		Block DNS				
Internet		Disconnect ISPs				Disconnect ISPs;Identify BOTs
Physical						

Wikileaks

	Individual	State	International	Global	Non-profits	Profit-seeking
				Wikileaks		
Logical	Applications					
	Services					
	Internet					
	Physical					

Spam marketing

	Individual	State	International	Global	Non-profits	Profit-seeking
				Spam		
Logical						

France and nazi memorabilia

	Individual	State	International	Global	Non-profits	Profit-seeking
		French law				
Logical						

Enforcement of IPR

	Individual	State	International	Global	Non-profits	Profit-seeking
			IPR enforcement			
Logical	Applications					
	Services					
	Internet					
	Physical					

Lessons

- This (and other) examples suggest the following: (I made this slide in advance...)
 - Remedies can be implemented at different levels and layers.
- Remedies at different levels (e.g. individual vs. state) may or may not be effective.
 - Want to understand issues.
- Remedies at different layers are often either ineffective or “blunt instruments”.

Analysis/synthesis

- Case studies of specific events help us generate a catalog of responses.
 - Our matrix is one approach to helping organize and discover the range of responses.
 - Need tools to help us think methodically.
- The harder problem is mechanism design.
 - The Internet is a built artifact.
 - A technology change can “change everything”.
 - How do we think methodically about that?

Systems engineering

- The art/science of designing large complex systems is called “systems engineering”.
 - Lots of books on how to do it.
- But they don’t tell us how to think methodically about the necessary range of issues.
 - For many systems (highways, planes, airports, power systems), we have prior experience to help us catalog the issues.
 - We have not built many Internets.

An example of a design question

- What would the implications be if we hardened the jurisdictional boundaries of the Internet by making sure that the binding from an IP address to a national jurisdiction was unambiguous?
 - In whose interest?
 - What would change for better or worse?
 - Should computers that fight cyber-wars wear uniforms?

The matrix

	Individual	State	International	Global	Non-profits	Profit-seeking
Logical	Applications					
	Services					
	Internet					
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The matrix

	Individual	State	International	Global	Non-profits	Profit-seeking
Logical	Applications					
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The matrix

	Individual	State	International	Global	Non-profits	Profit-seeking
Logical	People					
	Information					
	Applications					
	Services					
	Internet					
	Physical					

Examples of institutions

	Individual	State	International	Global	Non-profits	Profit-seeking	
Logical	People	FTC (consumer protection)			EFF, CDT Wikipedia		
	Information	Copyright Censors	WIPO		Spamhaus;	Google, NetFlix, etc.	
	Applications	Freerate			W3C; Open software	Facebook, Twitter	
	Services			I T U	ICANN* (DNS)	DynDNS, DNS registrars	
	Internet		Agencies as ISPs			NANOG; IETF	ISPs
	Physical		State-owned facilities			IEEE 802	Fiber, satellite, etc.

Summary

- My goal in my current research is to provide tools to think methodically about both analysis (of a specific situation) and about design (of future network mechanisms).
- Come back later to one approach to the latter
 - Control point analysis.
- There are potential class research topics about both analysis and design.

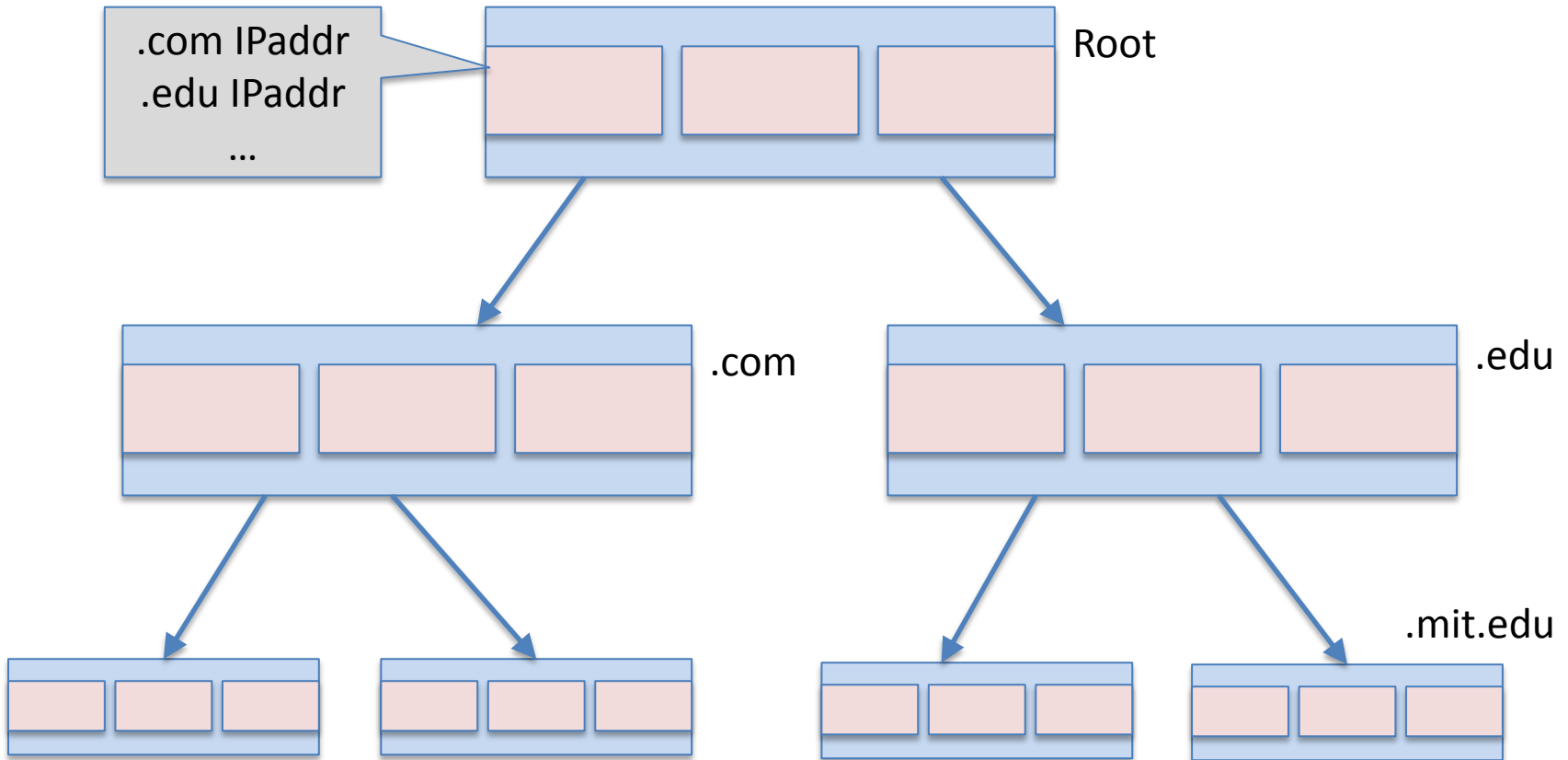
Quick tutorial on DNS

- Domain Name System
 - A means to use names, not IP addresses, to identify locations on the network.
 - Allows location dynamics.
 - Easier to remember (?)
 - Sometimes meaningful.

DNS is a name hierarchy

- Example name: www.mit.edu
 - Top level domains (TLDs) such as .edu, .com, .us, etc are stored in “root servers”.
 - The image is “the root of the tree”.
 - The addresses of the various root servers must be globally propagated in the background.
 - The root of the tree is always special.
 - The server at each level provides the name of the server at the next level.
 - The root server gives the address of the server for .edu, which gives the server address for .mit in .edu. And so on.

A picture



Design goals

- Resilience and failure-proof.
 - Replicated distributed servers at each level.
- But not resistance to attack.
 - Penetration and corruption.
 - Mis-direction.
 - Lack of assurance as to authority.
- Pharming, DHCP exploits

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