

Legal Network Analysis

Corinna Coupette

Getting started

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Studying the *law* using methods from *network analysis*.

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What does that mean in practice?

How do we find *graphs*?

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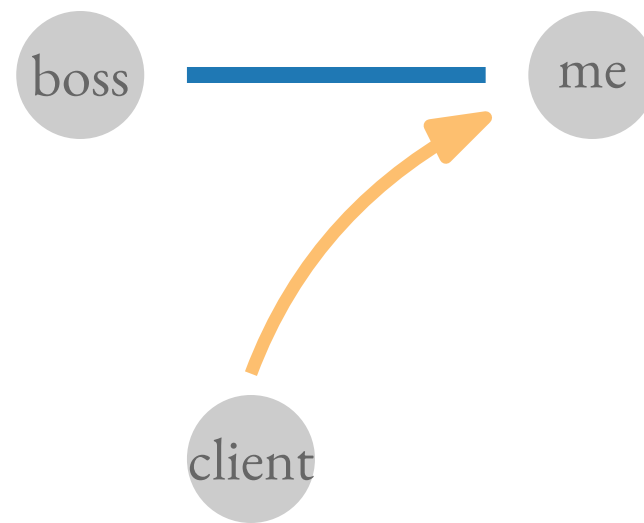


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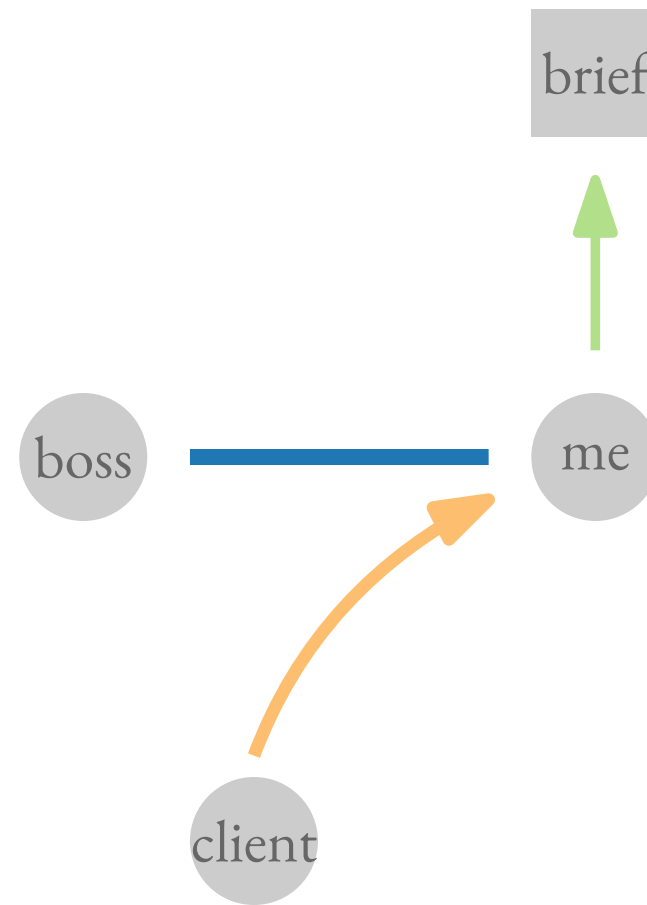
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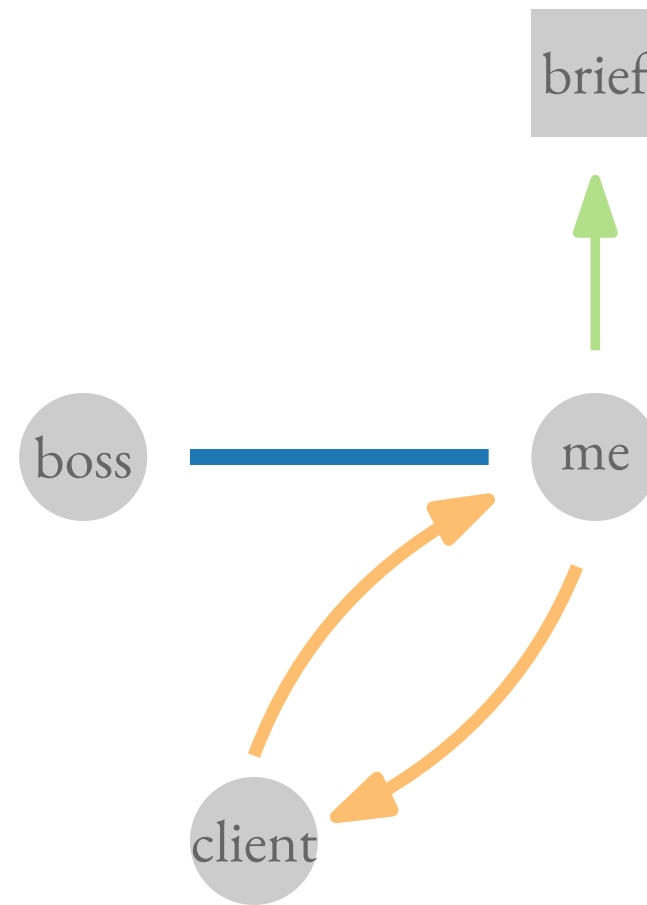
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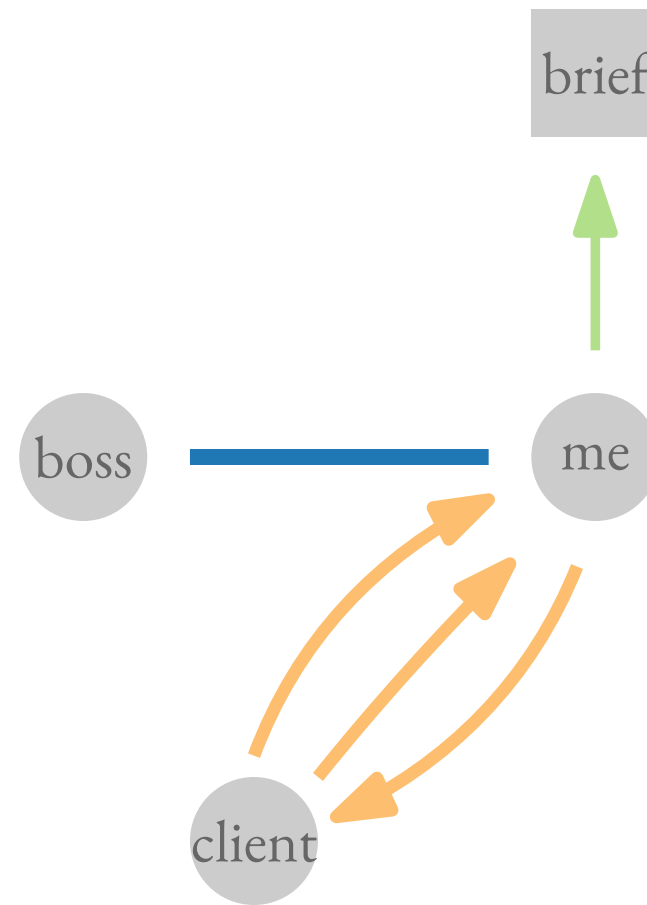
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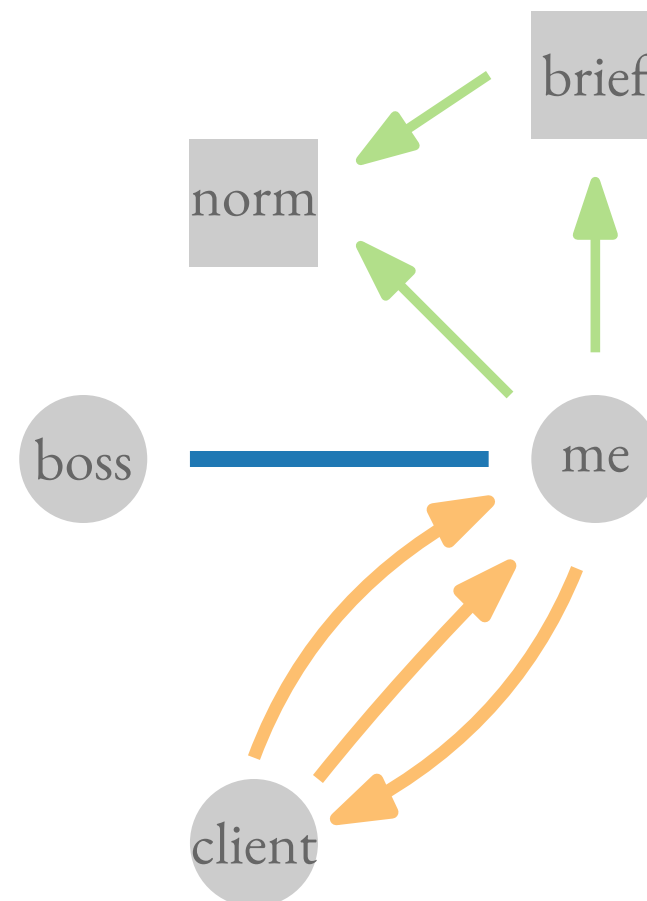
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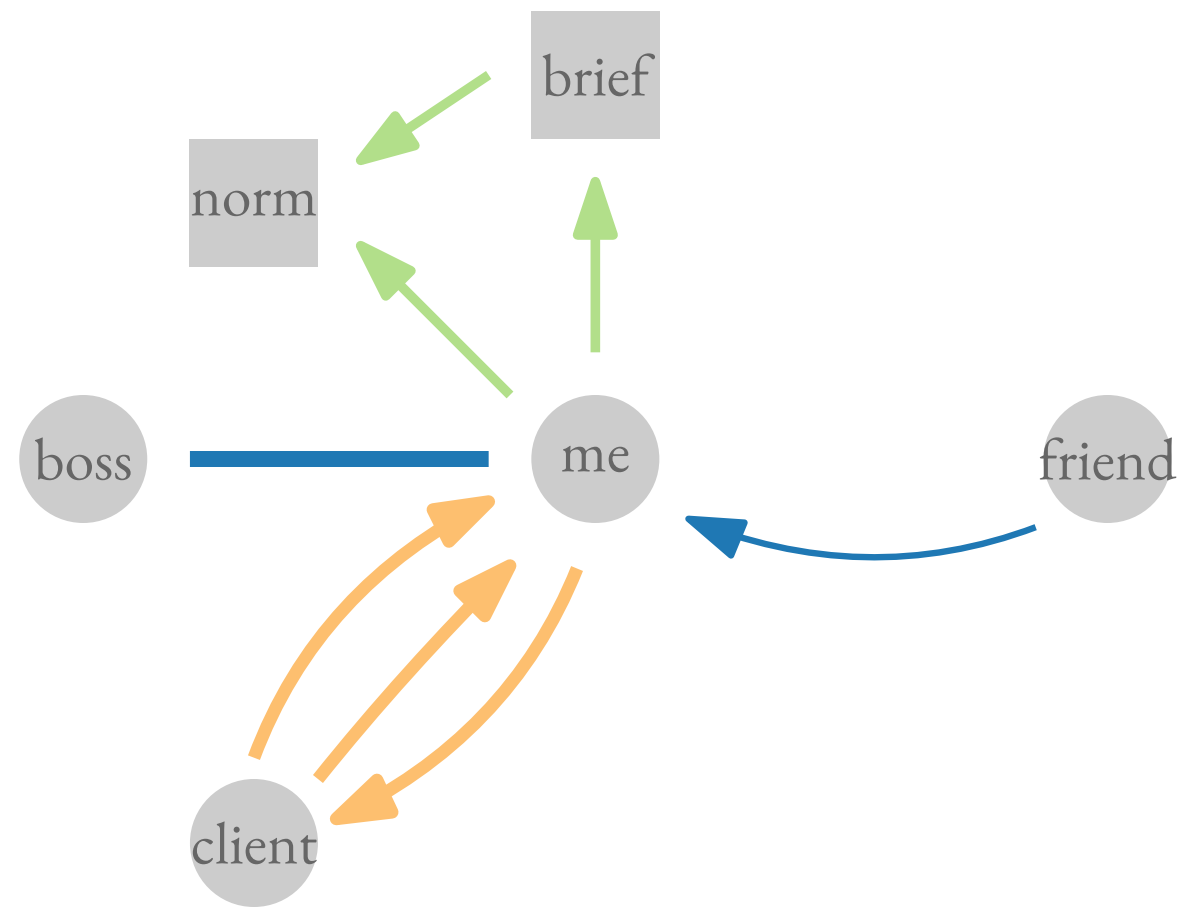
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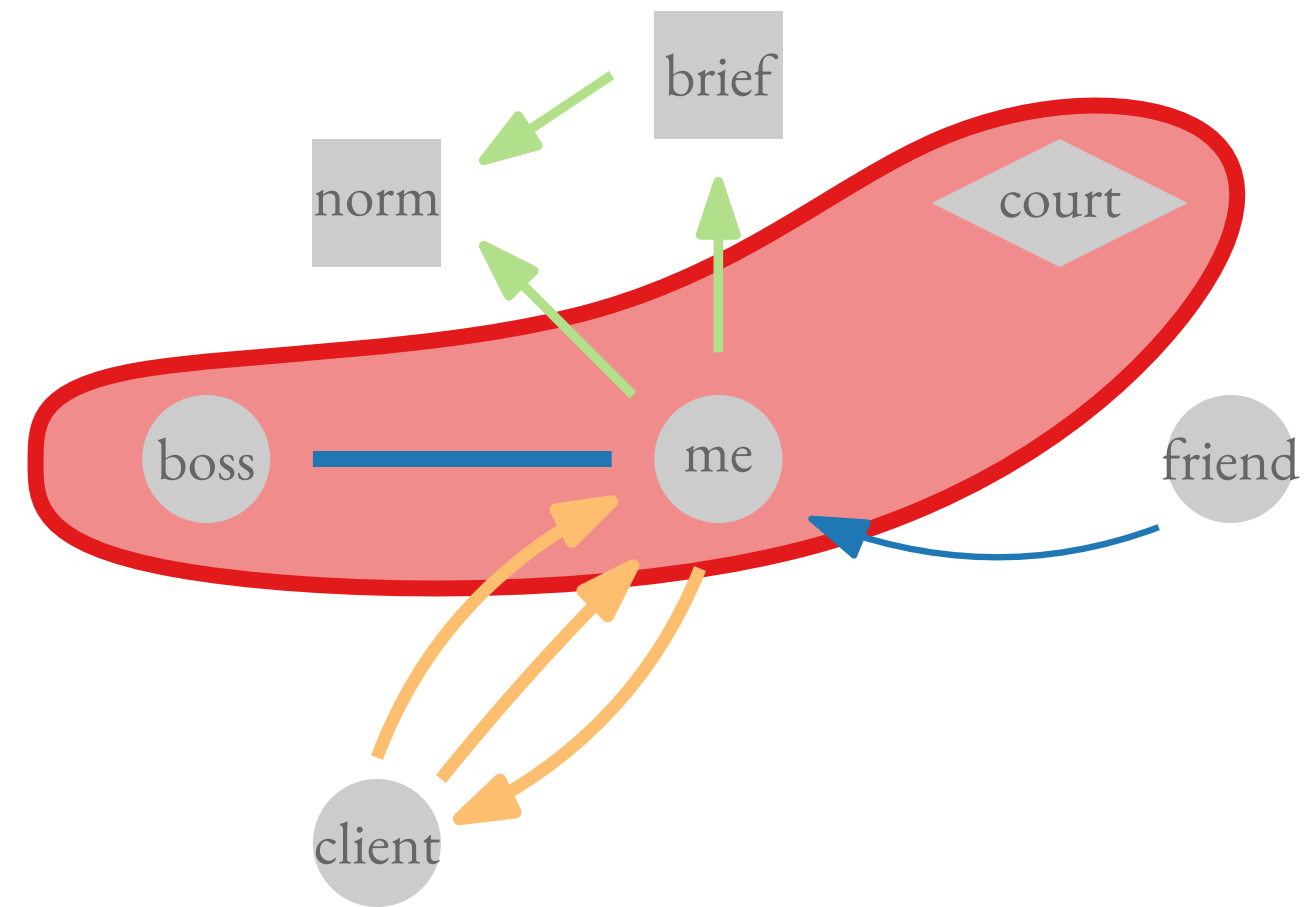
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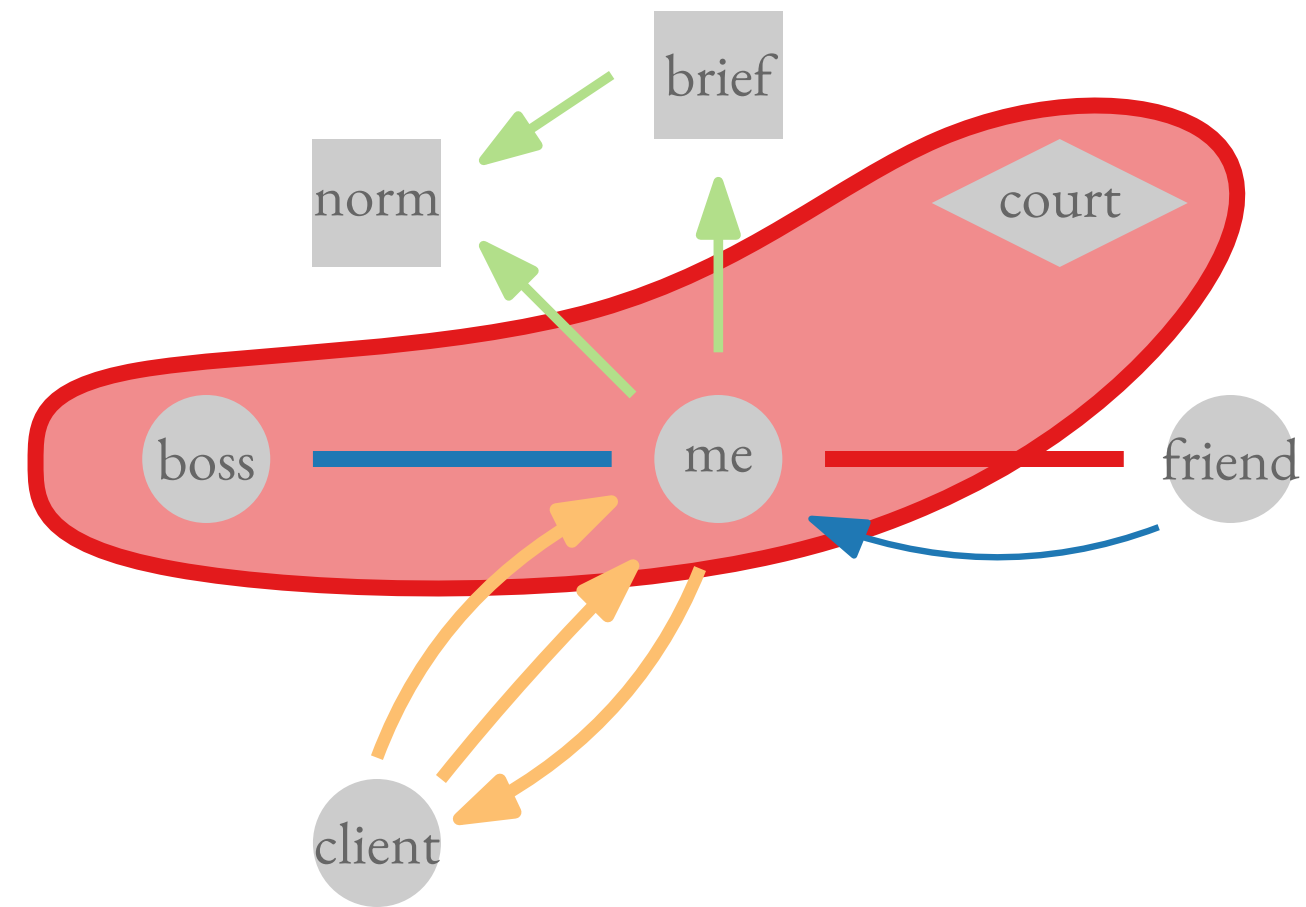
How do we find *graphs*?



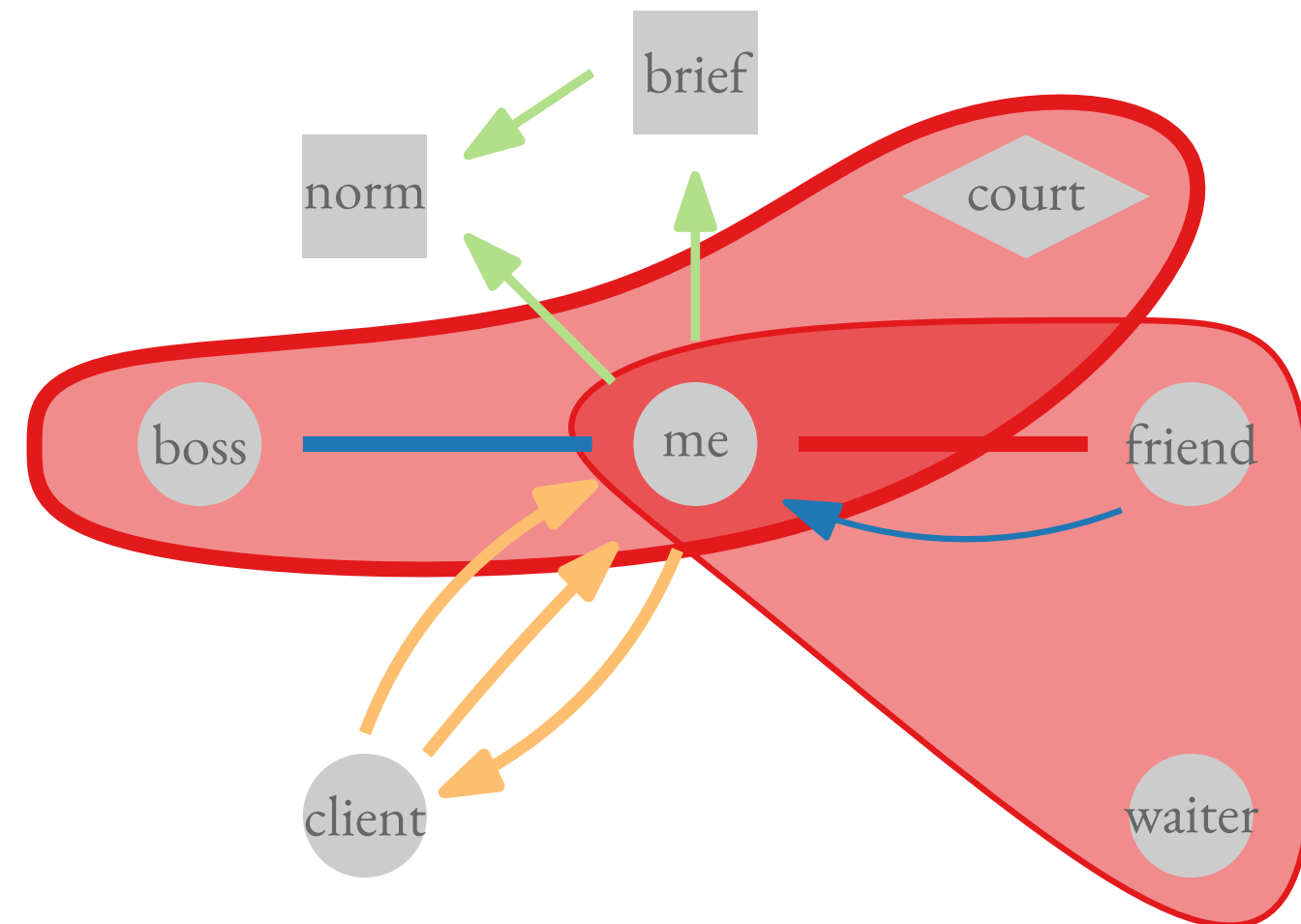
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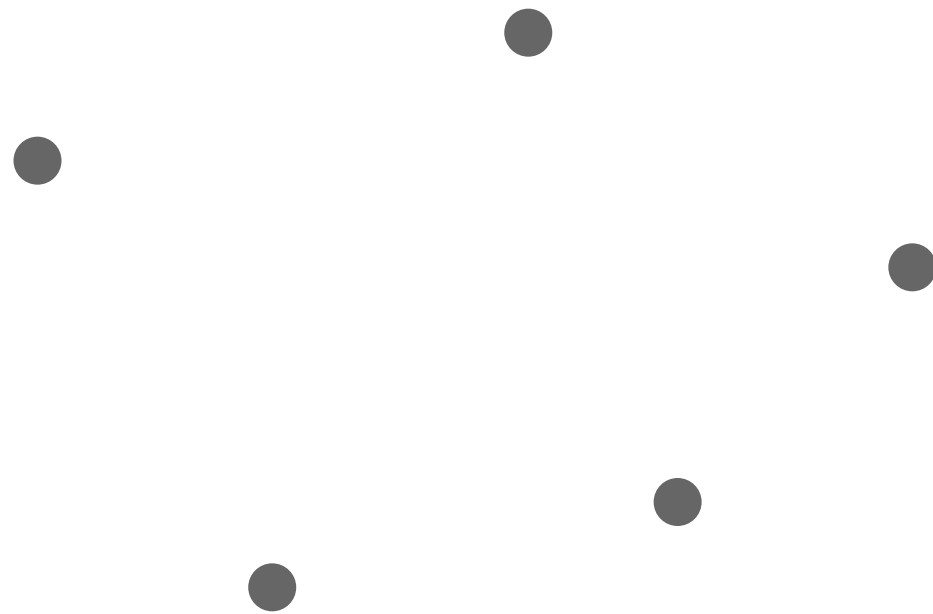
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A bit more abstractly...

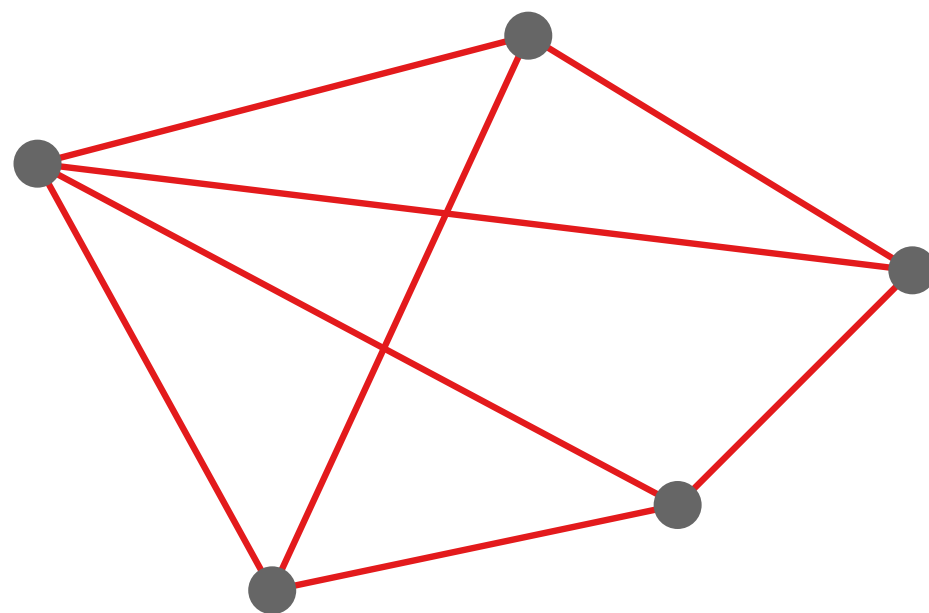
A bit more abstractly...

● Nodes V

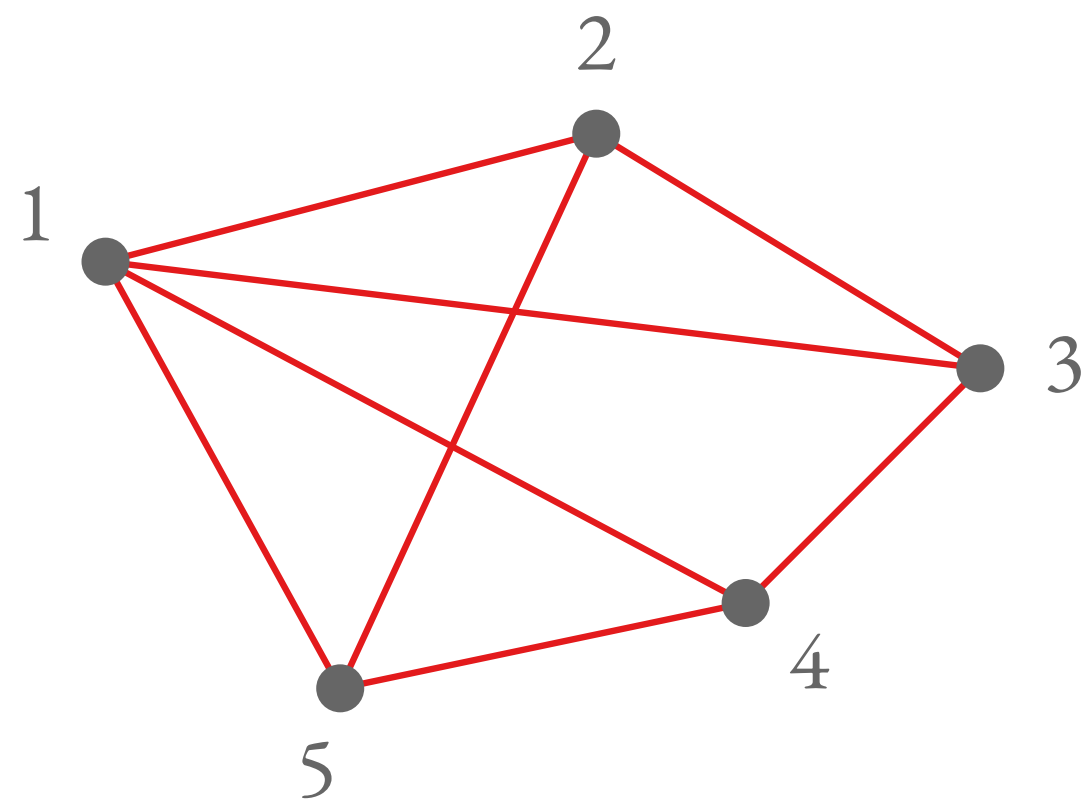


A bit more abstractly...

- Nodes V
- Edges E



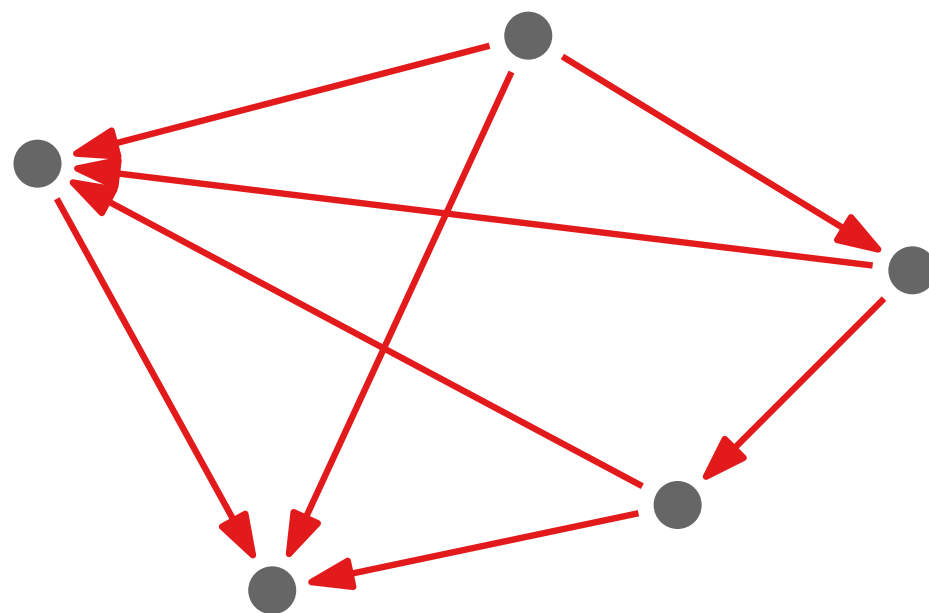
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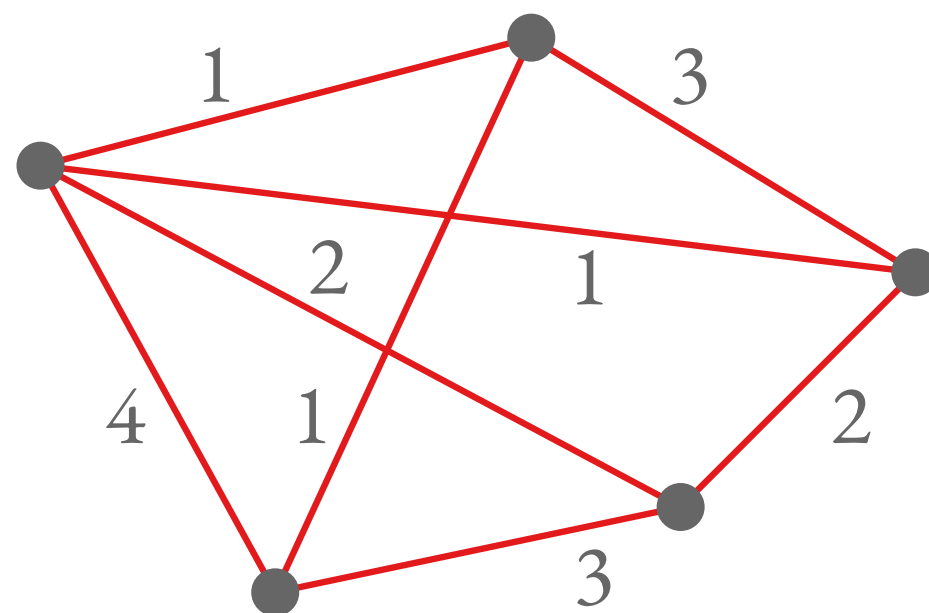
- Nodes V
- Edges E



Directed Graph

A bit more abstractly...

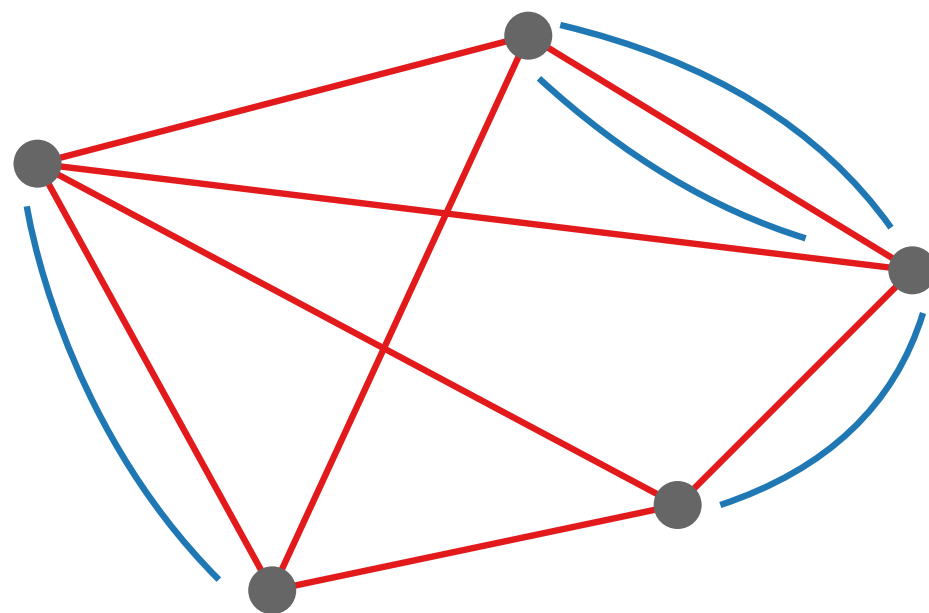
- Nodes V
- Edges E



Weighted Graph

A bit more abstractly...

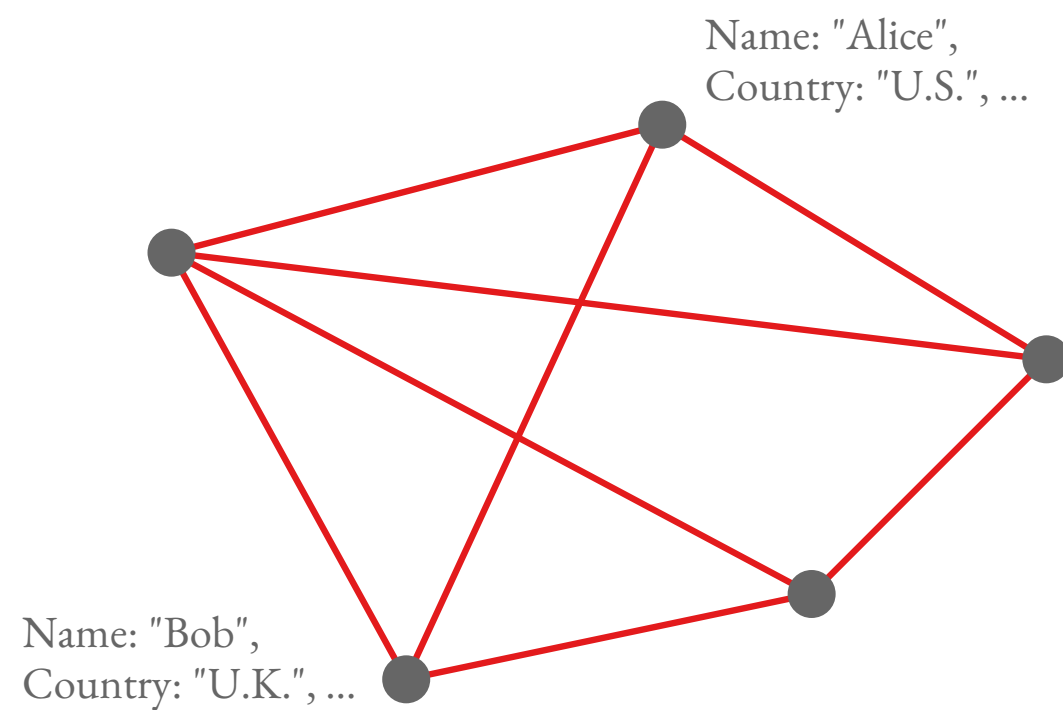
- Nodes V
- Edges E



Multigraph

A bit more abstractly...

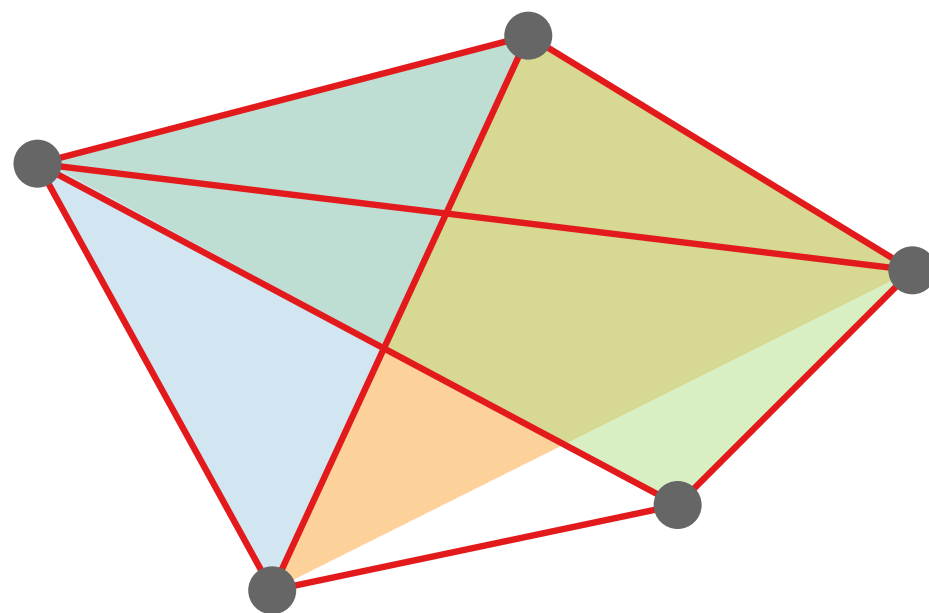
- Nodes V
- Edges E



Attributed Graph

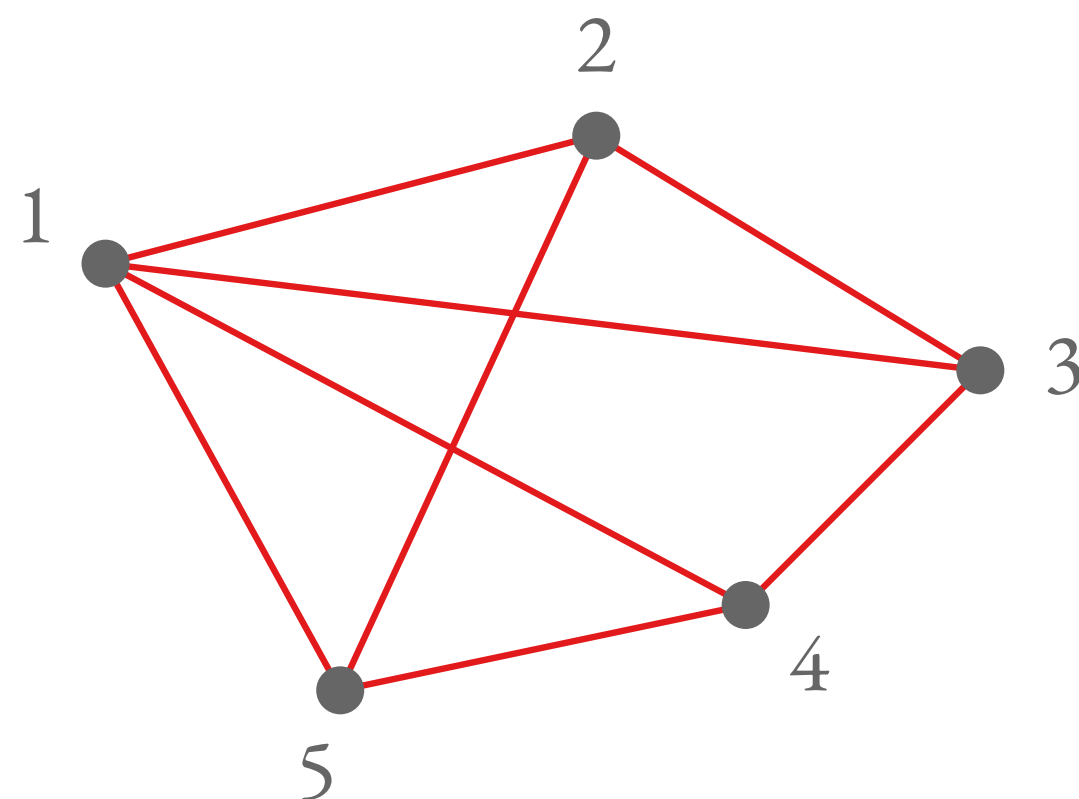
A bit more abstractly...

- Nodes V
- Edges E



Hypergraph

A bit more abstractly...



Graph G

- Nodes V
- Edges E

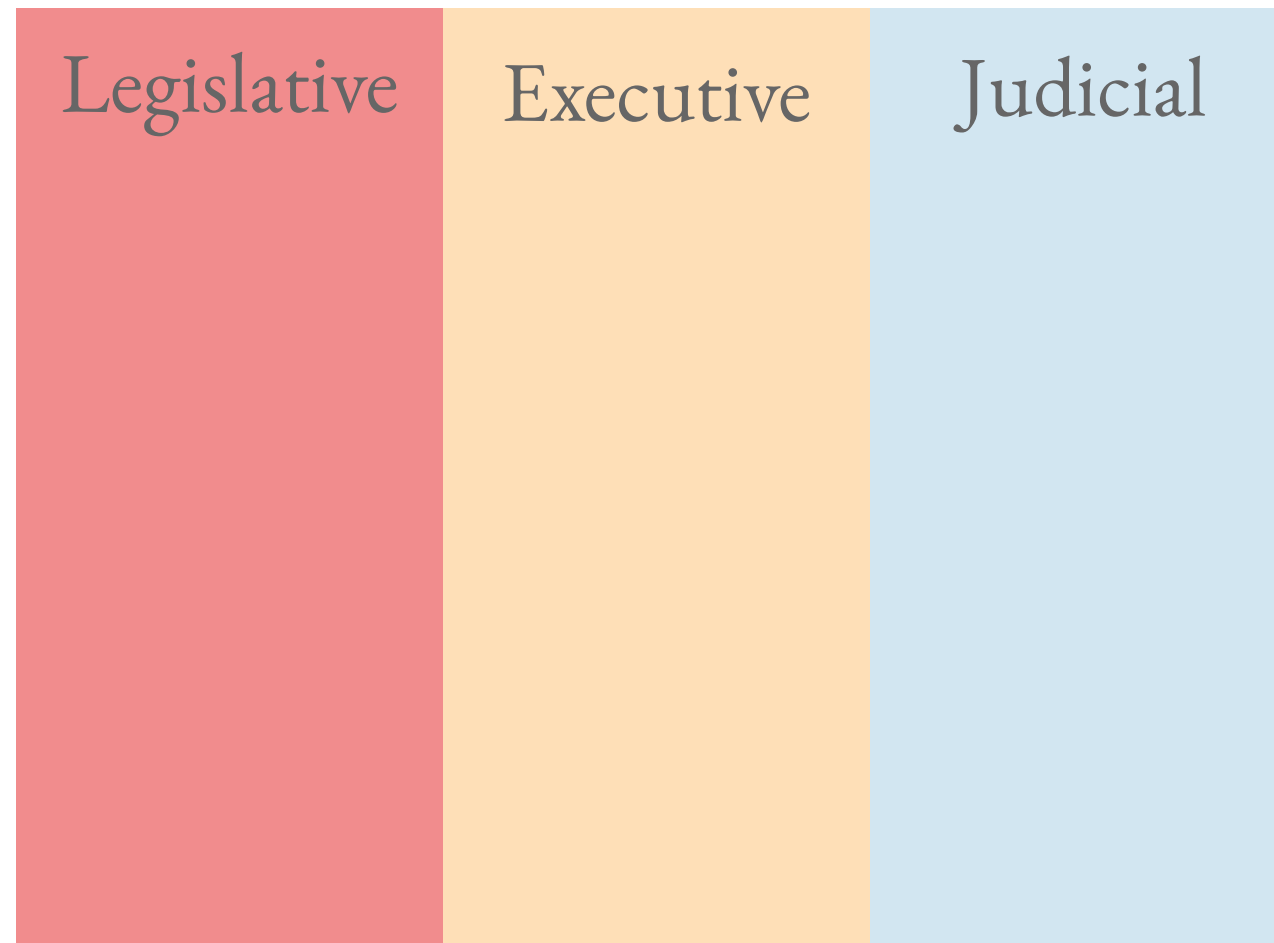
\Leftrightarrow

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

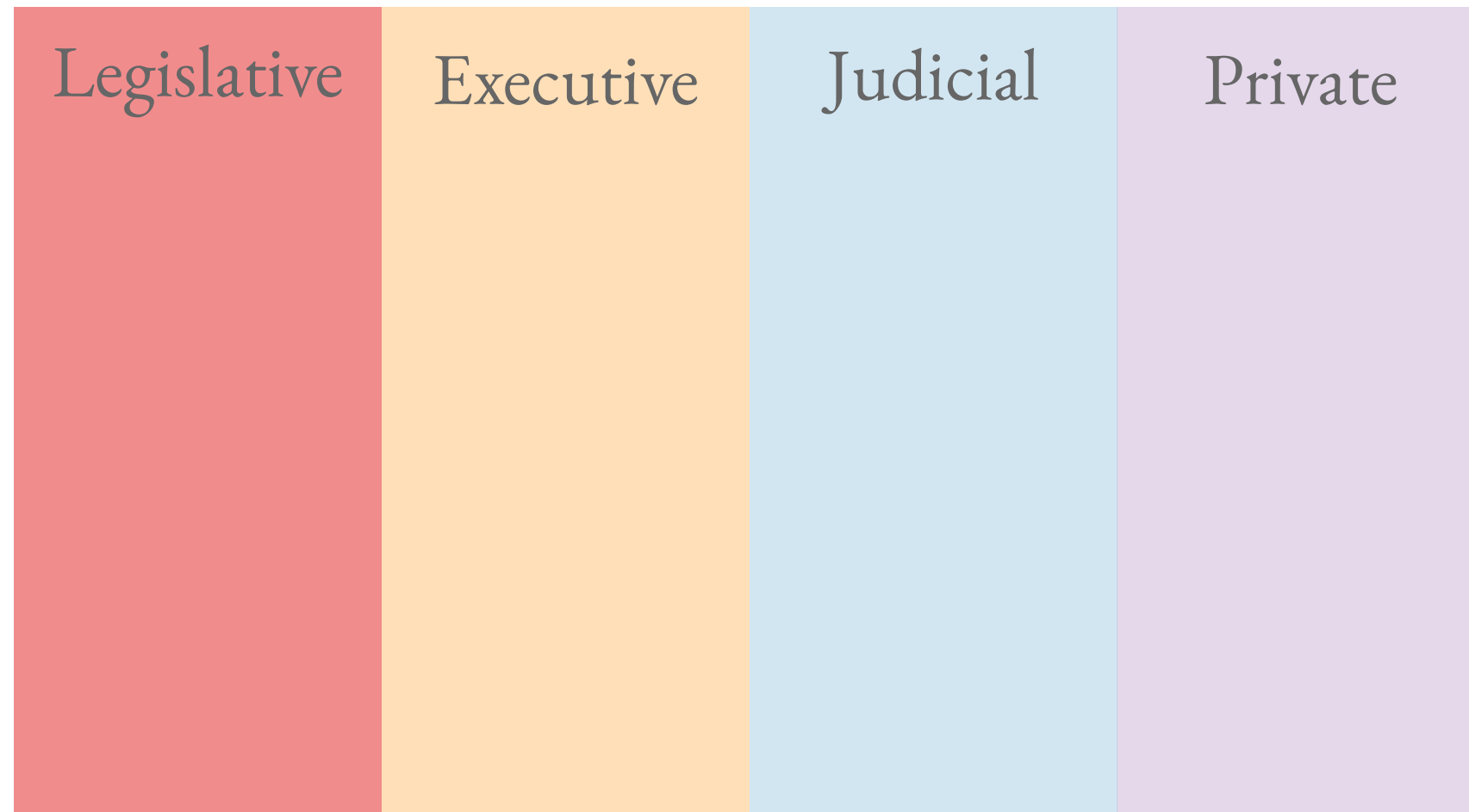
Adjacency Matrix A

Legal Systems

Legal Systems



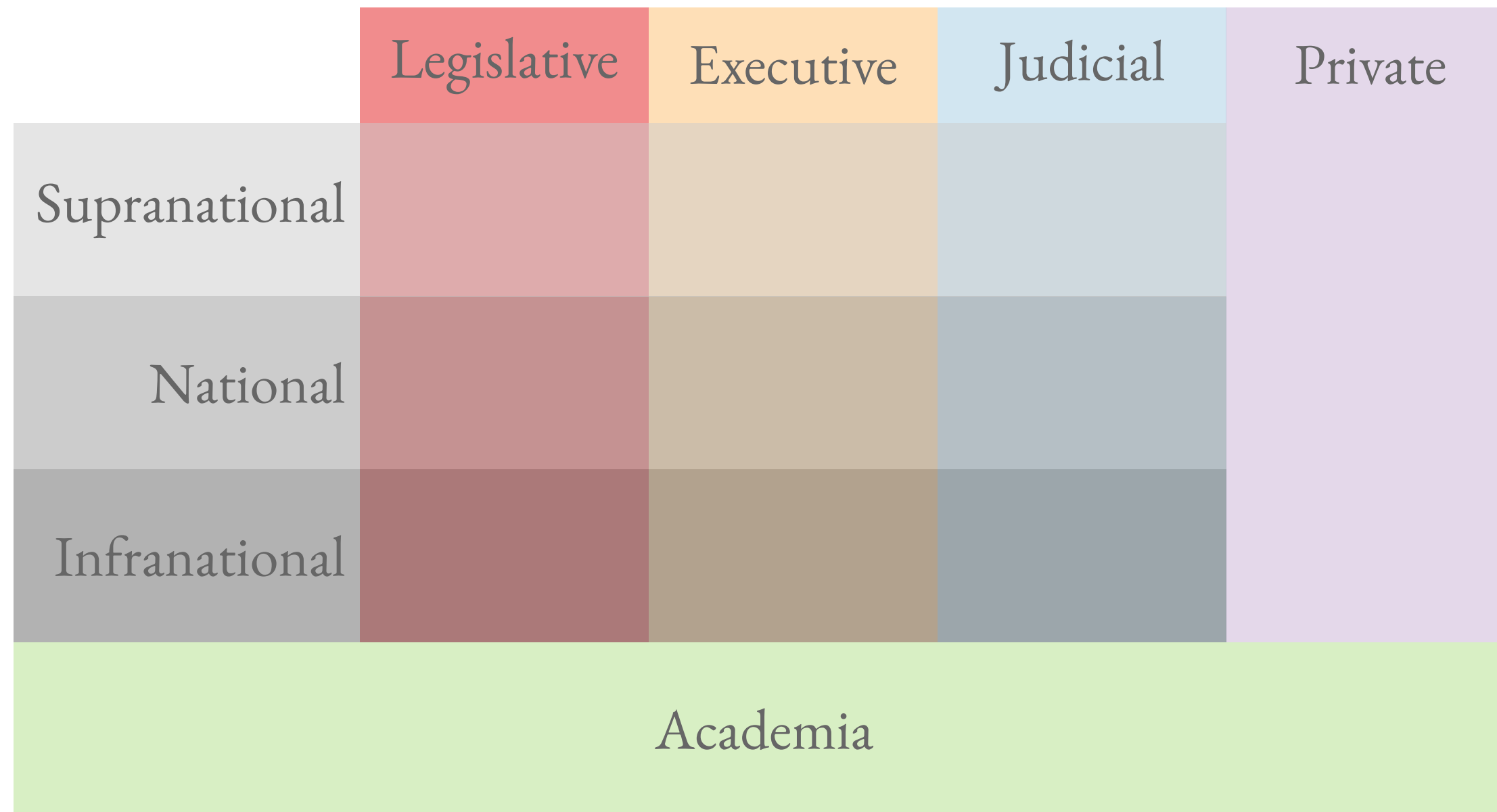
Legal Systems



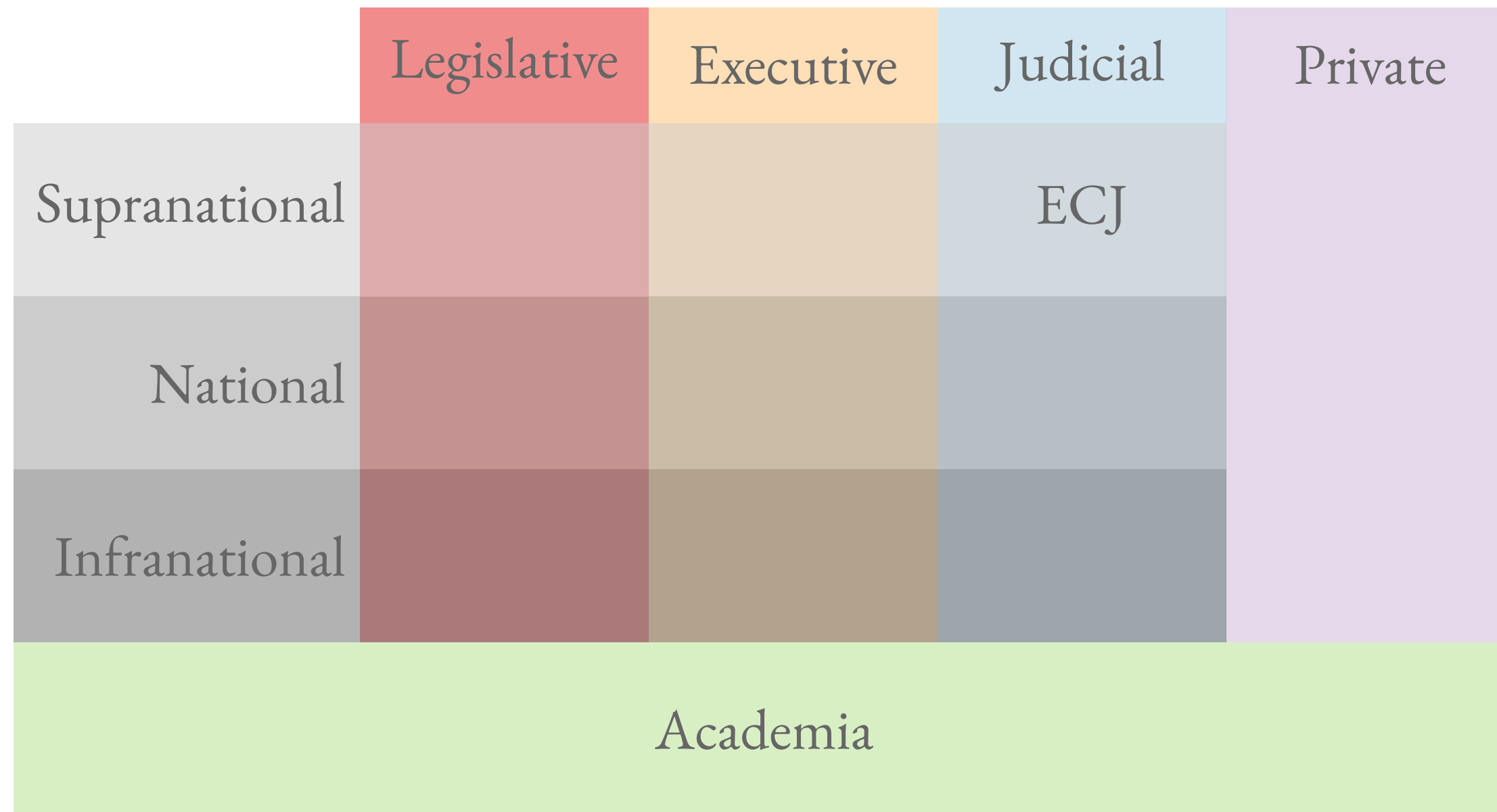
Legal Systems

	Legislative	Executive	Judicial	Private
Supranational				
National				
Infranational				

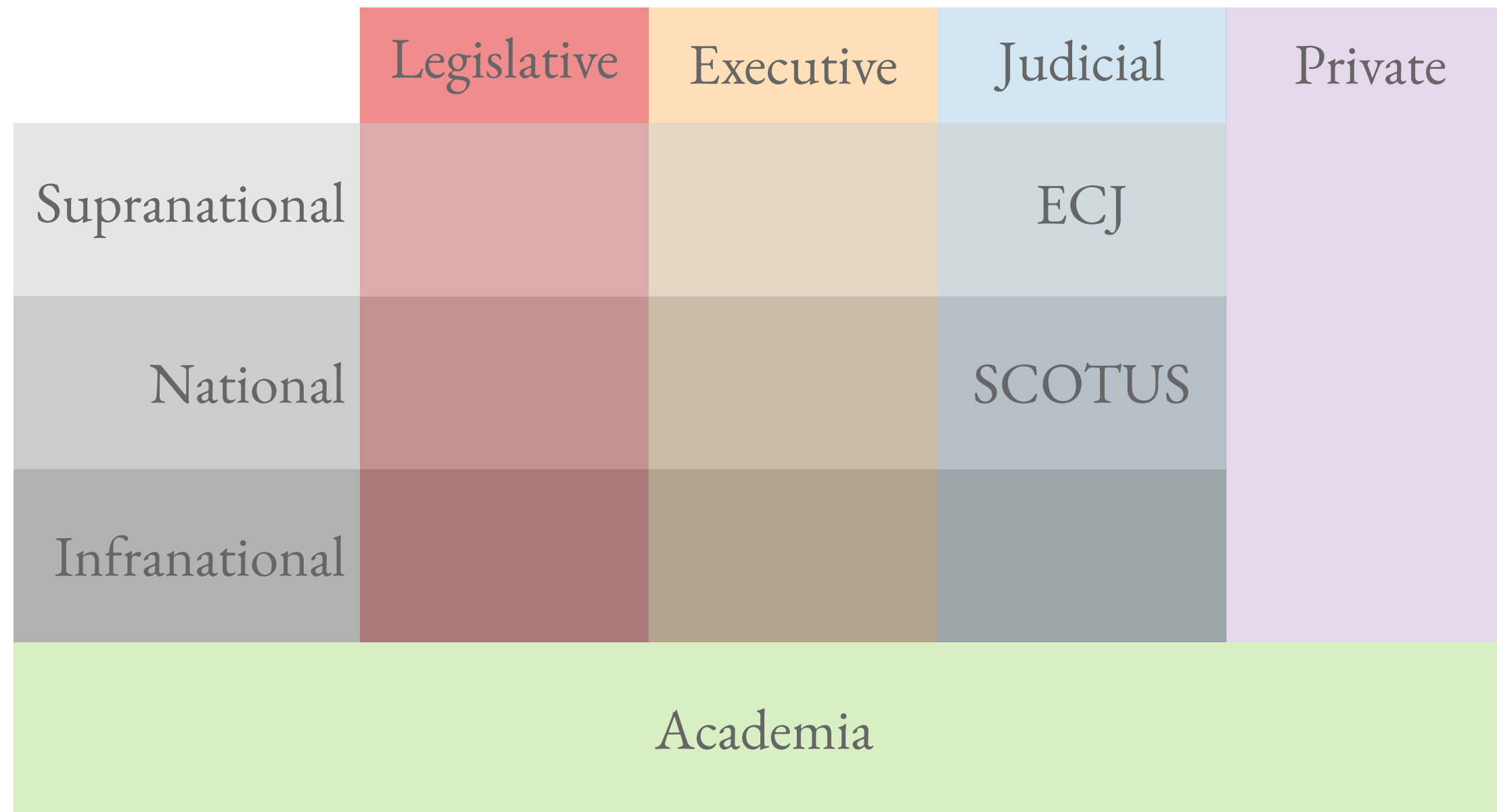
Legal Systems



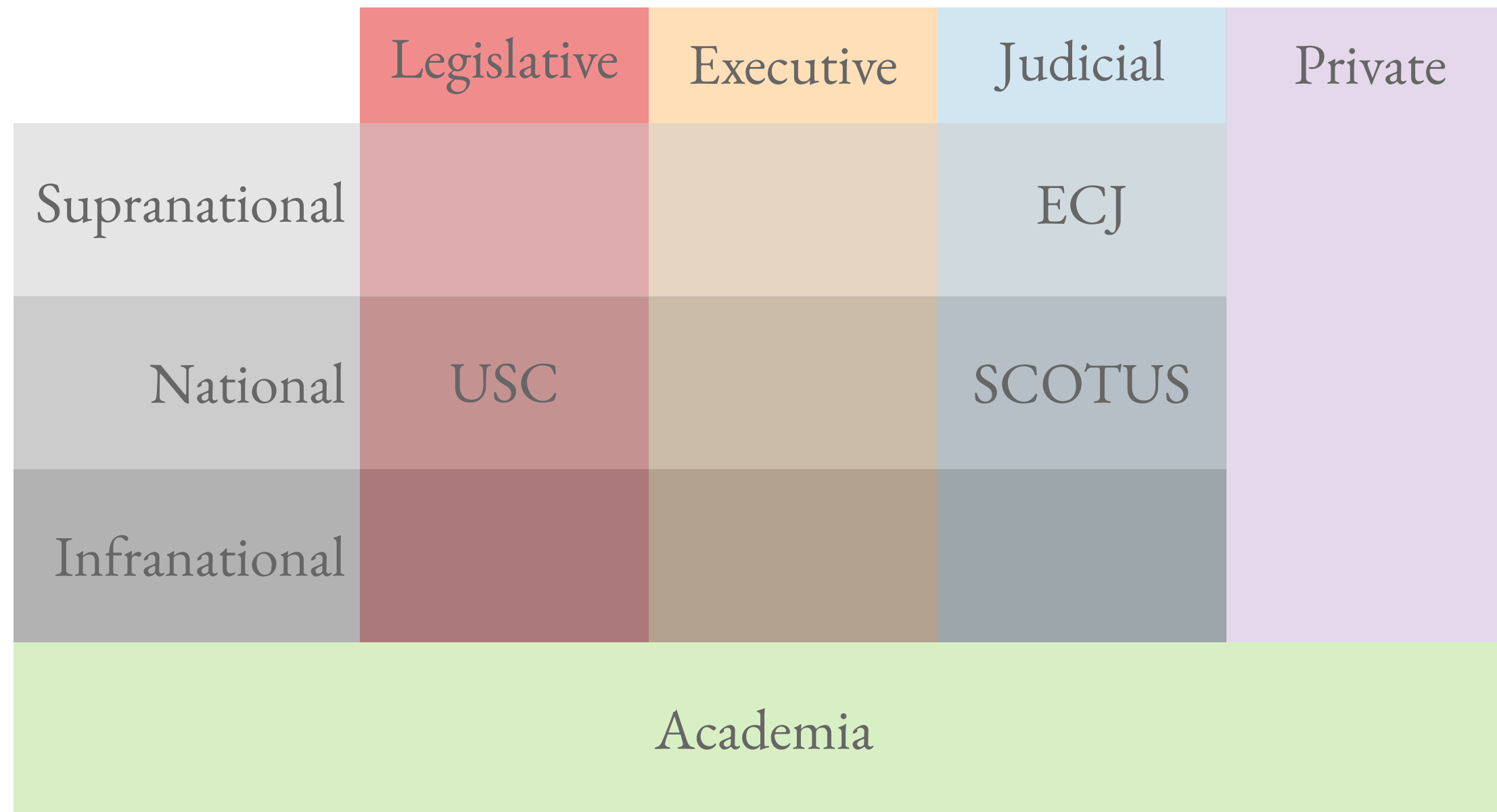
Legal Systems



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Legal Systems

	Legislative	Executive	Judicial	Private
Supranational			ECJ	
National	USC	CFR	SCOTUS	
Infranational				
Academia				

Legal Systems

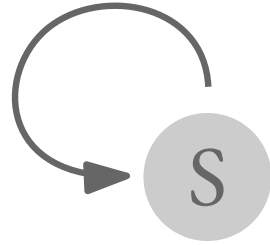
	Legislative	Executive	Judicial	Private
Supranational			ECJ	
National	USC	CFR	SCOTUS	
Infranational	State Law			
Academia				

Legal Systems

	Legislative	Executive	Judicial	Private
Supranational			ECJ	
National	USC	CFR	SCOTUS	
Infranational	State Law	Parking Fine		
Academia				

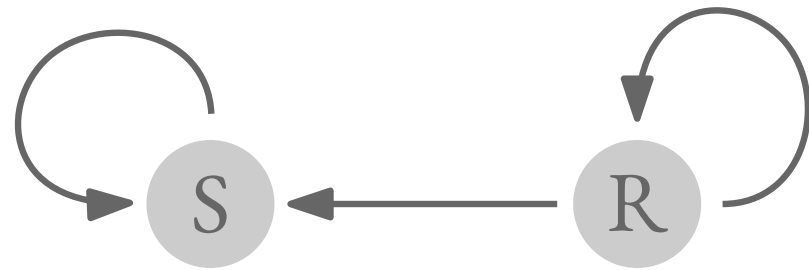
Types of Legal Documents

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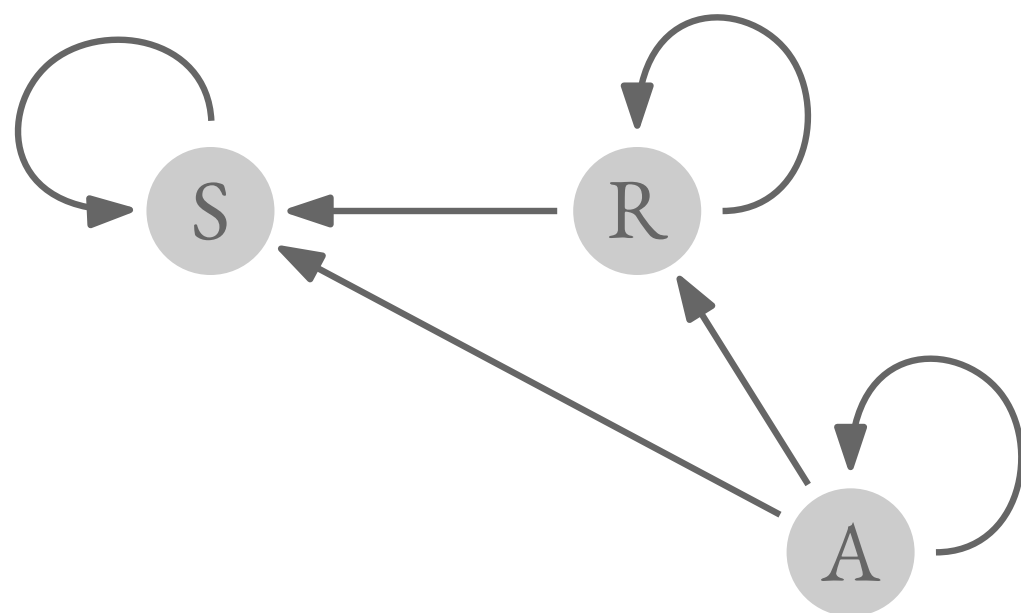
S Statutes

Types of Legal Documents



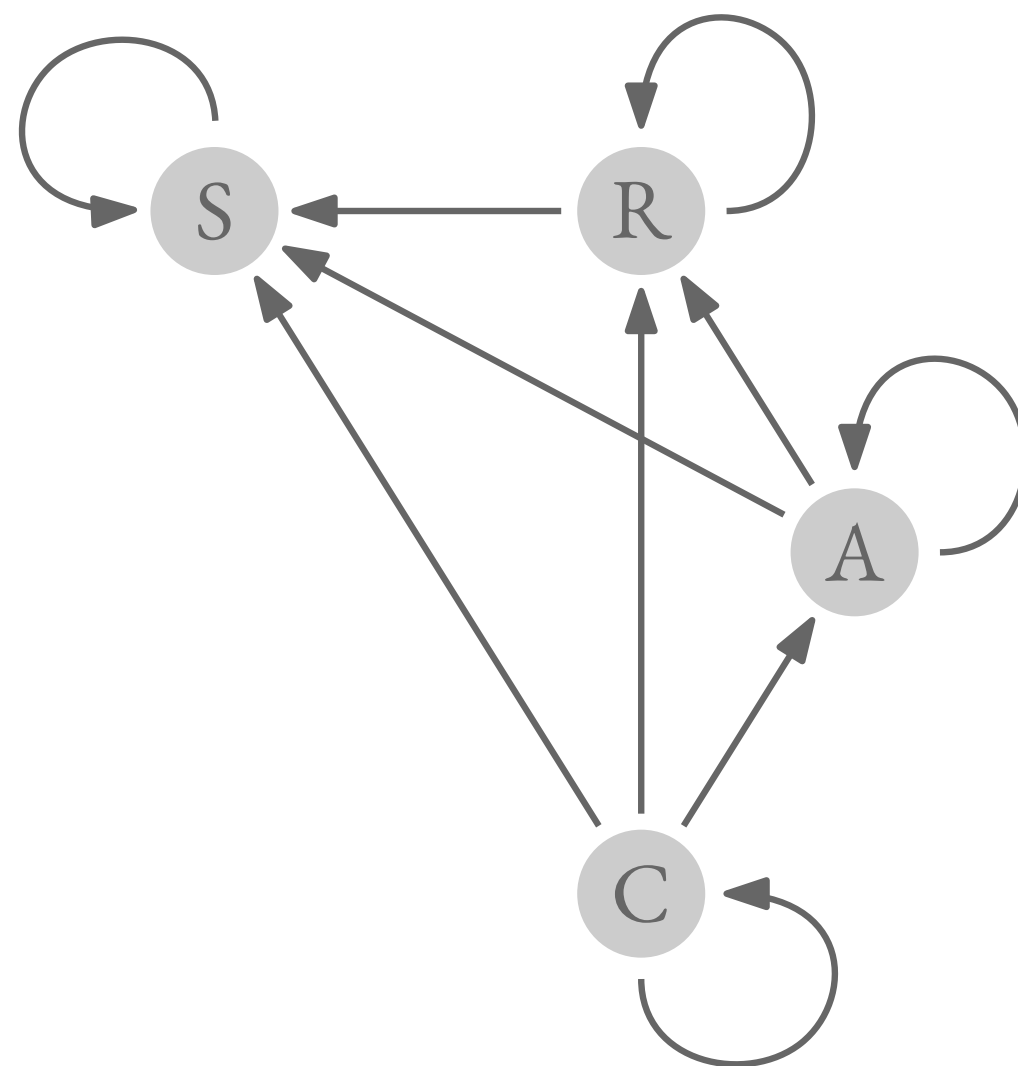
-  Statutes
-  Regulations

Types of Legal Documents



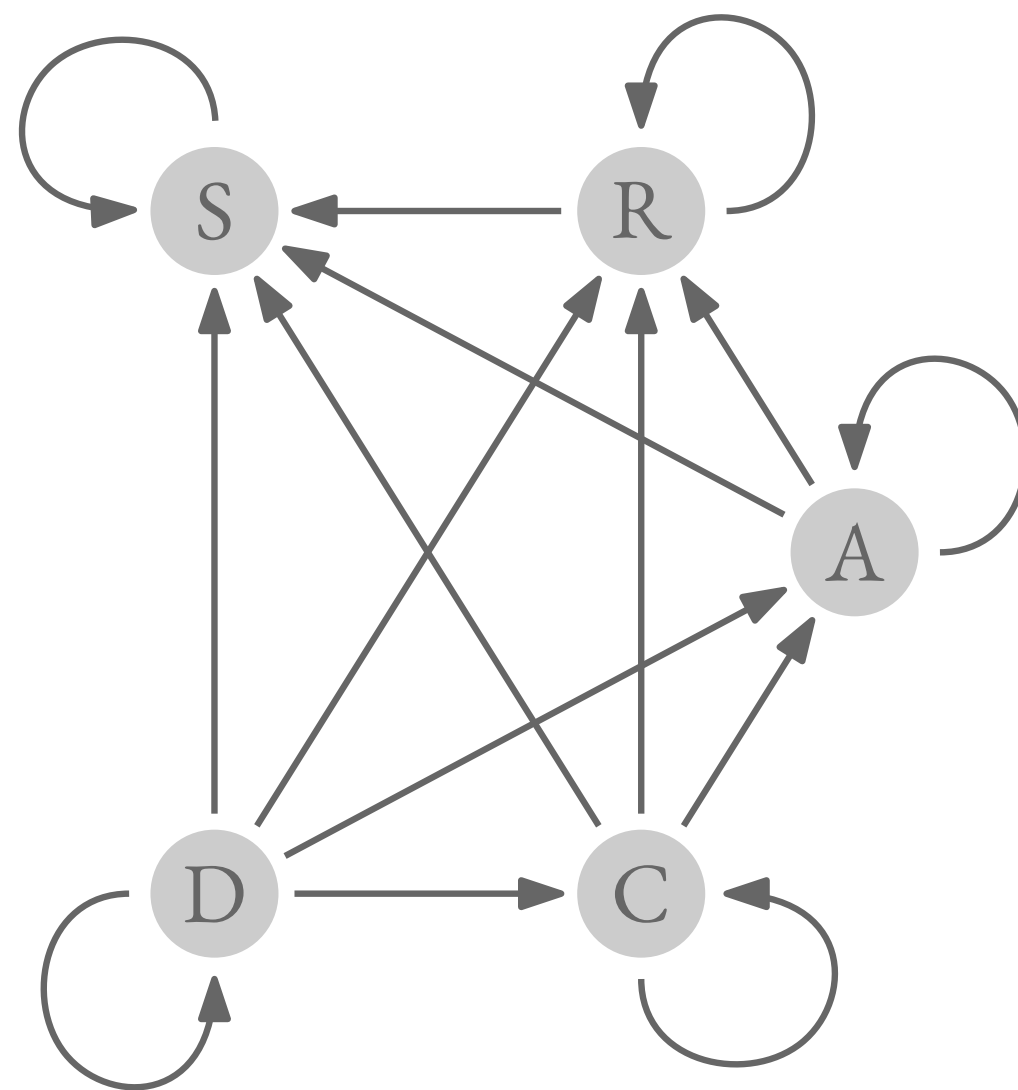
- S Statutes
- R Regulations
- A Administrative Acts

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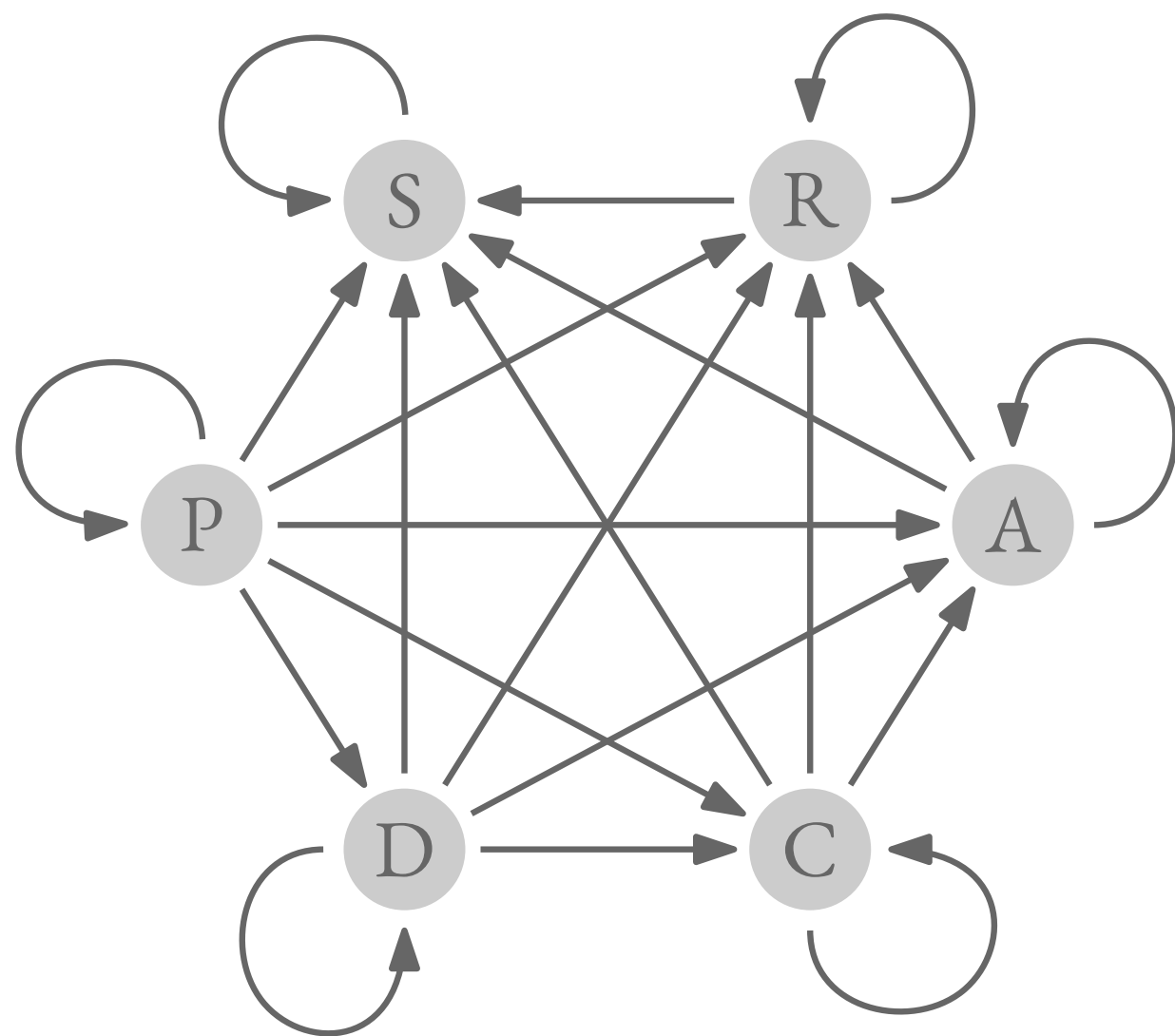
- S Statutes
- R Regulations
- A Administrative Acts
- C Contracts

Types of Legal Documents



- S Statutes
- R Regulations
- A Administrative Acts
- C Contracts
- D Judicial Decisions

Types of Legal Documents



- S Statutes
- R Regulations
- A Administrative Acts
- C Contracts
- D Judicial Decisions
- P Scholarly Papers

Legal Citation Networks

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15 U.S. Code § 15 - Suits by persons injured

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(a) AMOUNT OF RECOVERY; PREJUDGMENT INTEREST

Except as provided in subsection (b), any [person](#) who shall be injured in his business or property by reason of anything forbidden in the [antitrust laws](#) may sue therefor in any district court of the United [States](#) in the district in which the defendant resides or is found or has an agent, without respect to the amount in controversy, and shall recover threefold the damages by him sustained, and the cost of suit, including a reasonable attorney's fee. The court may award under this section, pursuant to a motion by such [person](#) promptly made, simple interest on actual damages for the period beginning on the date of service of such [person's](#) pleading setting forth a claim under the [antitrust laws](#) and ending on the date of judgment, or for any shorter period therein, if the court finds that the award of such interest for such period is just in the circumstances. In determining whether an award of interest under this section for any period is just in the circumstances, the court shall consider only—

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(b) AMOUNT OF DAMAGES PAYABLE TO FOREIGN STATES AND INSTRUMENTALITIES OF FOREIGN STATES

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- (2) Paragraph (1) shall not apply to a [foreign state](#) if—
 - (A) such [foreign state](#) would be denied, under [section 1605\(a\)\(2\) of title 28](#), immunity in a case in which the action is based upon a [commercial activity](#), or an act, that is the subject matter of its claim under this section;
 - (B) such [foreign state](#) waives all defenses based upon or arising out of its status as a [foreign state](#), to any claims brought against it in the same action;

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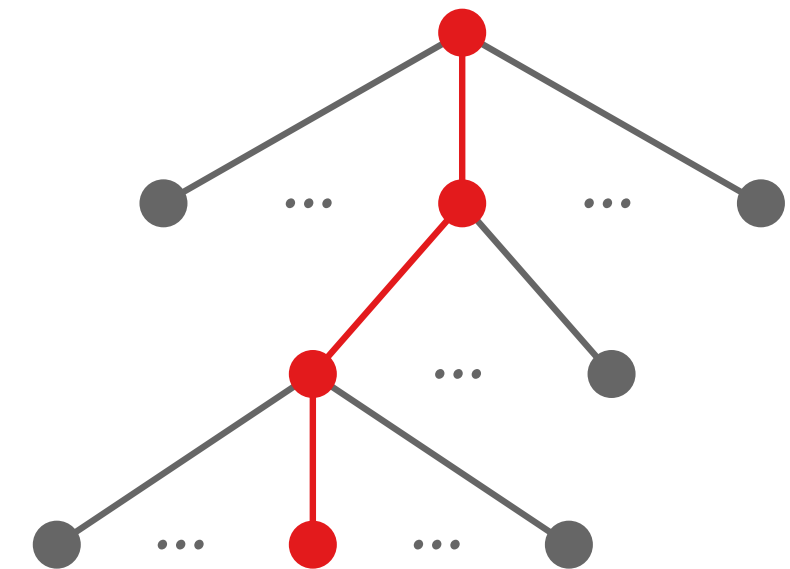
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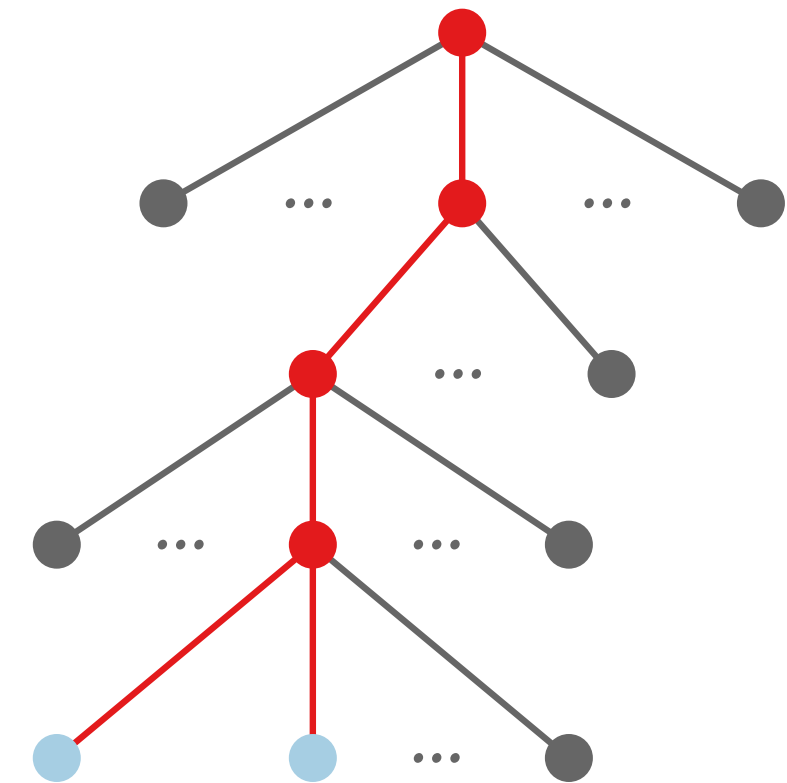
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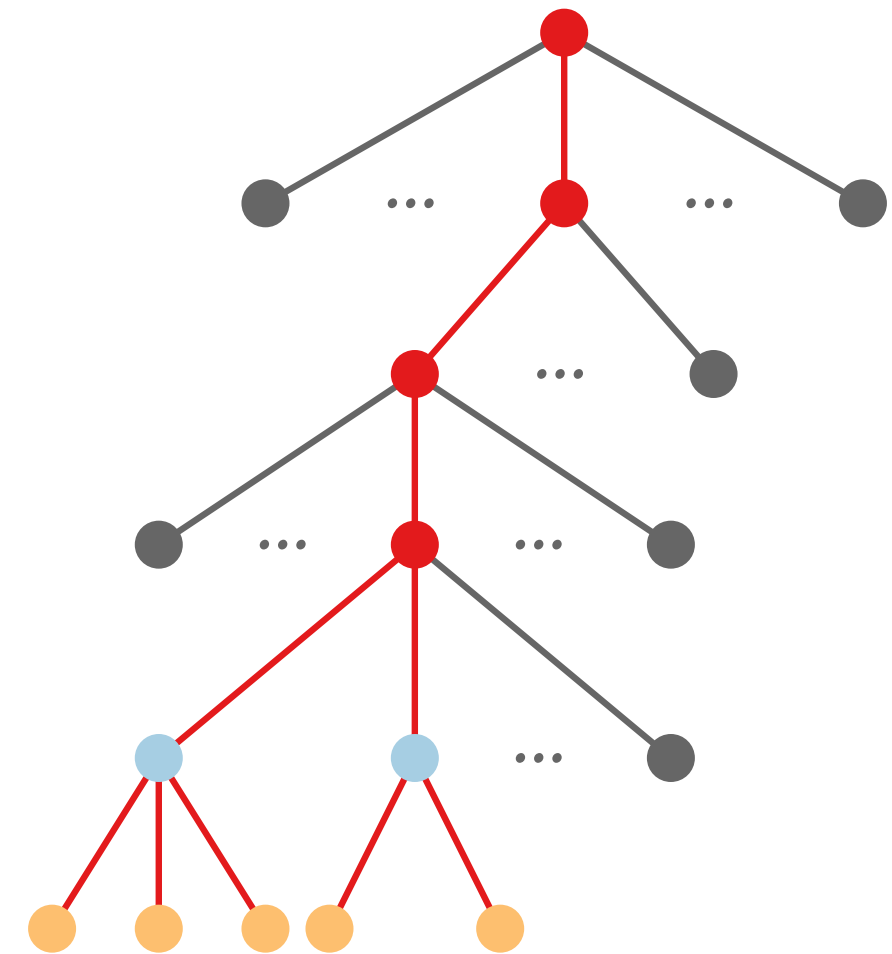
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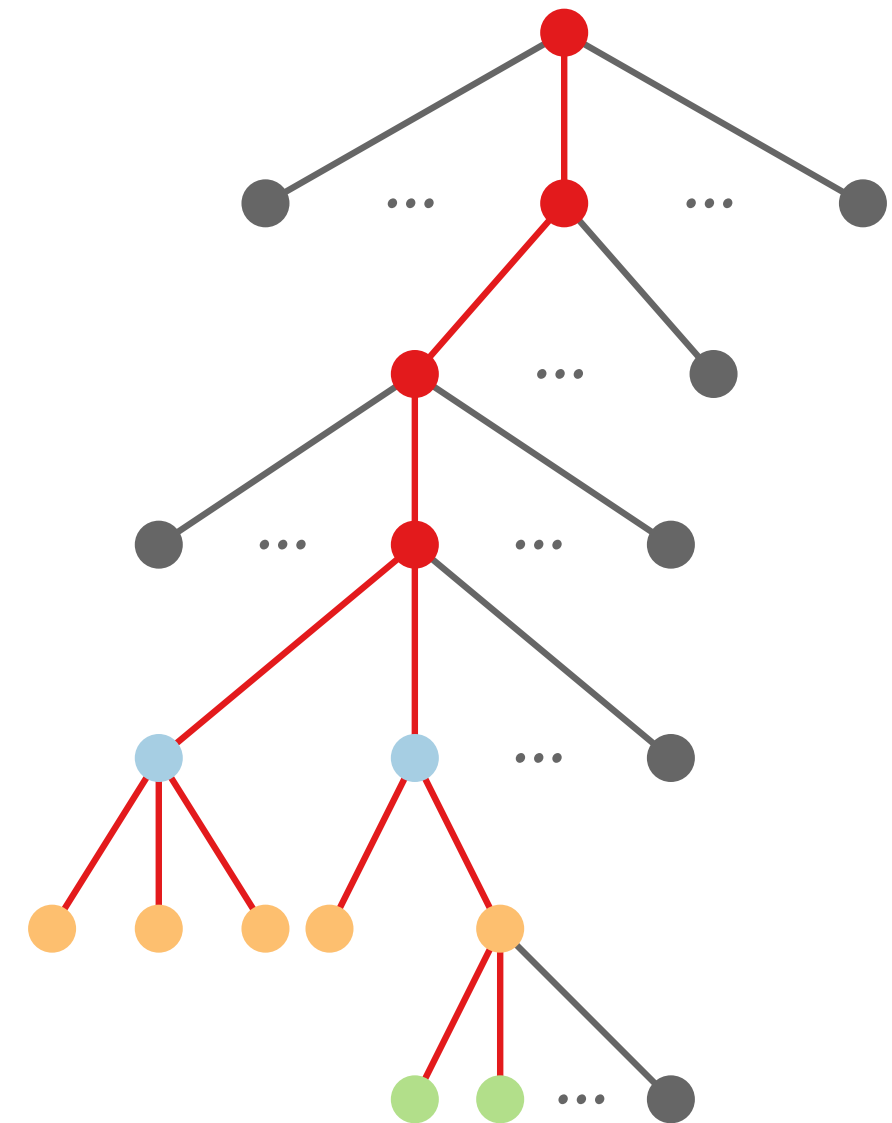
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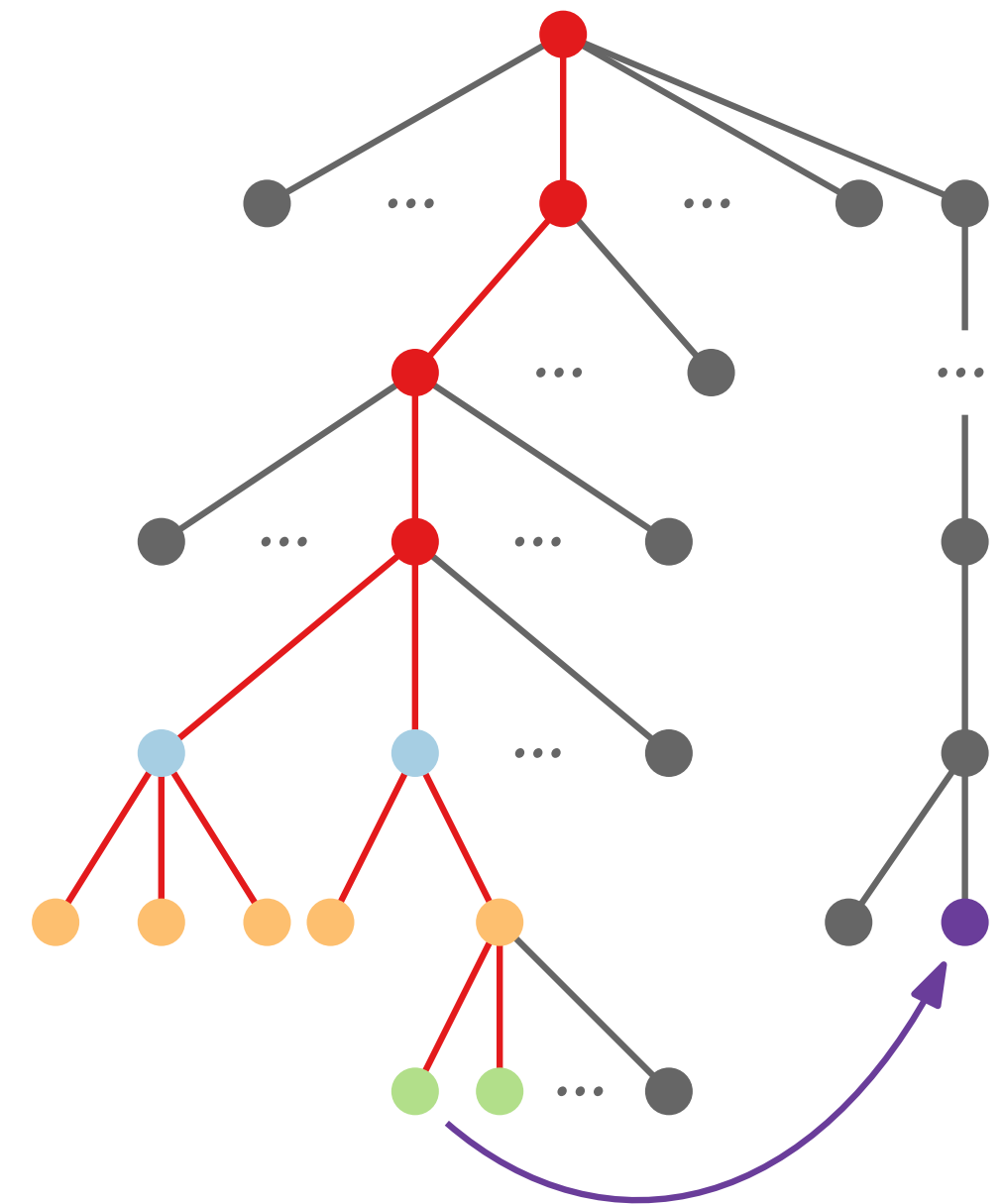
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- (2) whether, in the course of the action involved, such [person](#) or the opposing party, or either party's representative, violated any applicable rule, statute, or court order providing for sanctions for dilatory behavior or otherwise providing for expeditious proceedings; and
- (3) whether such [person](#) or the opposing party, or either party's representative, engaged in conduct primarily for the purpose of delaying the litigation or increasing the cost thereof.

(b) AMOUNT OF DAMAGES PAYABLE TO FOREIGN STATES AND INSTRUMENTALITIES OF FOREIGN STATES

- (1) Except as provided in paragraph (2), any [person](#) who is a [foreign state](#) may not recover under subsection (a) an amount in excess of the actual damages sustained by it and the cost of suit, including a reasonable attorney's fee.
- (2) Paragraph (1) shall not apply to a [foreign state](#) if—
 - (A) such [foreign state](#) would be denied, under [section 1605\(a\)\(2\) of title 28](#), immunity in a case in which the action is based upon a [commercial activity](#), or an act, that is the subject matter of its claim under this section;
 - (B) such [foreign state](#) waives all defenses based upon or arising out of its status as a [foreign state](#), to any claims brought against it in the same action;



Legal Citation Networks

LII > U.S. Code > Title 15 > CHAPTER 1 > § 15

15 U.S. Code § 15 - Suits by persons injured

U.S. Code Notes

[prev](#) | [next](#)

(a) AMOUNT OF RECOVERY; PREJUDGMENT INTEREST

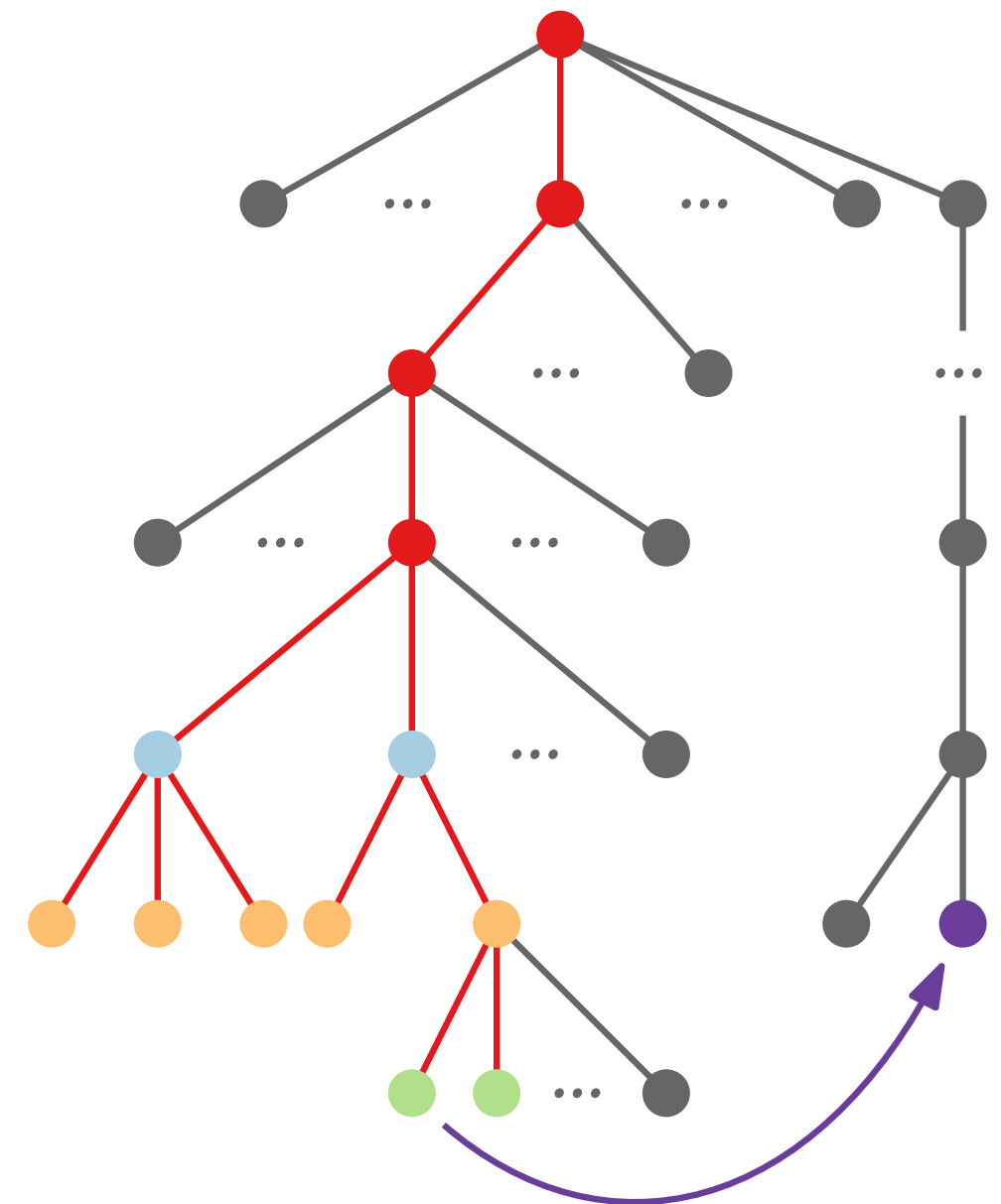
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Hierarchy



Legal Citation Networks

LII > U.S. Code > Title 15 > CHAPTER 1 > § 15

15 U.S. Code § 15 - Suits by persons injured

U.S. Code Notes

[prev](#) | [next](#)

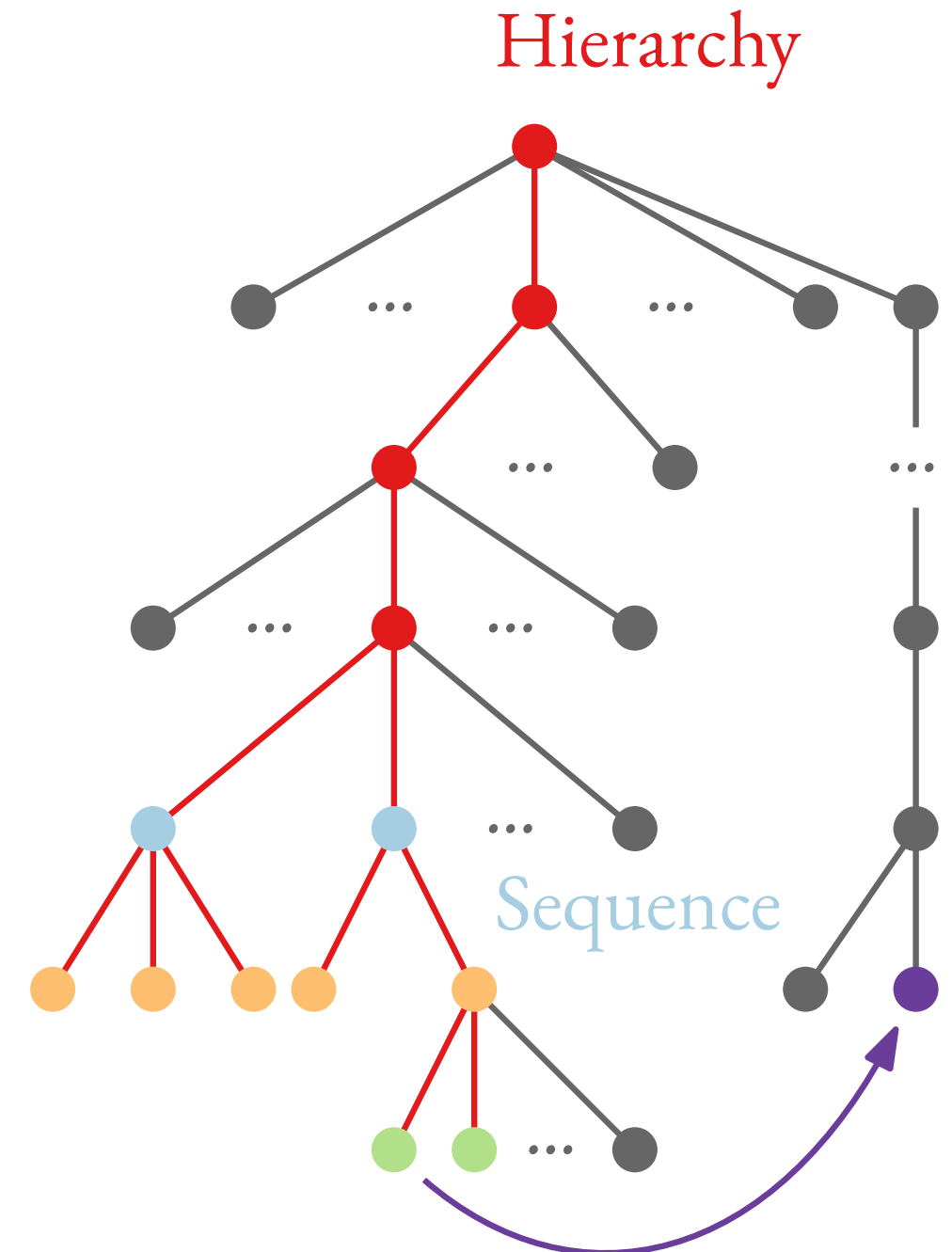
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Legal Citation Networks

LII > U.S. Code > Title 15 > CHAPTER 1 > § 15

15 U.S. Code § 15 - Suits by persons injured

U.S. Code Notes

[prev](#) | [next](#)

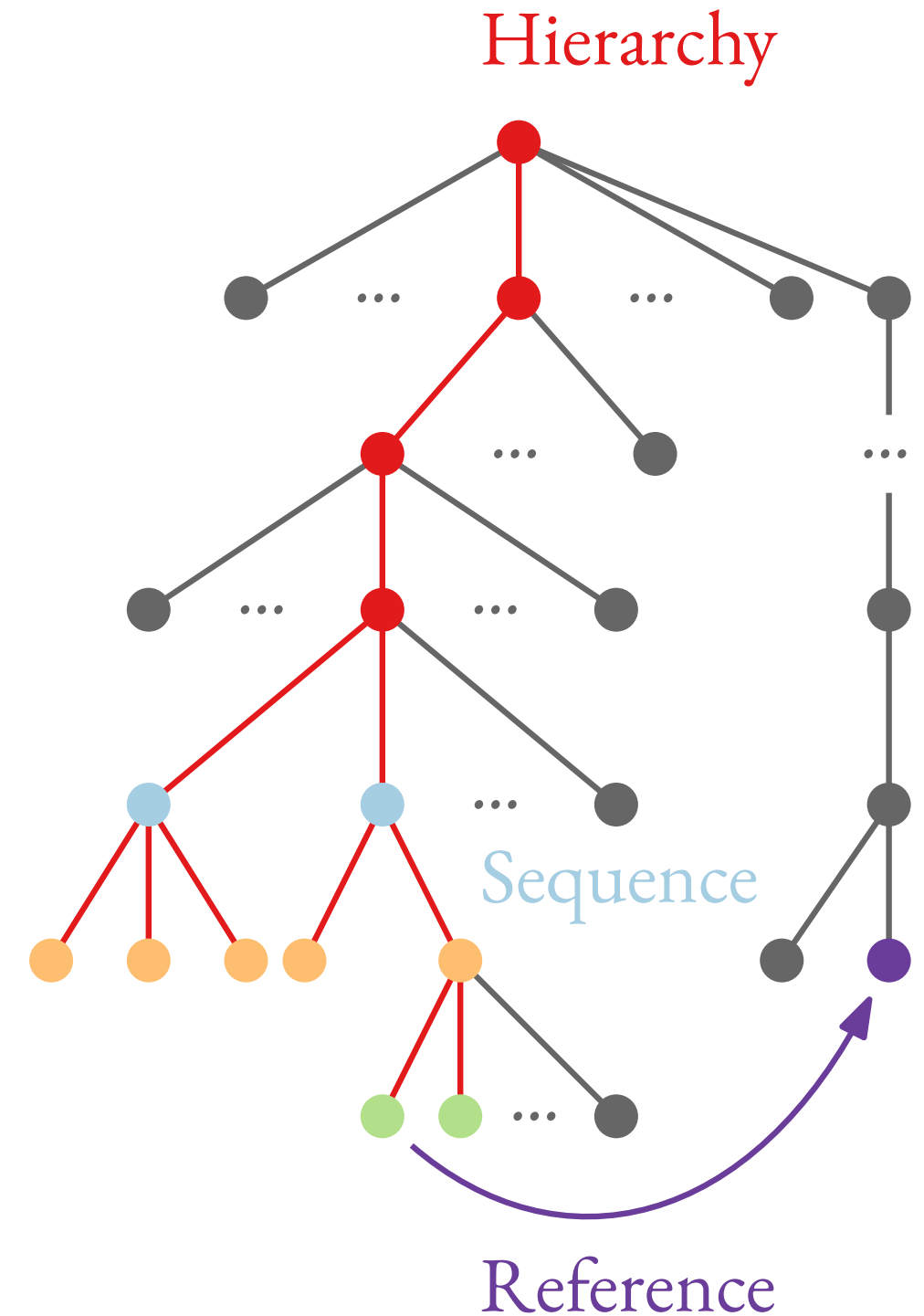
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Legal Citation Networks

Legal Citation Networks

BVerfGE 120, 274, Para. 271

aa) Covert surveillance measures by the state must respect an inviolable core of private life protected under Art. 1(1) of the Basic Law (cf. BVerfGE 6, 32 <41>; 27, 1 <6>; 32, 373 <378 and 379>; 34, 238 <245>; 80, 367 <373>; 109, 279 <313>; 113, 348 <390>). Even overriding public interests cannot justify an interference with this core (cf. BVerfGE 34, 238 <245>; 109, 279 <313>). The development of one's personality within the core of private life encompasses the possibility of expressing internal processes such as emotions and feelings, as well as reflections, views and experiences of a highly personal nature, without fear of surveillance by state authorities (cf. BVerfGE 109, 279 <314>).

Legal Citation Networks

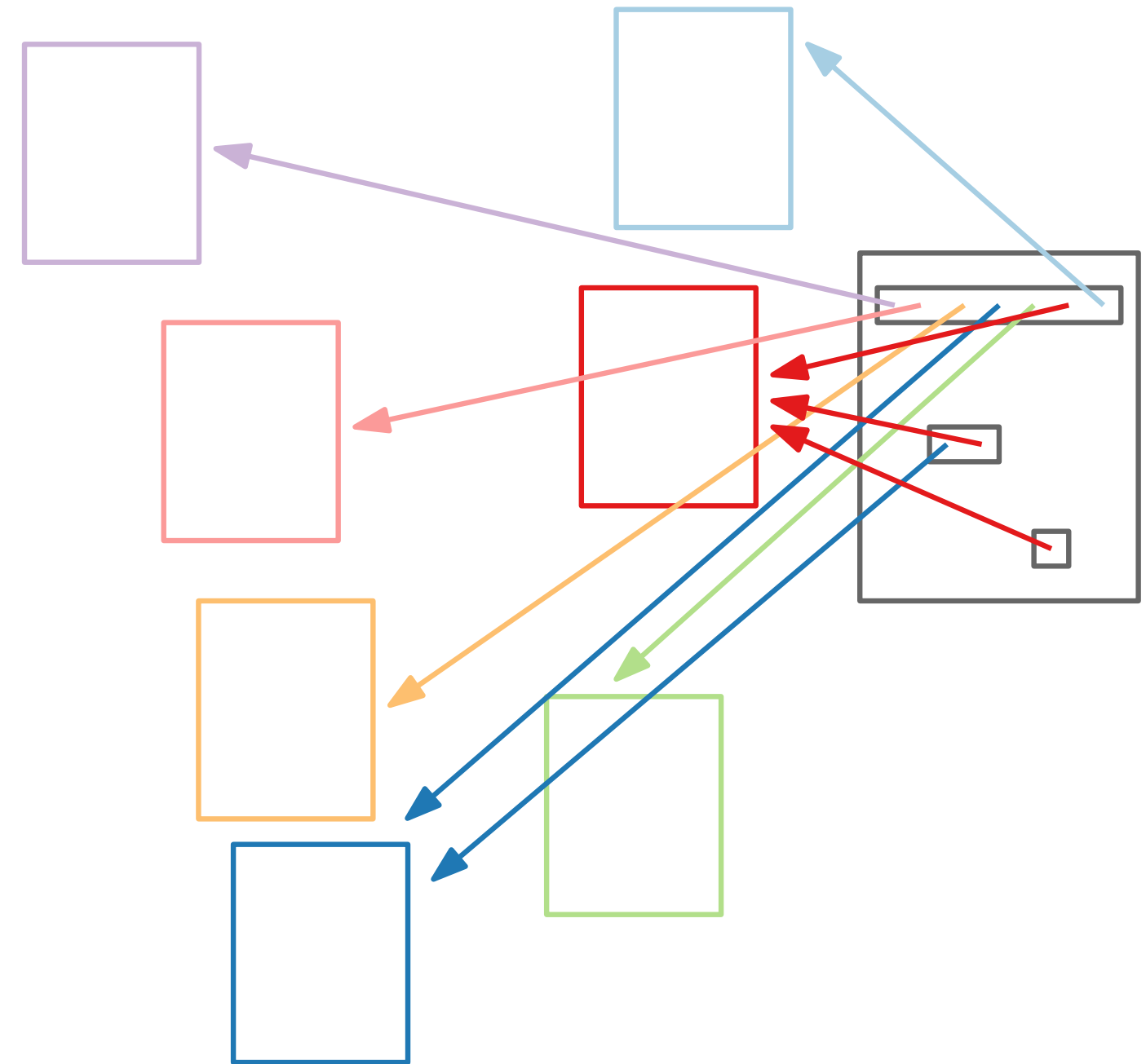
BVerfGE 120, 274, Para. 271

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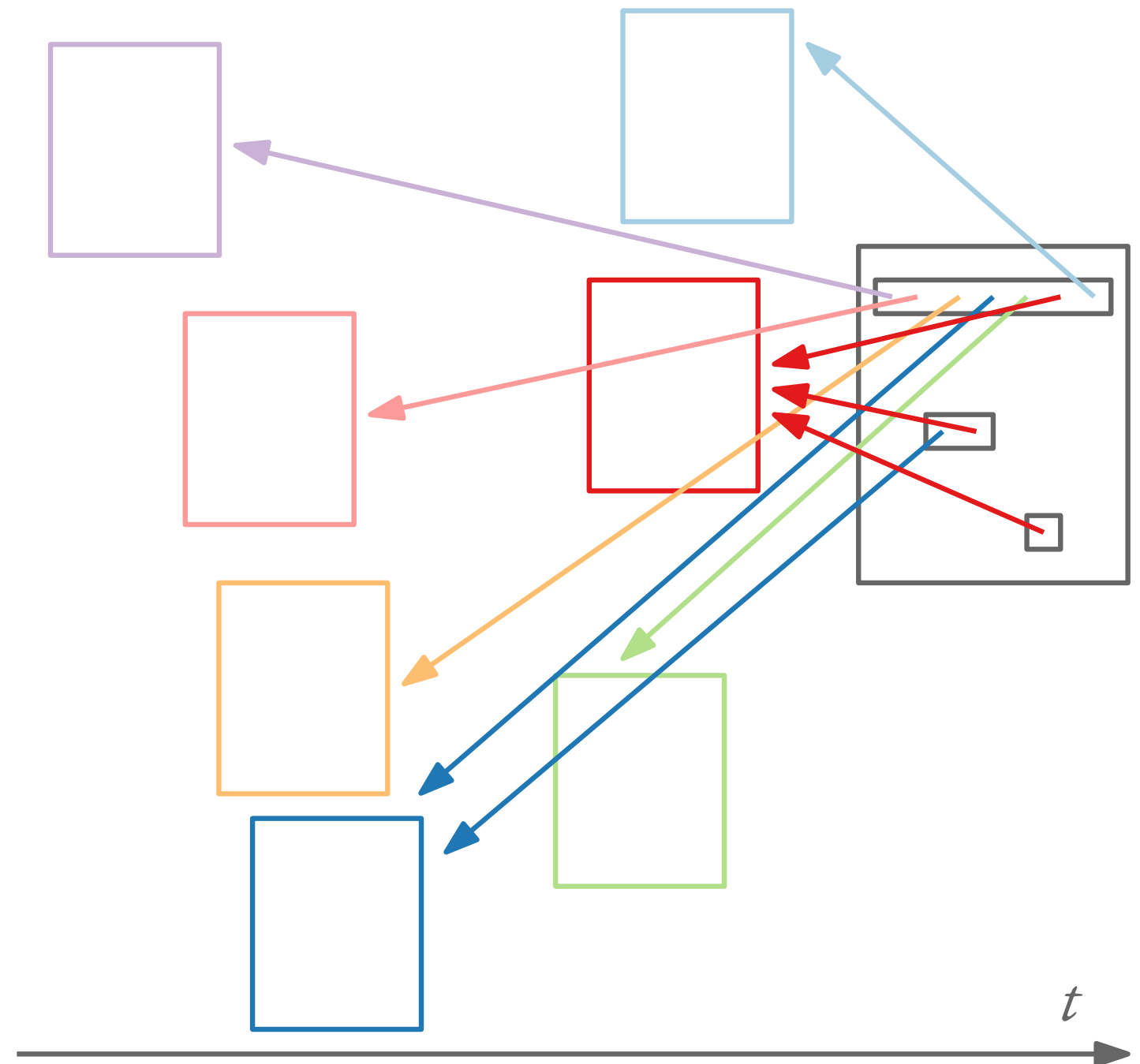
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Legal Collaboration Networks

Legal Collaboration Networks

(a) Original Proceeding	
Claimant(s)/Nationality(ies):(i)	Petronas (E&P) Overseas Venture Sdn. Bhd. (Malaysian), Petronas Carigali Chad Exploration & Production Inc. (British), Doba Pipeline Investment Inc. (British)
Respondent(s):	Republic of Cameroon (Cameroonian)
Date Registered:	November 11, 2022
Date of Constitution of Tribunal:	February 6, 2023
Composition of Tribunal	
President:	Pierre BIENVENU (Canadian) - Appointed by Co-Arbitrators
Arbitrators:	Thomas CLAY (French) - Appointed by the Claimant(s) Téa-Corinne KINTA (Congolese, French) - Appointed by the Respondent(s)
Party Representatives	
Claimant(s):	Cleary Gottlieb Steen & Hamilton, Paris, France Quinn Emanuel Urquhart & Sullivan, Paris, France
Respondent(s):	Gill Dingomé, Paris, France
Status of Proceeding:	Pending
Latest Development:	June 8, 2023 - The Tribunal issues an order taking note of the discontinuance of the proceedings with respect to Cameroon Oil Transportation Company S.A., Esso Pipeline Investments Limited, ExxonMobil International Holdings Inc., and Esso Exploration Holdings Inc., pursuant to ICSID Arbitration Rule 56.

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Legal Collaboration Networks

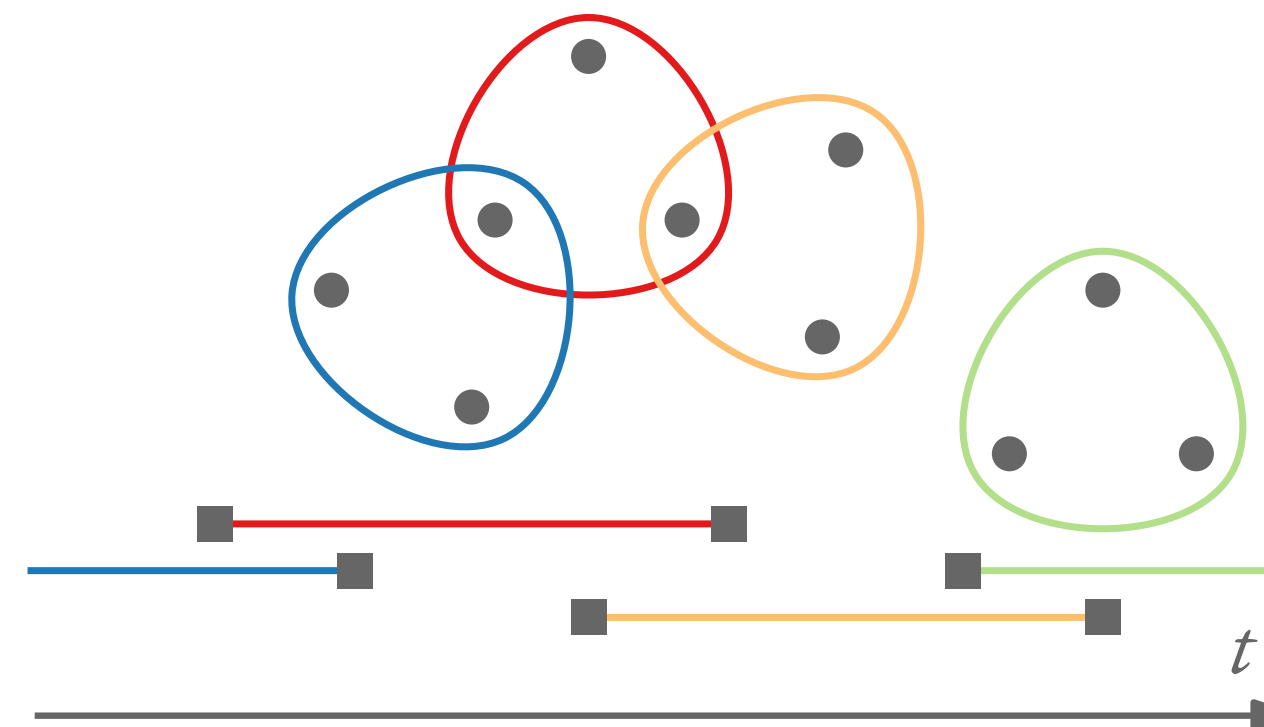
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Legal Collaboration Networks

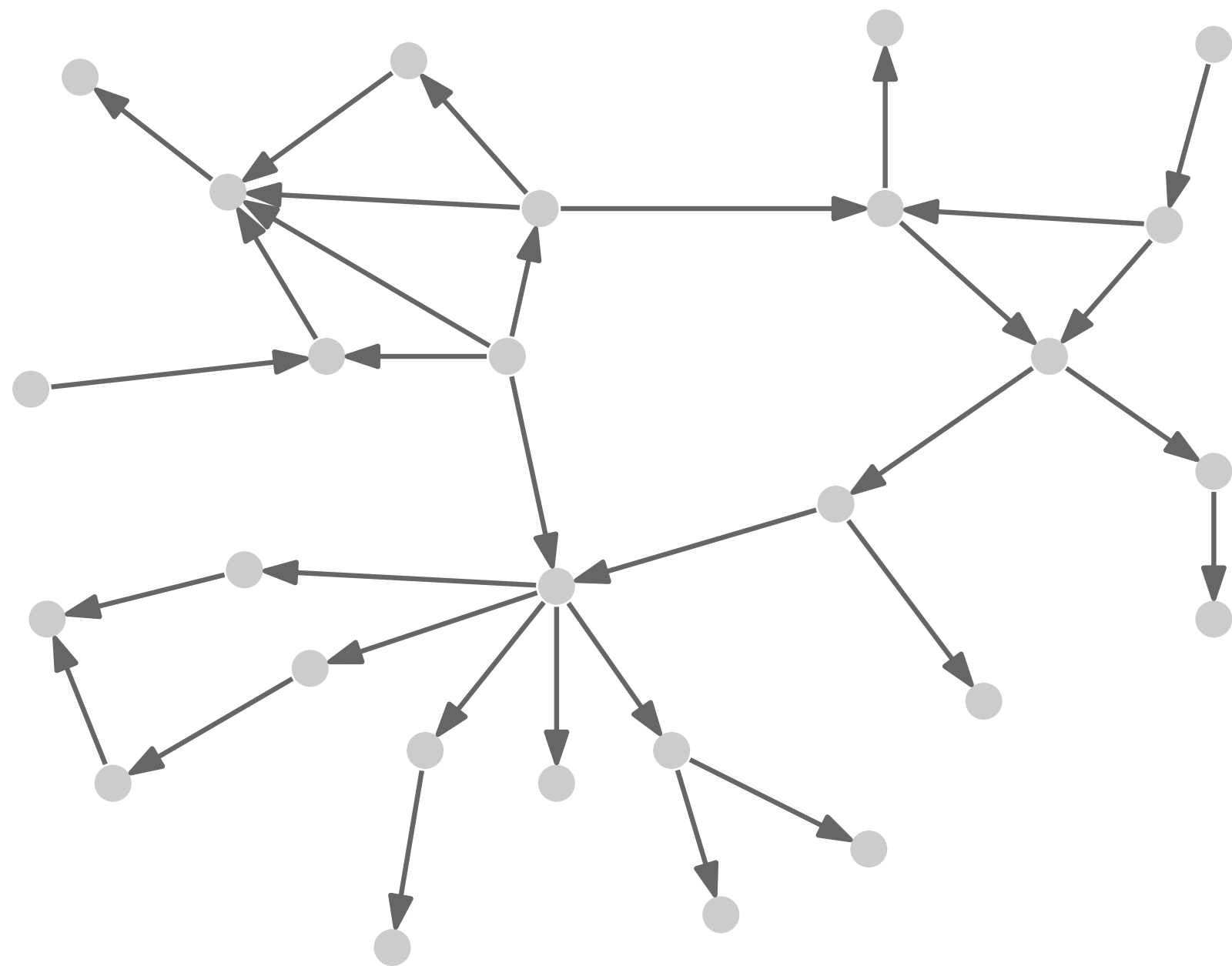
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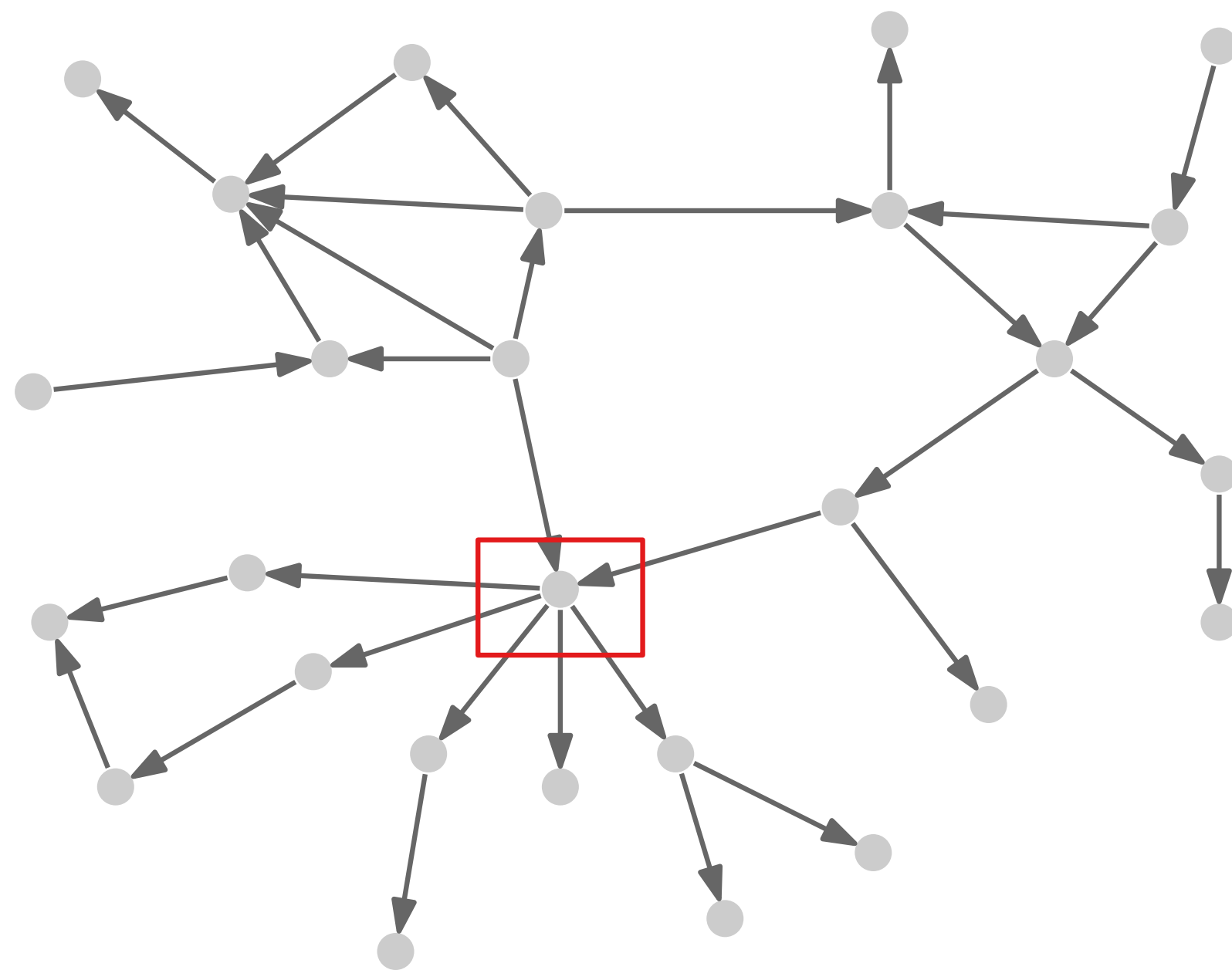


Levels of Analysis

Levels of Analysis



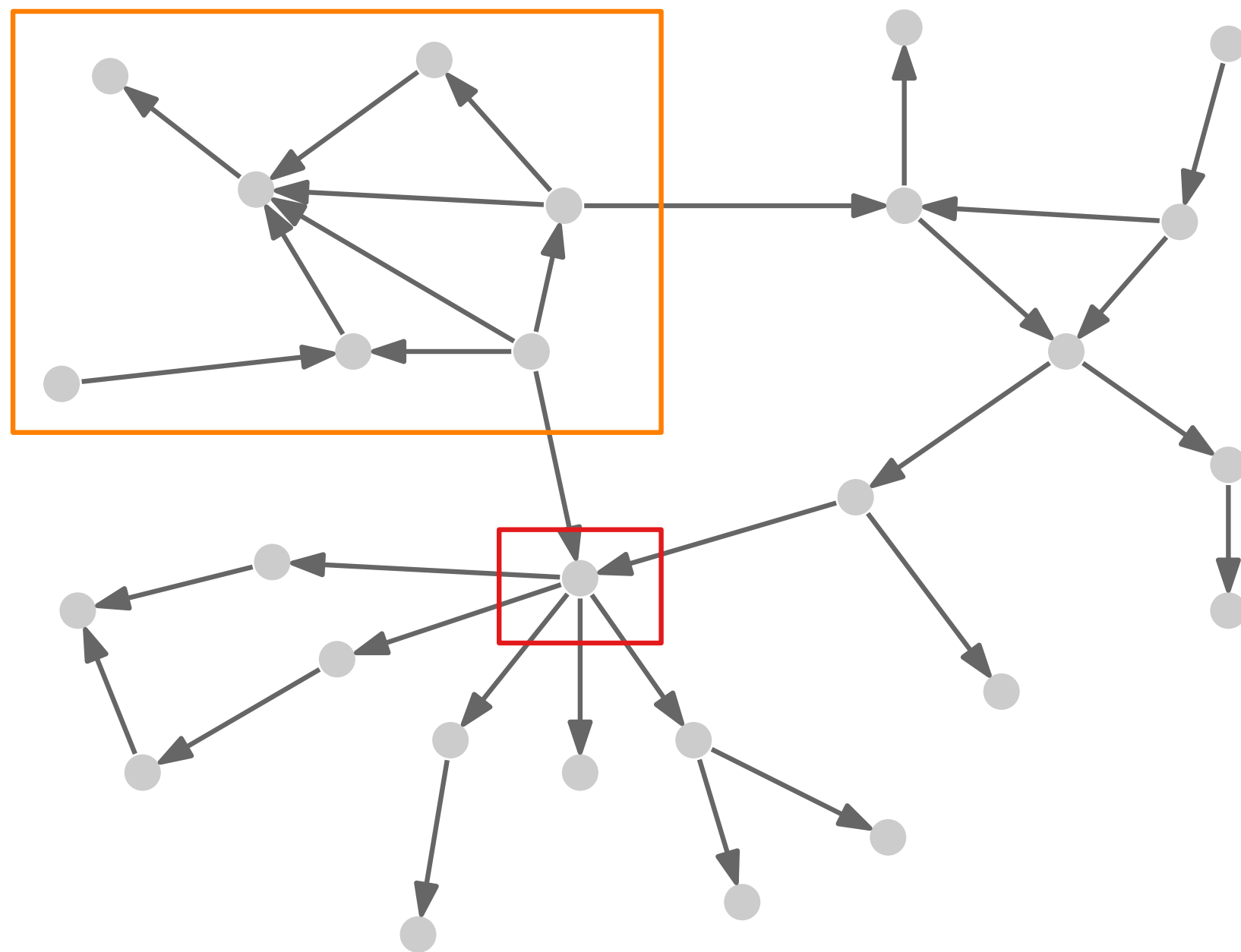
Levels of Analysis



Micro Level

Nodes & Neighborhoods

Levels of Analysis



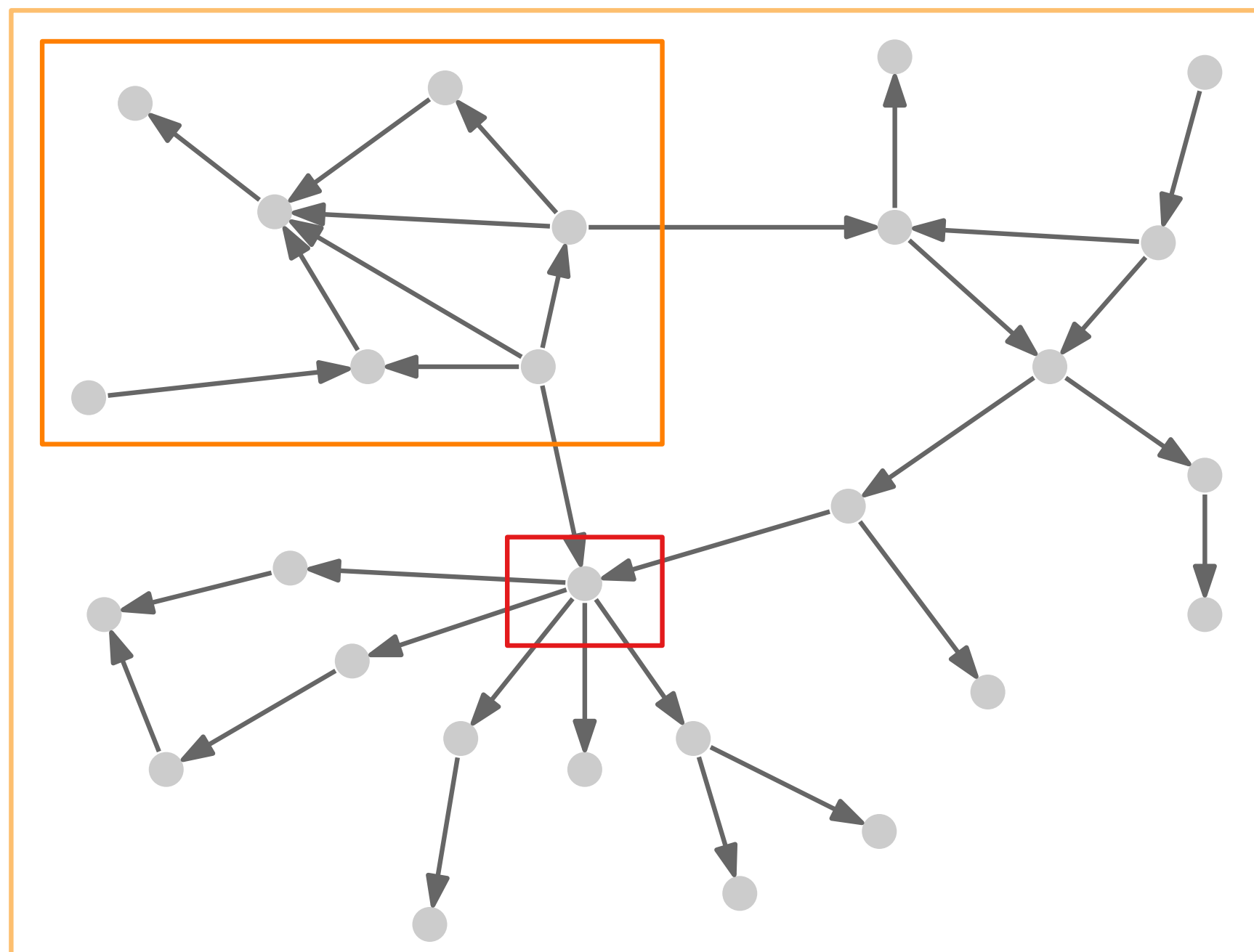
Micro Level

Nodes & Neighborhoods

Meso Level

Motifs & Communities

Levels of Analysis



Micro Level

Nodes & Neighborhoods

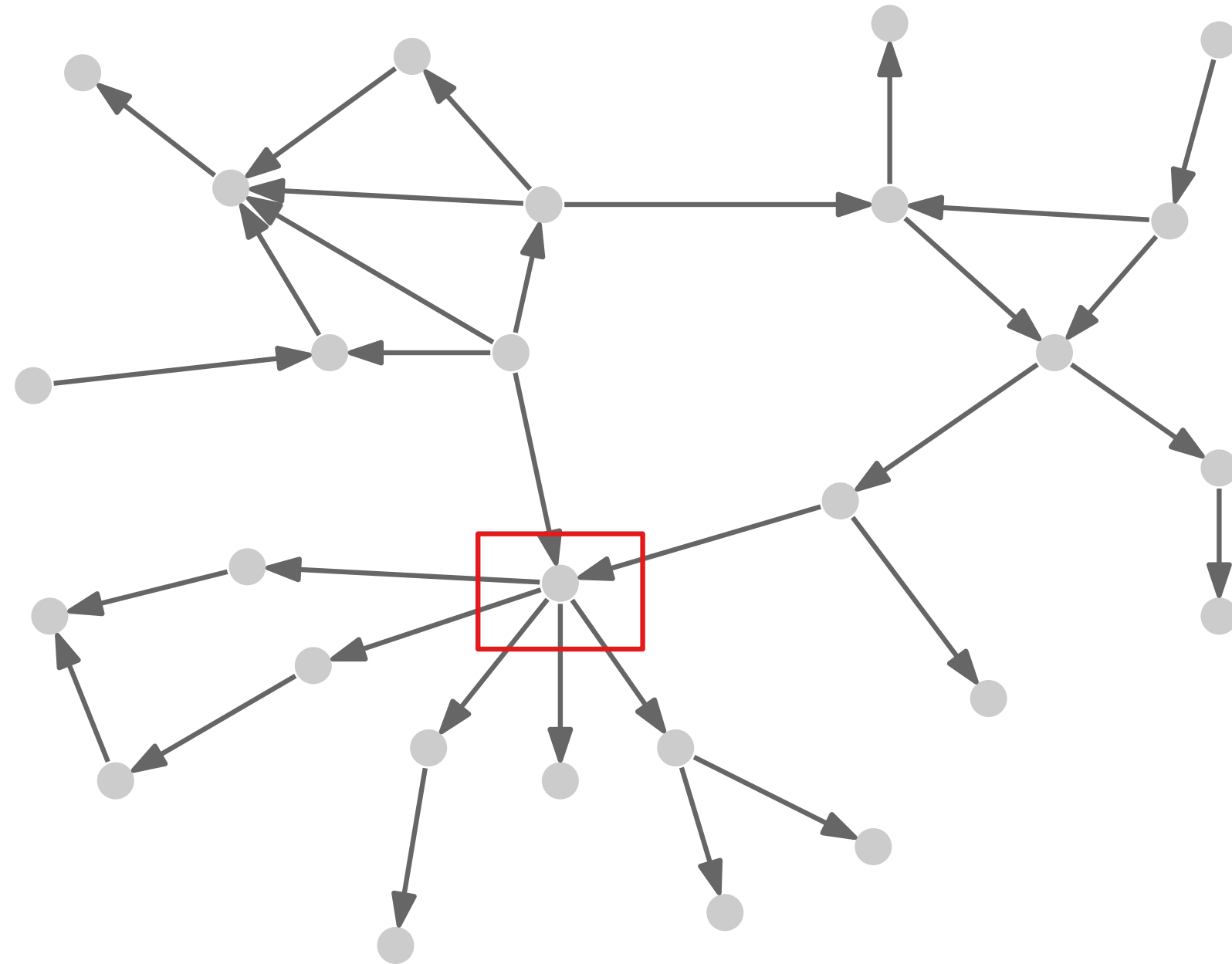
Meso Level

Motifs & Communities

Macro Level

Statistics & Invariants

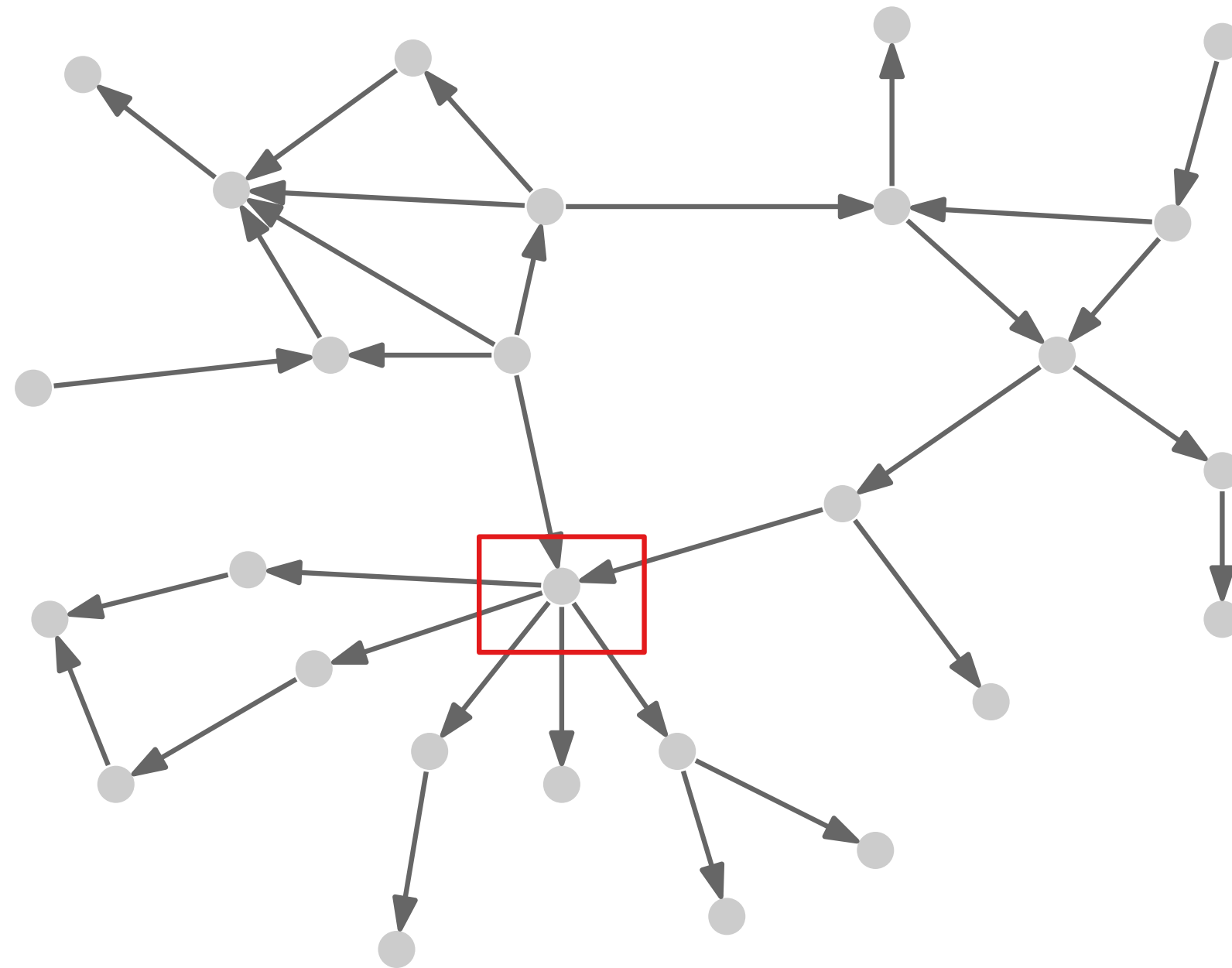
Micro-Level Analysis



Micro Level

Nodes & Neighborhoods

Micro-Level Analysis



Micro Level

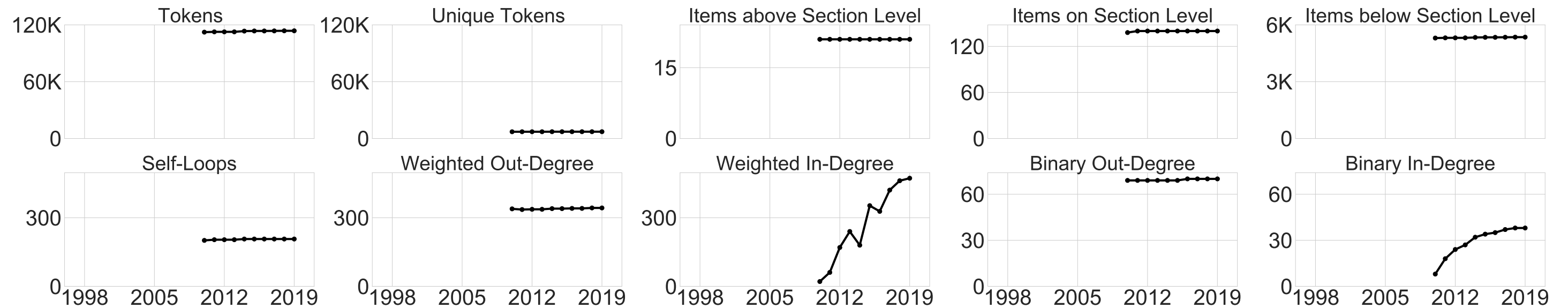
Nodes & Neighborhoods

Classic Tool

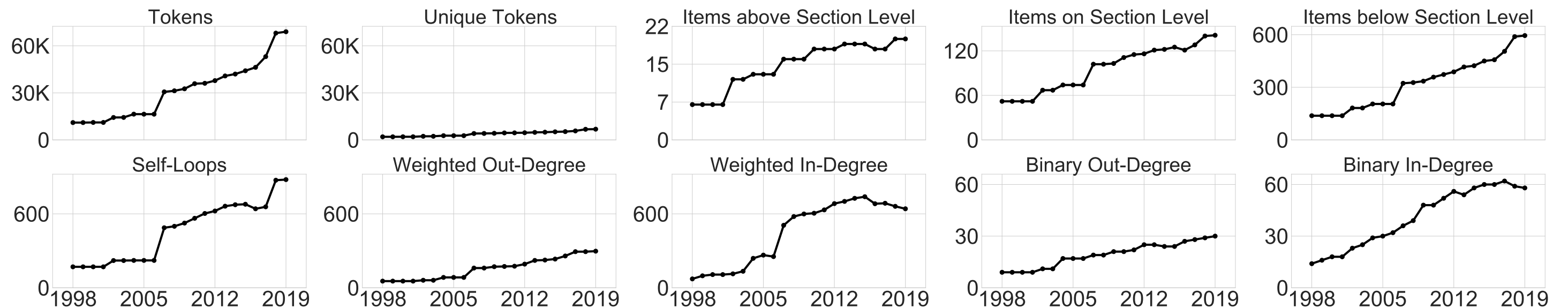
Centralities

Micro-Level Analysis

12 USC Ch. 53 (Dodd-Frank Act)

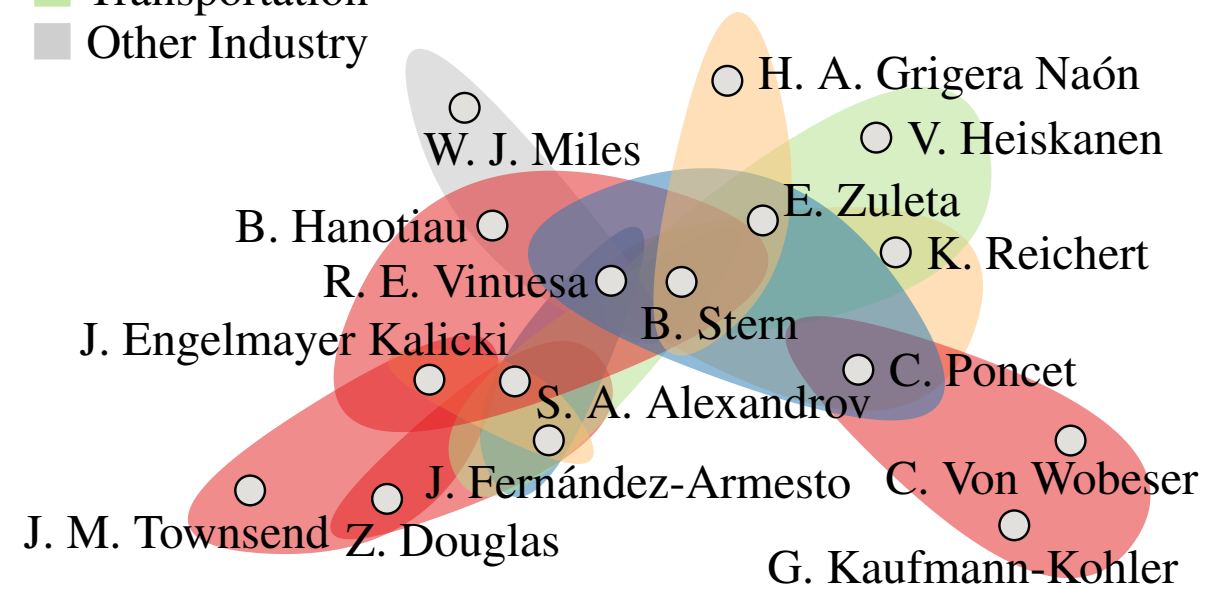


Securities Trading Act (WpHG)



Micro-Level Analysis

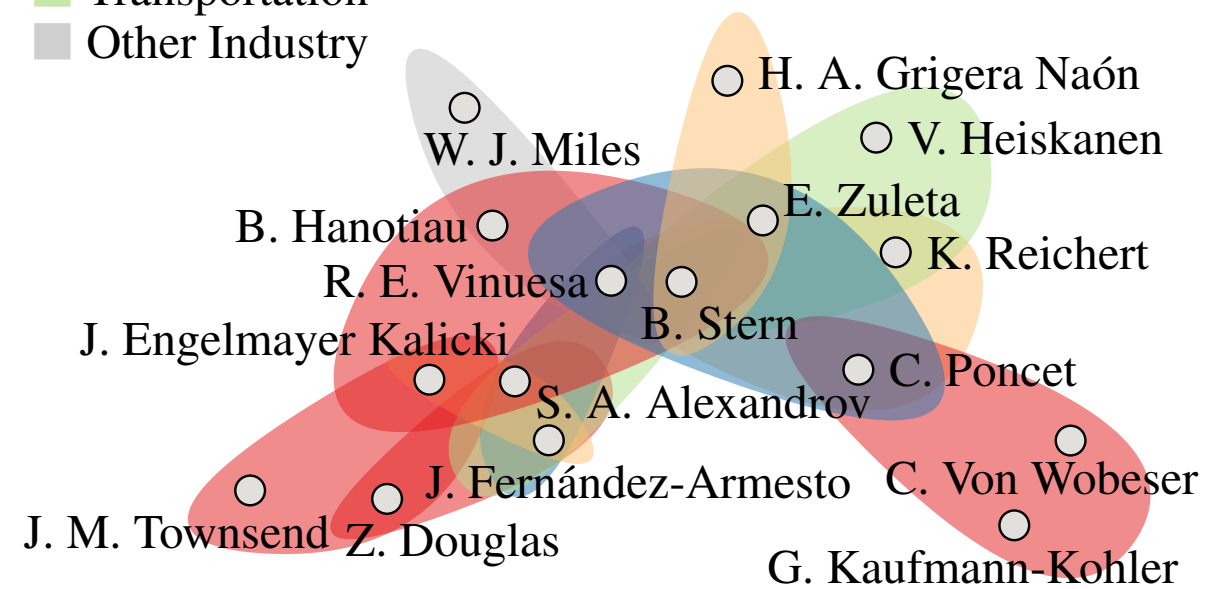
- Construction
- Electric Power & Other Energy
- Finance
- Information & Communication
- Oil, Gas & Mining
- Transportation
- Other Industry



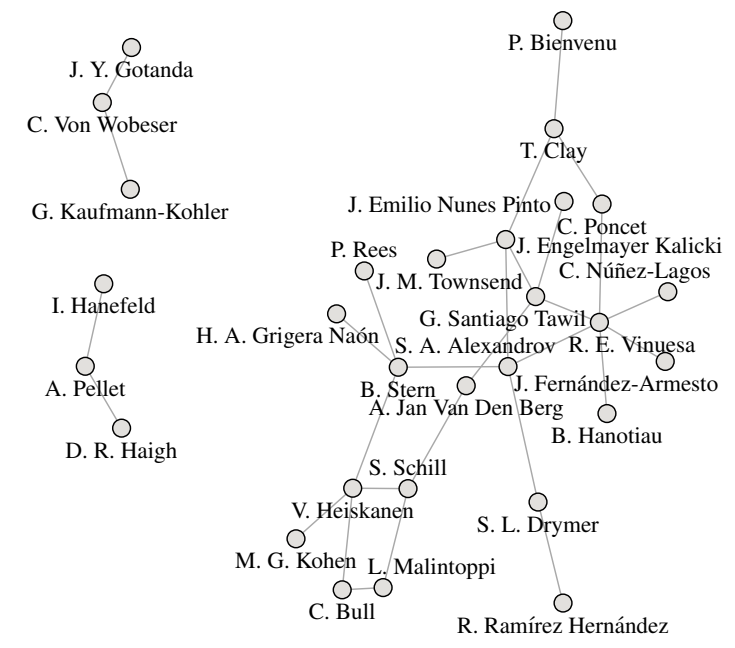
Higher-order betweenness

Micro-Level Analysis

- Construction
- Electric Power & Other Energy
- Finance
- Information & Communication
- Oil, Gas & Mining
- Transportation
- Other Industry



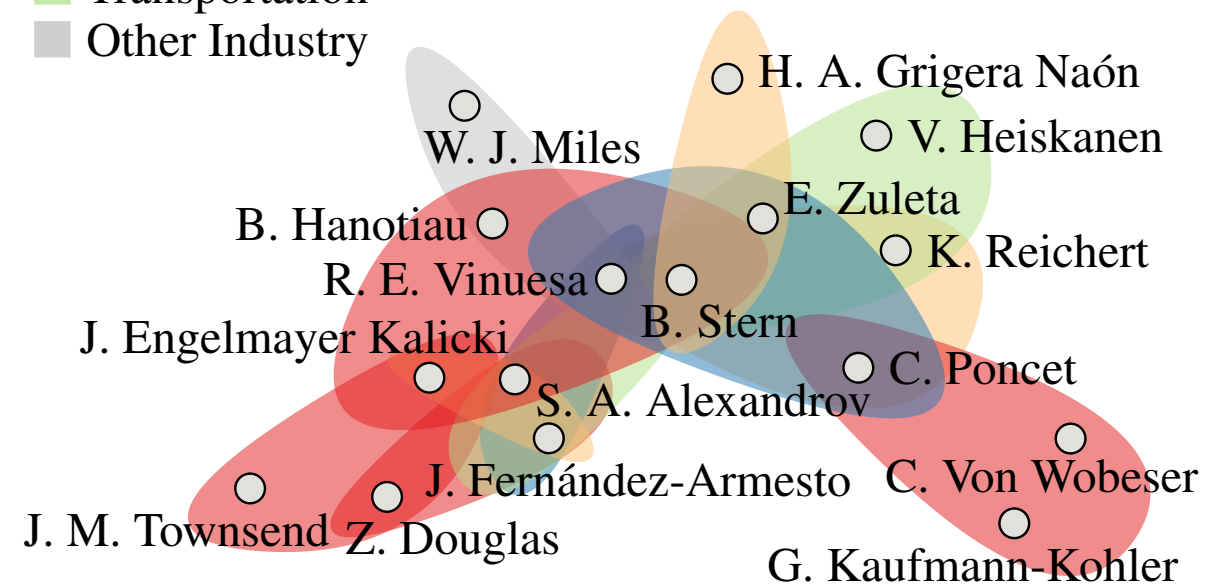
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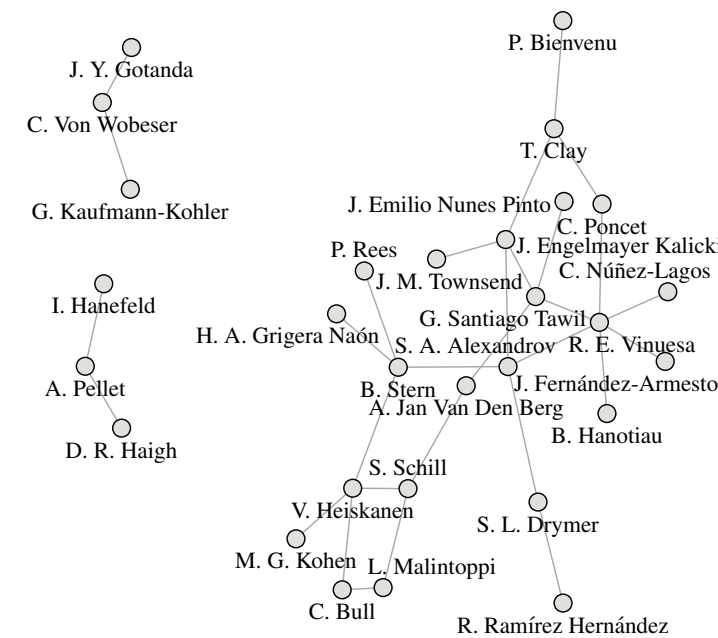
Binary betweenness

Micro-Level Analysis

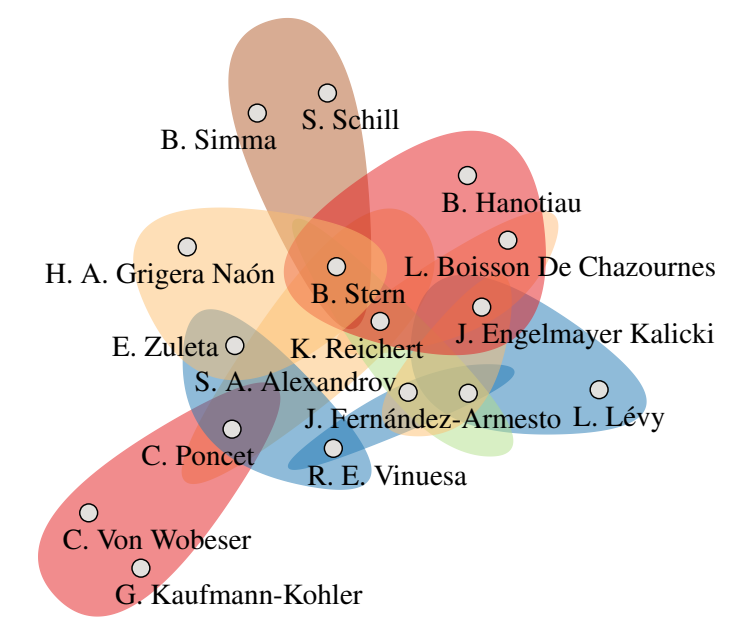
- Construction
- Electric Power & Other Energy
- Finance
- Information & Communication
- Oil, Gas & Mining
- Transportation
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Higher-order betweenness



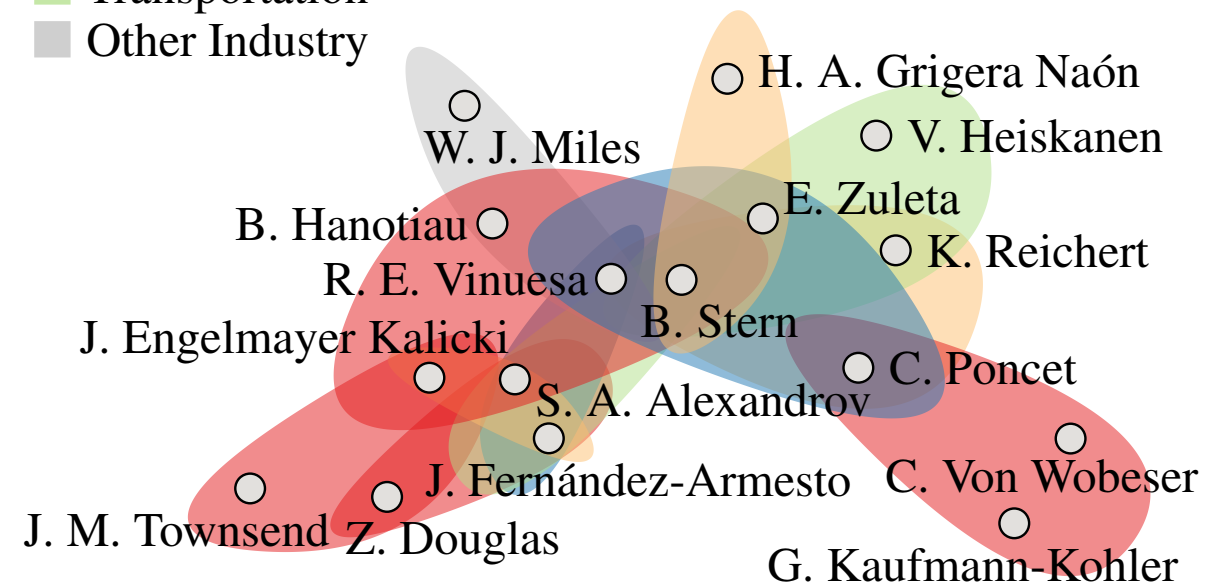
Binary betweenness



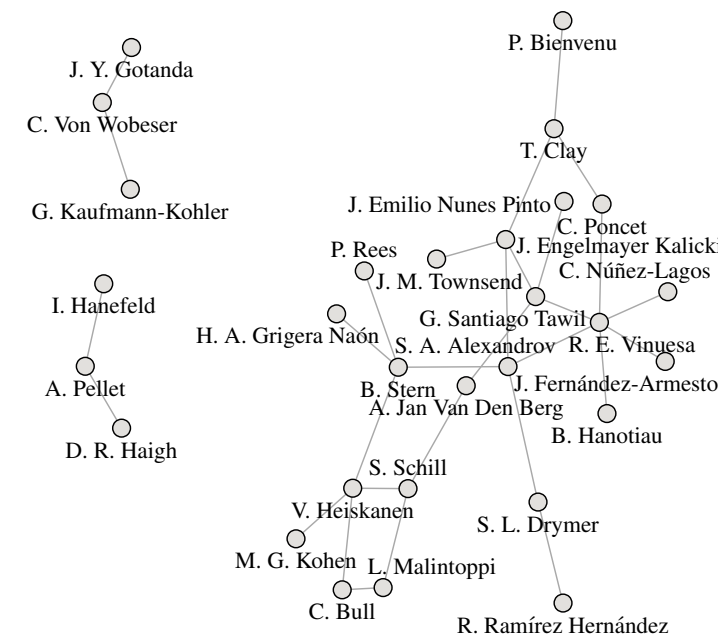
Closeness with time

Micro-Level Analysis

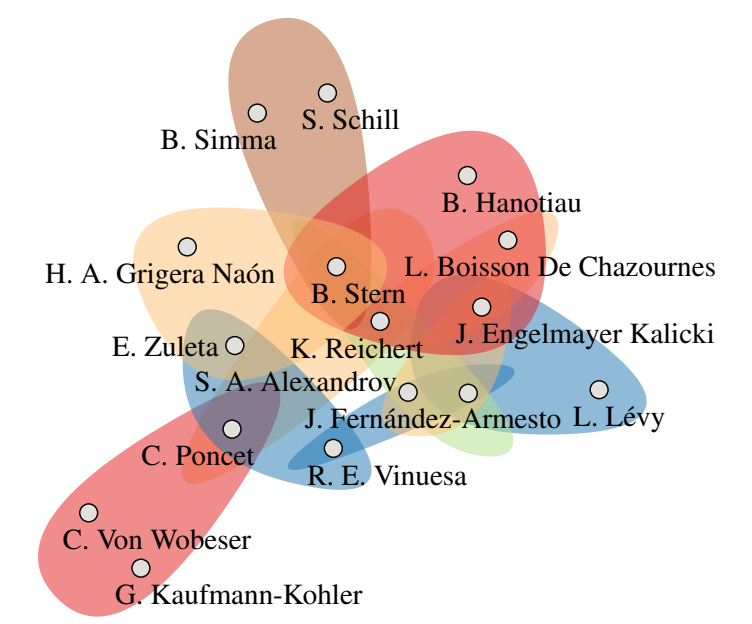
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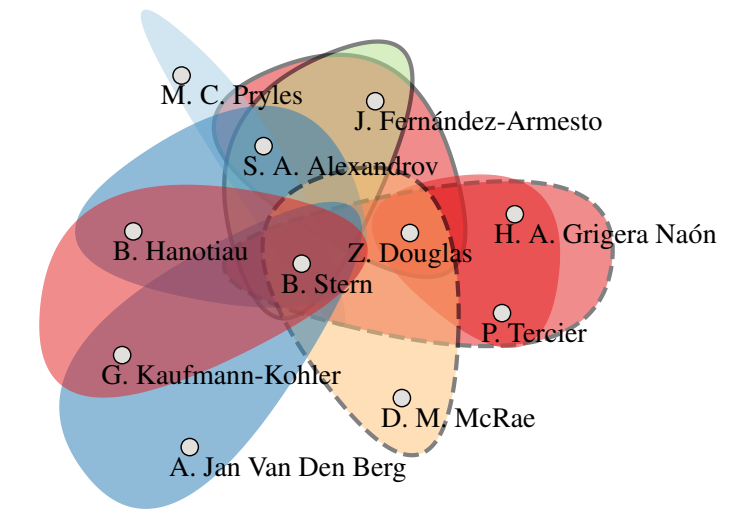
Higher-order betweenness



Binary betweenness

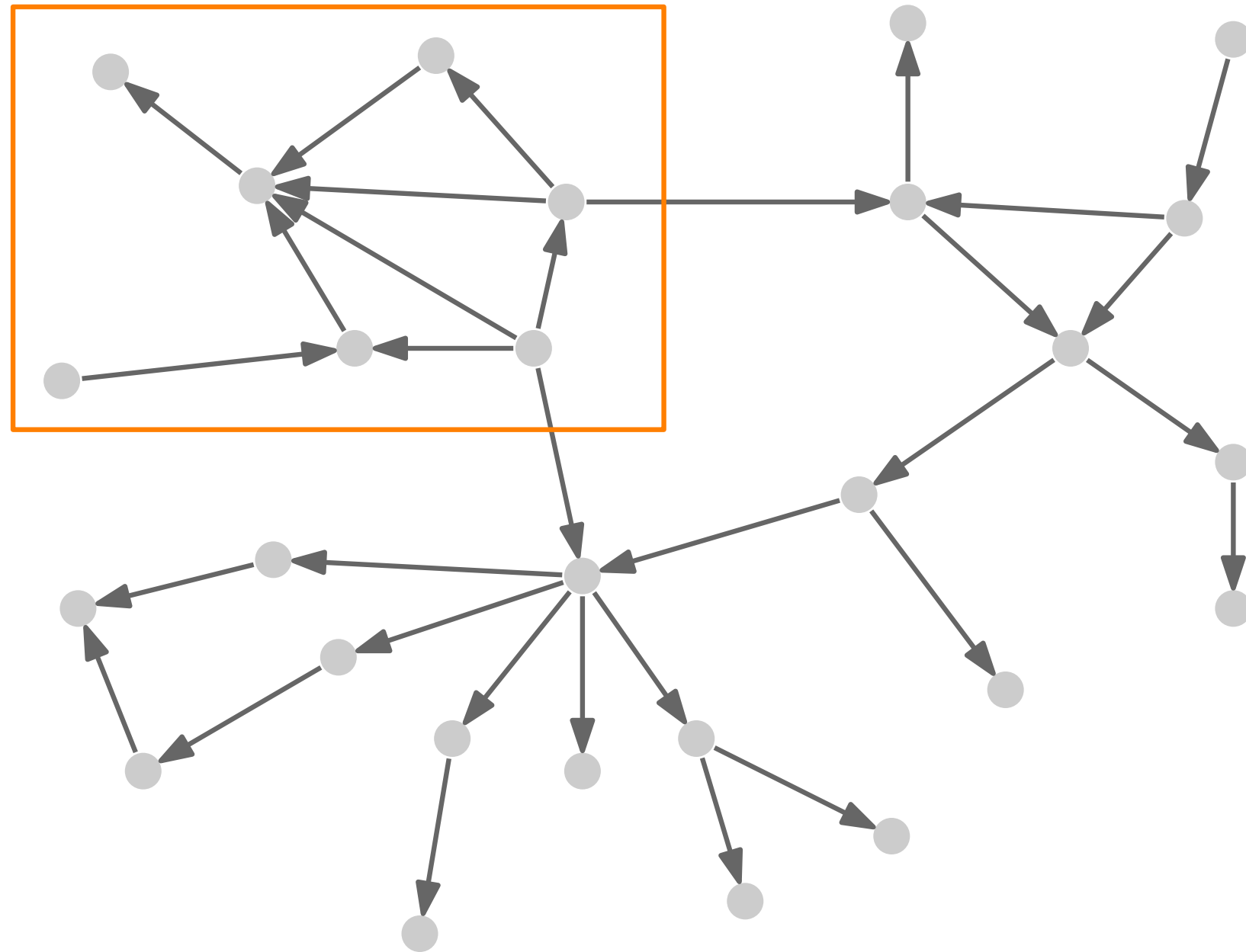


Closeness with time



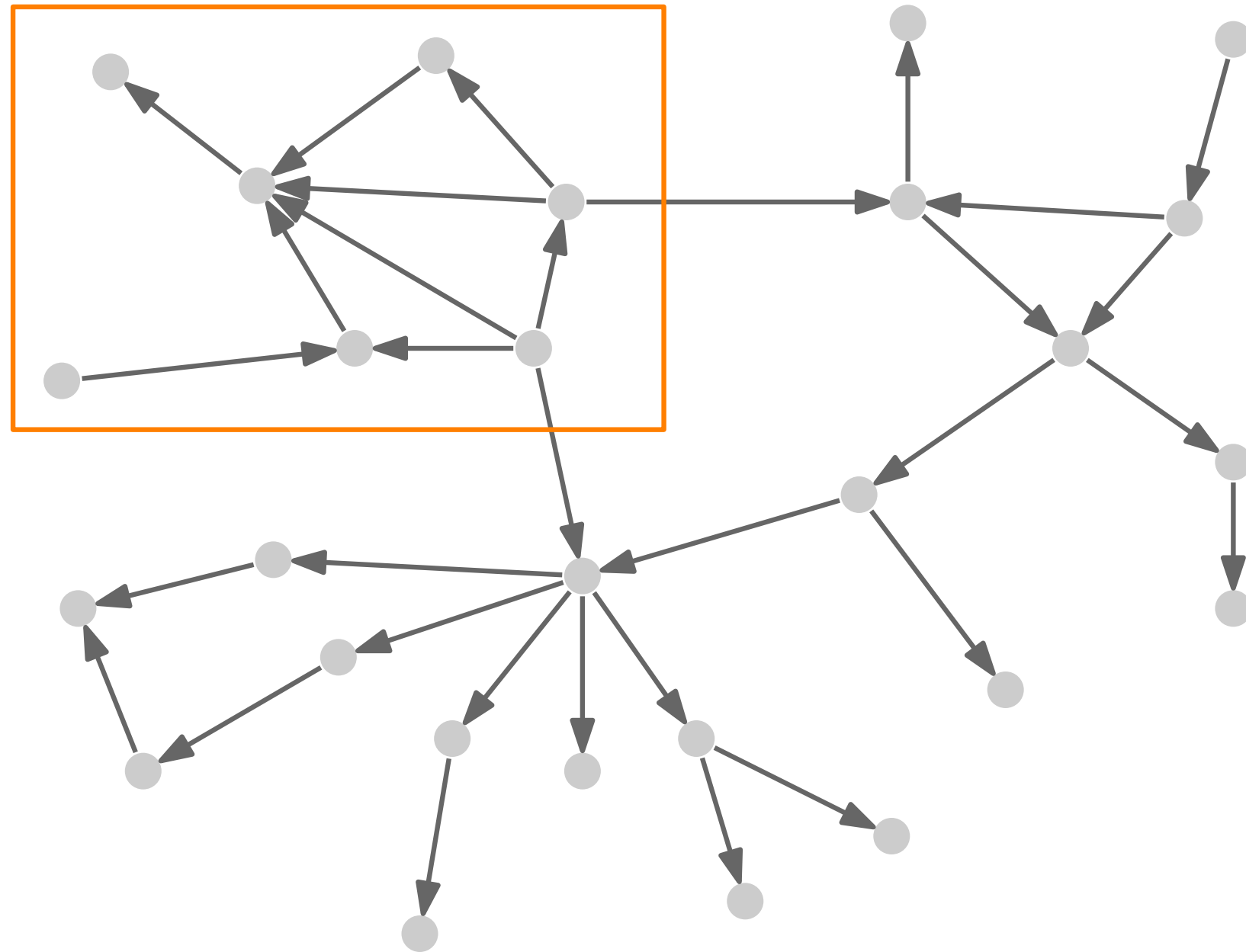
Closeness without time

Meso-Level Analysis



Meso Level
Motifs & Communities

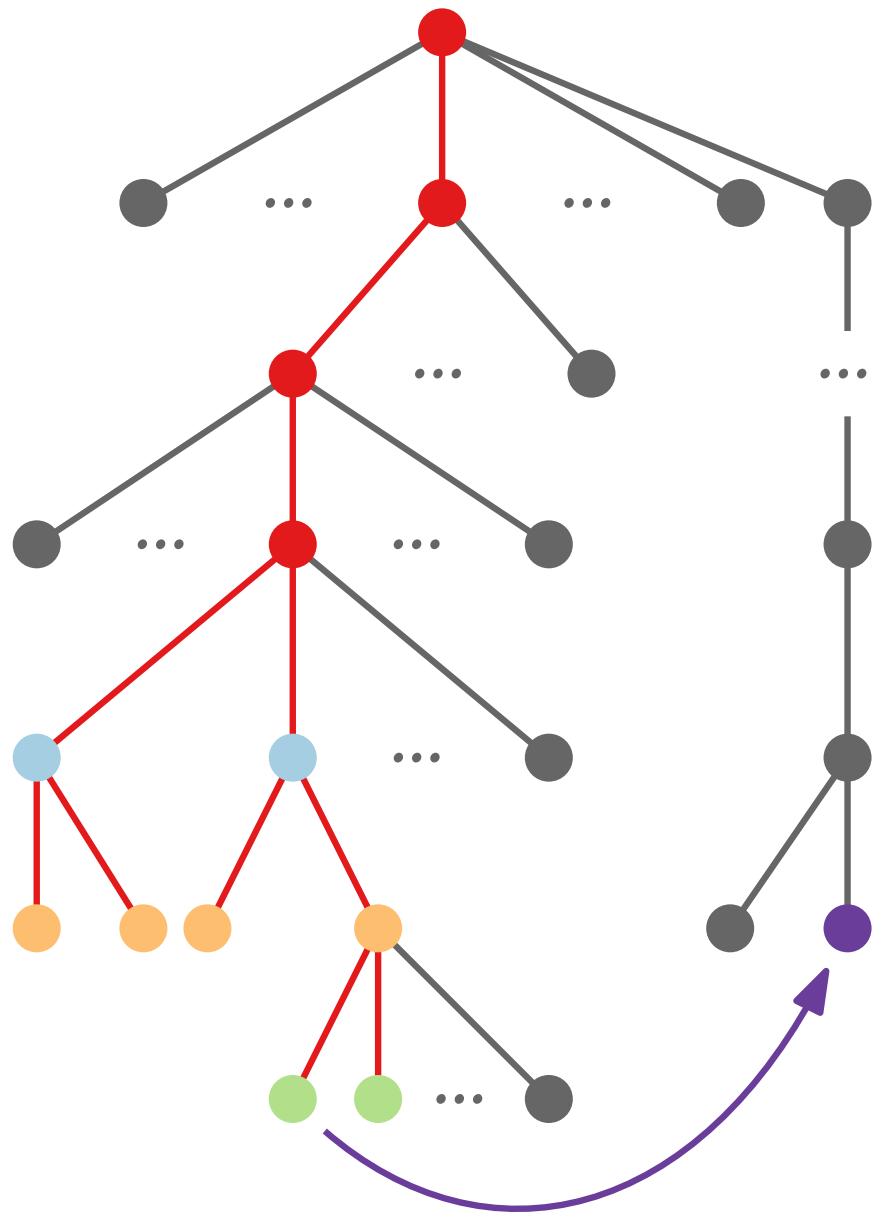
Meso-Level Analysis



Meso Level
Motifs & Communities
Classic Tools
Community Detection
Motif Analysis

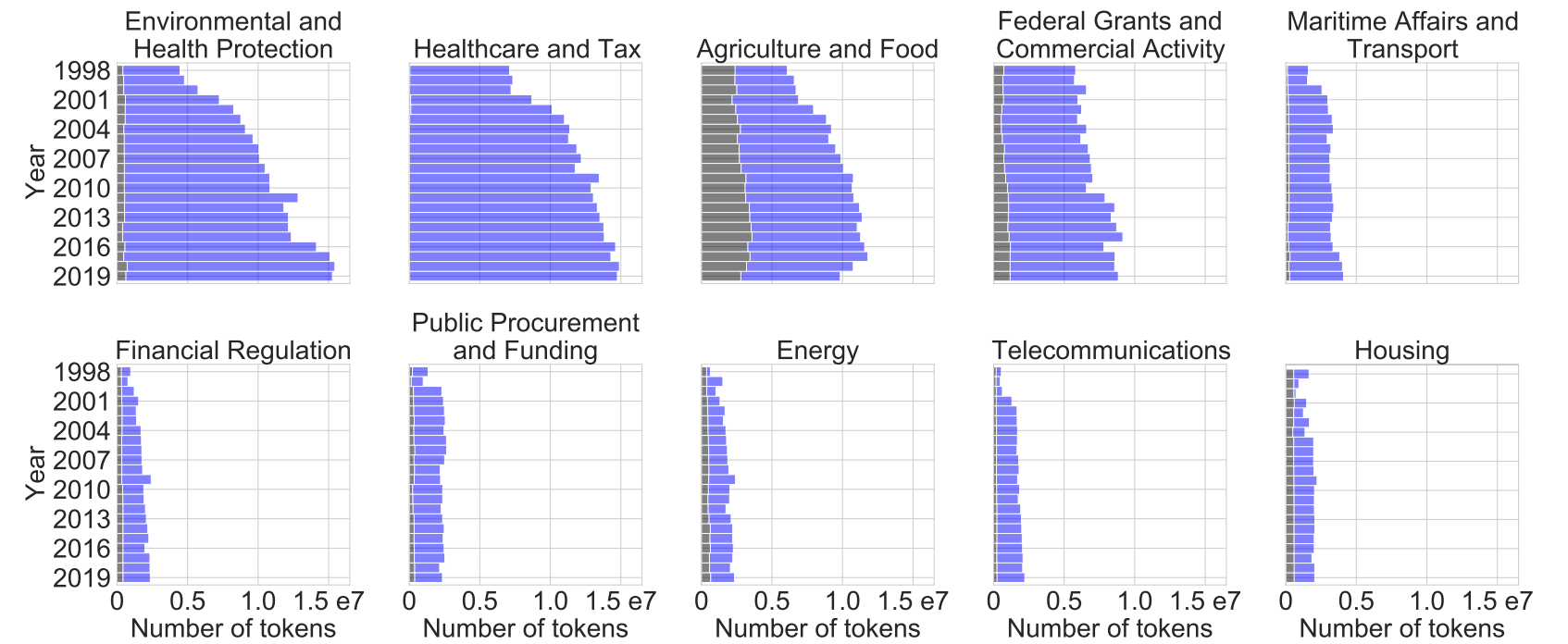
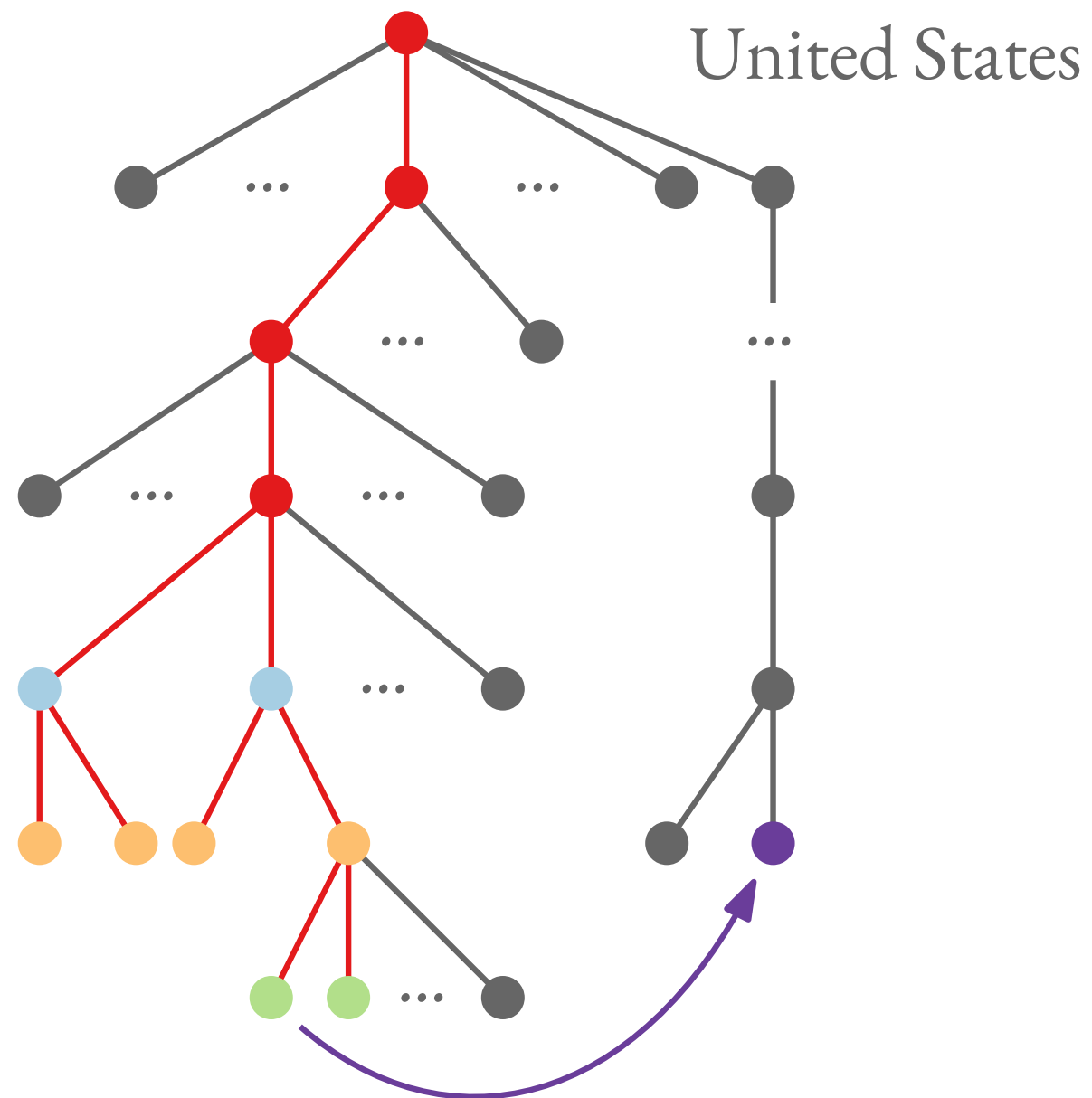
Meso-Level Analysis

Legislative Citation Networks



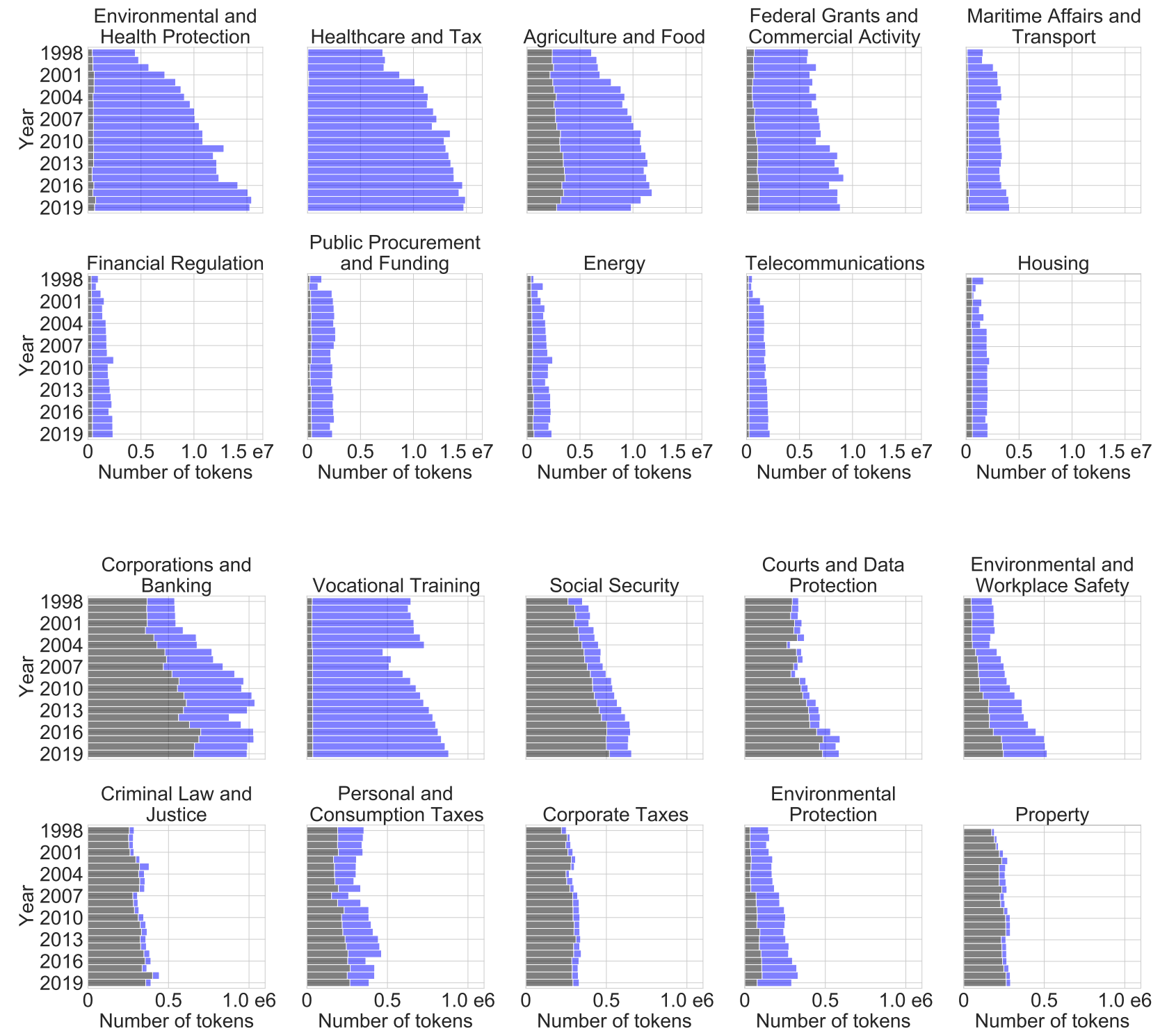
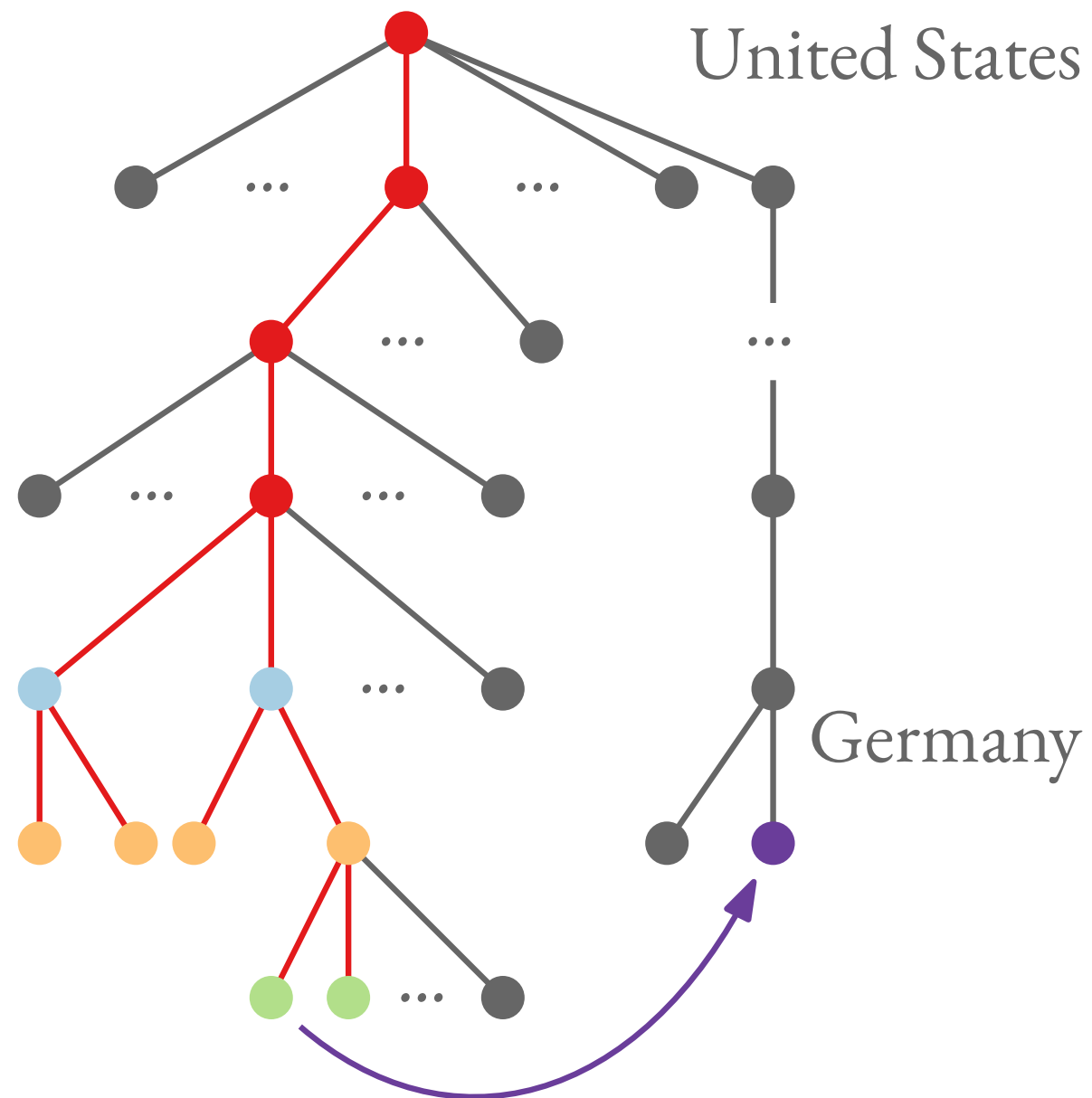
Meso-Level Analysis

Legislative Citation Networks



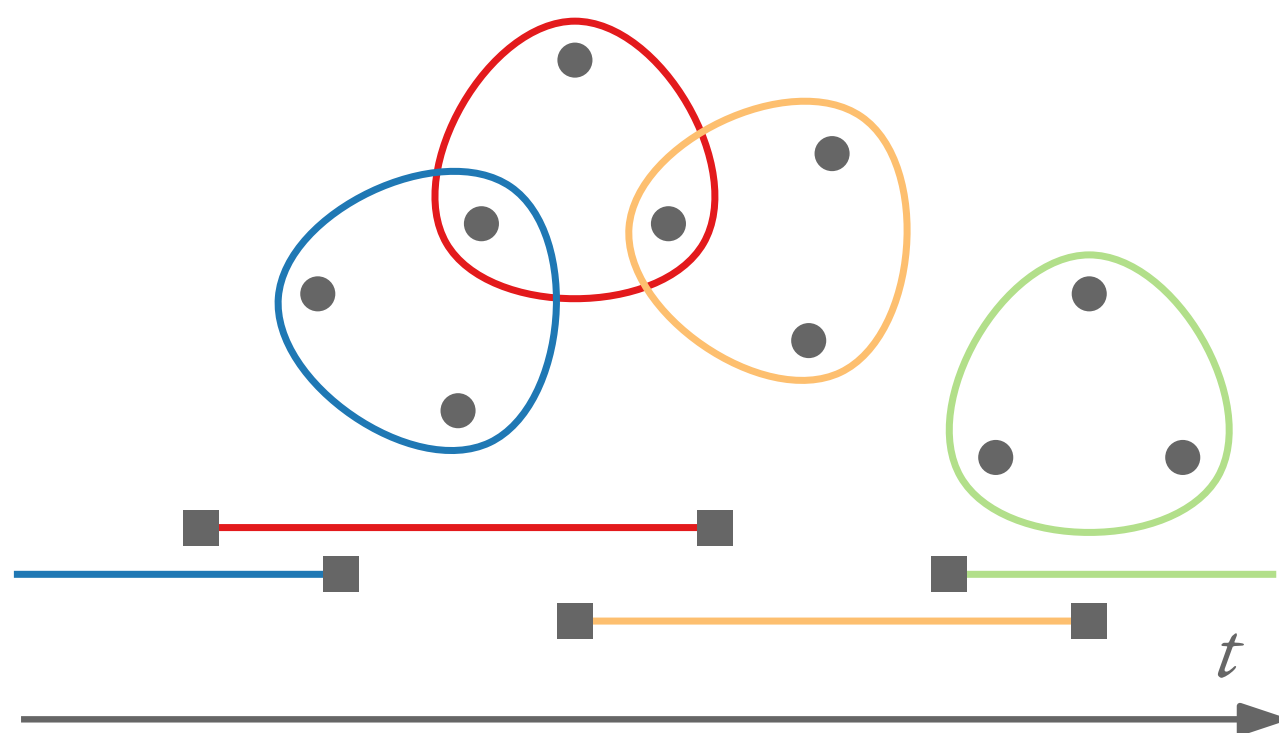
Meso-Level Analysis

Legislative Citation Networks



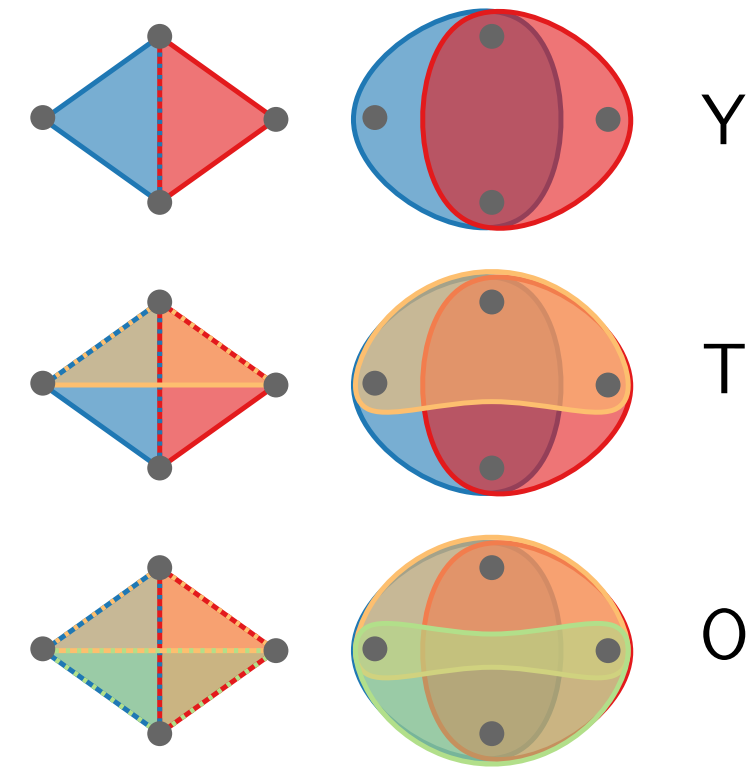
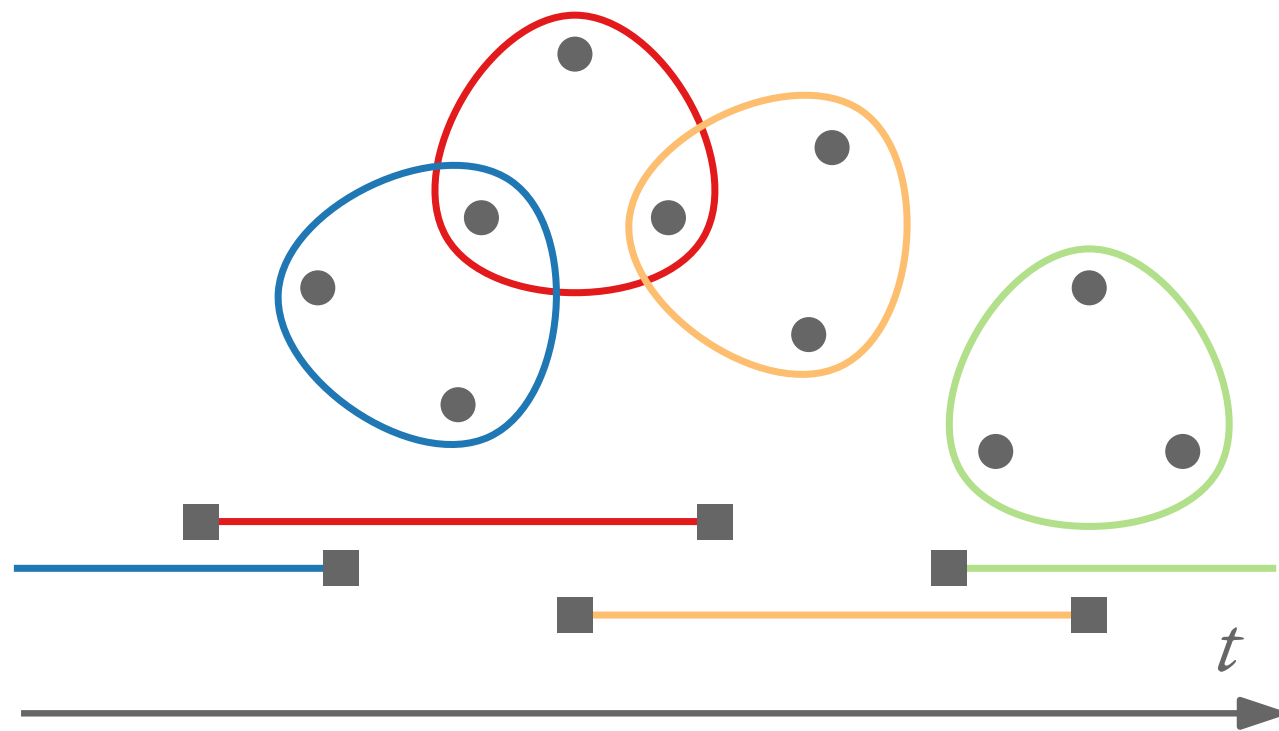
Meso-Level Analysis

Legal Collaboration Networks



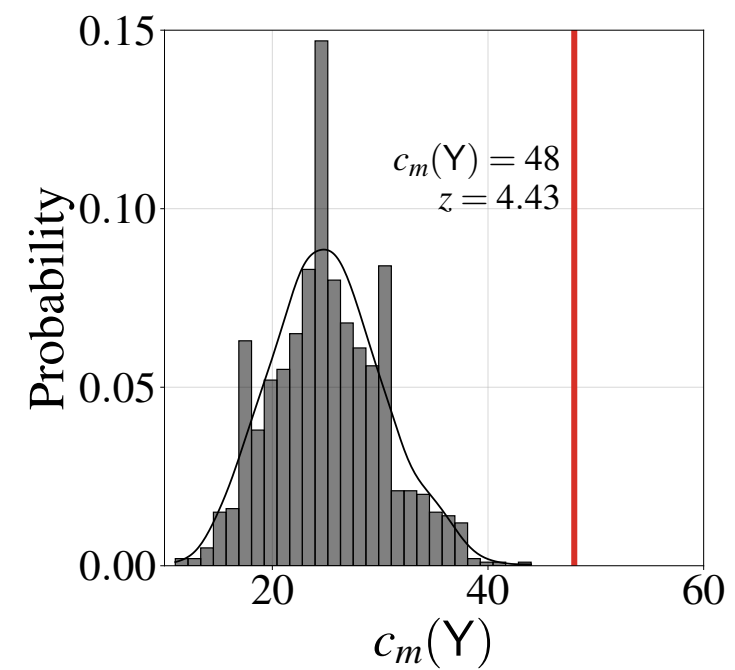
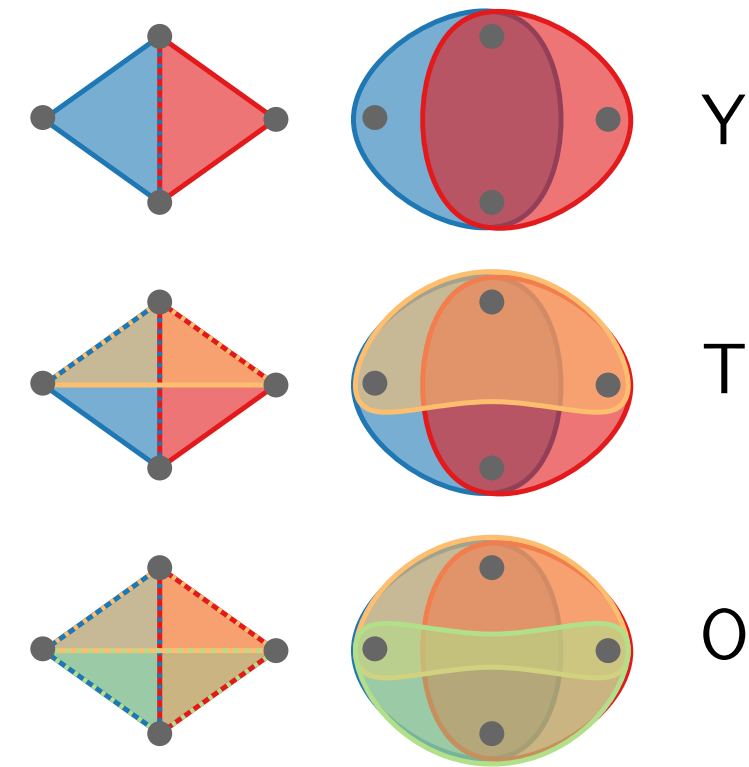
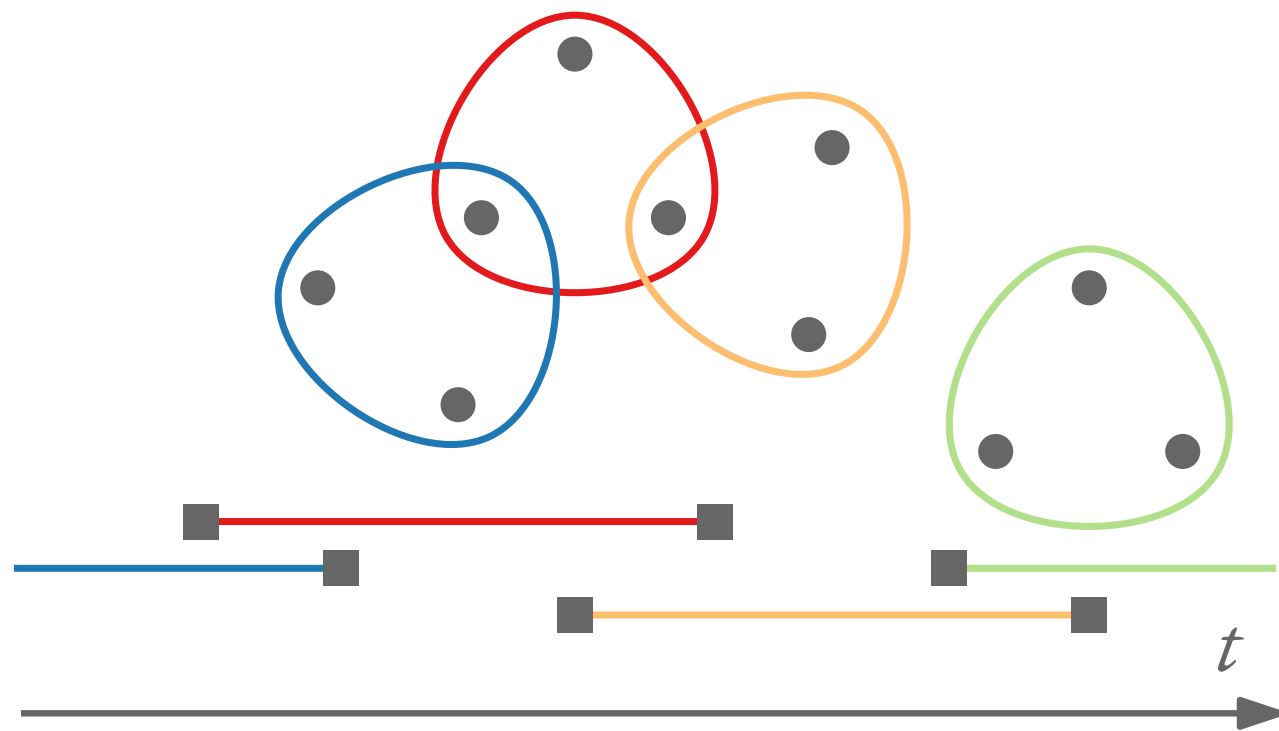
Meso-Level Analysis

Legal Collaboration Networks



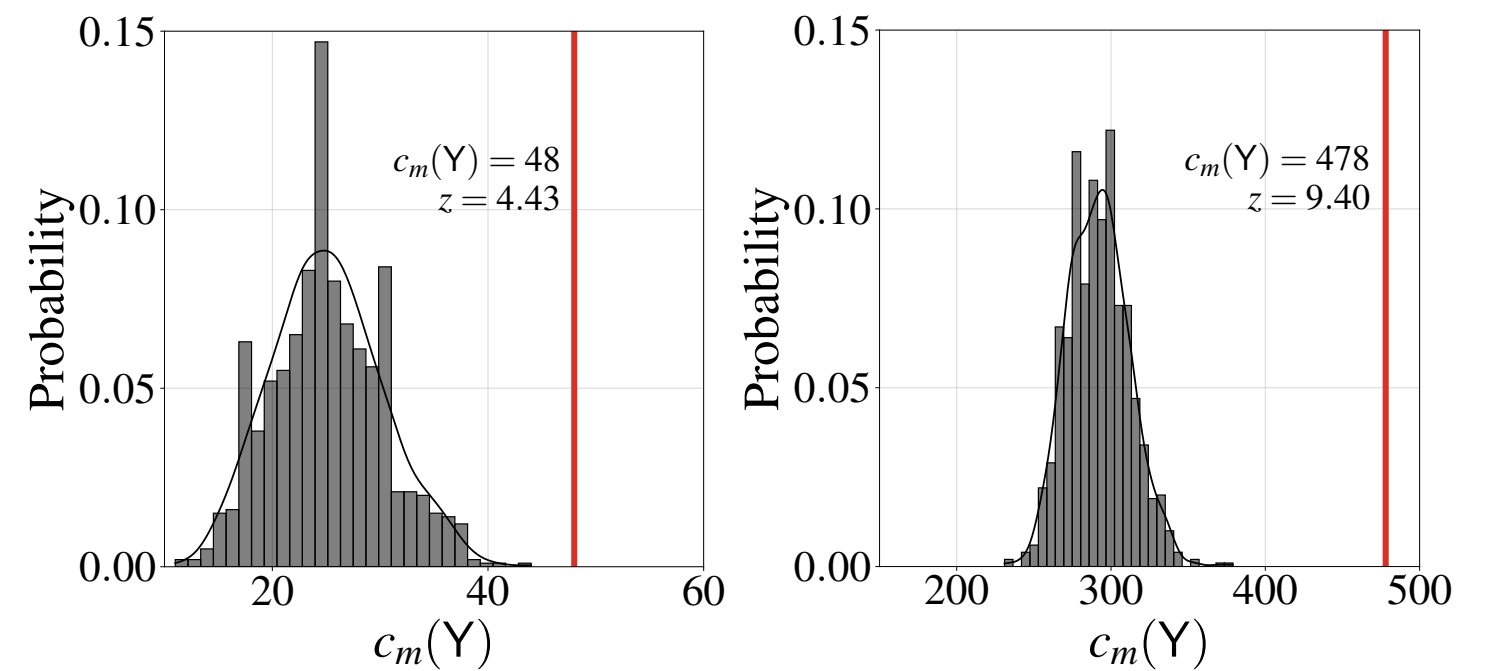
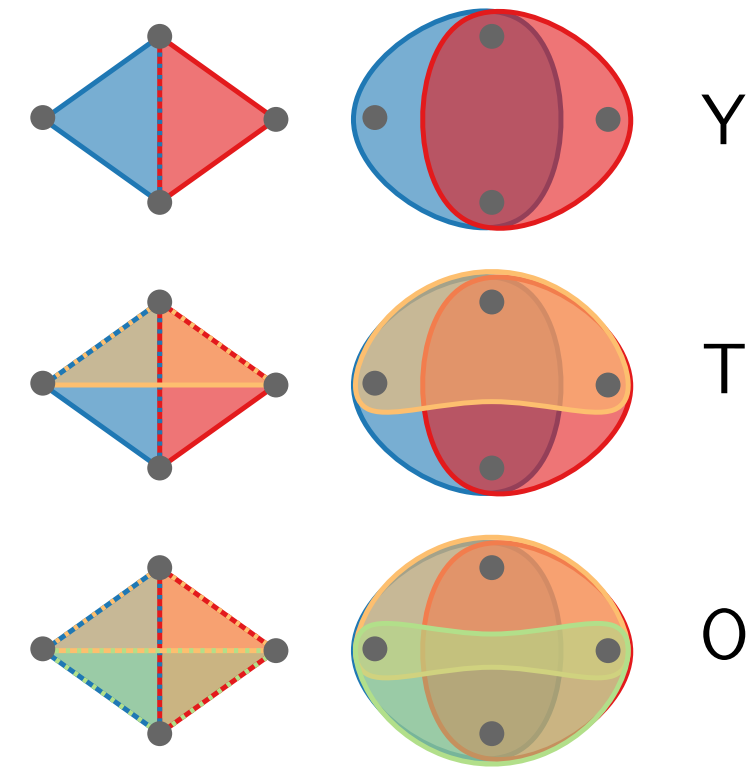
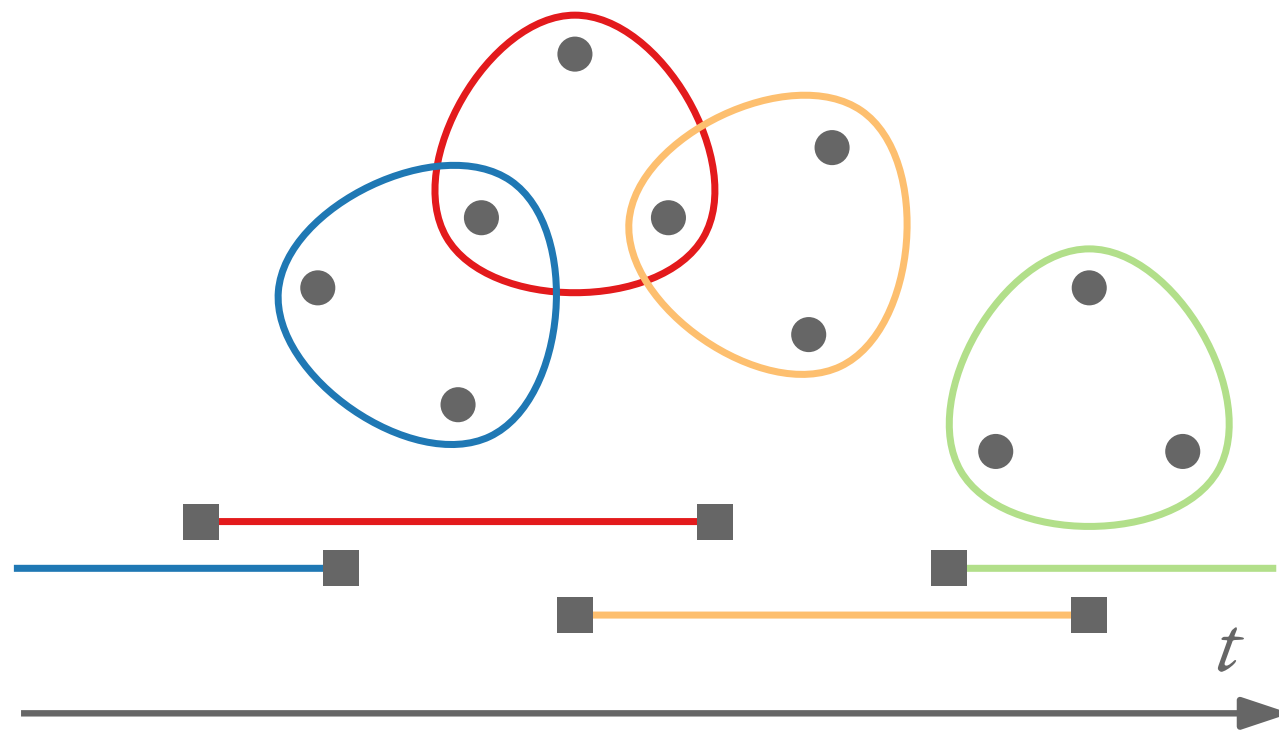
Meso-Level Analysis

Legal Collaboration Networks

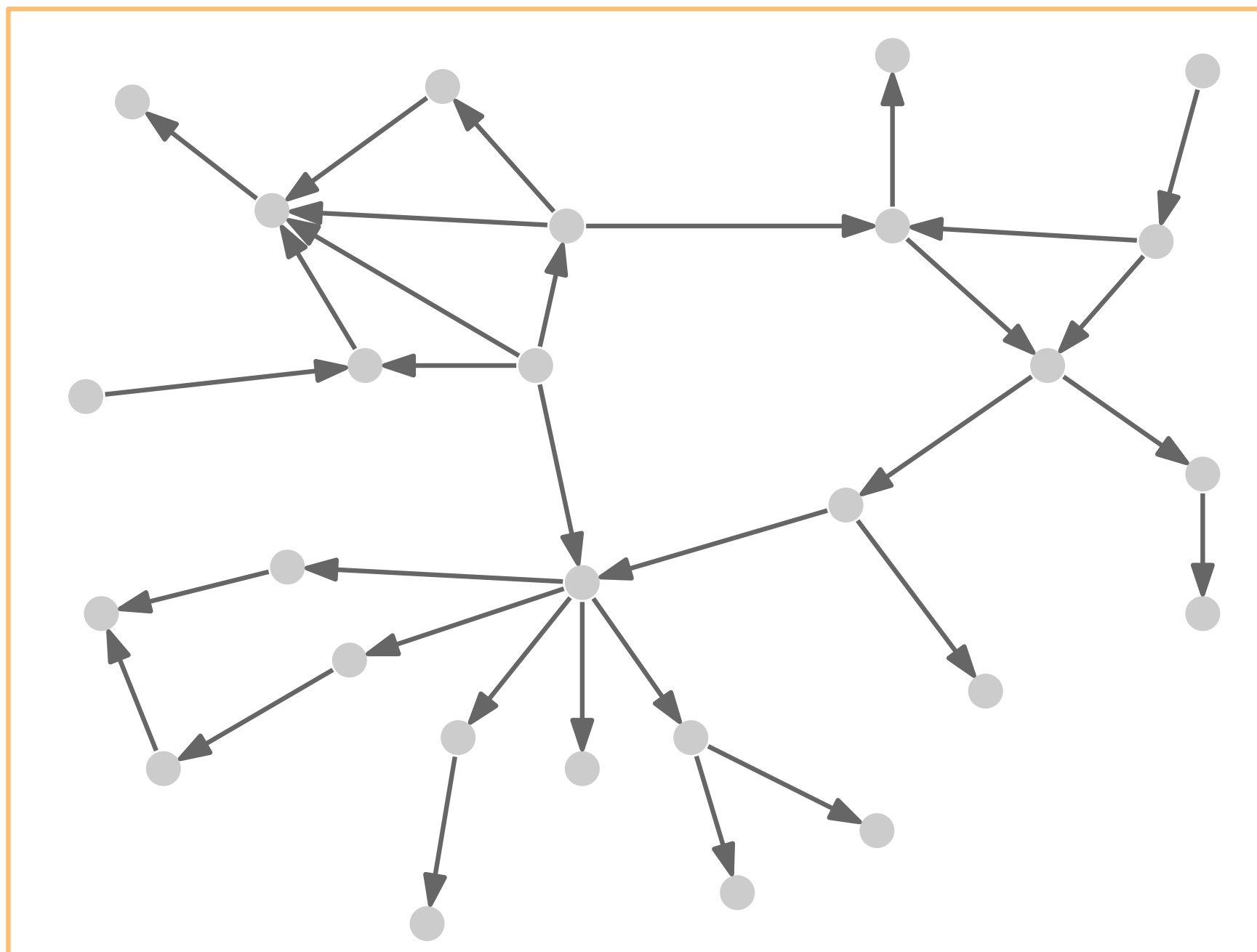


Meso-Level Analysis

Legal Collaboration Networks

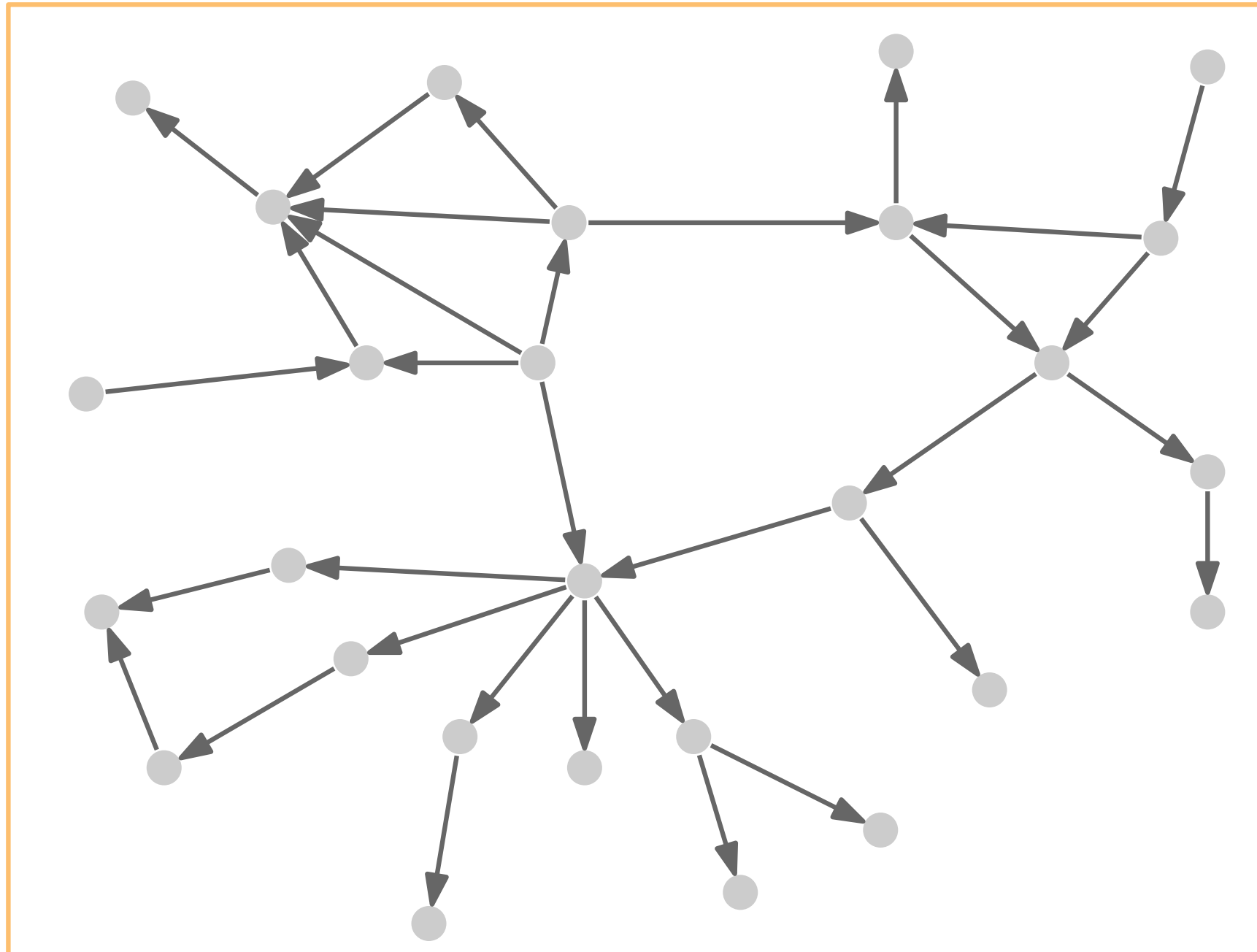


Macro-Level Analysis



Macro Level
Statistics & Invariants

Macro-Level Analysis



Classic Tool

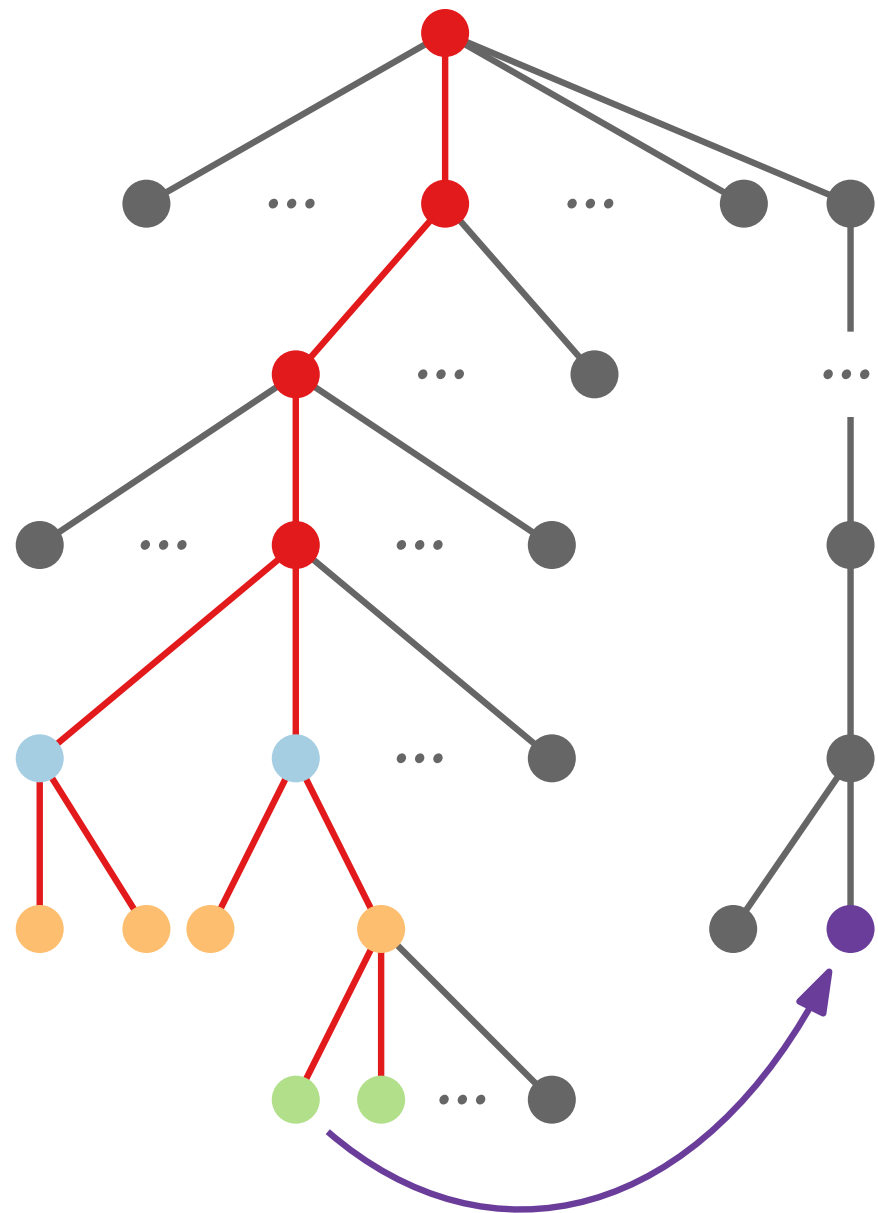
Distributions

Macro Level

Statistics & Invariants

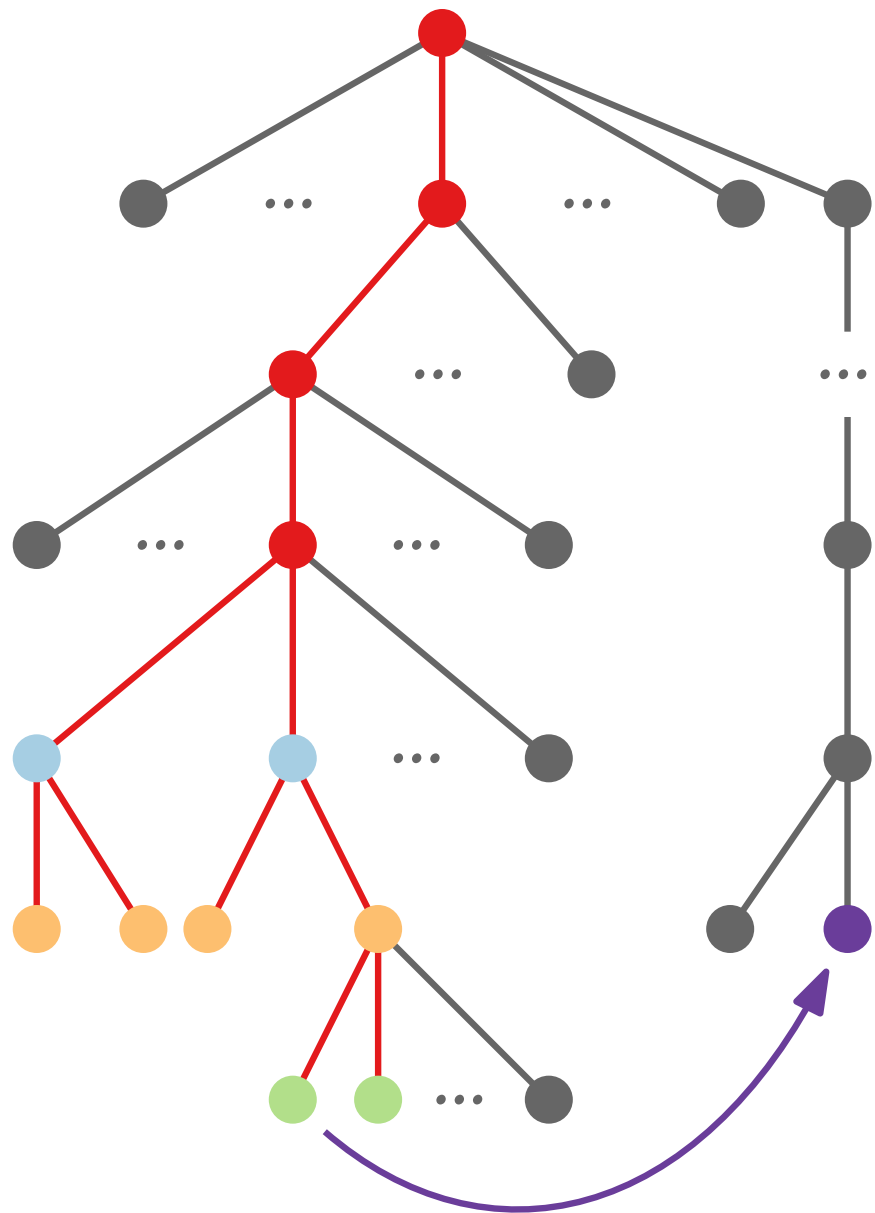
Macro-Level Analysis

Legislative Citation Networks

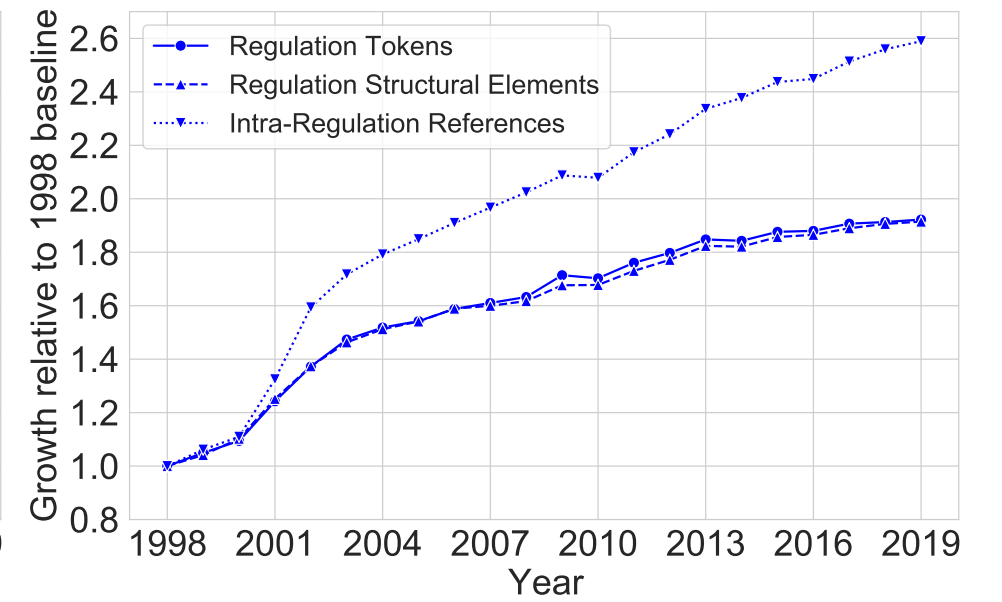
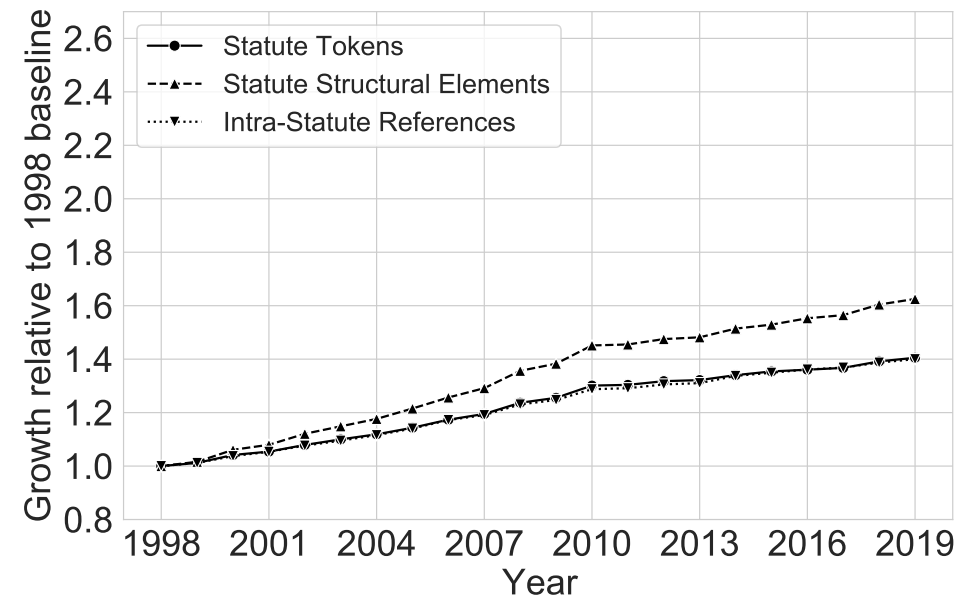


Macro-Level Analysis

Legislative Citation Networks

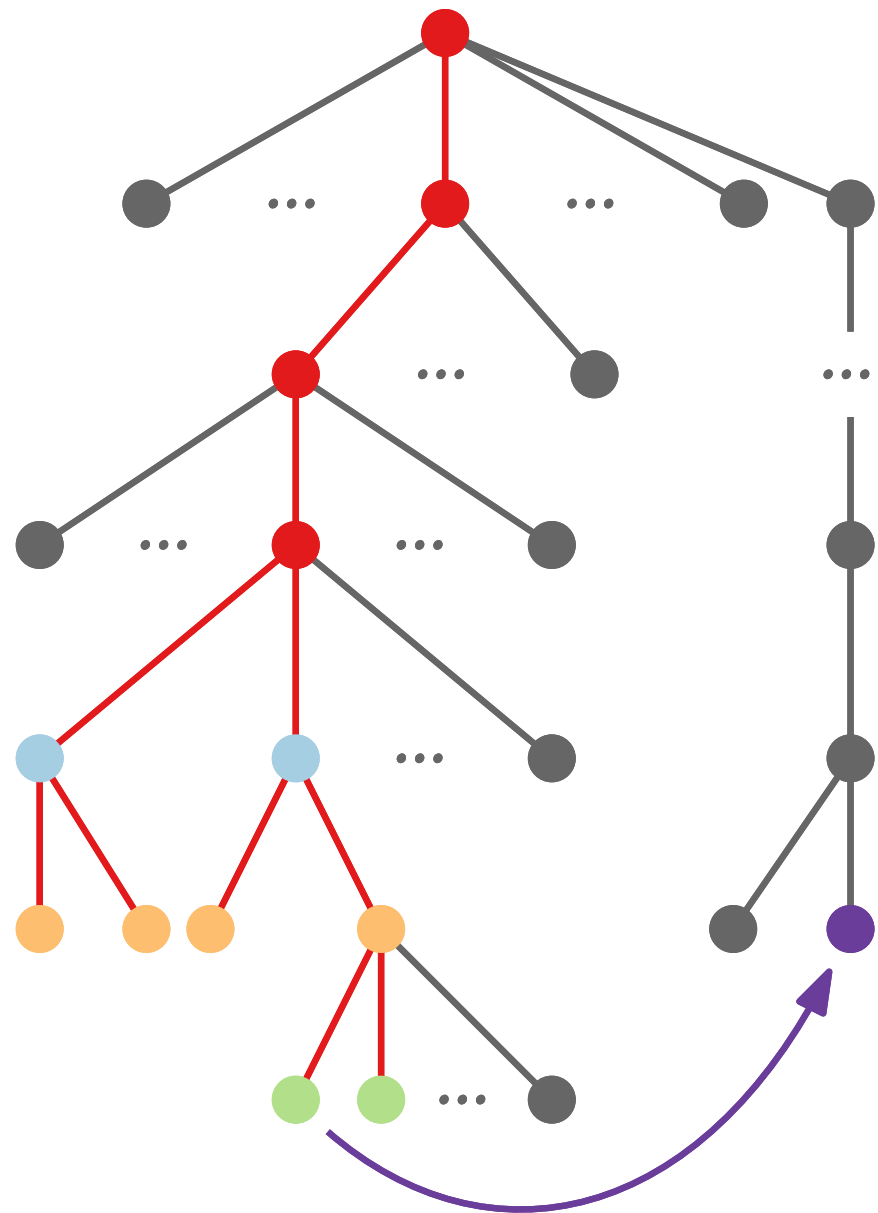


United States

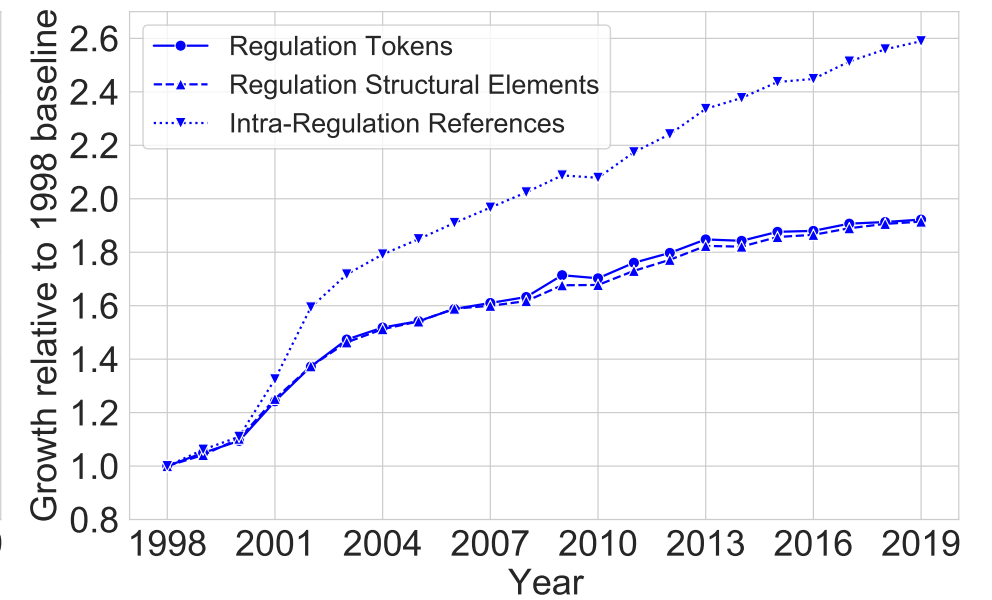
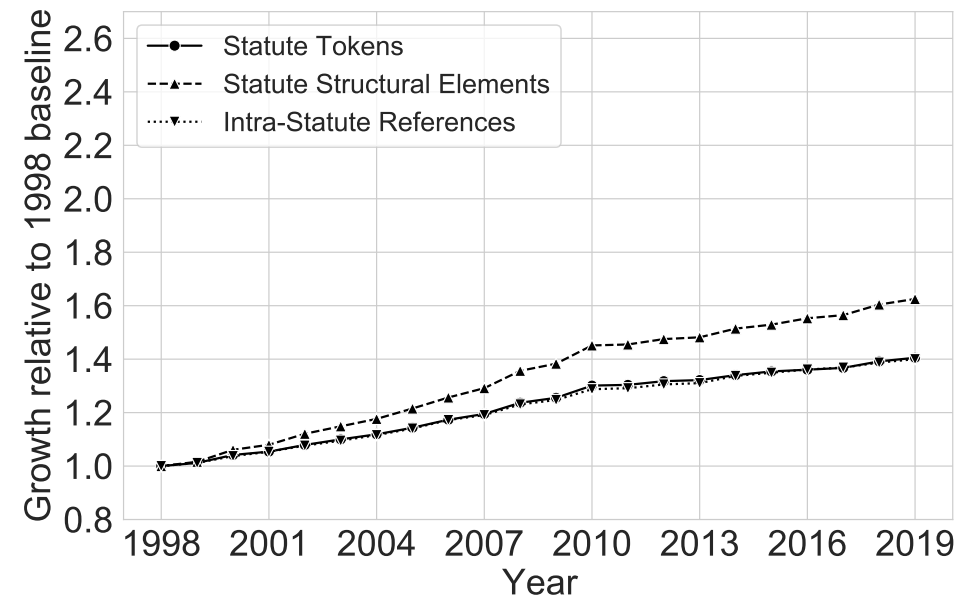


Macro-Level Analysis

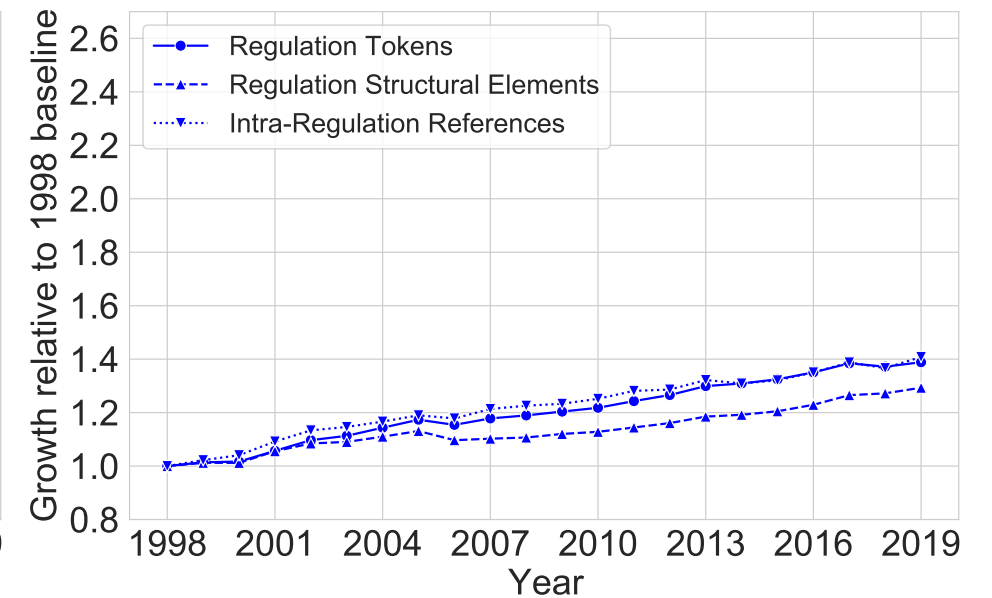
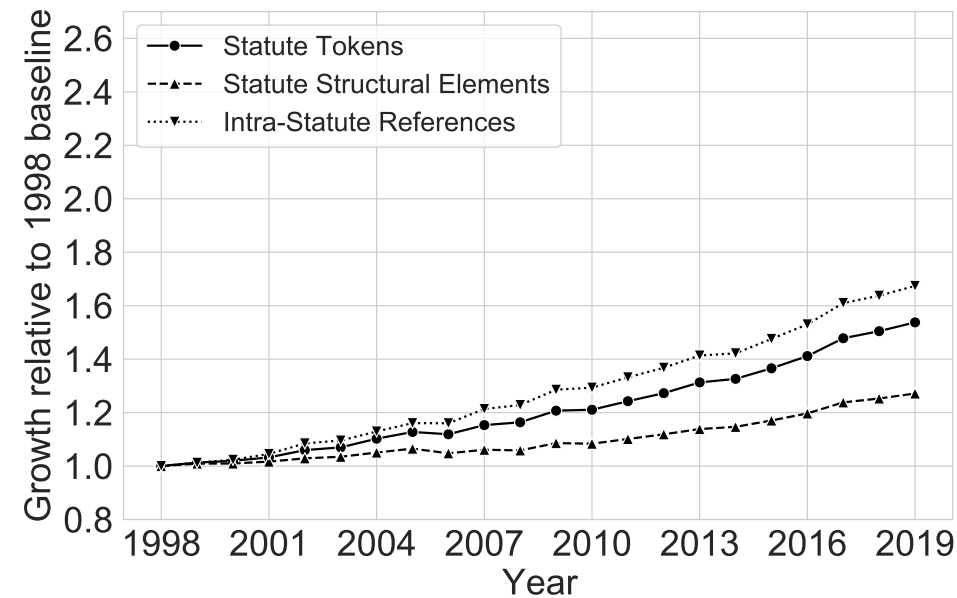
Legislative Citation Networks



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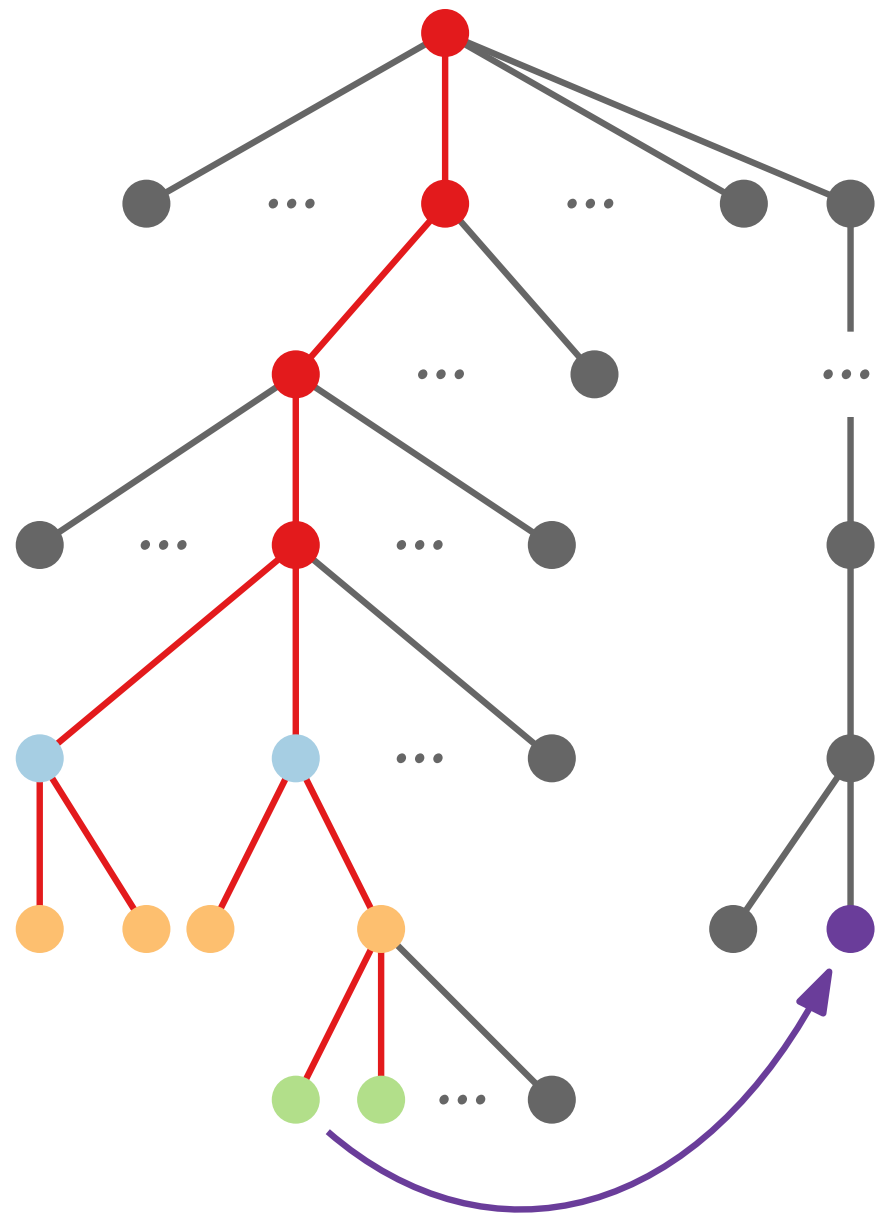


Germany

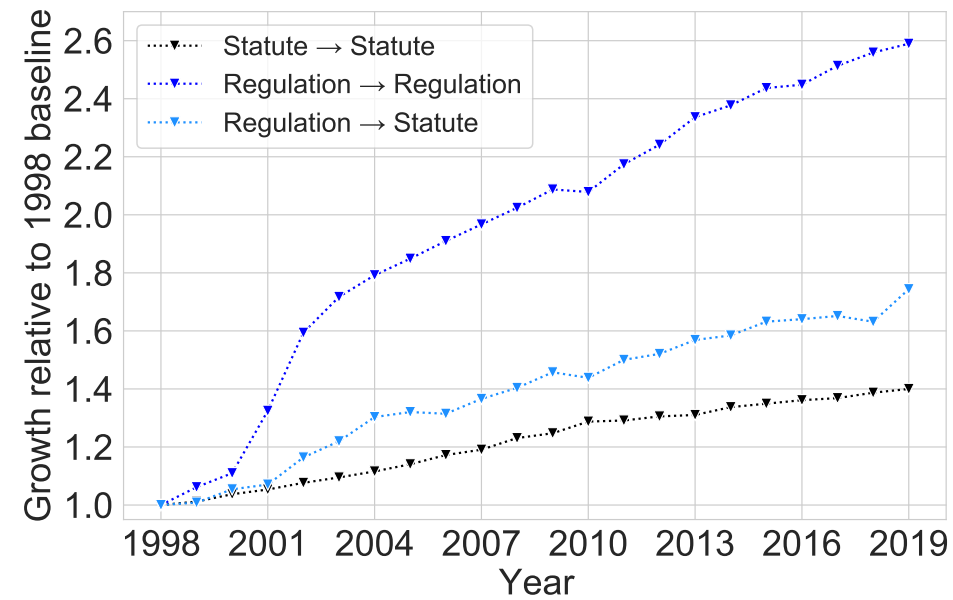


Macro-Level Analysis

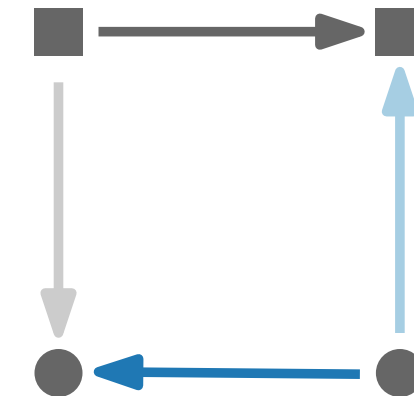
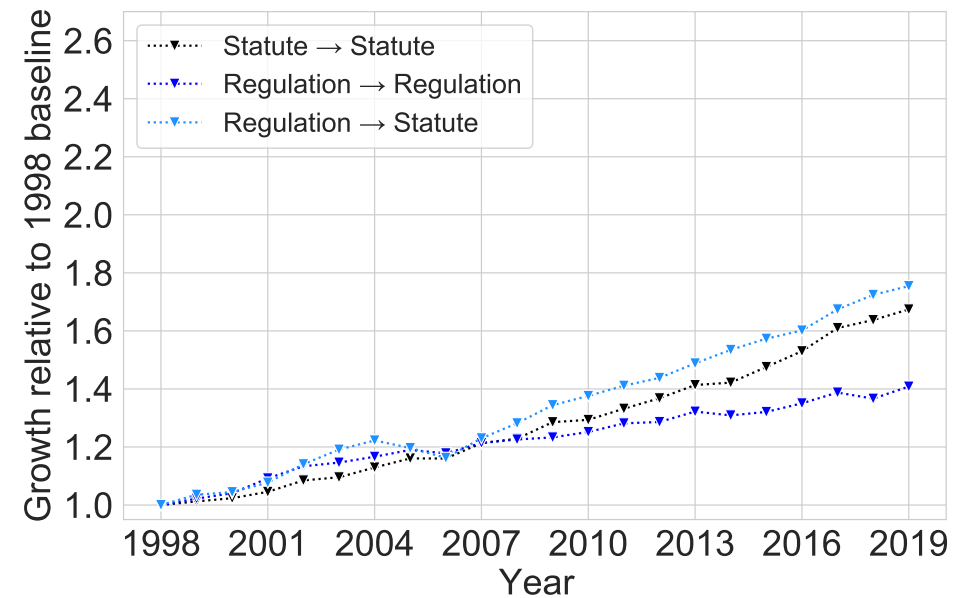
Legislative Citation Networks



United States

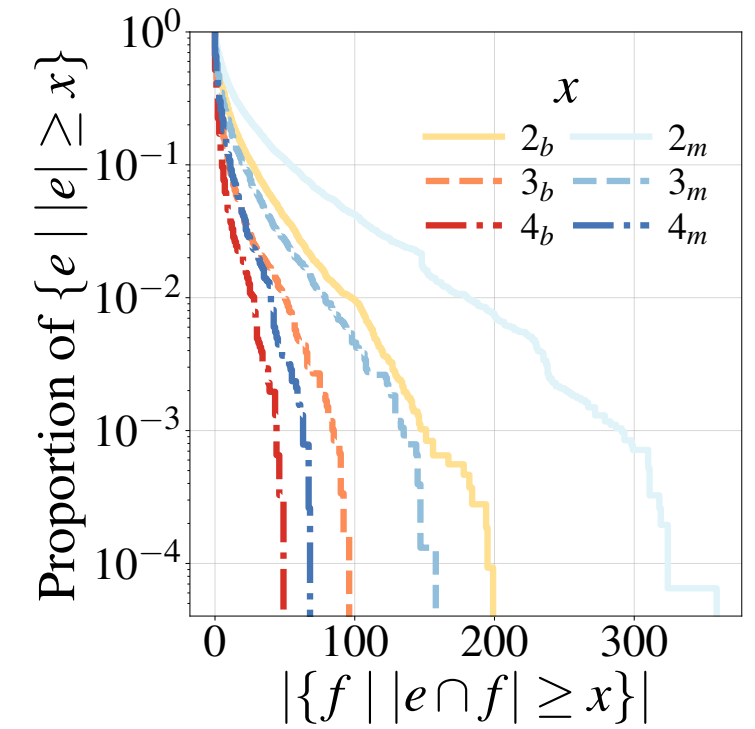
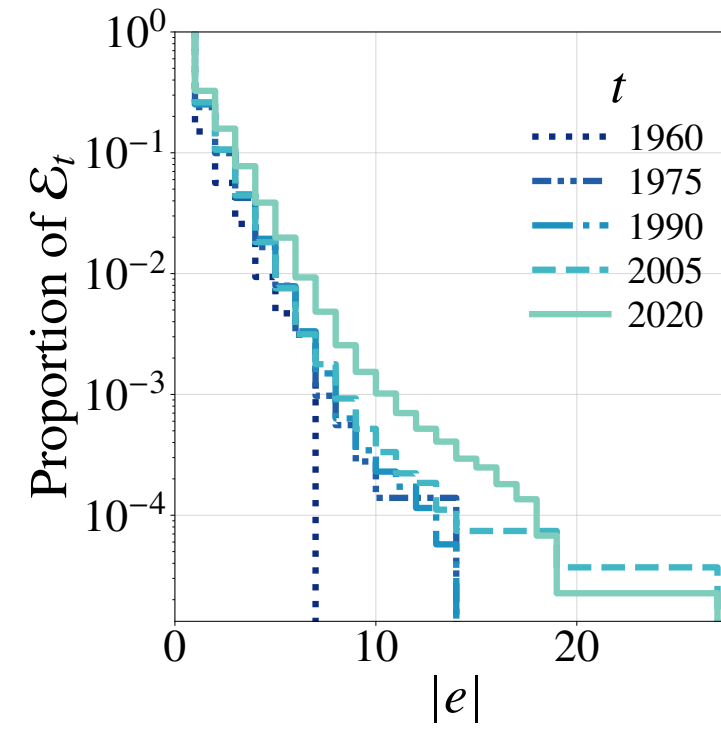
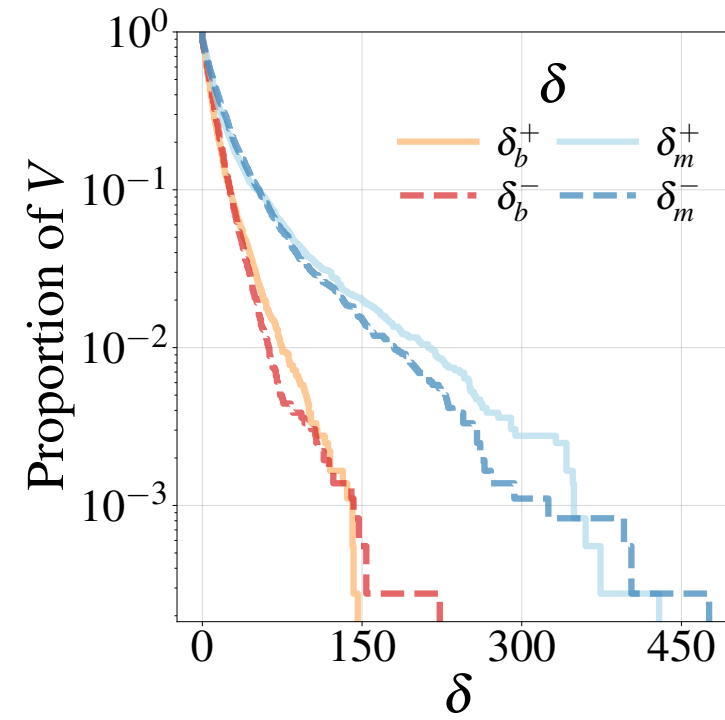


Germany



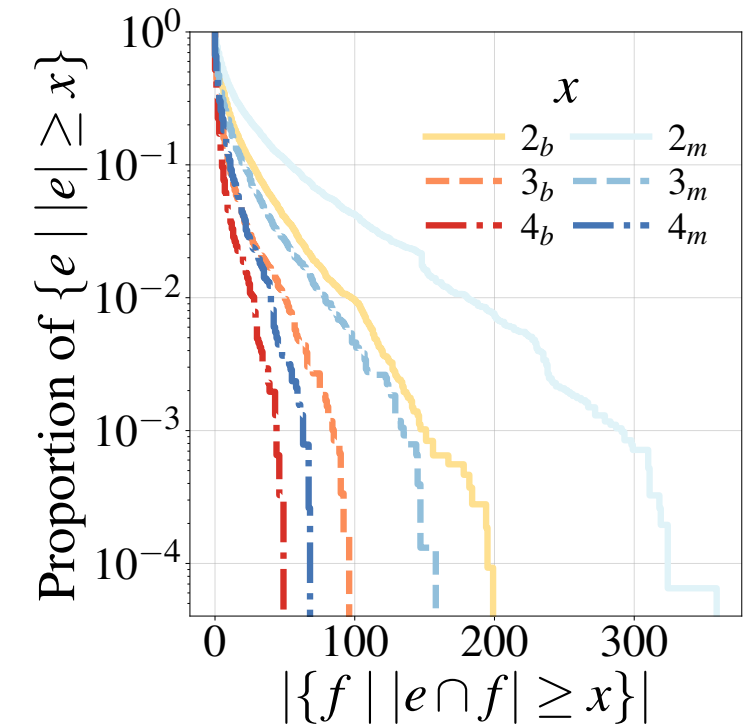
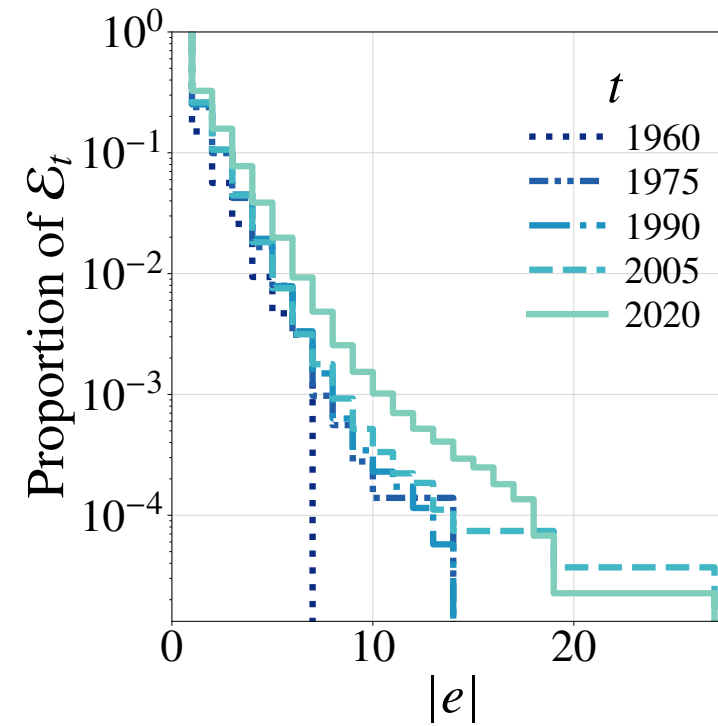
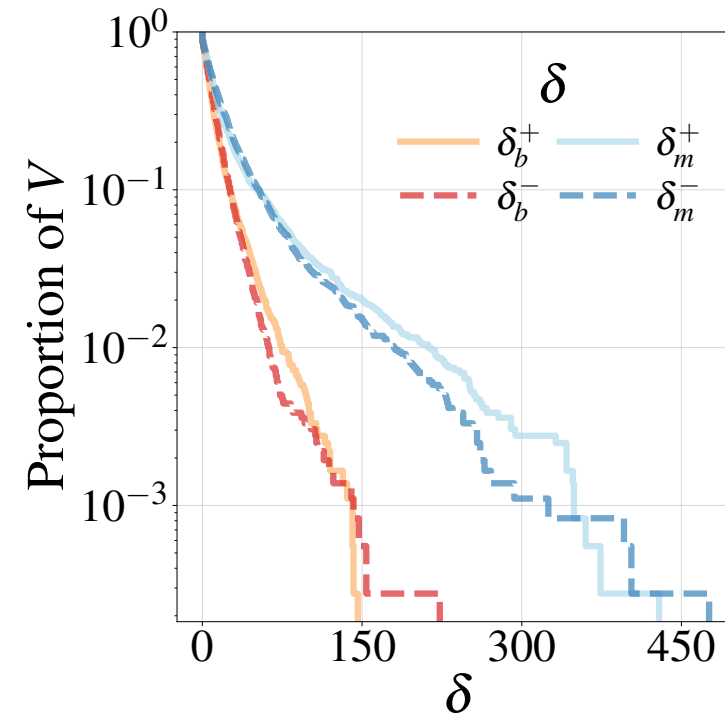
Macro-Level Analysis

Citations (BVerfG)

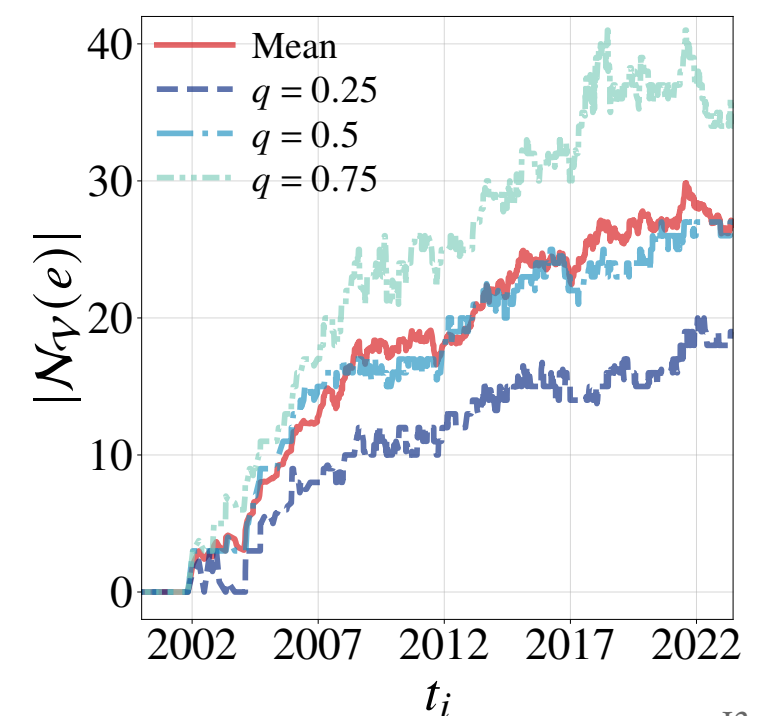
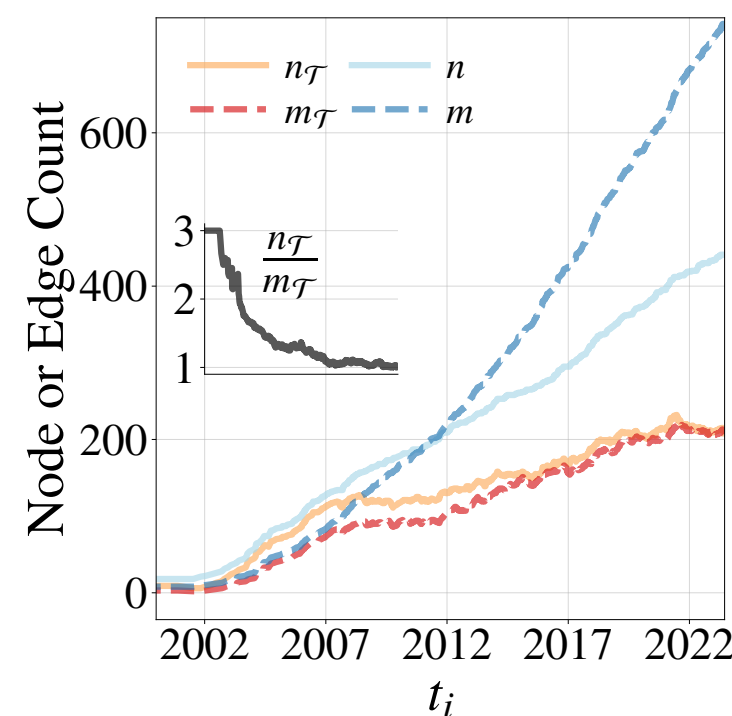
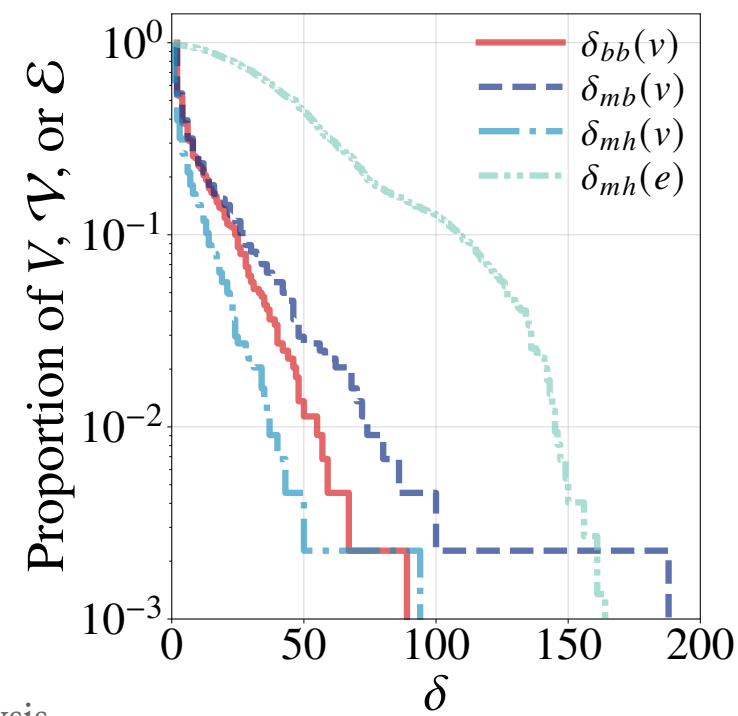


Macro-Level Analysis

Citations (BVerfG)



Collaborations (ICSID)



Analysis Tools

Analysis Tools

Python

Analysis Tools

Python

Analysis Tools

Python

networkx

Analysis Tools

Python

networkx

R

Analysis Tools

Python

networkx

igraph

R

Analysis Tools

Python

networkx

igraph

R

C++

Analysis Tools

Python

networkx

igraph

graph-tool

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C++

Analysis Tools

Python

networkx

igraph

graph-tool

R

C++

\$(Your favorite library)

Analysis Tools

Python

Julia

networkx

igraph

graph-tool

R

C++

\$(Your favorite library)

Analysis Tools

Python

Julia

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\$(Your favorite language)

igraph

graph-tool

R

C++

\$(Your favorite library)

Analysis Tools

Python

Julia

networkx

\$(Your favorite language)

igraph

graph-tool

R

C++

\$(Your favorite library)

\$(Your custom code)

Constructing Legal Networks

Constructing Legal Networks

Garbage in, garbage out—we need to get the data right

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...okay, *as right as possible* given limited resources

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Grunt work requiring careful planning and > 50% of the time

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Domain-specific difficulties

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Hardly any FAIR data

Constructing Legal Networks

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Most data is unstructured or semi-structured at best

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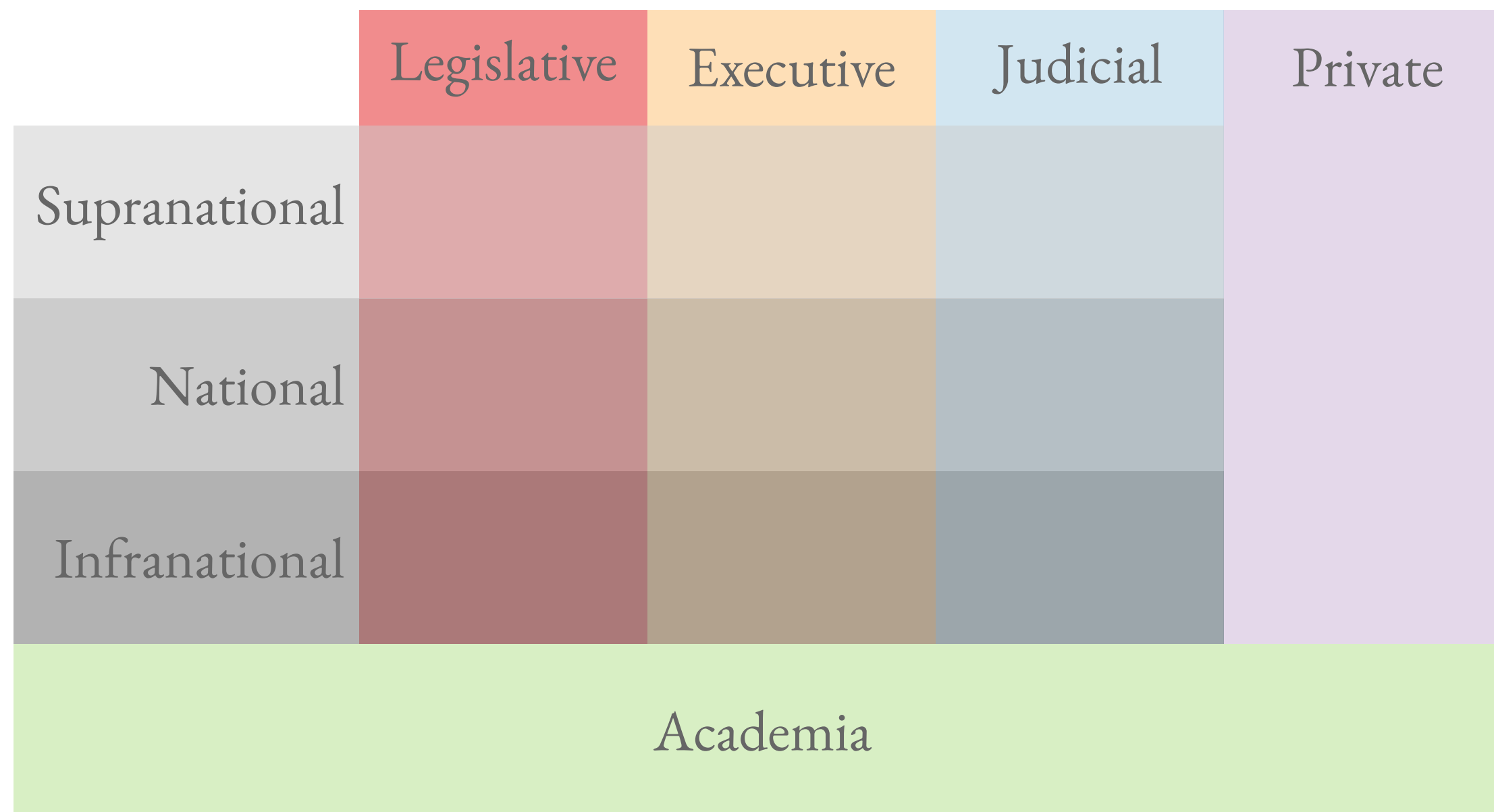
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Also, *lawyers*.

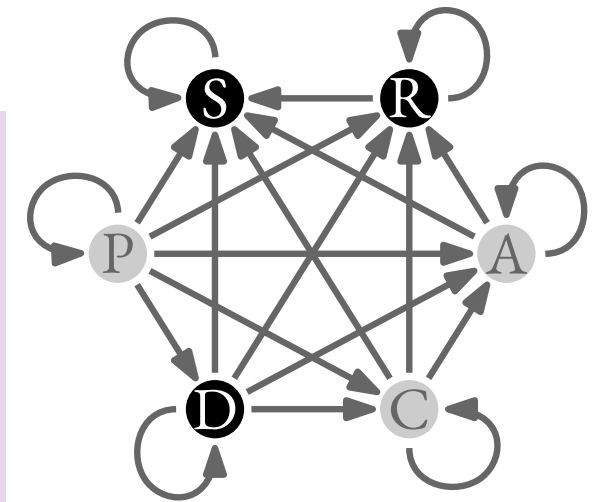
Outlook

Outlook



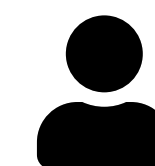
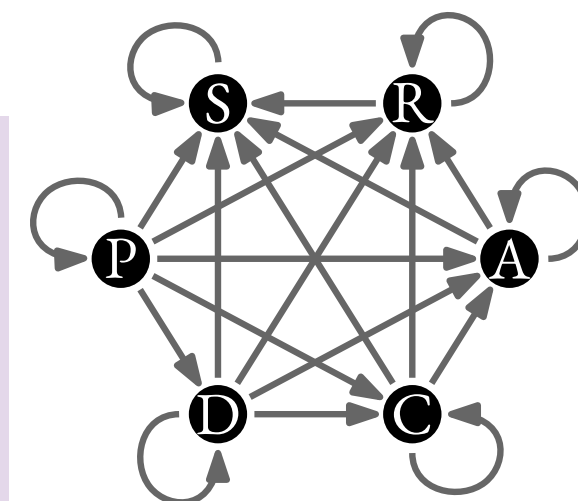
Outlook

	Legislative	Executive	Judicial	Private
Supranational			★	
National	★	★	★	
Infranational				
Academia				



Outlook

	Legislative	Executive	Judicial	Private
Supranational	★	★	★	
National	★	★	★	★
Infranational	★	★	★	
Academia ★				



Thank You!

	Legislative	Executive	Judicial	Private
Supranational	★	★	★	
National	★	★	★	★
Infranational	★	★	★	
Academia ★				

