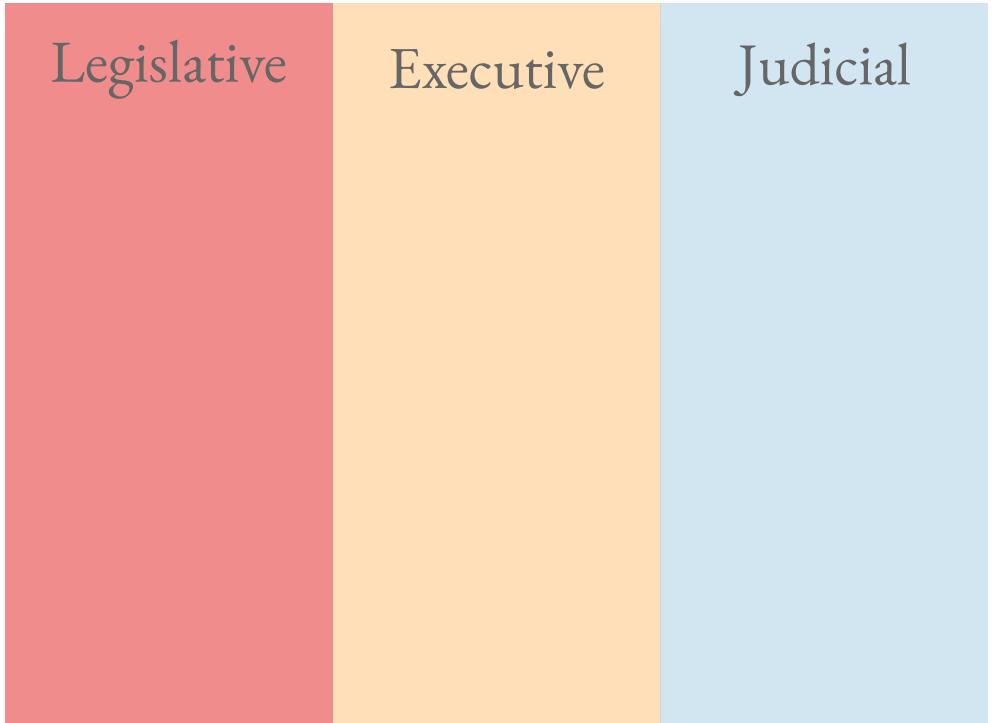


Legal Hypergraphs

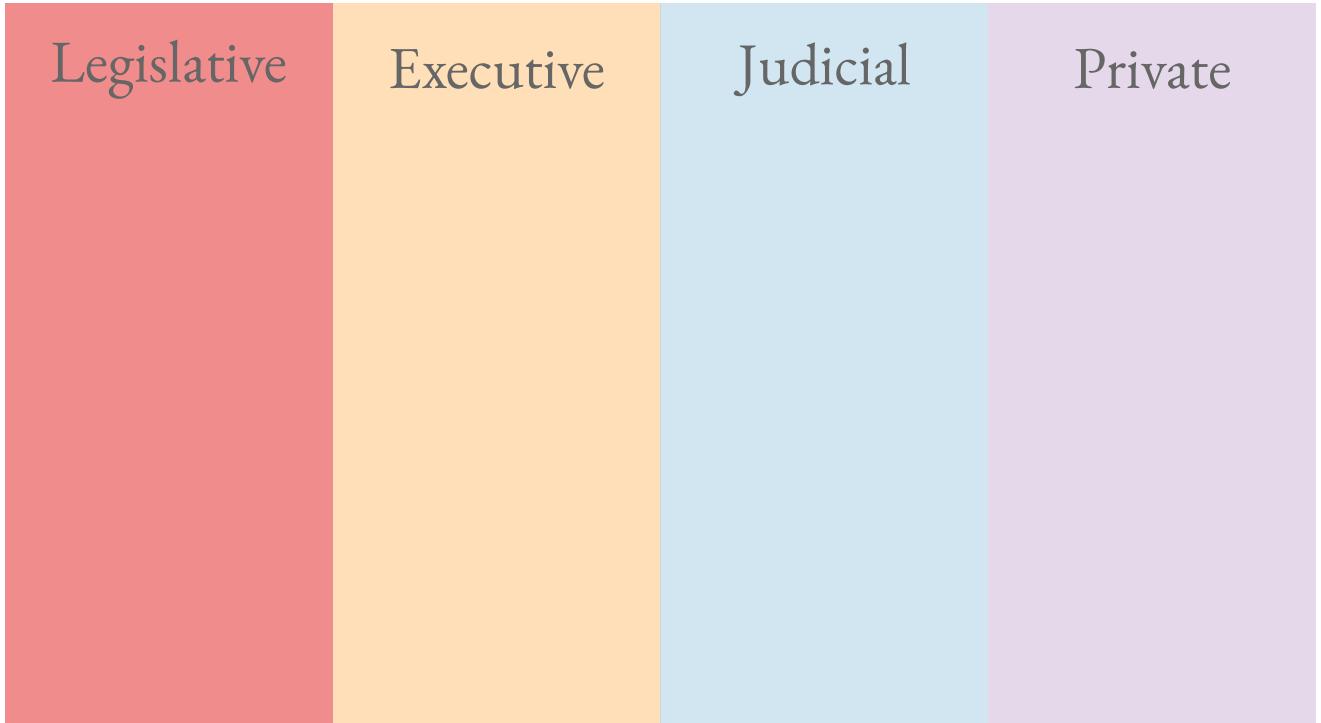
Corinna Coupette, Dirk Hartung, and Daniel Martin Katz

Motivation

Motivation



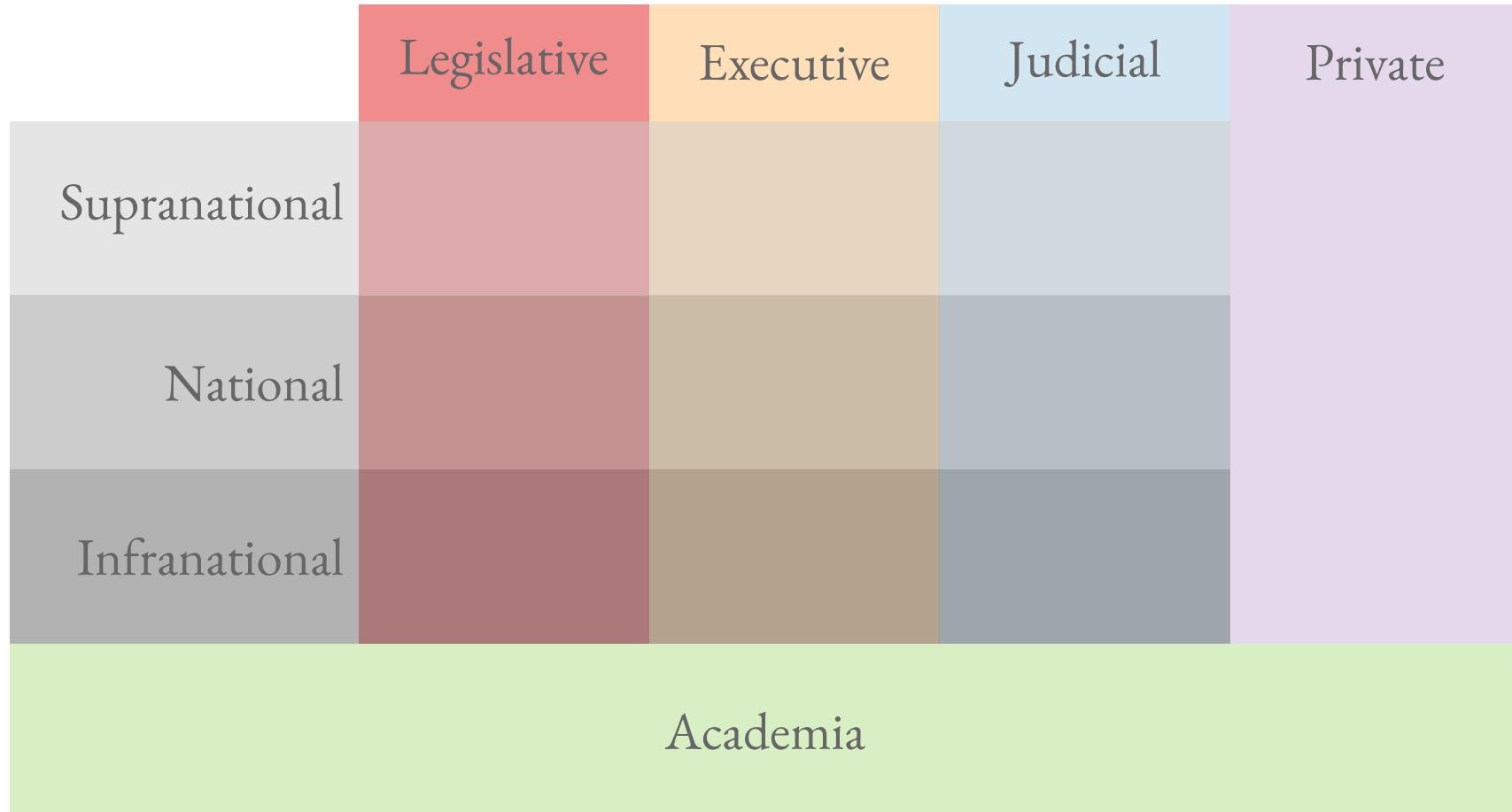
Motivation



Motivation

	Legislative	Executive	Judicial	Private
Supranational				
National				
Infranational				

Motivation

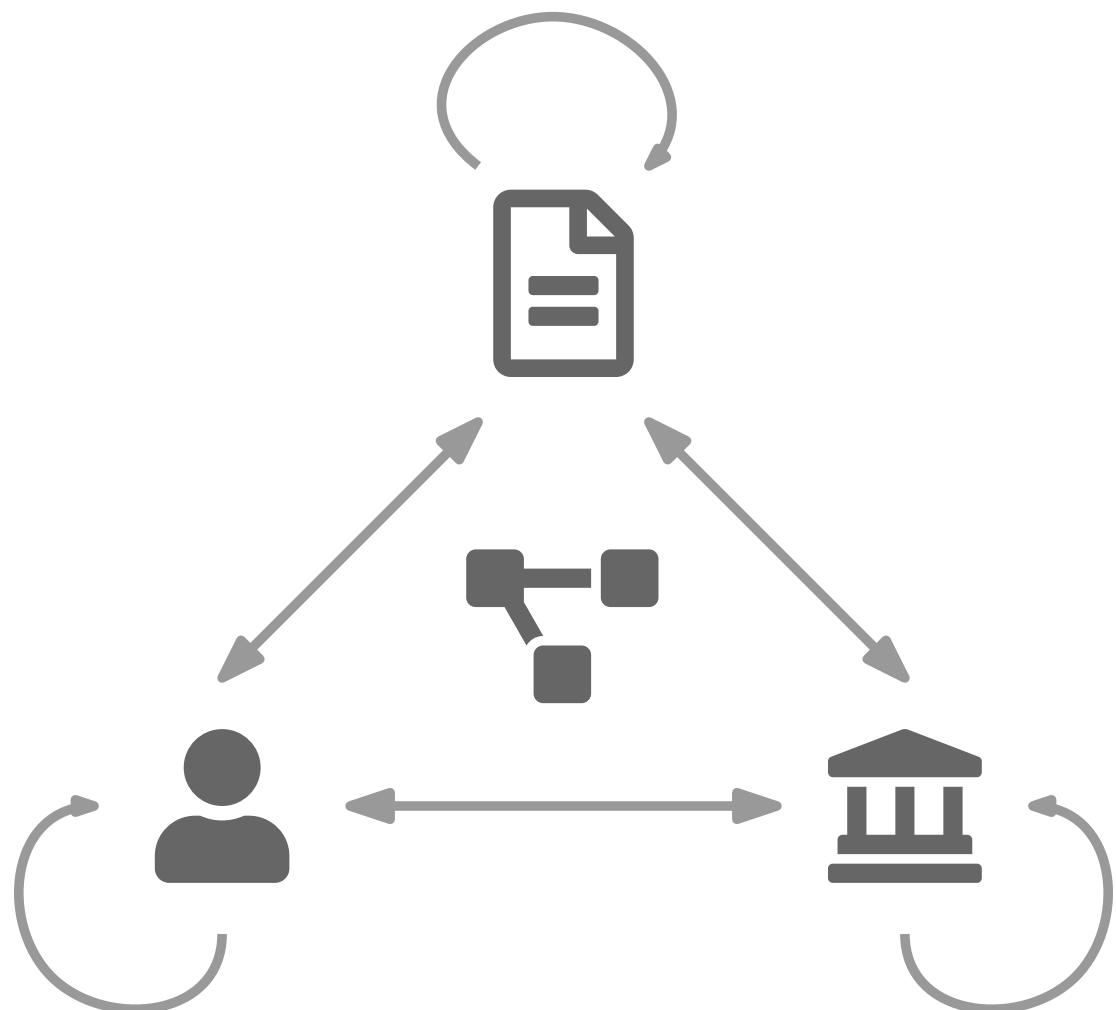


Motivation

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

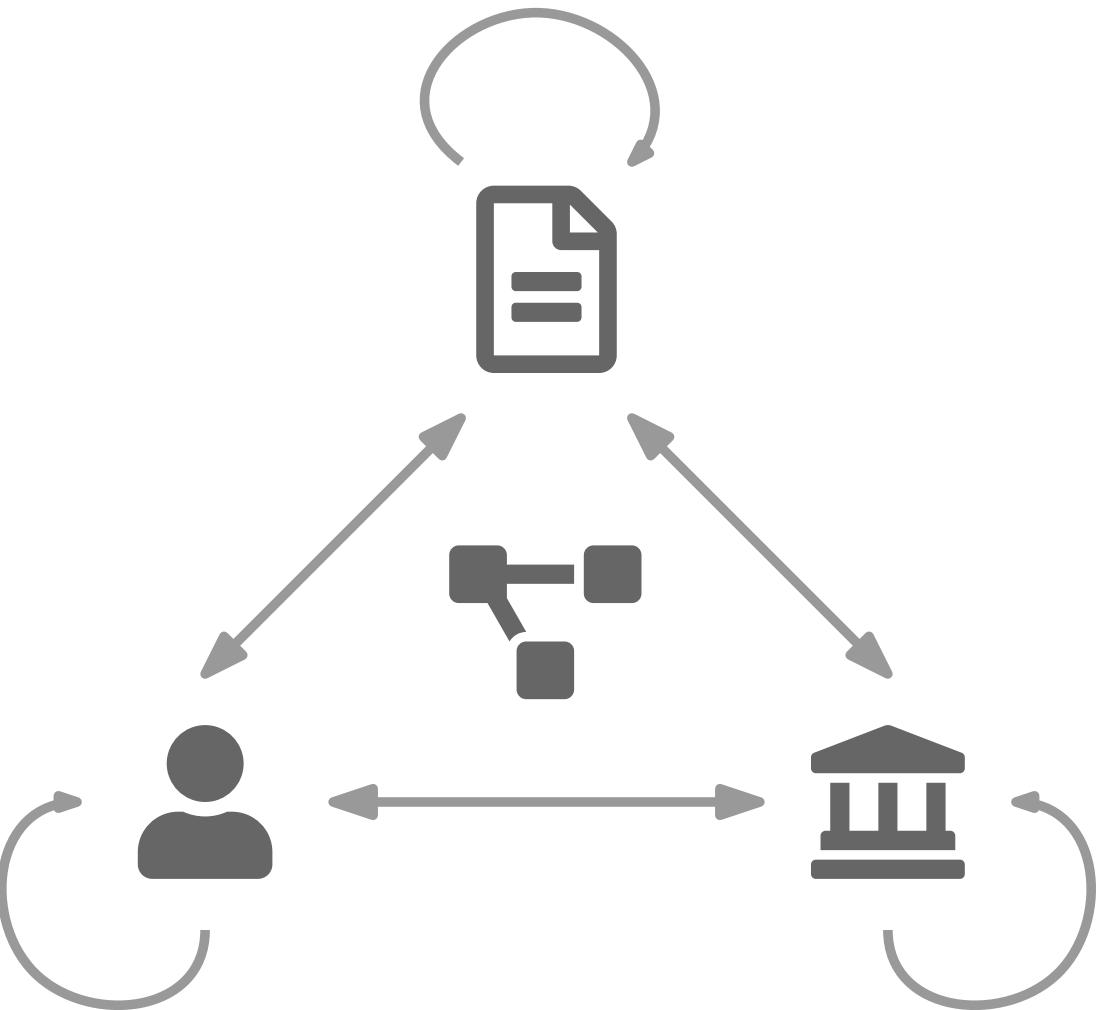
Motivation

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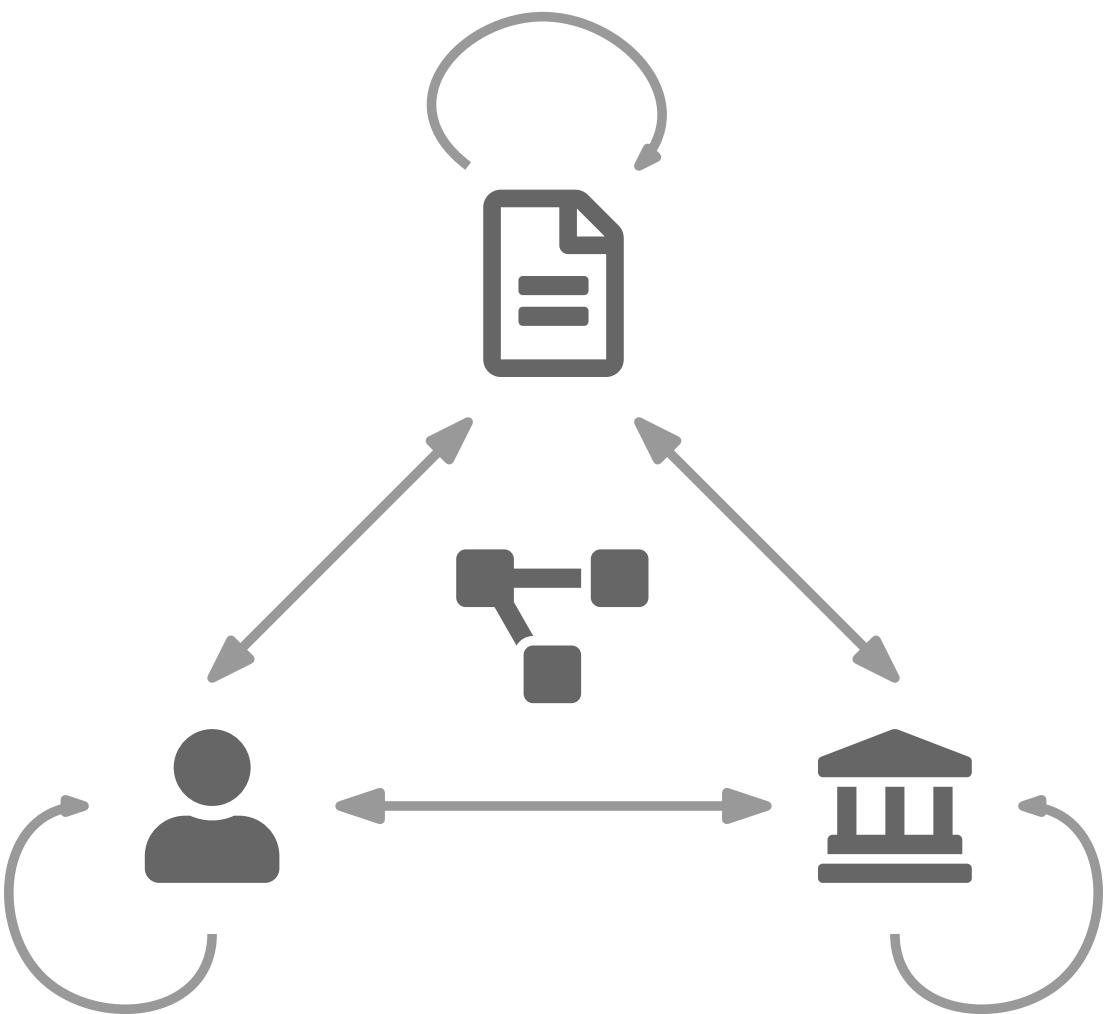
Motivation

Static Graphs

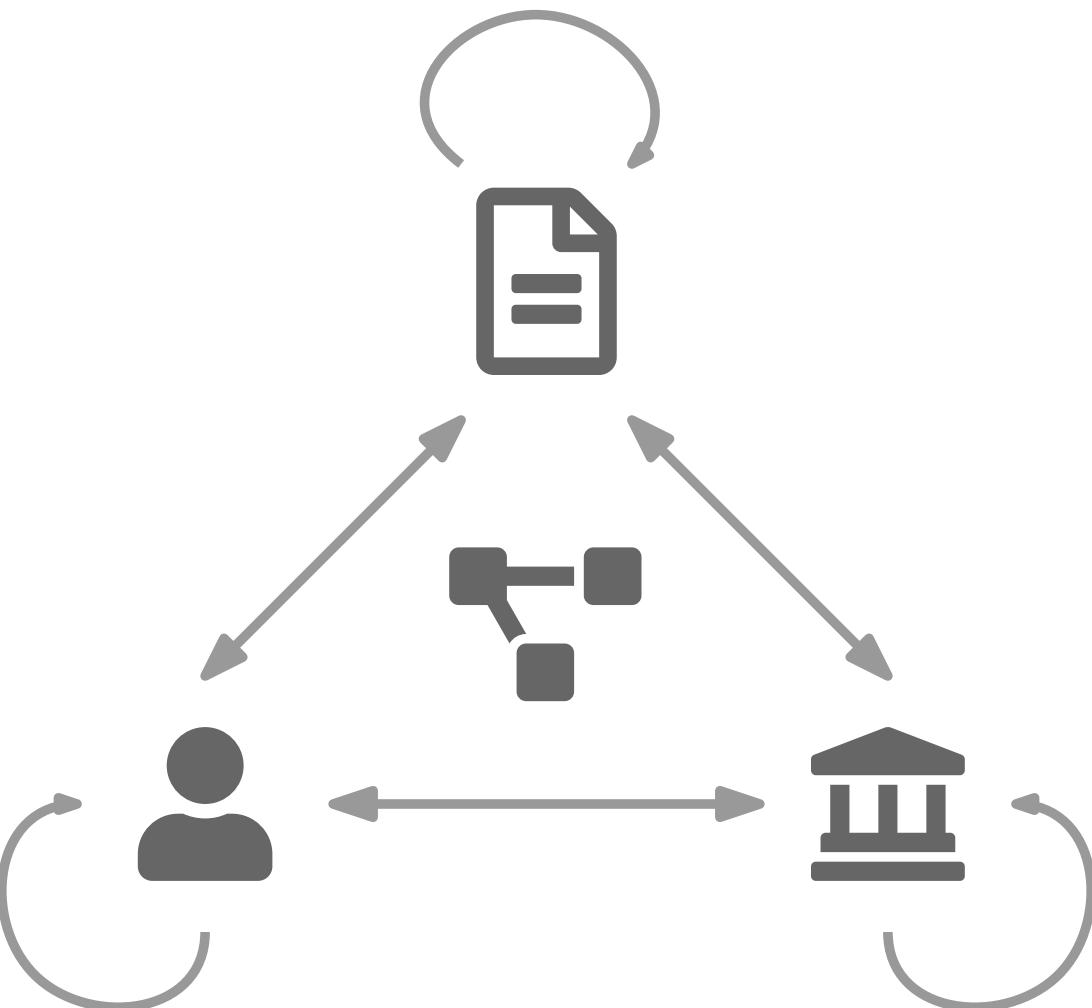
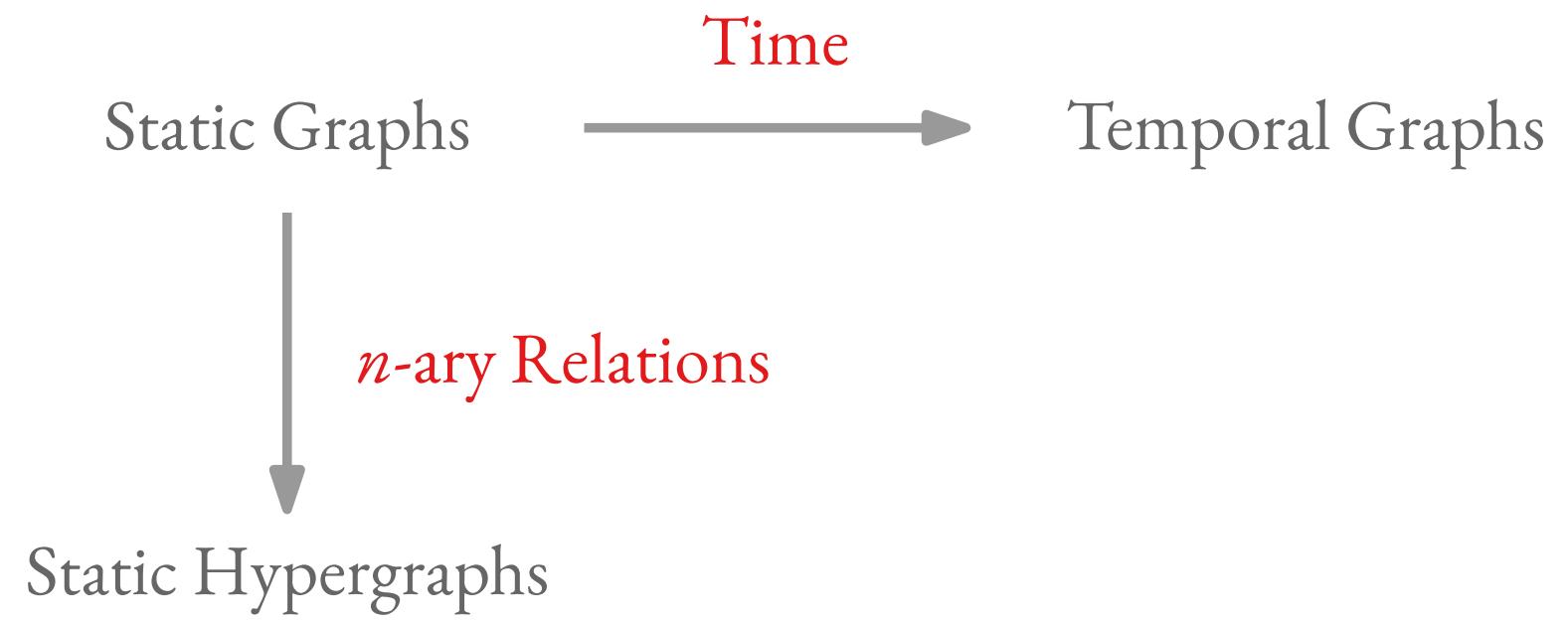


Motivation

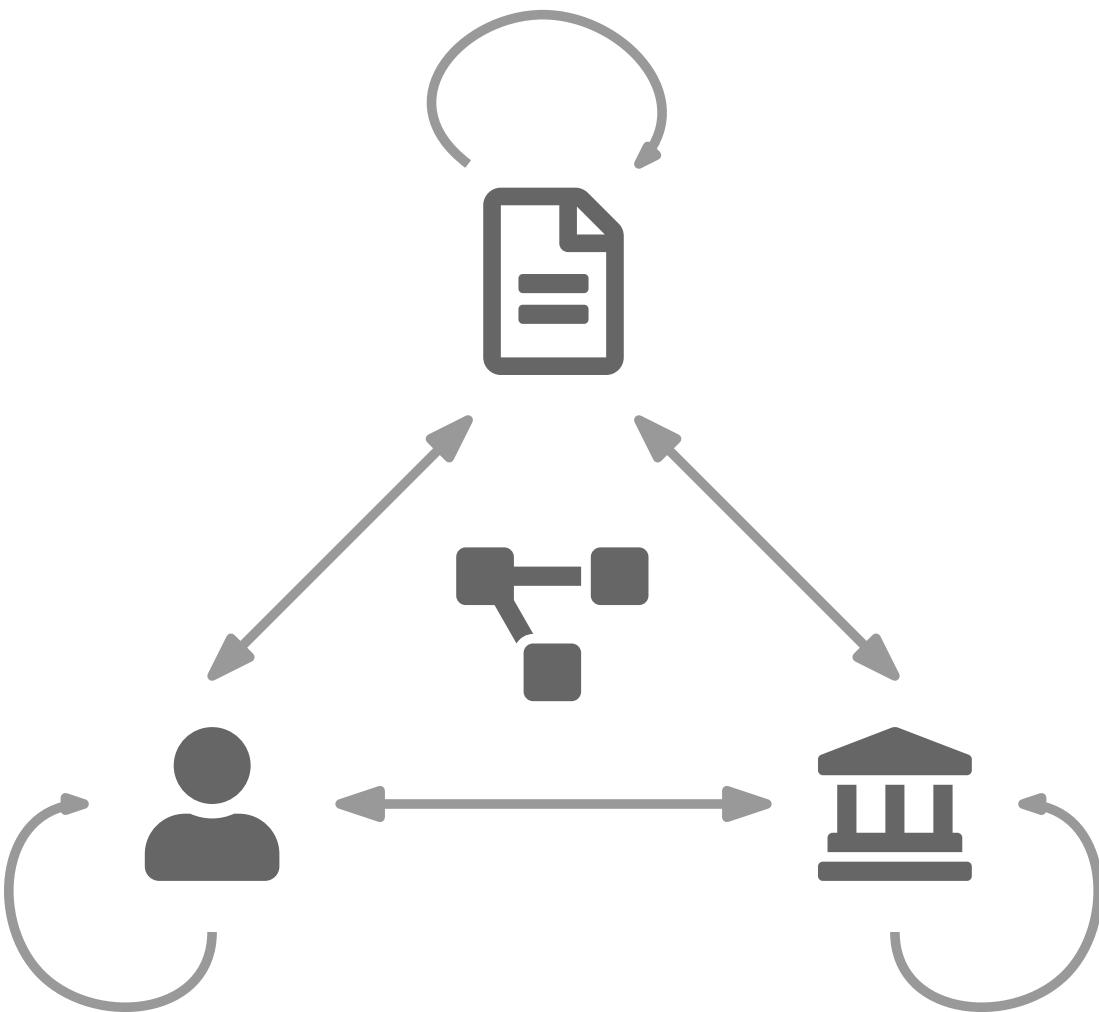
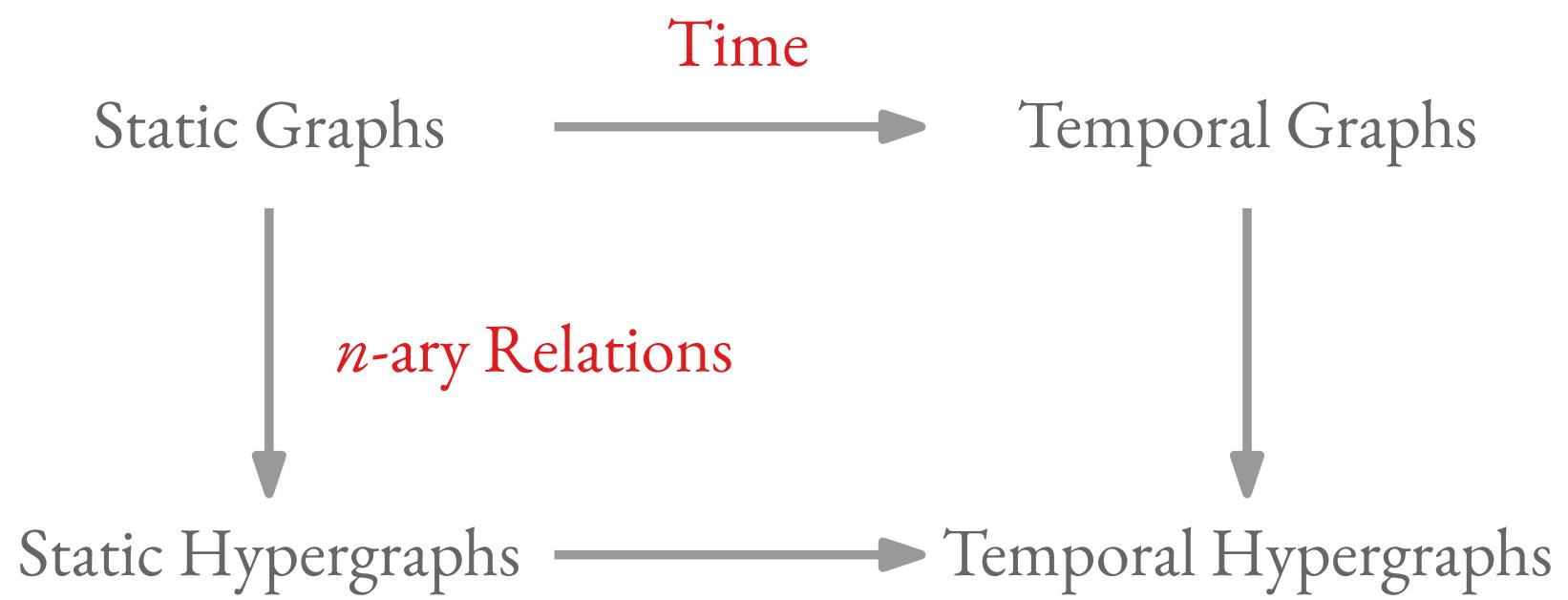
Static Graphs → Time → Temporal Graphs



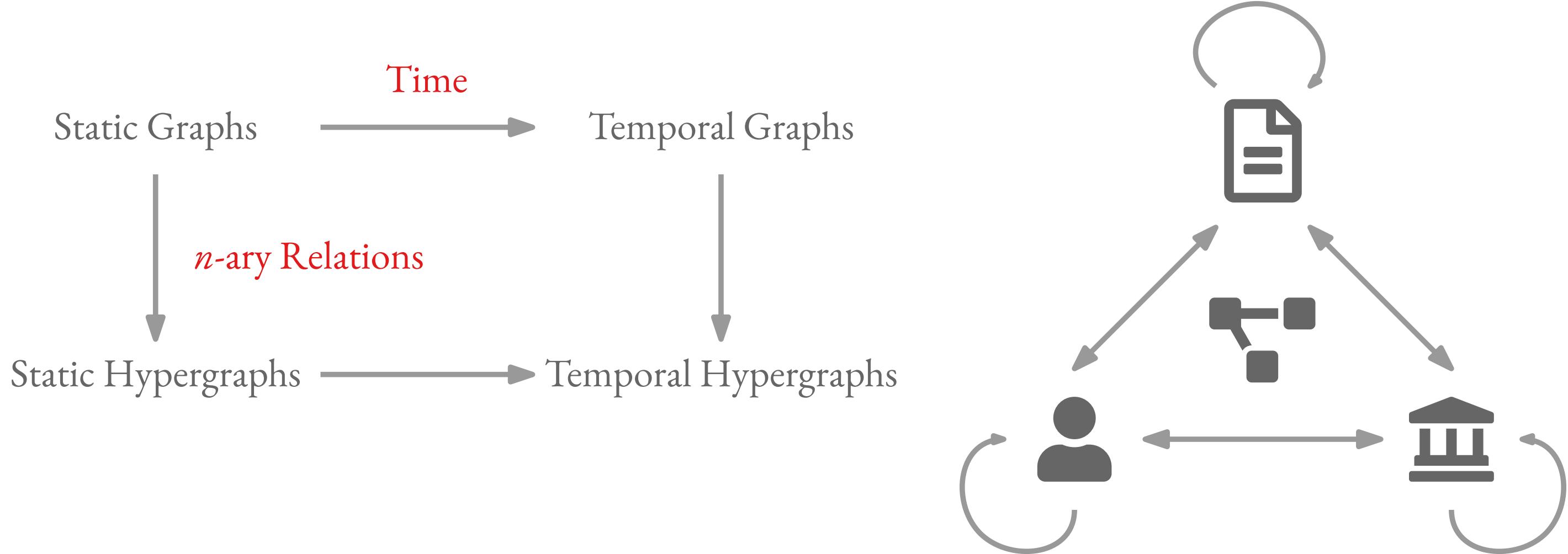
Motivation



Motivation

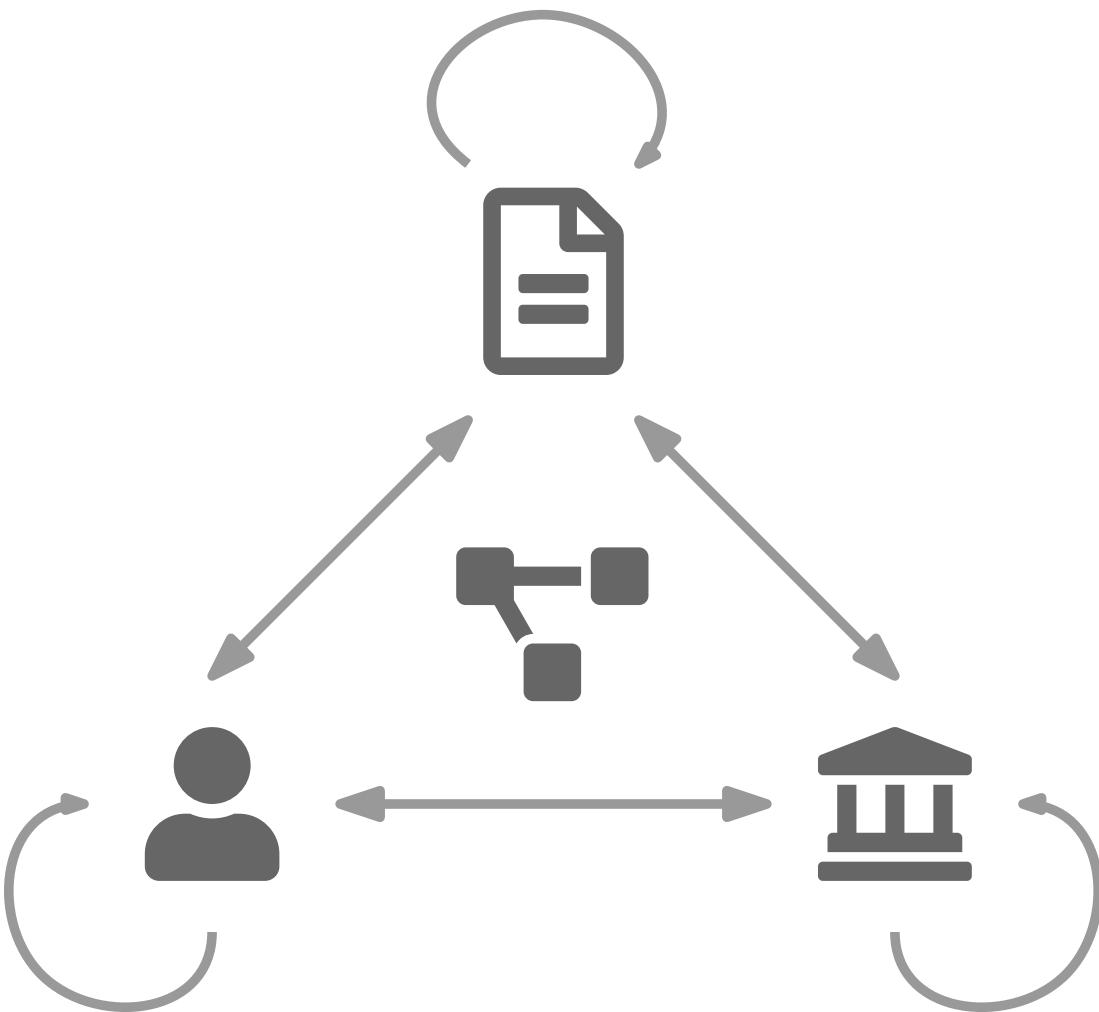
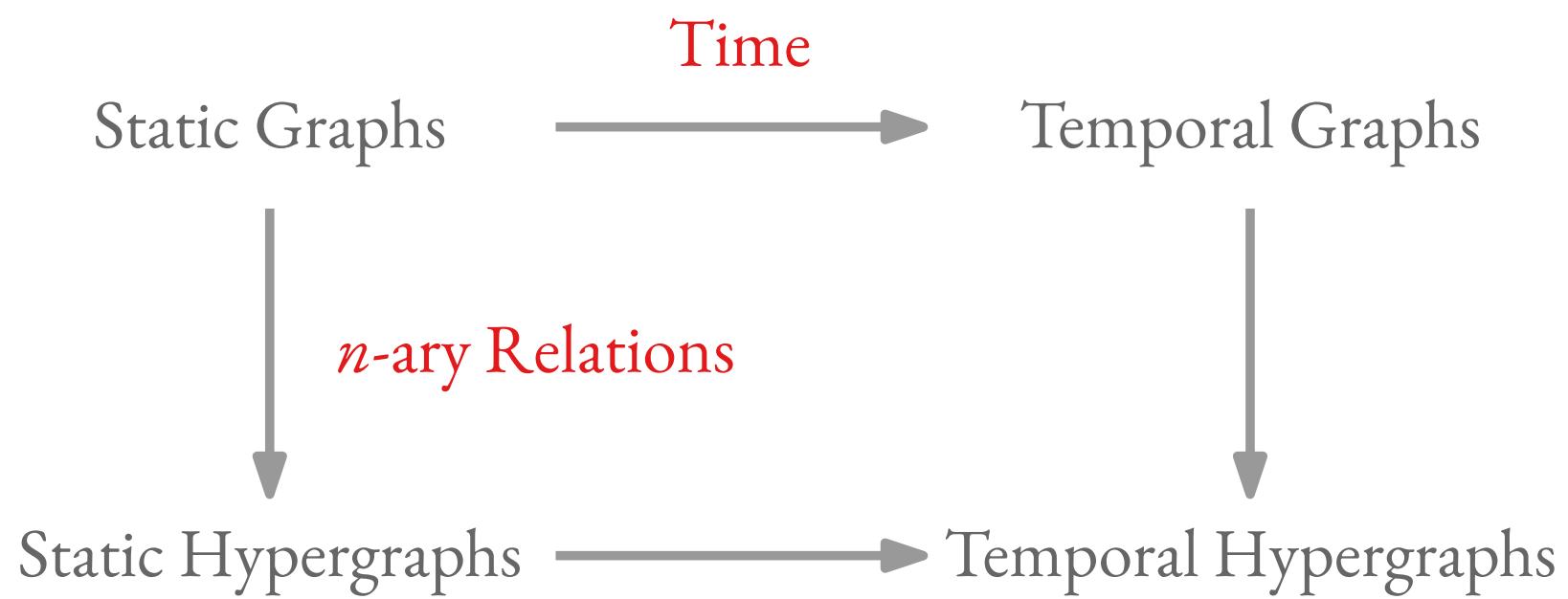


Motivation



How can we model legal networks as temporal hypergraphs?

Motivation



How can we model legal networks as temporal hypergraphs?

How do our modeling decisions impact our results?

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. I(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

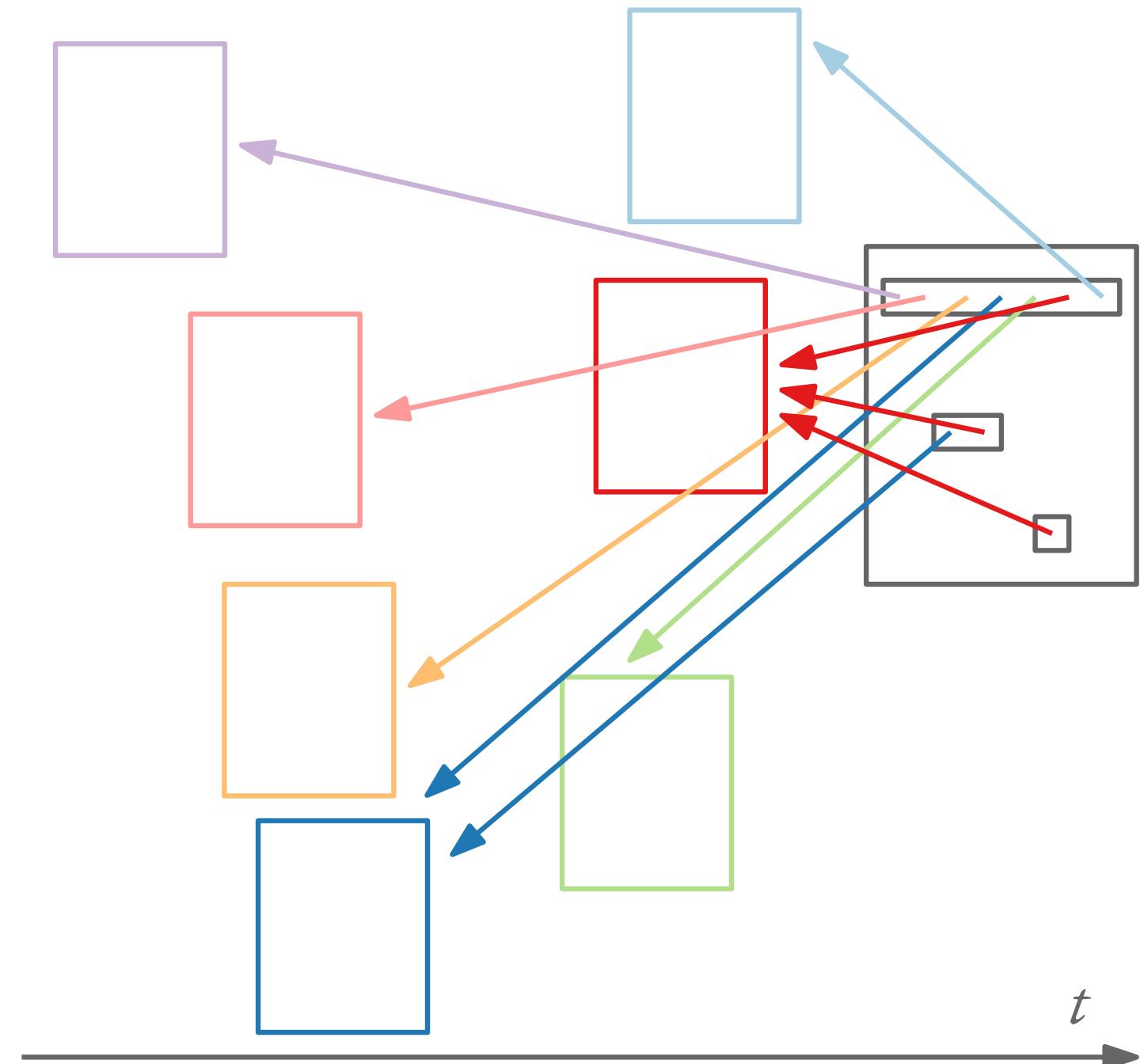
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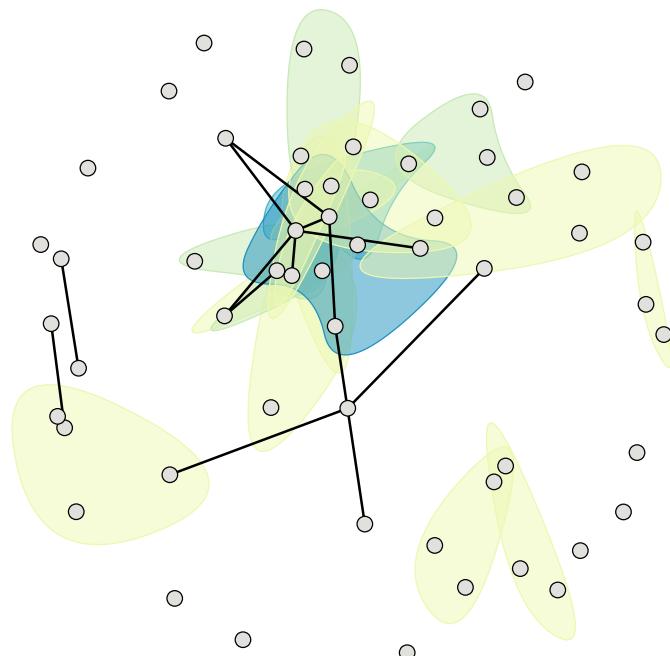
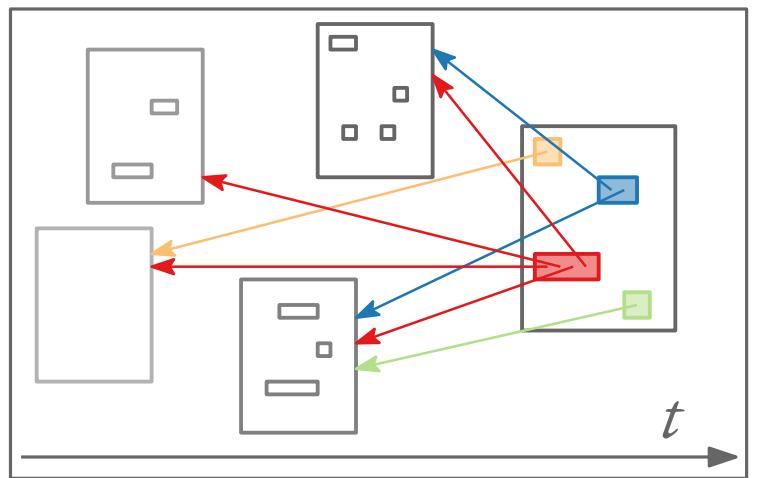
Legal Citation Networks

BVerfGE 120, 274, Para. 271

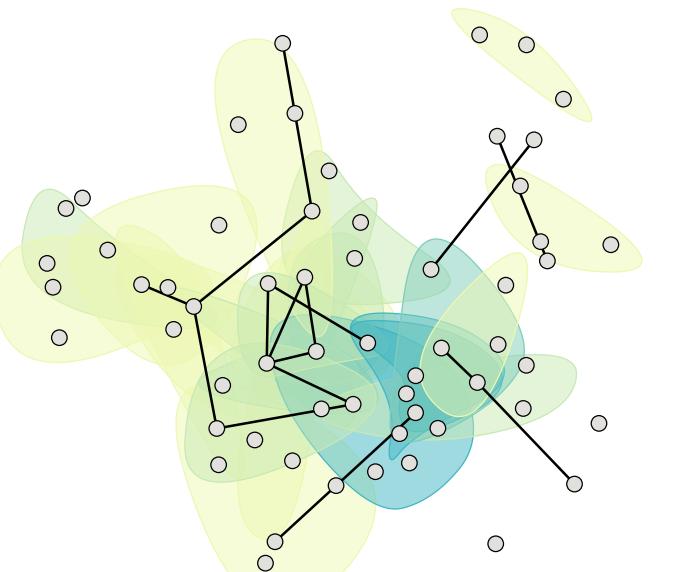
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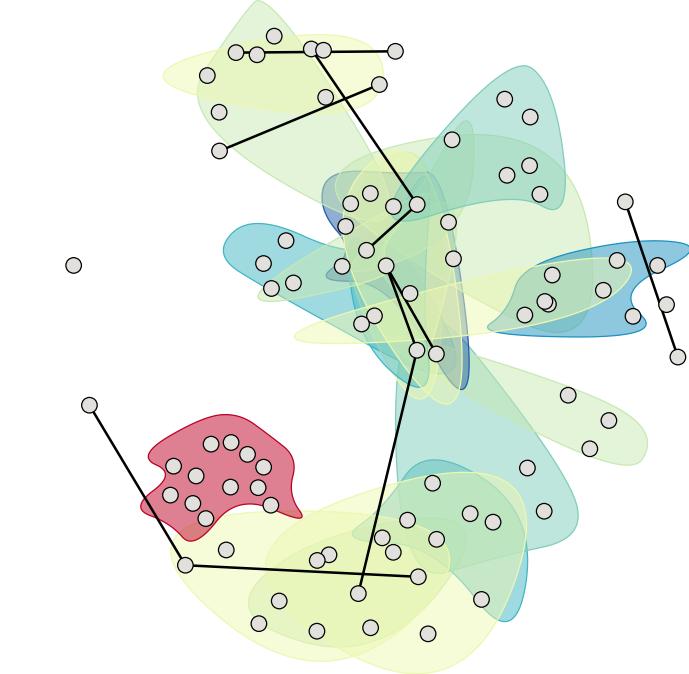
Legal Citation Networks



BVerfGE 125, 260—Retention of Data



BVerfGE 153, 317—ESM Treaty



BVerfGE 153, 1—Headscarf III

Legal Collaboration Networks

Legal Collaboration Networks

(a) Original Proceeding

Claimant(s)/Nationality(ies): 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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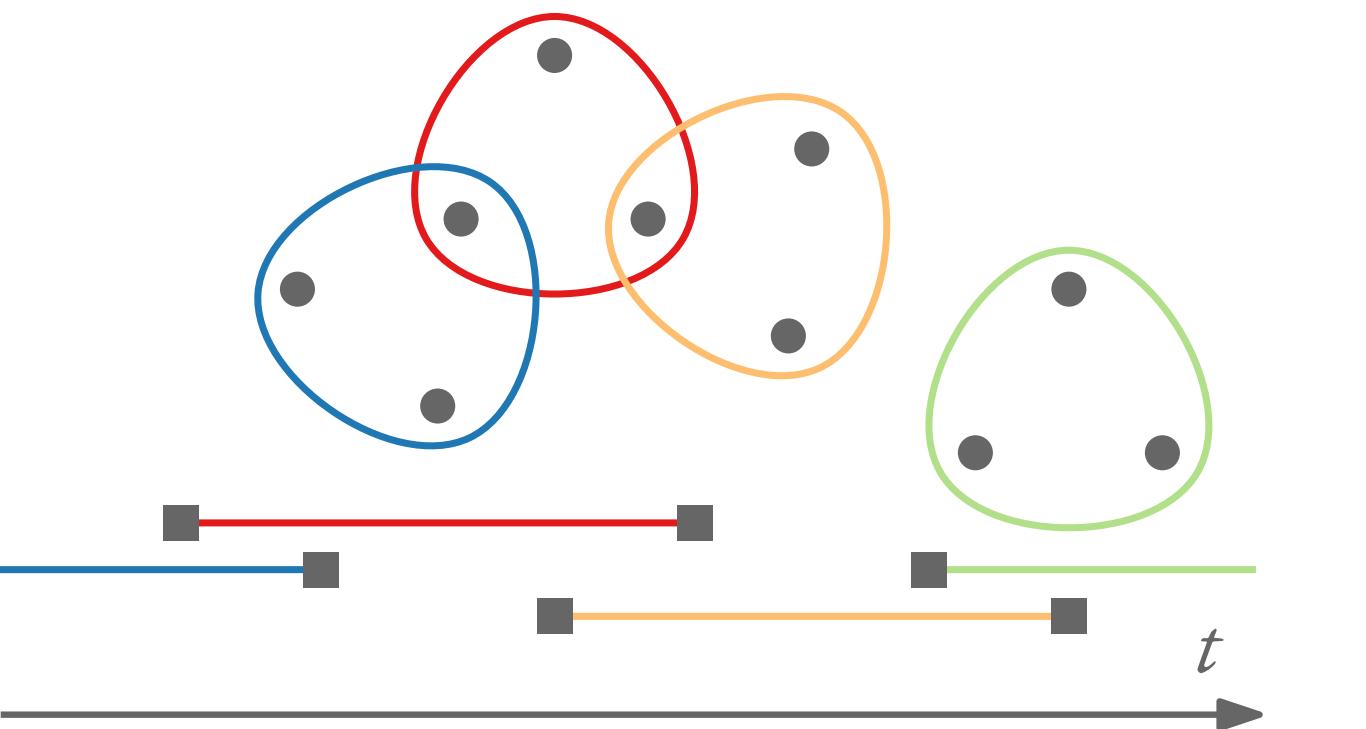
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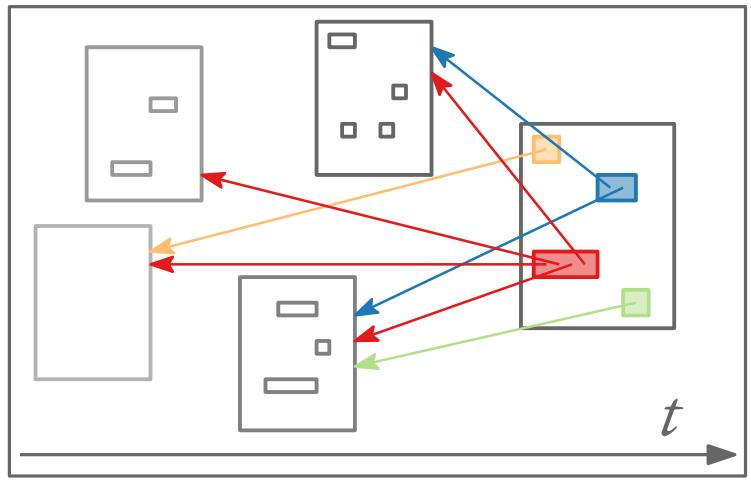
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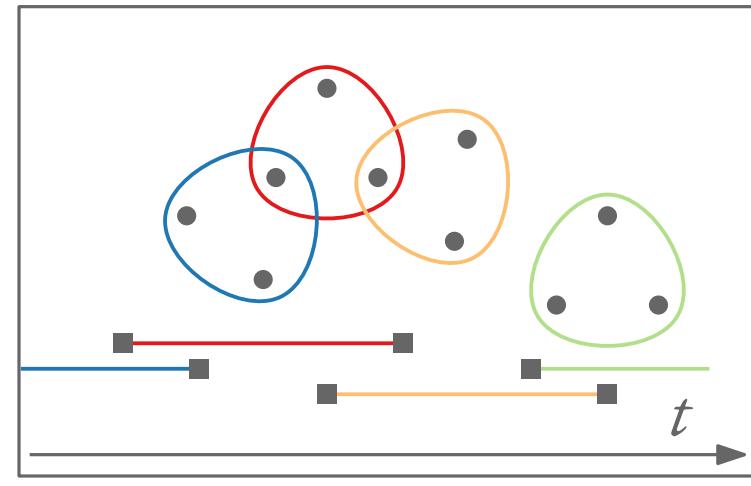
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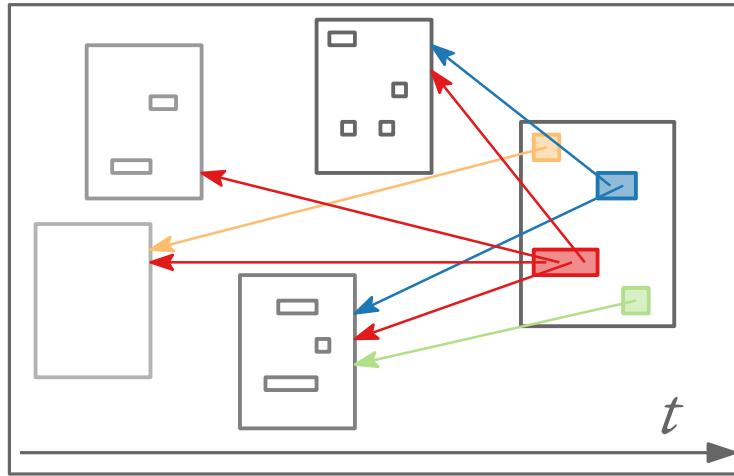


GFCC Citations

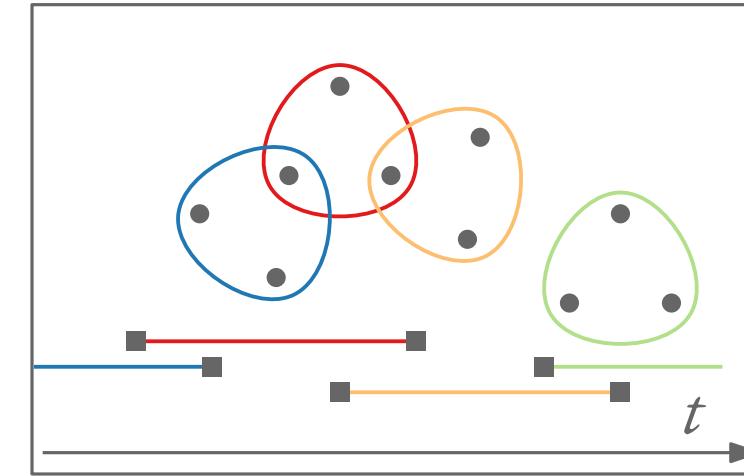


ICSID Collaborations

Dataset	Network Type	Raw Data	Cases	Coverage	T	Evolution Type
GFCC	Citation	Case Texts	3 618	1951–2022 (72y)	2 109	Point-Aggregation
ICSID	Collaboration	Case Metadata	742	1974–2023 (50y)	1 077	Interval-Event

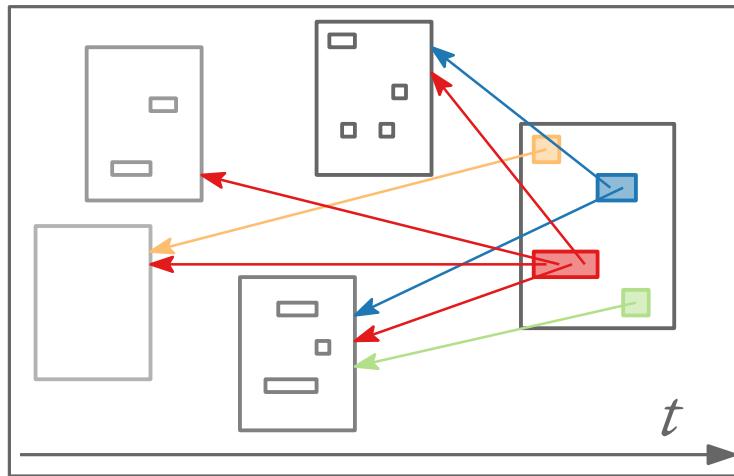


GFCC Citations

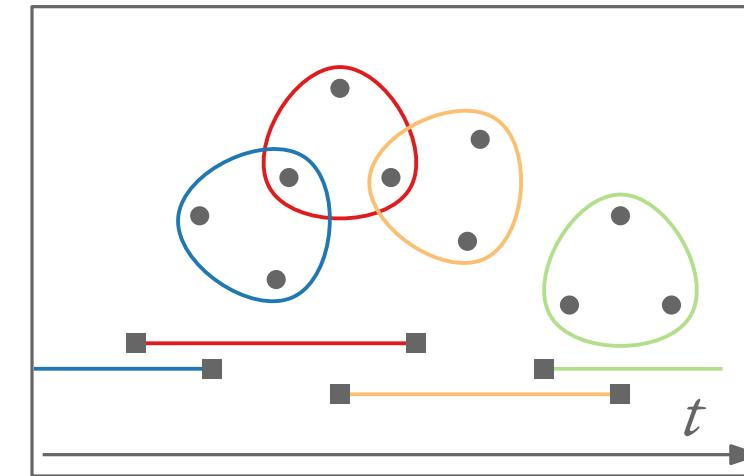


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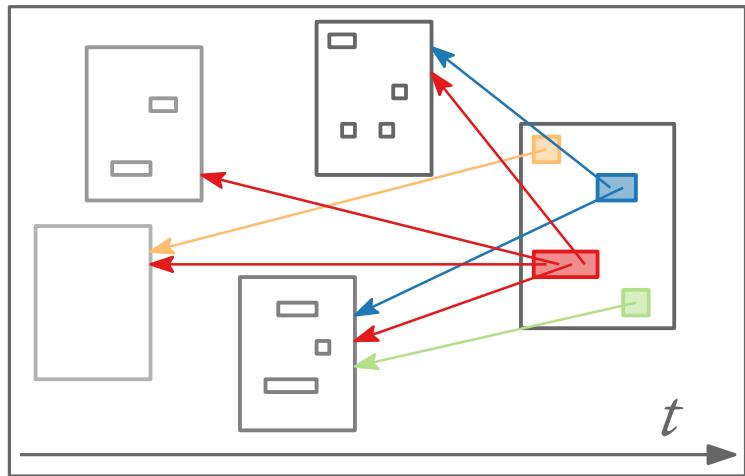
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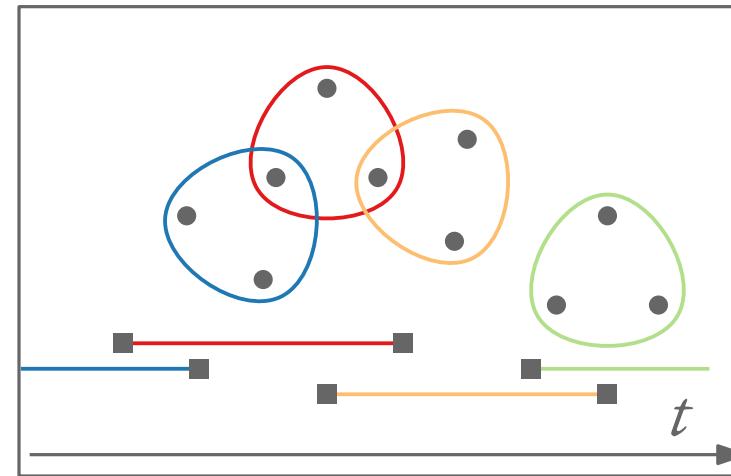
ICSID Collaborations

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	mb	77 284	21.4	$9^+ 10^-$
Citation Blocks	bb	13 541	10.2	6
	mb	46 257	21.4	10

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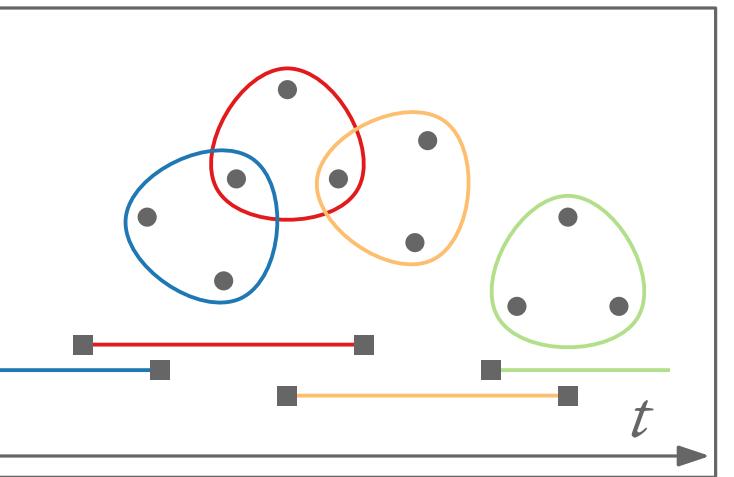


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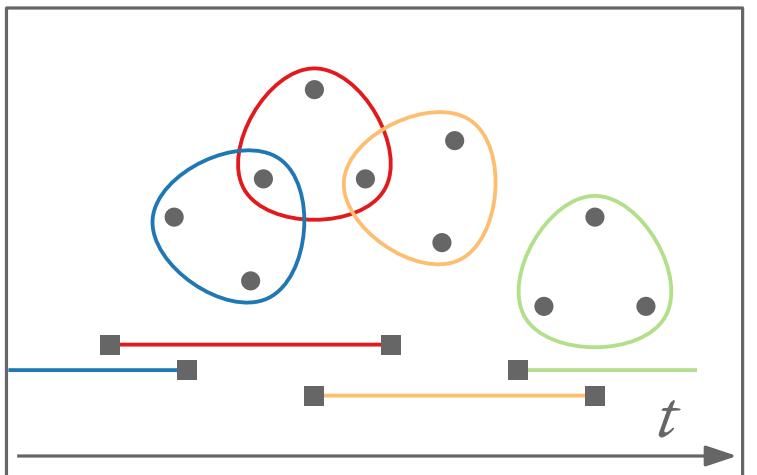
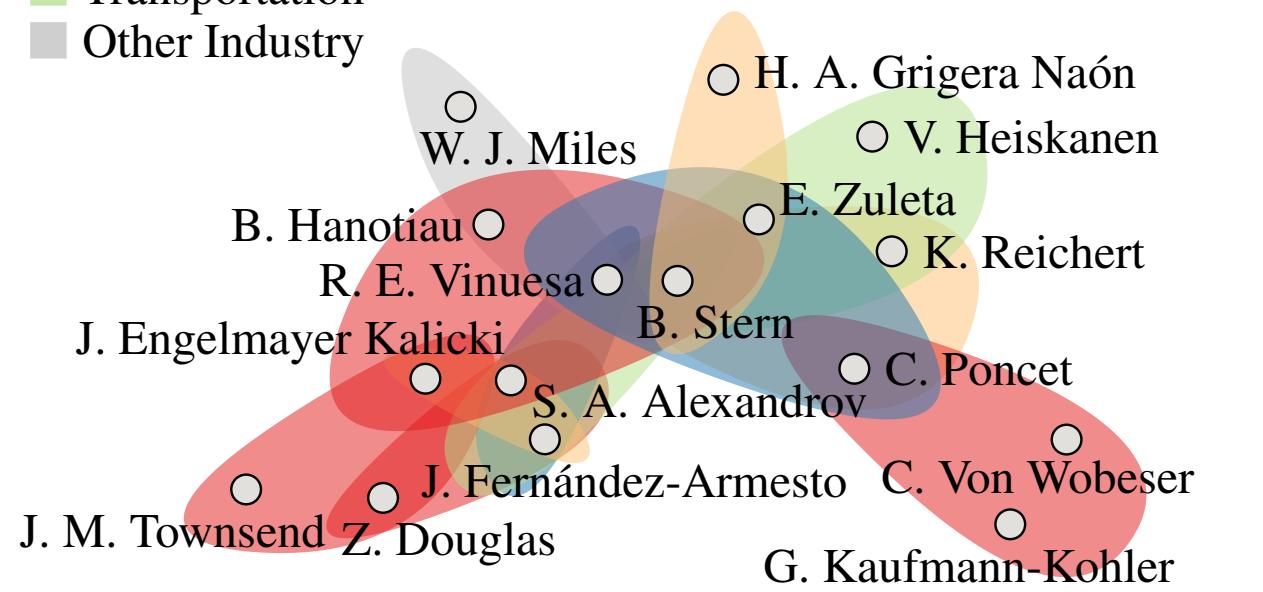
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	<i>mb</i>	2 226	10.1	4
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Micro-Level: Centralities



Micro-Level: Centralities

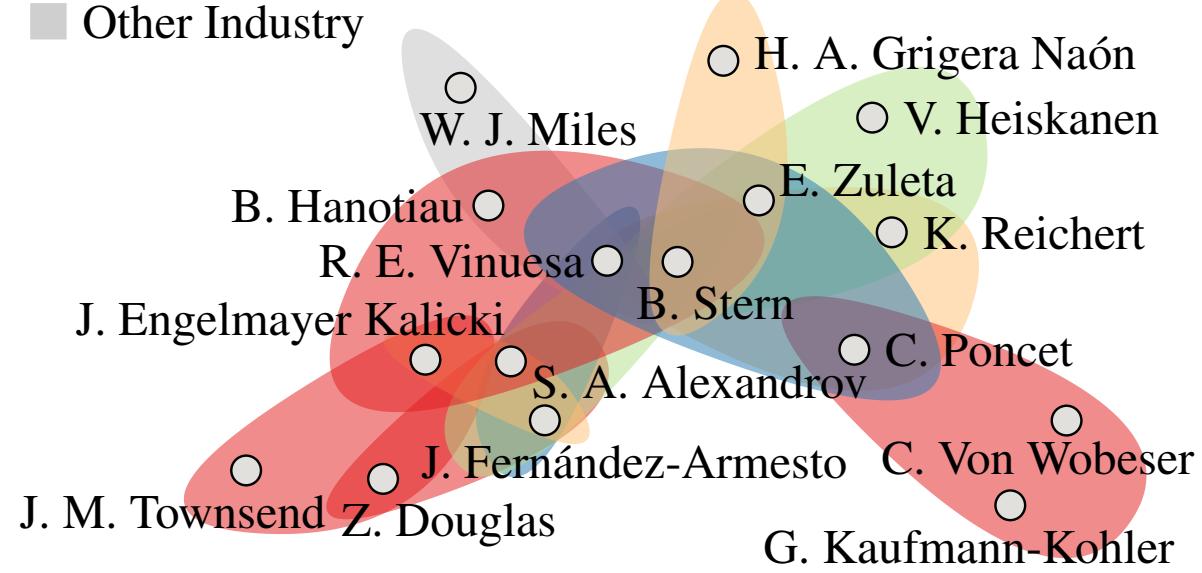
- Construction
- Electric Power & Other Energy
- Finance
- Information & Communication
- Oil, Gas & Mining
- Transportation
- Other Industry



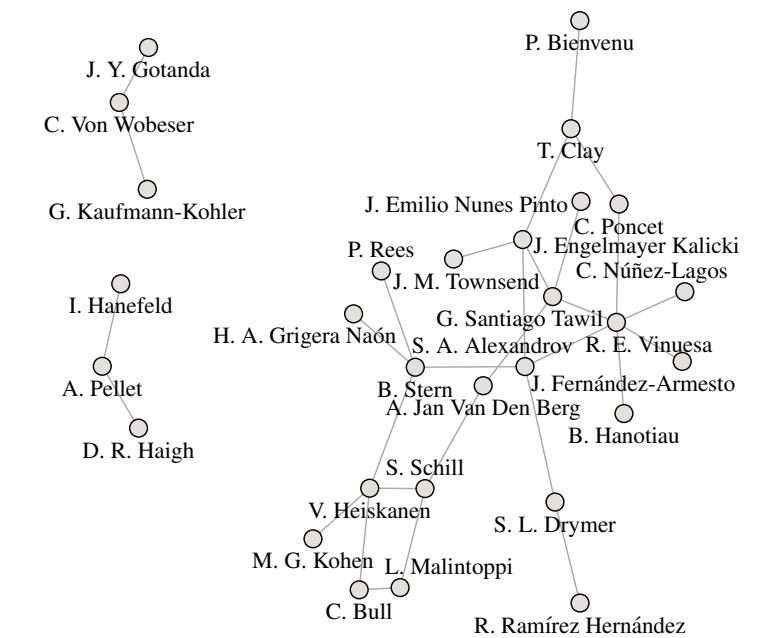
Higher-order betweenness

Micro-Level: Centralities

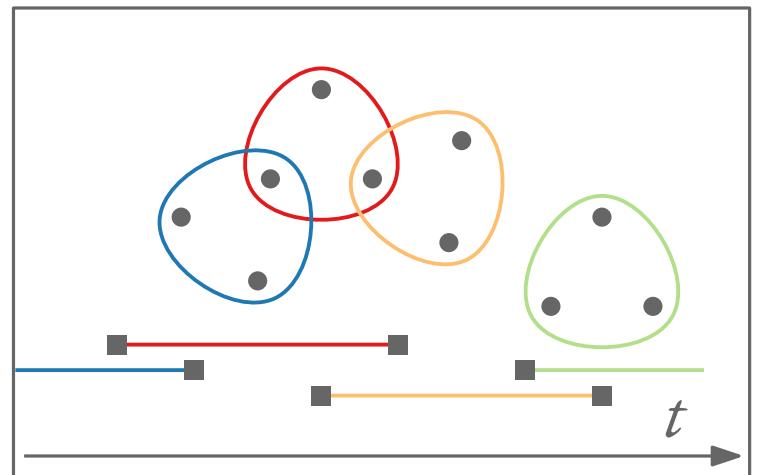
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Higher-order betweenness

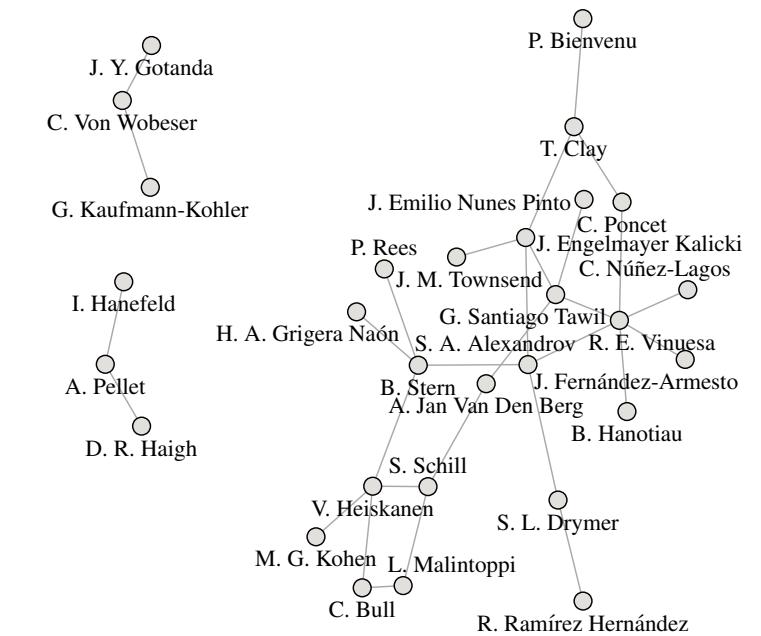
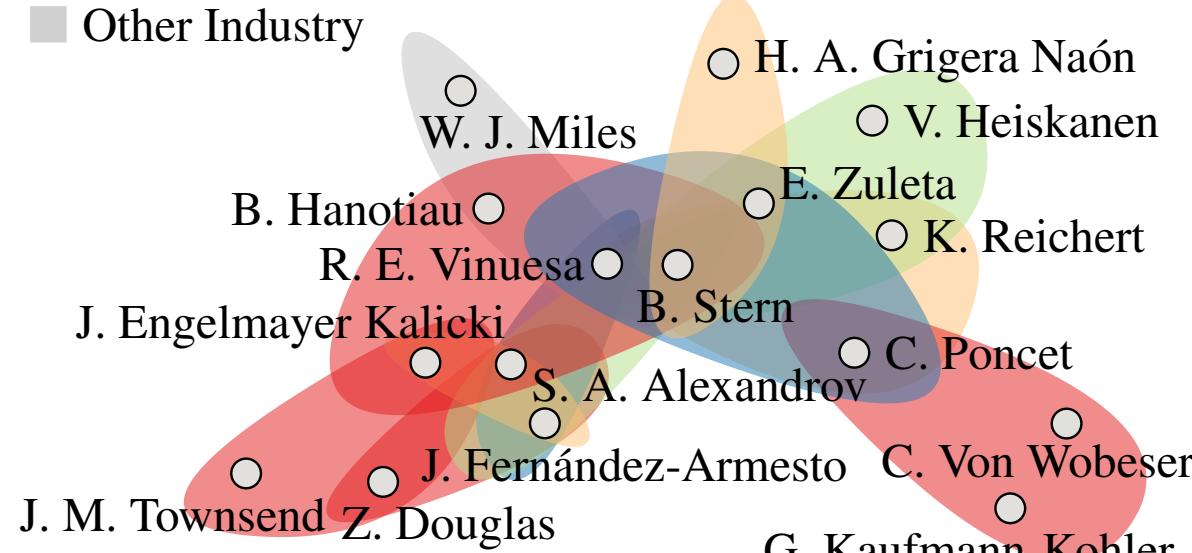


Binary betweenness

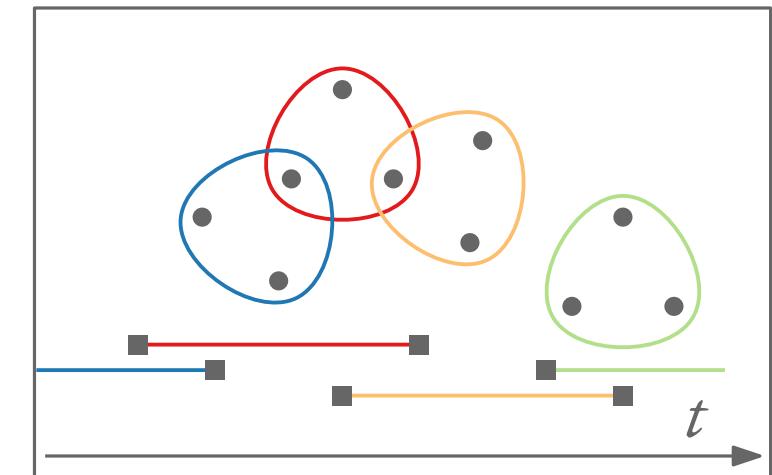
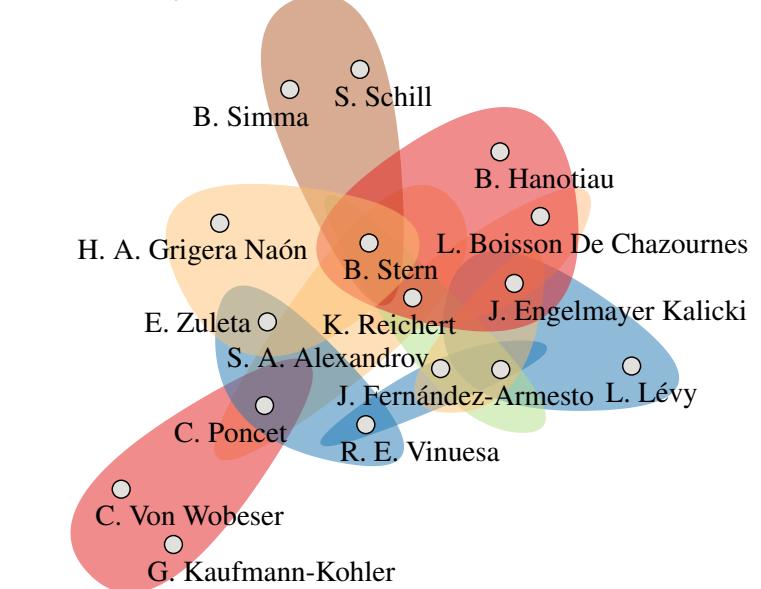


Micro-Level: Centralities

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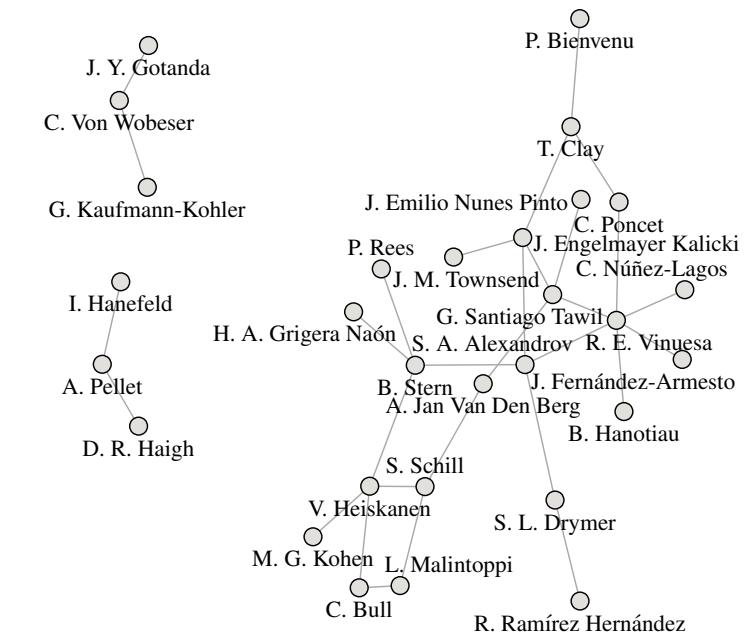
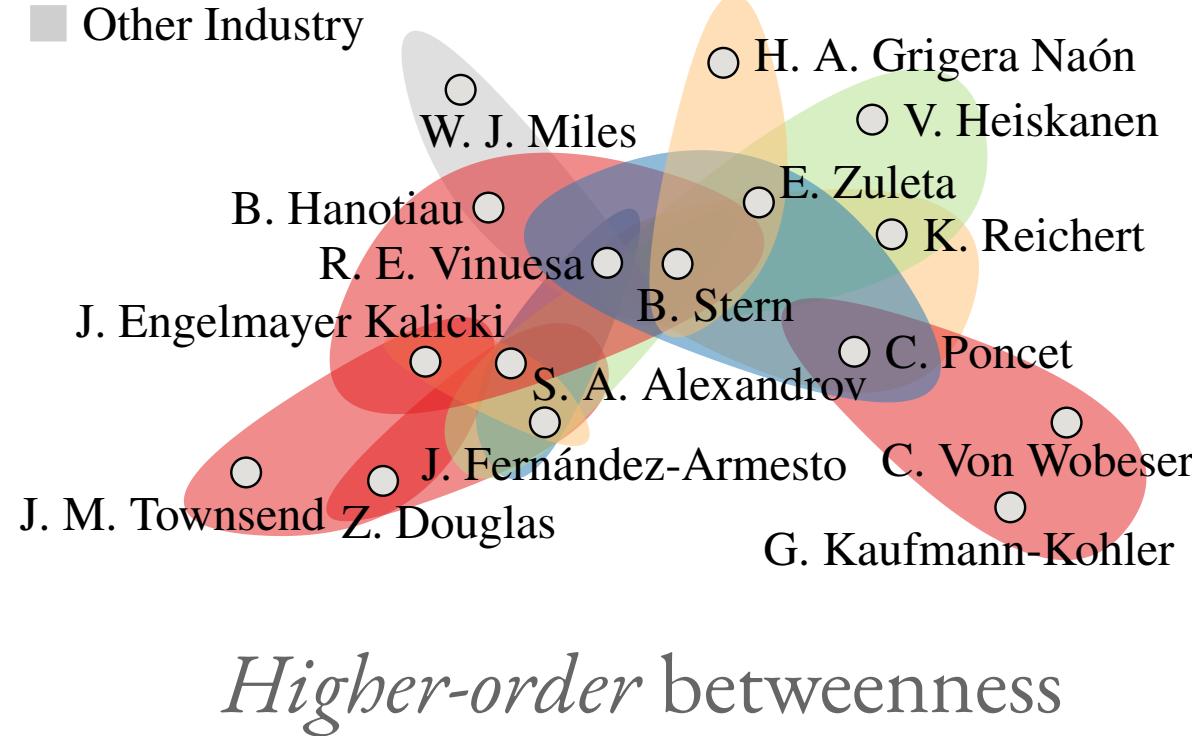


Binary betweenness

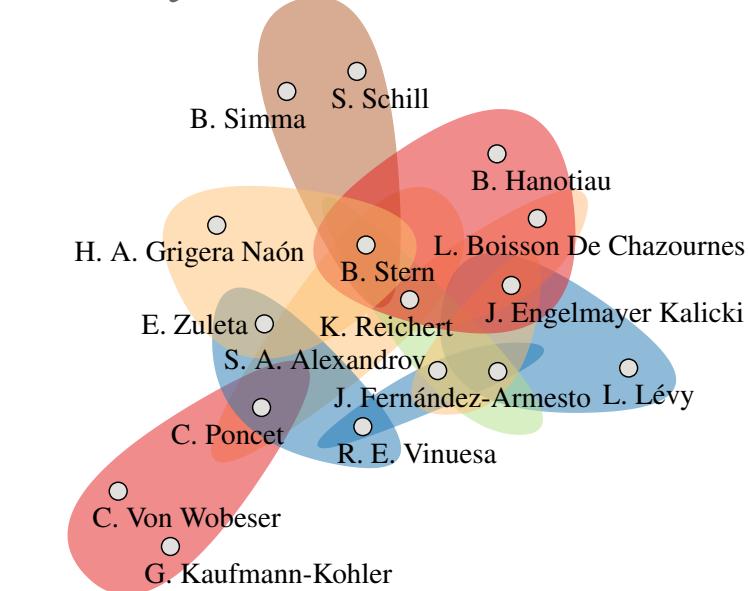


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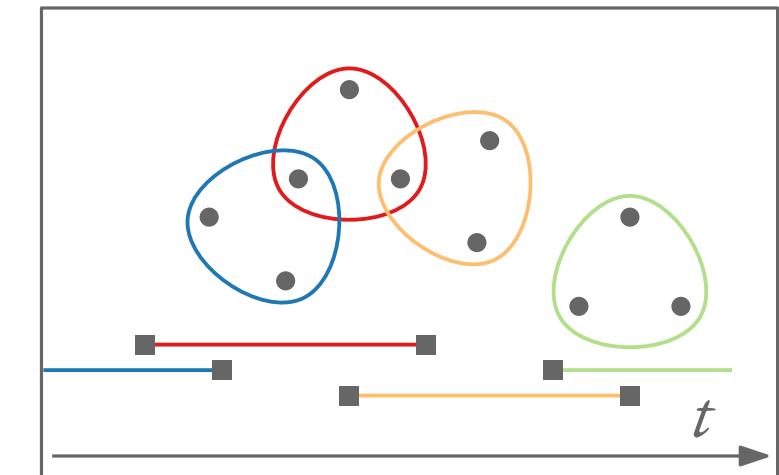
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Binary betweenness

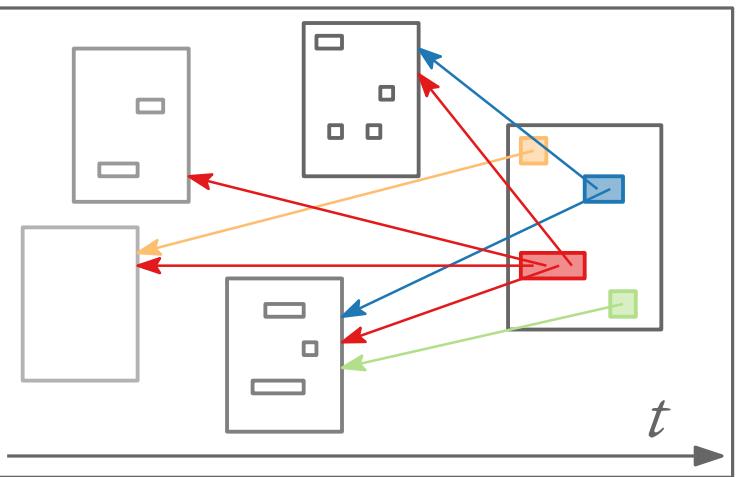


Closeness with time

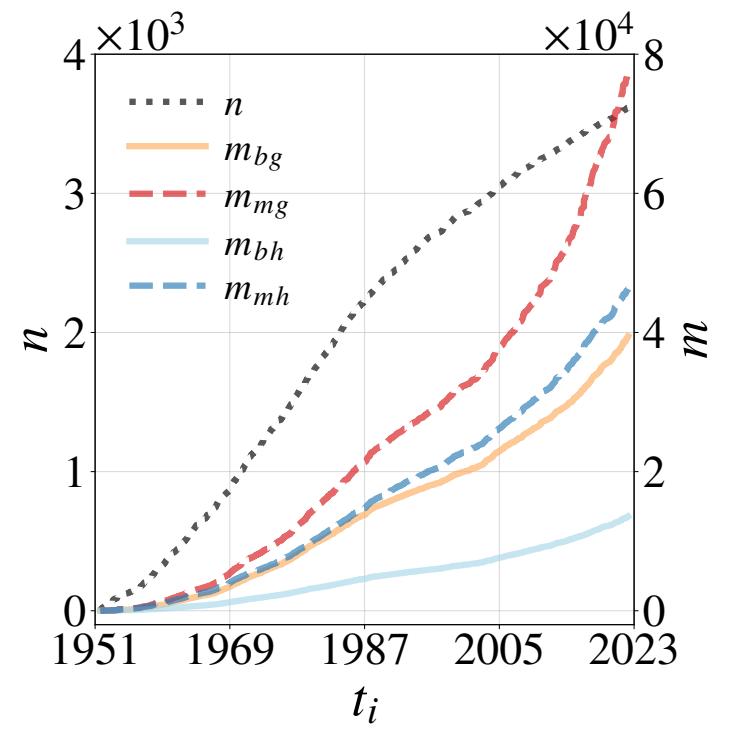
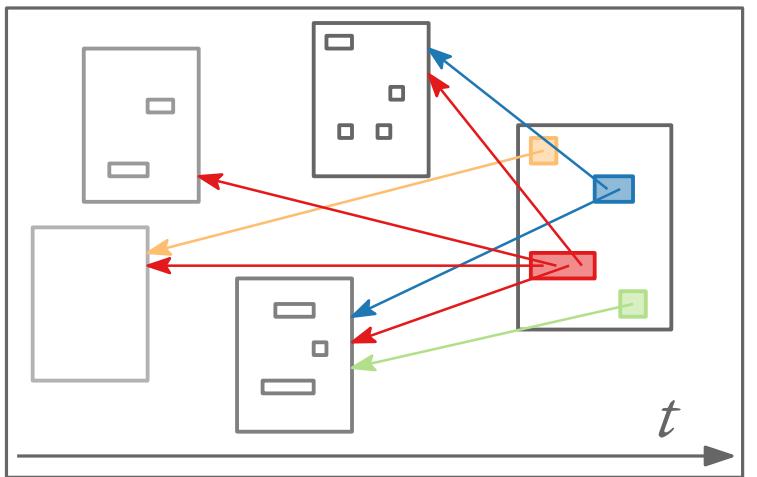


Closeness without time

Macro-Level: Distributions

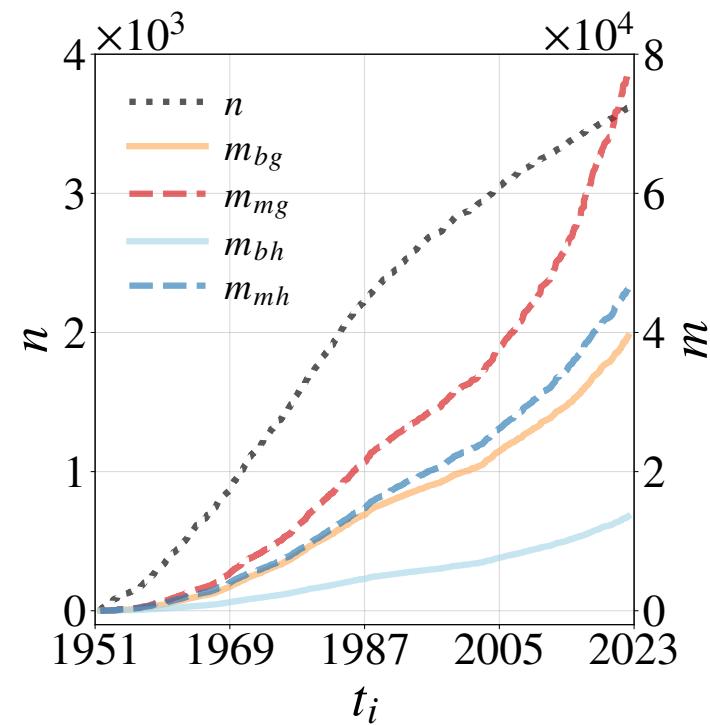
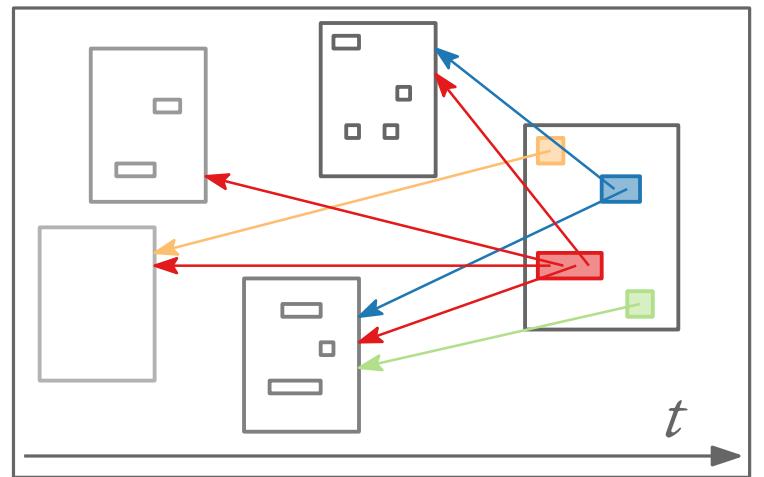


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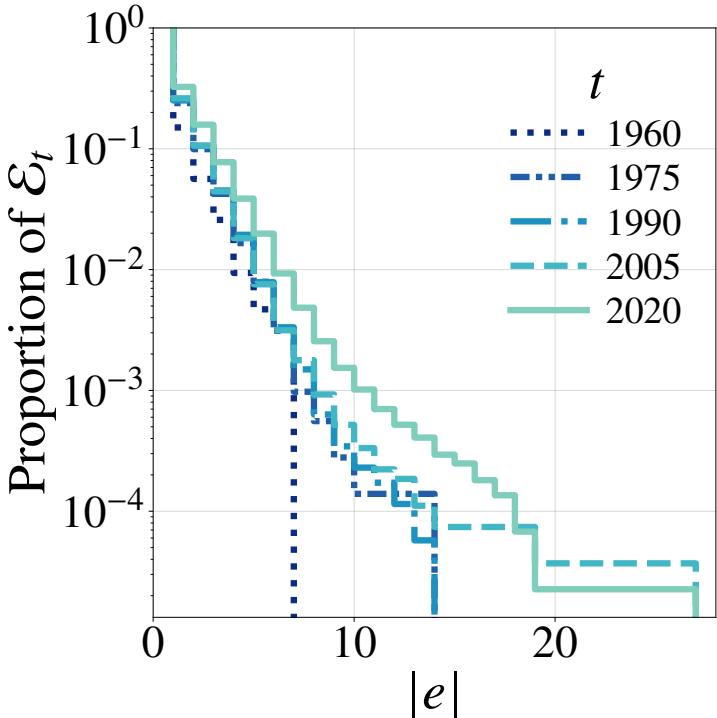


Growth of Temporal Graph

Macro-Level: Distributions

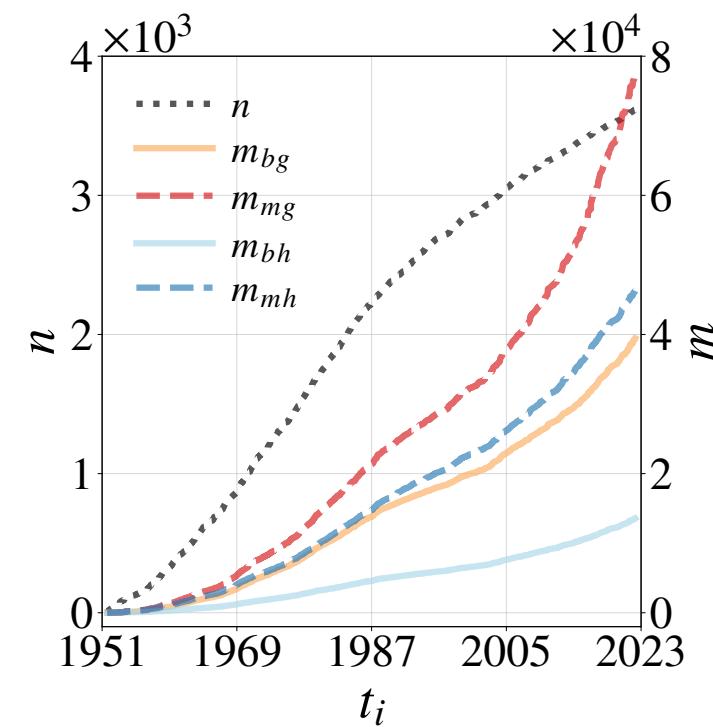
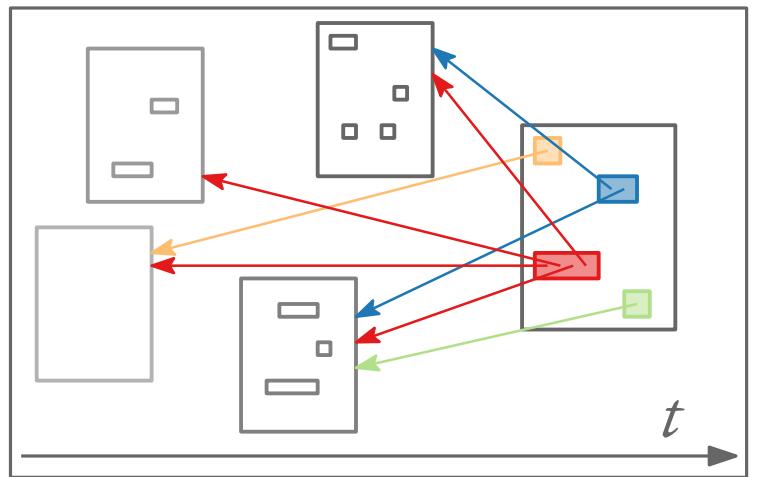


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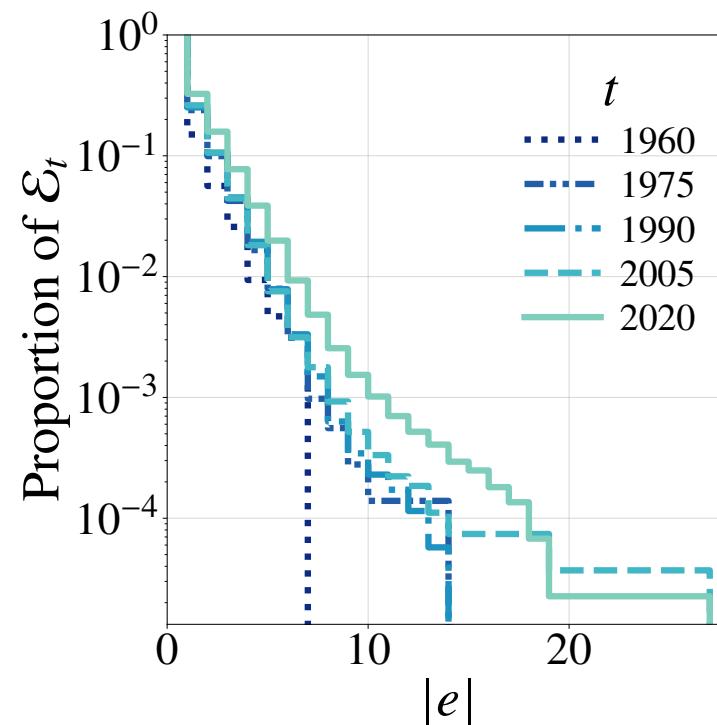


Edge Sizes in Temporal Hypergraph

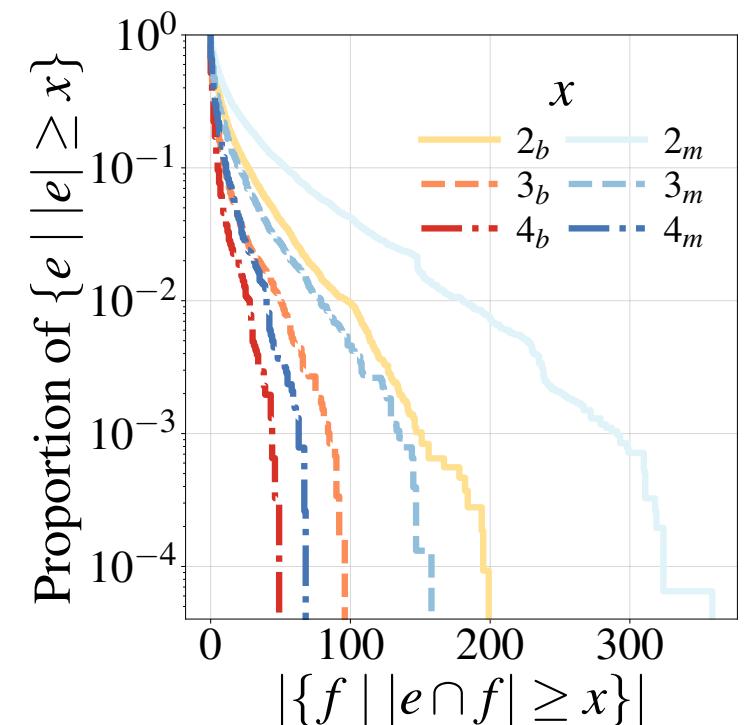
Macro-Level: Distributions



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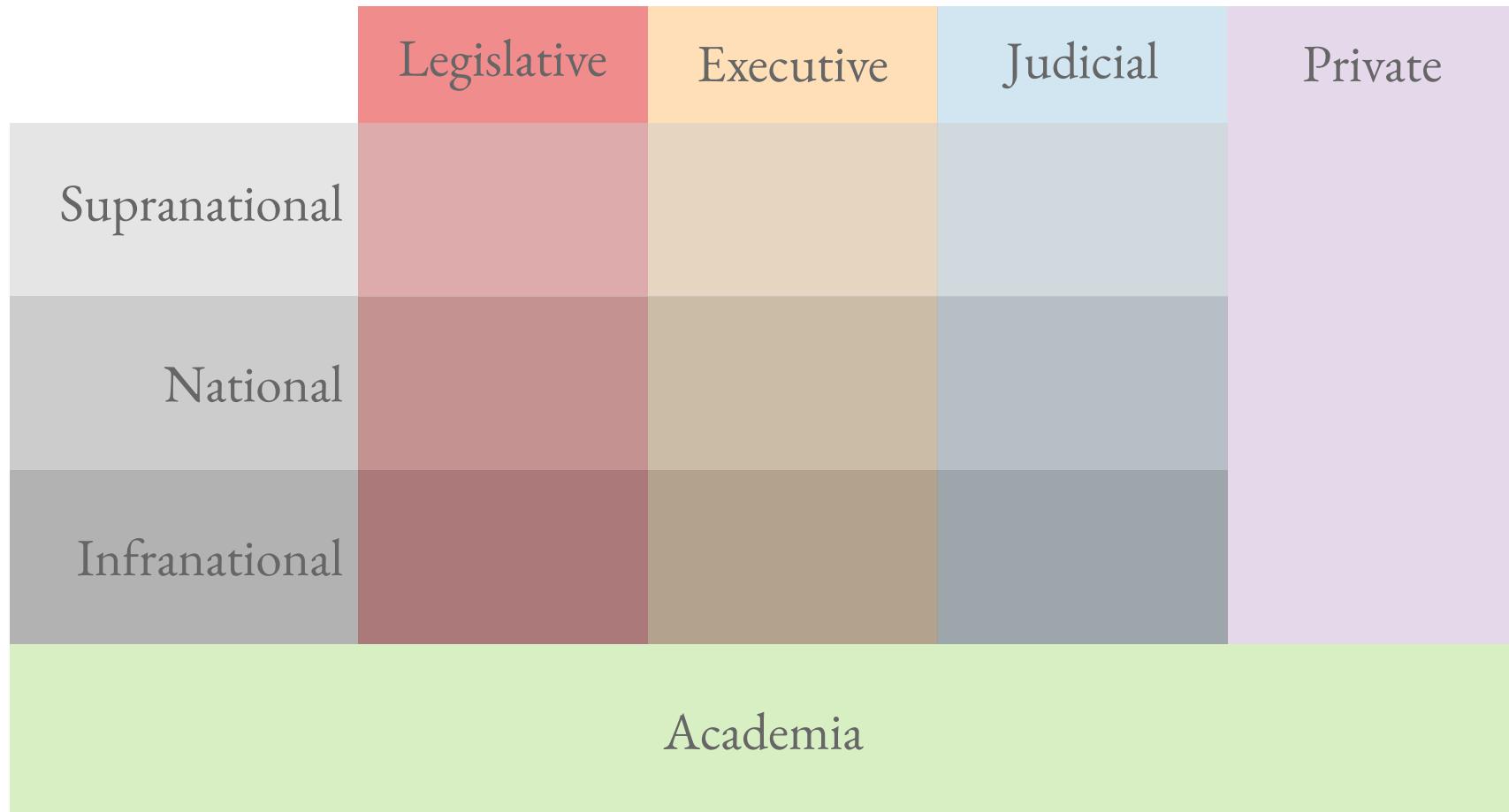


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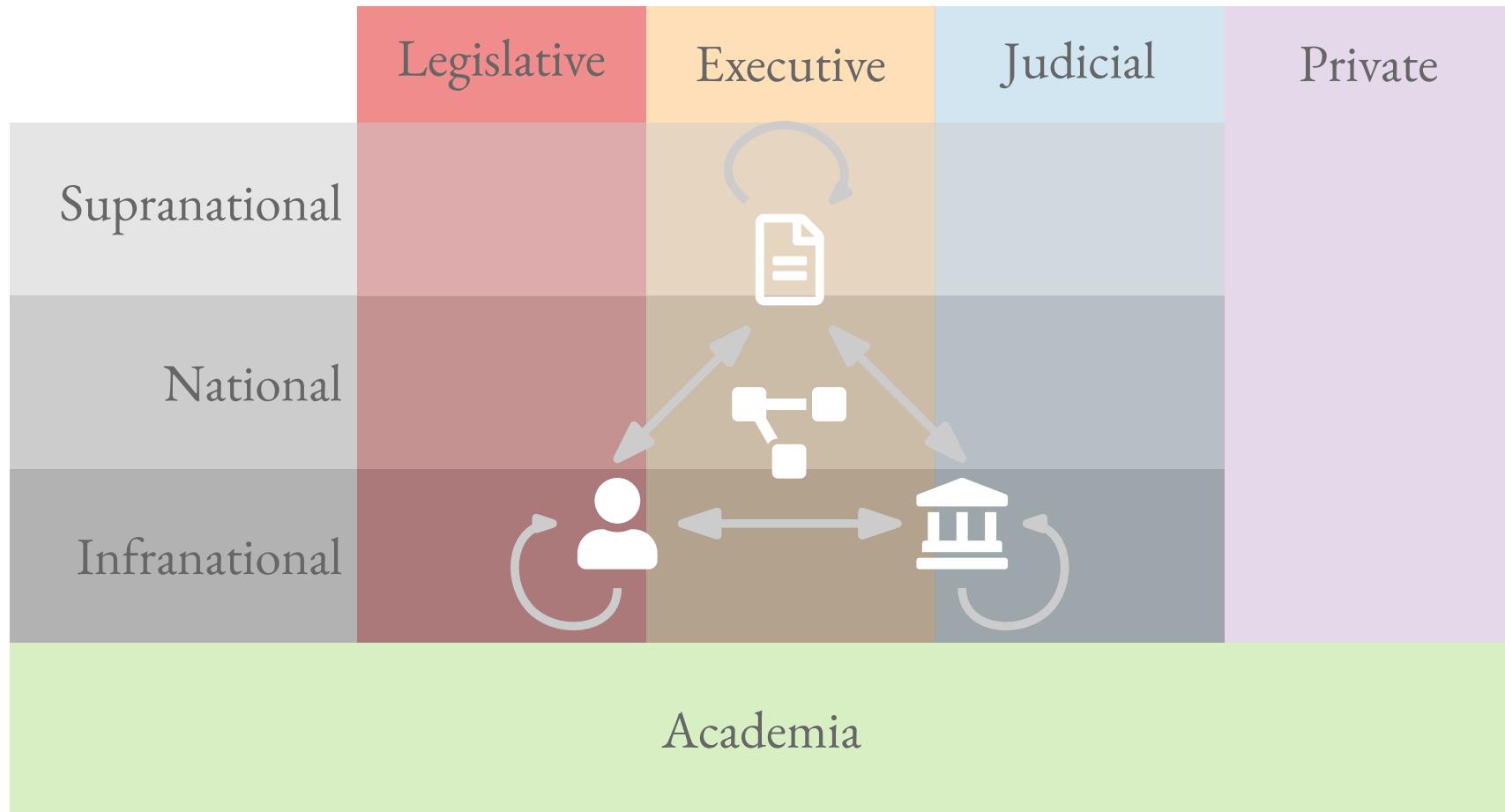


Edge-Neighborhood Sizes
in Temporal Hypergraph

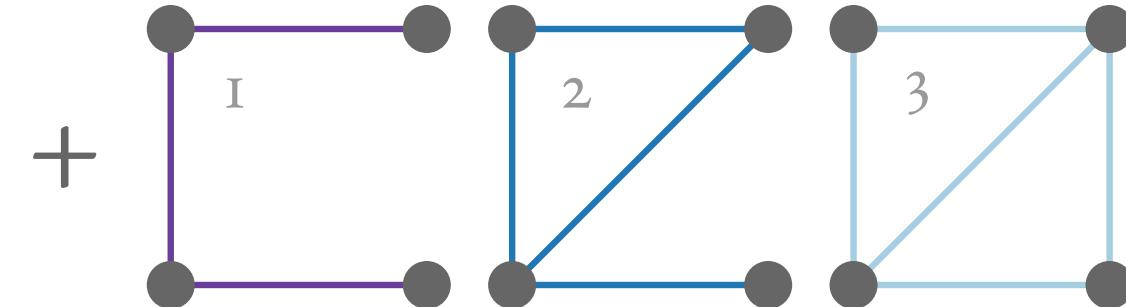
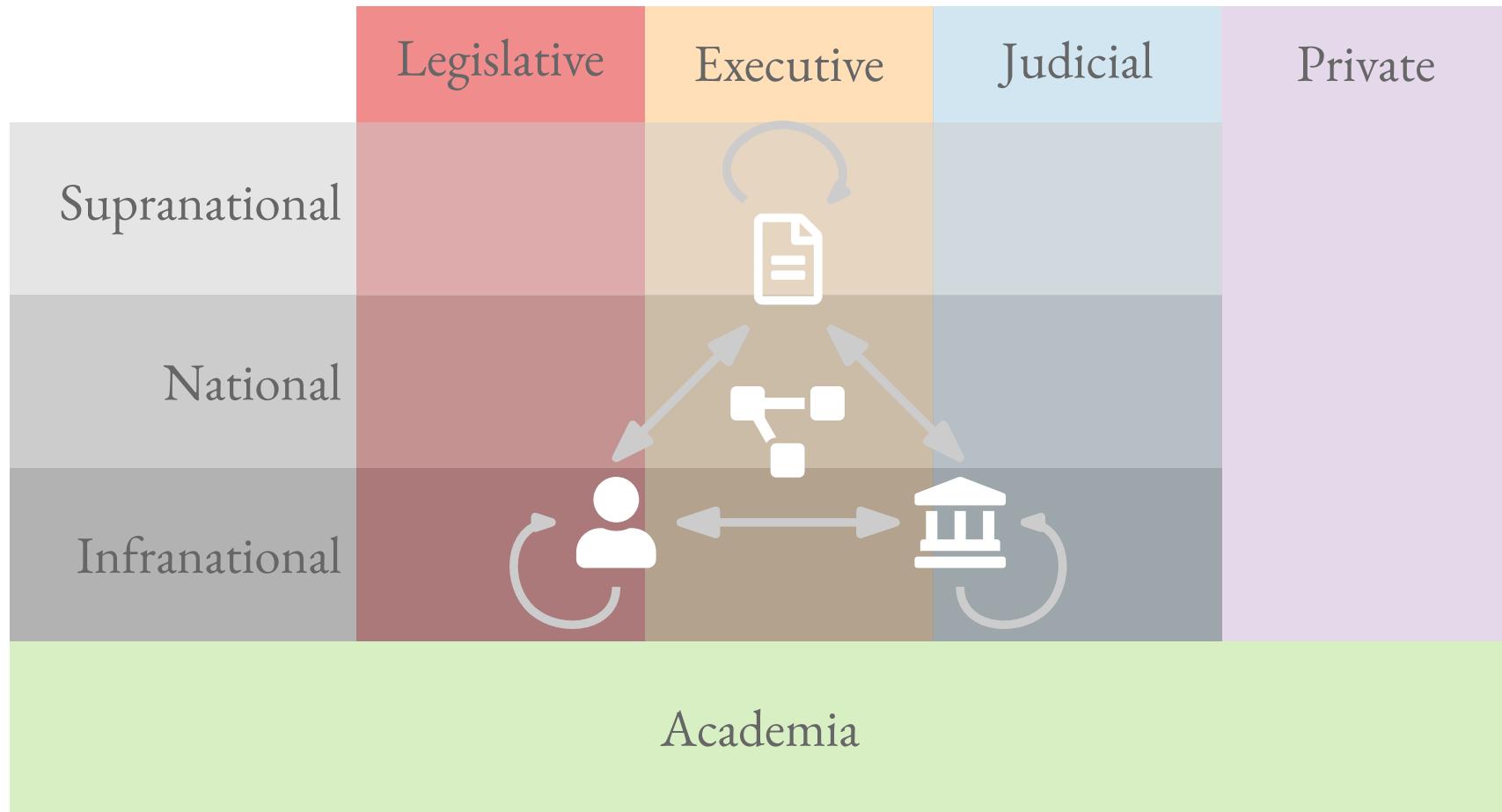
Outlook



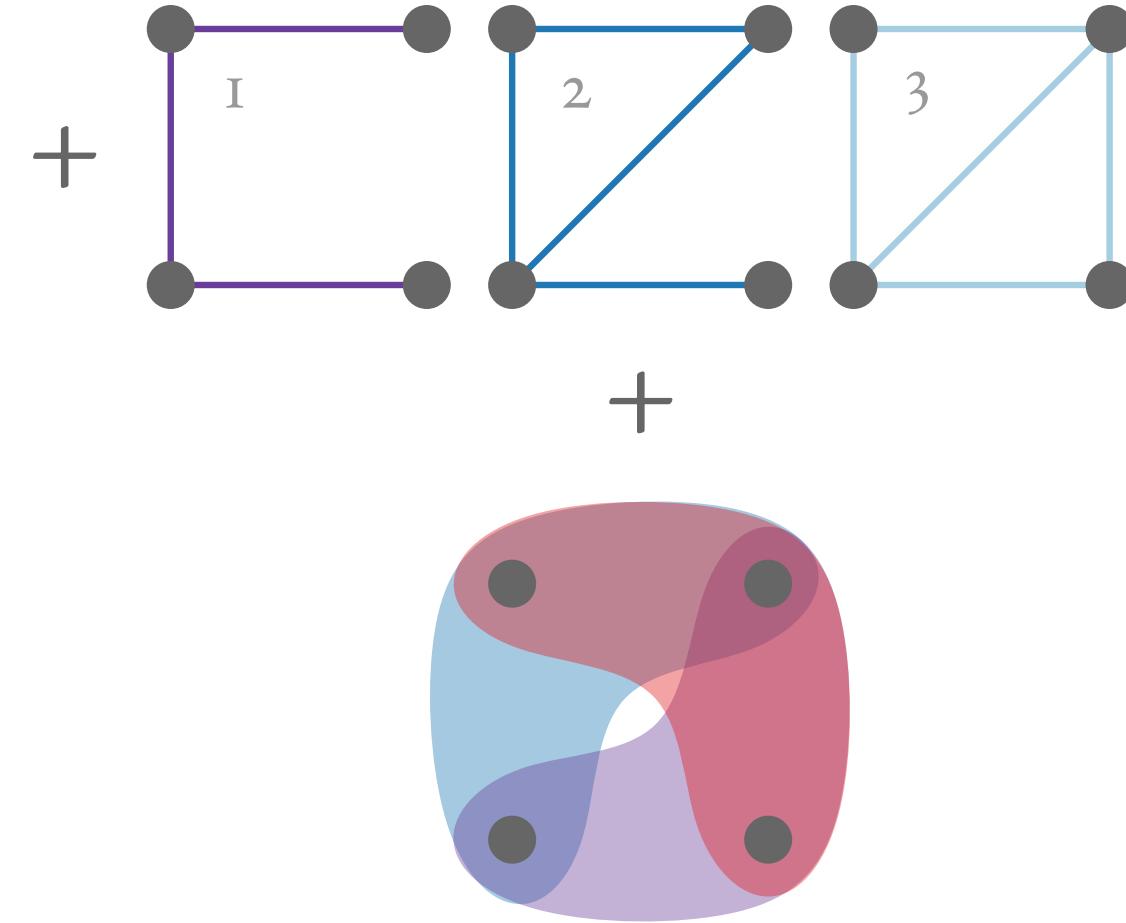
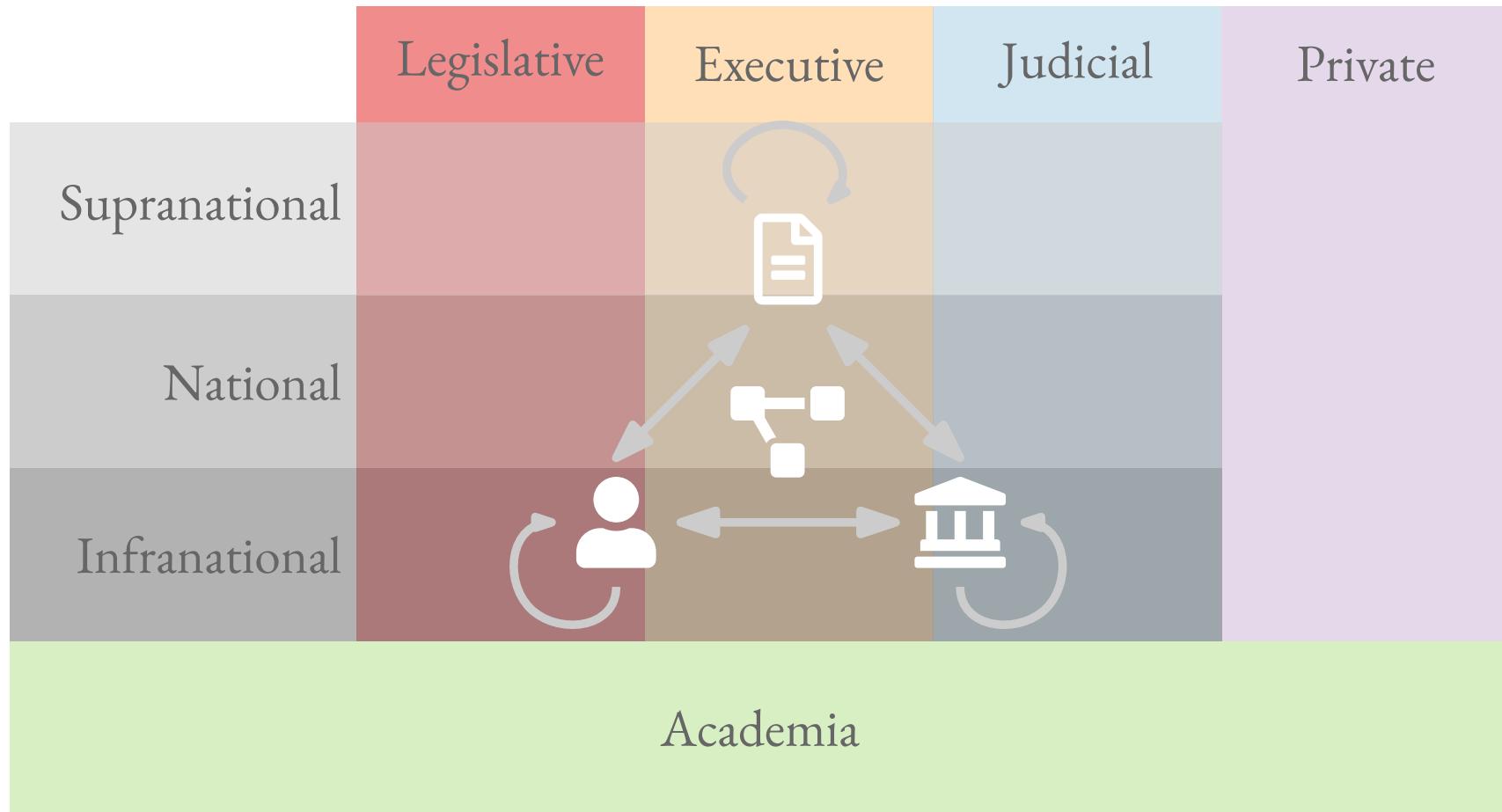
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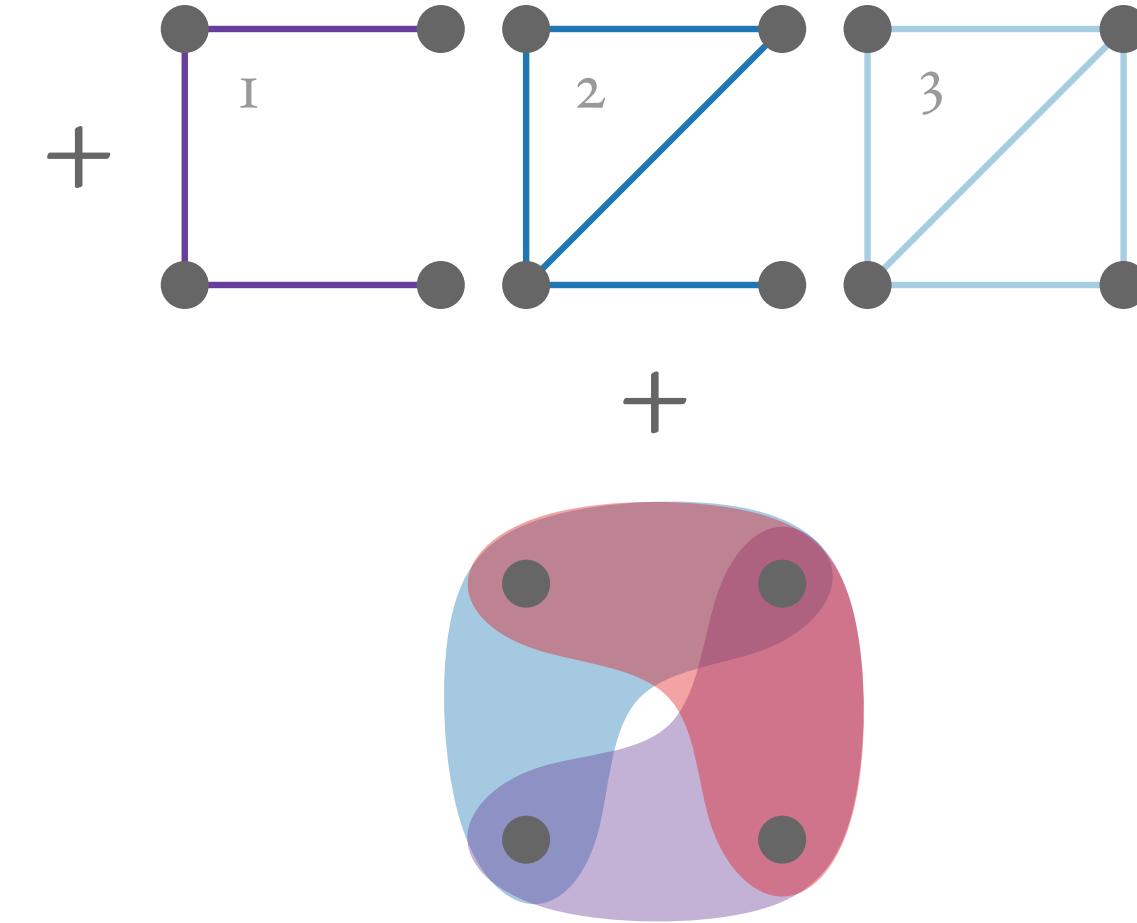
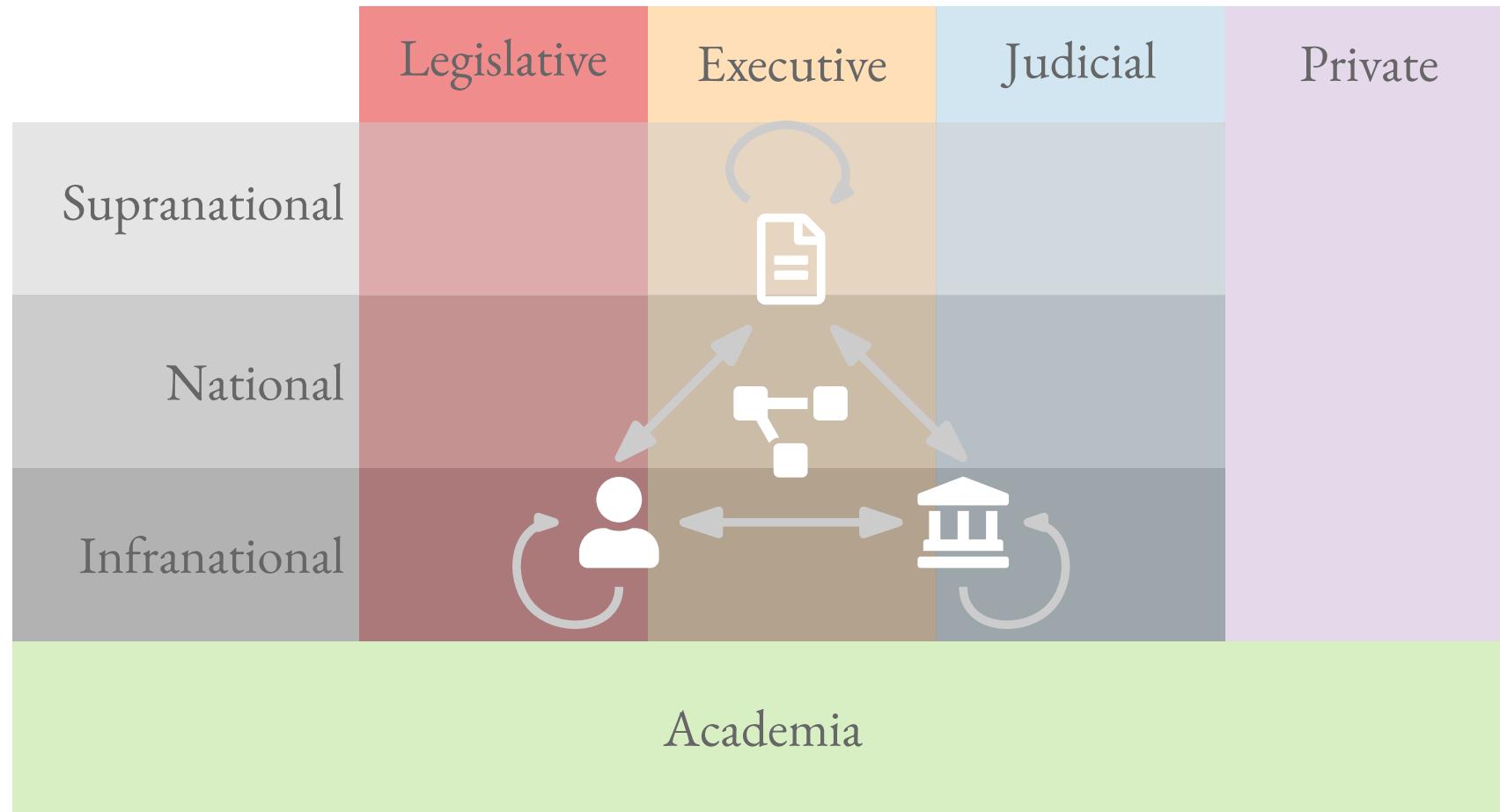
Outlook



Outlook

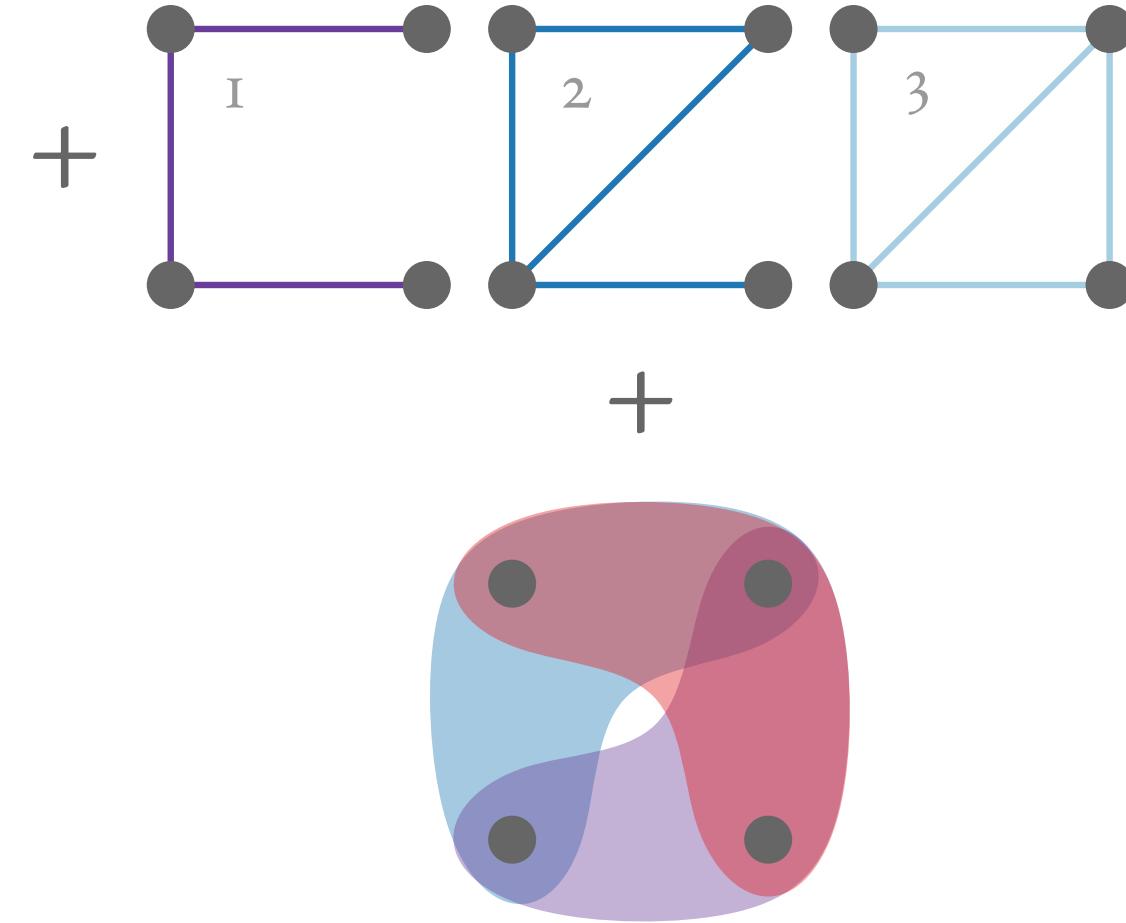
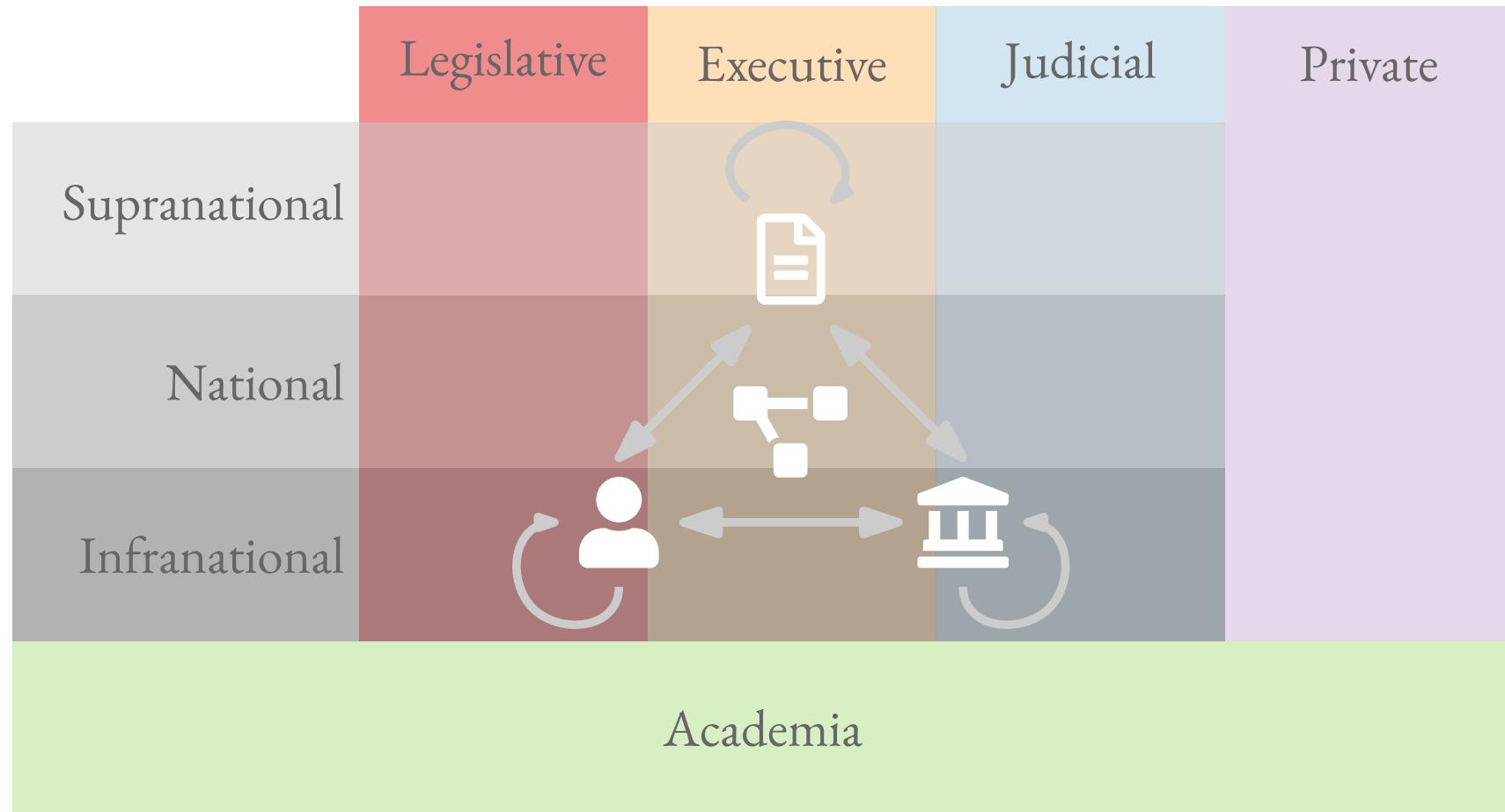


Outlook



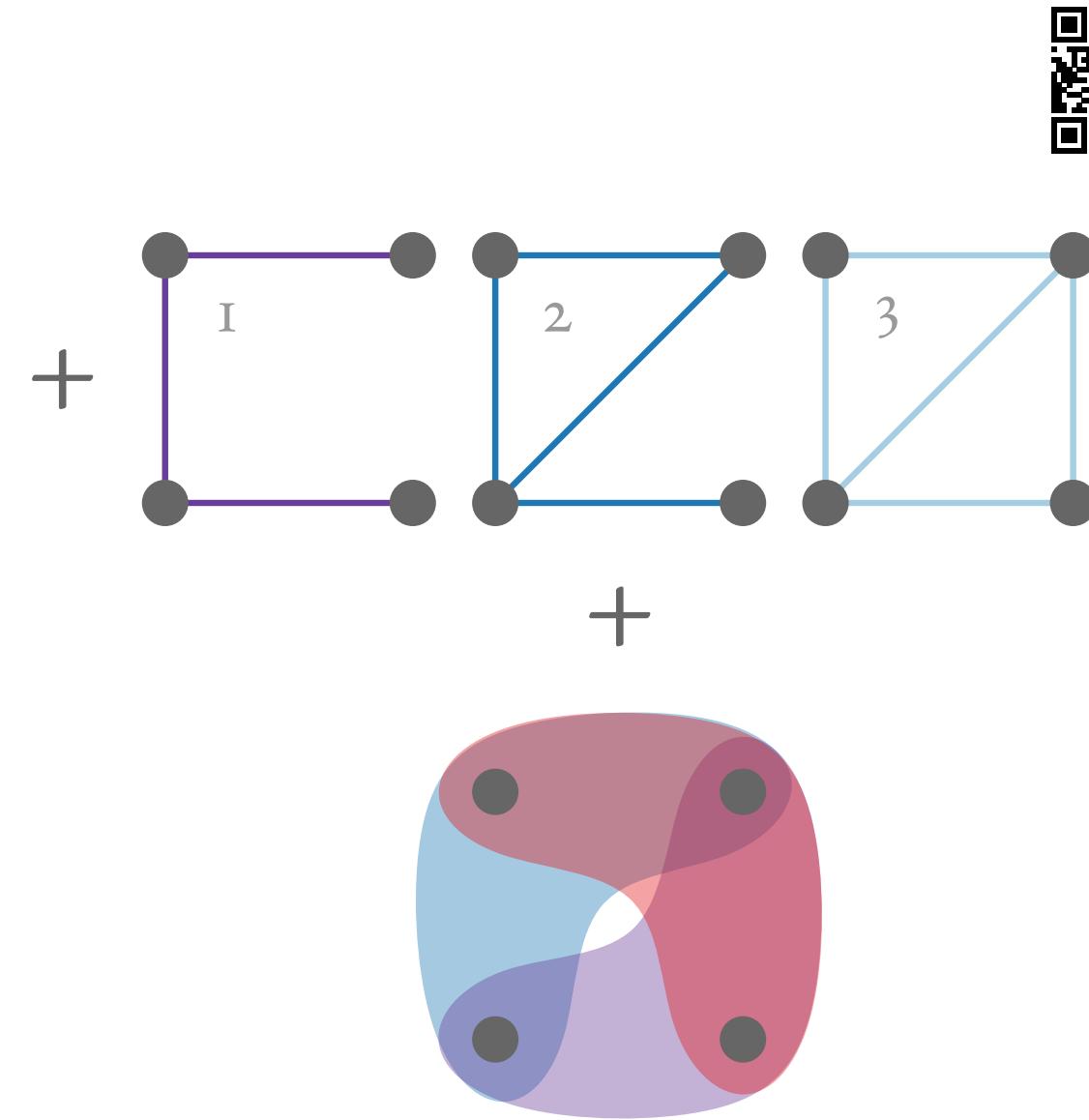
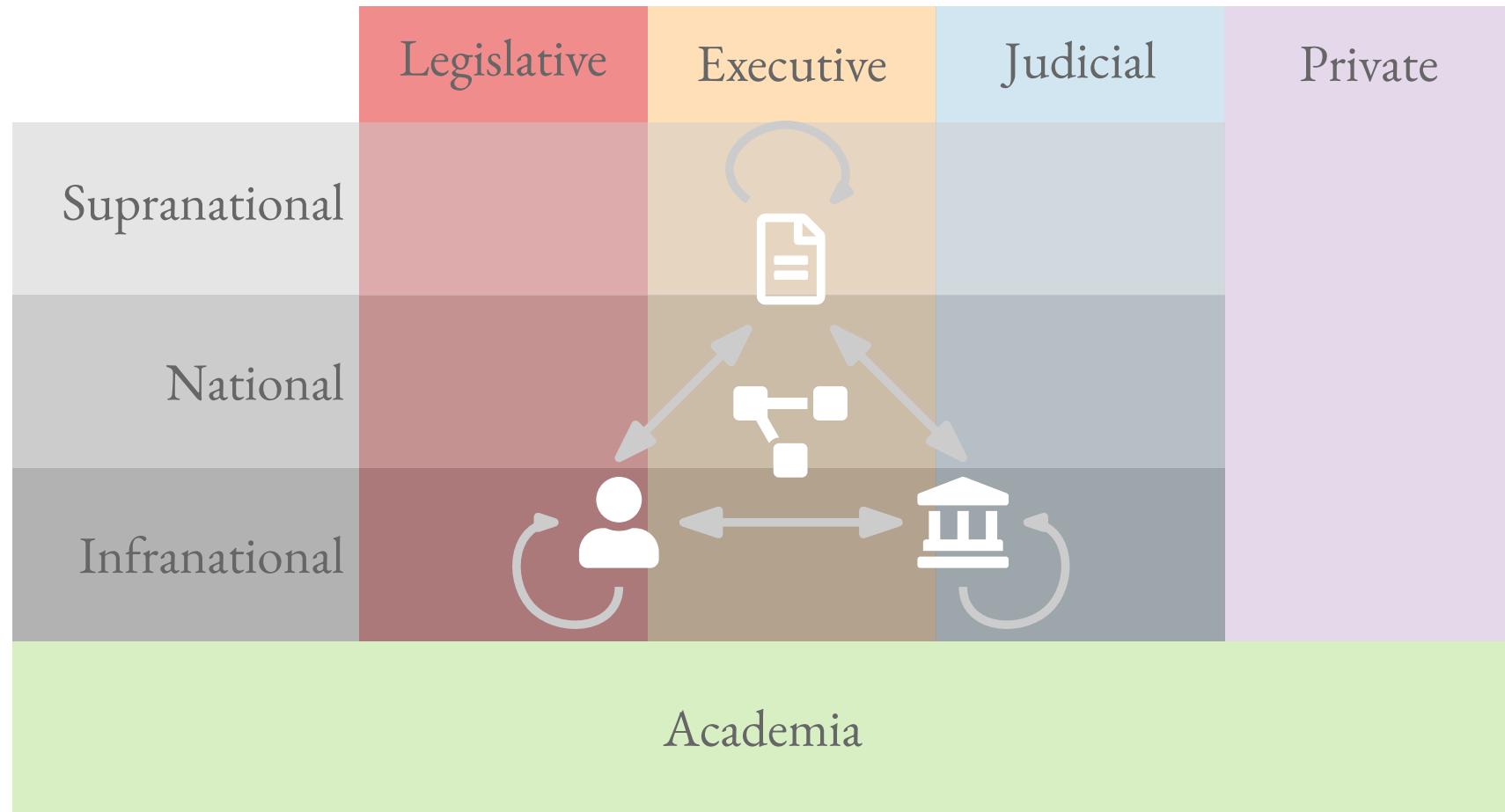
How can we analyze temporal hypergraphs in law?

Outlook



How can we analyze temporal hypergraphs in law?
What novel methods do we need?

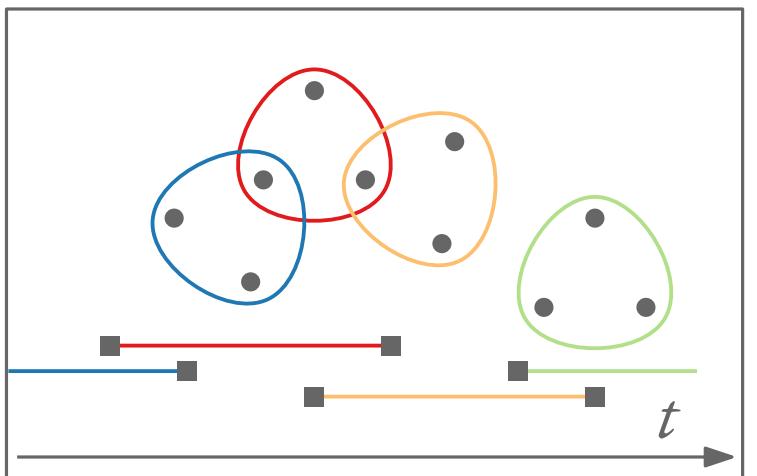
Questions?



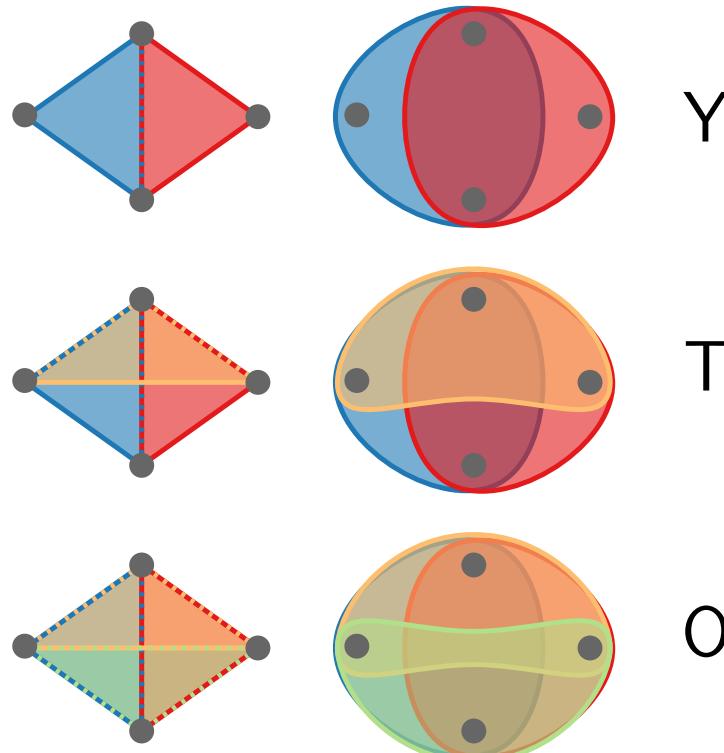
How can we analyze temporal hypergraphs in law?

What novel methods do we need?

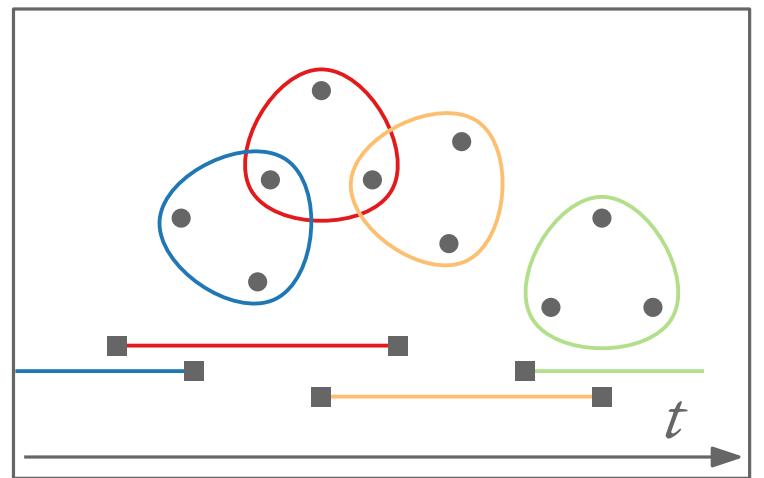
Meso-Level: Motifs



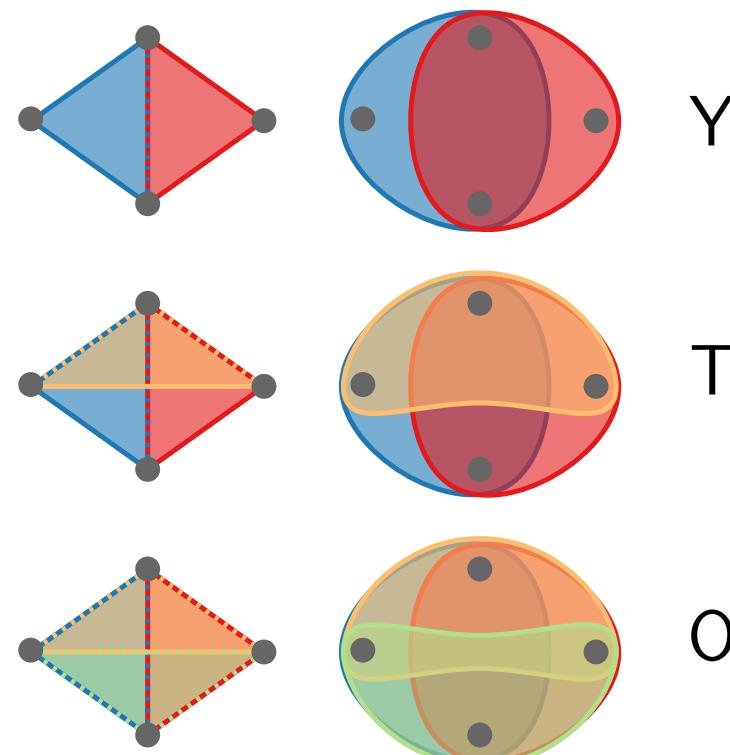
Meso-Level: Motifs



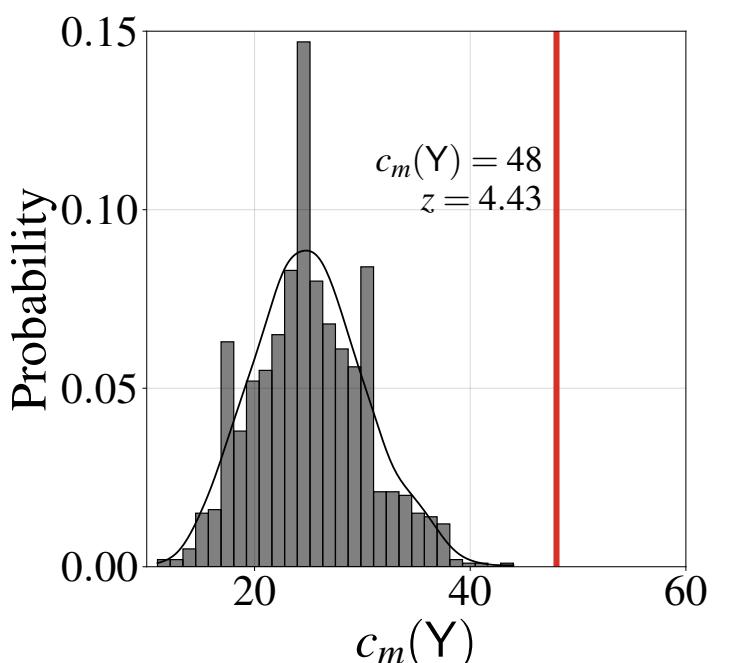
Potential 4-Motifs



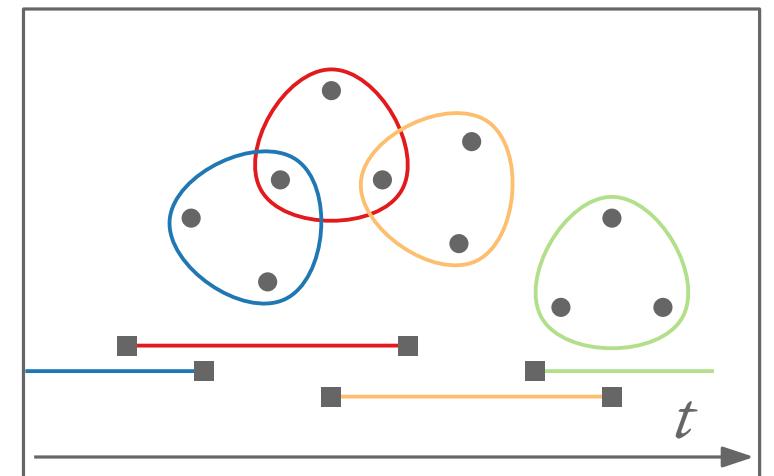
Meso-Level: Motifs



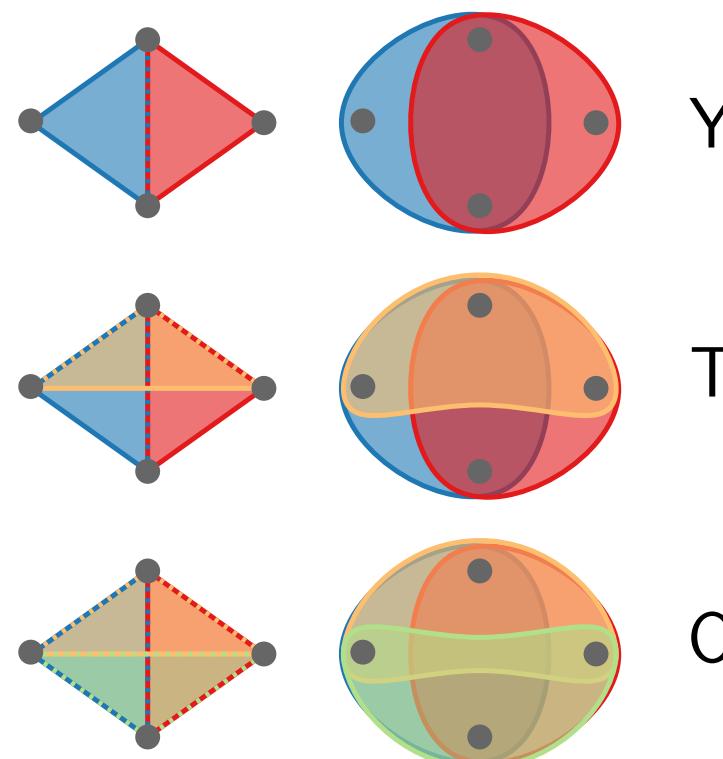
Potential 4-Motifs



Temporal Hypergraph



Meso-Level: Motifs

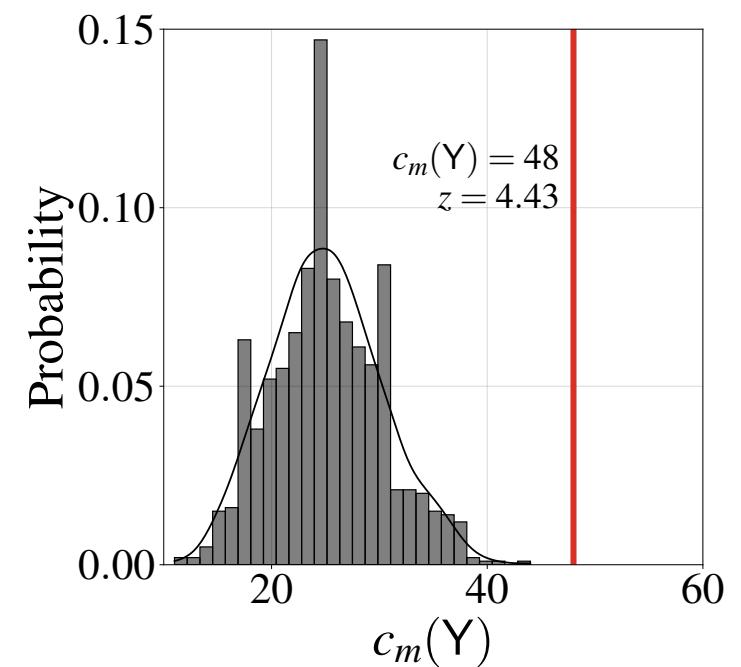


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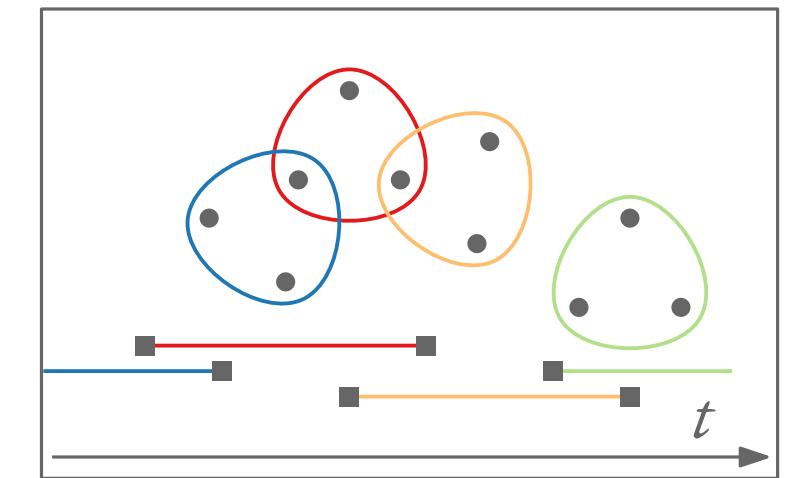
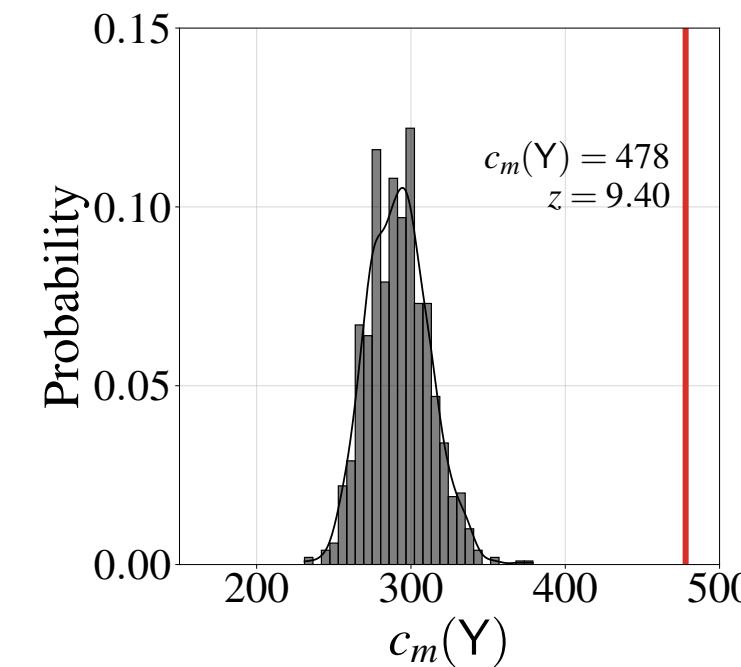
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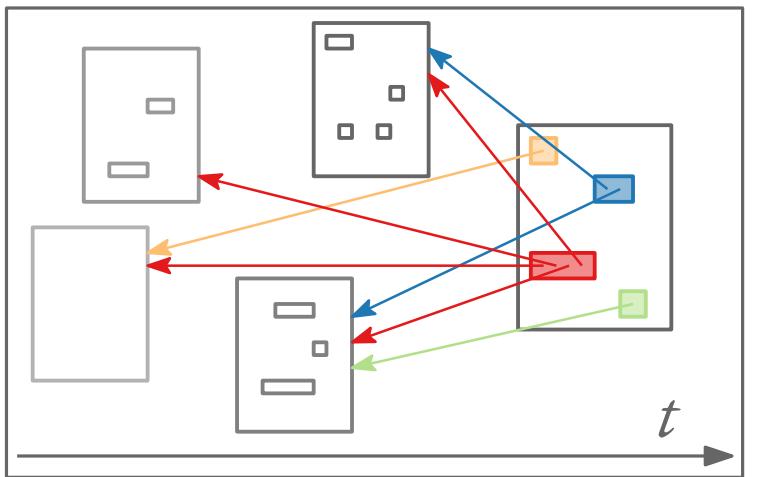
Temporal Hypergraph



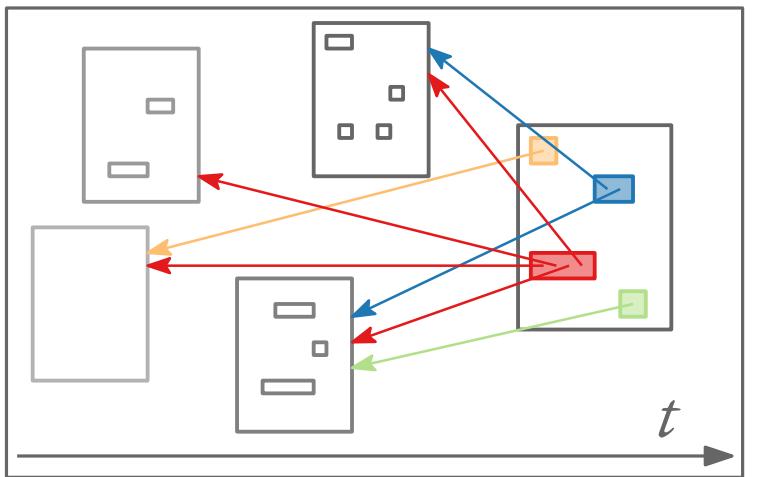
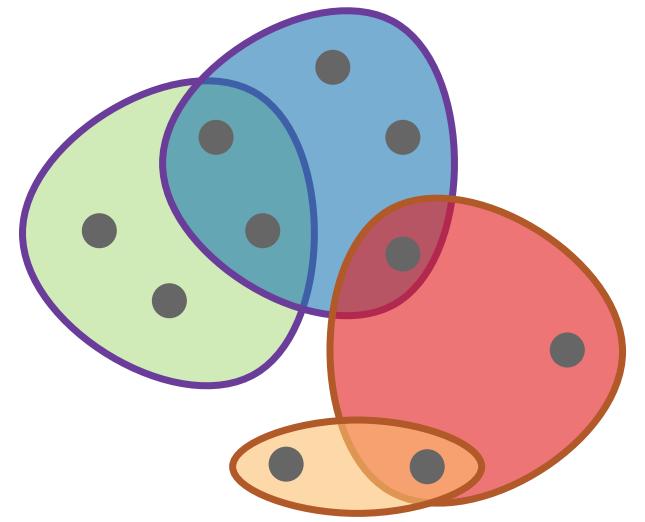
Static Hypergraph



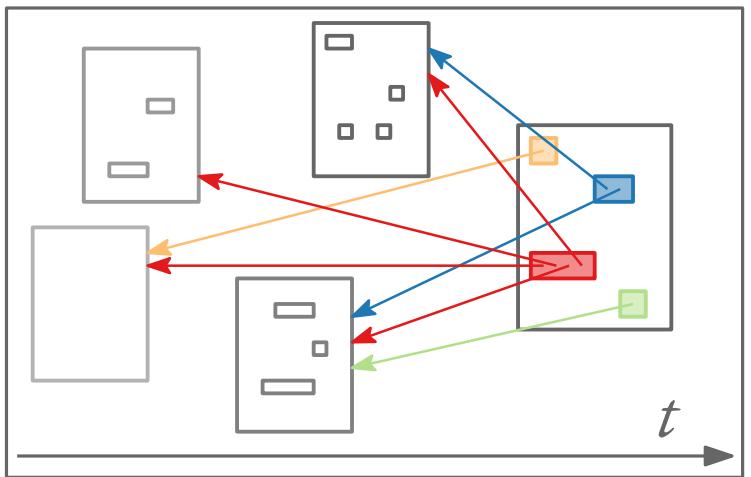
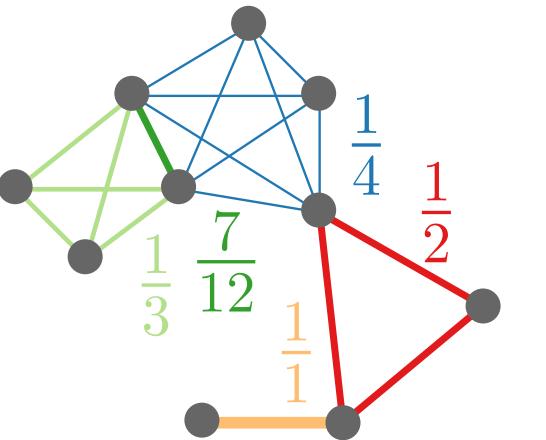
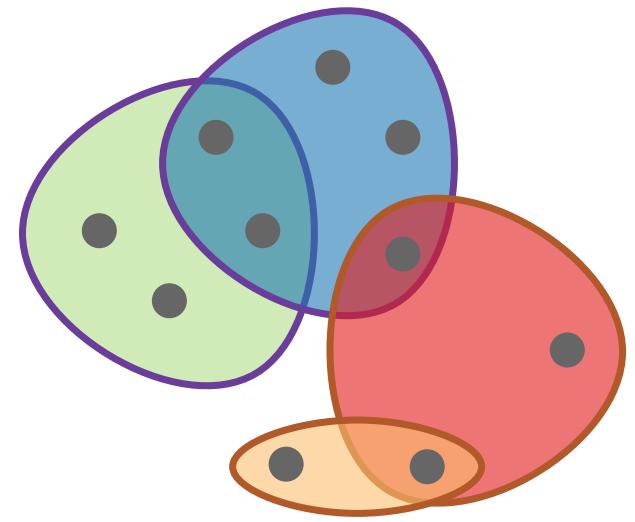
Meso-Level: Communities



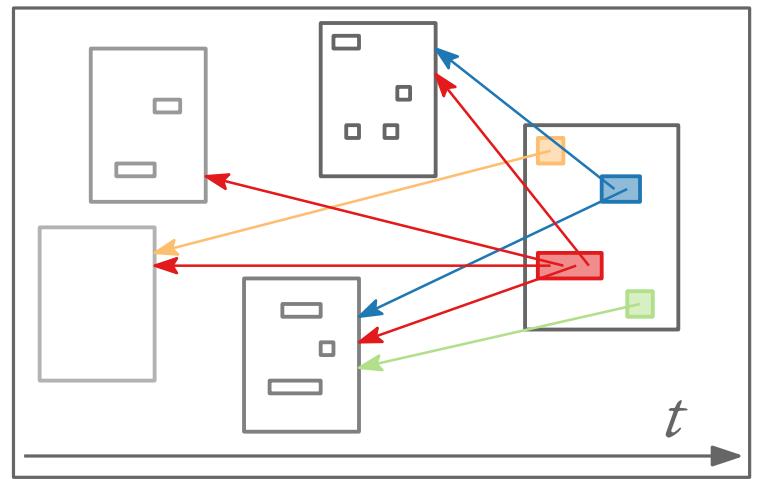
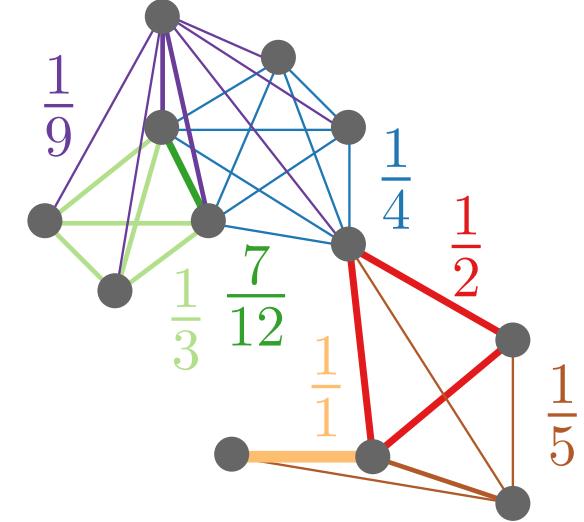
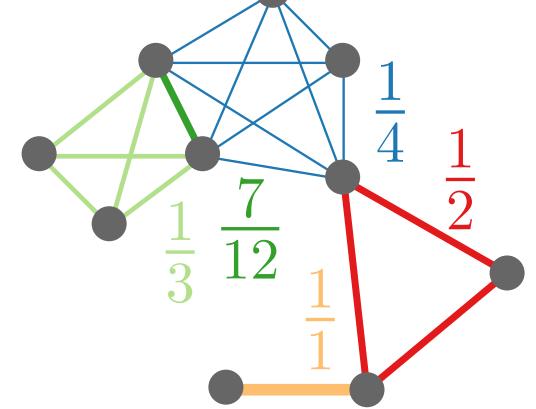
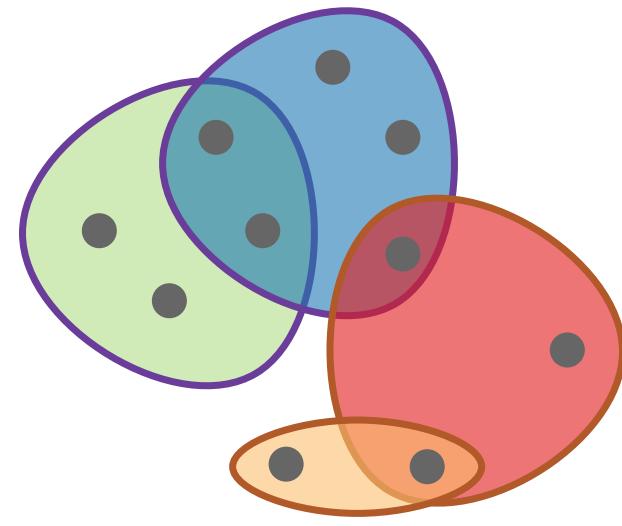
Meso-Level: Communities



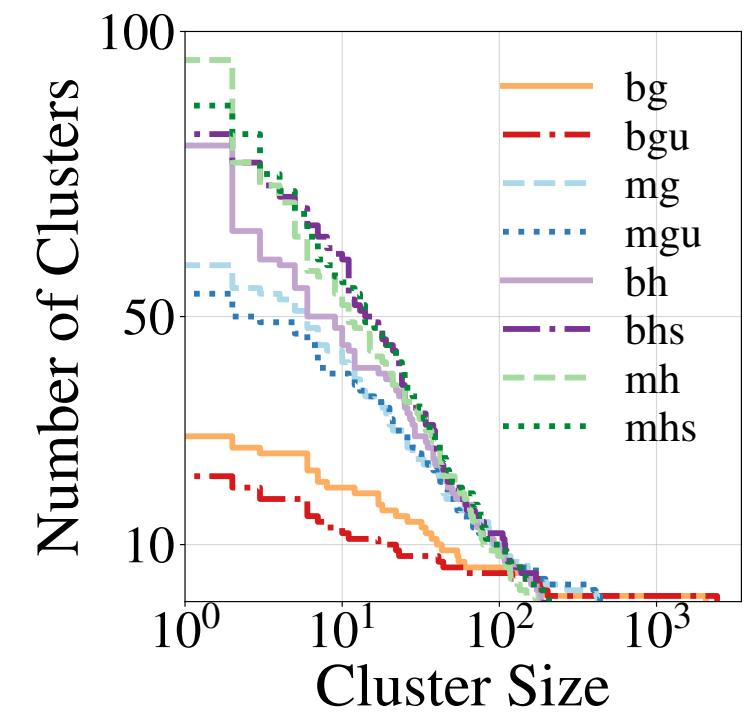
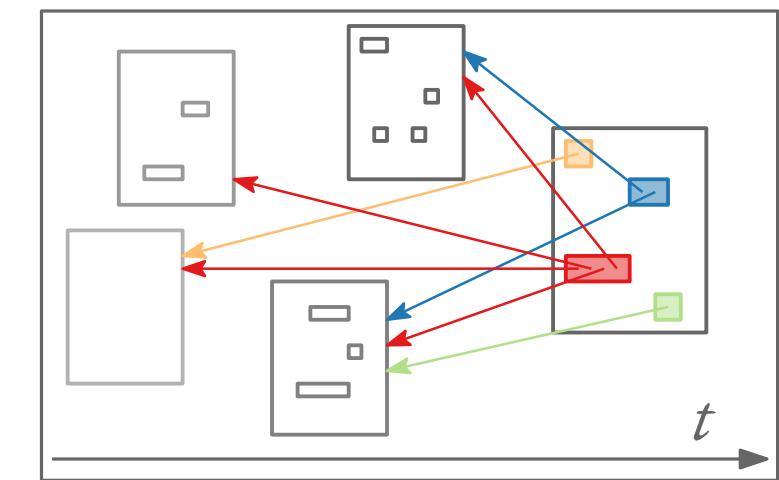
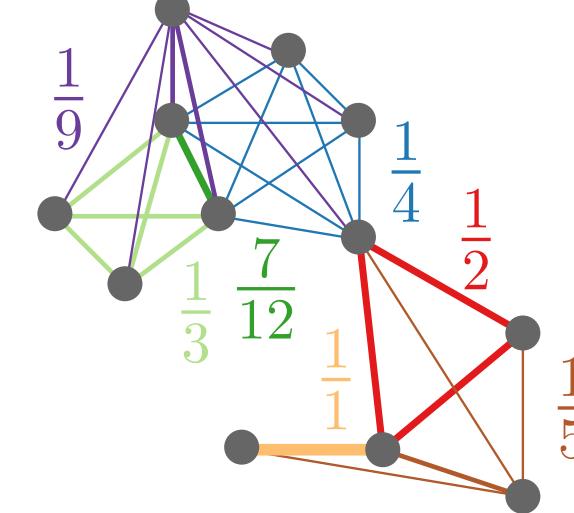
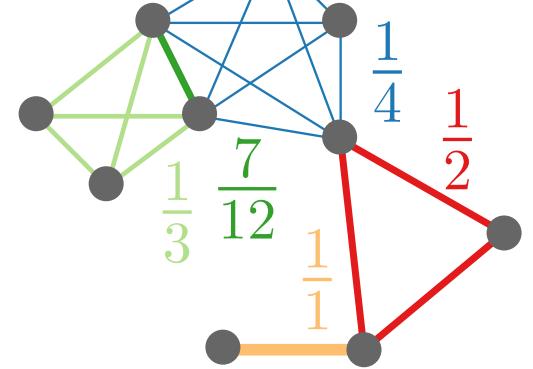
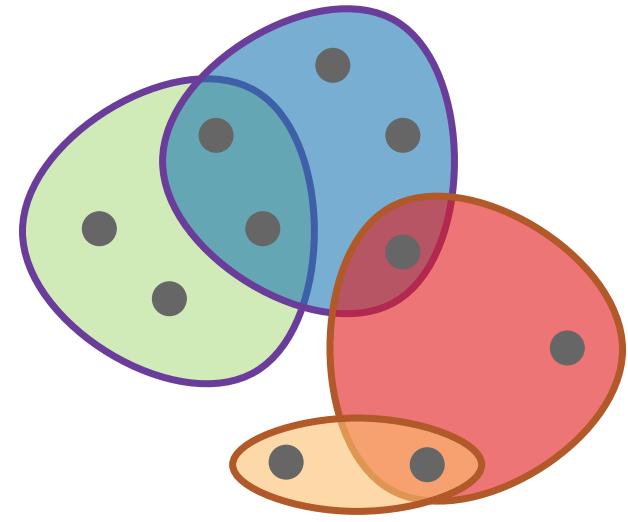
Meso-Level: Communities



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