Operationalizing Systemic Risk & Financial Networks

Yaacov Mutnikas

What good looks like

Reduce the frequency of significant crisis events

Reduce economic and social impact when they occur

Landscape

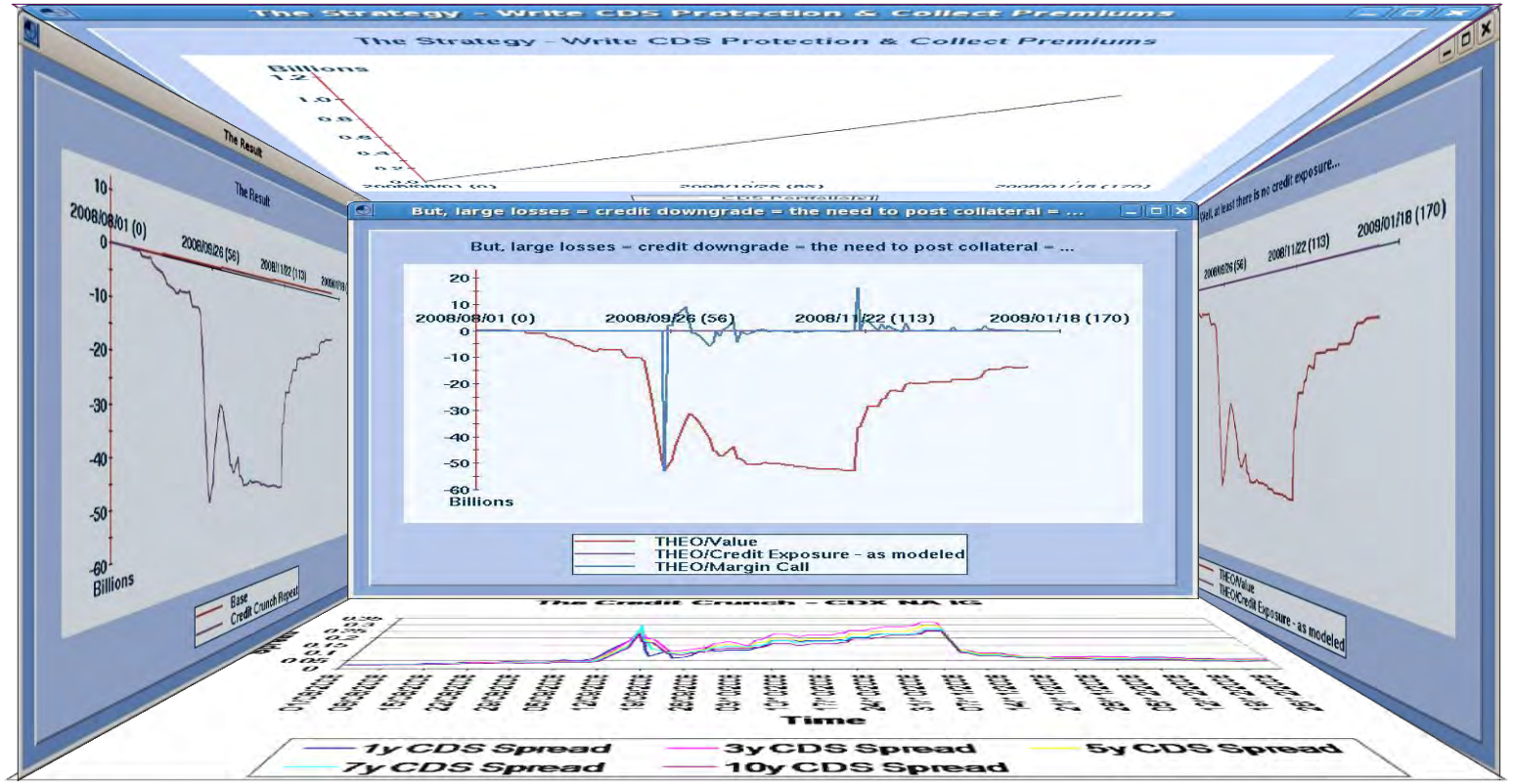
Financial markets are not intrinsically stable, nor are they self-stabilising under certain conditions at acceptable costs (Jamie Caruana 2010).

Systemic risk "internal" to the functioning of financial markets.

Financial innovation unstoppable in the long run (unknown unknowns).

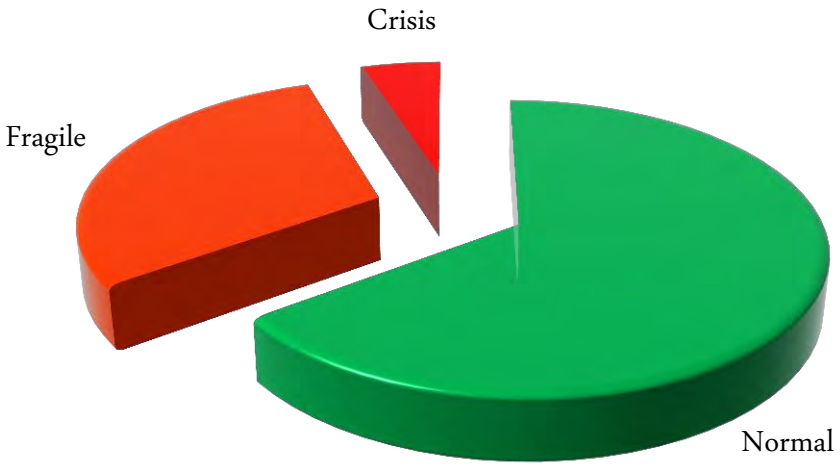
Fallacy of "one in a lifetime" events. Such events typically occur every 10 years (93 countries experienced 117 systemic and 51 lesser disruptions as at 2010 during 25 year period - ex. BIS).

Incorporating event risk with market factors



Different market states require different analysis

Multiple states of economy



Different concerns across the different states(*)

Identify transitions

Identify the financial networks that matter

Regulators have some good tools

Capital buffers;

Macro/Micro prudential regulation;

CCP's;

Recovery and resolution;

Other…

Individual firms risk assessment does not account for accumulation of system wide risks.

Complex challenges

- Large scale multi-dimensional, multi-phase, non-linear, aperiodic, dynamic, time irreversible system with no clear origin
- Ongoing challenge to our intuition and ability to synthesise the unexpected behaviour.
- Need for a coherent picture including the understanding of causality, financial interconnectedness and potential risk transmission channels, logical consequences, correlation migration and other considerations.

Complexity of systemic risk

implies a need for a

multidisciplinary approach

The purpose of models is

insight not numbers

Let's focus on financial networks

We can see how risk propagates

We can explore interconnectedness

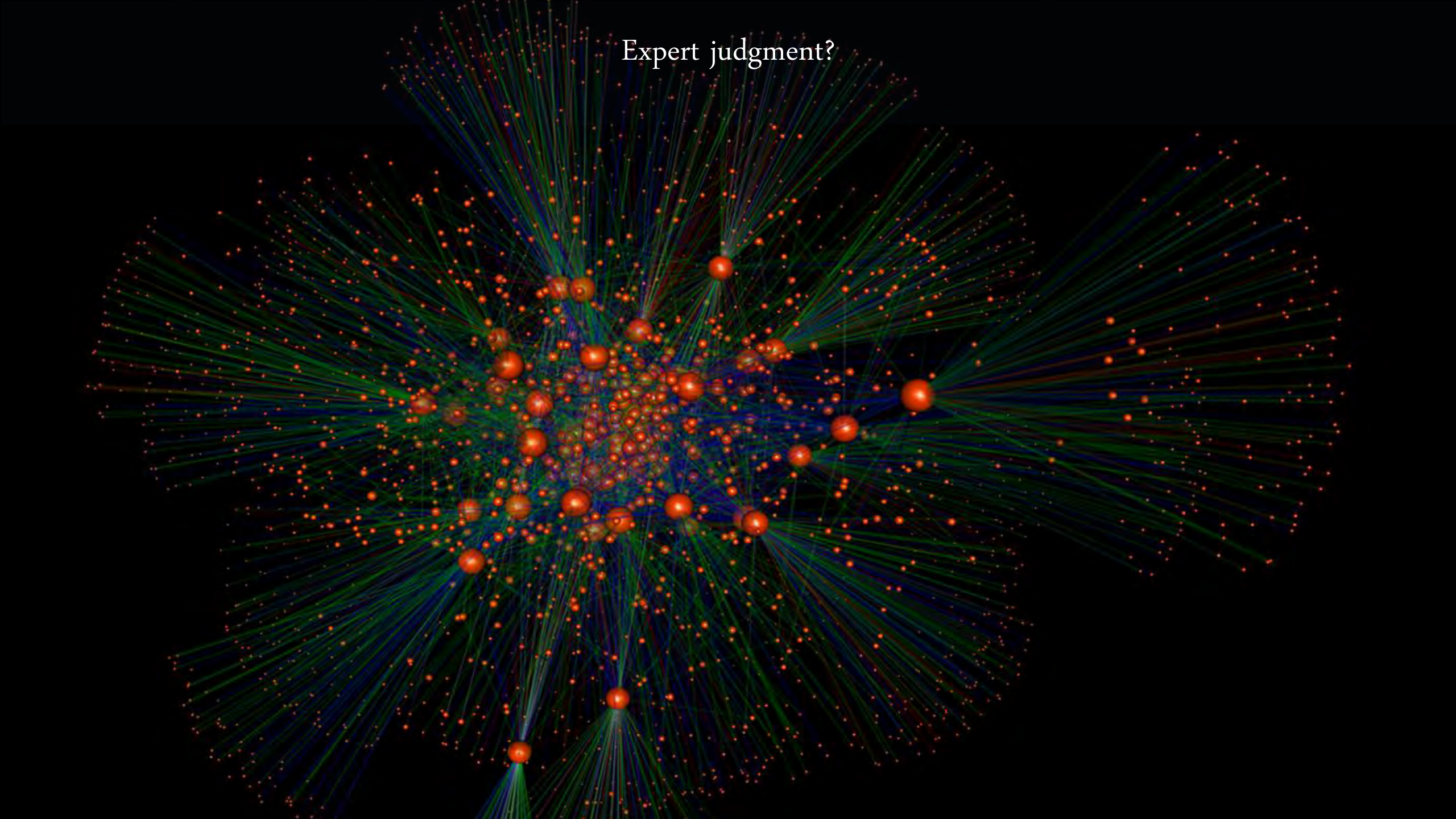
We can visualize the whole

We can establish patterns and signals

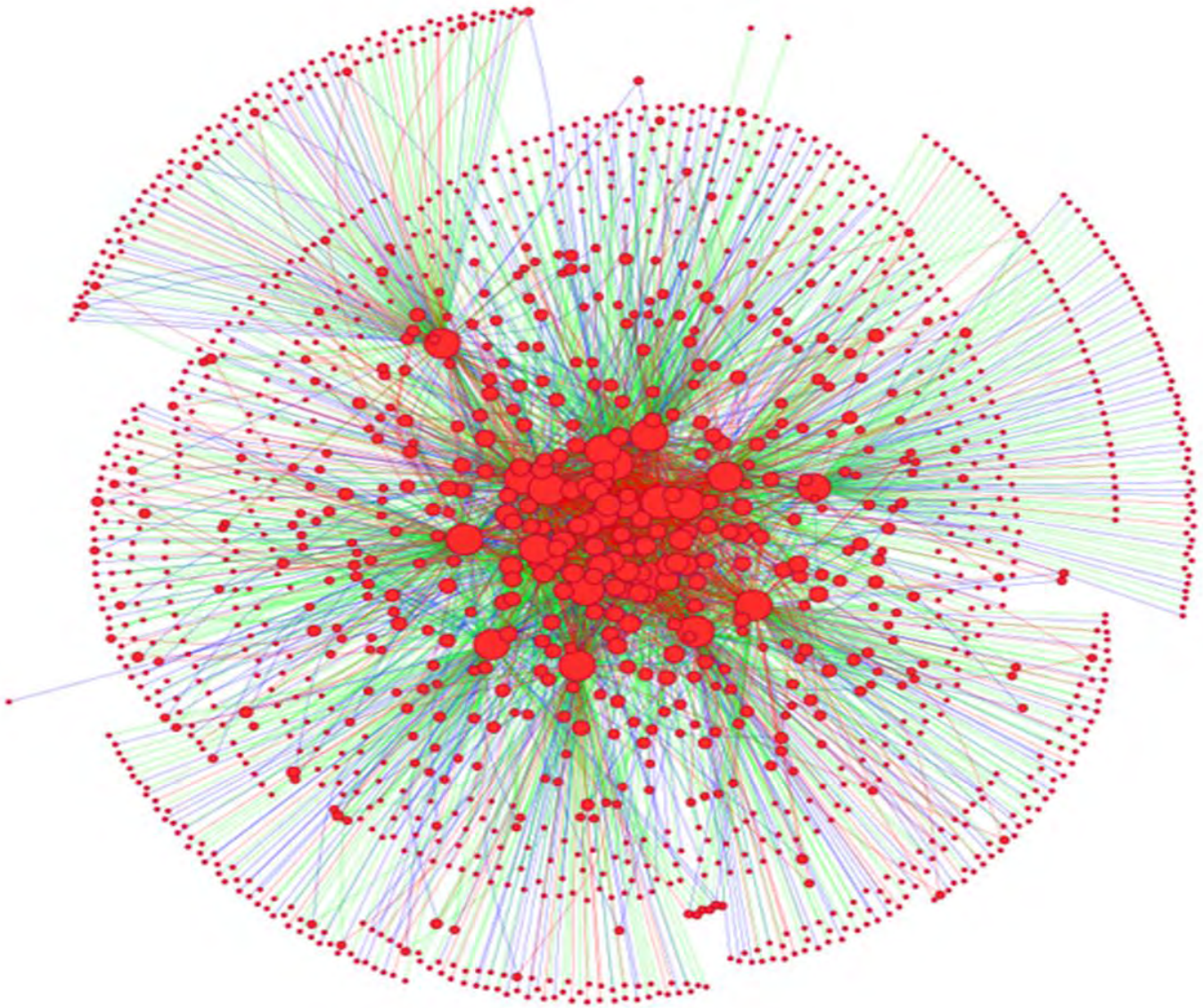
We can make use of graph theory

We can spot bad data

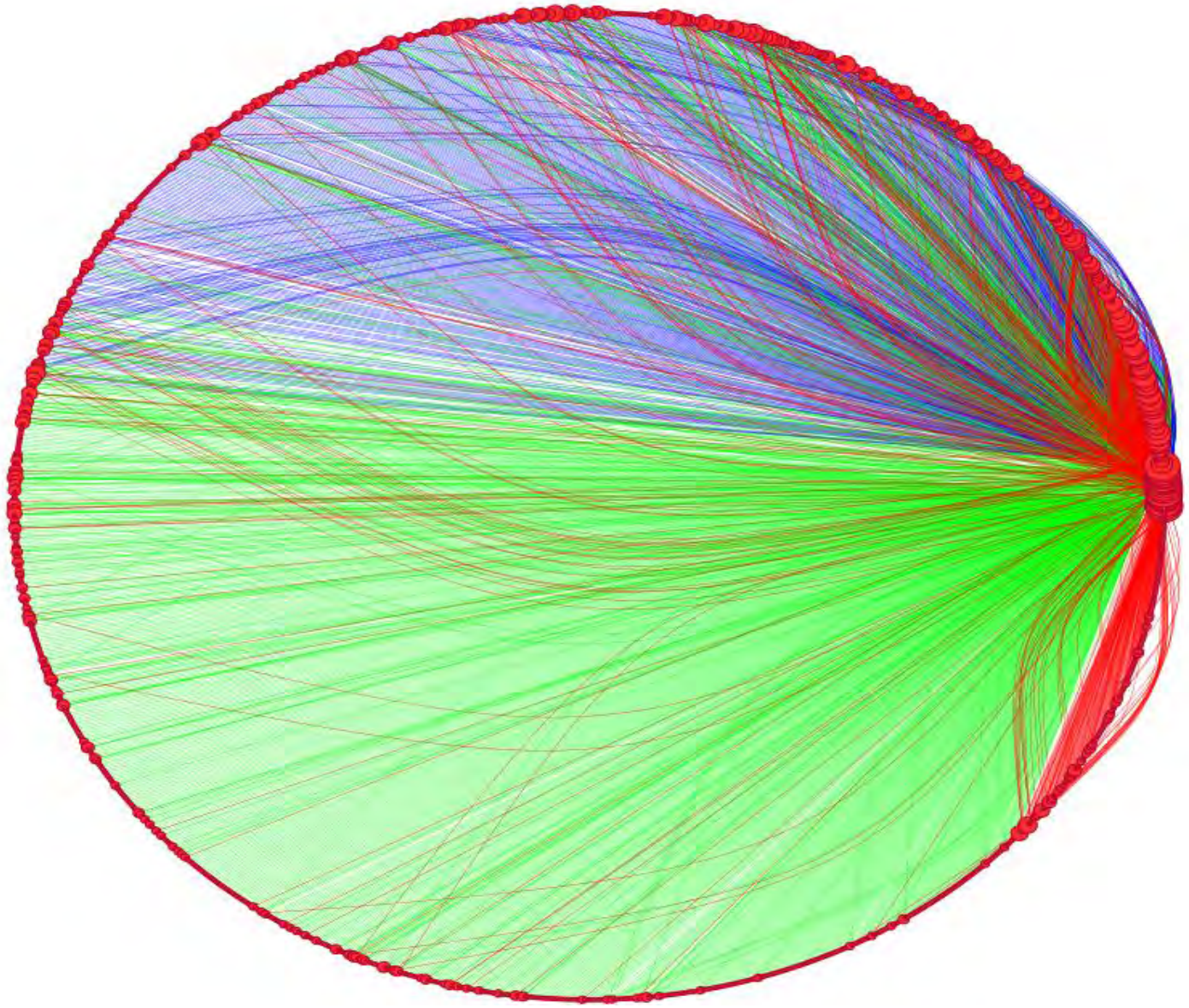
Expert judgment?



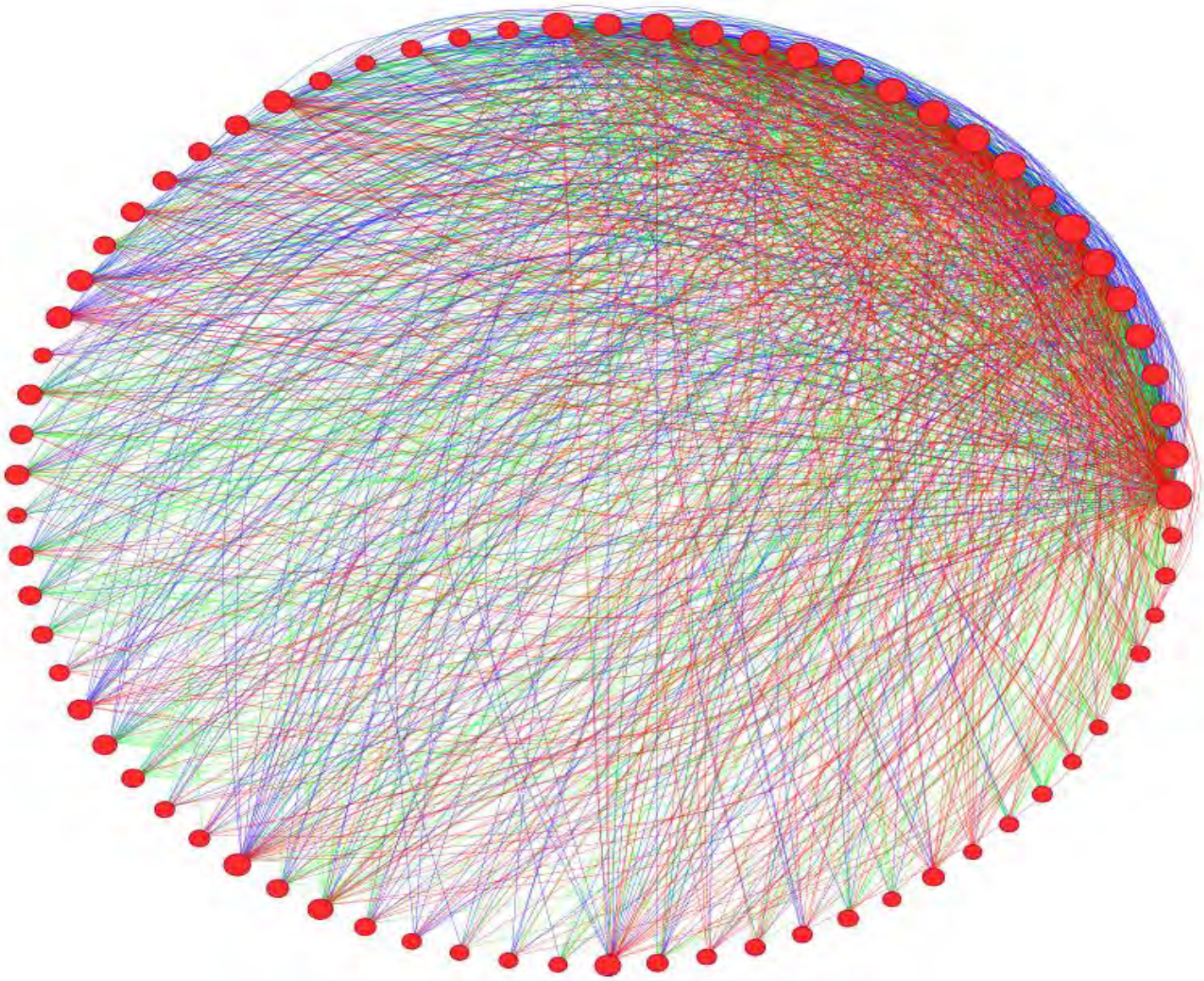
Big picture



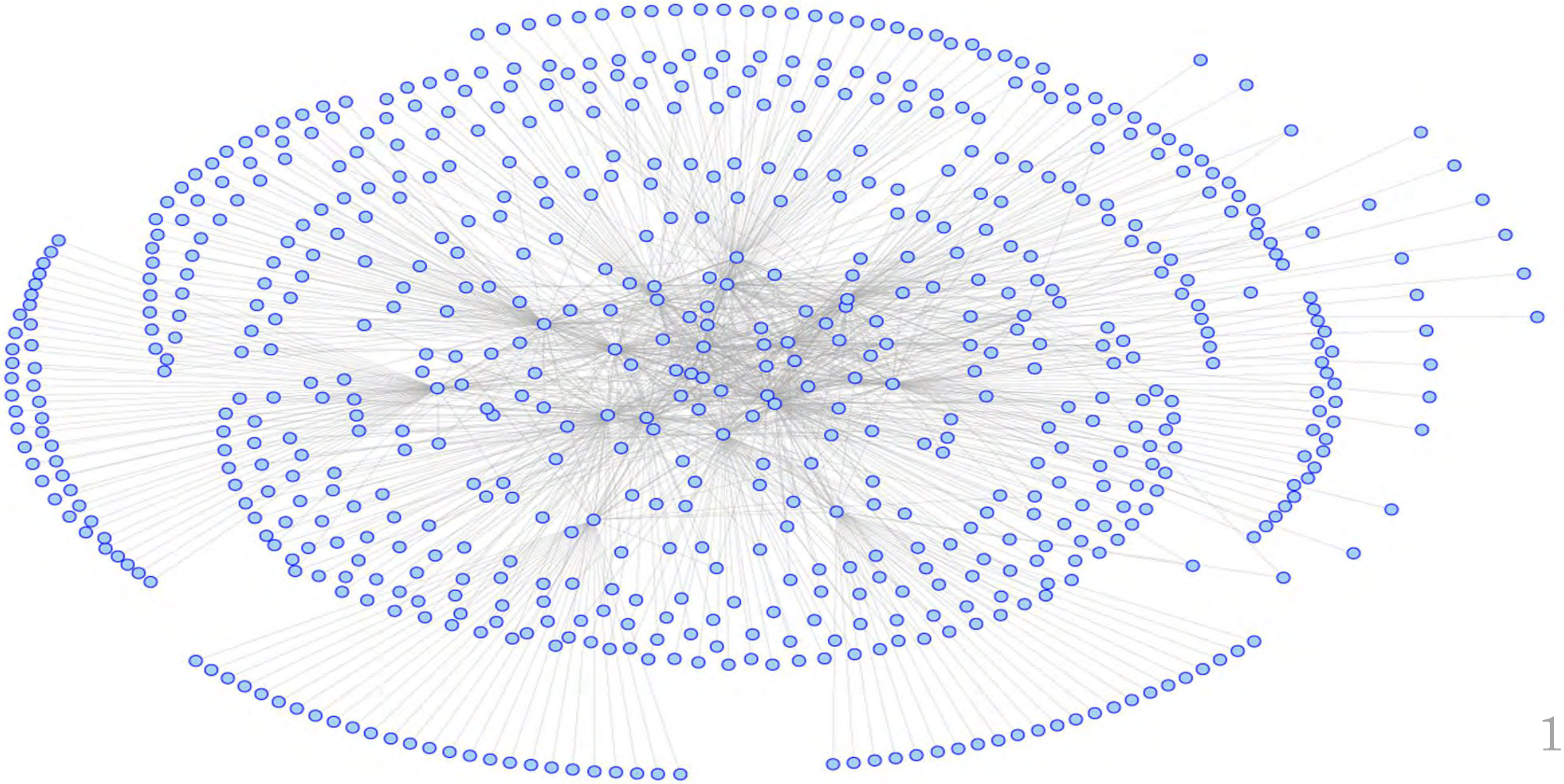
Different view



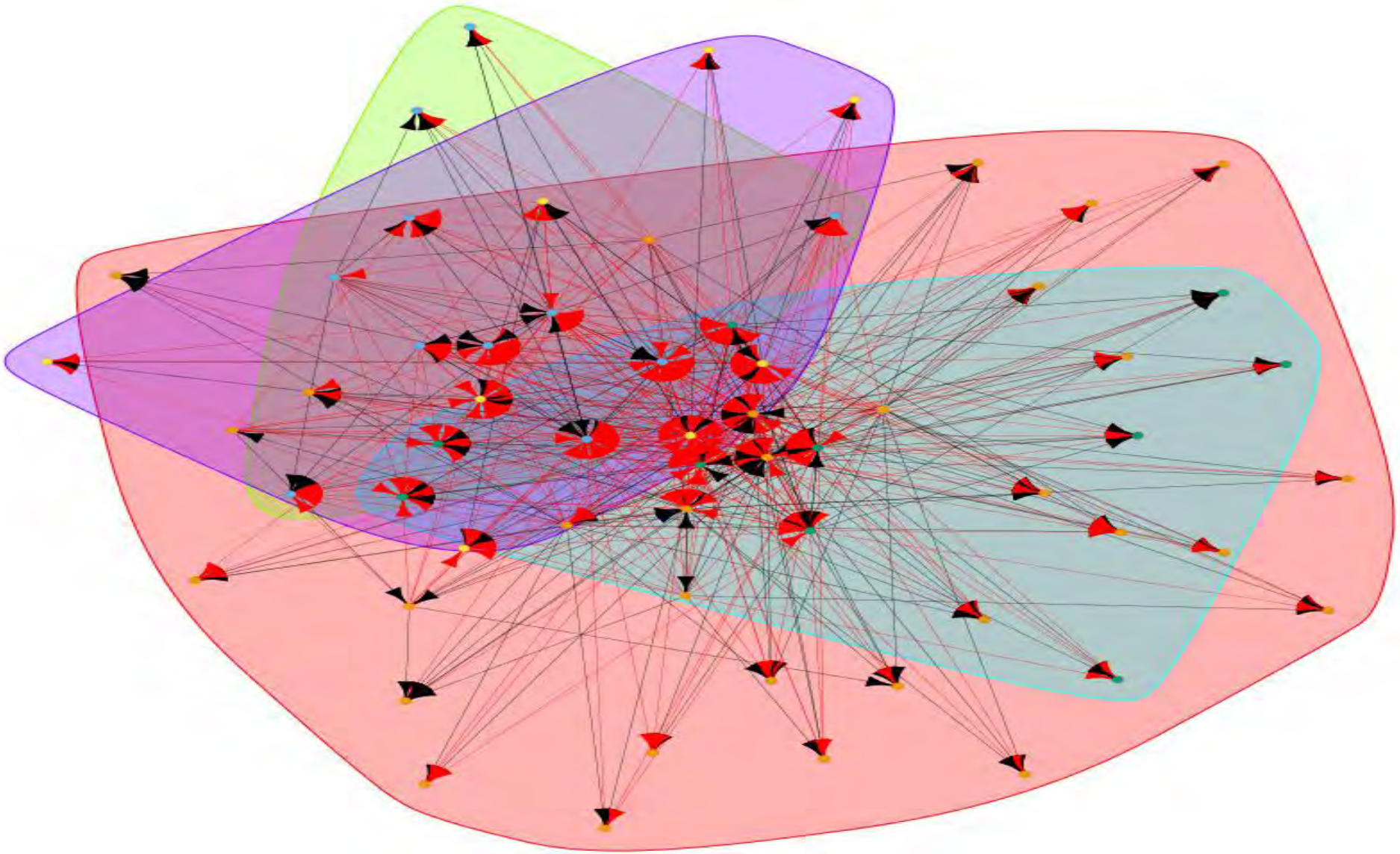
Next layer



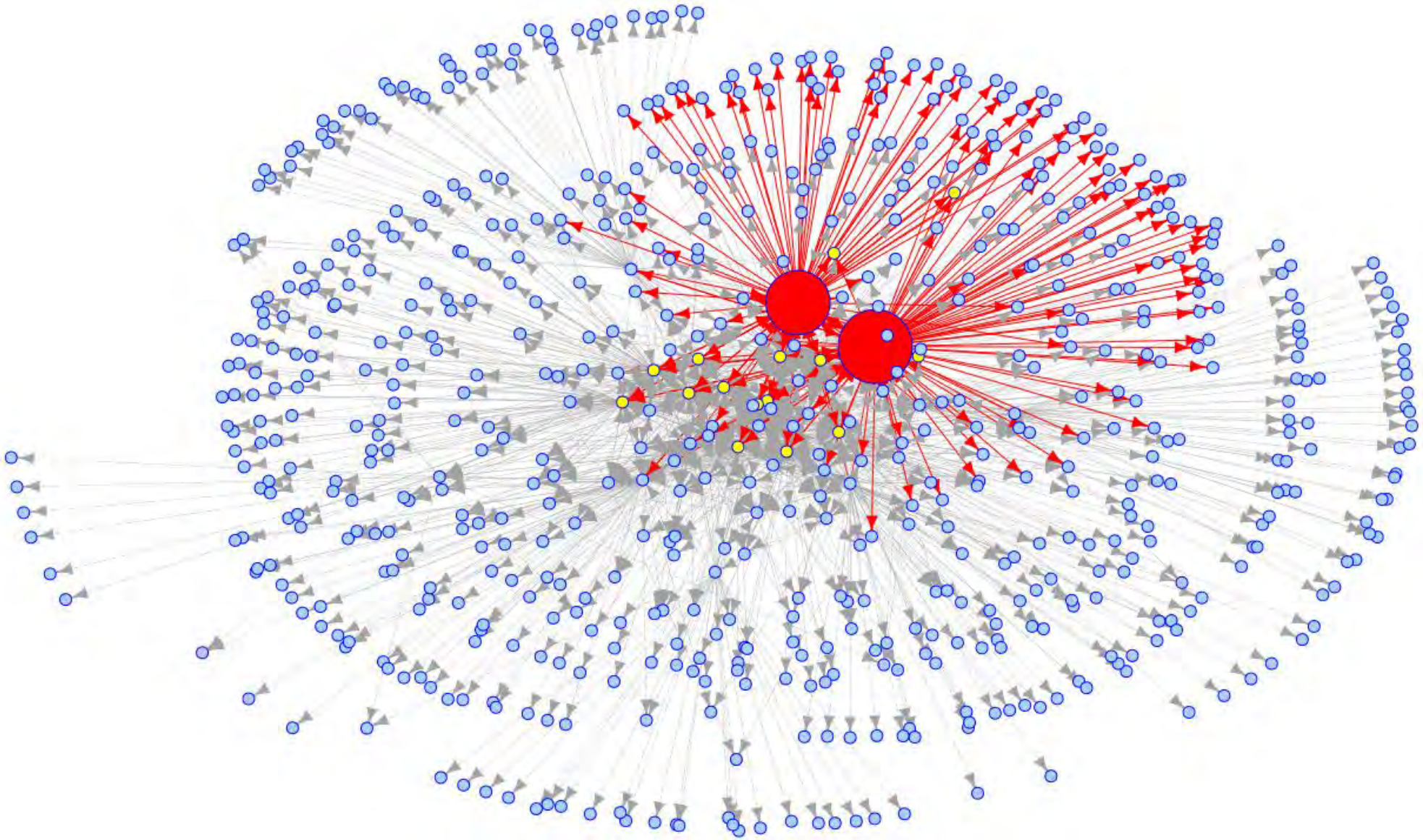
Specific asset network only



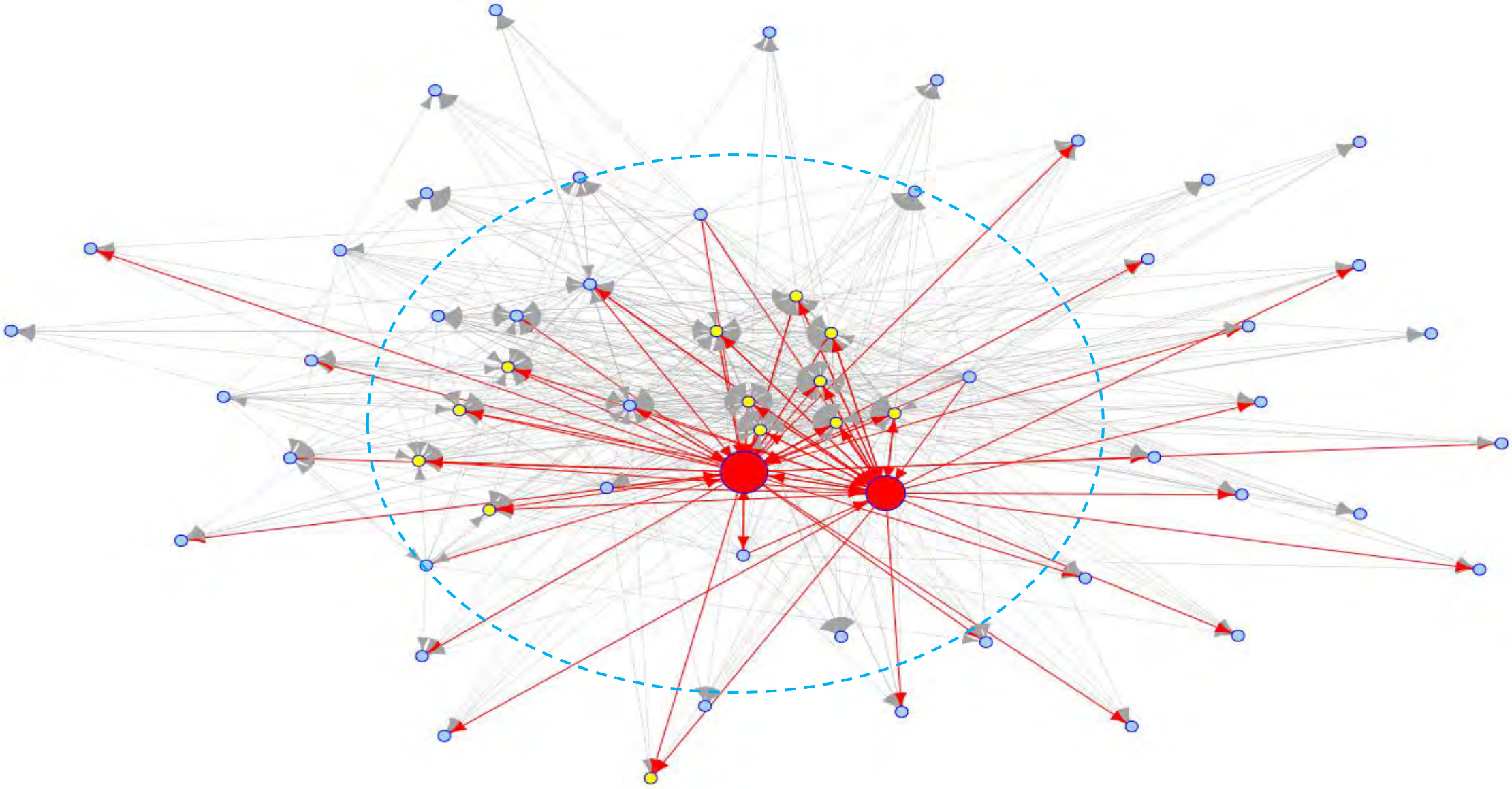
Recognizing similarities and differences amongst institutions (leading eigenvector)



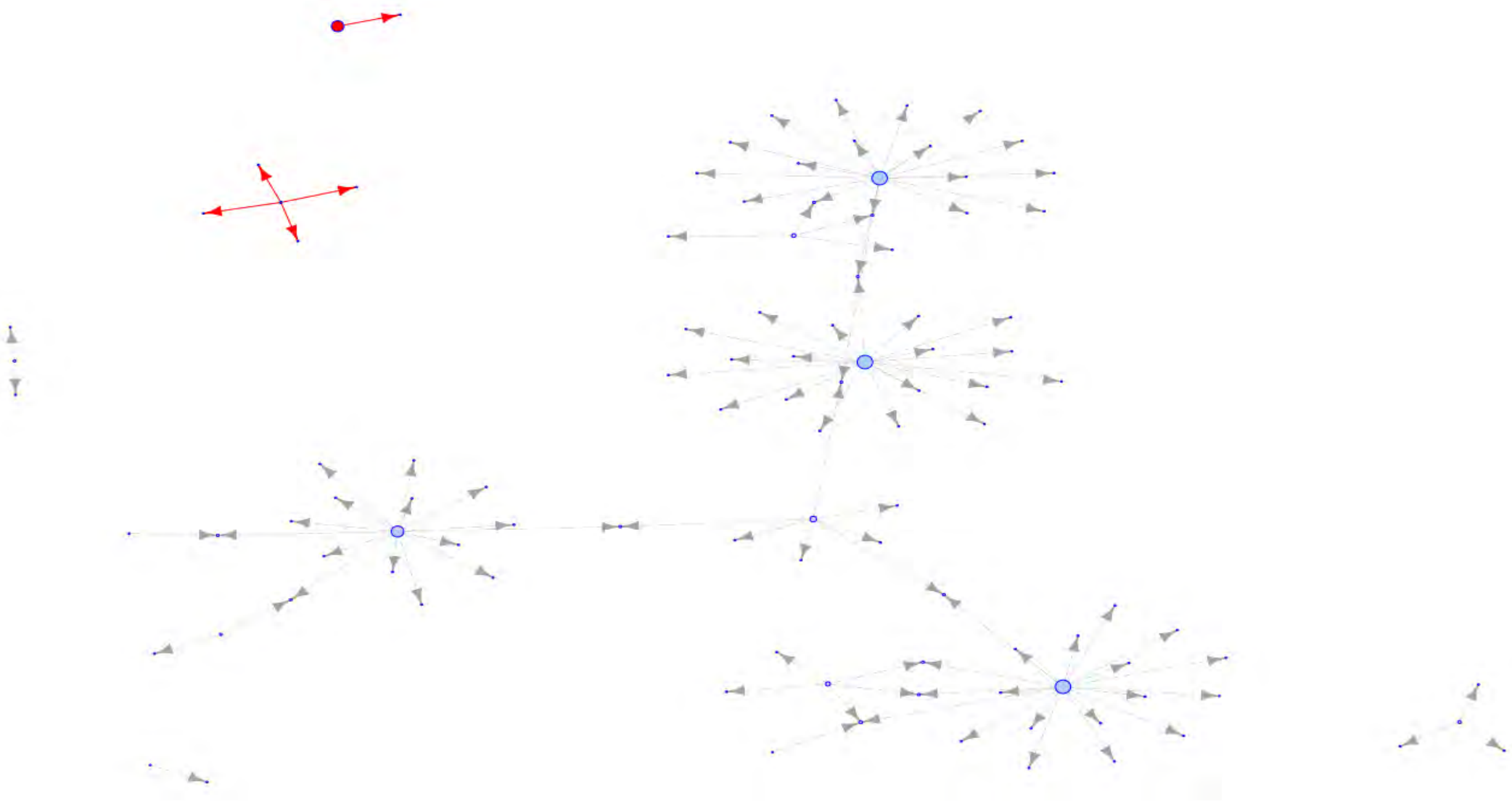
Investigating specific nodes



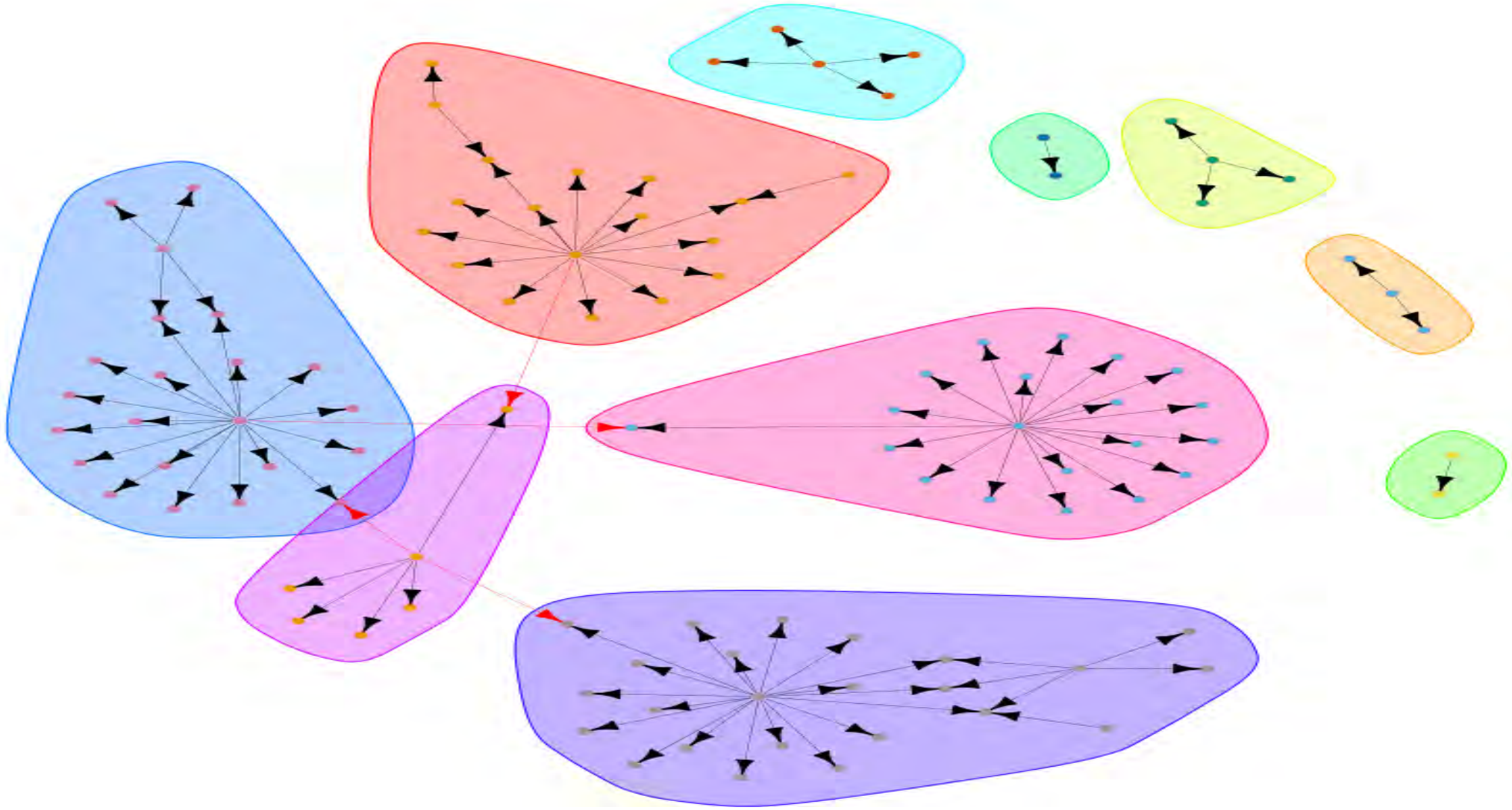
Drill down - Core network



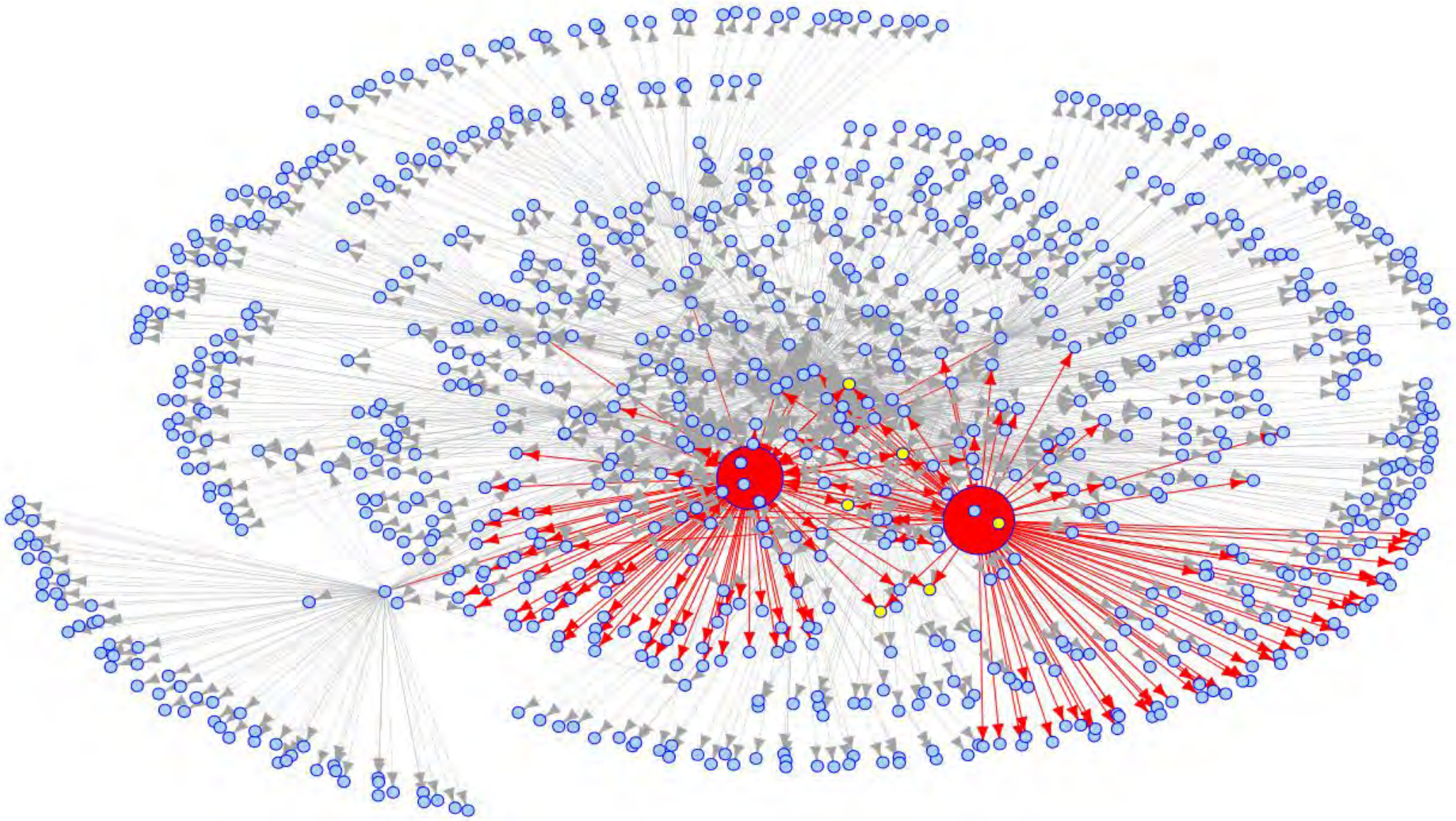
Different agent types



Recognizing similarities and differences amongst institutions (leading eigenvector)



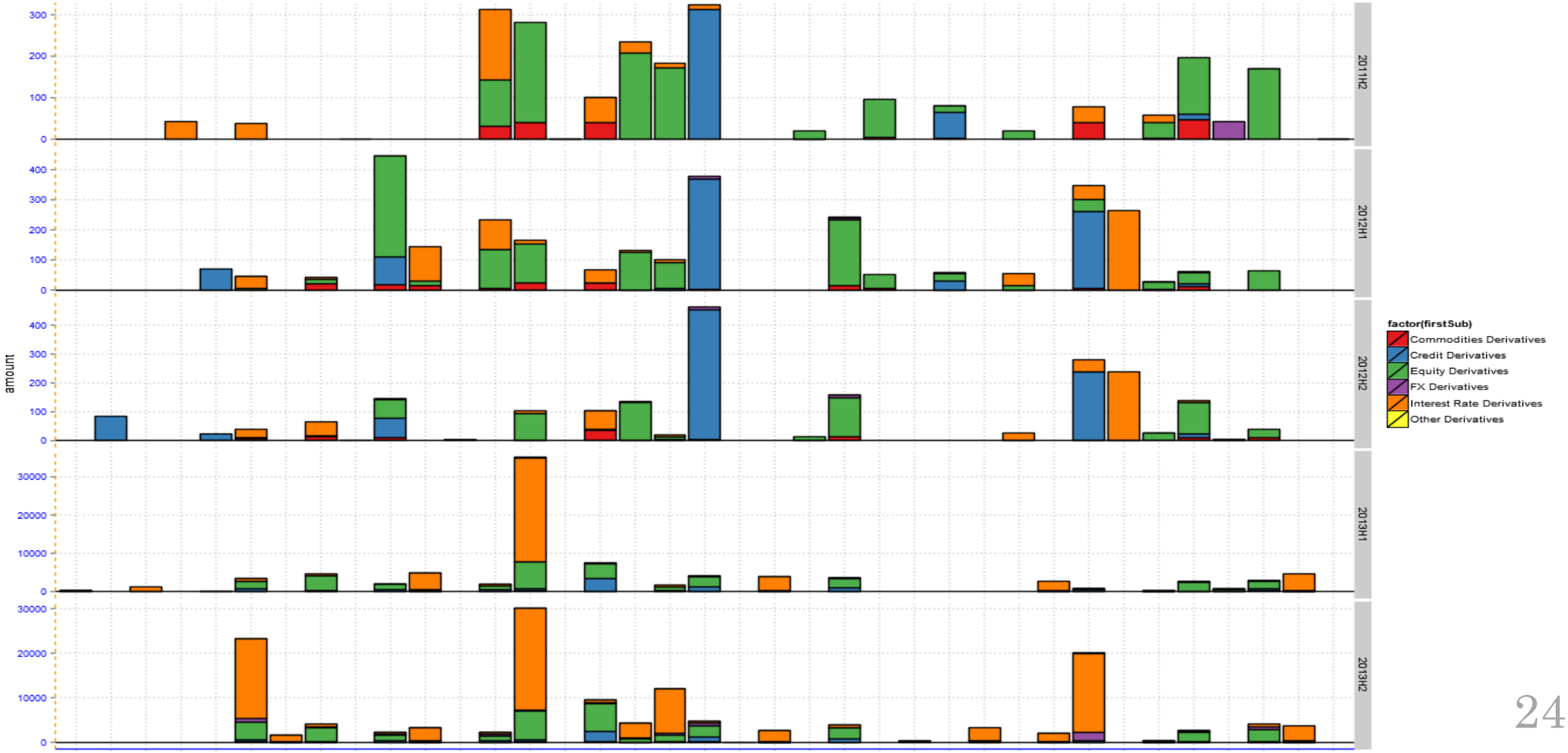
Different asset class



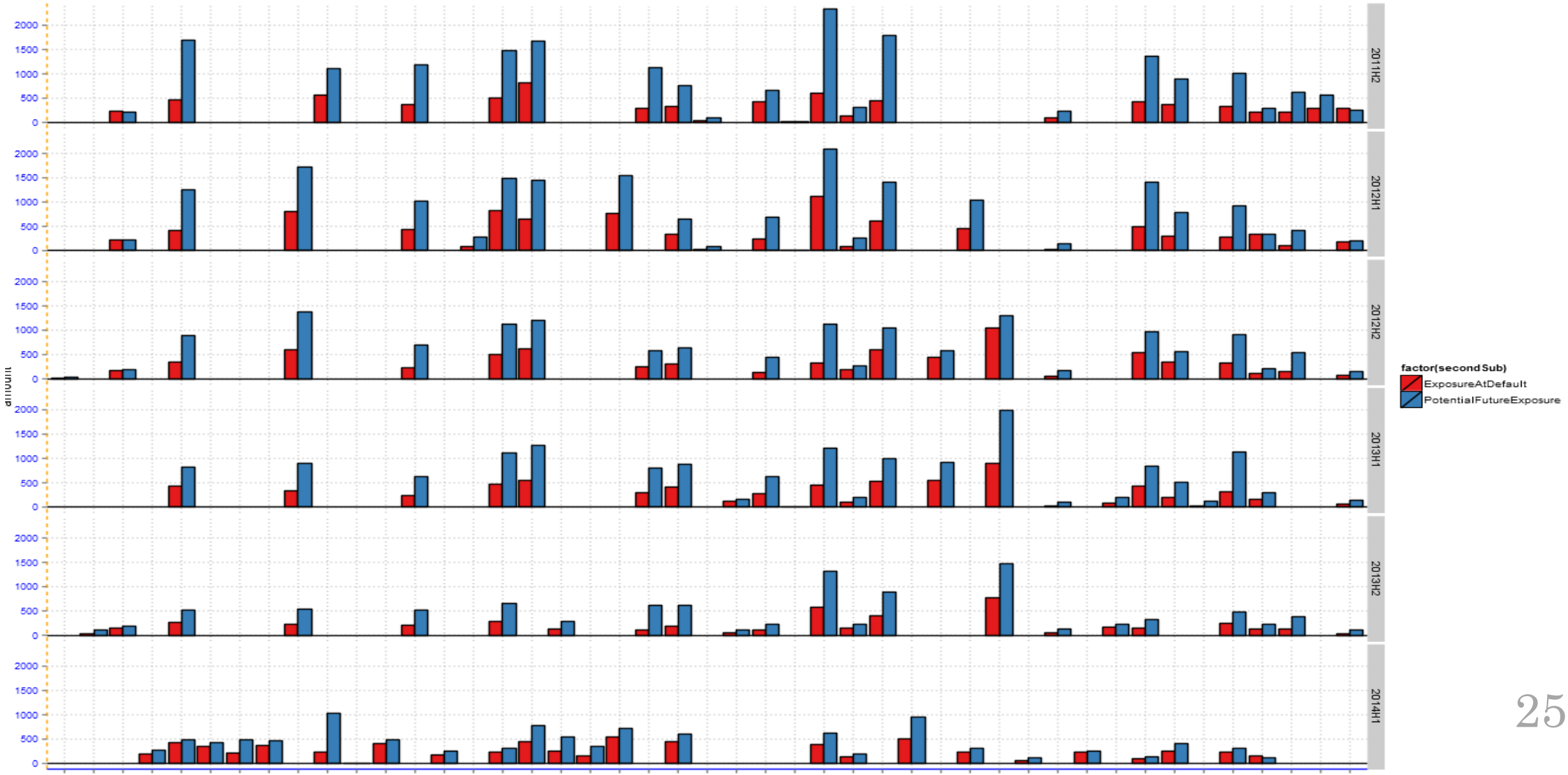
Underlying analytics

cores	degin	degout	degall	strength	clos	between	eigen
19	104	104	104	104	0.000799360511590728	22643.9143590854	1
19	90	90	90	90	0.000775795190069822	19574.6786509484	0.900097215490459
19	100	100	100	100	0.000796178343949045	32477.5238736109	0.83953527030592
17	28	28	28	28	0.000629326620516048	2405.30224425743	0.545218770728394
15	83	83	83	83	0.000732600732600733	21433.0610525645	0.545548444422692
12	49	49	49	49	0.000661813368630046	17829.372280285	0.310033403583558
19	102	102	102	102	0.000801924619085806	25581.8613365676	0.915560259538526
19	103	103	103	103	0.000797448165869219	26885.0486562654	0.969477977654551
13	41	41	41	41	0.000648088139987038	15772.2595395623	0.307149389791642
19	101	101	101	101	0.000783699059561128	22228.8013285297	0.923339625156238
19	83	83	83	83	0.000765696784073507	23611.4950956569	0.854426889411759
16	73	73	73	73	0.000716845878136201	19642.7411911714	0.65362966071321
13	26	26	26	26	0.000624219725343321	5132.60070242114	0.295370514510632
19	100	100	100	100	0.000793021411578113	26977.5244538177	0.906178551769292
19	99	99	99	99	0.00078064012490242	29854.8032465552	0.808023530934772
12	24	24	24	24	0.000571428571428571	4960.05240662317	0.274950459748393
19	101	101	101	101	0.000771010023130301	24118.8430594208	0.944312113353414
19	78	78	78	78	0.000729394602479942	20500.0530472009	0.78588898434466

Next level drill down(MtM through time)



Next level drill down (Portfolio analytics)



Open questions

How do communities/clusters form?

How and if scale matters?

How and why network topology changes through time?

How do we propagate state variable changes?

How do we inform stress testing (PGM, BN...)?

Modelling what-if (ABM, Game Theory...)?

Other...

Needed capability

Repeatable

Believable

Scalable

Timely

Cost effective

Coherent tools and methods

Moving from surveillance to intervention

Where to intervene?

When to intervene (forward looking modelling)?

What are the potential downsides of an intervention?

Questions?