

The Semantic Web

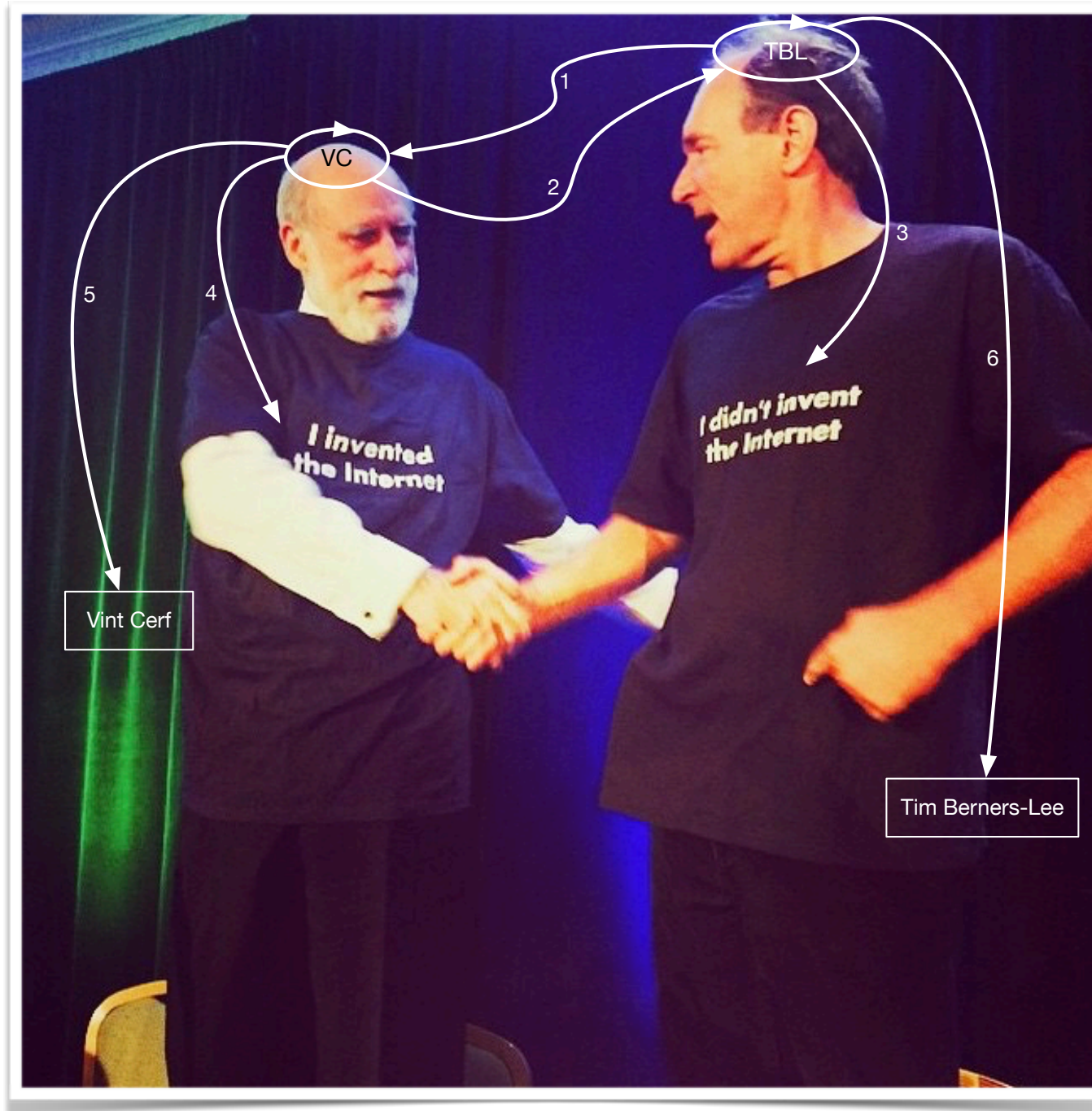
A Categorical Approach

Henry Story, August 2020

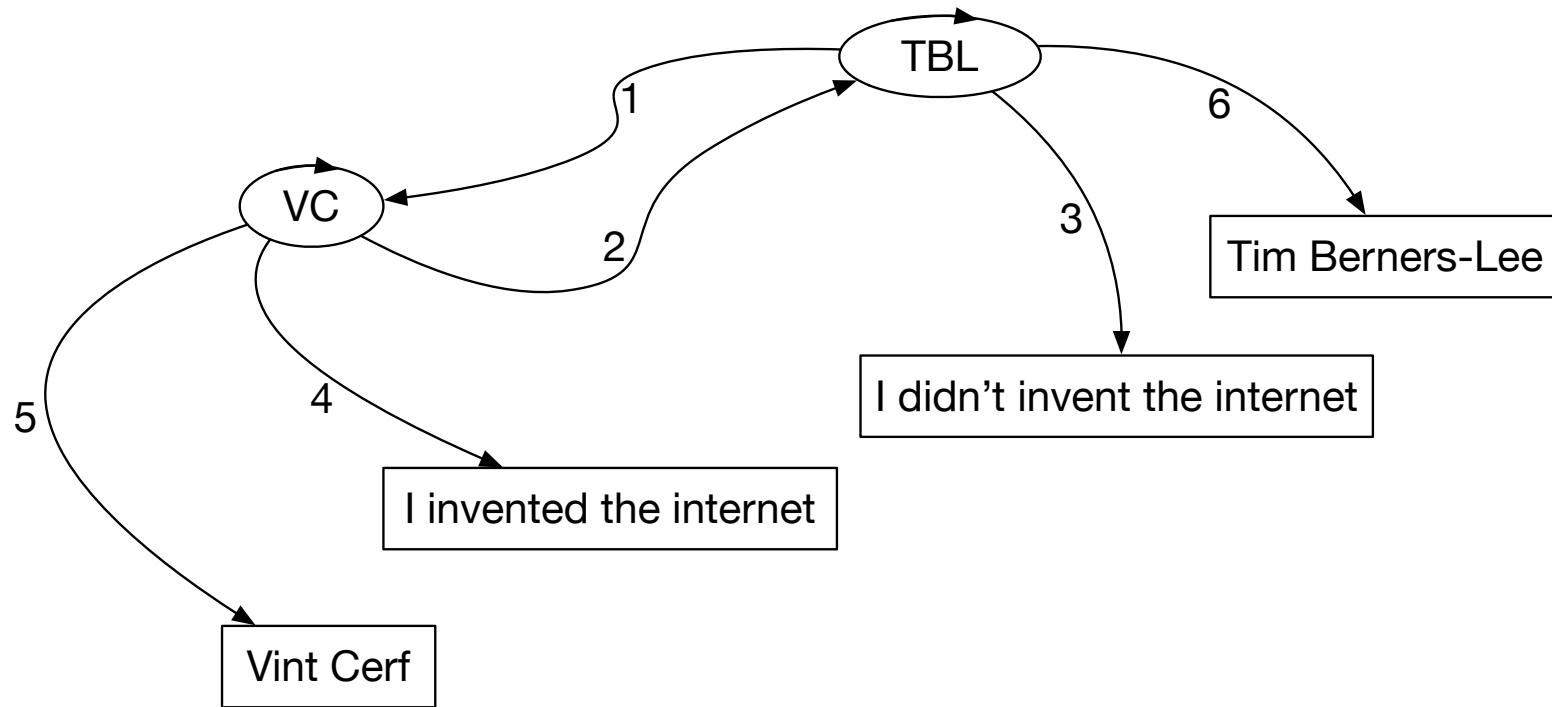
A partial timeline

- 1991 R.V.Guha PhD - Contexts: a formalization and some applications
- 1997 Meta Content Framework, W3C Technical note - Guha & Tim Bray
- 2000 RDF Schema Specification, W3C - Guha & Dan Brickley
- 2004 RDF Semantics, W3C standard - 1.0 Pat Hayes & Brian McBride
- 2004 OWL - ... Jim Hendler, Michale Horrocks,
- 2008 SPARQL Query Language for RDF - Eric Prud'hommeaux, Andy Seaborne
- 2013 SPARQL 1.1 W3C Standard - Steve Harris, Andy Seaborne, Prud'hommeaux
- 2014 RDF 1.1
- 2015 Linked Data Platform 1.0
- ...

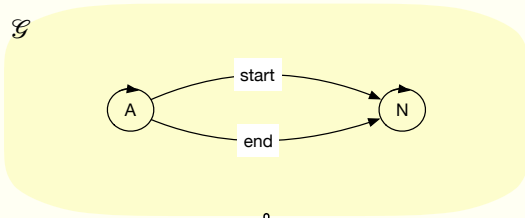
We can describe a situation by drawing relations (arrows)



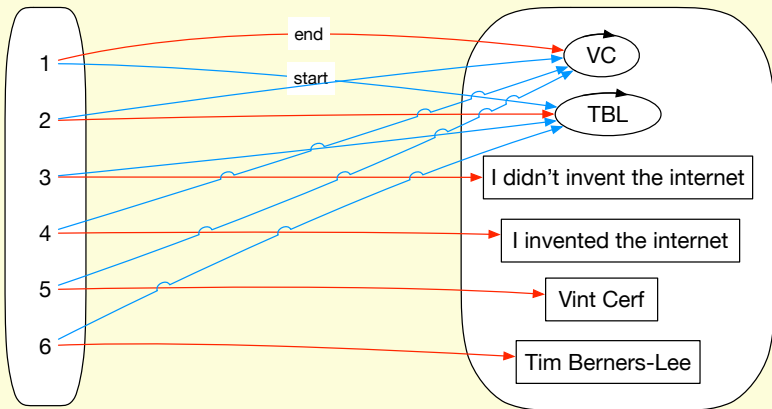
the graph alone



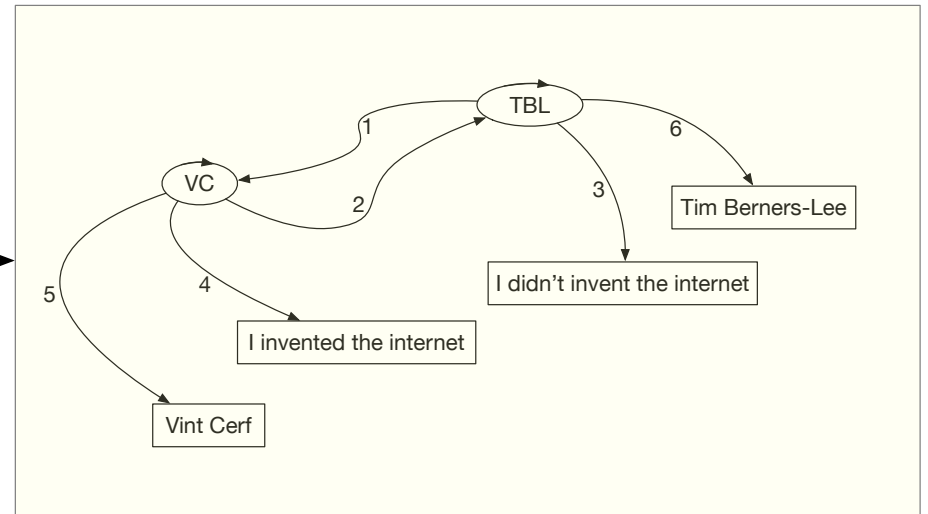
Inst



Set

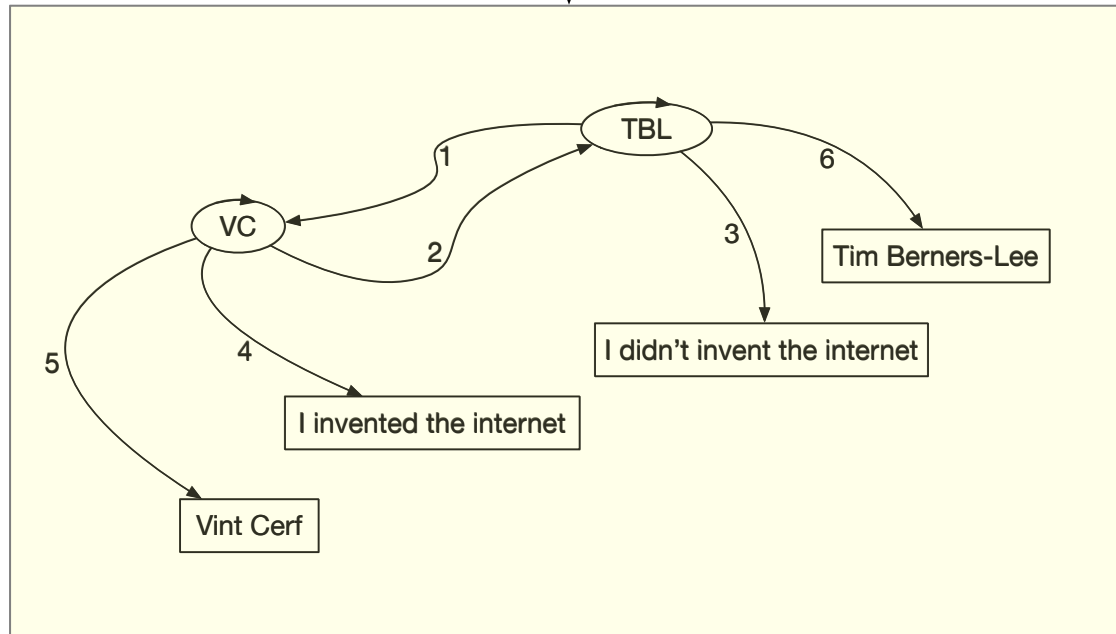


Free



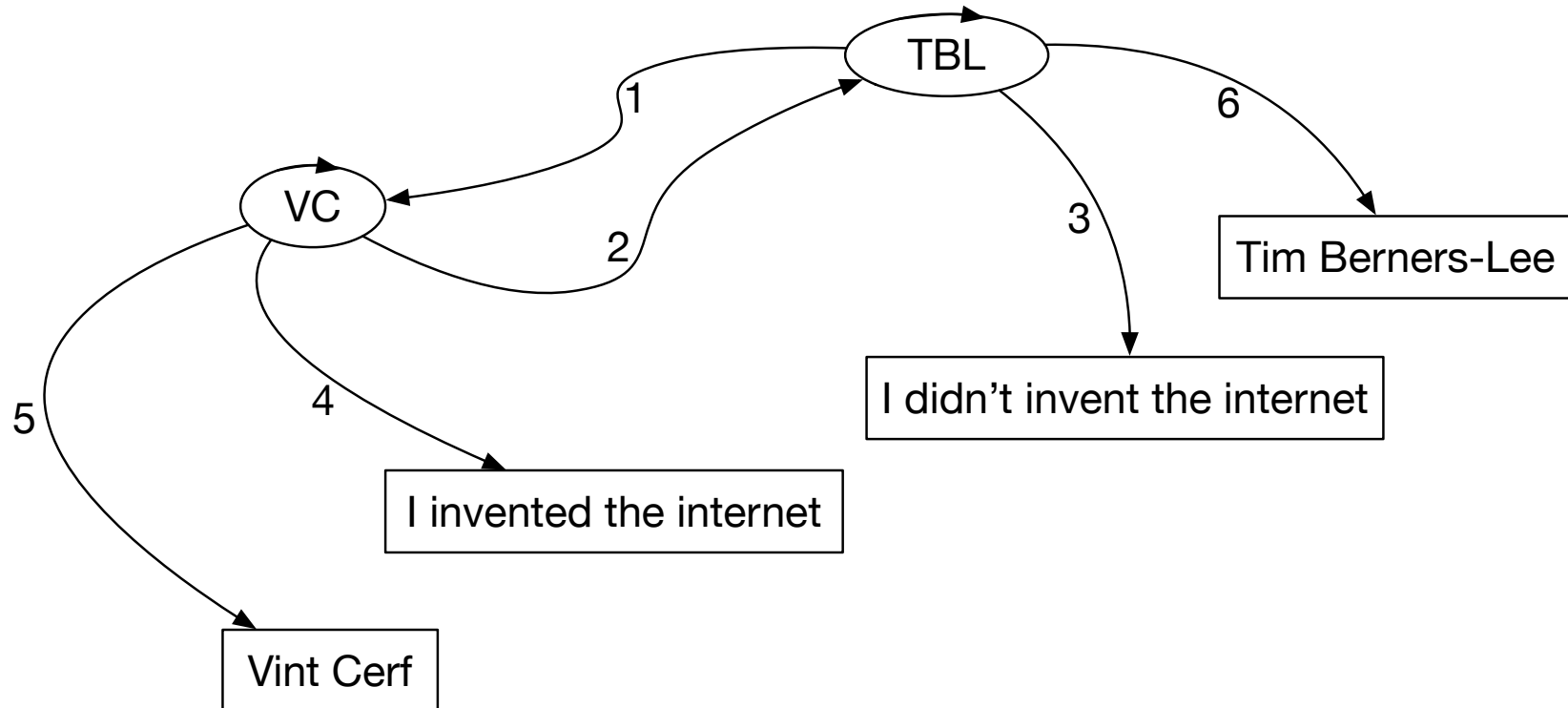
Inst

1	TBL	VC
2	VC	TBL
3	TBL	"I didn't invent the Internet"
4	VC	"I invented the Internet"
5	VC	"Vint Cerf"
6	TBL	"Tim Berners-Lee"

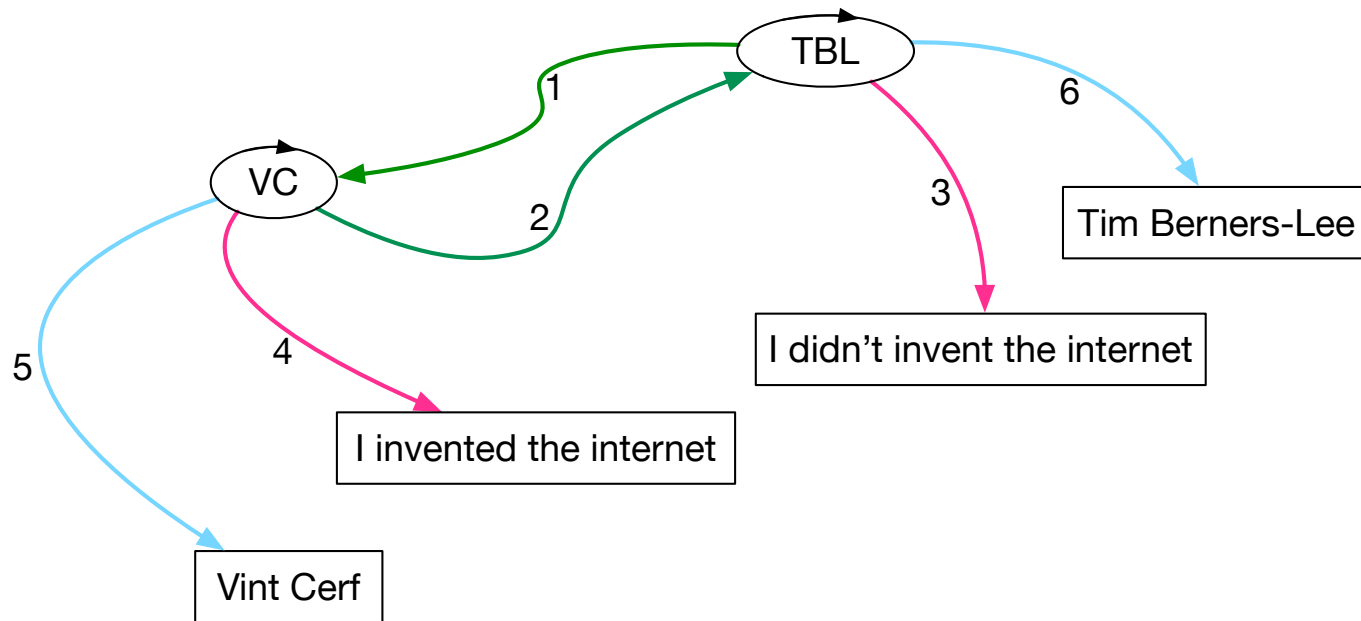


2 Problems

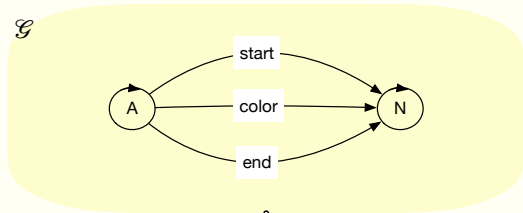
- untyped arrows
- opaque arrow names



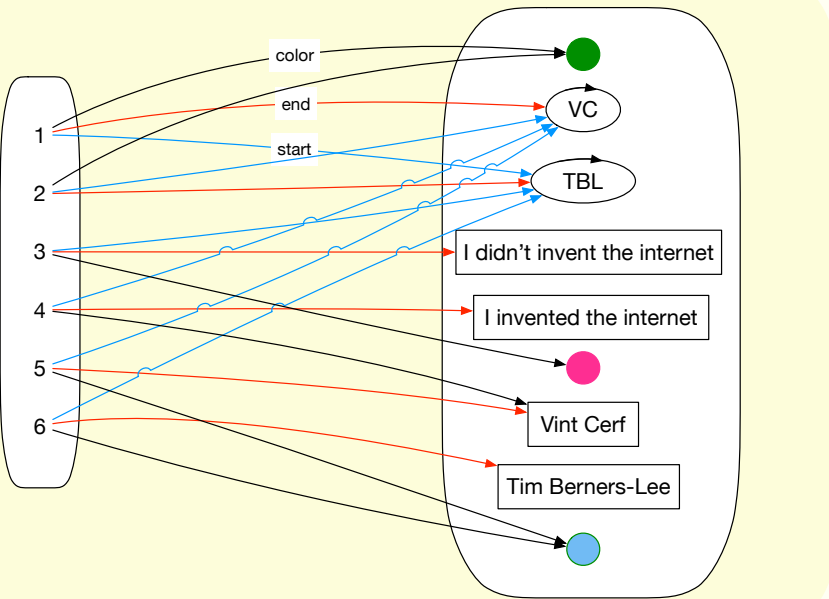
coloring arrows



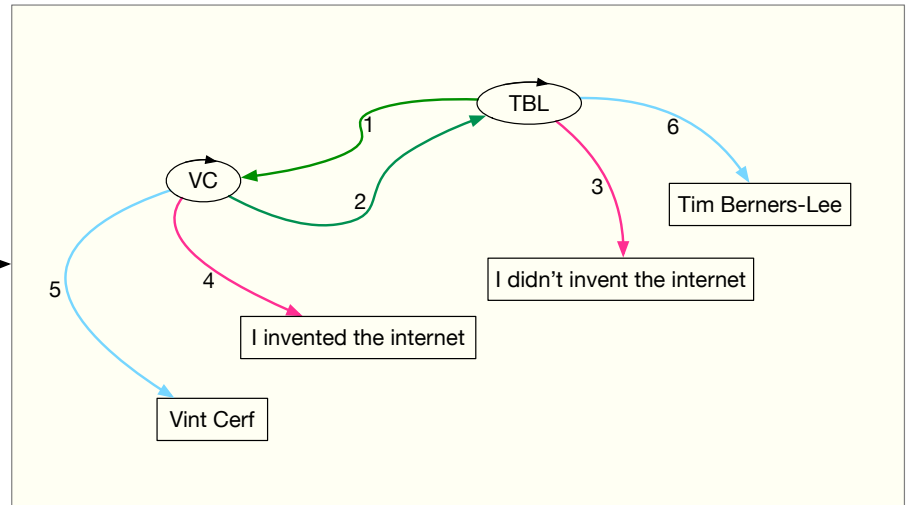
Inst



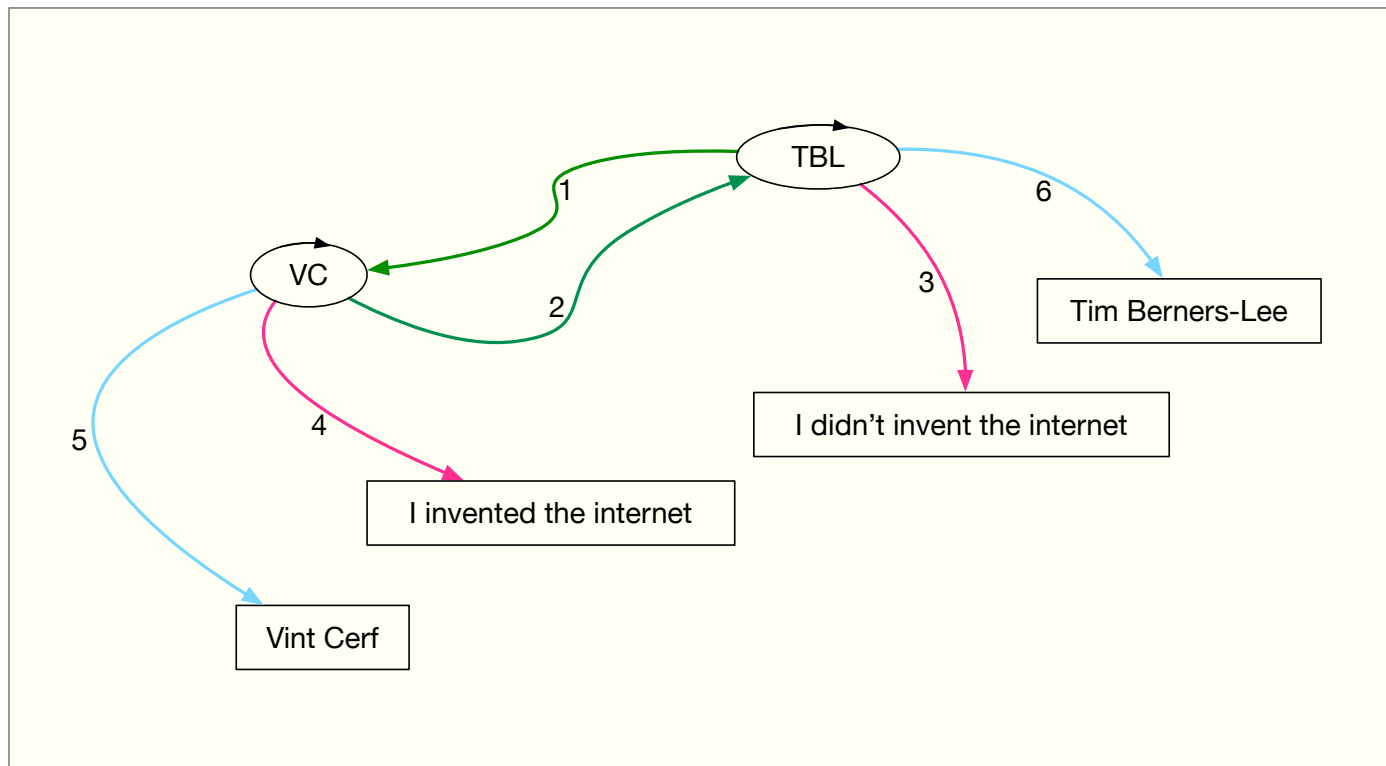
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Free?

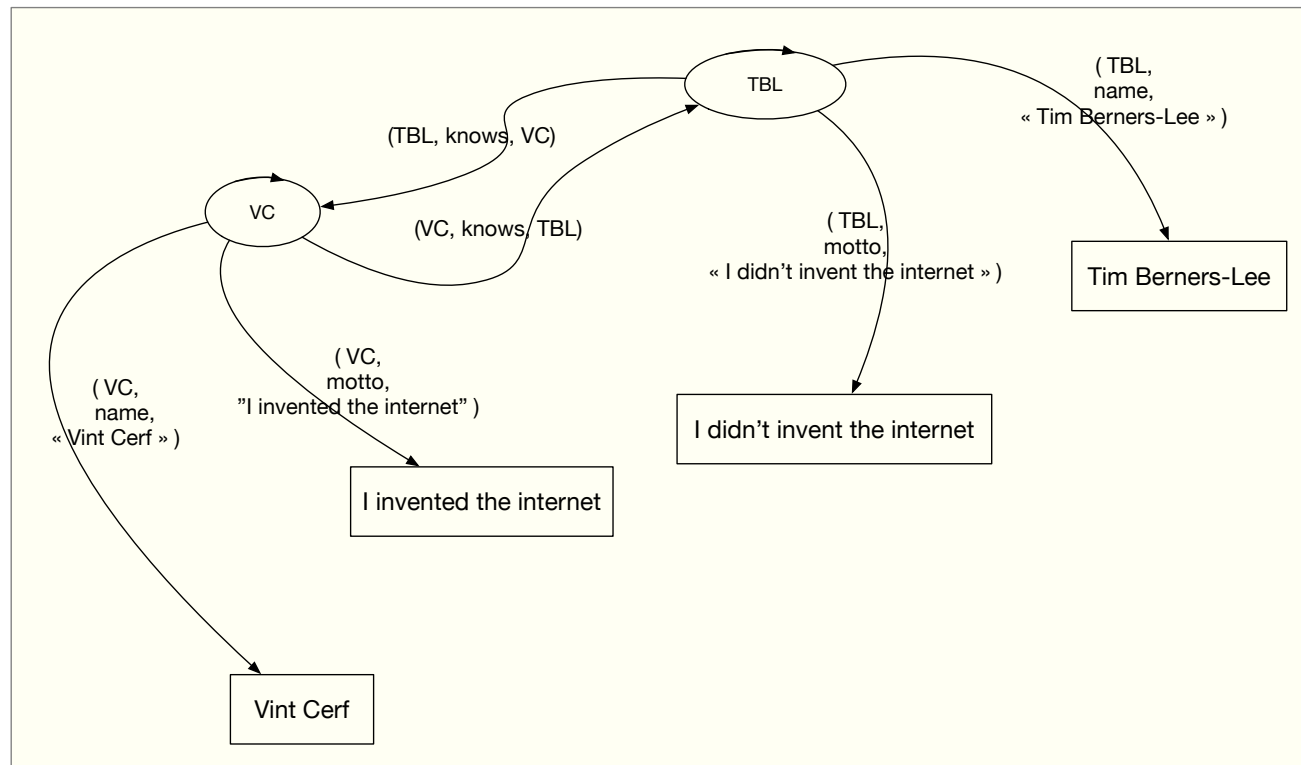


A	subj	color	obj
1	TBL	●	VC
2	VC	●	TBL
3	TBL	●	"I didn't invent the Internet"
4	VC	●	"I invented the Internet"
5	VC	●	"Vint Cerf"
6	TBL	●	"Tim Berners-Lee"

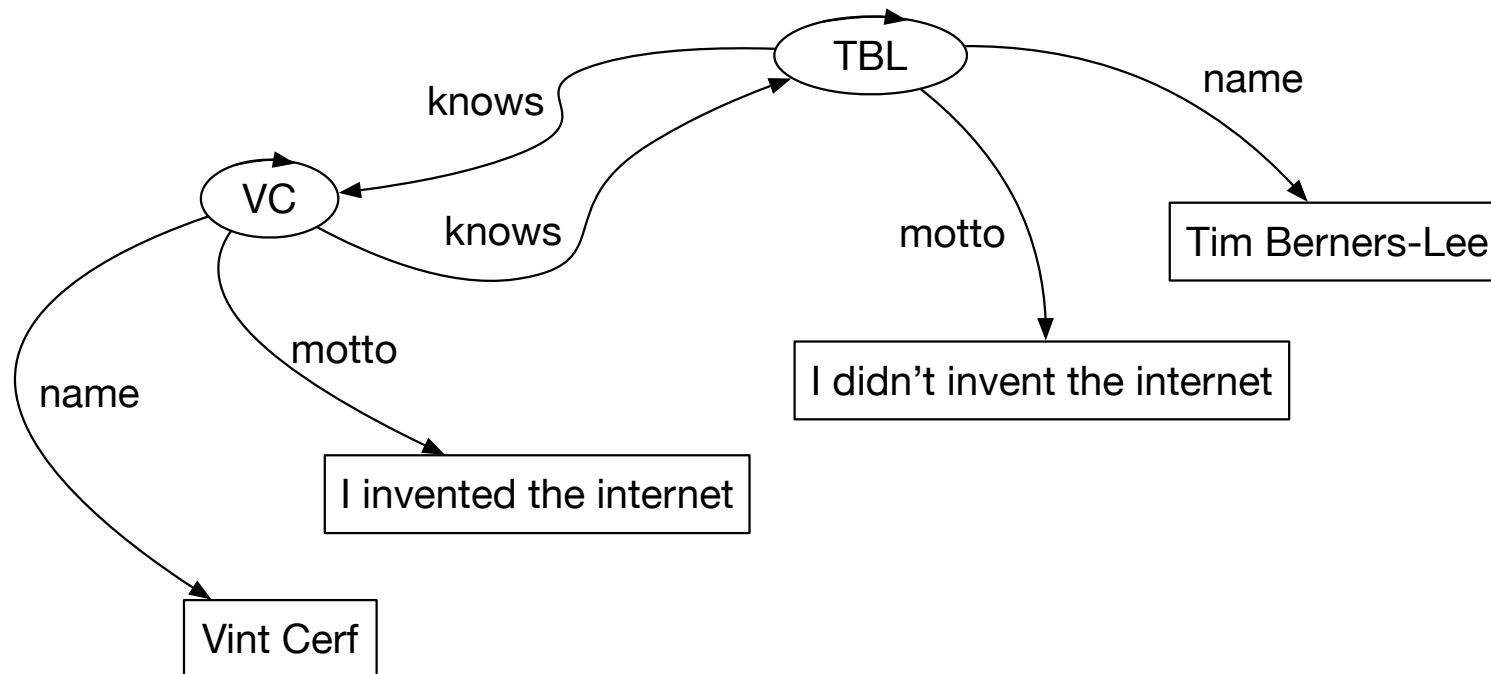


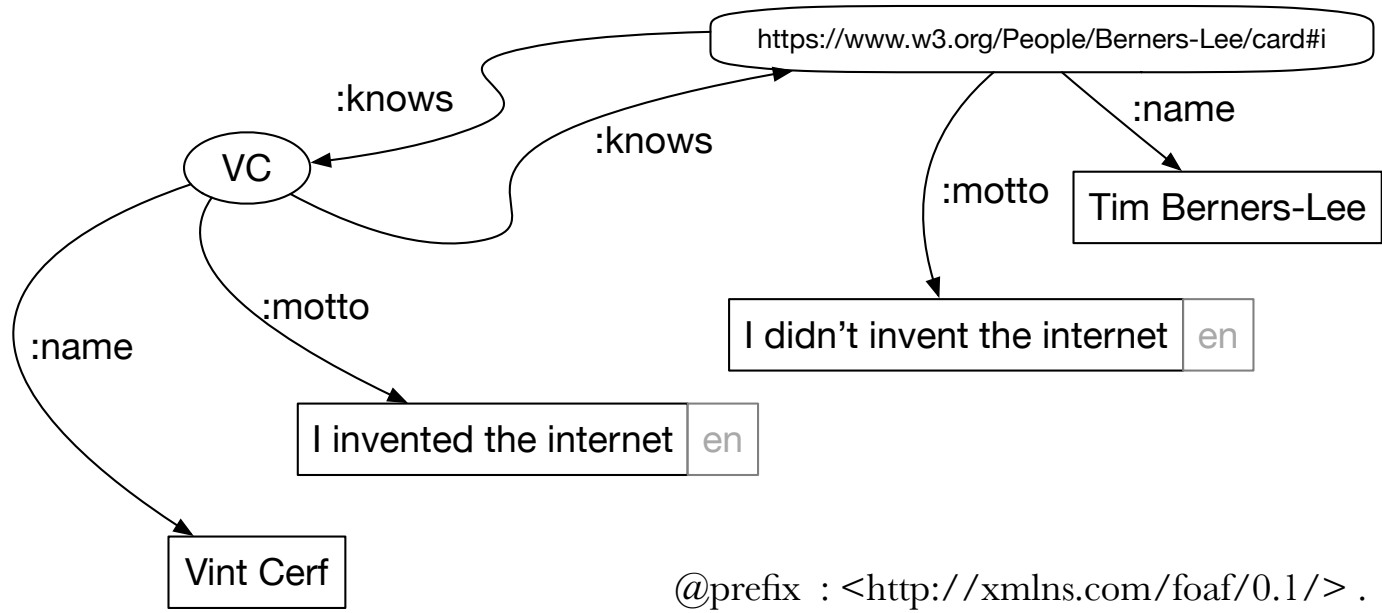
in RDF every (subj,rel,obj) triple uniquely identifies an Arrow
so we can name the arrows with those triples

A	subj	relationType	obj
1	TBL	knows	VC
2	VC	knows	TBL
3	TBL	motto	"I didn't invent the Internet"
4	VC	motto	"I invented the Internet"
5	VC	name	"Vint Cerf"
6	TBL	name	"Tim Berners-Lee"

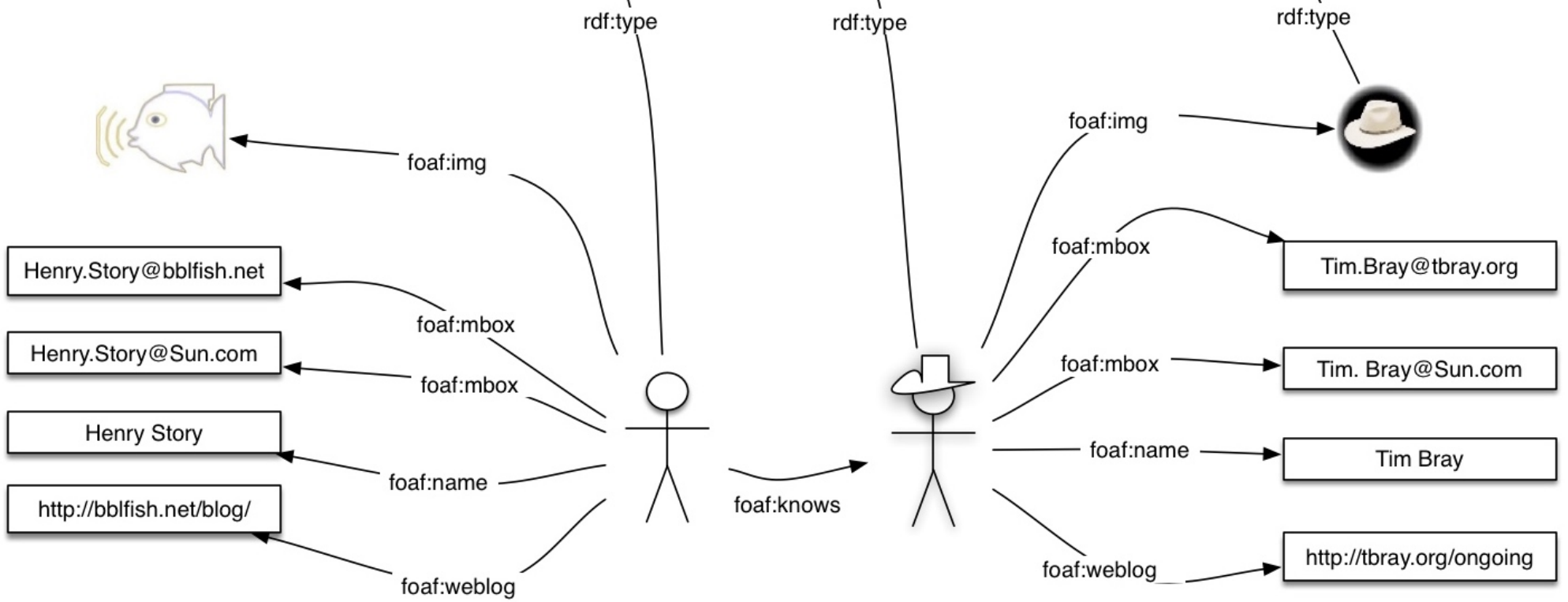
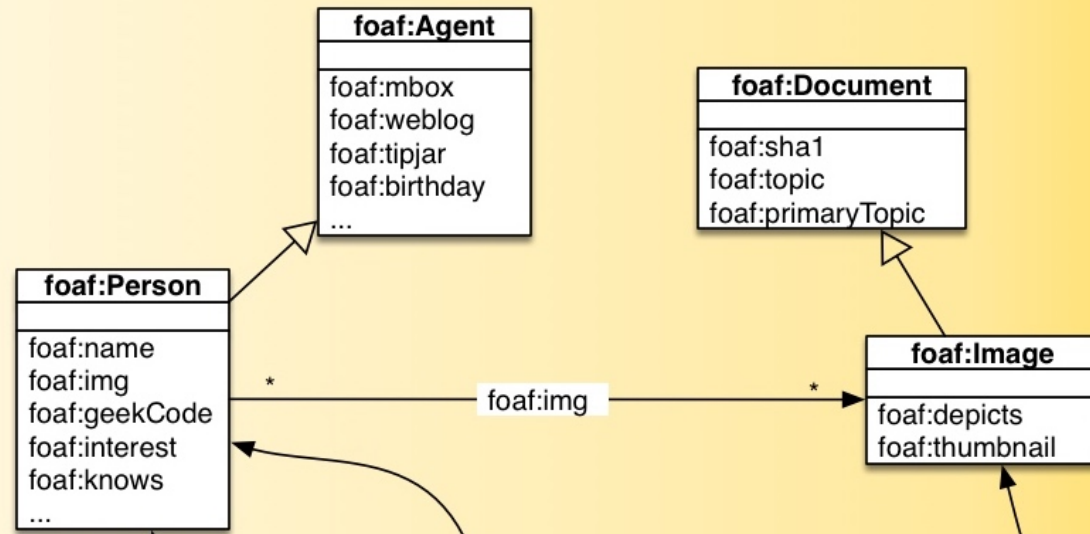


We remove redundant info for readability





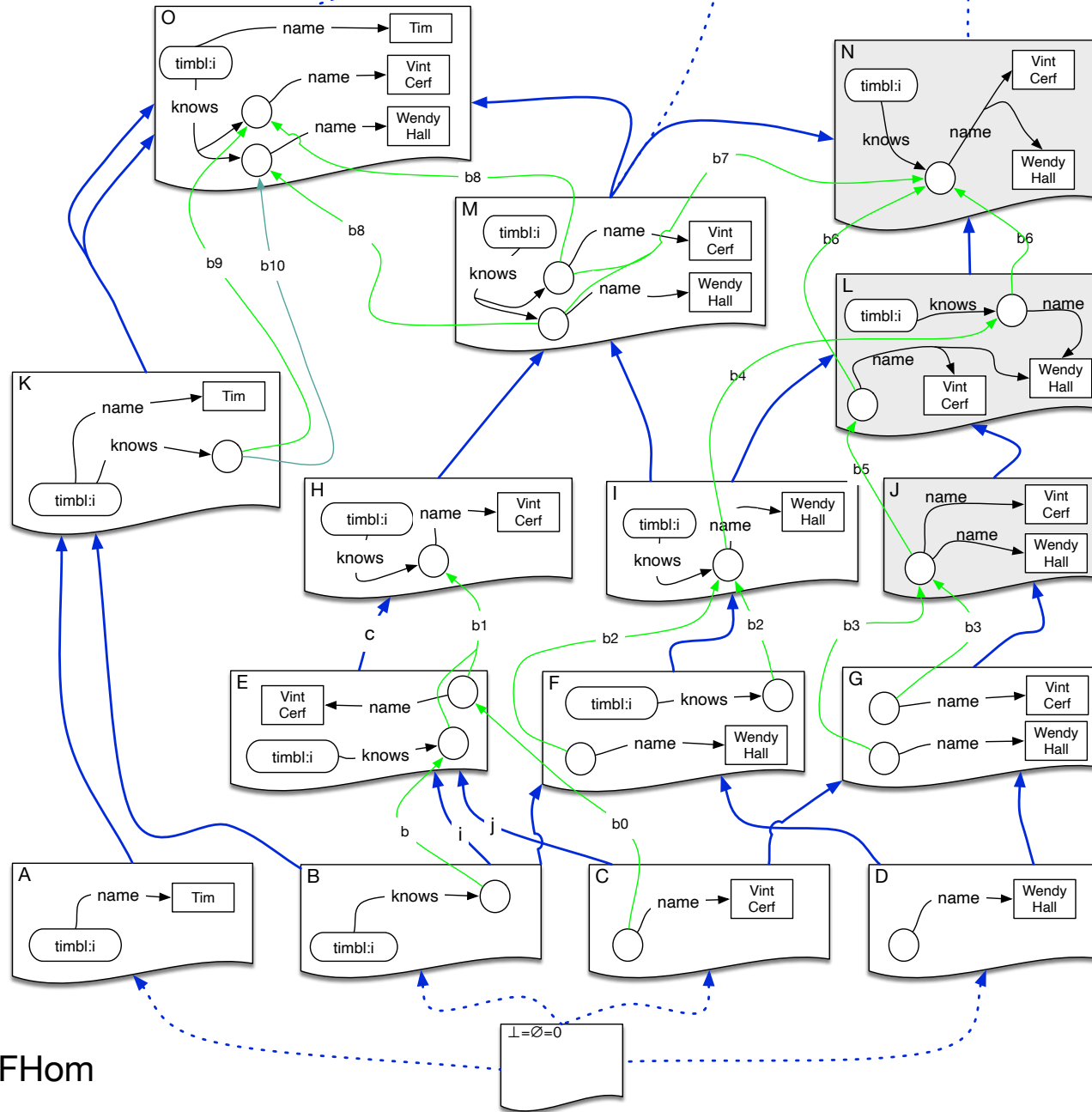
OWL



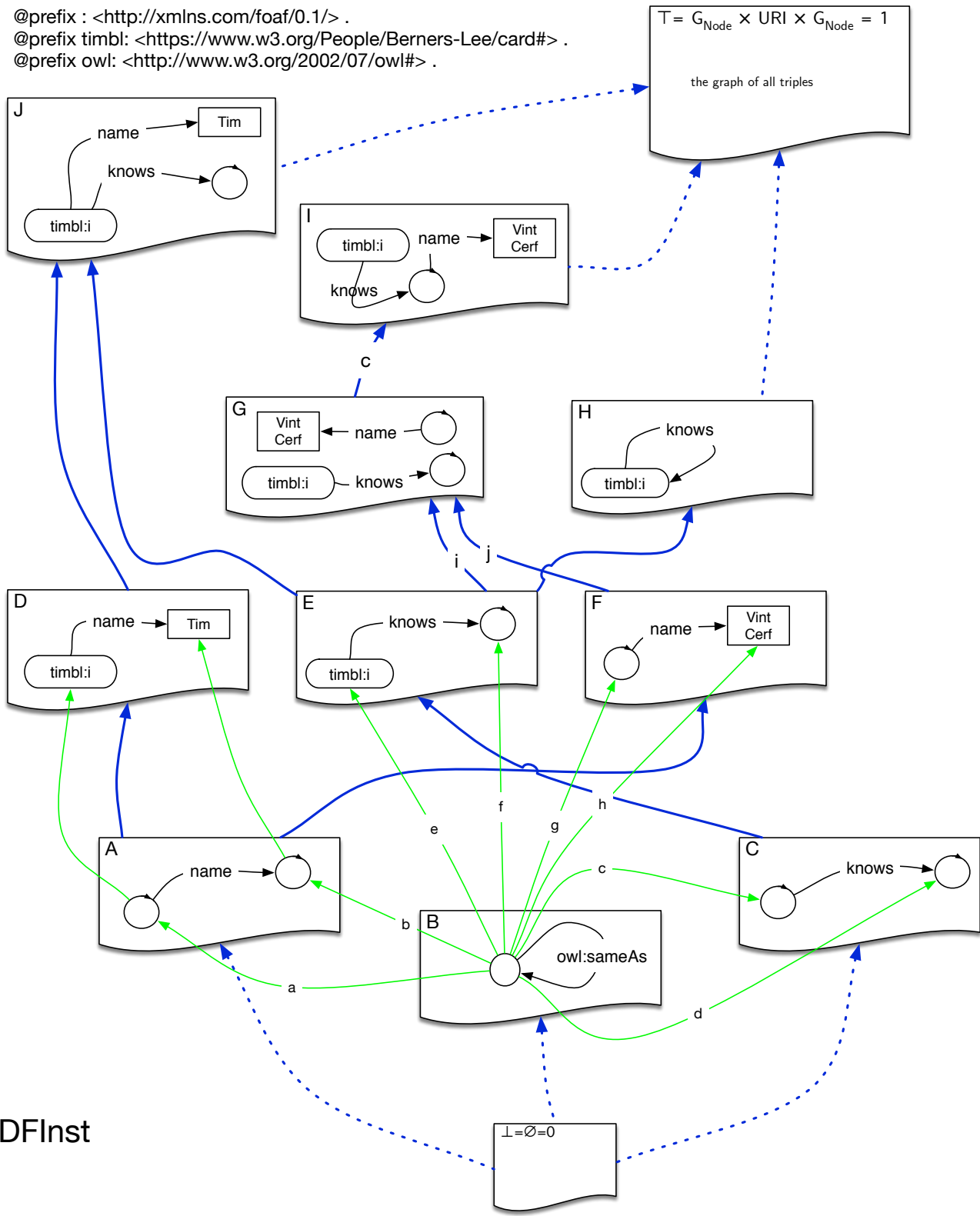
foaf: <<http://xmlns.com/foaf/0.1/>>
rdf: <<http://www.w3.org/1999/02/22-rdf-syntax-ns#>>

@prefix : <http://xmlns.com/foaf/0.1/>
 @prefix timbl: <https://www.w3.org/People/Berners-Lee/card#>

$T = G_{Node} \times URI \times G_{Node} = 1$
 the graph of all triples



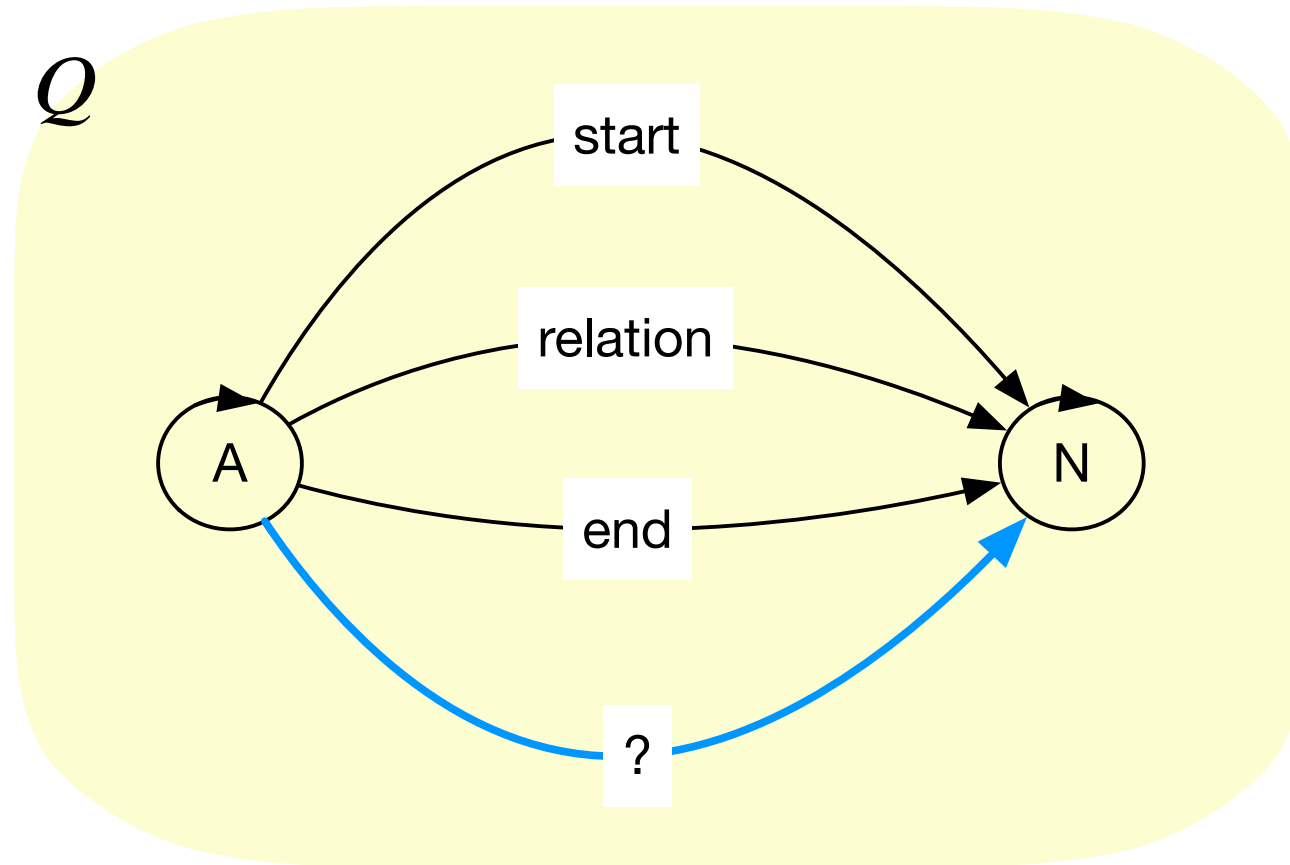
@prefix : <http://xmlns.com/foaf/0.1/> .
 @prefix timbl: <https://www.w3.org/People/Berners-Lee/card#> .
 @prefix owl: <http://www.w3.org/2002/07/owl#> .

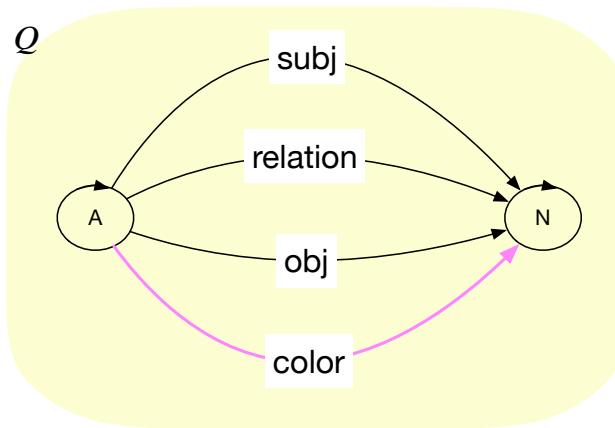


Braatz: Category RDFInst

Hypergraphs

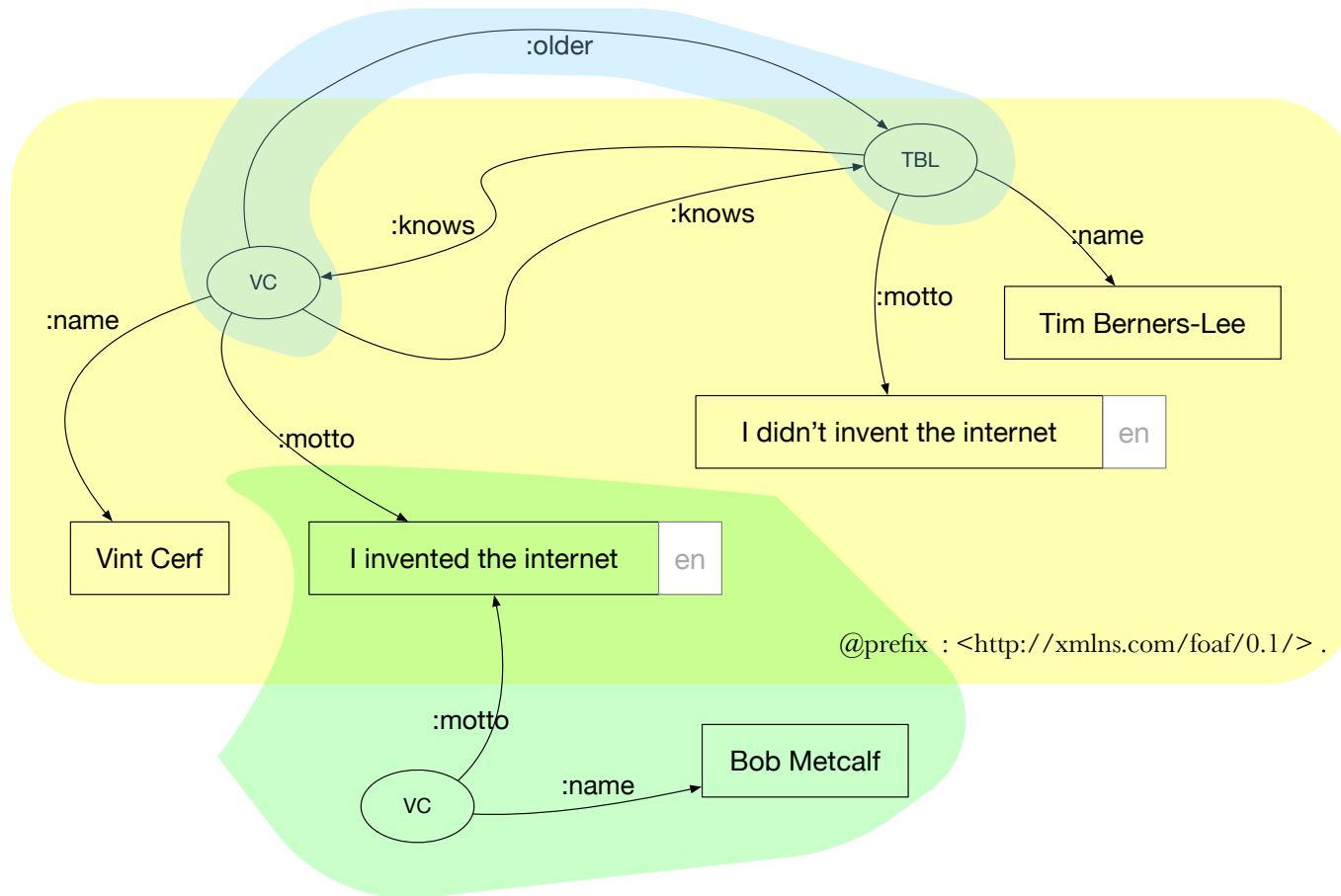
Quads



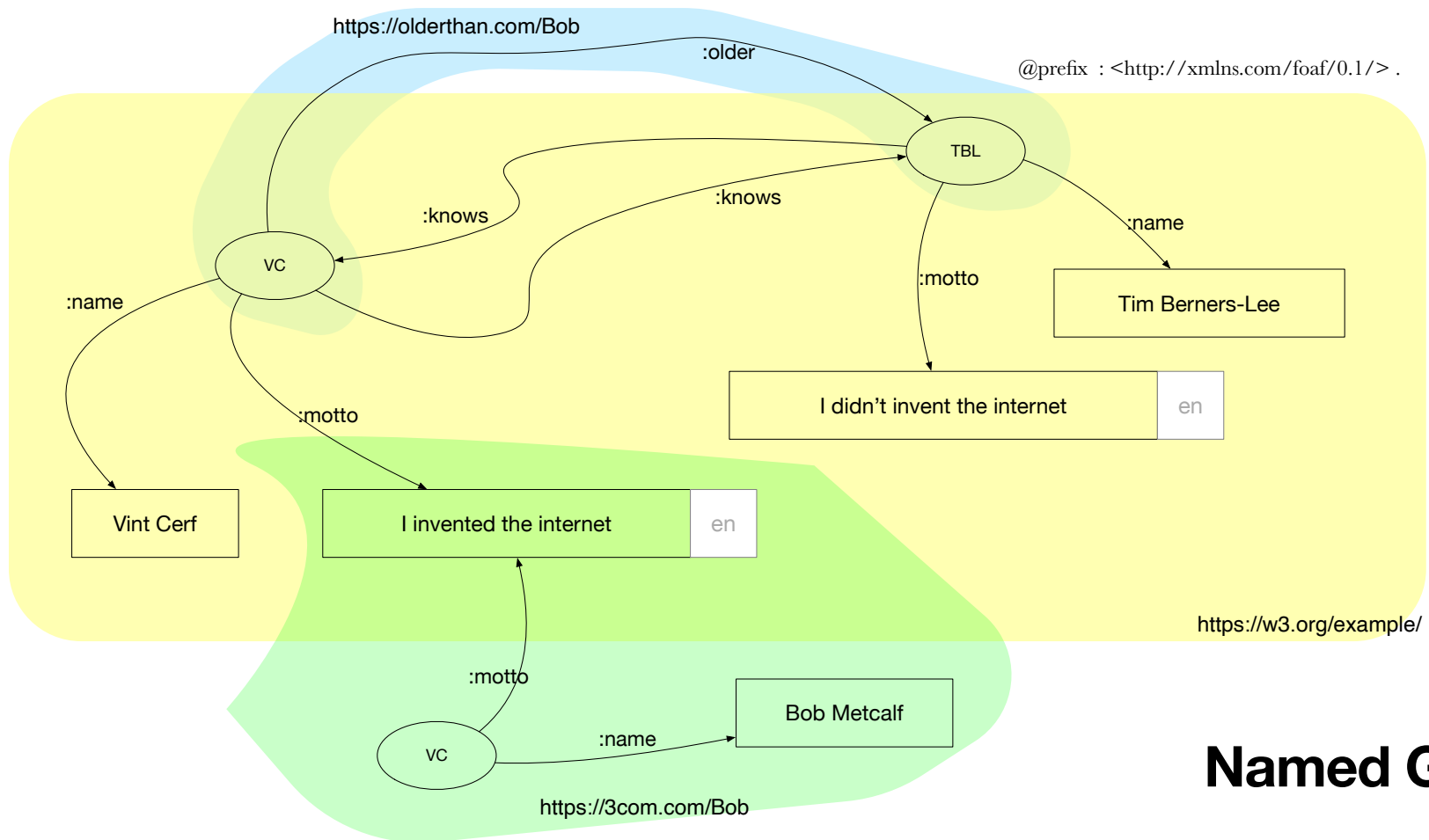


A	subj	relation	obj	color
1	TBL	:knows	VC	●
2	VC	:knows	TBL	●
3	TBL	:motto	"I didn't invent the Internet"	●
4	VC	:motto	"I invented the Internet"	●
5	VC	:name	"Vint Cerf"	●
6	TBL	:name	"Tim Berners-Lee"	●
7	BOB	:name	"Bob Metcalf"	●
8	BOB	:motto	"I invented the Internet"	●
9	BOB	:older	TBL	●

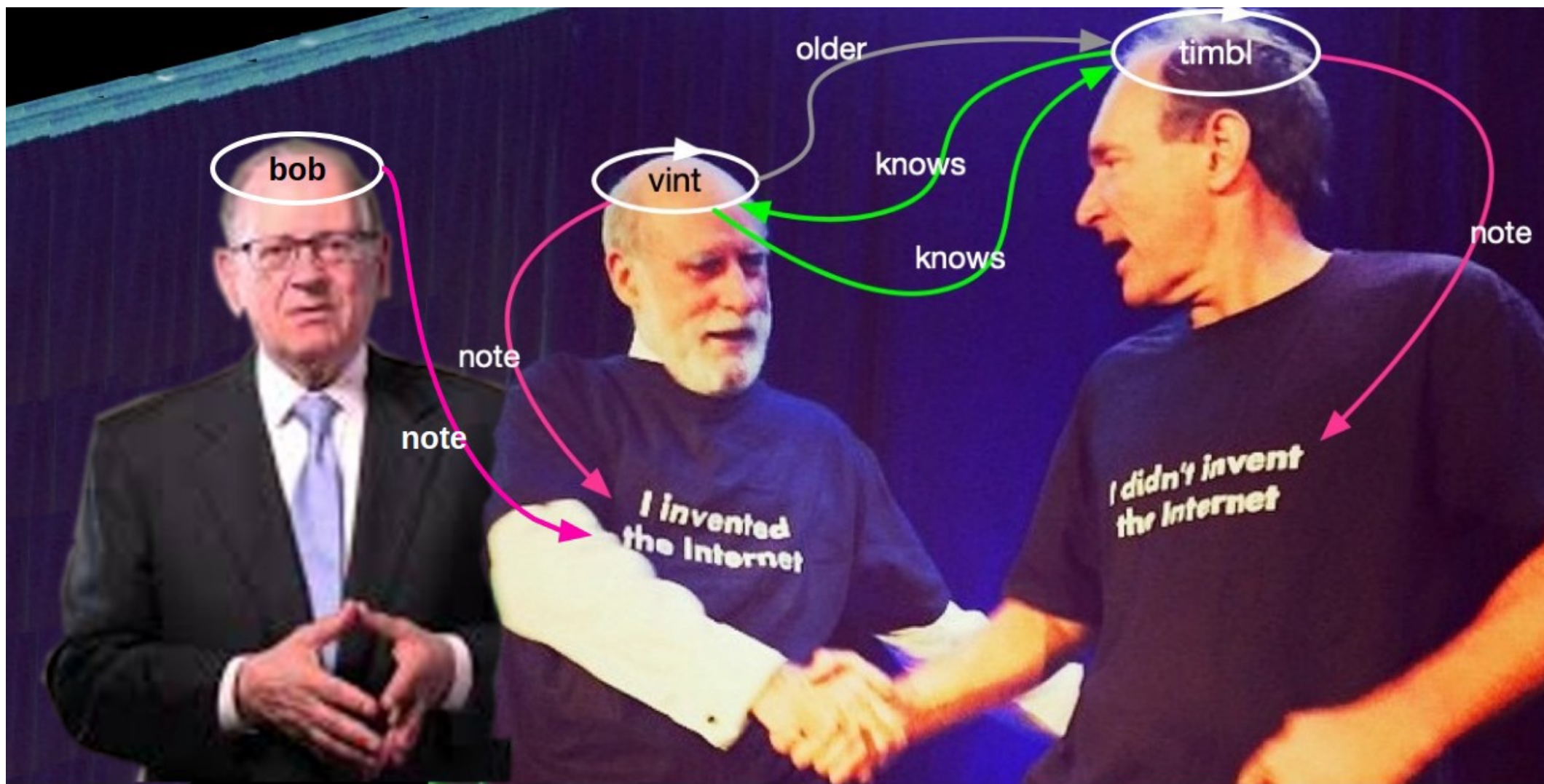
A	subj	relation	obj	Color
1	TBL	:knows	VC	●
2	VC	:knows	TBL	●
3	TBL	:motto	"I didn't invent the Internet"	●
4	VC	:motto	"I invented the Internet"	●
5	VC	:name	"Vint Cerf"	●
6	TBL	:name	"Tim Berners-Lee"	●
7	BOB	:name	"Bob Metcalf"	●
8	BOB	:motto	"I invented the Internet"	●
9	BOB	:older	TBL	●



A	subj	relation	obj	Graph Name
1	TBL	:knows	VC	https://w3.org/example/
2	VC	:knows	TBL	https://w3.org/example/
3	TBL	:motto	"I didn't invent the Internet"	https://w3.org/example/
4	VC	:motto	"I invented the Internet"	https://w3.org/example/
5	VC	:name	"Vint Cerf"	https://w3.org/example/
6	TBL	:name	"Tim Berners-Lee"	https://w3.org/example/
7	BOB	:name	"Bob Metcalf"	https://3com.com/Bob
8	BOB	:motto	"I invented the Internet"	https://3com.com/Bob
9	BOB	:older	TBL	https://olderthan.com/Bob

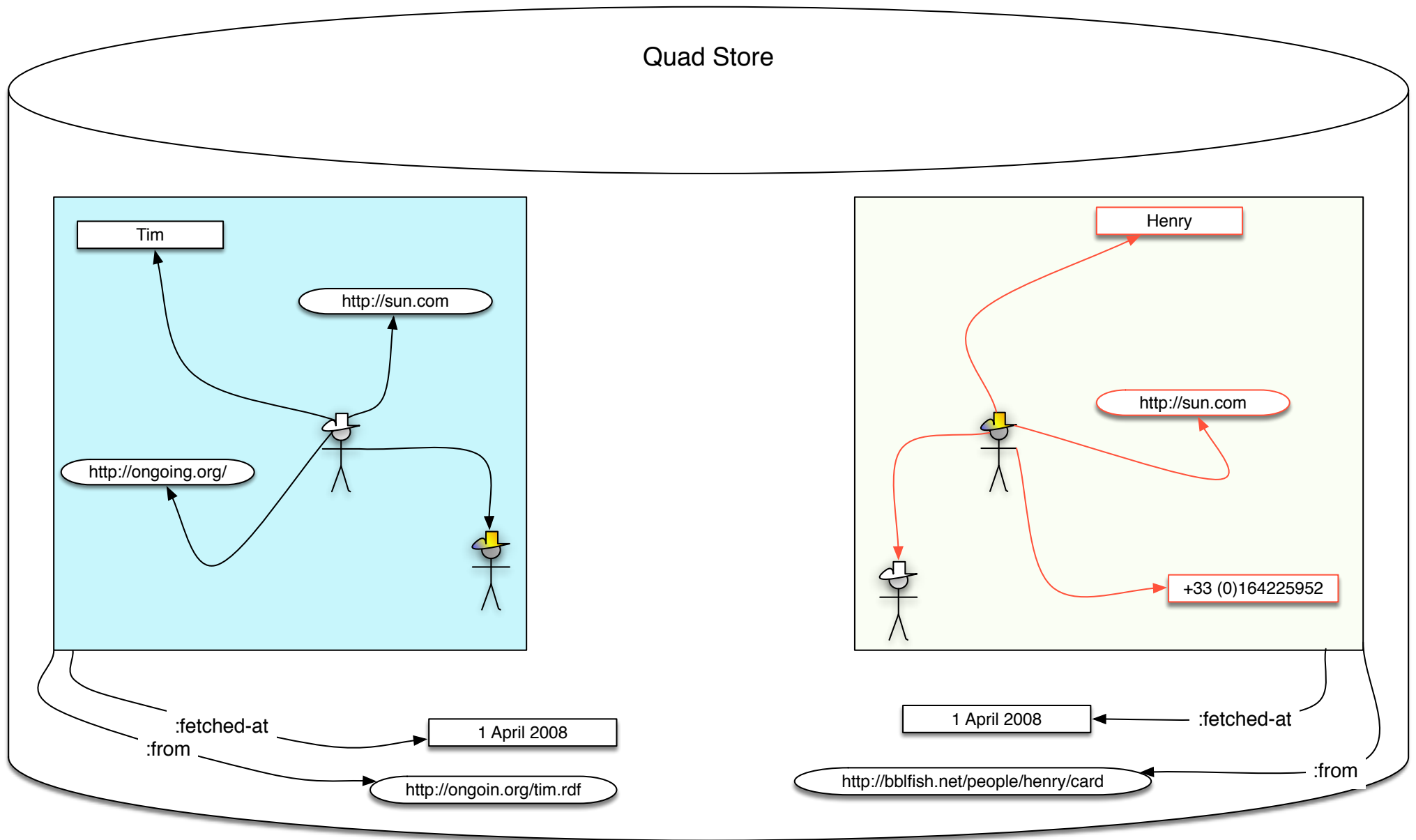


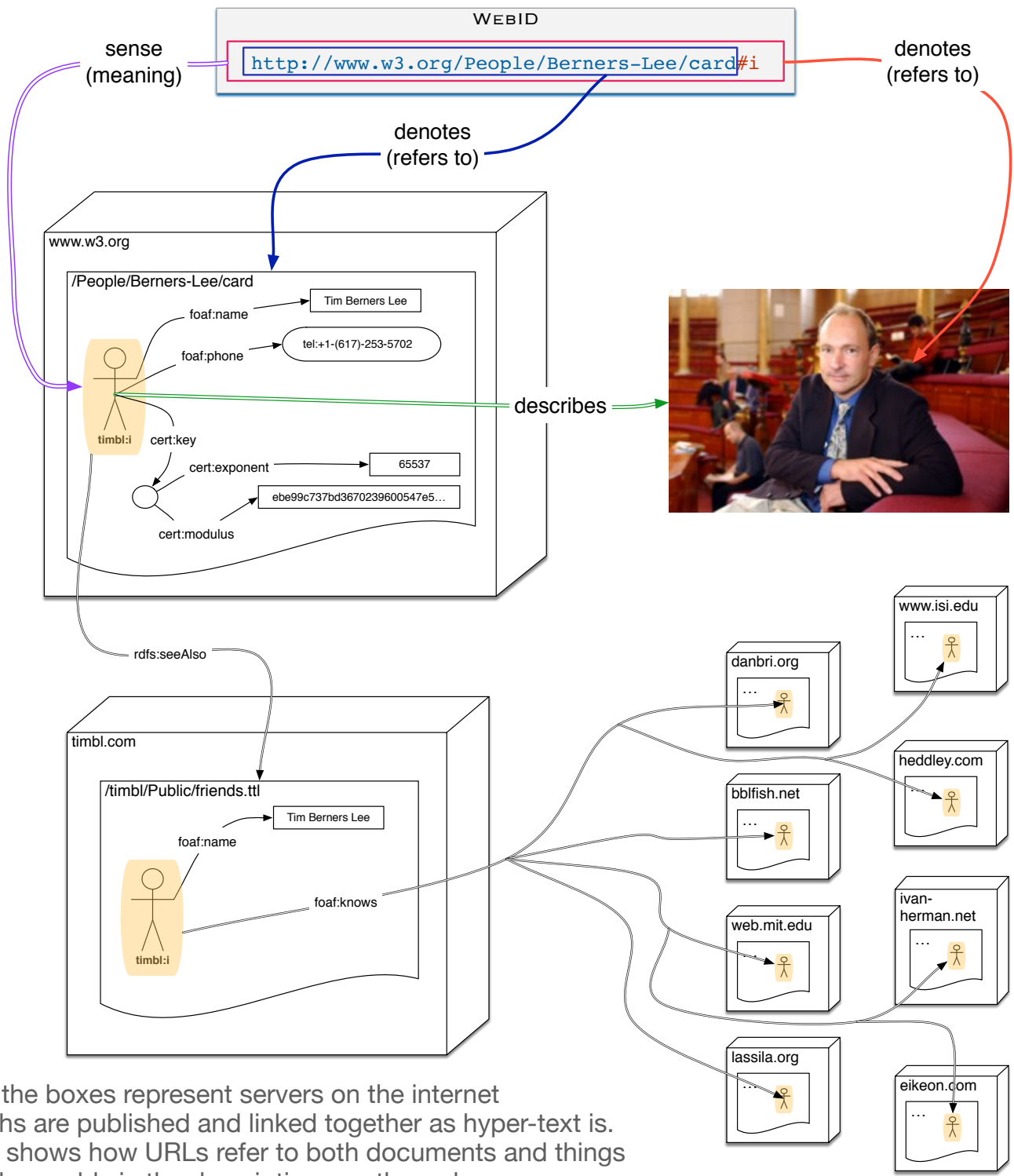
Named Graphs



If we merge the three graphs, we get one graph that contains the collage of both.
Here is a picture collage

A Quad Store (an RDF database) is a pointed hyper-graph instance. The hyper-graph gives the collection of graphs, the point selects one graphs as the default (admin) graph. Below the dates and places at which the two graphs were fetched reside in that default graph.





Here the boxes represent servers on the internet where the graphs are published and linked together as hyper-text is. The WebID URL shows how URLs refer to both documents and things in the world via the descriptions on the web.