Dynamic schema discovery

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stitching tables back together from RDF

Dematerialisation

given table,
generate RDF tuples representing it

RDF: subject (IRI or blank), predicate (IRI), object (IRI or blank or literal)

(IRI = Internationalized Resource Identifier)

Dematerialisation

name	age	score
McLeod	NULL	98
Pitt	82	39

Dematerialisation

tableURI

BNI	name	age	score
	McLeod	NULL	98
	Pitt	82	39

Dematerialisation

tableURI

BNI	name	age	score
	McLeod	NULL	98
	Pitt	82	39

for each row
    assign blank node identifier (BNI)
    for each attribute
        print (BNI, attribute, entry) if entry != NULL

Dematerialisation

tableURI

BNI	name	age	score
_:...a2	McLeod	NULL	98
	Pitt	82	39

```
(_:...a2,<datatype>#name,"McLeod")
(_:...a2,<datatype>#integer,98)
(_:...a2,<datatype>#dataset,tableURI)
```

Dematerialisation

tableURI

BNI	name	age	score
_:...a2	McLeod	NULL	98
_:...d0	Pitt	82	39

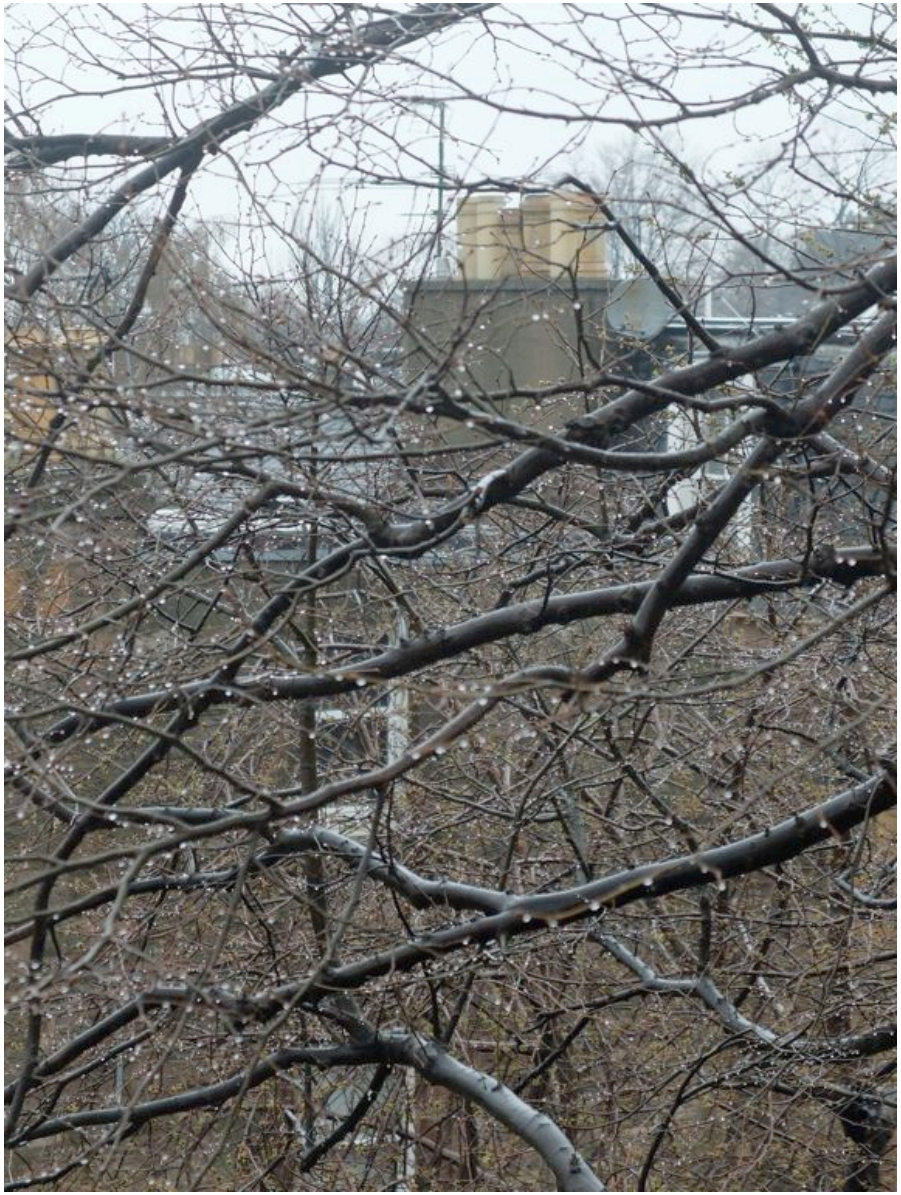
```
(_:...d0,<datatype>#name,"Pitt")
(_:...d0,<datatype>#age,82)
(_:...d0,<datatype>#integer,39)
(_:...d0,<ontology>#dataset,tableURI)
```

Rematerialisation

given a collection of RDF tuples,
reconstruct table they came from

Data

Structure



Database schema

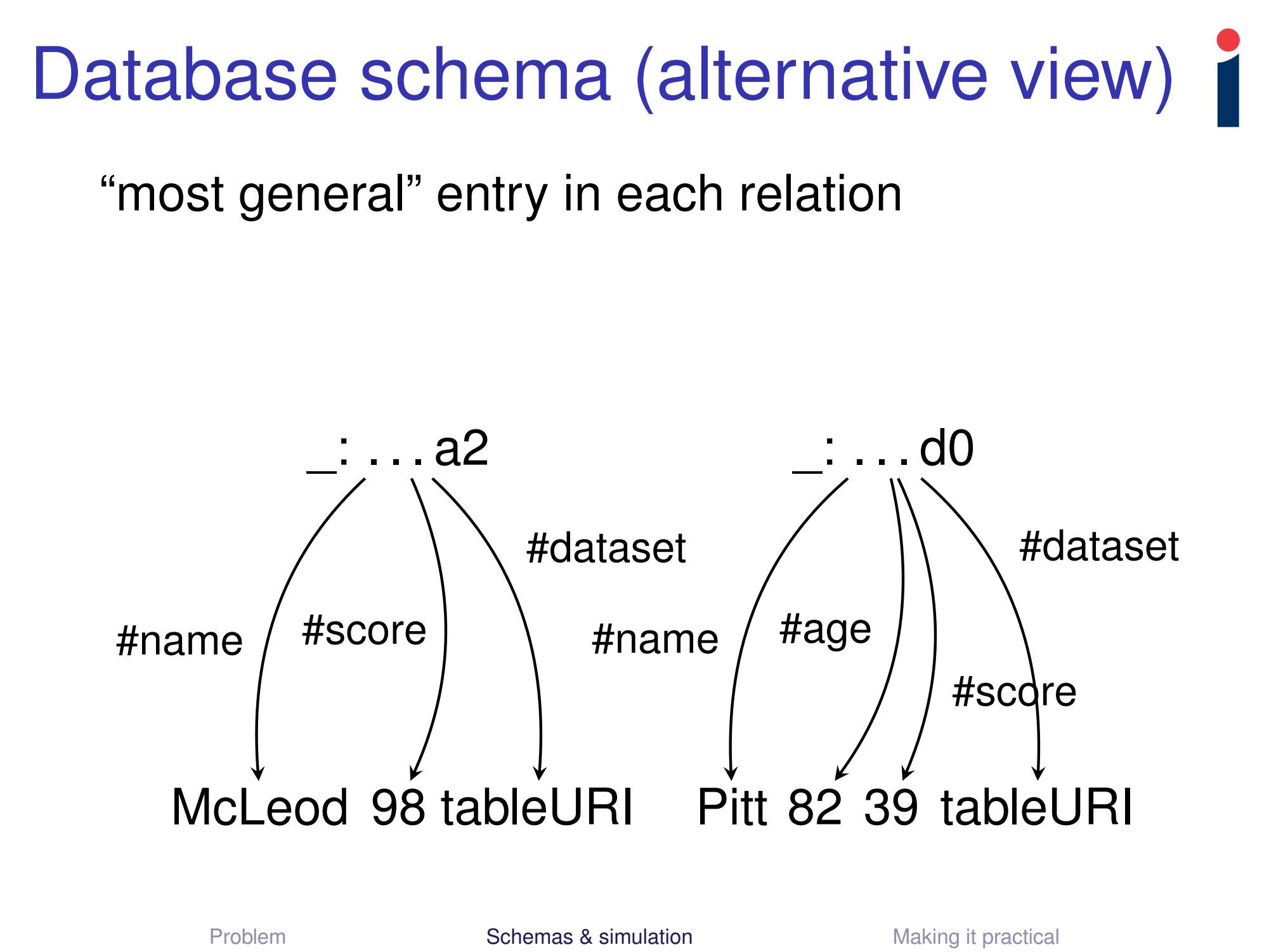
keep headings of table, throw away data (easy)

dependencies (hard)

what if table not given?

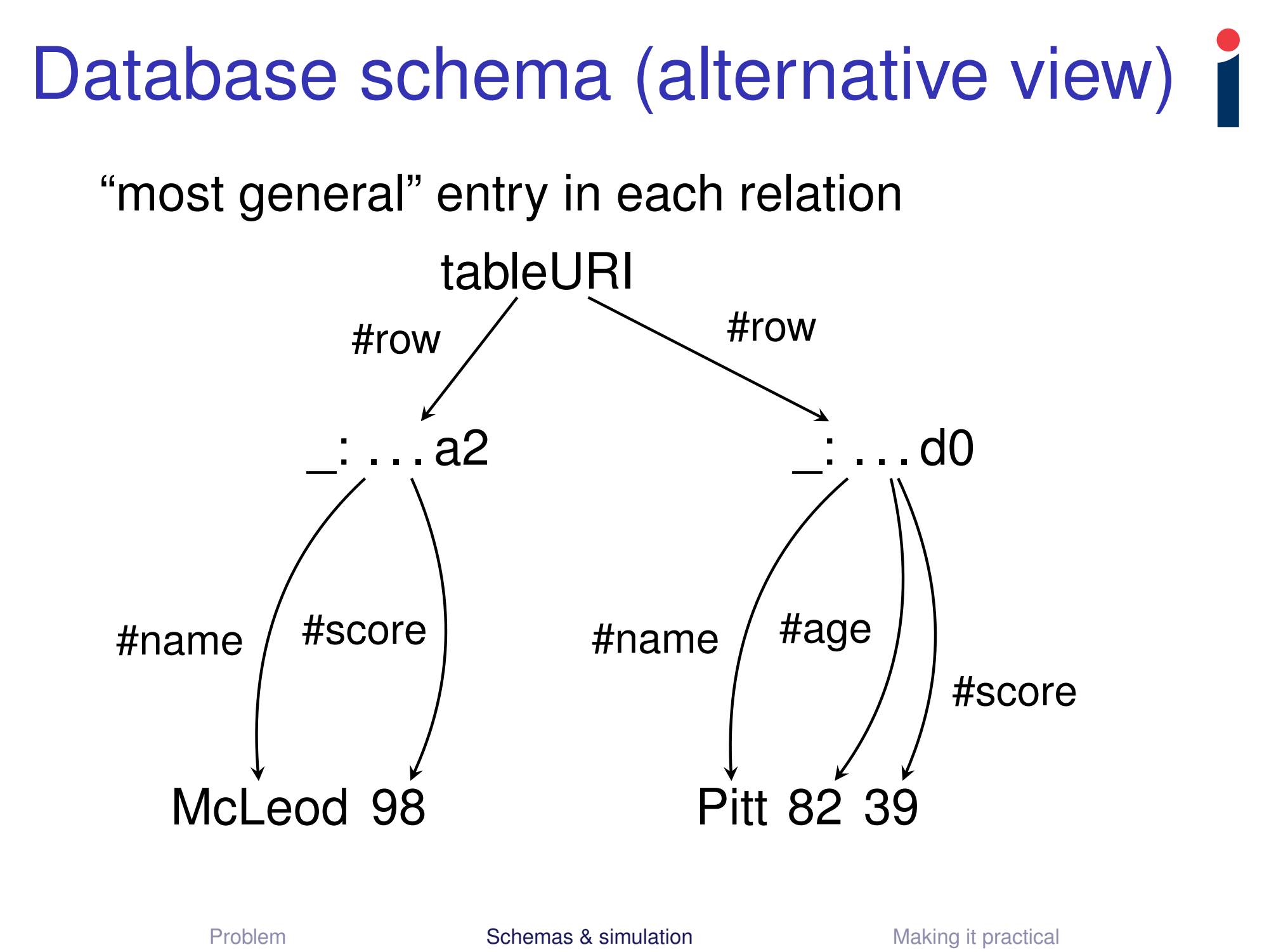
Database

Database schema (alternative view)



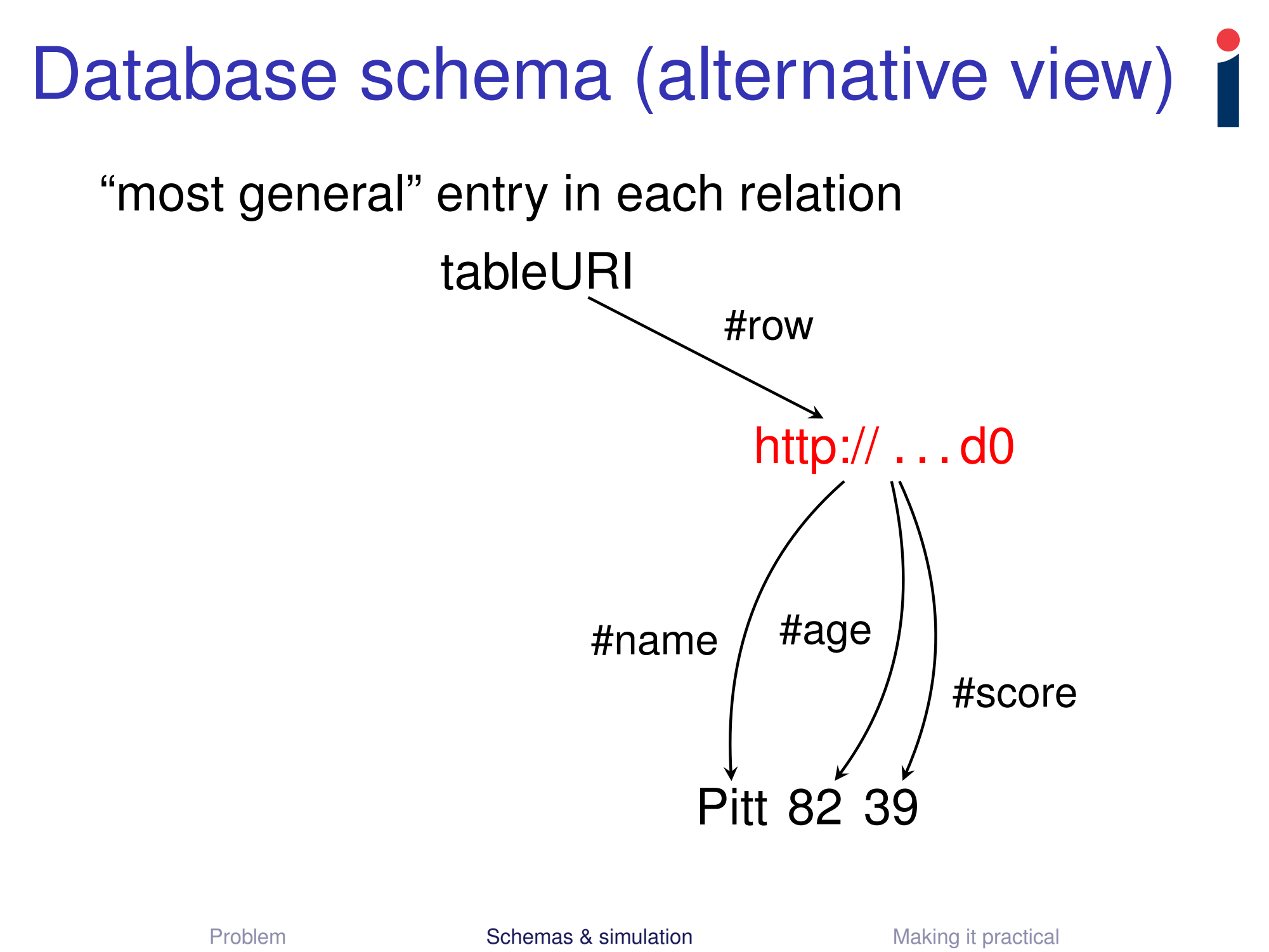
"most general" entry in each relation

Database schema (alternative view)



"most general" entry in each relation

Database schema (alternative view)



"most general" entry in each relation

Up-ended tree

Database schema (yet another view)

A *simulates* B if A is at least as general as B

keep only maximal elements in this order

quotient of RDF graph: keep only most general

Personal view

linked data is forest-like: tangled core, tree-like periphery

Personal view

linked data is forest-like: tangled core, tree-like periphery

most real RDF graphs are trees or are close to trees (Pichler, Polleres, Wei, Woltran 2008)

98.4% of connected components were trees (Mallea, Arenas, Hogan, Polleres 2011)

power-law distributions (Luo, Fletcher, Hidders, De Bra, Wu 2013)

Computer science forest

Real forest

Tangled core

Tree-like periphery

Forest-like tree

Computing largest simulation

n nodes in RDF graph ($\sim 500 \times 10^6$)
takes $O(n^3)$ time, $O(n^2)$ space
(oops. . .)

bit messy. . .

less messy

k-bisimulation

(Luo, Fletcher, De Bra, Wu, van Heeswijk @TU Eindhoven; Hidders @TU Delft; Vansummeren @ULB 2012–4; Buneman, S., Viglas, Klein, Waites @Ed 2011–2 k-step simulation)

one layer at a time (leaves and parent)

do k layers (k small)

output hashes of local schemas as stream

can do in parallel (Hadoop)

(also DAG representation of XML: Maneth/S.)

Not perfect

Not perfect

typos in predicates or dirty data: heuristics, ML

relies on sorting (but incremental updates OK)

literals not always equivalent: type inference

needs row with all attributes: concept analysis

can’t touch tangled core

Conclusion

dynamic schema discovery works well

"k-bisimulation" (k-step simulation)

ongoing work