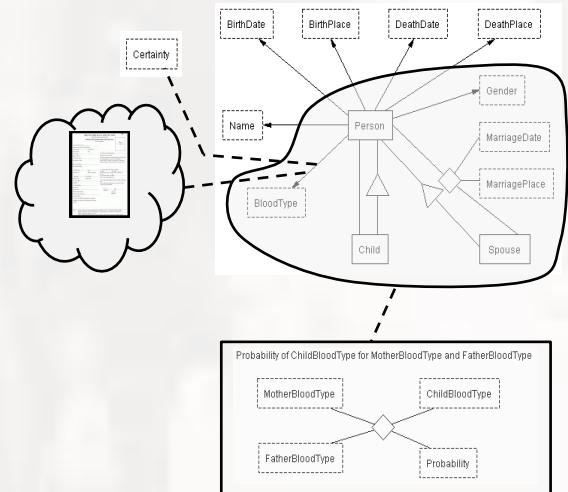


A Superstructure for Organizing Family History Information

David W. Embley

Scott N. Woodfield



Often a computer is little more than
an electronic filing clerk.

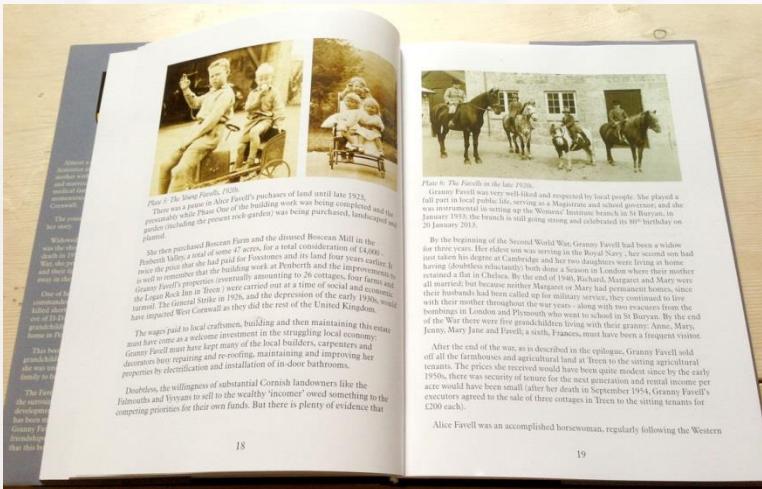


To make computers do more (especially for family history), they must:

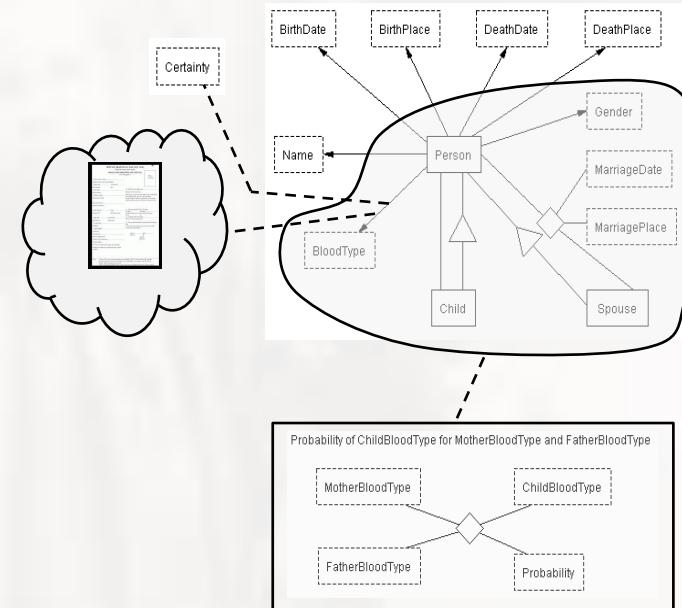
- Automatically process
 - Certainty information
 - Conflicting information
- Support
 - Evidence-based family history research
 - Automated collaboration
- Provide automated research guidance

Our solution is inspired by how people think.

gather information

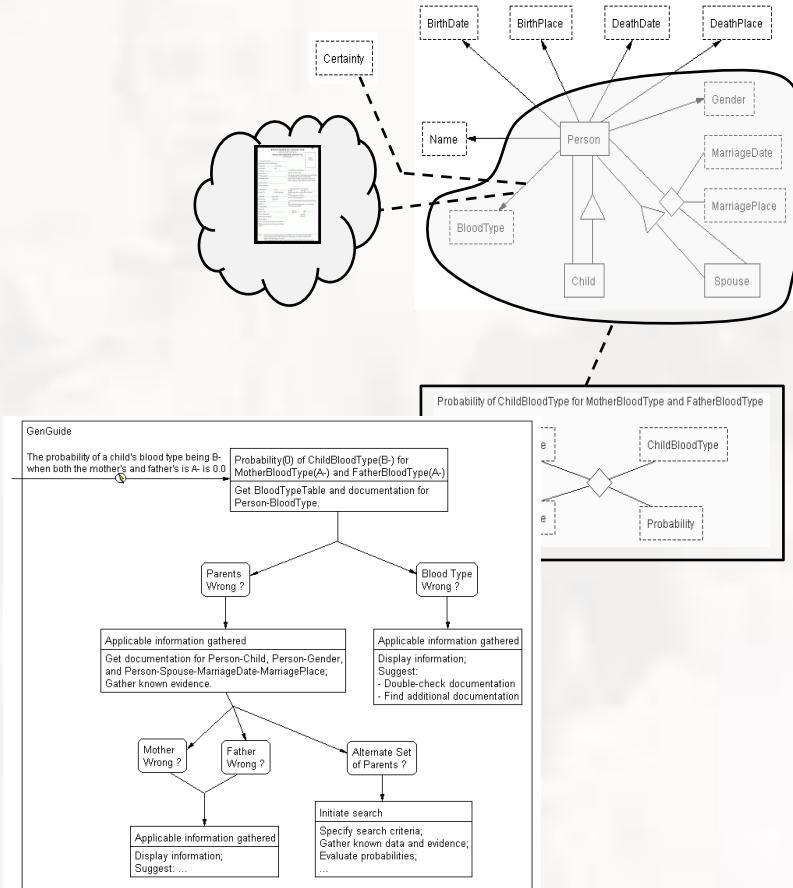


conceptualize



A Proposed Superstructure

- Seven Layers*
- Symbol
- Class
- Information
- Knowledge
- Evidence
- Communication
- Action
- Wisdom



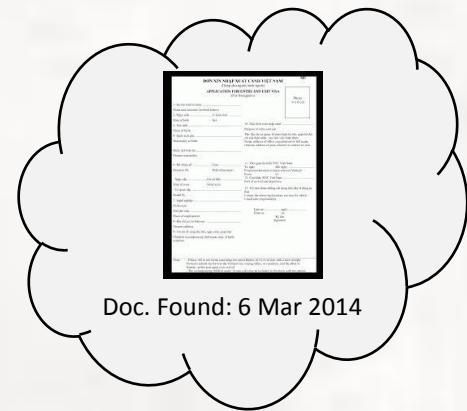
* Charles T. Meadow and others

Our Story

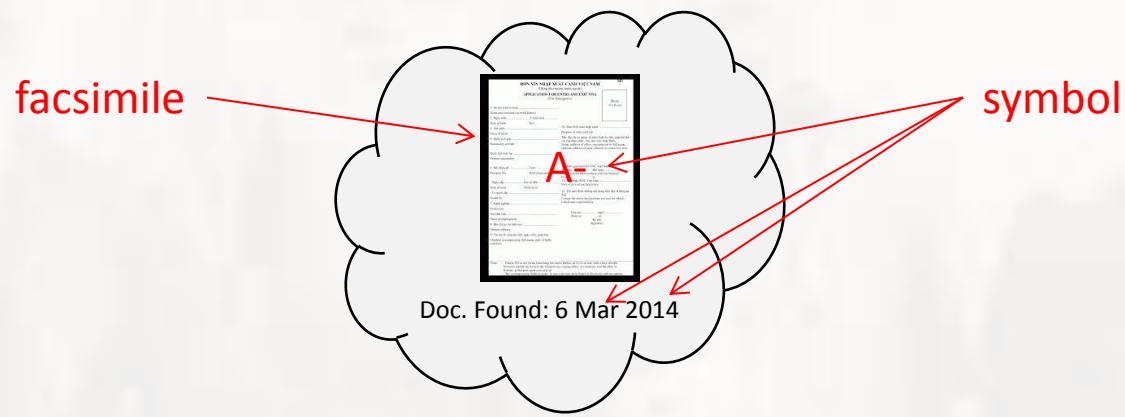


Our Story

Symbol



Symbol



Class

```
BloodType
```

BloodType

external representation:

`\b(A+|A-|B+|B-|AB+|AB-|O+|O-)\b`

context keywords: `\b[Bb]lood\s[Tt]ype\b`

input method: BloodTypeToString

output method: StringToBloodType

operator methods:

`CanDonateTo(x:BloodType, y:BloodType)`

returns Boolean

end

Class

BloodType

regular-expression recognizer for reading text

external representation: $\b(A+|A-|B+|B-|AB+|AB-|O+|O-)\b$

context keywords: $\b[Bb]lood\s[Tt]ype\b$

input method: BloodTypeToString ← **read & store**

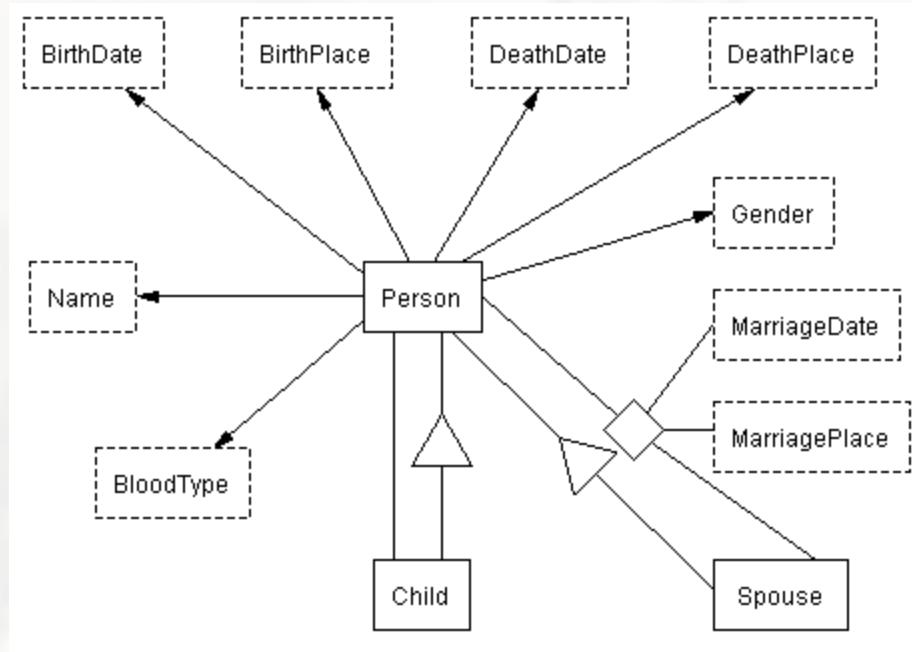
output method: StringToBloodType ← **write to text**

operator methods:

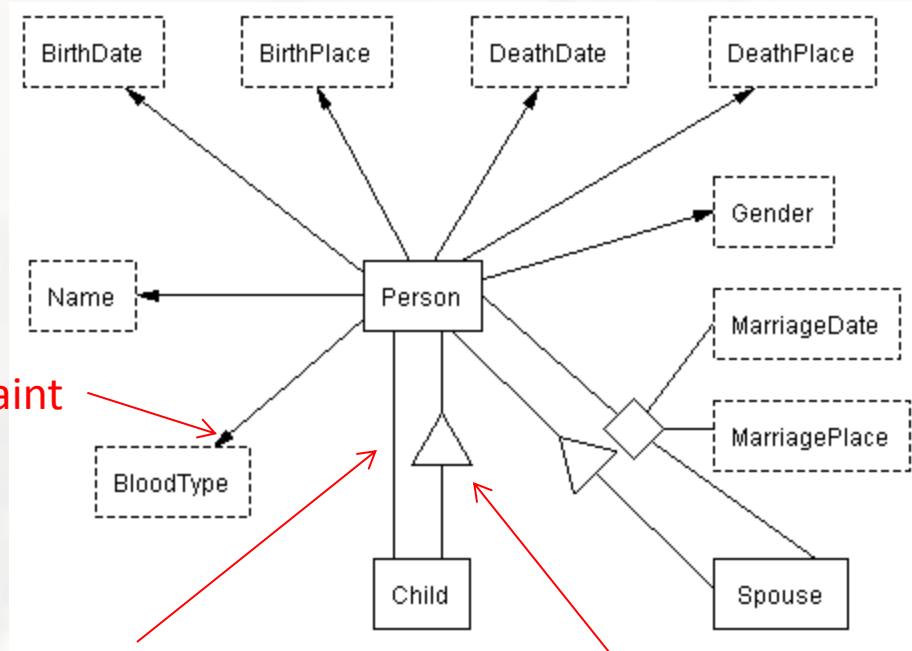
CanDonateTo(x:BloodType, y:BloodType)
 returns Boolean ← **operate/compute**

end

Information



Information

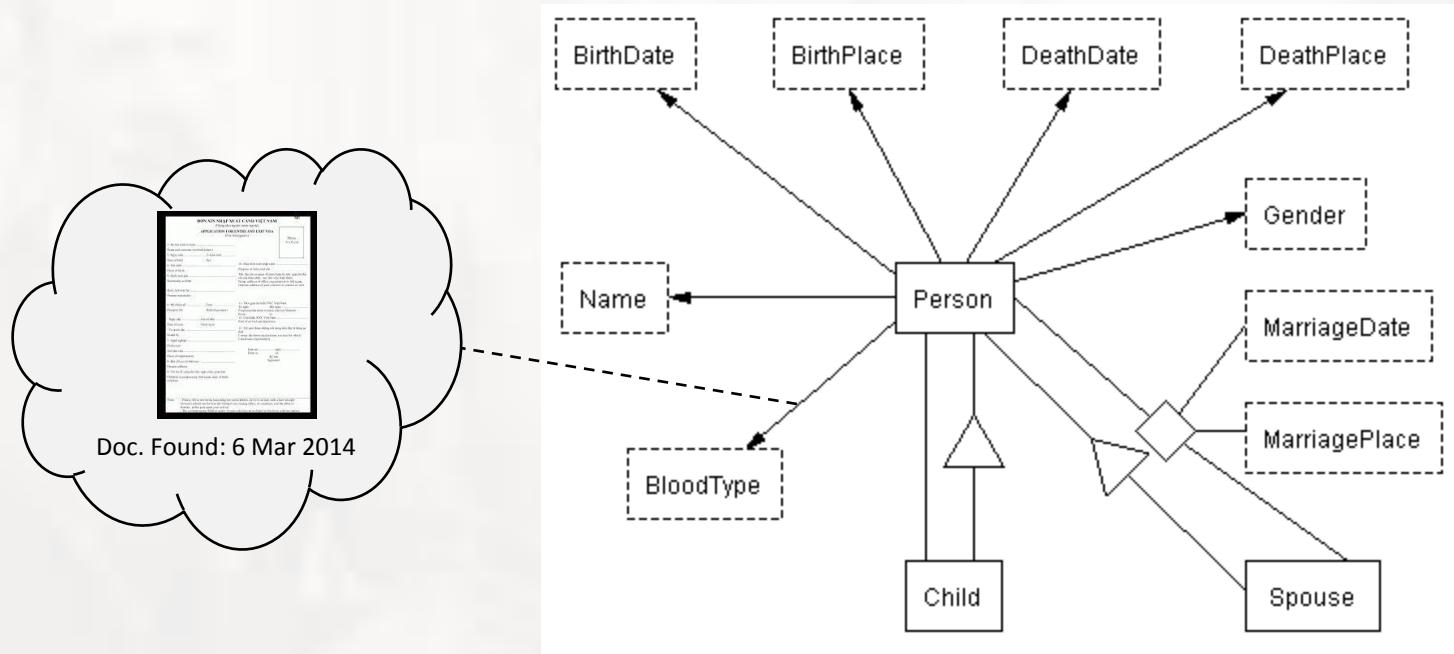


functional constraint

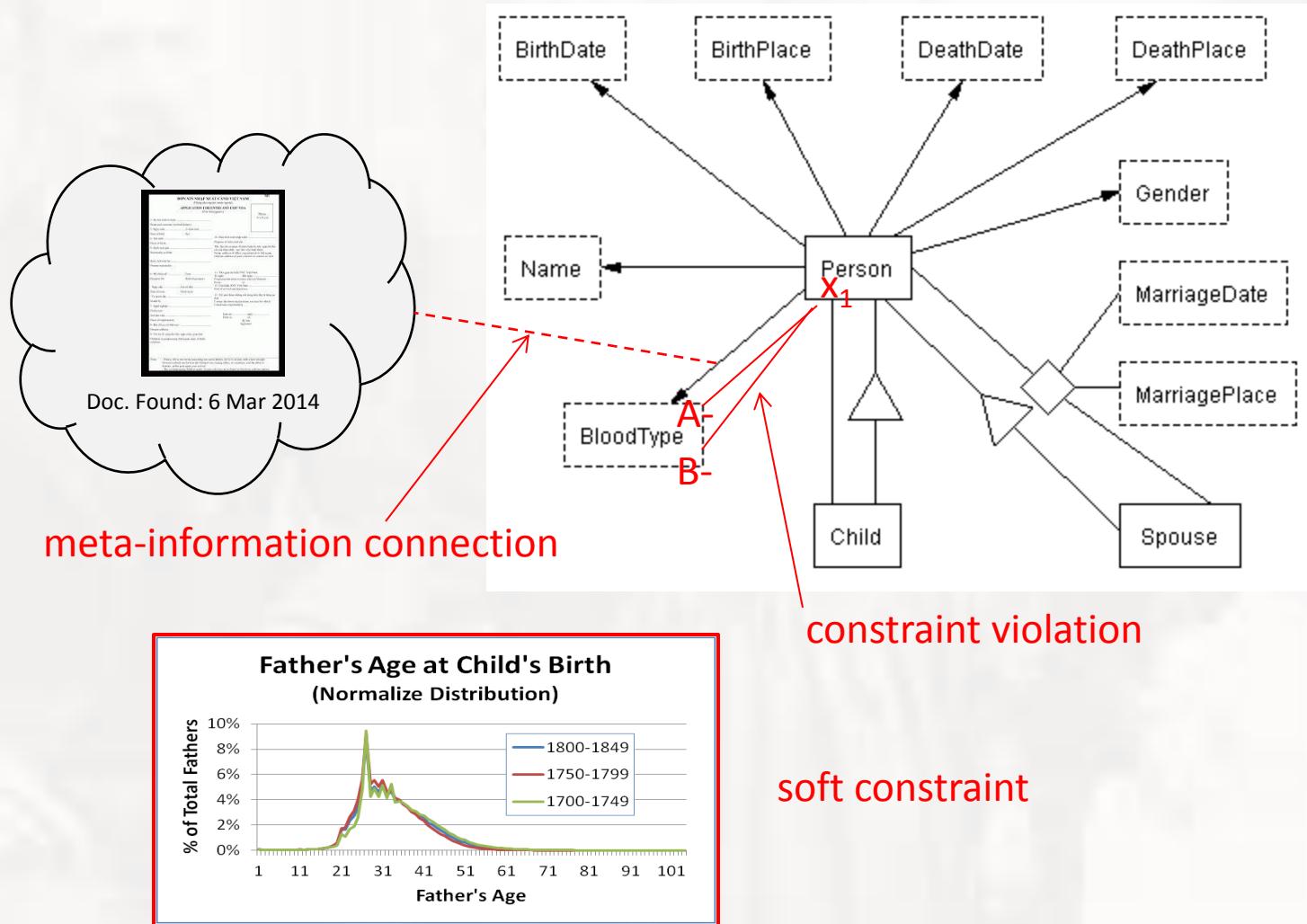
relationship set

Generalization/specialization,
“isa” constraint

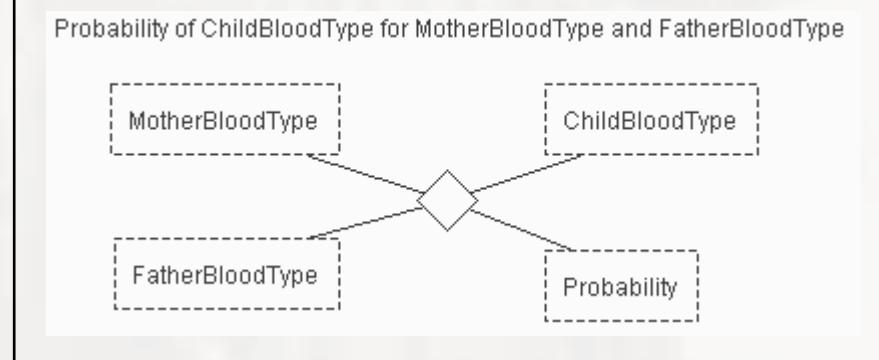
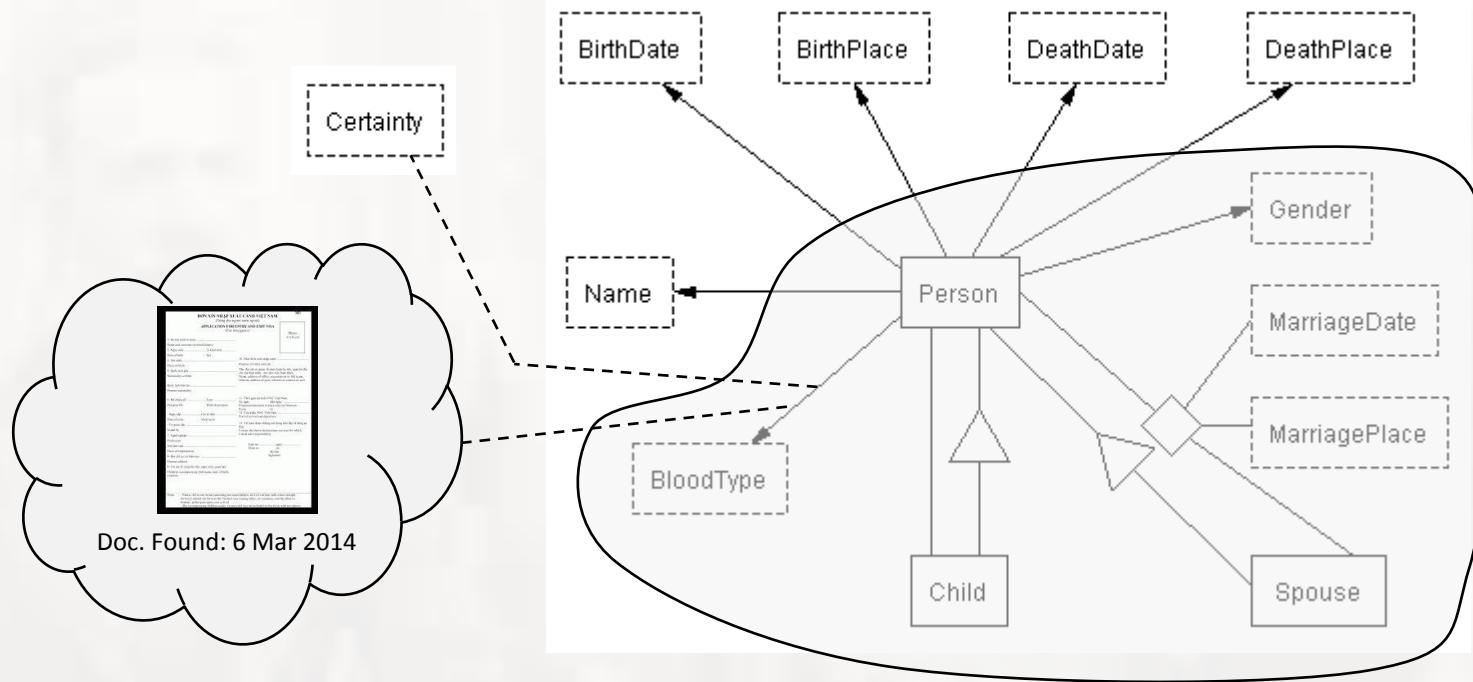
Knowledge



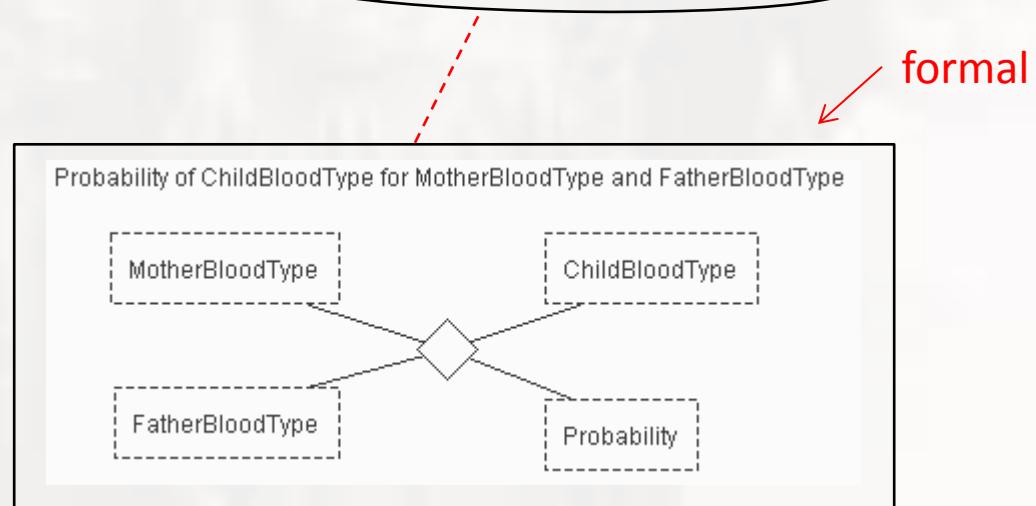
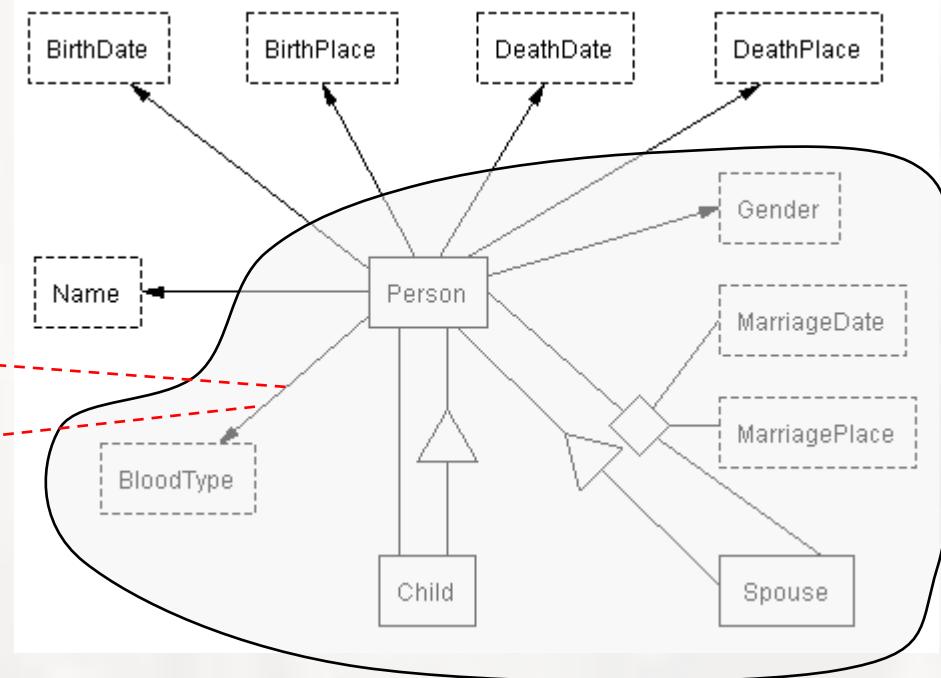
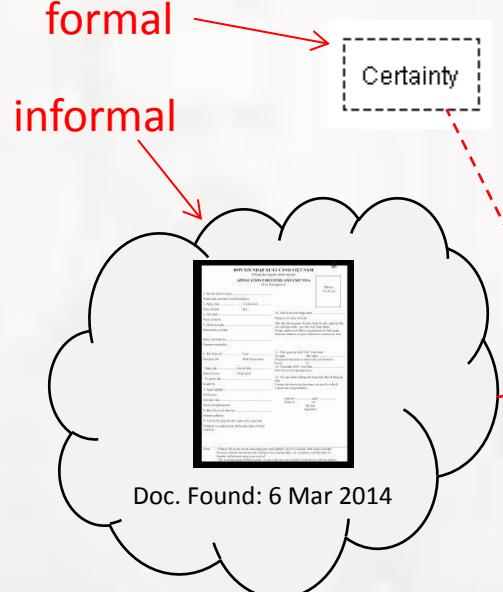
Knowledge



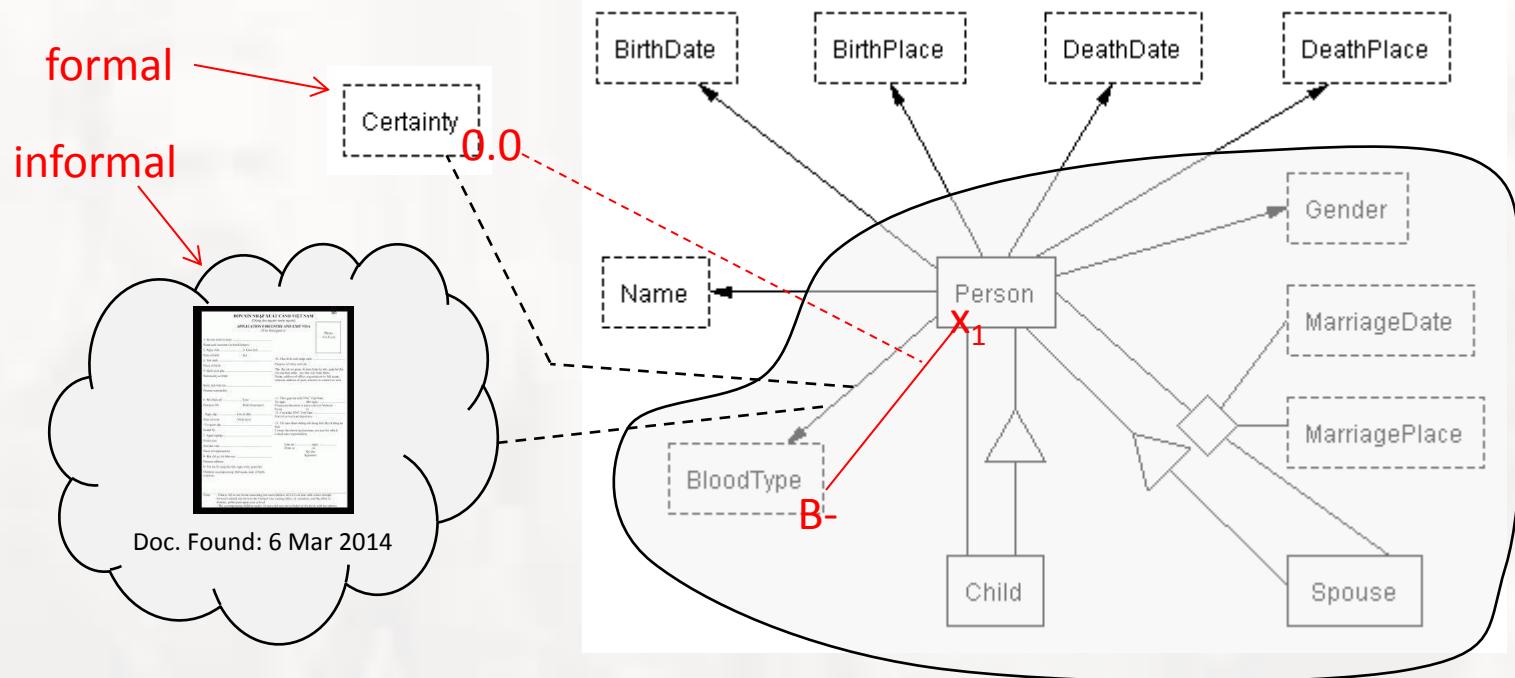
Evidence



Evidence

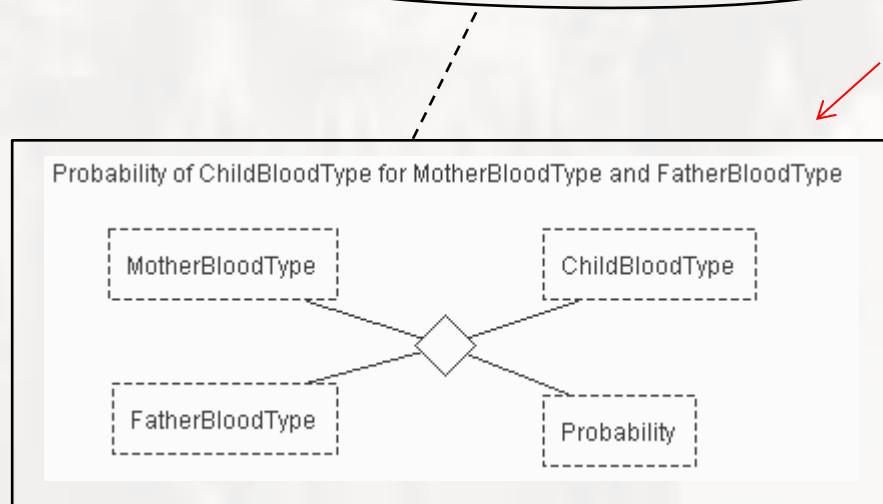


Evidence

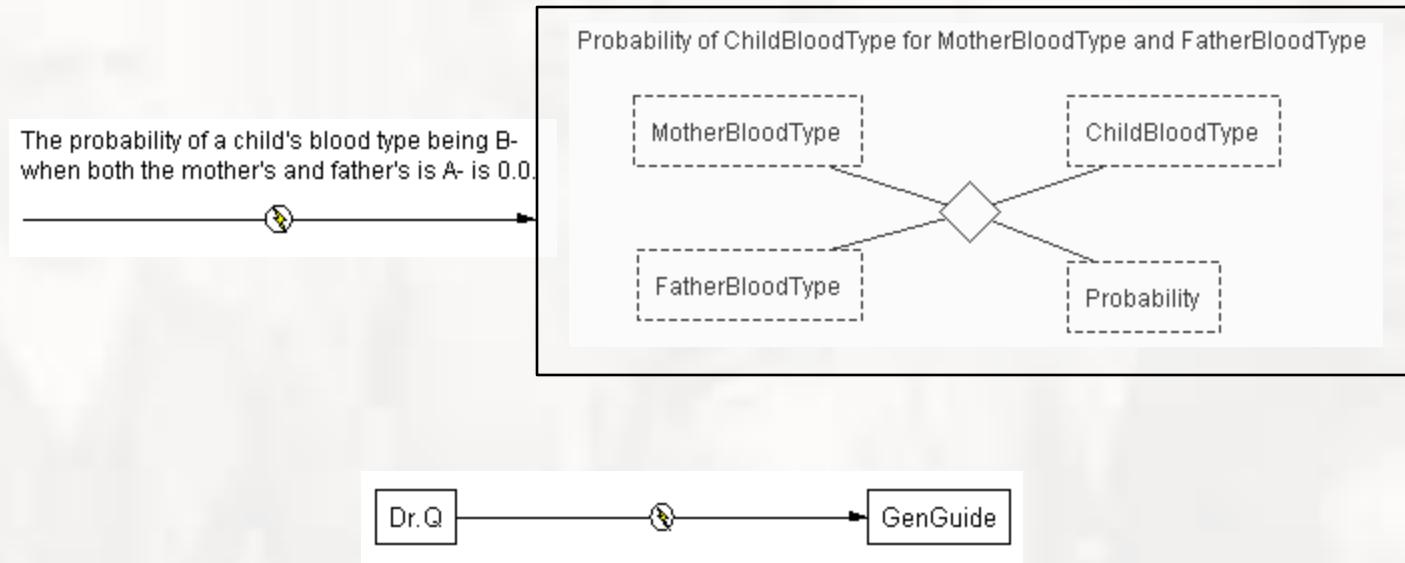


Reasoning with the evidence:

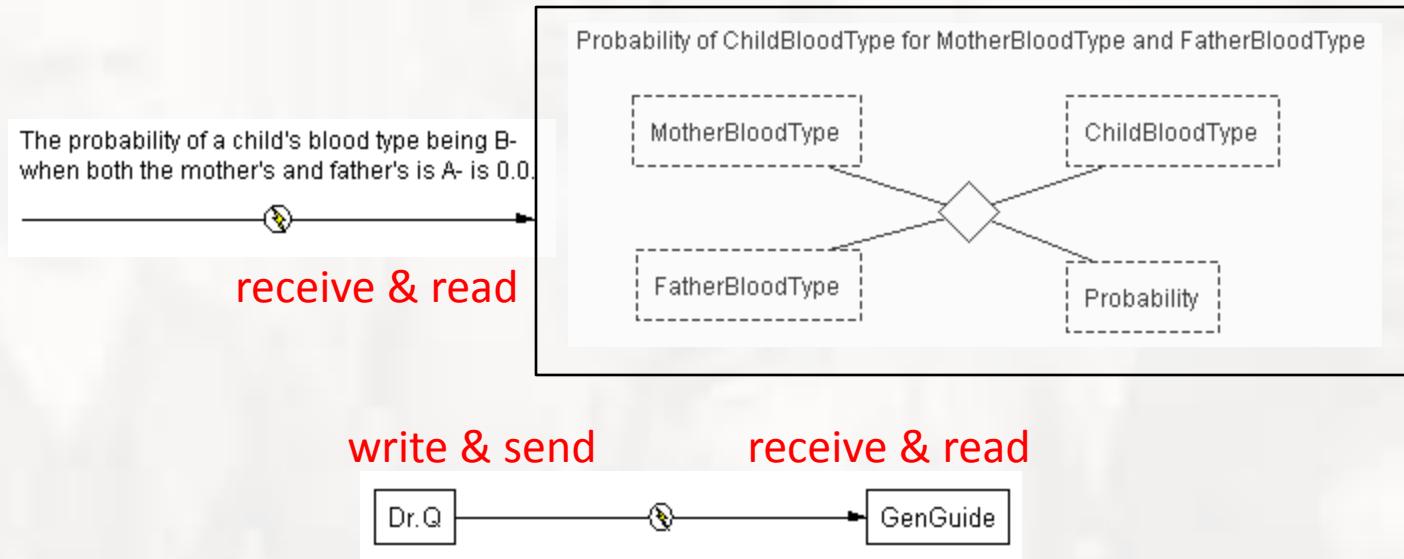
$\text{Person}(x_1)\text{-BloodType}(x_2)$,
 $\text{Person}(x_3)\text{-BloodType}(x_4)$, $\text{Person}(x_5)\text{-BloodType}(x_6)$,
 $\text{Child}(x_1)\text{-Person}(x_3)$, $\text{Person}(x_3)\text{-Gender('F')}$,
 $\text{Child}(x_1)\text{-Person}(x_4)$, $\text{Person}(x_4)\text{-Gender('M')}$,
 $\text{Probability}(x_7)\text{-of-ChildBloodType}(x_2)\text{-and-}$
 $\text{MotherBloodType}(x_4)\text{-FatherBloodType}(x_6)$,
 \rightarrow
 $\text{Certainty}(x_7)\text{---Person}(x_1)\text{-BloodType}(x_2)$



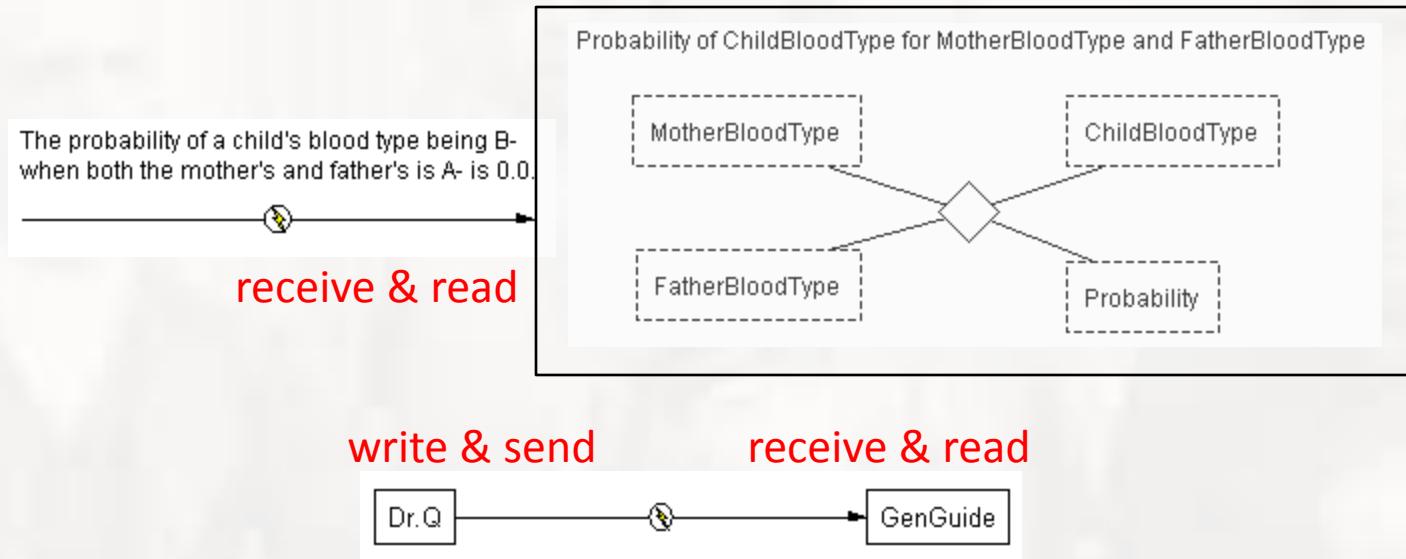
Communication



Communication



Communication



model structure:

```
Probability[1:*] of ChildBloodType[1:*] for MotherBloodType[1:*] and FatherBloodType[1*]  
end;
```

model instance:

```
Probability(93.75%) of ChildBloodType(A-) for MotherBloodType(A-) and FatherBloodType(A-);  
Probability(6.25%) of ChildBloodType(O-) for MotherBloodType(A-) and FatherBloodType(A-);  
...
```

```
end;
```

Action

GenGuide

The probability of a child's blood type being B- when both the mother's and father's is A- is 0.0

Probability(0) of ChildBloodType(B-) for MotherBloodType(A-) and FatherBloodType(A-)

Get BloodTypeTable and documentation for Person-BloodType.

Parents Wrong ?

Blood Type Wrong ?

Applicable information gathered

Get documentation for Person-Child, Person-Gender, and Person-Spouse-MarriageDate-MarriagePlace; Gather known evidence.

Applicable information gathered

Display information;
Suggest: _____
- Double-check documentation
- Find additional documentation

Mother Wrong ?

Father Wrong ?

Alternate Set of Parents ?

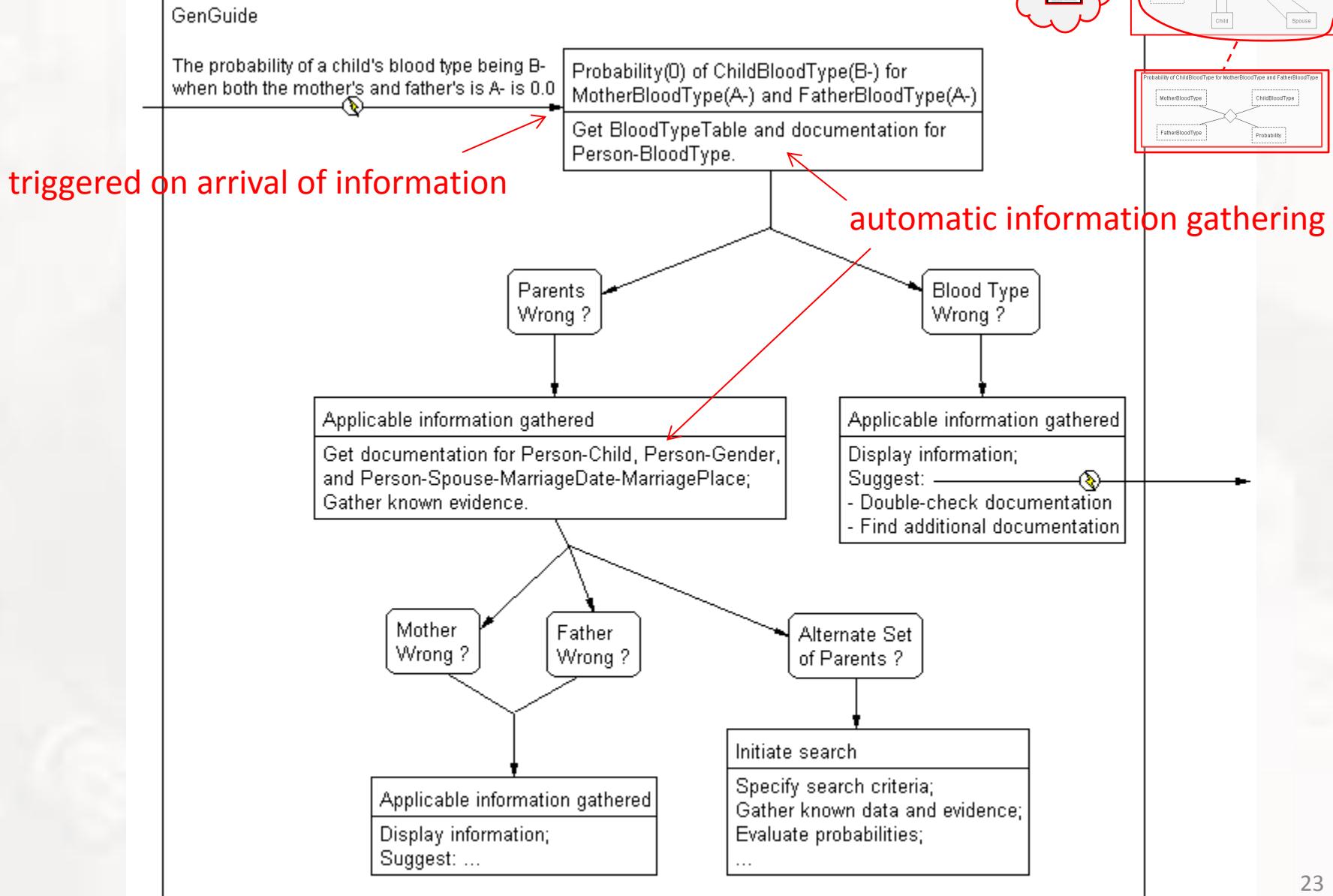
Applicable information gathered

Display information;
Suggest: ...

Initiate search

Specify search criteria;
Gather known data and evidence;
Evaluate probabilities;
...

Action



Wisdom

- The proper application of
 - Knowledge
 - Evidence (Truth)
 - Communication
 - Action
 - When Properly Applied
 - Record and process richer information
 - Perform evidence-based reasoning
 - Collaborate effectively
 - Semi-automate family history research
- 
- Upper 4 superstructure layers