Insurance Portfolio Management

Michael Genesereth
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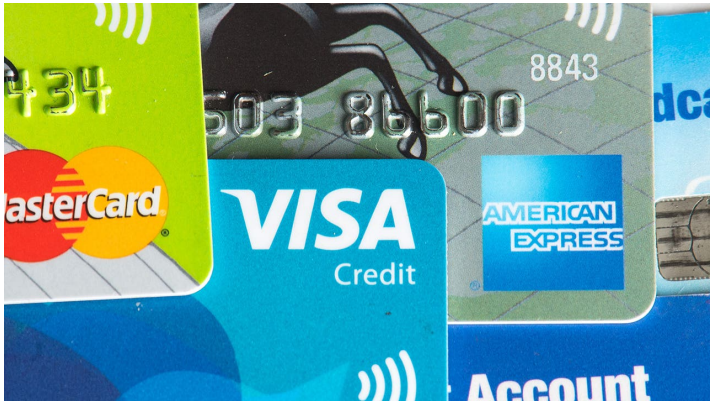
Stanford University

Insurance Policies



Insurance Portfolio Management

Insurance portfolio management (IPM) is the process of managing *overlapping insurance policies* with an eye to *minimizing insurance costs* while *ensuring adequate coverage*.

Example

INSURANCE
POLICY
SHOULD I GET
RENTAL CAR
INSURANCE?
Tips for Bu
8843
VISA
Credit
AMERICAN
EXPRESS

Complexity of Insurance Policies

Policies are complex, incomplete, inconsistent.

CodeX Insurance Analyst

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Sign Out

Products

Click on the link to **view** available insurance products.

People

Click on the link to **view** or **add** people you would like to include on your policies.

Policies

Click on the link to **view**, **add**, or **analyze** policies.

Properties

Click on the link to **view** or **add** properties that are insured or that you wish to insure (automobiles, houses, etc.).

Claims

Click on the link to **view**, **add**, or **analyze** claims.

Events

Click on the link to **view** recorded events (accidents, fires, etc.) or to **record** new events.

Feedback

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Product	Insurer	Actions
aflac_hospital_cash	aflac	
axa_travel_policy	axa	
calcas_auto_insurance	calcas	
chubb_hospital_cash	chubb	
codex_plana	codex	
codex_planb	codex	
codex_planc	codex	
codex_pland	codex	
codex_plane	codex	
codex_planf	codex	
codex_plang	codex	
codex_planh	codex	
hertz_rental_insurance	hertz	
lifesecure_hospital_cash	lifesecure	
visa_signature	visa	

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Policies

Policy	Insurer	Type	Insuree	Begin	End	Actions
policy1234567821	chubb	chubb_hospital_cash	steve_squirrel	2021_01_01	2021_12_31	
policy1234567822	axa	axa_travel_policy	sally_squirrel	2021_01_01	2021_12_31	
policy1234567831	codex	codex_plana	steve_squirrel	2021_01_01	2021_12_31	
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policy1234567834	codex	codex_pland	steve_squirrel	2021_01_01	2021_12_31	
policy1234567841	visa	visa_signature	sally_squirrel	2021_01_01	2021_12_31	

Add Policy

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Claims			
Claim	**Event**	**Recommendation**	**Justification**
claim21	hospitalization21	decline	Explain
claim22	hospitalization22	pay	Explain
claim31	repair31	pay	Explain

Add Hospitalization Add Repair

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Claim Information

Claim: claim21 New
Event: hospitalization21 New
Date: 2021_11_30

Hospitalization Detail

Patient: sally_squirrel Diagnosis: sprained_ankle
Hospital: Johns Hopkins Medical Center Physician: Dr. Kildare
Date Admitted: 2021_08_23 Time Admitted: 10:00 pm
Date Discharged: 2021_08_24 Time Discharged: 10:00 am
WARNING: Your hospital stay was less than 24 hours. You will not be covered for this claim.
Was hospitalization recommended by a practicing physician? Yes
What was the cause of the condition requiring hospitalization? accident21 New

Accident Information

Id: accident21
Subject: sally_squirrel
Activity: Dancing
Country: usa
Date: 2021_08_23

Load Save

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Products | Policies | Claims | People | Properties | Events

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Claim Information

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Hospital: Johns Hopkins Medical Center Physician: Dr. Kildare
Date Admitted: 2021_08_23 Time Admitted: 10:00 pm
Date Discharged: 2021_08_24 Time Discharged: 10:00 pm
Was hospitalization recommended by a practicing physician? Yes
What was the cause of the condition requiring hospitalization? accident21 New

Accident Information

Id: accident21
Subject: sally_squirrel
Activity: Skydiving
WARNING: Your accident is due to an extreme activity. You will not be covered for this claim.
Country: usa
Date: 2021_08_23

Load Save

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Add Policy

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Provisions

```
covers(policy1234567831,Z) :-
  hospitalization.patient(Z,steve_squirrel) &
  hospitalization.hospital(Z,V72) &
  hospital.country(V72,usa) &
  hospitalization.startdate(Z,V73) &
  hospitalization.enddate(Z,V74)
```

```
covers(policy1234567831,Z) :-
  hospitalization.patient(Z,V80) &
  person.spouse(V80,steve_squirrel) &
  hospitalization.hospital(Z,V81) &
  hospital.country(V81,usa) &
  hospitalization.startdate(Z,V82) &
  hospitalization.enddate(Z,V83)
```

```
covers(policy1234567831,Z) :-
  hospitalization.patient(Z,V89) &
  person.parent(V89,steve_squirrel) &
  hospitalization.hospital(Z,V90) &
  hospital.country(V90,usa) &
  hospitalization.startdate(Z,V91) &
  hospitalization.enddate(Z,V92)
```

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Products | Policies | Claims | People | Properties | Events

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☐	policy1234567841	visa	visa_signature	sally_squirrel	2021_01_01	2021_12_31	
☐	policy1677517451	codex	codex_planh	steve_squirrel	2021_01_01	2021_12_31	

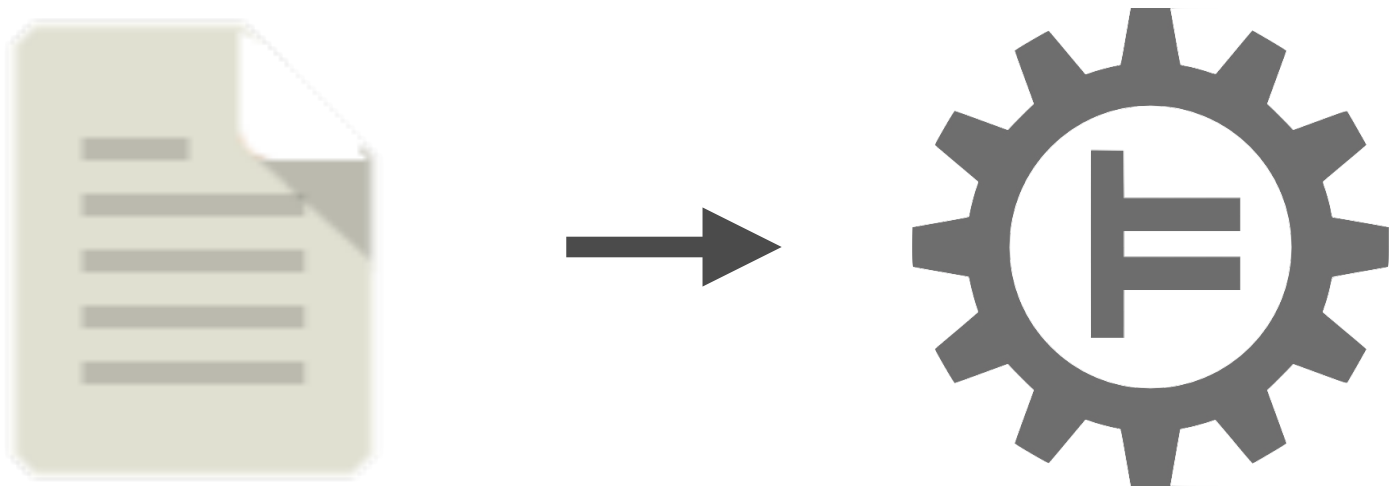
Provisions

✔

```
covers(policy1234567841,Z) :-
  repair.vehicle(Z,v1234) &
  collision.vehicle(V166,v1234) &
  collision.country(V166,usa)
```

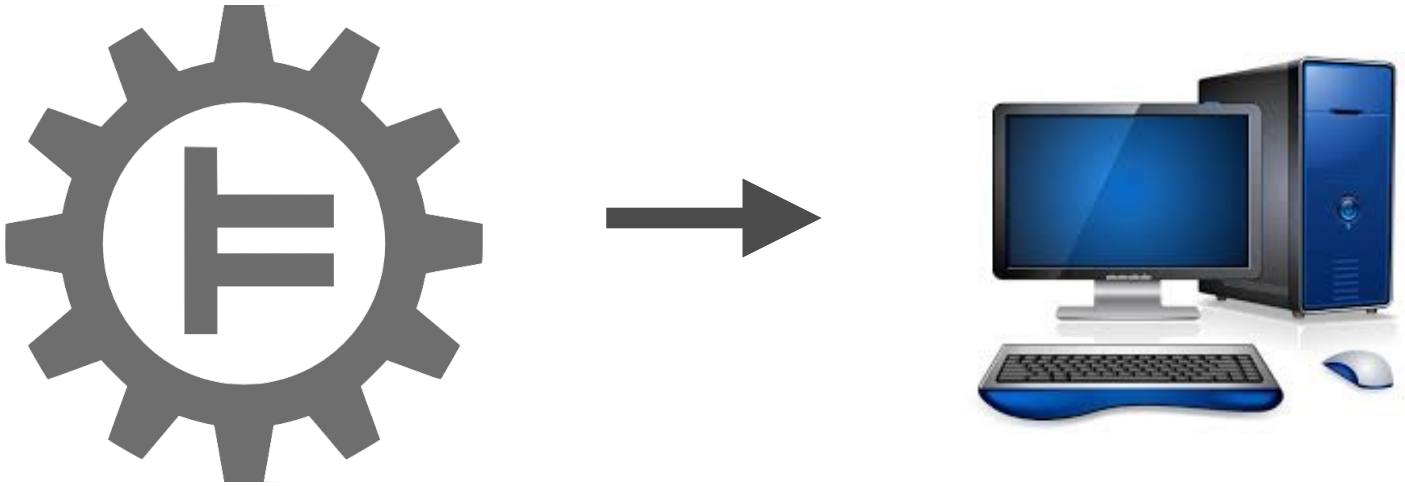
Feedback

Computable Contracts



From Textual Policies to Computable Contracts

Contract Automation



Automating Insurance Processes

Formal, Declarative Representation

Definitions of Concepts (Ontologies)

A grandparent is a parent of a parent.

```
grandparent(X,Z) :- parent(X,Y) & parent(Y,Z)
```

Constraints

Parents are older than their children.

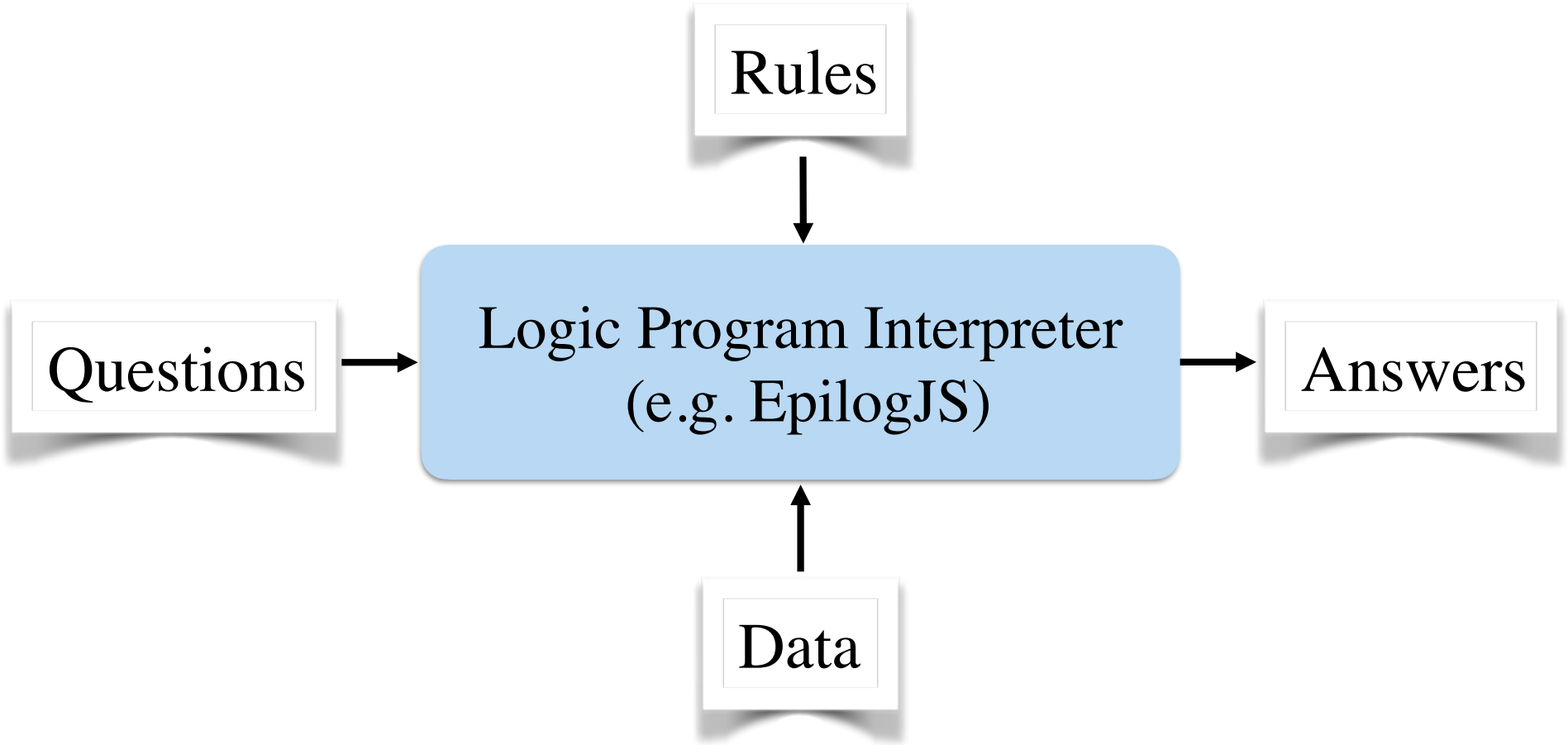
```
illegal :- parent(X,Y) & age(X)<age(Y)
```

Policies - Definitions of Coverage

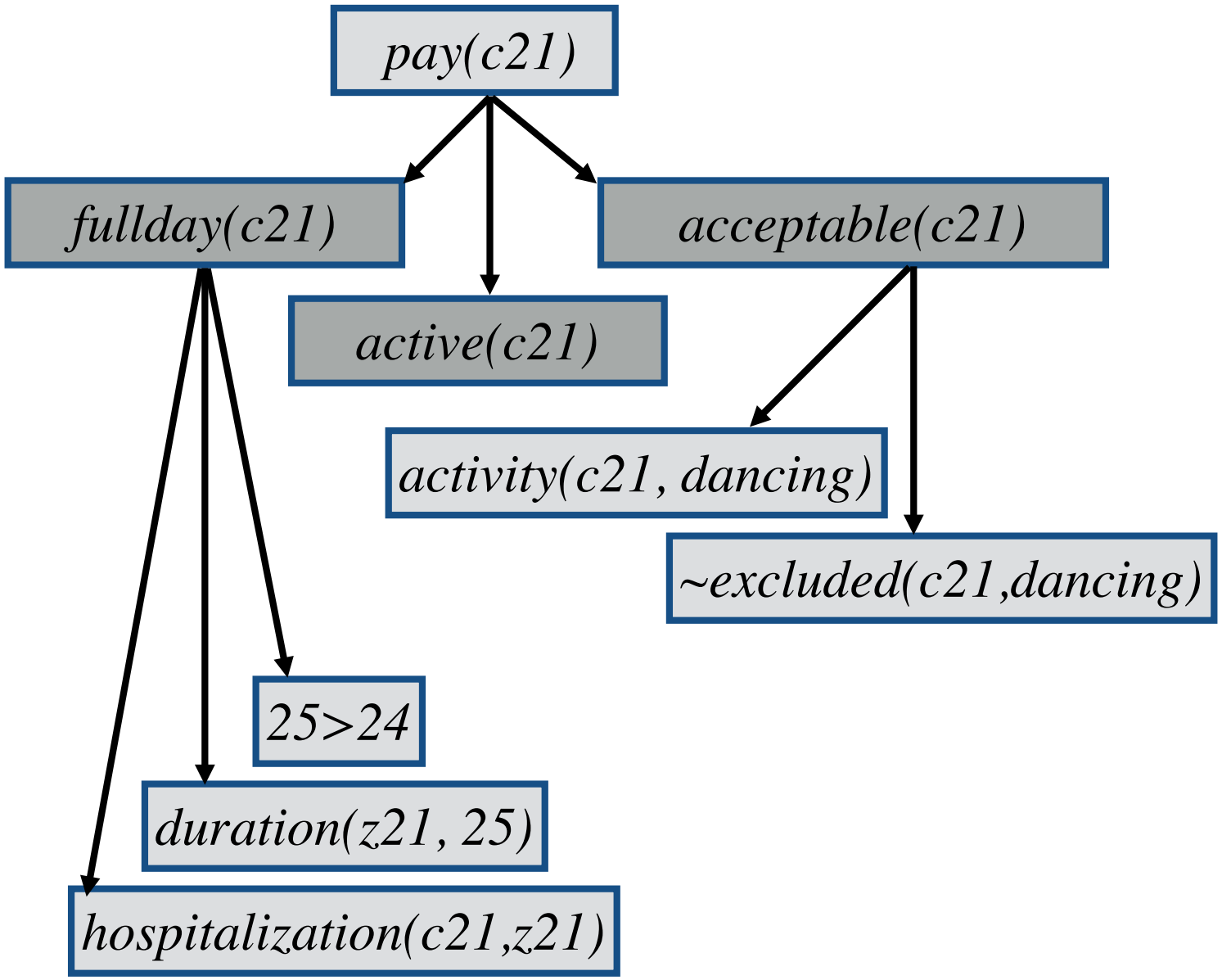
Policy 1 covers all hospitalizations in the usa.

```
covers(policy1,H) :- location(H,usa)
```

Logic Programming Interpreter



Derivation Trees



Template-Based NL Generation

Templates:

`fullday(X)`	→	*"Claim* X *is full day"*
`hospitalstay(X,Z)`	→	*"the hospital stay of* X *is* Z"
`duration(Z,H)`	→	*"the duration of* Z *is* H *hours"*
`H>J`	→	"H *is greater than* J"

Derivation Tree:

```
fullday(c21) :-
 hospitalstay(c21,z21)&
 duration(z21,25)&
 25>24
```

Explanation:

Claim c21 is full day because
the hospital stay of c21 is z21 and
the duration of z21 is 25 hours and
25 is greater than 24.

In progress: Pronouns, prepositional phrases, relative clauses

Contract Definition Language (CDL)

View Definition Language (Epilog)

terms of coverage in terms of domain concepts

definitions of concepts in terms of available data

Contract / Insurance Ontology (in progress)

offer, acceptance, consideration, etc.

premiums, claims, claim lines, deductibles, exclusions

Domain Ontology and Data (in progress)

e.g. diseases, drugs, medical procedures, etc.

e.g. fenders, radiators, repair procedures, etc.

e.g. walls, external water, internal water, etc.

Contract IDE

Contractnet

Background Datasets

Geography
Hospitals

Background Rulesets

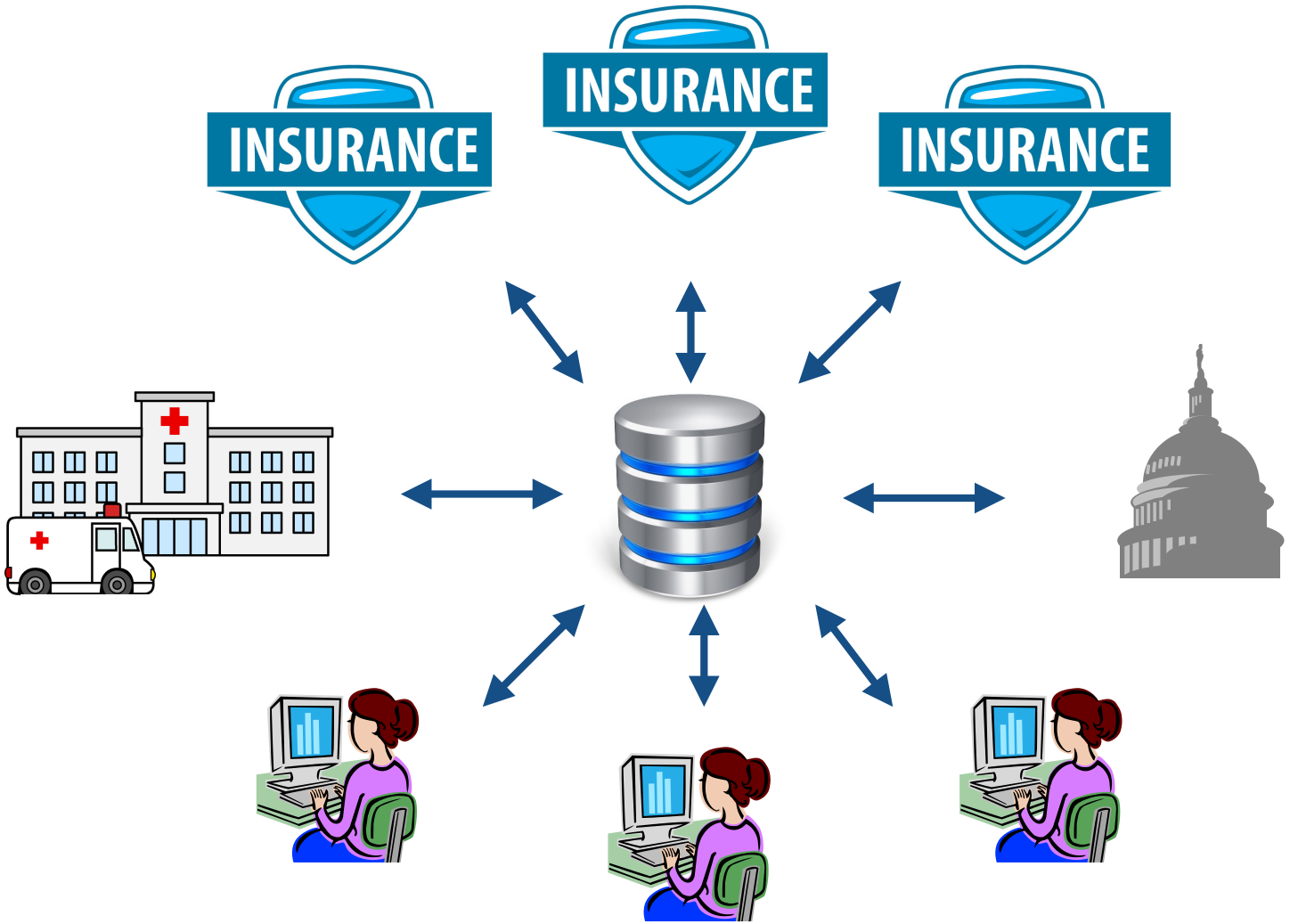
e.g. a week is 7 days
e.g. parents are older than their children

Open-Source Contract Processing Software

Compliance checking (EpilogJS)
Explaining contractual analysis (ExplainJS, EnglishJS)
User Worksheets (WorksheetsJS)
Containment Testing and Configuration Aids (TBD)

Github for Computable Insurance Contract Software

CodeX Insurance Ecosystem



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CodeX Insurance Analyst for Businesses

Products

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Events

Click on the link to **view** recorded events (accidents, fires, etc.) or to **record** new events.

CodeX Insurance Analyst for Insurance Companies

Products

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Policies

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The Stanford Center for Legal Informatics

Legal Empowerment through Information Technology