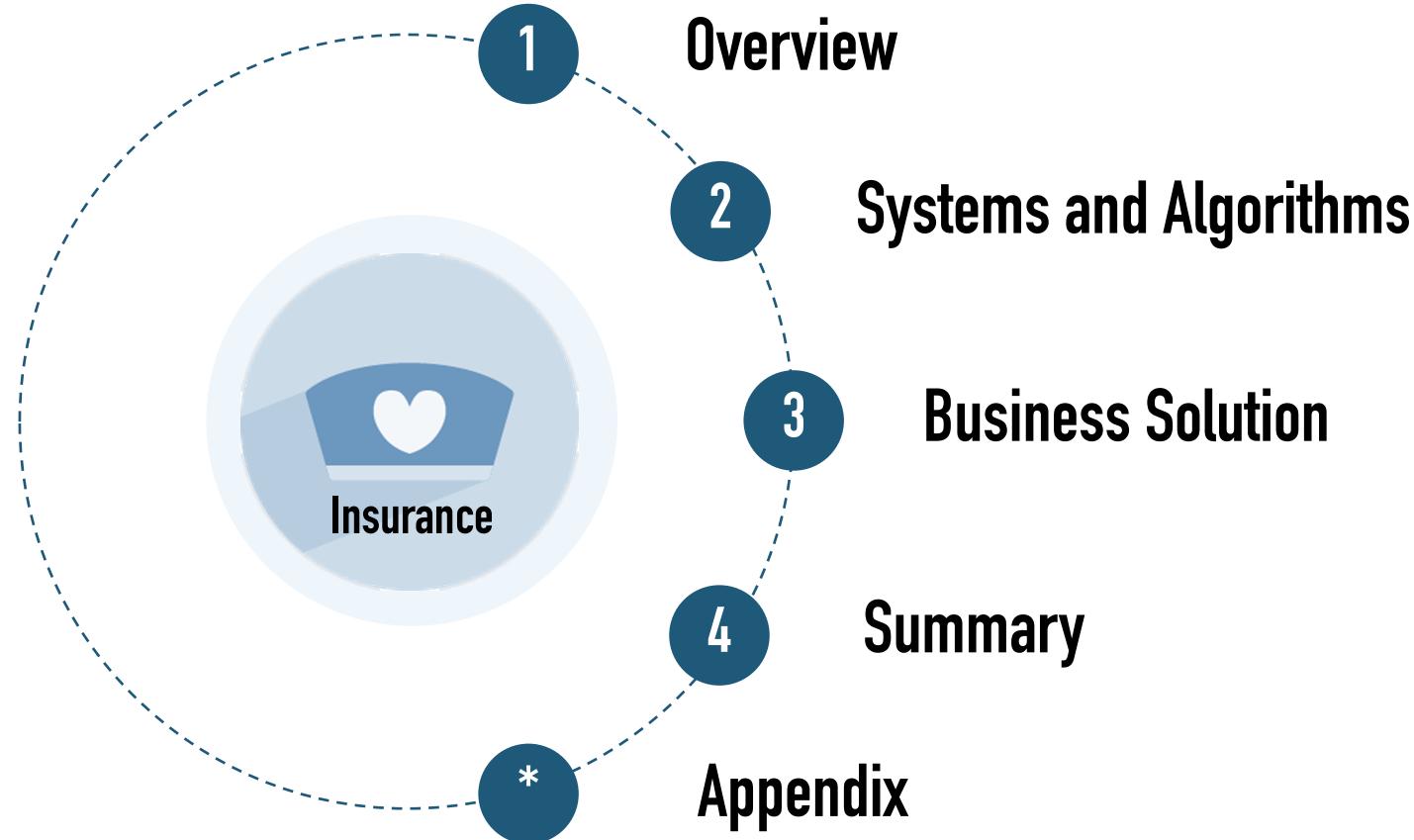


2019  
KPMG

# Figure The Knowledge

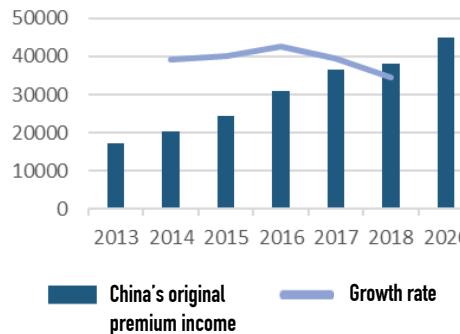
# Contents



## Insurance Plays an Increasingly Important Role in Society of China

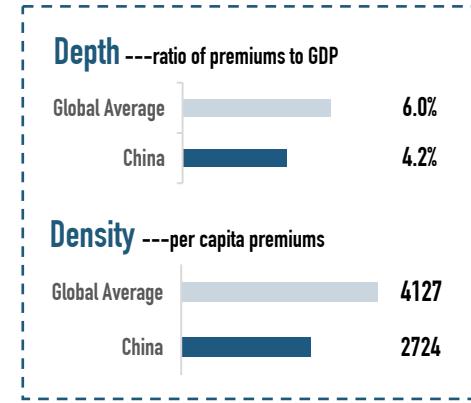
### 1 National Background

- China's insurance industry developed rapidly.
- The goal in "13th Five-Year Plan": national insurance premium income will reach 4.5 trillion yuan in 2020.



### 2 Industry

- The public acceptance of insurance is increasing.
- Per capita policy holdings and per capita premium expenditures increased year by year.
- The depth of the insurance market and density still have much room for development.



### 3 Product

- China's current insurance market shows a trend of optimization.
- But the structure still needs to be adjusted and optimized.



### 4 Social Value

- Providing retirement, medical and property protection.
- Preventing loss and encouraging a healthy lifestyle.



## Company Insight

### Insurance Companies Often Have Complex Business Process

#### PRODUCT

- Product Design
- ✓ Determine the functions and terms
- Actuarial Pricing
- ✓ Market research
- ✓ Risk assessment
- Product Audit
- Product Launching



#### MARKETING

- Customer Searching
- ✓ Direct: salesman
- ✓ Indirect: agency
- Advertising
- Communication
- ✓ Online & Offline
- Insurance Acceptance



#### COMPANSATION

- Audit of liability
- ✓ Whether the policy is valid
- ✓ Whether the loss is covered by the policy
- Investigate the loss
- ✓ Analyze the cause
- ✓ Ascertain of damage
- Claims
- ✓ Avoid fraud

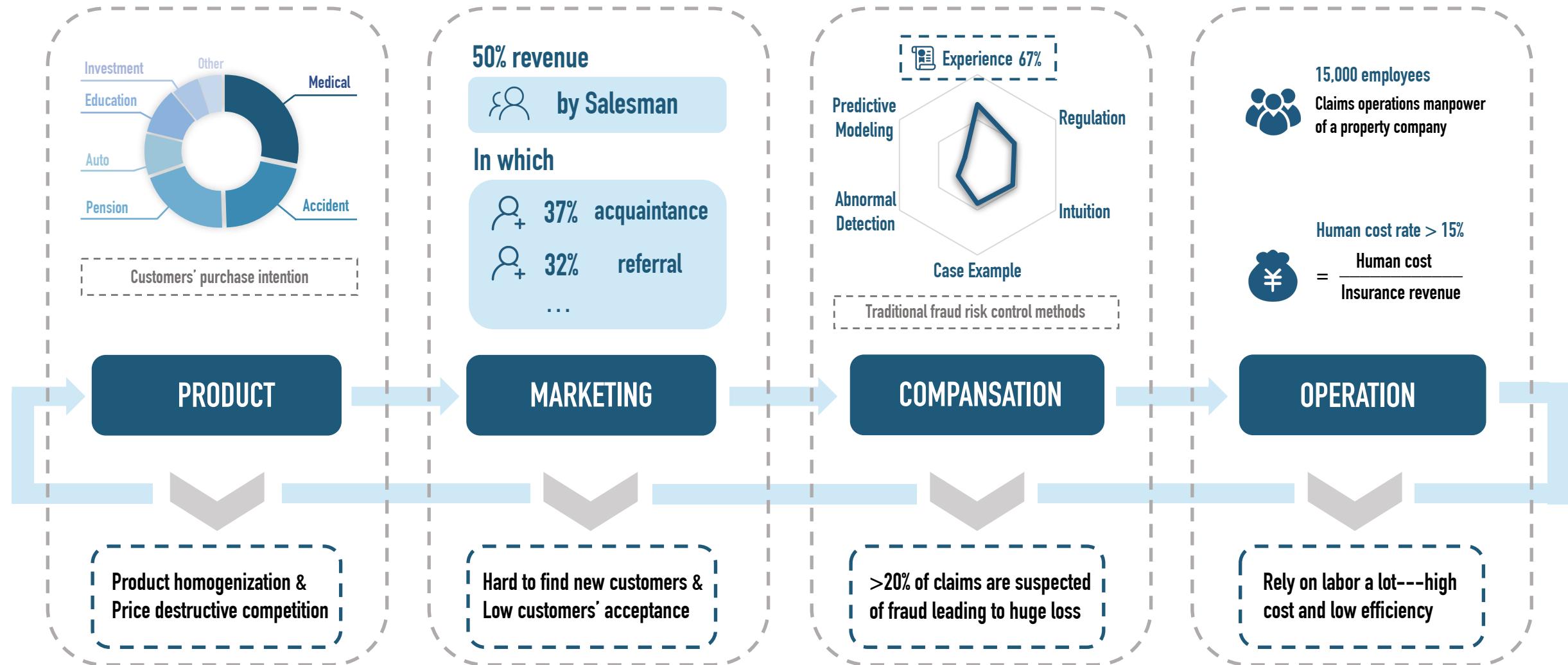


#### OPERATION

- Customer Feedback
- Financial Management
- ✓ Cost, fund, revenue, investment
- ✓ Profit analysis
- Other service
- ✓ Customer Inquiries



## Major Problems that Insurance Companies Face with



# PARTI Overview | Knowledge Graph Example

## Constructing Knowledge Graph of Insurance Industry Can Break Through the Industry Barrier and Integrate Resources

### 1 Composition

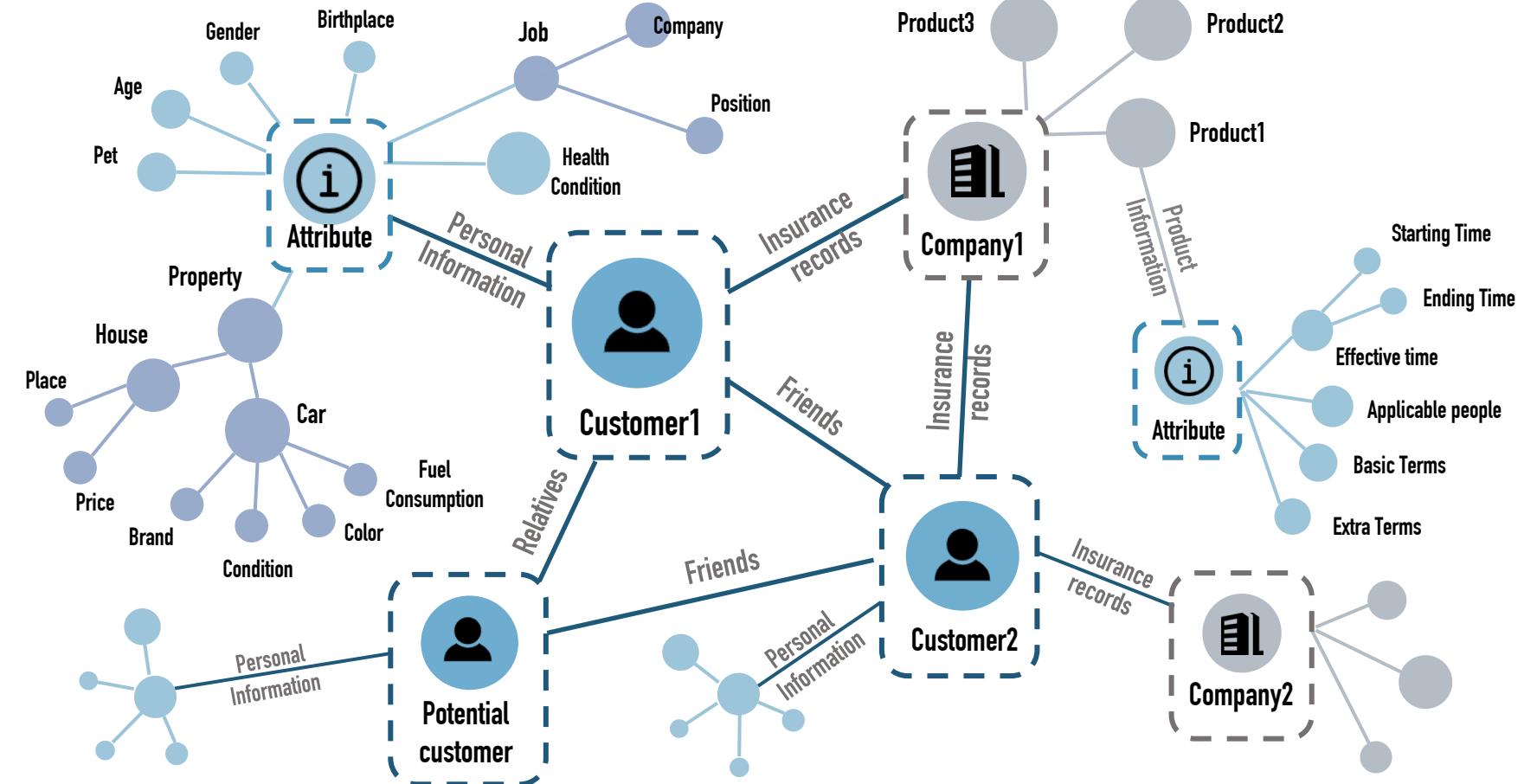
Nodes  
Represent the entities



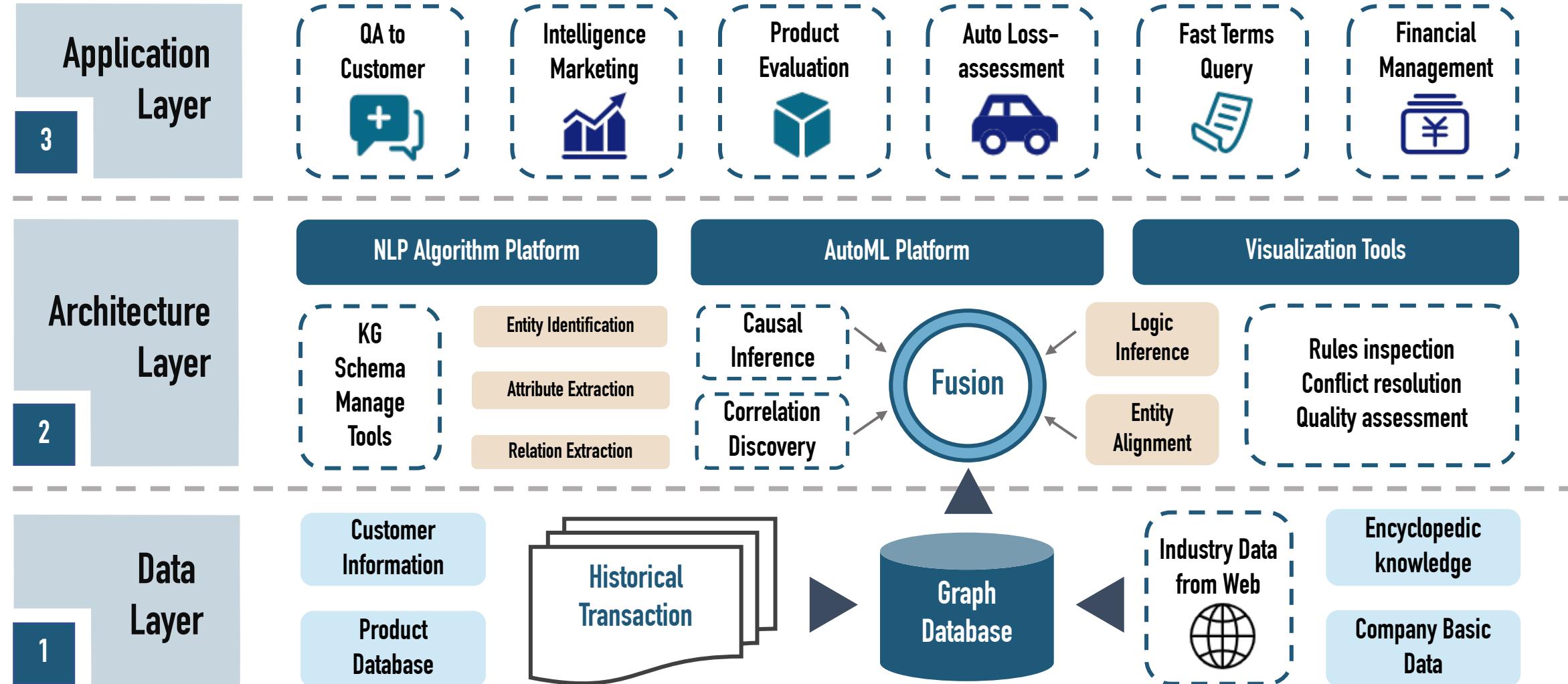
Edges  
Represent the relations

Triad  
(Entity1, Relation, Entity2)  
(Entity, Attribute, Value)

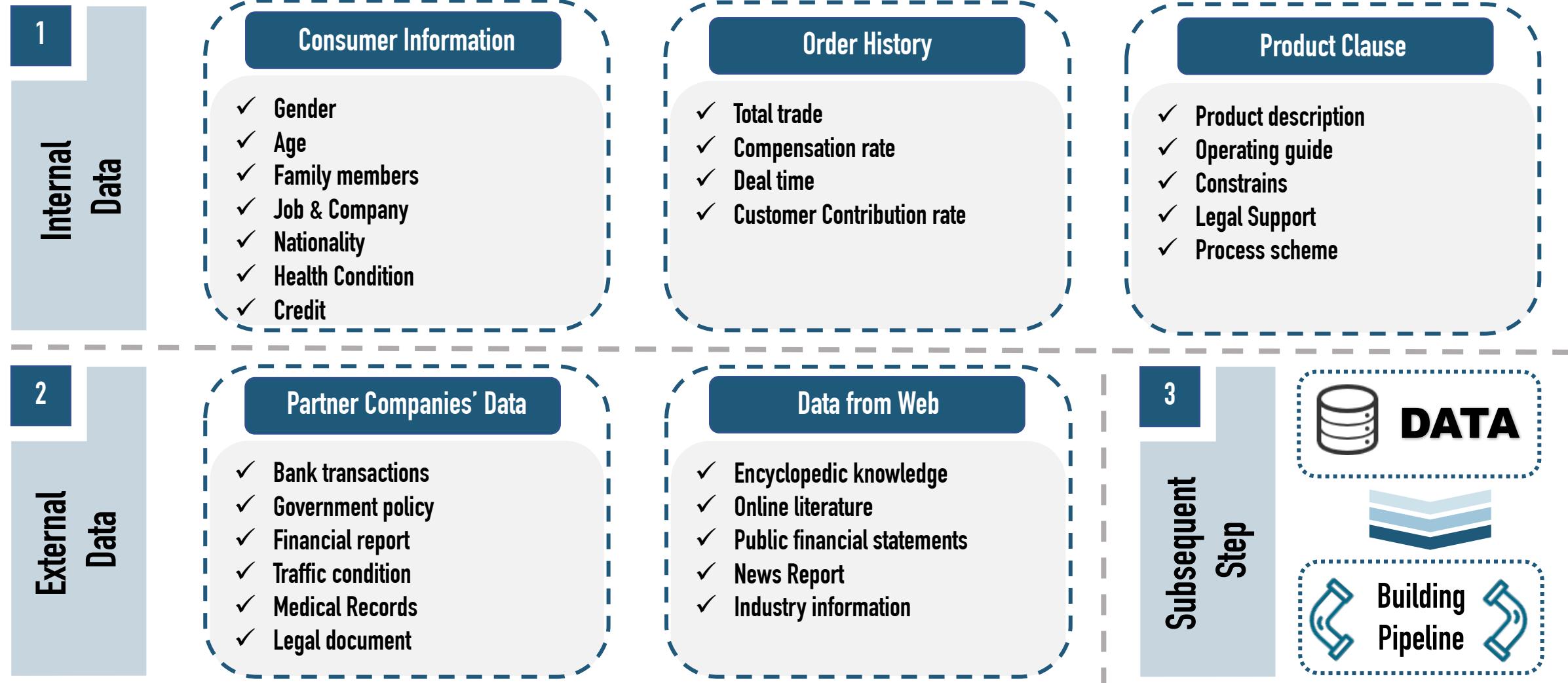
### 2 Example



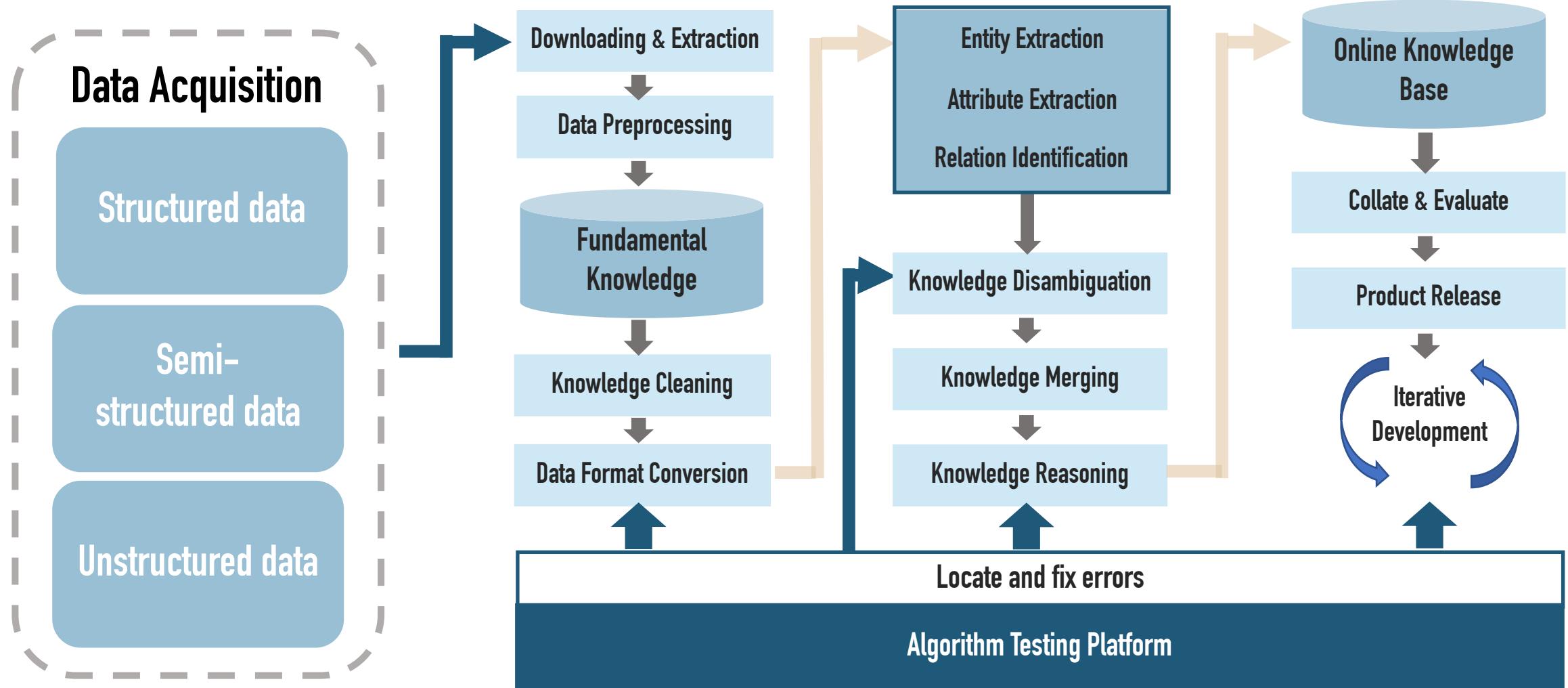
## Business Intelligent System Design with Knowledge Graph in Insurance Companies



## Huge Amounts of Data From Insurance Companies Can be Made Full Use of

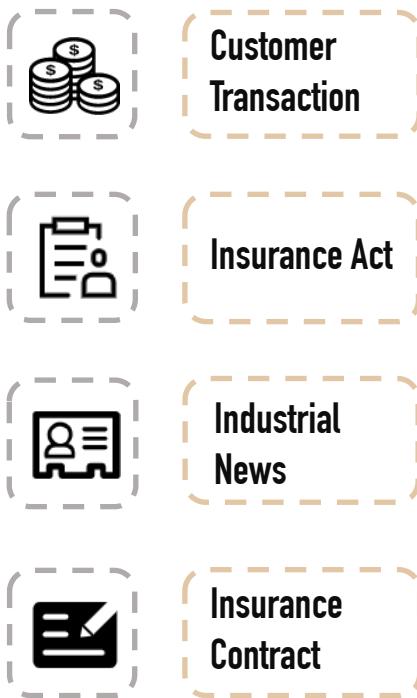


# The Overall Process of Constructing Knowledge Graph in Insurance Industry

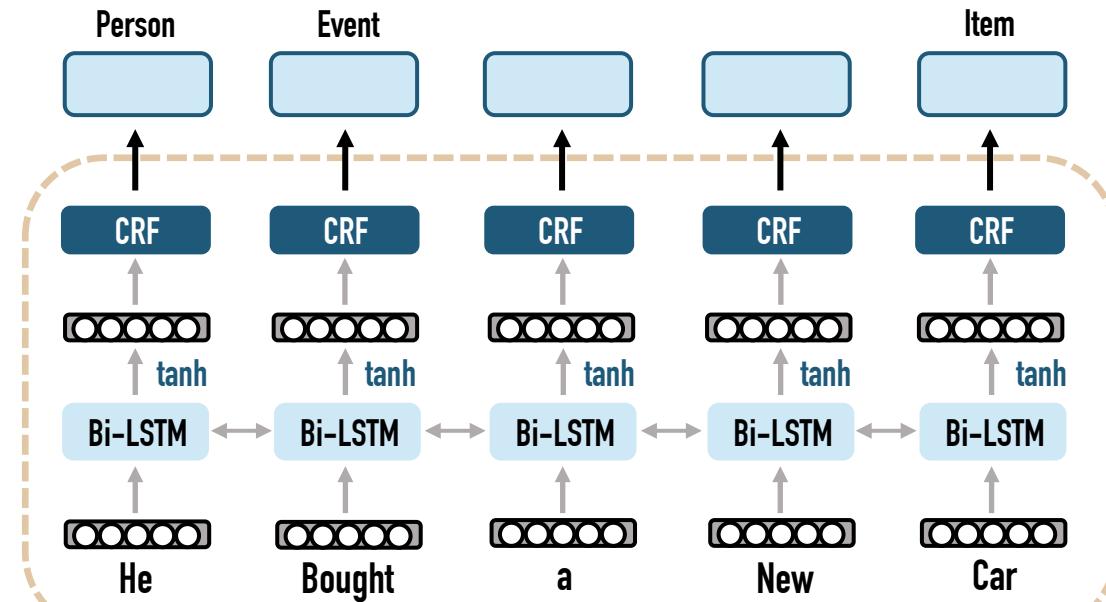


## Entity Identification: Identify and Extract Entities with Specific Meanings in the Text

### 1 Select Data



### 2 Architecture



Make use of plenty textual data from the company

- Input sentences and transform to word vectors
- Neural network models: Bi-LSTM + CRF
- Artificially defined features are required for some particular texts

### 3 Application

- ✓ Find the main cause of events
- ✓ Identify key customers
- ✓ Matching and recommendation
- ✓ Sentiment analysis

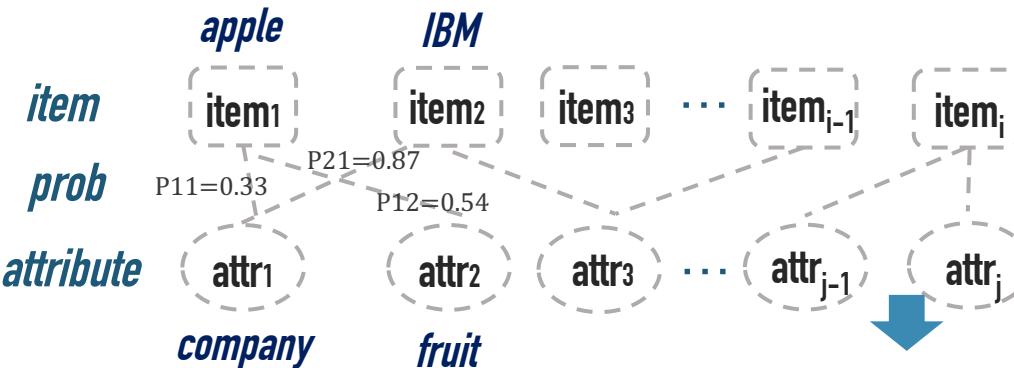


### 4 Value

- Labor costs reduction
- Faster information gathering

## Attribute Extraction: Determine the Attributes an Entity Owns

### 2 Model



- Discriminative model based on probability. [App. A]

New input:  
Bob was promoted to CEO of IBM last Friday.

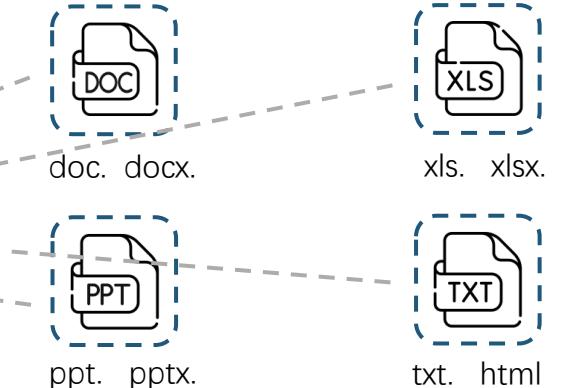
### 4 Benefit

- Comprehensive client portrait
- Logical knowledge of product

Customer Archives
Product Guide
Company Outline

### 1 Source

Insurance Document  
doc. docx.  
txt. wps.

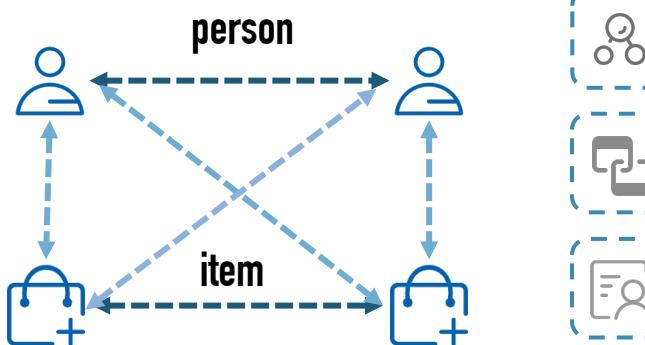


### 3 Output

Person	Bob	
Attribute	Company	Position
Event	IBM	CEO
Time	Promoted	Last Friday

## Relation Extraction: Discover Connections Between Two Entities or Between Entities and Attributes

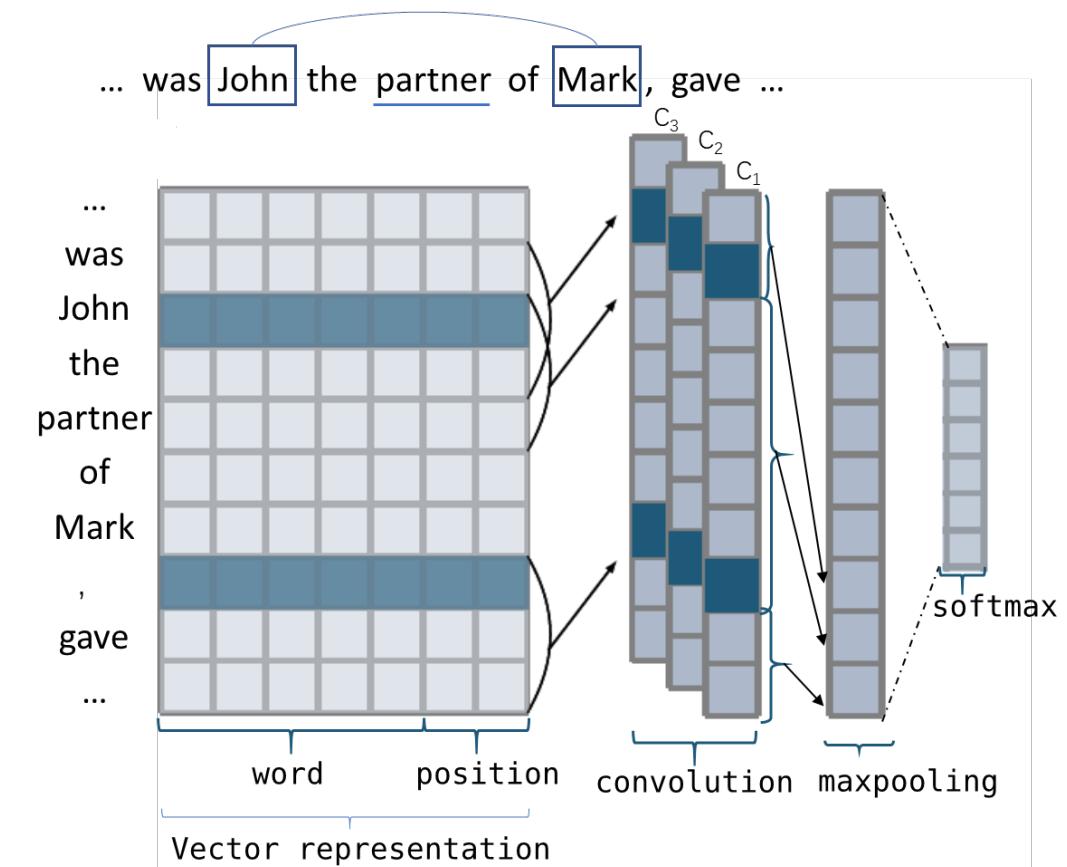
### 1 Identify the Relationships



### 2 Build the Model

- Input sentences and transform to word vectors
- Add the position labels to the word vectors
- Neural network: PCNN
  - Convolution layer: Extract features
  - Maxpooling layer: Compress the model
  - Softmax classifier: Output the probabilities of relations

### 3 Framework



## Knowledge Disambiguation: Determine the Semantic Characteristics of an Object From the Context

### 1 Ambiguity



*ENTITY*

Michael Jeffrey  
Jordan

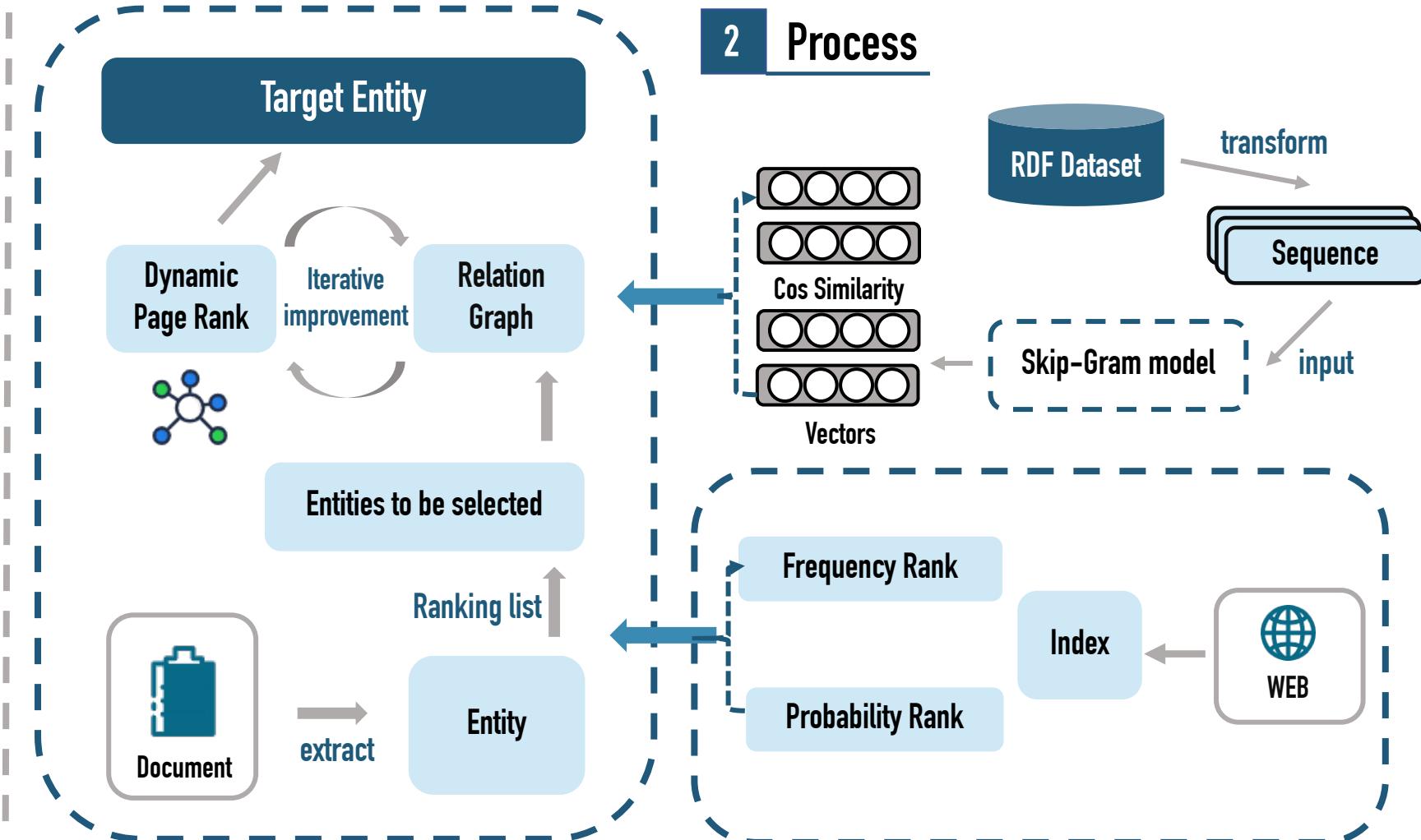
Michael I. Jordan

Document 1

Jordan is recognized as one of the greatest basketball players of all time.

Document 2

Jordan works for the national academy of sciences and the American academy of engineering.



## Knowledge Fusion: Connect Vast Amounts of Knowledge From Different Sources

### 1 Problem

#### Data quality challenges

- ✓ fuzzy naming
- ✓ data entry errors
- ✓ Pronoun & Polysemy
- ✓ typing mistakes
- ✓ .....

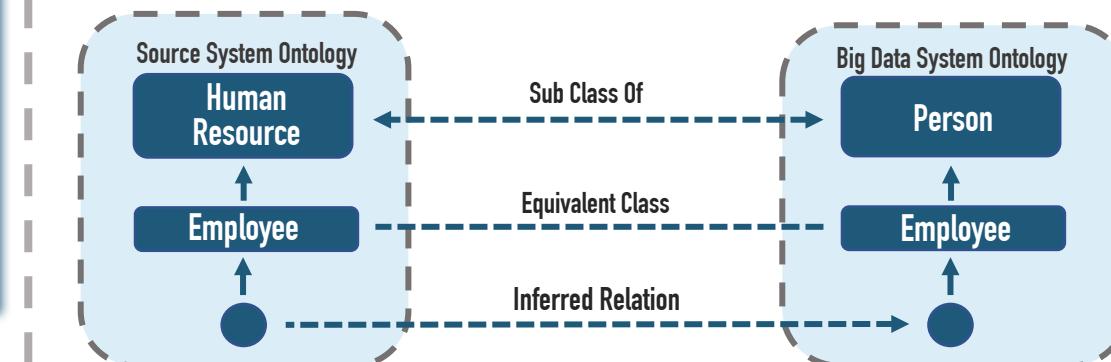
#### Data scale challenges

- ✓ data variety
- ✓ name matching
- ✓ multiple relationships
- ✓ .....

### 2 Architecture

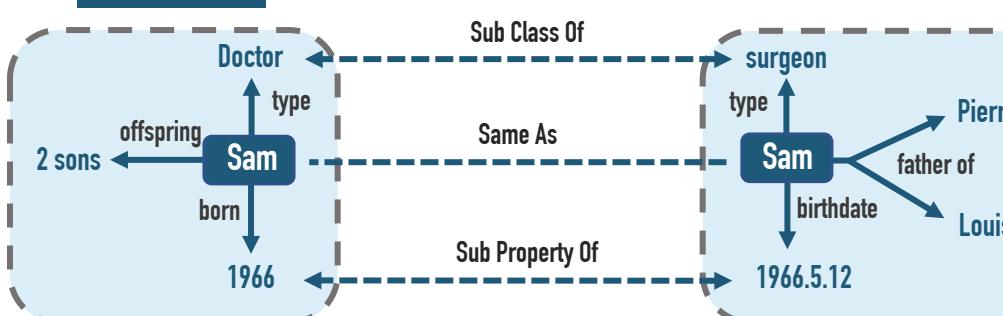
#### Schema layer

#### Ontology Alignment

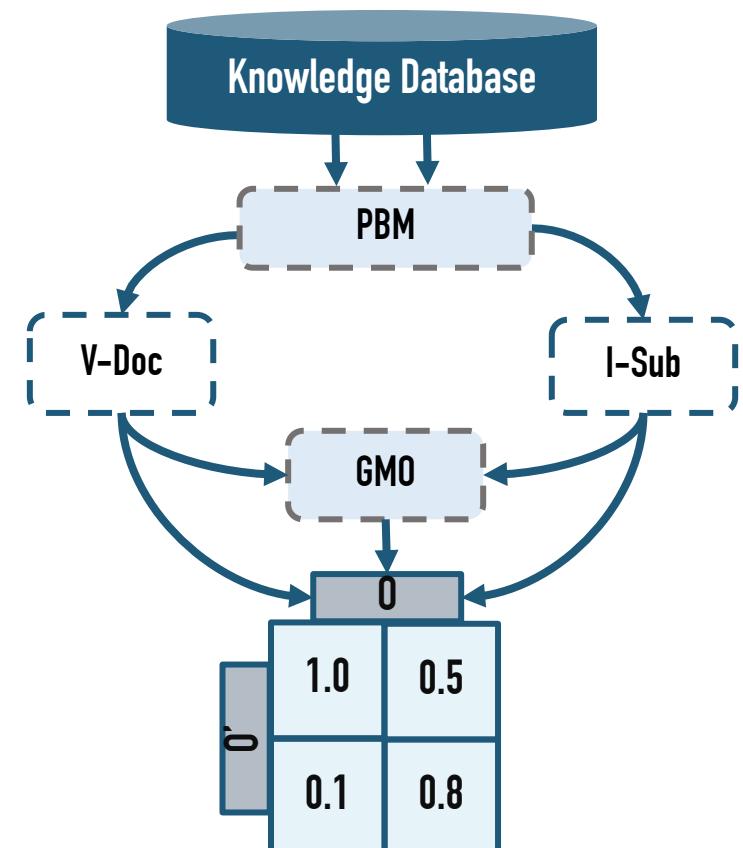


#### Data layer

#### Entity Alignment



#### Knowledge Database



## Knowledge Reasoning: Infer Implied Knowledge From Existing Information

### 1 Discovery

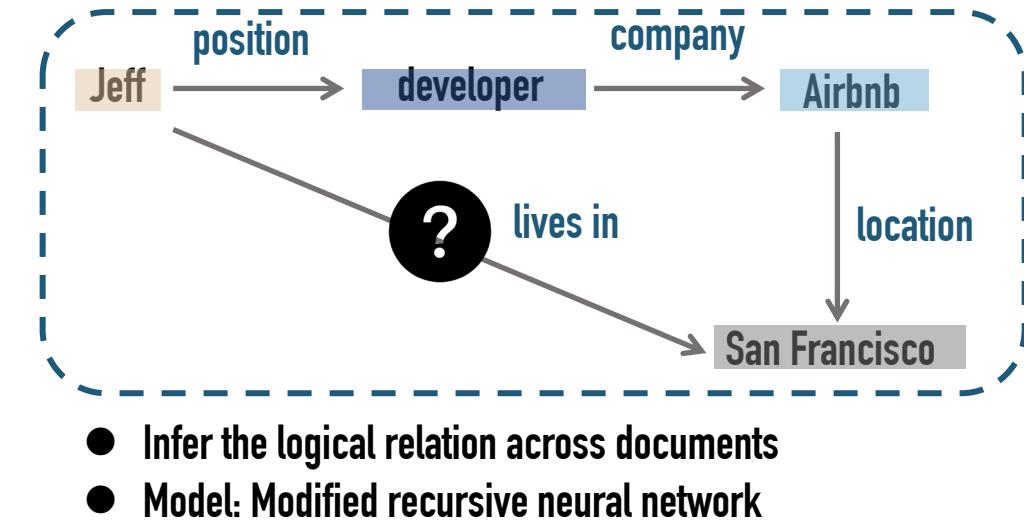
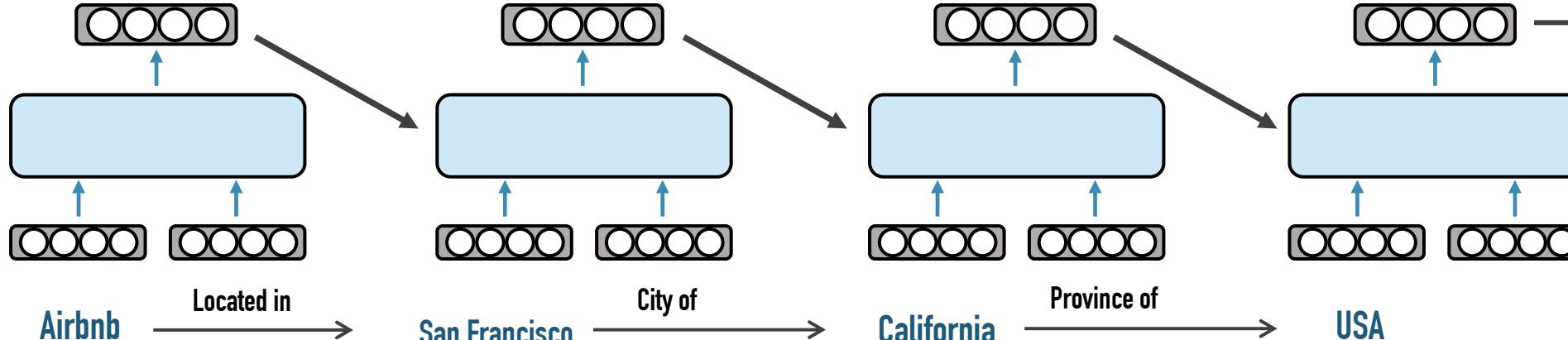
- Infer customers' preferences
- Design new types of insurance
- Predicting future risks

### 2 Principle

The records show that, Jeff, changed his job recently and entered Airbnb as a developer...

Airbnb is one of the largest Internet companies in San Francisco and raised more than 117 million dollars in 2012...

### 3 Framework

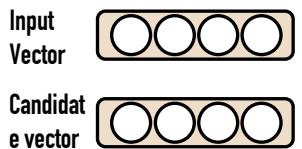


## Products and Services that Insurance Companies Can Provide Using Knowledge Graph Technology

### 1 QA to Customer

- ✓ Intelligent customer service
- ✓ Automatic product consulting
- ✓ Purchase process guidance

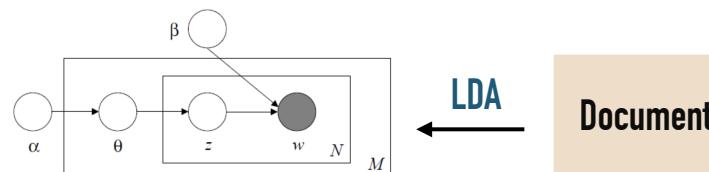
#### Vector Comparison



#### Principle

$$T(X, Y) = \frac{XY^T}{\sqrt{|X|^2 \times |Y|^2}}$$

#### Semantic parsing

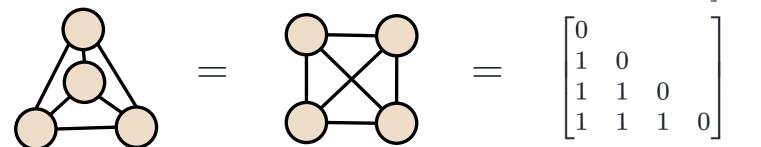


$$p(\theta, z, w | \alpha, \beta) = p(\theta | \alpha) \prod_{n=1}^N p(z_n | \theta) p(w_n | z_n, \beta)$$

### 2 Marketing

- ✓ Intelligent customer acquisition
- ✓ Users precise matching
- ✓ Intelligent promotion channel

#### Graph Isomorphism



#### Extract Features

	Item1	Item2	Item3	Item4
User1		1		
User2	2			4
User3		2		
User4			1	3

$$A = U\Sigma V^T, A_{m \times n} \approx U_{m \times r}^1 \Sigma_{r \times r}^1 (V_{n \times r}^1)^T$$

### 3 Product Evaluation

- ✓ Product income measurement
- ✓ Automatic product improvement

### 4 Fast Terms Query

- ✓ Quick quote and reference
- ✓ Correlation item monitoring

### 5 Financial Management

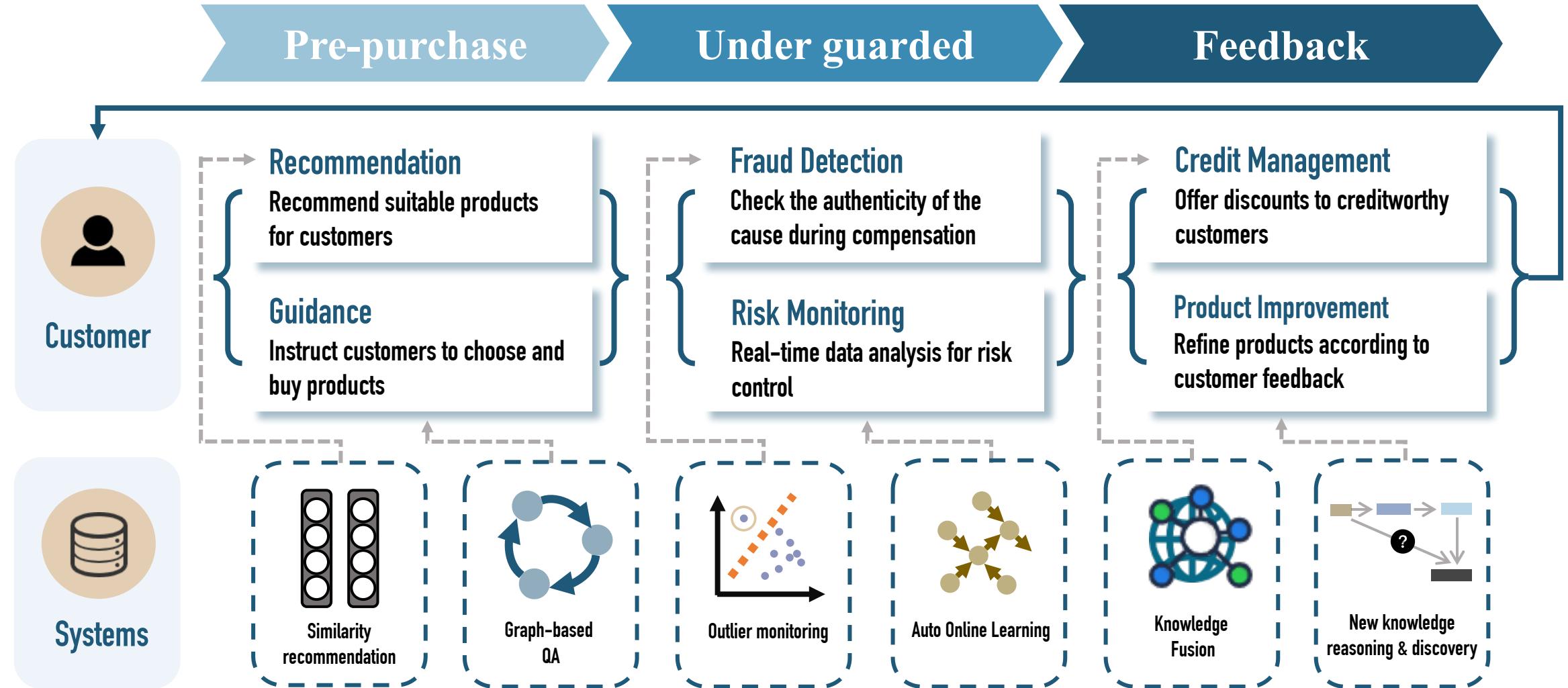
- ✓ Intelligent financial analysis
- ✓ Automatic report generation

### 6 Customer Fraud Detection

- ✓ Automatic loss calculation
- ✓ Fraud risk assessment

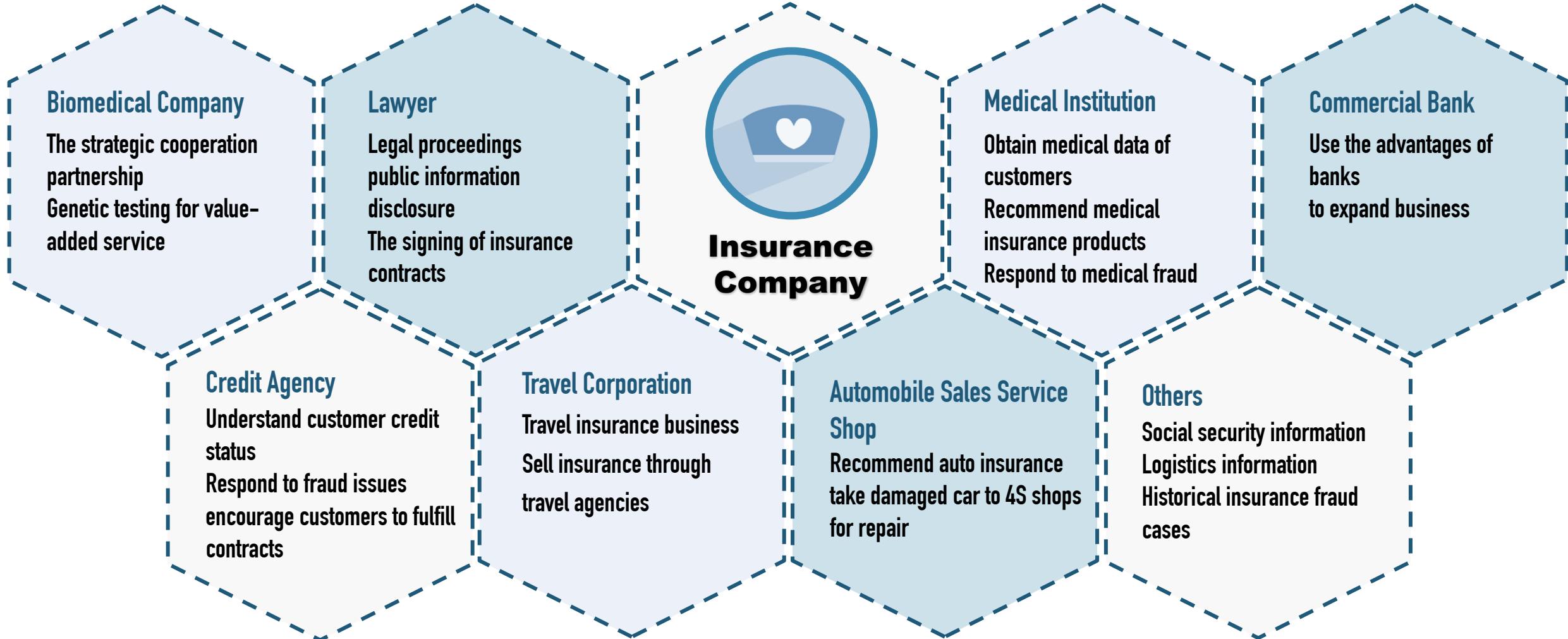
## PARTIII Business Solution

# Insurance Companies Need to Use Technology to Optimize Process to Improve Customer Experience

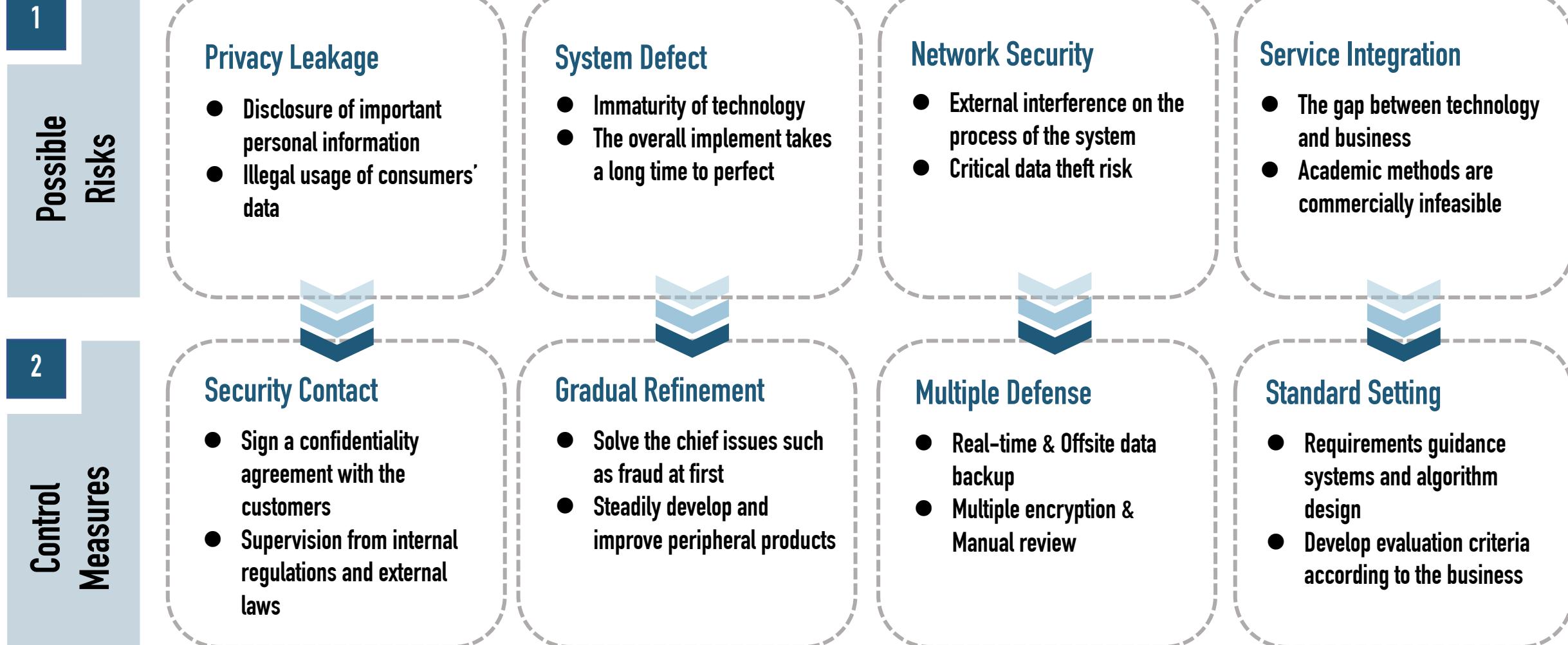


## PARTIII Business Solution

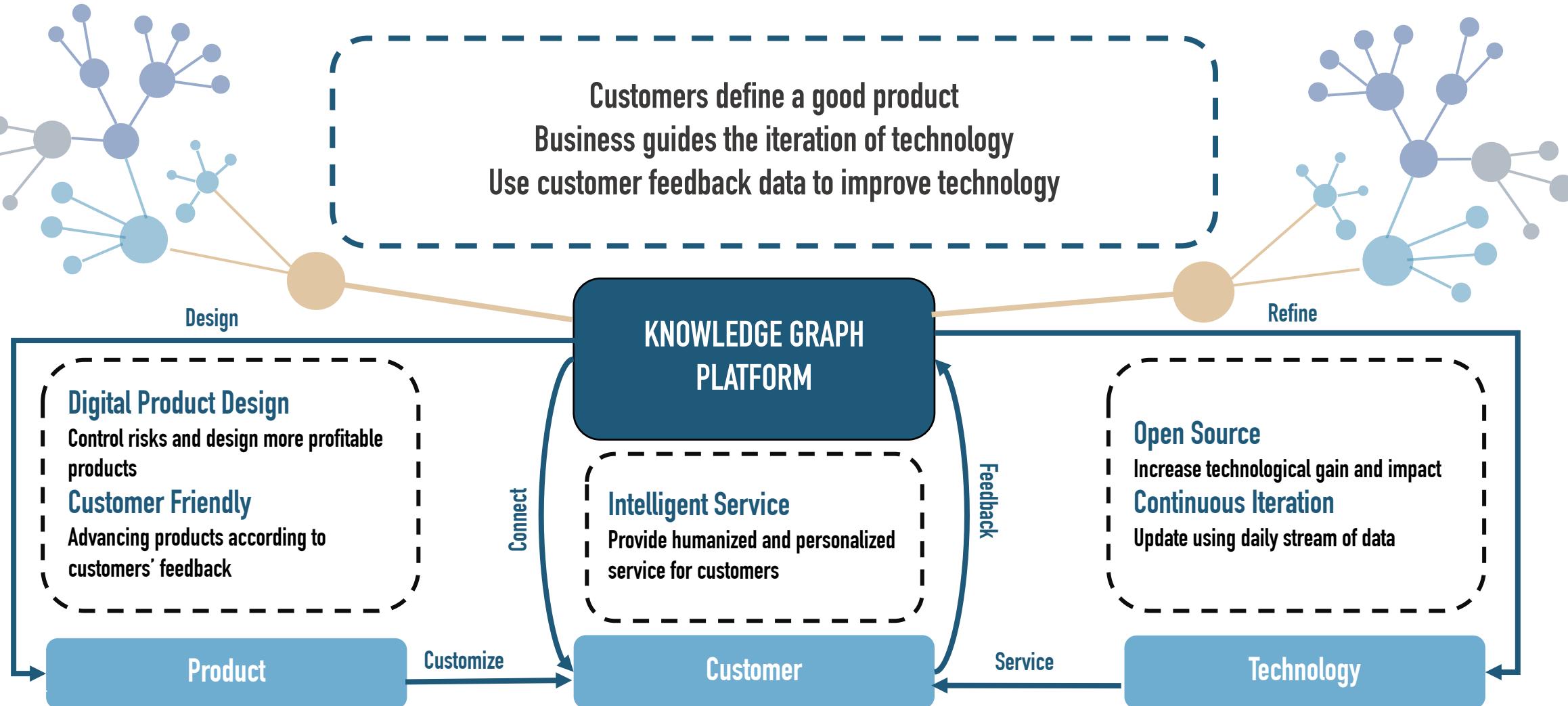
# Using Block Chain With Various Industries for Data Sharing and Security



## Possible Risks and Control Measures



## Establish Industrial Ecosystem to Connect Product, Technology and Customers



# Thank You



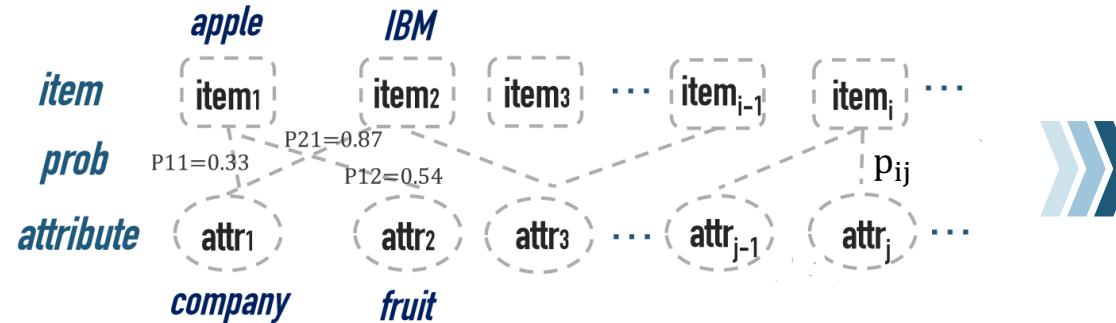
# Appendix A

## Algorithm Illustration of Attribute Extraction Model

### Using massive document data

$freq(i, d)$  means the occurrence times of words  $i$  in document  $d$ .

Document groups	What apple means in these documents	Calculate frequency
$D_1$ ...	apple means company	$freq(i, D_1) = \sum_{d \in D_1} freq(i, d)$
$D_2$ ...	apple means fruit	$freq(i, D_2) = \sum_{d \in D_2} freq(i, d)$
$\vdots$		
$D_j$ ...	apple means xxx	$freq(i, D_j) = \sum_{d \in D_j} freq(i, d)$
$\vdots$		



Calculate the probability

$$P_{ij} = \frac{freq(i, D_j)}{\sum_k freq(i, D_k)}$$

Actual attribute for item i:

$$attr_{idx} = \arg \max_j p_{ij}$$

# Appendix B

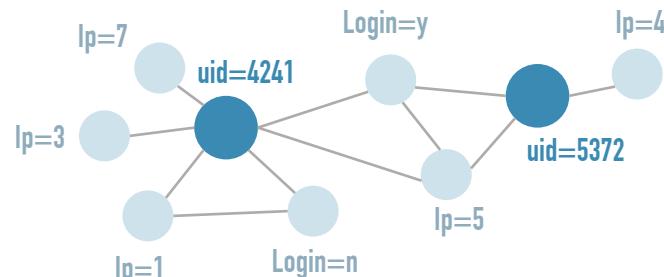
## Algorithm Implementation in Customer Fraud Risk Identification

### 1 Algorithm

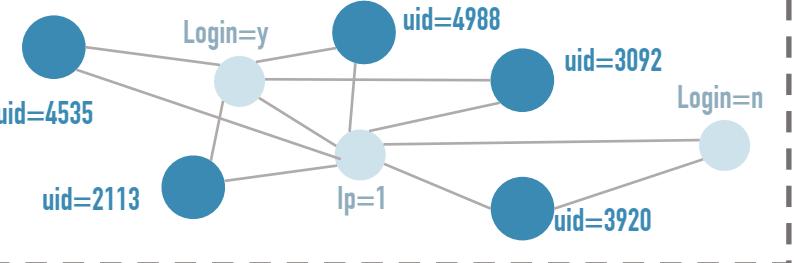
- PageRank
  - ✓ Random walk
  - ✓ Search with damping
- Graph isomorphism
- Minimum spanning tree
- Centrality discovery algorithm
  - ✓ Degree Centrality
  - ✓ Closeness Centrality
  - ✓ Betweenness Centrality
- Community discovery algorithm
  - ✓ Louvain Modularity
  - ✓ Label Propagation

### 2 Results

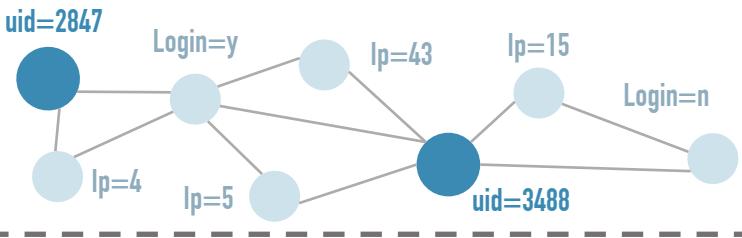
Risk of attack raises  
Different account names log in continuously  
from the same IP.



Risk of malicious scalping raises  
Frequent use of different logins for the same  
account.



Risk of account stolen raises  
More than two accounts logged in a hardware,  
one of which has logged in on another hardware.



# Appendix C

## Data and Reference

### 1 Database

- EPS
- IAC(the Insurance Association of China)

### 2 Reference

#### Knowledge Graph

- [1] Q. Wang, Z. Mao, B. Wang and L. Guo, "Knowledge Graph Embedding: A Survey of Approaches and Applications," in IEEE Transactions on Knowledge and Data Engineering, vol. 29, no. 12, pp. 2724–2743, 1 Dec. 2017.
- [2] Jin Z., Zhang Y., Kuang H., Yao L., Zhang W., Pan Y. (2019) Named Entity Recognition in Traditional Chinese Medicine Clinical Cases Combining BiLSTM-CRF with Knowledge Graph. In: Douligeris C., Karagiannis D., Apostolou D. (eds) Knowledge Science, Engineering and Management. KSEM 2019. Lecture Notes in Computer Science, vol 11775. Springer, Cham
- [3] Zeng, Daojian et al. "Distant Supervision for Relation Extraction via Piecewise Convolutional Neural Networks." EMNLP (2015).

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- [1] James Webb, Fadata (2018, November 13). Rethinking Insurance: Customer Value and Solution Innovation for the Digital Age.
- [2] Insurance Information Institute(2019). The 2019 Insurance Fact Book[White paper].
- [3] McKinsey & Company (2017, March) Digital disruption in insurance: Cutting through the noise [White paper].