CSCWD

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Use of Linked Data in the Design of Information Infrastructure for Collaborative Emergency Management System

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Outline

- Context and Motivation
- Knowledge in Emergency Response
- Linked Open Data (LOD) Concepts
- Proposed Architecture
  - Use of LOD in the design of an Emergency Management System
- Conclusion and Next Steps

Context and Motivation

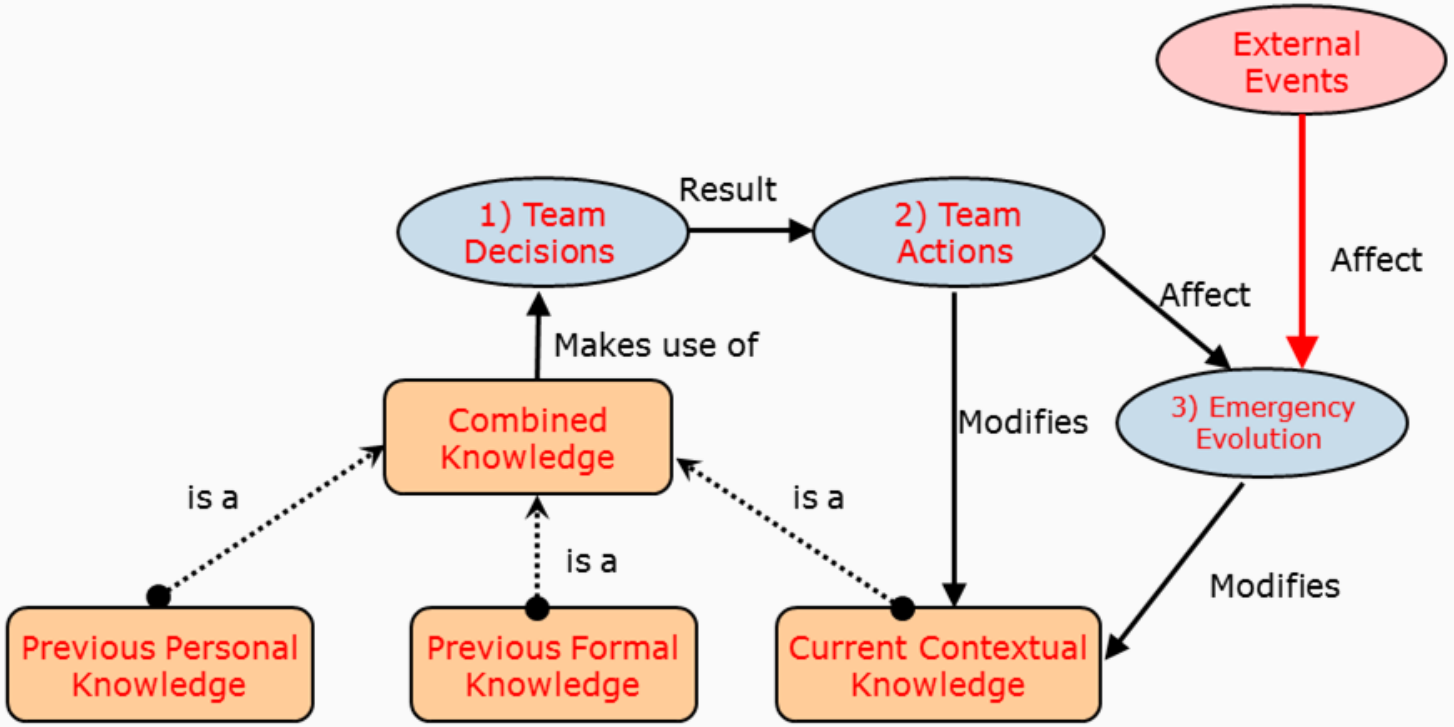
- Growing availability of public data on web
  - Government Agencies
  - Social Media and Social Network
- Information heterogeneity
  - Formats
  - Meaning
- Critical problem in emergency response systems
  - Disasters
  - Crisis

Context and Motivation

- Challenges on the information infrastructure of Collaborative Knowledge Management Systems in Emergency Response
  - must support information dynamics, trustee and integration
- The Linked Open Data paradigm can address some of these challenges
  - make available current contextual information combined with previous knowledge

KNOWLEDGE IN EMERGENCY RESPONSE

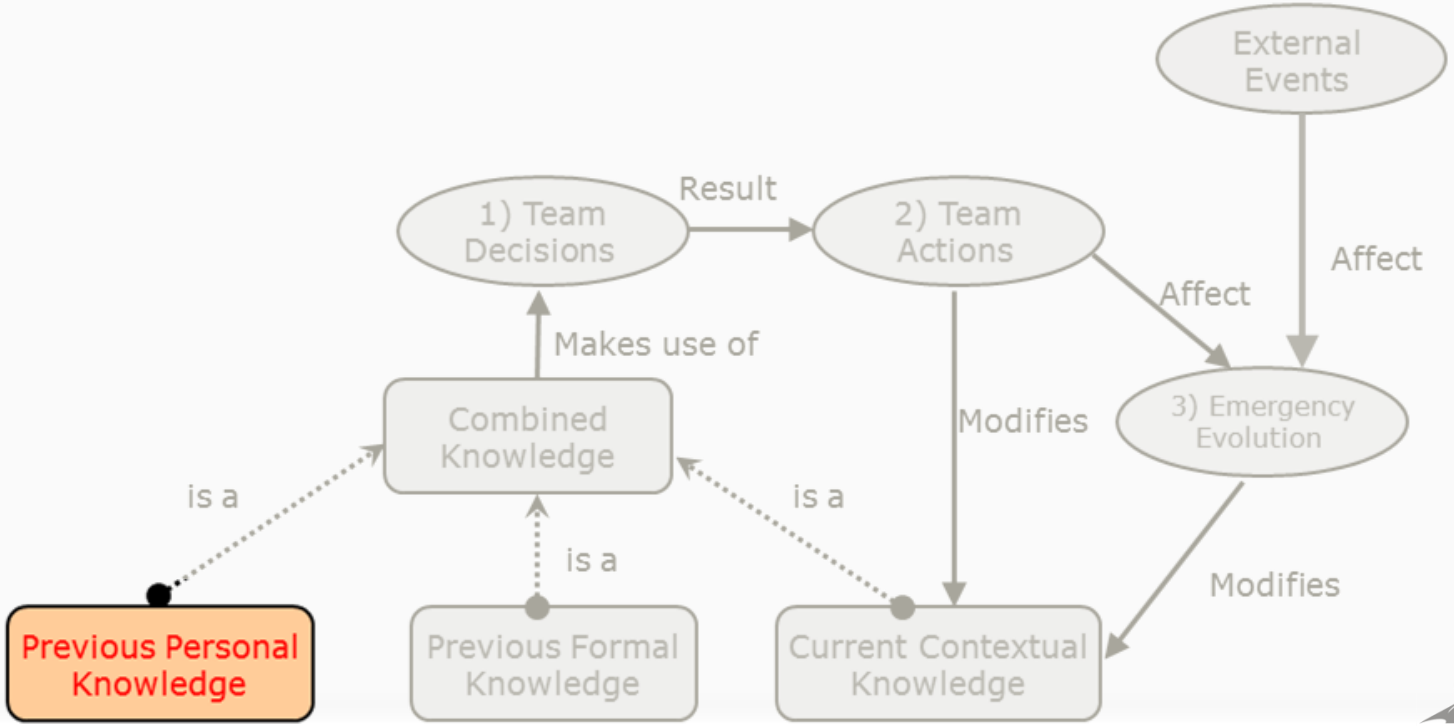
- Conceptual map of knowledge support during an emergency response phase



V. B. Diniz, M. R. S. Borges, J.O. Gomes, J.H. Canós, "Knowledge management support for collaborative emergency response" In Proceedings of the 9th International Conference on Computer Supported Cooperative Work in Design - CSCWD (Vol. 2, pp. 1188-1193). 2005, IEEE.

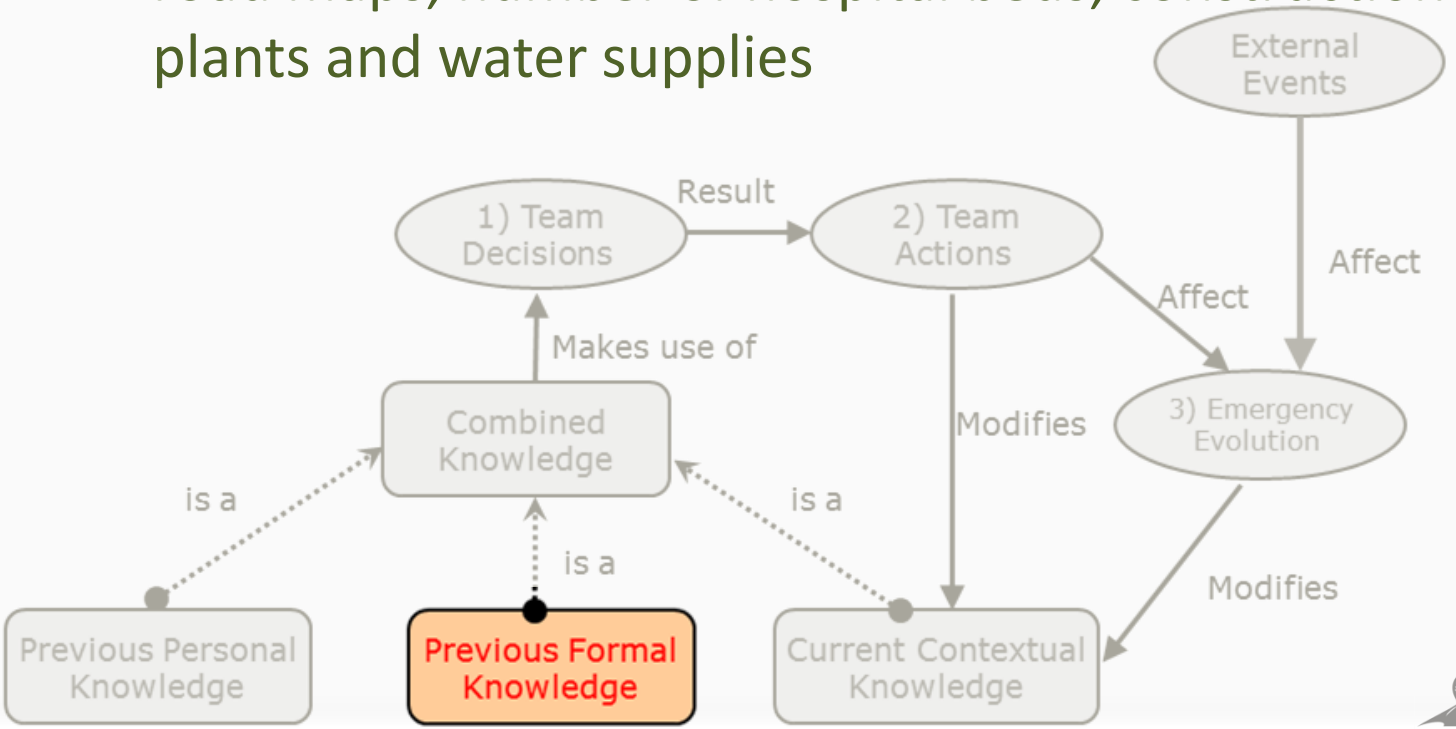
KNOWLEDGE IN EMERGENCY RESPONSE

- **Previous Personal Knowledge**:
  - Developed over time by each member team experience
    - from previous operations, including training



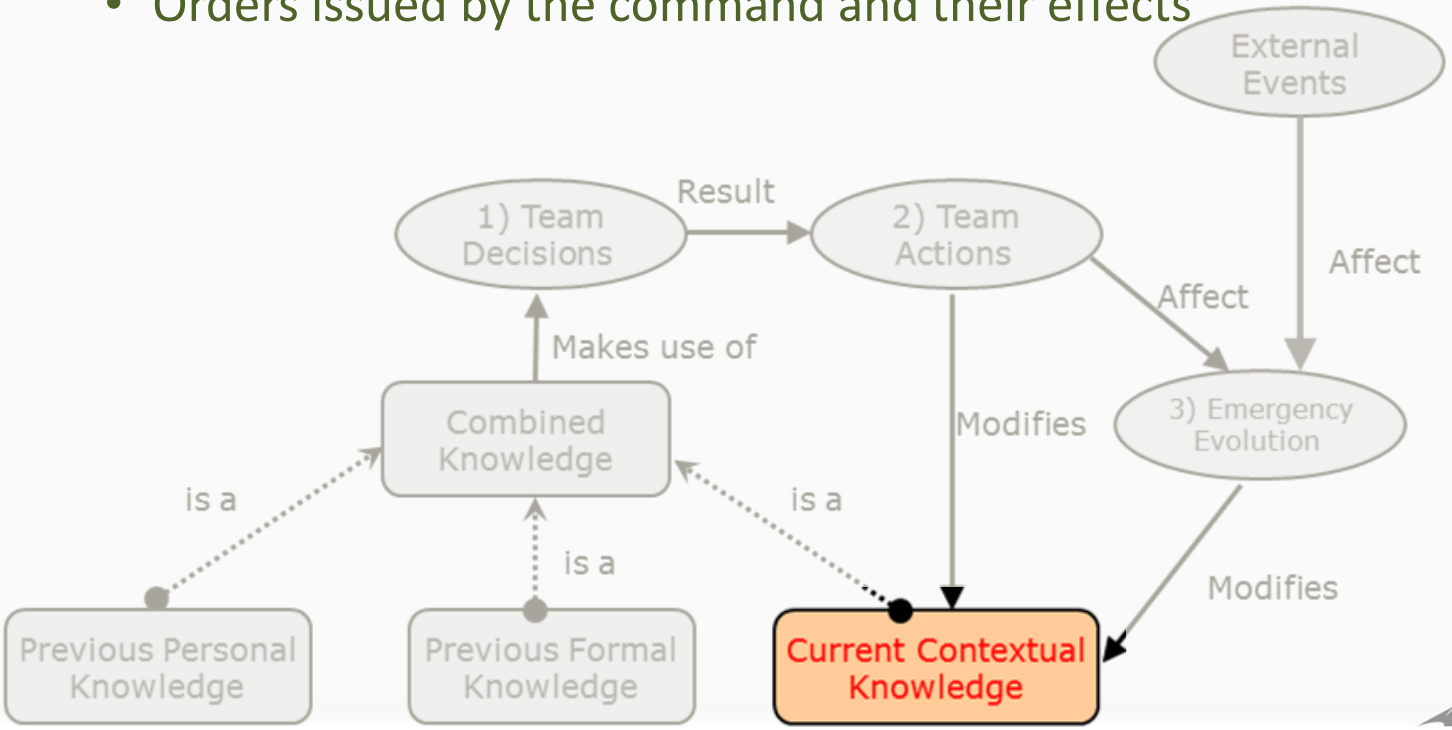
KNOWLEDGE IN EMERGENCY RESPONSE

- **Previous Formal Knowledge**:
  - Originated from government agencies
  - Refers to information about an affected area
    - road maps, number of hospital beds, construction plants and water supplies



KNOWLEDGE IN EMERGENCY RESPONSE

- **Current Contextual Knowledge**:
  - Generated during the emergency evolution process
    - Situation assessment done by field agents, including information about victims and damages
    - Orders issued by the command and their effects

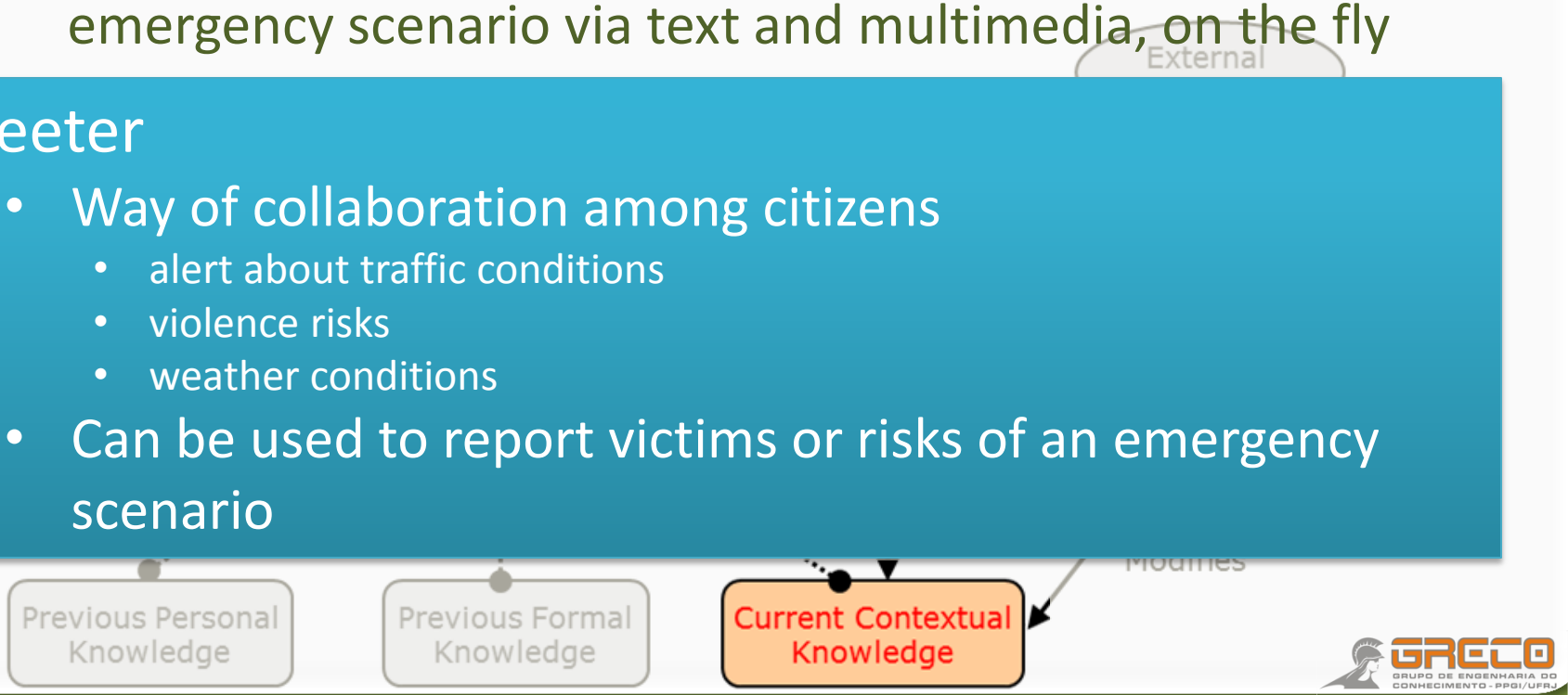


Knowledge in Emergency Response

- **Current Contextual Knowledge:**
  - Advances of mobile communication devices and social networks can turn common citizens into “field agents”
  - Citizens can report their perceptions from the current emergency scenario via text and multimedia, on the fly

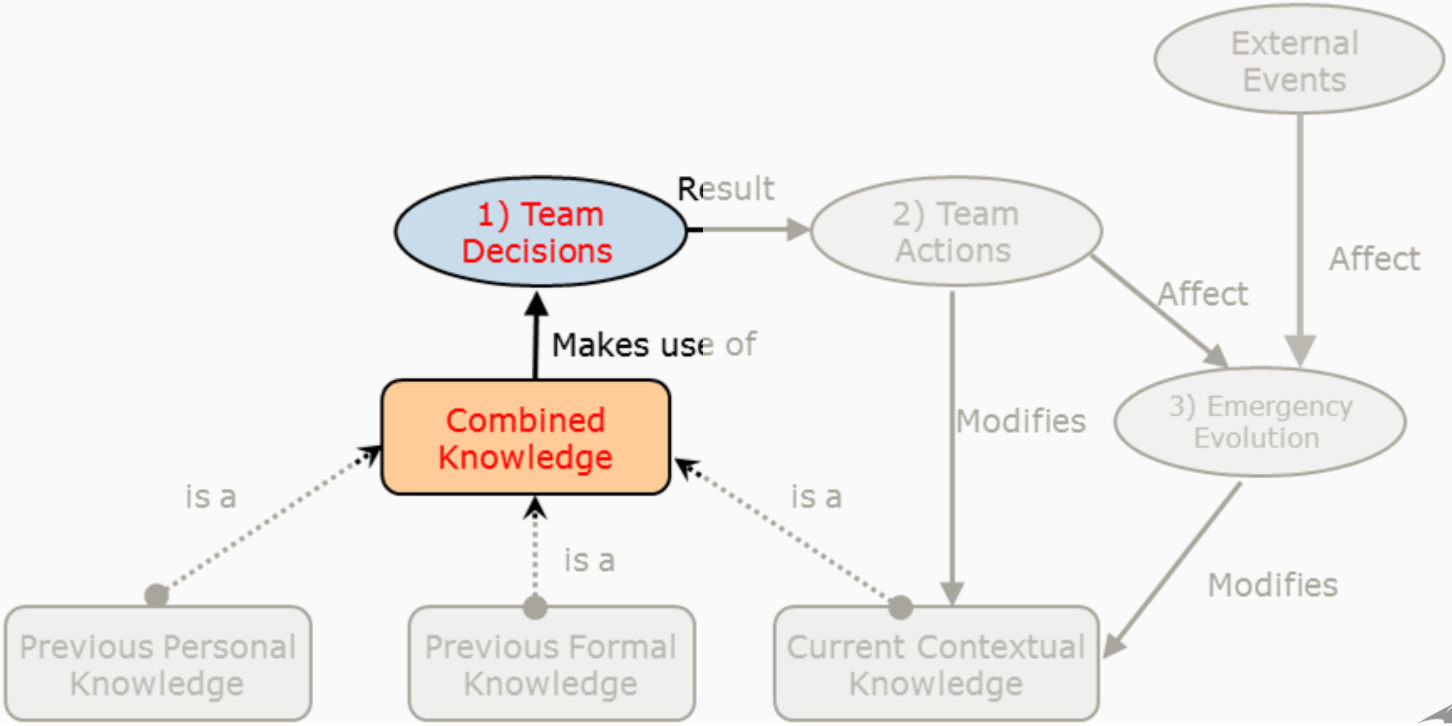
Tweeter

- Way of collaboration among citizens
  - alert about traffic conditions
  - violence risks
  - weather conditions
- Can be used to report victims or risks of an emergency scenario



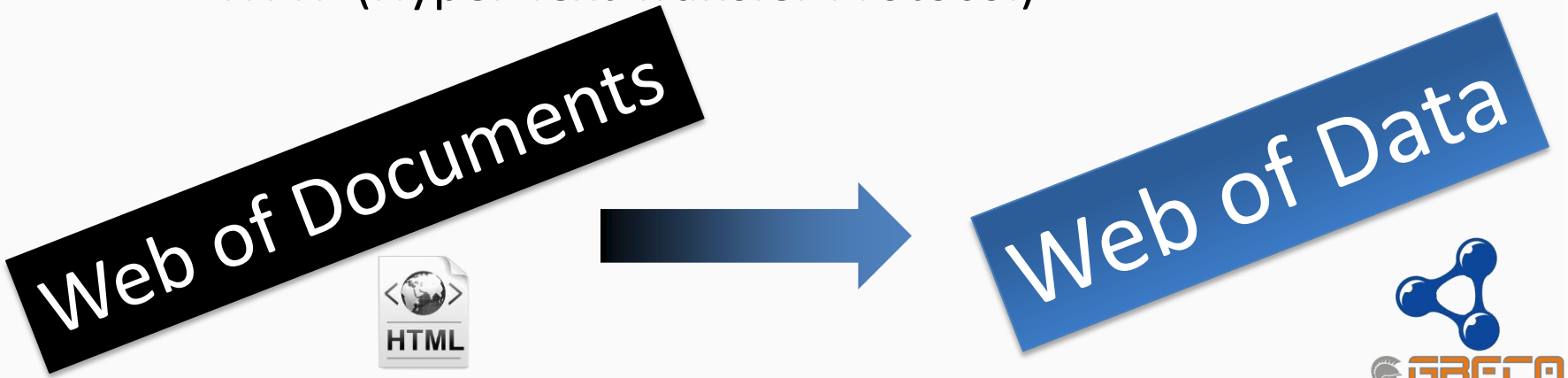
KNOWLEDGE IN EMERGENCY RESPONSE

- **Combined Knowledge:**
  - Current + Previous
  - Very dynamic knowledge



Linked Data: an approach for interrelating heterogenous data

- In 2006, Tim Berners-Lee posted, on his W3C´s design issues site:
  - Connecting data, not originally associated, across the web, using standards:
    - RDF (Resource Description Framework)
    - URI (Uniform Resource Identifier)
    - HTTP (Hyper Text Transfer Protocol)



Linked Data: an approach for interrelating heterogenous data

- RDF (Resource Description Framework)
  - The heart of Linked Data
  - Well-established specifica… Recommenda…
  - Support conne… …ta resources on the web (links)

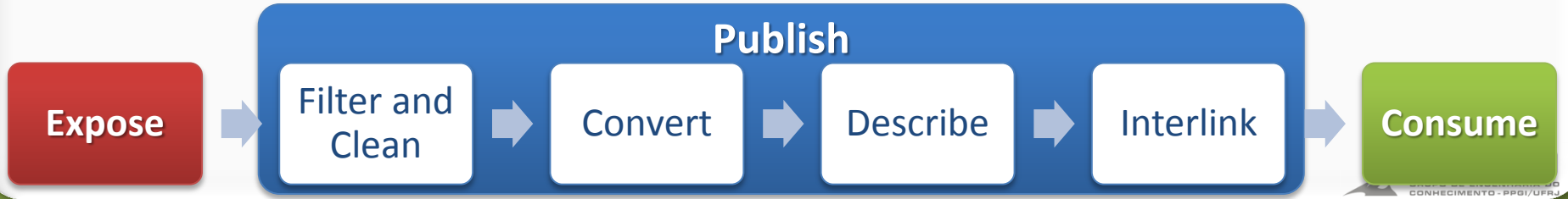
Triples

(subject, predicate, object)


```
<rdf:RDF
   xmlns:rdf="http://www.w3c.org/1999/02/22-rdf-syntax-ns#"
   xmlns:prog="http://greco.ppgi.ufrj.br/program#">
  <rdf:Description rdf:about="#ConceptualModel">
    <prog:professor>Maria Luiza</ex:professor>
  </rdf:Description>
</rdf:RDF>
```

Linked Data: an approach for interrelating heterogenous data

- Basic Linked Data Publishing Process
  - Producers expose their raw data on the web
    - Filter and Clean
    - Convert
      - Transform data to RDF format
    - Description using vocabularies and ontologies
      - support an integrated view of data and semantic interoperability between dataset
    - Interlink
      - using RDF URI Reference
  - Consumers use appropriate engines do explore Linked Data



Linked Data: an approach for interrelating heterogenous data

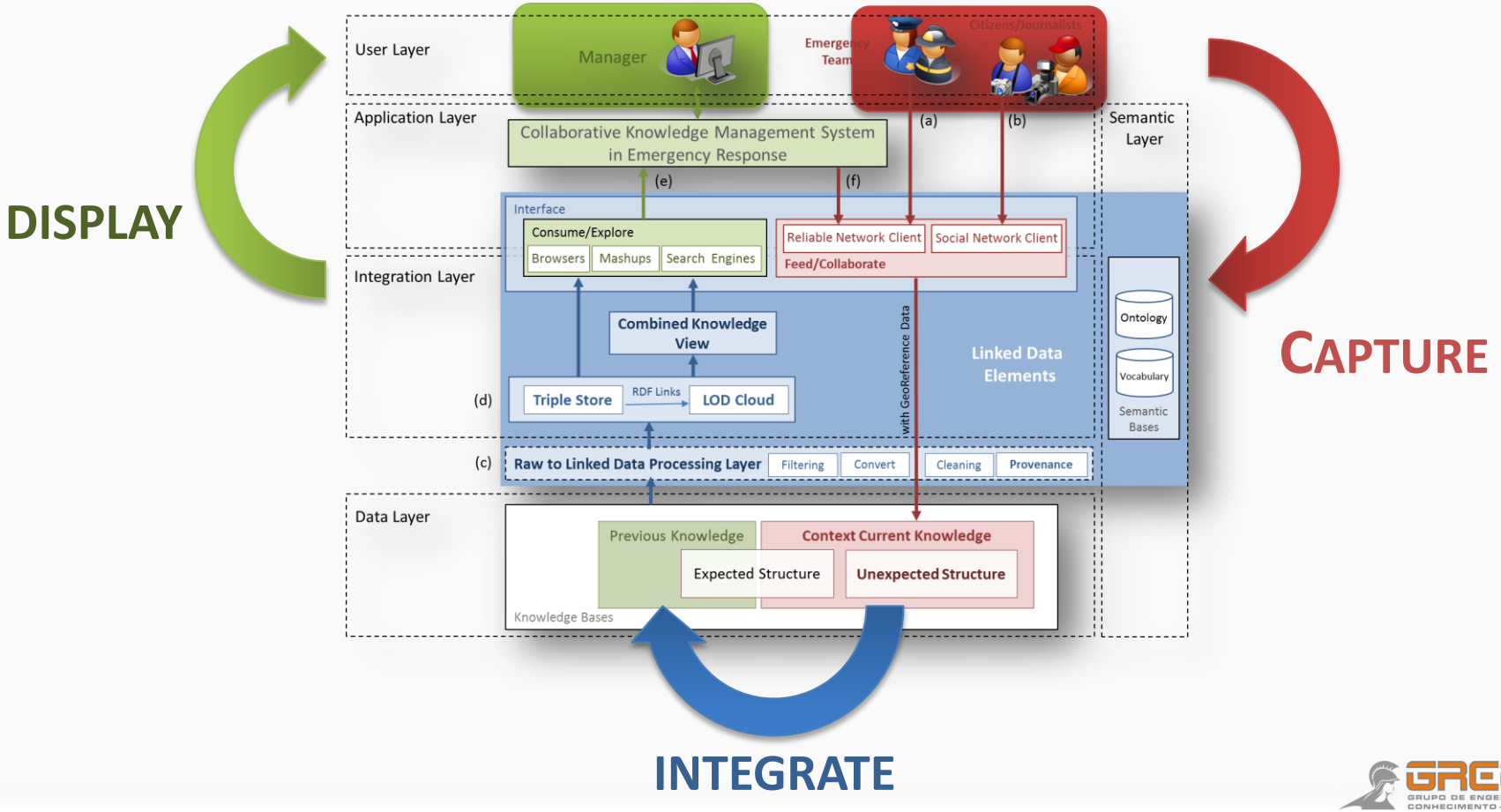
- Provenance tracking
  - Helps to determine the quality and trust of the data
  - Critical issue in collaboration environments that support the decision-making process
    - especially in Emergence Response scenarios, due to the various sources of data

Linked Data: an approach for interrelating heterogenous data

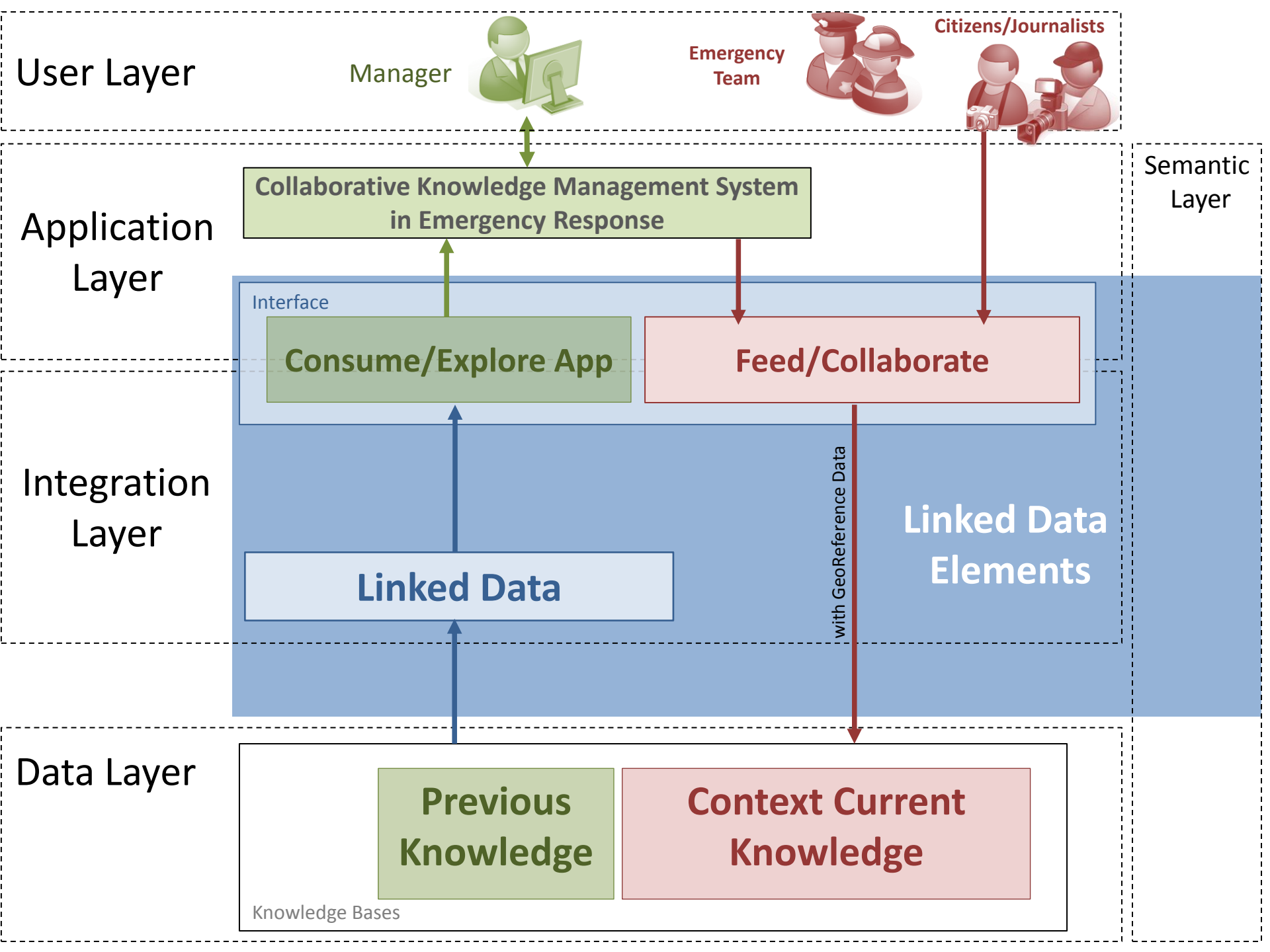
- Collaboration with Linked Data
  - special interest in the context of this work
    - interface for collaboration
  - How to facilitate the publication and linking of user´s contributions (current contextual knowledge)?
    - How to combine it with previous knowledge?

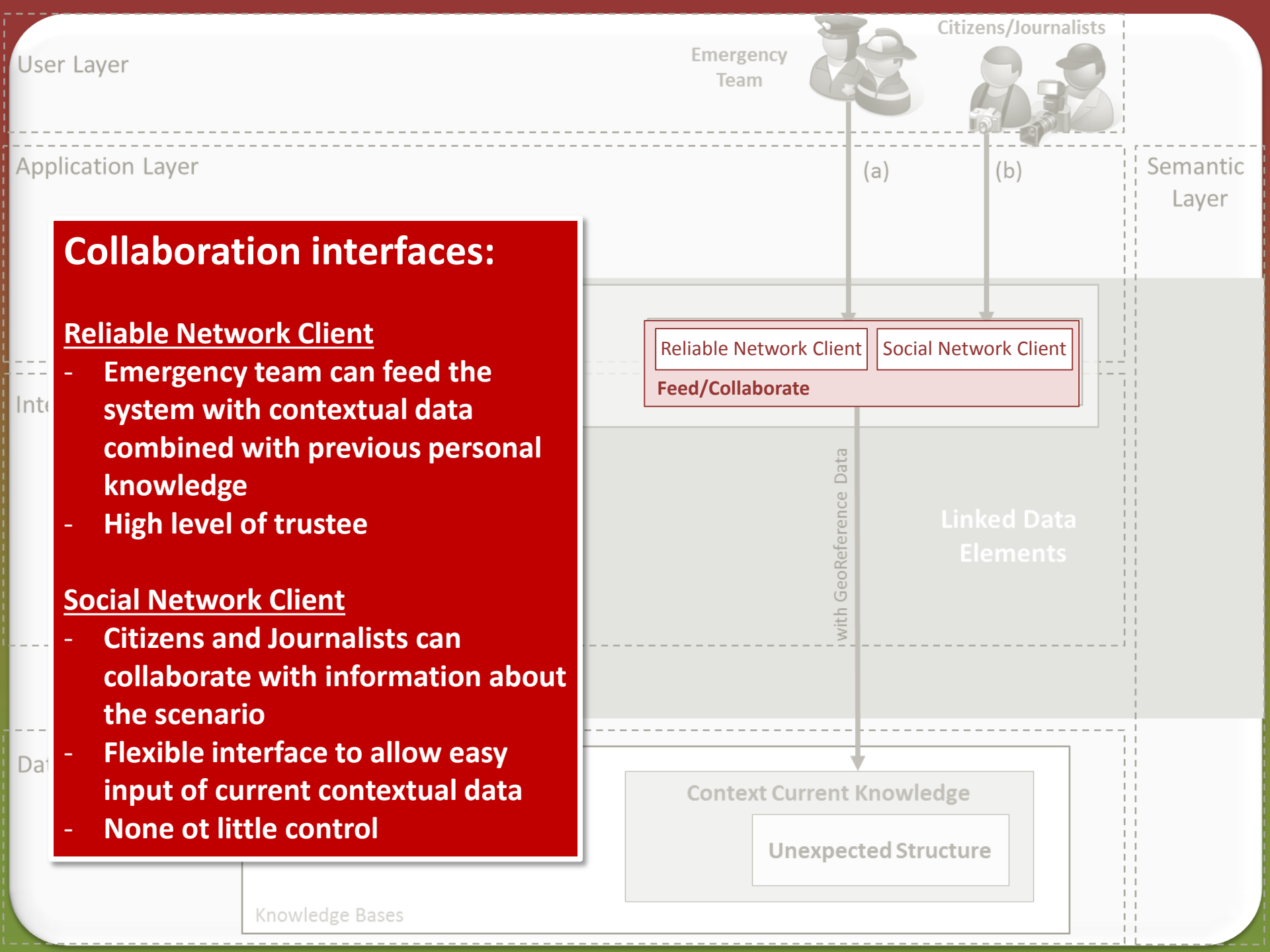
Proposed Architecture

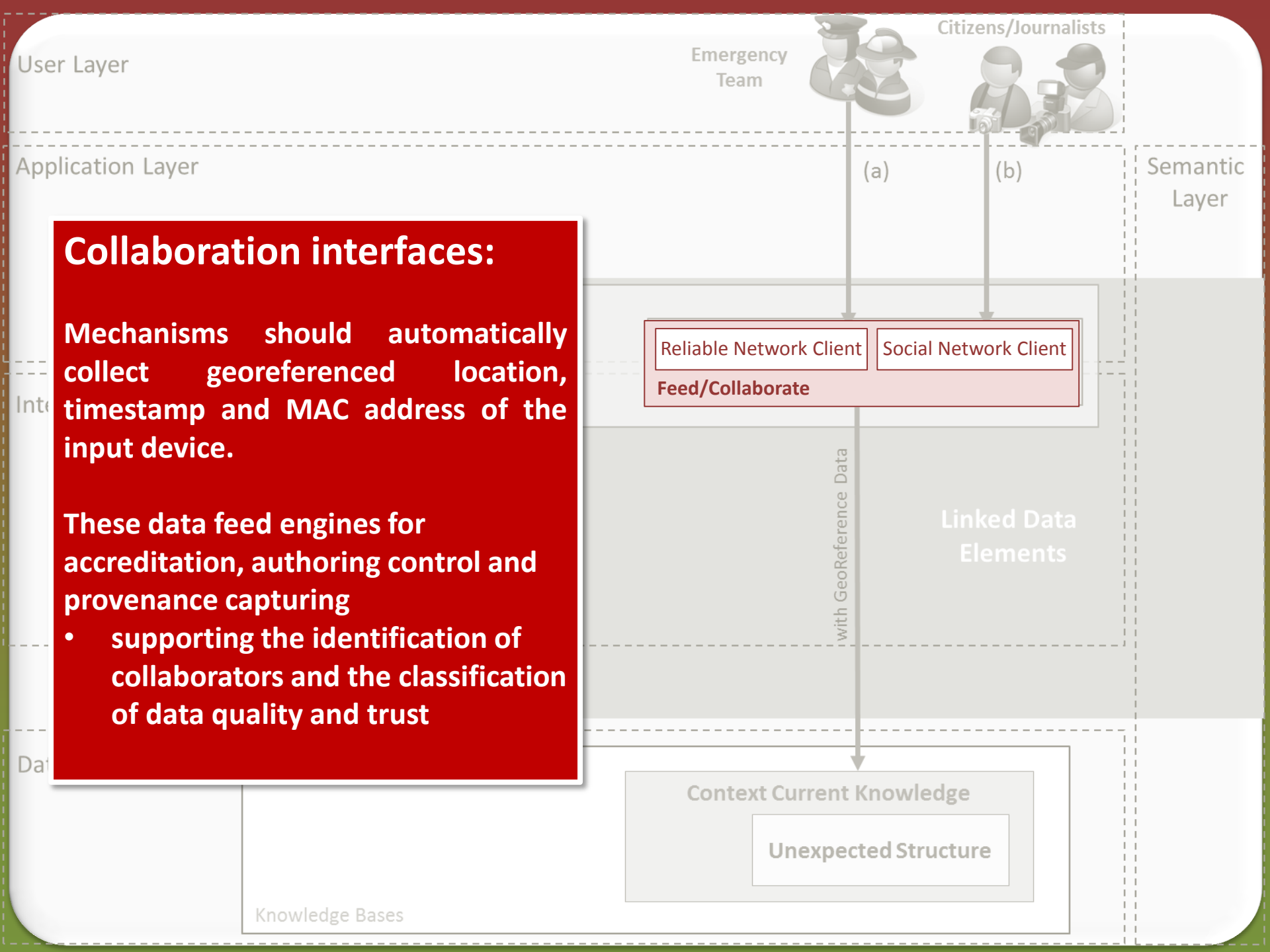
- Capturing, integrating and displaying current contextual knowledge as Linked Data




User Layer
Application Layer
Integration Layer
Data Layer
Semantic Layer


User Layer
Manager
Emergency Team
Citizens/Journalists
Application Layer
Collaborative Knowledge Management System in Emergency Response
Semantic Layer
Interface
Consume/Explore App
Feed/Collaborate
Integration Layer
with GeoReference Data
Linked Data Elements
Linked Data
Data Layer
Previous Knowledge
Context Current Knowledge
Knowledge Bases


User Layer
Emergency Team
Citizens/Journalists
Application Layer
(a)
(b)
Semantic Layer
Reliable Network Client
Social Network Client
Feed/Collaborate
with GeoReference Data
Linked Data Elements
Context Current Knowledge
Unexpected Structure
Knowledge Bases
Collaboration interfaces:
Reliable Network Client
- Emergency team can feed the system with contextual data combined with previous personal knowledge
- High level of trustee
Social Network Client
- Citizens and Journalists can collaborate with information about the scenario
- Flexible interface to allow easy input of current contextual data
- None ot little control

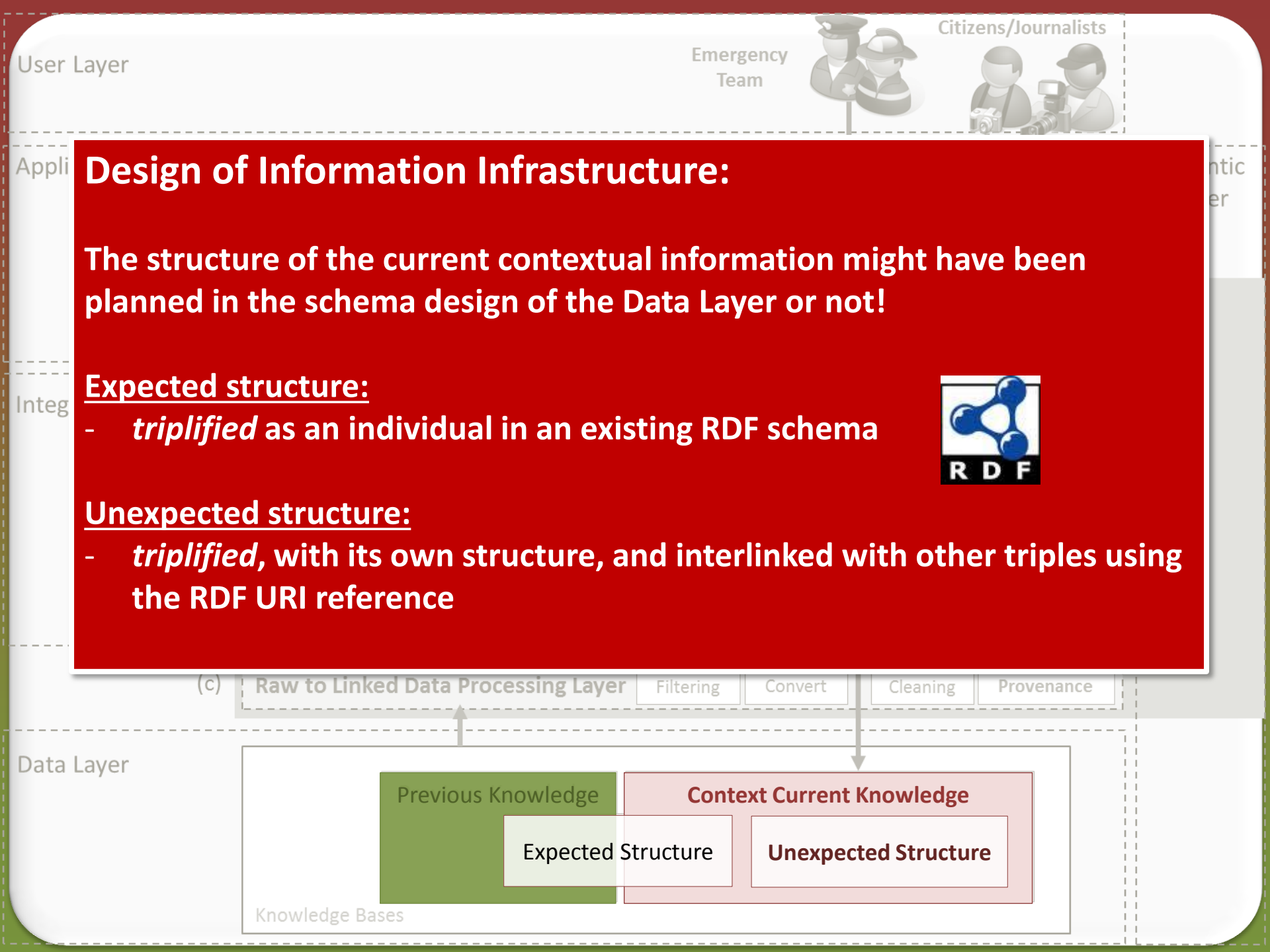


Collaboration interfaces:

Mechanisms should automatically collect georeferenced location, timestamp and MAC address of the input device.

These data feed engines for accreditation, authoring control and provenance capturing

- **supporting the identification of collaborators and the classification of data quality and trust**



Design of Information Infrastructure:

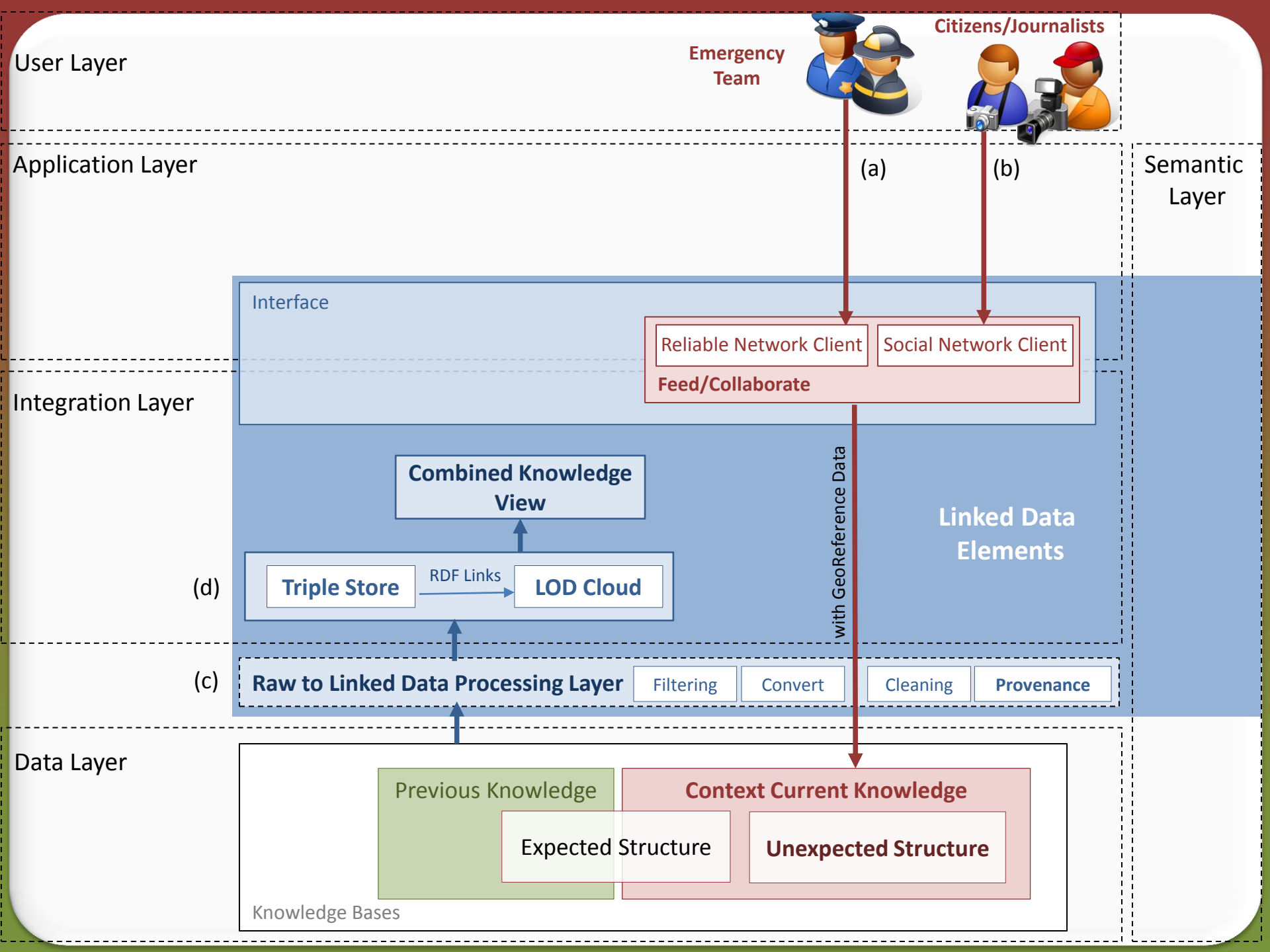
The structure of the current contextual information might have been planned in the schema design of the Data Layer or not!

<u>Expected structure:</u>

- ***triplified*** **as an individual in an existing RDF schema**

<u>Unexpected structure:</u>

- ***triplified*****, with its own structure, and interlinked with other triples using the RDF URI reference**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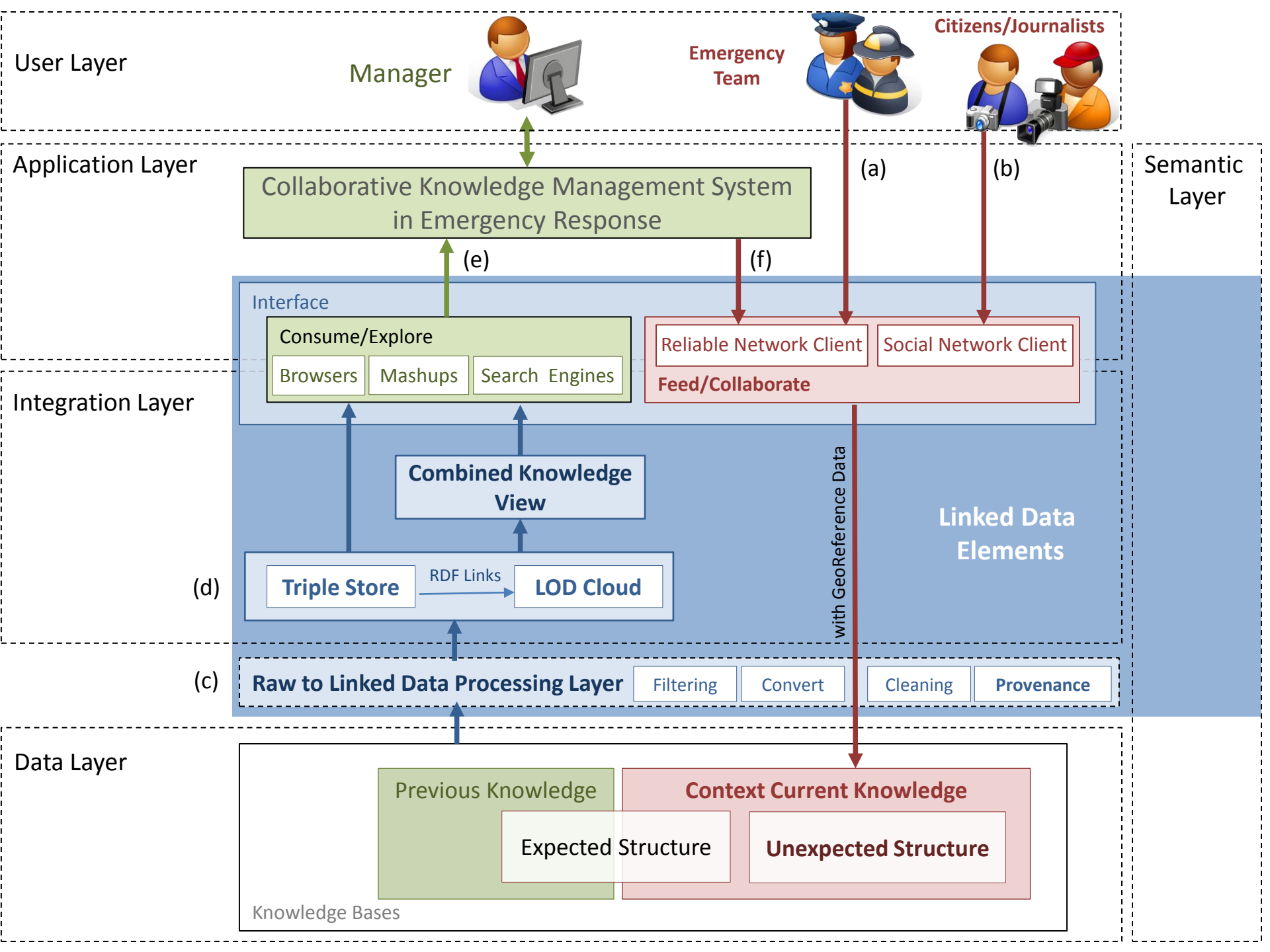
(a)
(b)
Interface
Reliable Network Client
Social Network Client
Feed/Collaborate
Combined Knowledge View
Triple Store
RDF Links
LOD Cloud
(d)
with GeoReference Data
Linked Data Elements
(c)
Raw to Linked Data Processing Layer
Filtering
Convert
Cleaning
Provenance
Previous Knowledge
Context Current Knowledge
Expected Structure
Unexpected Structure
Knowledge Bases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Collaborative Knowledge Management System in Emergency Response
(a)
(b)
Semantic Layer
(e)
(f)
Interface
Consume/Explore
Browsers
Mashups
Search Engines
Reliable Network Client
Social Network Client
Feed/Collaborate
Integration Layer
Combined Knowledge View
with GeoReference Data
Linked Data Elements
(d)
Triple Store
RDF Links
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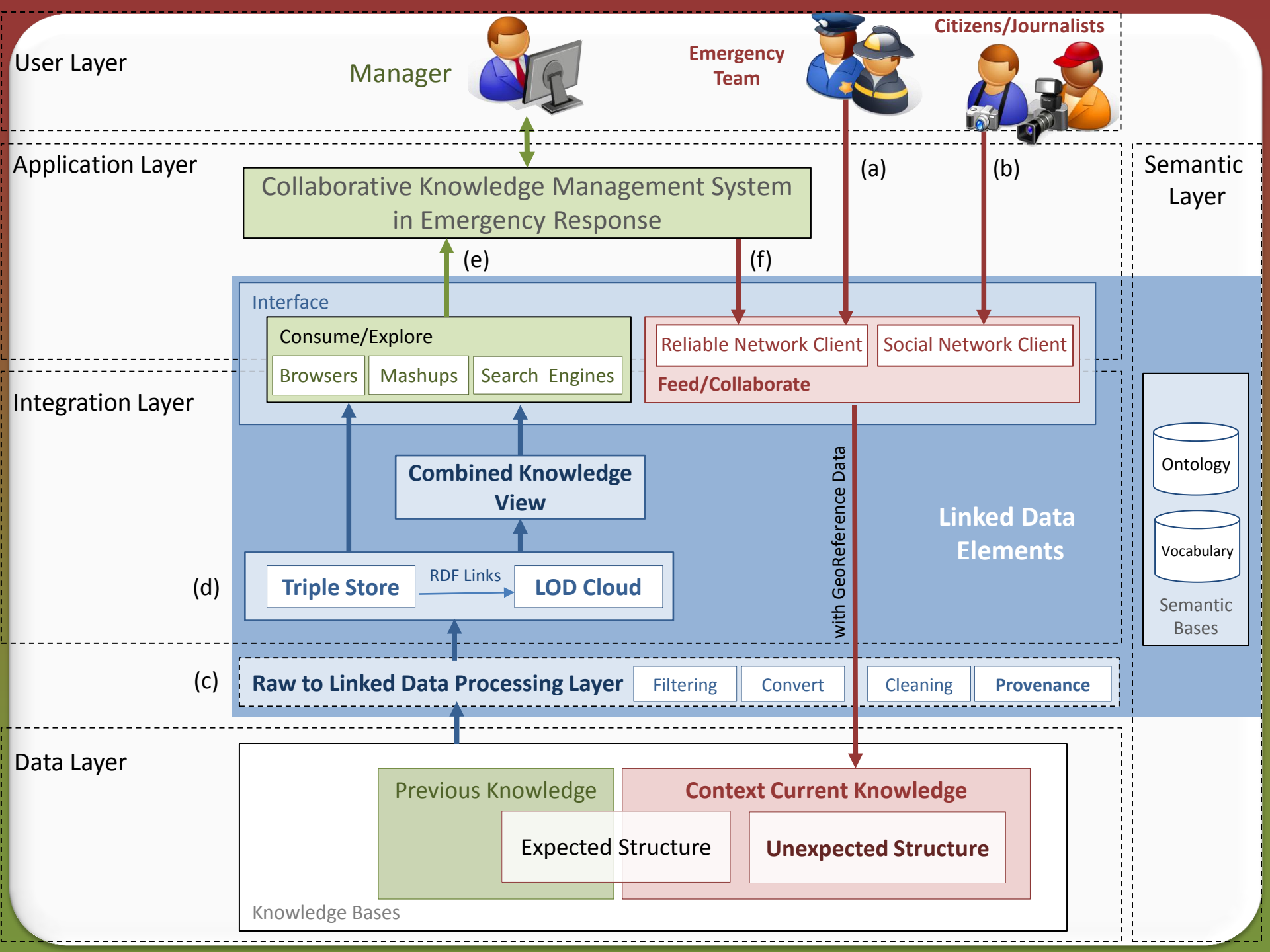
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Raw to Linked Data Processing Layer
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Previous Knowledge
Context Current Knowledge
Expected Structure
Unexpected Structure
Knowledge Bases

Conclusions

- In Emergency Reponse Scenario
  - We described an architecture based on the knowledge framework that makes use of the Linked Data approach for data integration
    - Expected and Unexpected Structure
  - We showed how a collaborative supply of information can be integrated into a comprehensive scheme aimed to support the decision-making process

Next Steps

- Design of a domain independent architecture
  - the scheme can be applied to any scenario that needs a collaborative interface and an integration layer to support dynamic information with unexpected structure
- Identification of the issues for each type of collaboration on LOD Process (under discussion)
  - Development of appropriate tools

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Thank you!

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Linked Data: an approach for interrelating heterogenous data

- Linked Data Perspectives
  - Status (November 2010)
    - 203 datasets, approximately 27 billion triples and 400 millions of RDF outgoing links
  - European projects
    - LOD Around The Clock (LATC) Support Action
      - support institutions and people in publishing and consumption of Linked Open Data.
    - LOD2 Project
      - handle some challenges of the LOD paradigm associated to intelligent information management:
        - » the exploitation of the web as a platform for data and information integration in addition to document search

Linked Data: an approach for interrelating heterogenous data

- Linked Open Data
  - The appeal for the government to open and expose data to the public as Linked Data
  - Motivated by the the growth of e-government programs