An Attribute-Based Protection Model for JSON Documents

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Outline

- Summary
- Motivation
- Background
- JSON protection model
- Labeling JSON elements
- Implementation
- Q/A

Summary

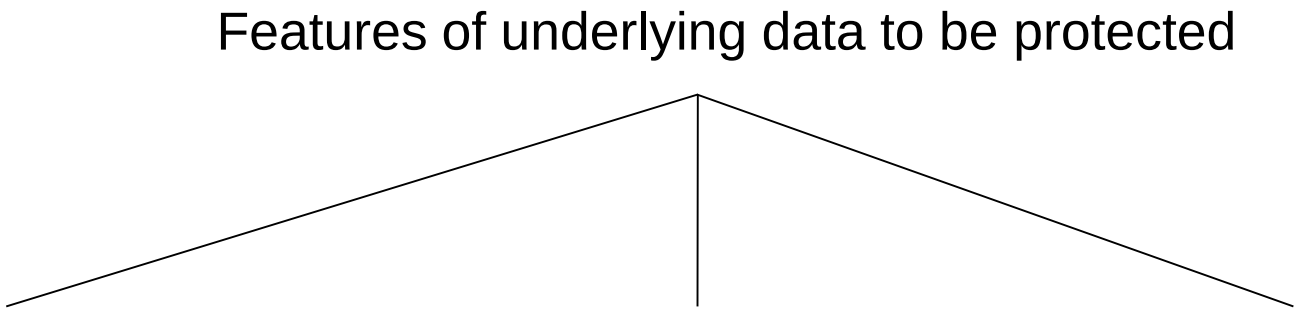
- We have presented an attribute based protection model and labeling schemes for securing JSON documents.

Motivation

- **Why JSON documents?**

Motivation (continuing)

- **Why not reuse XML protection models?**



Hierarchical relationship
(e.g. house-no, street, town)

Semantic association
(e.g. phone-no, email, fax, mobile)

Scatteredness
(due to redundancy/duplicity)

- Considered in XML protection models

- Not considered

Motivation (continuing)

❑ Existing XML models vs proposed model

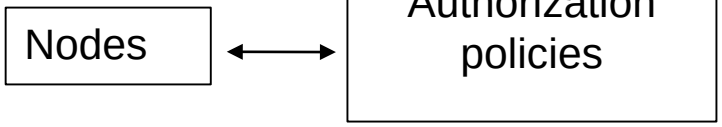


Fig 1 (a): Existing XML protection models

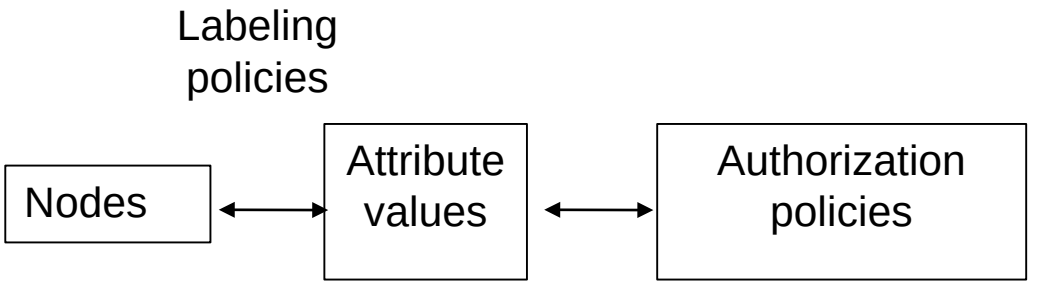


Fig 1(b): Proposed JSON protection model

Background - JSON

- **JSON data forms a rooted tree hierarchical structure (like XML)**

```
{
“emp-rec”:{
“name”: “...”,
“con-info”:{
        “email”:
“...”,
        “work-phone”:
“...”
        },
“emp-info”:{
        “mobile”: “...”,
        “EID”:  “...”,
        “salary”: “...”
}
“sen-info”: {
        “SSN”: “...”,
        “salary”: “...”
        }
}
}
```

Fig 2 (a): JSON data

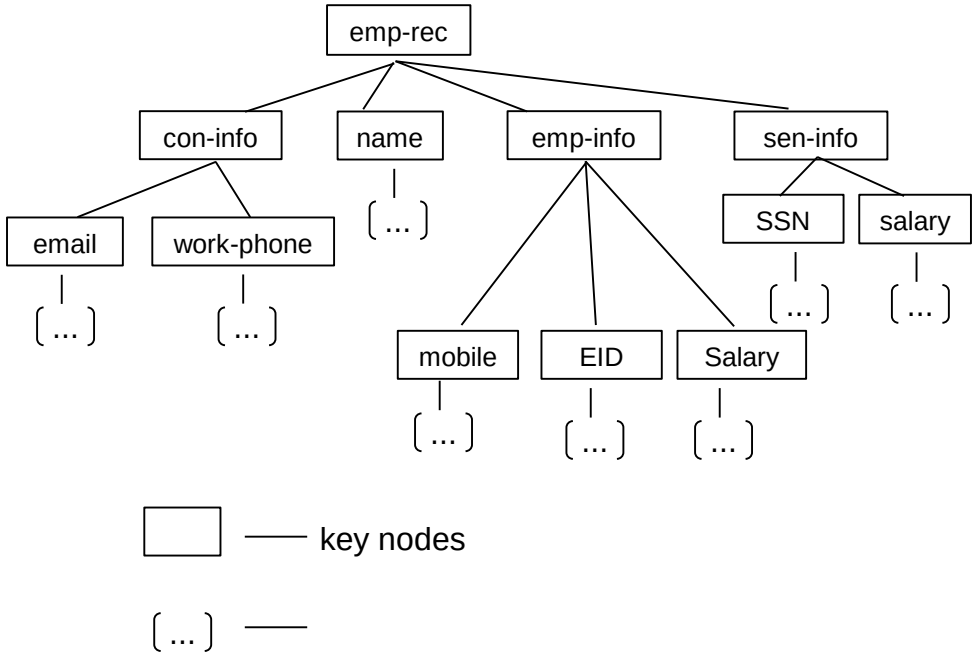


Fig 2 (b): Corresponding JSON tree

JSON protection model

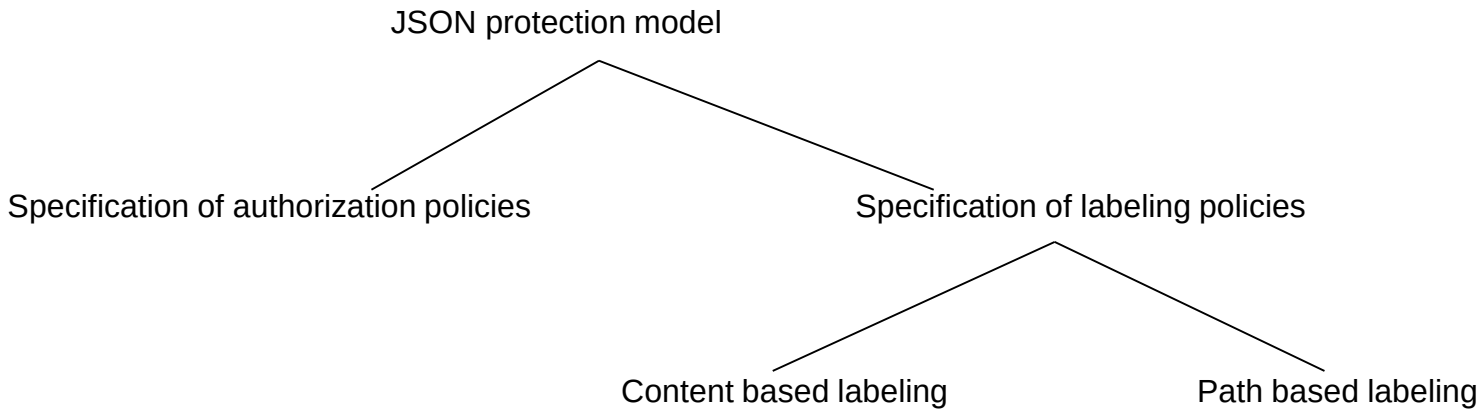


Fig 3: Scope of the JSON protection model

JSON protection model (continuing)

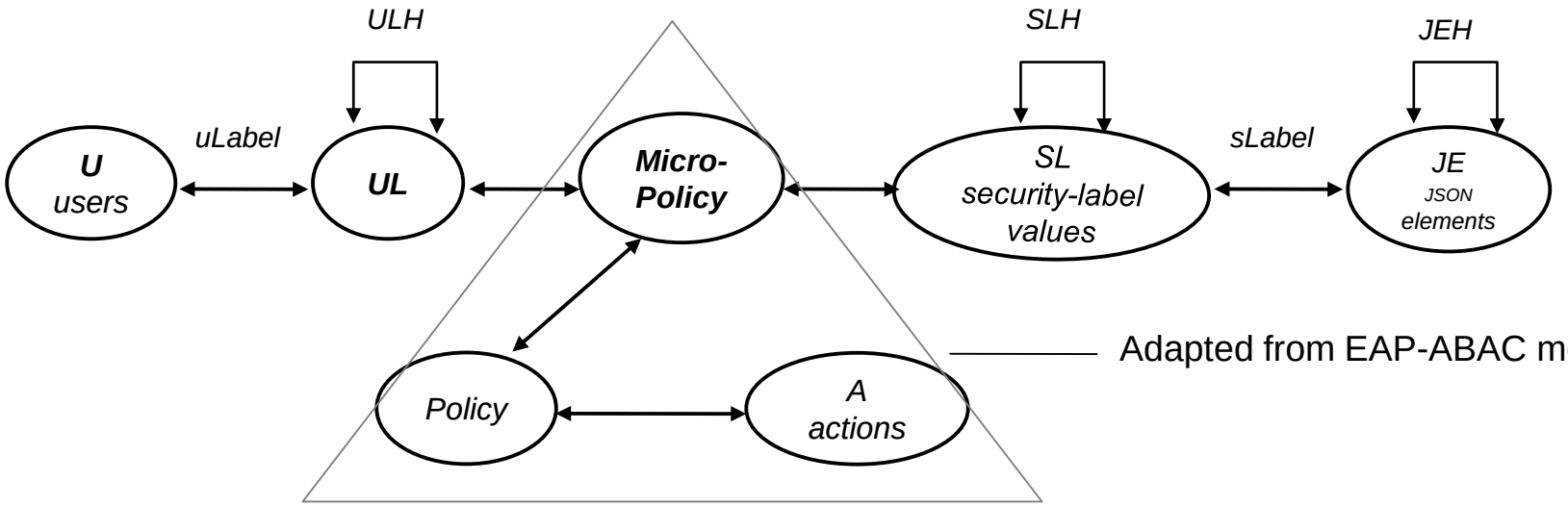


Fig 4: The Attribute-based Operational Model (AtOM)

[1] Biswas, Prosunjit, Ravi Sandhu, and Ram Krishnan. "Label-Based Access Control: An ABAC Model with Enumerated Authorization Policy." Proceedings of the 2016 ACM International Workshop on Attribute Based Access Control. ACM, 2016.

JSON protection model - examples

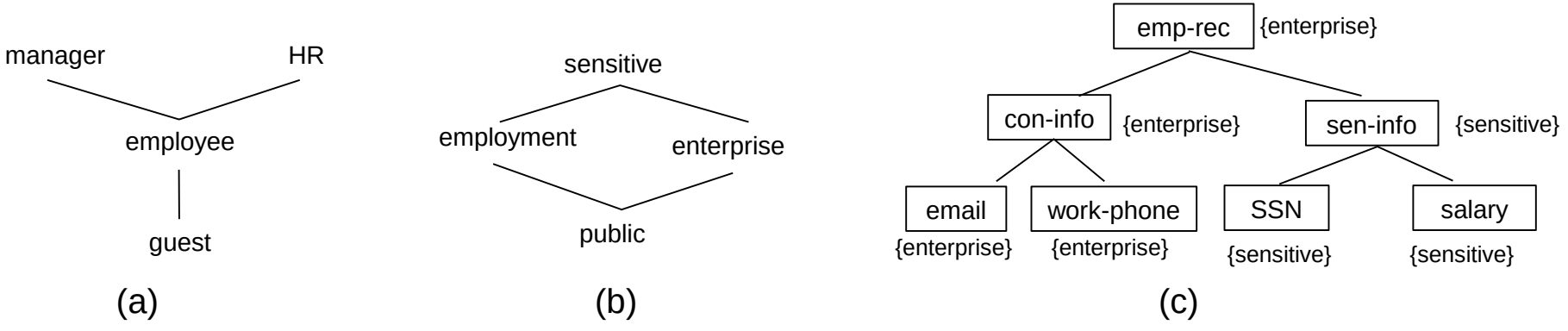


Fig 5: (a) User-label values, (b) security-label values and (c) annotated JSON tree

Example of a policy, $Policy_{read}$ =
{(manager, sensitive), (HR, employment), (employee, enterprise), (guest,public) }

Labeling JSON documents

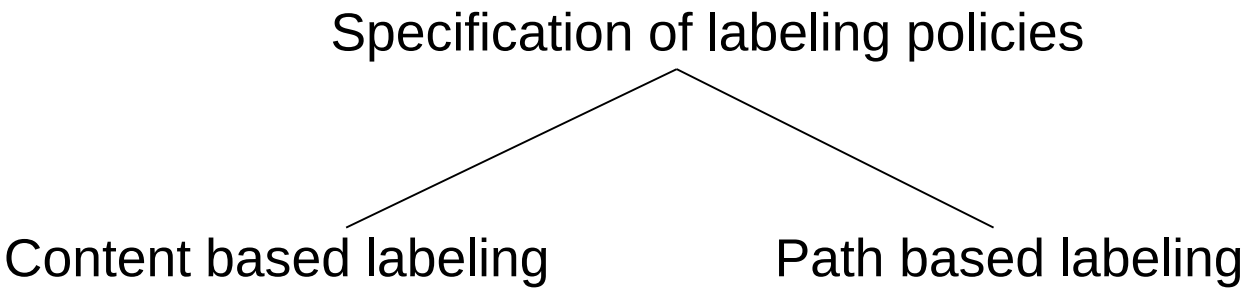


Fig 6 (a): Types of labeling policies

Labeling JSON documents (continuing)

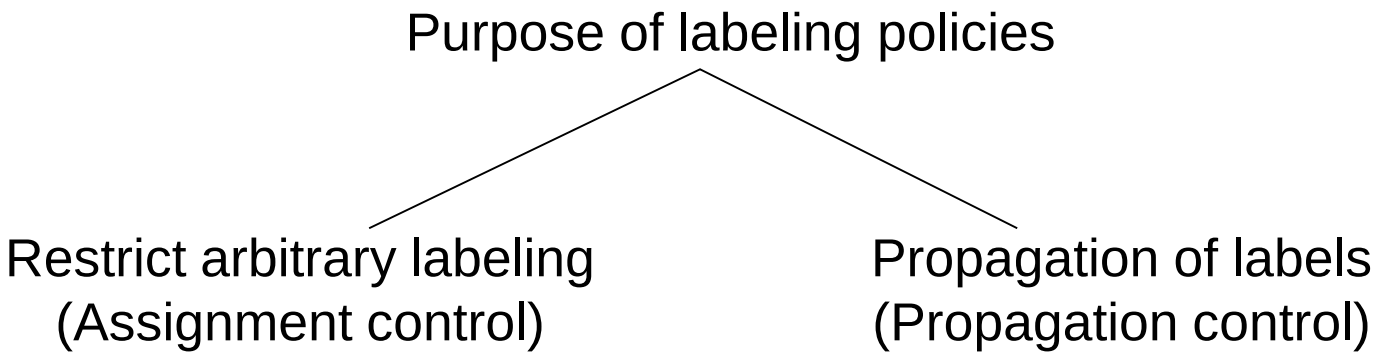


Fig 6 (b): Purpose of labeling policies

Labeling JSON documents – Assignment control

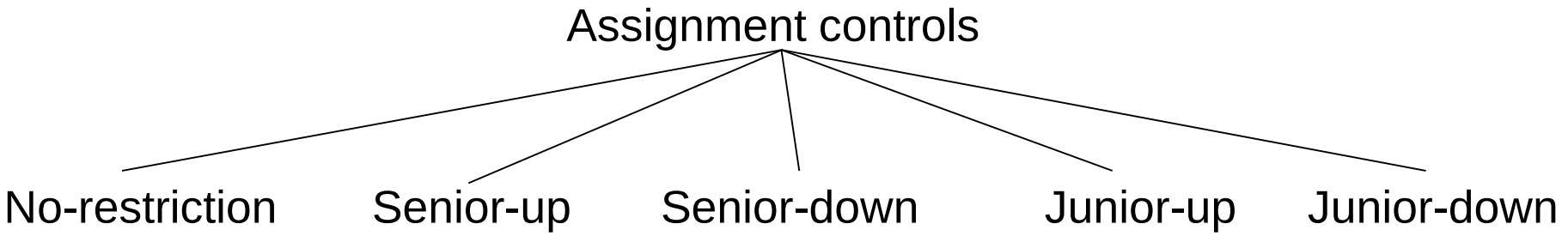


Fig 7 (a): Different types of Assignment controls

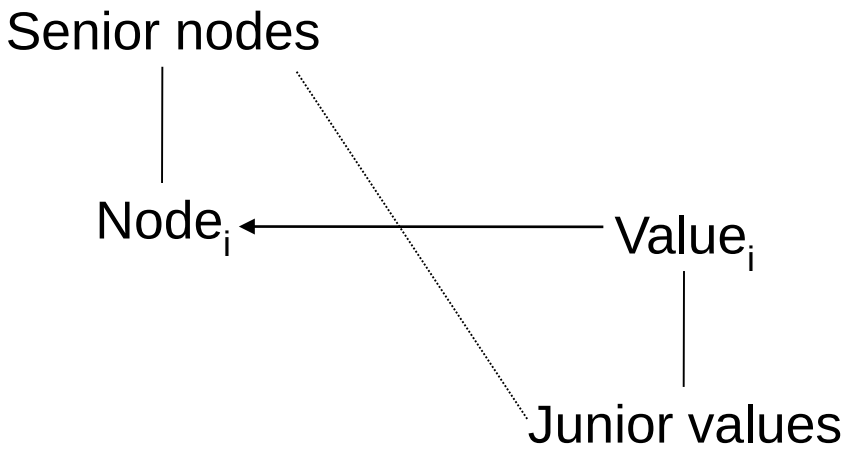


Fig 7 (b): Junior-up assignment control

Assignment

Senior nodes of **Node$_i$** must be assigned junior values of **Value$_i$**

Labeling JSON documents – Propagation control

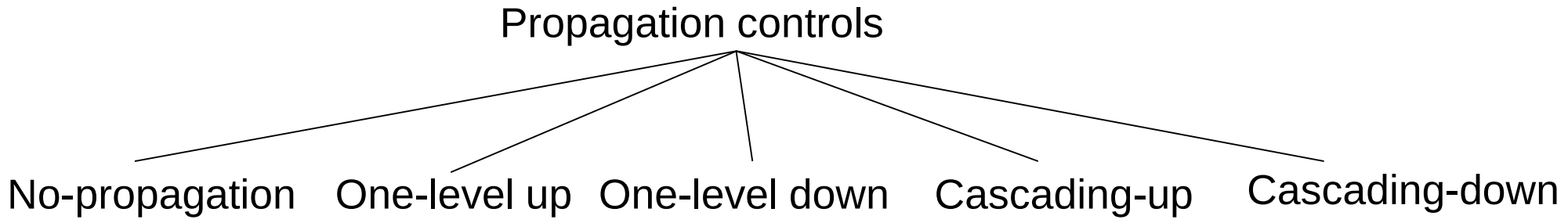


Fig 8: Different types of propagation controls

Labeling JSON documents – Path-based labeling model

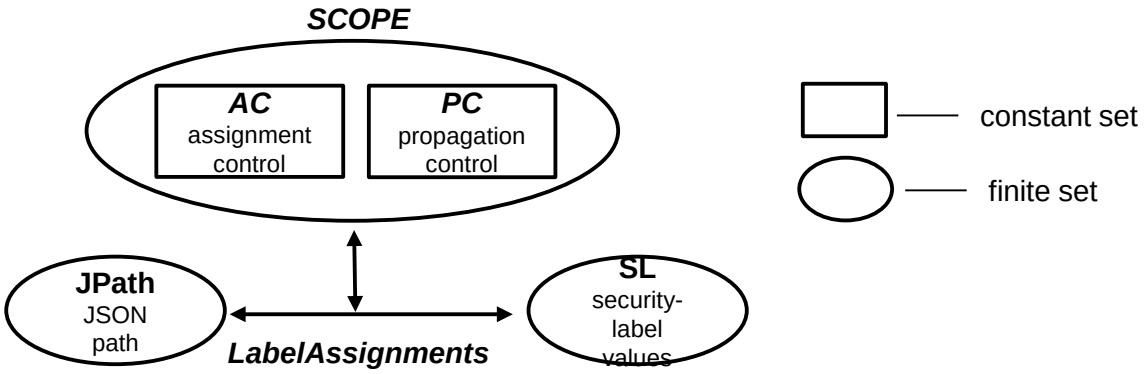


Fig 9: Model for path-based labeling of JSON data

I. JSONPaths
- path-to-email=$.emp-rec.con-info.email
- path-to-salary=$.emp-rec.sen-info.salary
II. LabelAssignments
- LabelAssignments= { (path-to-email, (no-prop, unrestricted), {enterprise}), (path-to-salary, (no-prop, unrestricted), {sensitive}) }

Table 1: Example of path-based labeling

Prototype implementation

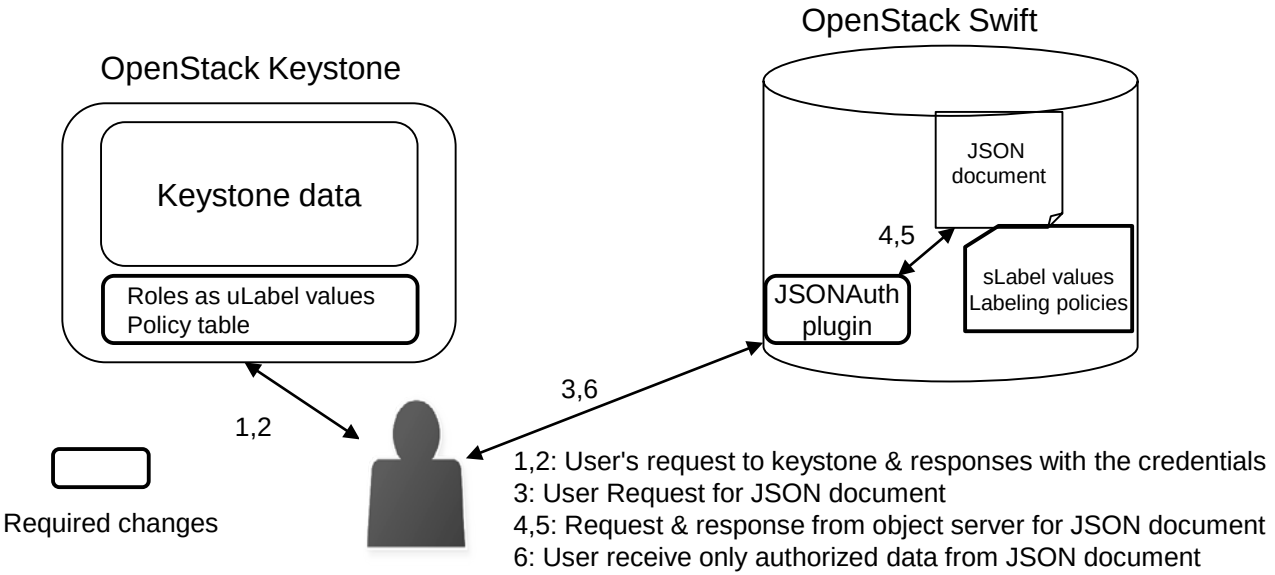


Fig 10: Implementation in OpenStack Cloud

Implementation - evaluation

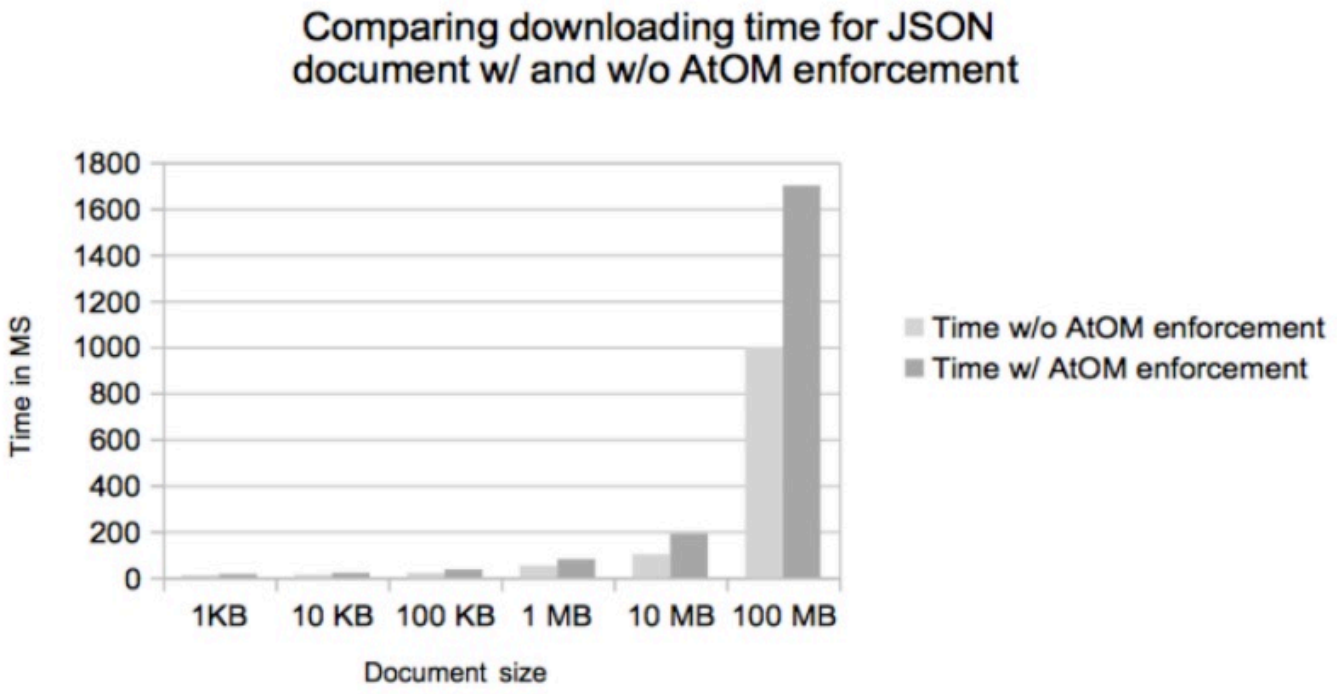


Fig 11: Performance evaluation

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