UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR | COLLÈGE STEE SCIENCES ET TECHNOLOGIES POUR L'ÉNERGIE ET L'ENVIRONNEMENT

Département des Landes

IdSM-O : an IoT data Sharing Management Ontology for Data Governance

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Outline

IdSM-O : an IoT data Sharing Management Ontology for Data Governance

- Context & Problematic
- Contextual usage control management
- IdSM-O: IoT Data Sharing Management Ontology
- The system architecture
- Conclusion

Context

- Implementation of a decentralized architecture allowing the sharing and traceability of information.
- Design and develop a dynamic usage control policy (i.e. able to adapt according to the context), to address data governance issues in IoT environments.
- Generate licenses that stay attached to an observation.

Context

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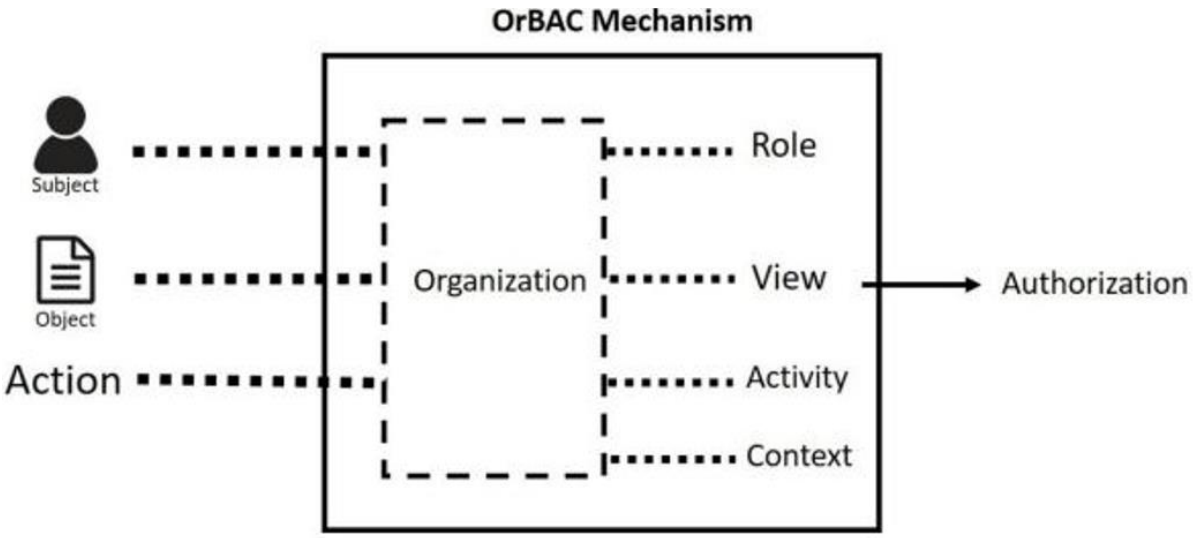
Information security requirements

Semantic interoperability, data governance, digital commons

Contextual usage control management

- Modeling a usage control model within OrBAC

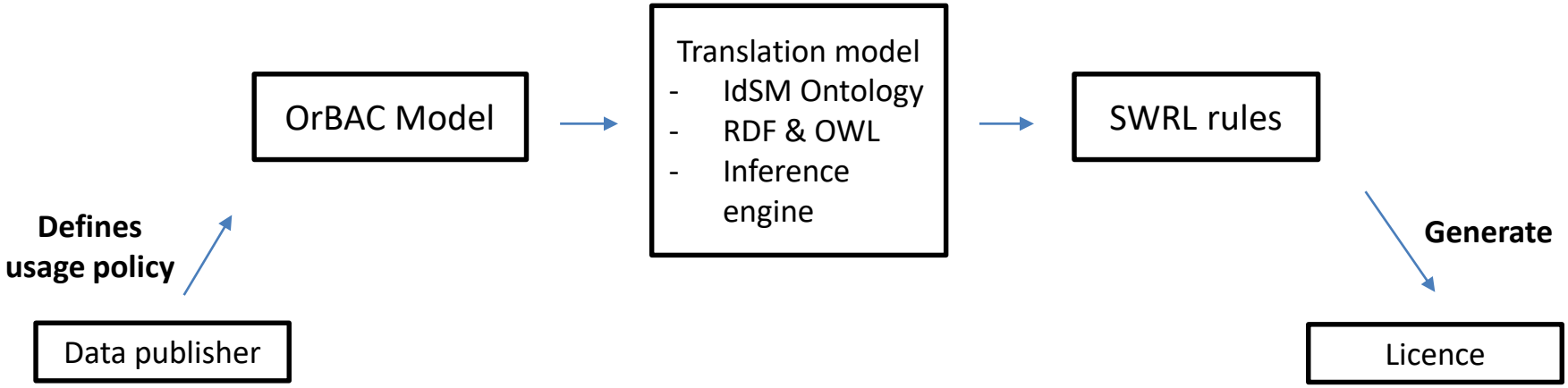


- Exemple of a usage control role

$$R1 \equiv Permission(\text{"}Data\_Producer\_Facility\text{"}, \text{"}farmer\text{"}, \text{"}access\text{"}, \text{"}soil\_humidity\text{"}, \text{"}delete\_after\_treatment\text{"})$$

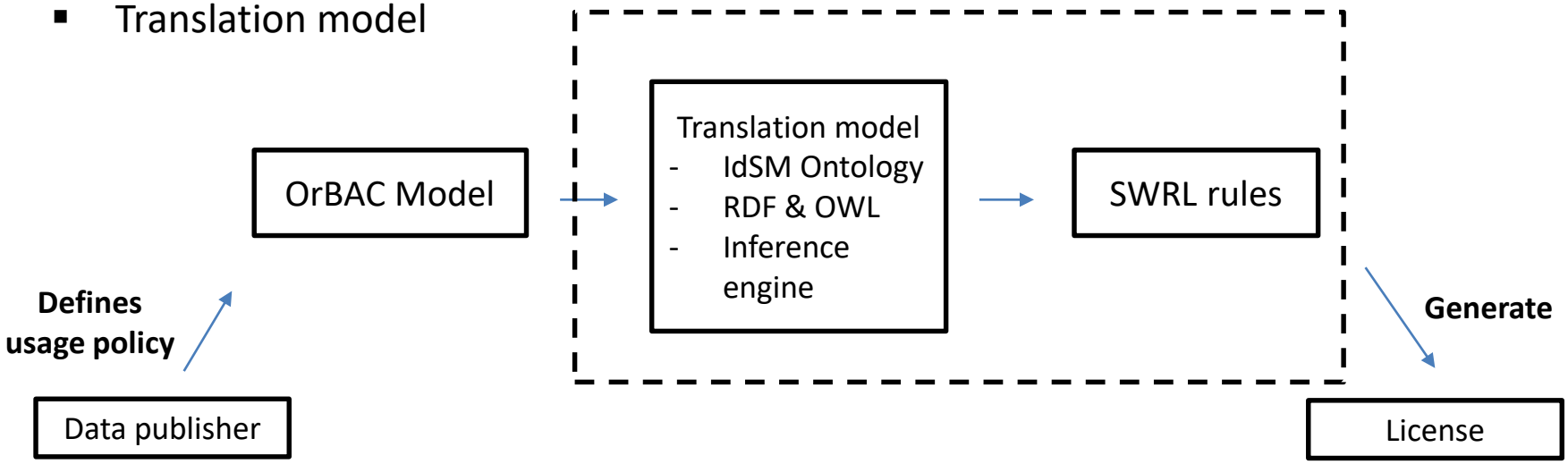
Contextual usage control management

- Translation model



Contextual usage control management

- Translation model



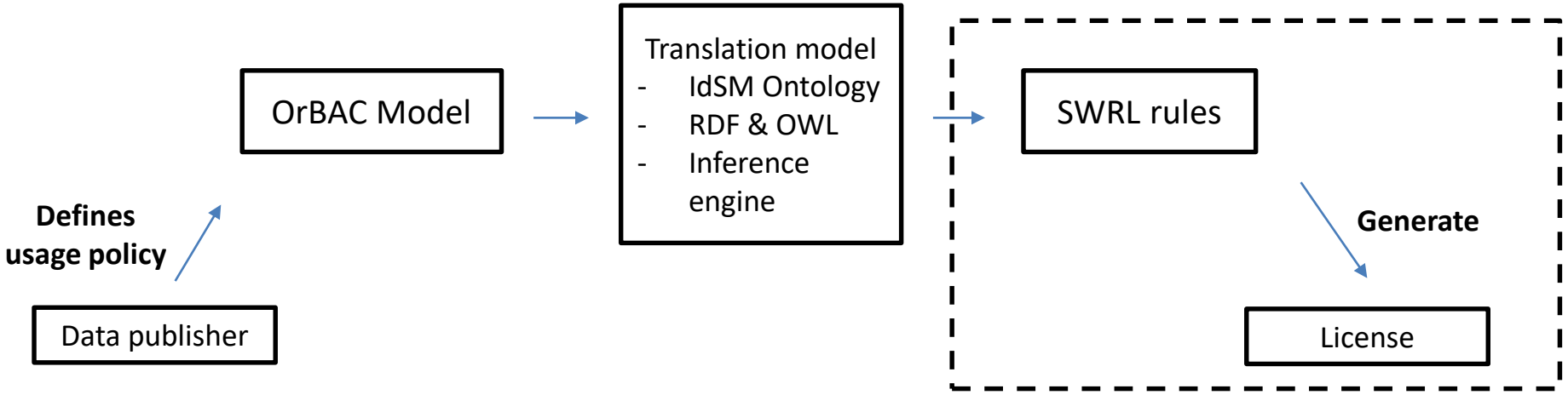
- Rule translation with our model

R1 ~

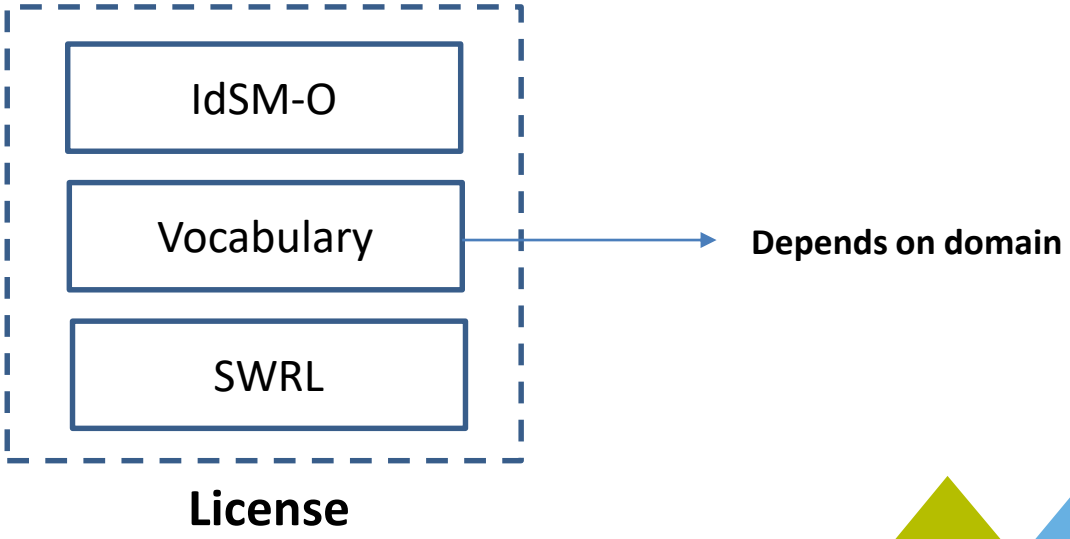
$$
\begin{aligned}
&\text{Consumer}(?c) \wedge Observation(?obs) \wedge \\
&Professional(?r) \wedge Prov : Activity(?a) \wedge \\
&Context(?cntx1) \wedge IoT\_device(?device) \wedge \\
&isMadeBy(?obs, ?device) \wedge OperationType(?op) \wedge \\
&hasRole(?c, ?r) hasView(?a, ?obs) \wedge \\
&\wedge hasSubject(?a, ?c) \wedge hasOperationType(?a, ?op) \wedge \\
&hasContext(?a, ?cntx1) \wedge \\
&sameAs(?obs, \textbf{soil\_humidity}) \wedge \\
&sameAs(?cntx1, \textbf{delete\_after\_treatment}) \wedge \\
&sameAs(?r, \textbf{farmer}) \wedge sameAs(?op, \textbf{access}) \\
&\rightarrow is\_Permitted(?a)
\end{aligned}
$$

Contextual usage control management

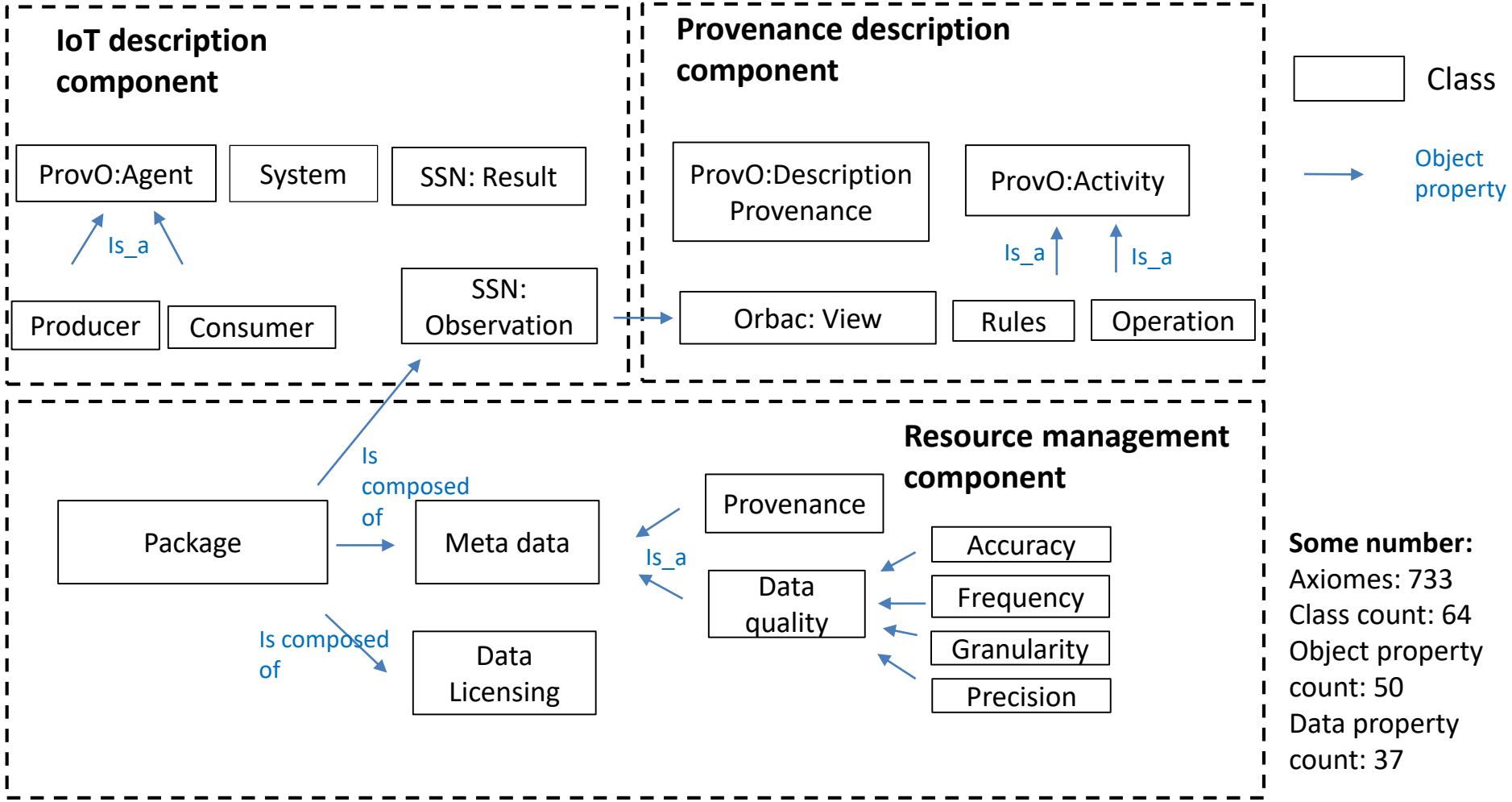
- Translation model



- License generation on three layers

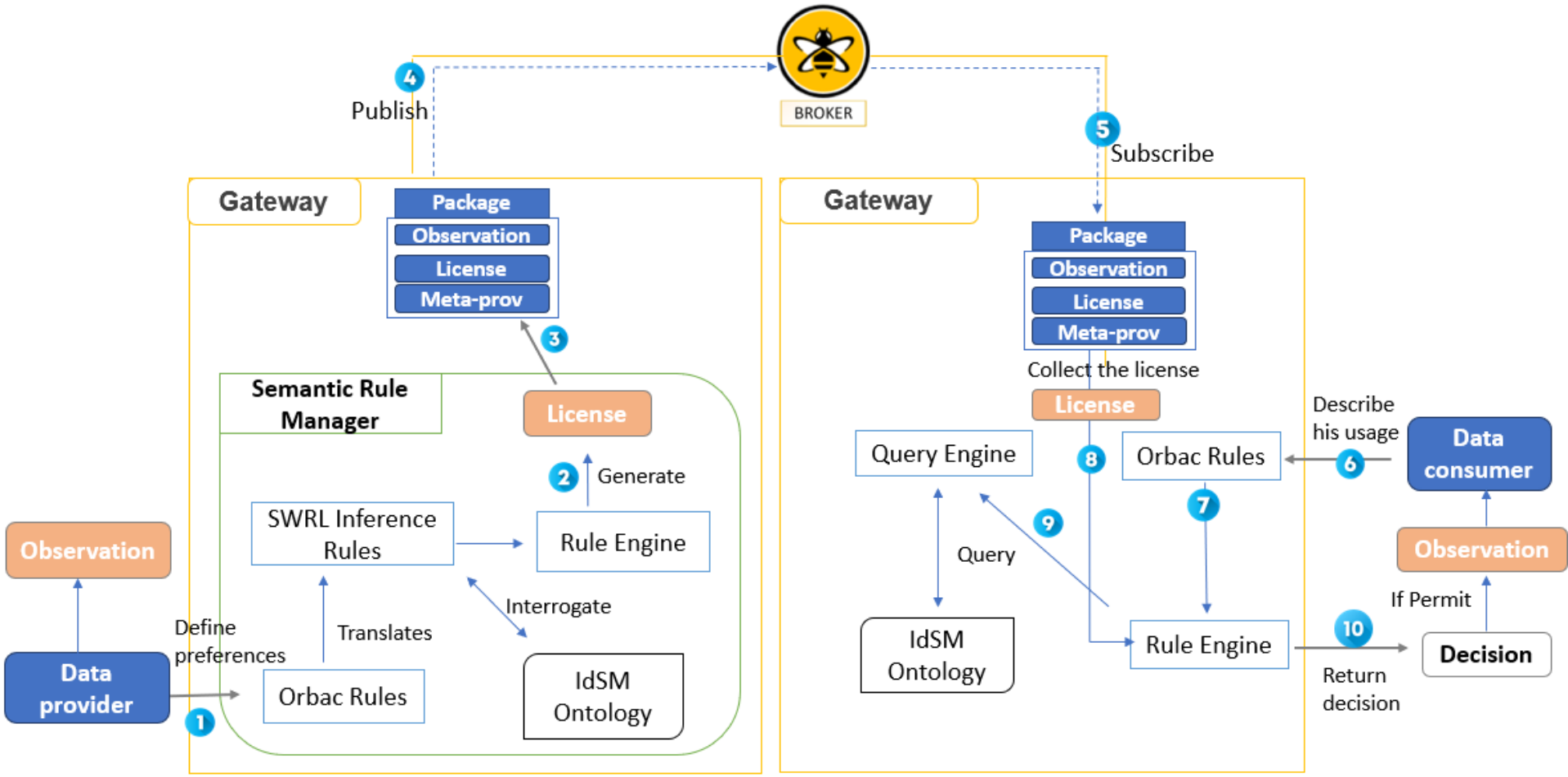


IdSM Ontology overview



Some number:
Axiomes: 733
Class count: 64
Object property count: 50
Data property count: 37

The system architecture



Conclusion

- The **data producer** has little to no control over his IoT data once shared, and **data requesters** don't have the ability to trace the source of the asset as well as its processing history to tailor it to their business needs.
- Place agents at the core of a distributed solution : data producers set the requirements that service providers need to respect to be able to use their assets.
- Semantic model rule manager and usage control policy and as a security preservation mechanism for IoT applications.
- Our solution is being developed in an ongoing smart agriculture research project.

Sources

[1] Cuppens Frédéric and Miège Alexandre. 2004. Or-BAC, Organization Based Access Control. The Review of Politics, Journées Druide (2004).

[2] Armin Haller, Krzysztof Janowicz, Simon Cox, Danh Phuoc, Kerry Taylor, and Maxime Lefrançois. 2017. Semantic Sensor Network Ontology.

[3] I. Horrocks, P.F. Patel-Schneider, H. Boley, Said Tabet, Benjamin Grosof, and Mike Dean. 2007. SWRL: A semantic web rule language combining oWL and ruleML. W3C Member submission 21 (01 2007).

[4] Anas Kalam, R.E. Baida, P. Balbiani, S. Benferhat, Frédéric Cuppens, Yves Deswarte, A. Miege, Claire Saurel, and G. Trouessin. 2003. Organization based access control. 120 – 131.

[5] Timothy Lebo, Satya Sahoo, Deborah Mcguinness, Khalid Belhajjame, James Cheney, David Corsar, Daniel Garijo, Stian Soiland-Reyes, Stephan Zednik, and Jun Zhao. 2013. PROV-O: The PROV Ontology.

[6] Jorge López de Vergara Méndez, Enrique Vázquez, Martin Antony, Dubus Samuel, and Lepareux Marie-Noëlle. 2009. Use of Ontologies for the Definition of Alerts and Policies in a Network Security Platform.

ANY QUESTIONS ?

Context

- Smart agriculture