



ICAR 2022
MONTRÉAL CANADA
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Exchanges of French genetic data are driven by farmer consent managed in a dedicated blockchain

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What are we speaking about ?

- ▶ French technical data records structured by breeders' organizations since the 60's
- ▶ System in production managed by France Génétique Elevage in the last 14 years with a large amount of data collected on animal identification, parentages, performances and genotyping, with record of consent available since 2016

	Identities	Births	Lactations	Milk records	Weighing	Morphology records	Inseminations
Records created in 2021	7,012	6,749	2,232	20,393	1,271	1,156	6,514
Total in the Data base	233,6	158,0	114,3	857,0	49,1	25,2	189,0

Number of data managed in the cattle information system (in Millions)

- ▶ More than 300 data providers contributed to the system in 2019
 - ▶ 135 of them who exchanged more than 10 000 records

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A new landscape for regulation



- ▶ By the end of 2023, EU regulation on personal information (RGPD) will be updated with the Data Governance Act
 - ▶ It creates the processes and structures to facilitate data sharing
 - ▶ It clarifies who can create value from data and under which conditions
 - ▶ It defines a new role of Data Intermediary Service Provider which must be independent of any storage or treatment of any kind
 - ▶ It asks for an explicit consent on non personal data



A new landscape for Farmer Union position on Data



- ▶ Data-agri is an approach
 - ▶ Promoted by Farmer Union
 - ▶ That aims to raise farmers' awareness of the use of agricultural data, to create trust in digital farming and to guarantee constant innovation and fair use of agricultural data

- ▶ Data-agri consists of two elements
 - ▶ A charter and a label.
 - ▶ The Data-agri label distinguishes companies that collect agricultural data and that respect all the principles defined in the Data-agri charter



A new landscape for actors...



- ▶ Very Different sizes of actors in the field of genetic improvement
 - ▶ Some with internal information system where zootechnical data are integrated in their ERP



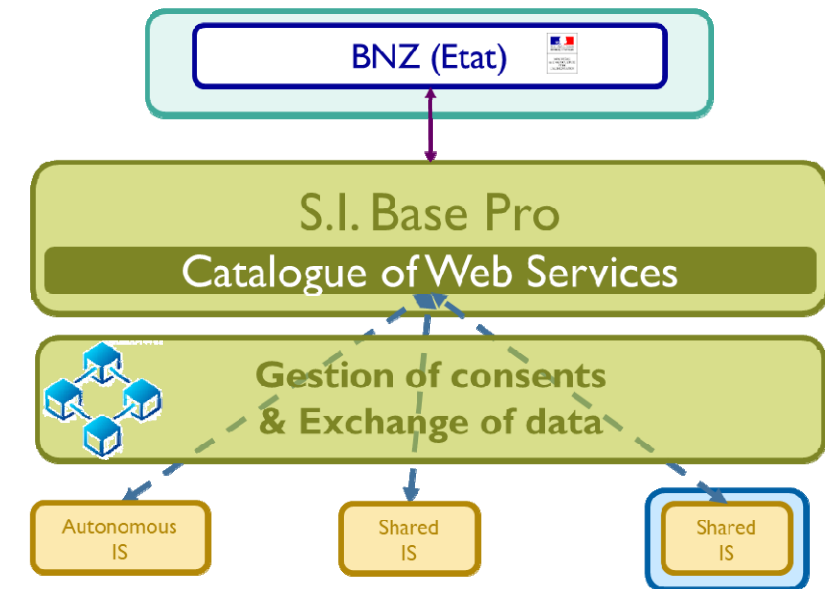
- ▶ Demand of
 - ▶ Exchange of data for multiple uses by many companies
 - ▶ Inside and outside the genetic field
 - ▶ With the guaranty of verification of breeder consent
 - ▶ *Is pushing the development of new solutions of exchange*

New system

Central database + Management of consents

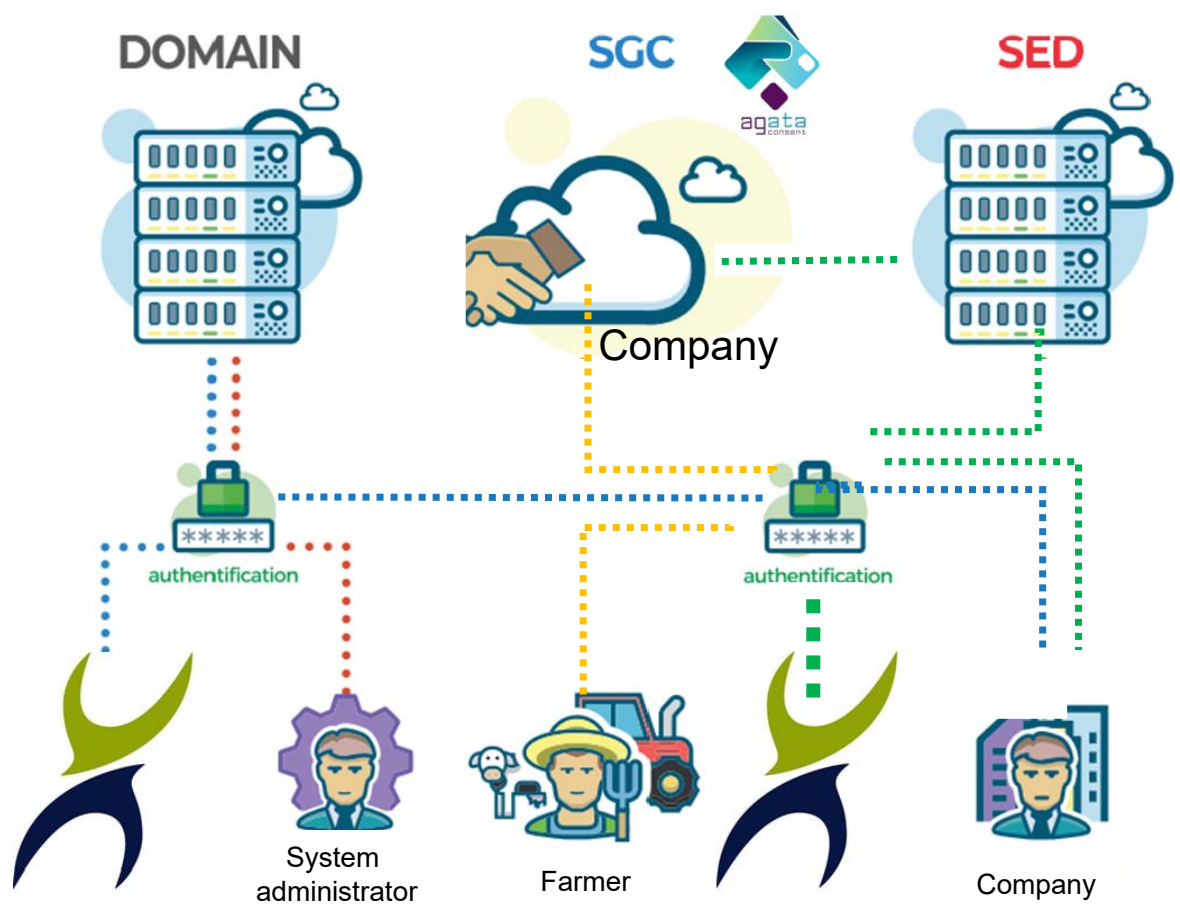


- ▶ A central system
 - ▶ National database managed by FGE to capitalize all the data
 - ▶ Set of web services published to support data exchange with all the other information systems
- ▶ A consent management system based on blockchain
 - ▶ capacity of disintermediation, trust creation and the legal value of data encrypted and stored
 - ▶ Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network (<https://www.ibm.com/topics/what-is-blockchain>)
- ▶ High compatibility of the new system with international data exchange standard included **ICAR ADE** and with legal (**Data Governance Act**) or professional requirements (**Data Agri**)





Exchange architecture

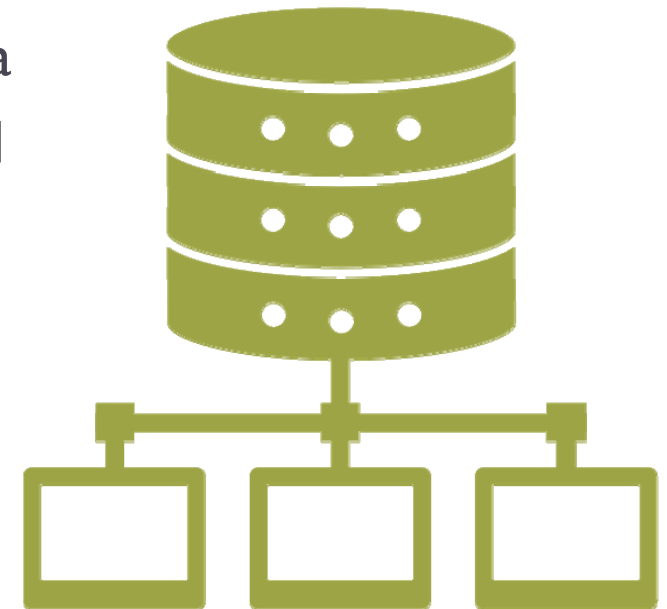


The consent management system (SGC) paired with a web services exchange system (SED) aims at ensuring the informed consent of breeders speaking about the use of their data

National database and exchange system (1/2)



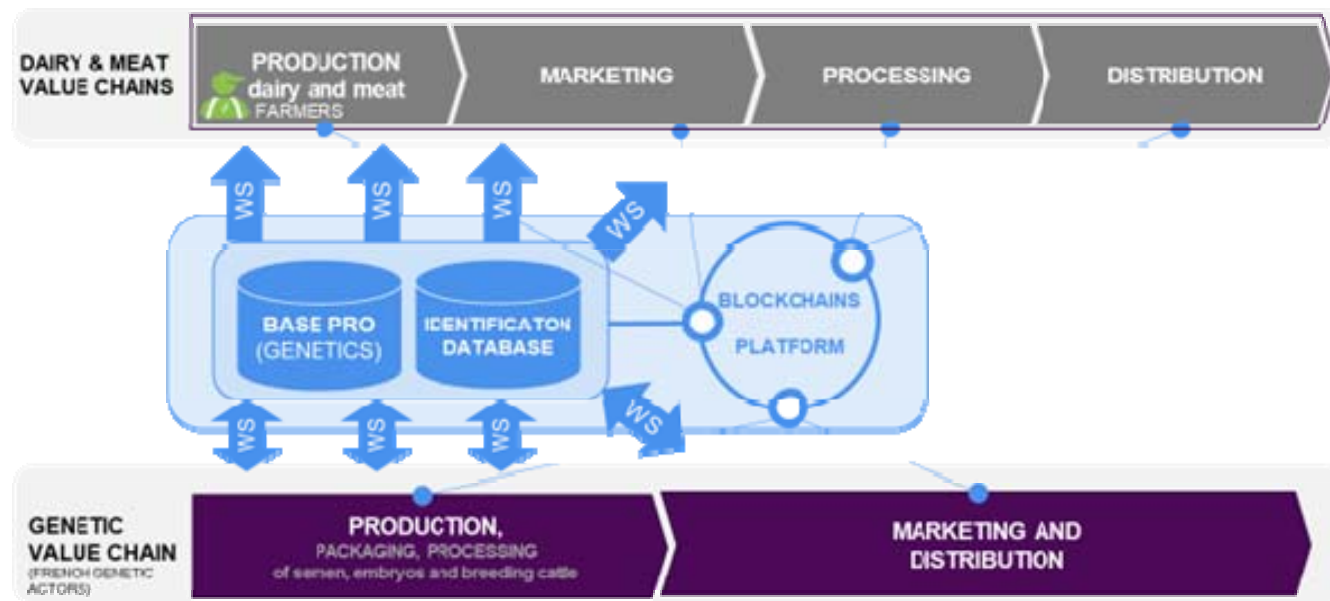
- ▶ Based on the PostgreSQL opensource technology
- ▶ Modalities of exchange compliant with IT state of the art
- ▶ Systematic consent verification before any access to data
- ▶ Technical application accounts are stored in a LDAP and managed through the administration portal which allows the management of the accounts and their access grants
- ▶ *Authentication based on a Keycloak standard solution*
 - ▶ *Open Source Identity and Access Management Server*
 - ▶ *OAuth2 and OpenID Connect(OIDC) protocol complaint*
- ▶ *Technical framework based on the standard technologies*
 - ▶ *java/Rest/Wildfly/Swagger*



National database and exchange system (2/2)



- ▶ The Base Pro web services are deployed on a multi-node infrastructure which offers
 - ▶ Scalability / Redundancy & Security
 - ▶ Multi-node load balancing and resilience
 - ▶ Continuous integration platform
- ▶ Industrialized platform
 - ▶ based on standard components
- ▶ Documented Interface Contract
 - ▶ Swagger
- ▶ Volumetric capacity
 - ▶ 10 000 000 requests/month
 - ▶ Peak of 20 000 000 requests/day
 - ▶ Capacity Load Tests
 - ▶ 13 000 000 requests/hour





Consent management system (1/3)

System managing consents organized into functional areas called “domains”

- Adaptable to data from all sectors (agri-food value chains and other sectors of economy)

APIs or ergonomic interfaces for administrators of the system

- To administrate, create, modify the consents



Free farmers' interface

- To consult and manage consents



The DIGITAL OFFICE for farmers

Solution based on open-source components

Webservices : Opensource Springboot framework

Full web management interfaces : Javascript Angular framework, design responsive

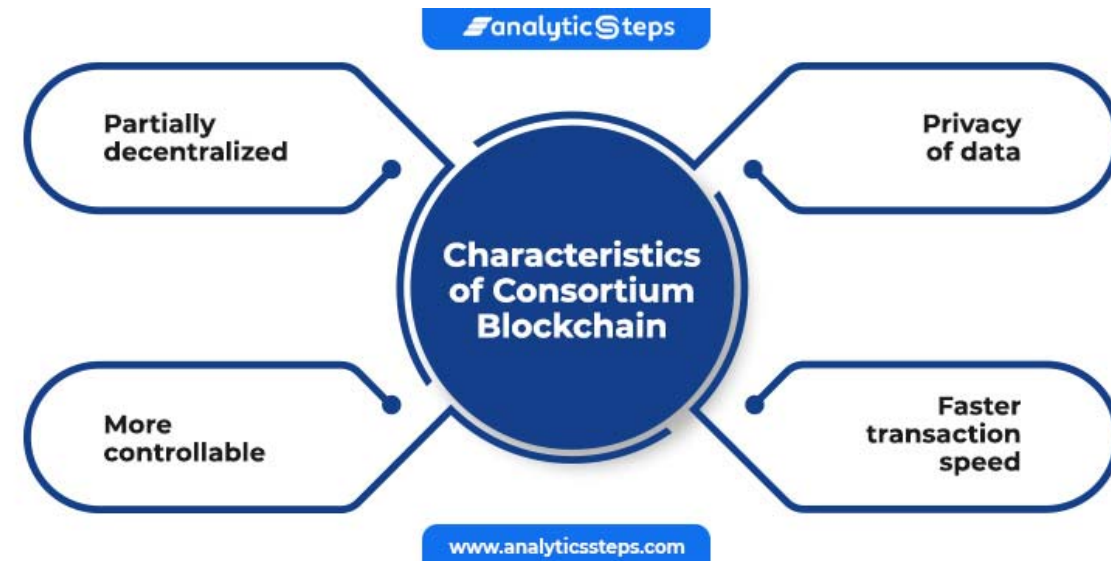
Types encoding uses UTF-8 for exchange and storage, dates are encoded using the ISO 8601 norm

Solution based on open-source components

Consent management system (2/3)



- ▶ Decentralized consent management solution (Blockchain of consortium)
- ▶ Distributed architecture with a variable number of nodes (coherent with blockchain philosophy) to ensure the security of the system
- ▶ For each node :
 - ▶ *HyperLedger Fabric Ledger*
 - ▶ *data storage in the blockchain*
 - ▶ *Smart contract*
 - ▶ *Java code used in the blockchain*
 - ▶ *Couch DB : database technology Fabric-CA*
 - ▶ *certification authority*
 - ▶ *Orderer*
 - ▶ *Hyperledger control*



Consent management system (2/4)



- ▶ *System initialization*
 - ▶ **273 071 consents** have been loaded
 - ▶ **74 534 herds**
 - ▶ **138 companies**
- ▶ *1st test in production condition*
 - ▶ **0,2 second** to
 - ▶ *verify consent*
 - ▶ *exchange a set of Data*

Farmers' interface on Agri Maker

Conclusion

...Beyond the technical choices



- ▶ A solution to recreate trust on the exchange of Data
 - ▶ High compatibility with
 - ▶ International data exchange standard included the ICAR ADE
 - ▶ Data Governance Act
 - ▶ Professional engagement Data Agri
 - ▶ Using technologies allow disintermediation



- ▶ The initialization of the system ended in May 2022 for genetic field, it will be followed by the phase of increase in load
- ▶ The promoters of this solution hope that it will be applied on a large fields of animal data exchange