4TU Redesign

REthinking the food system together;
DESIGNing a high-tech and data-driven food system of the future
2023-2027

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PROBLEMS WITH THE CURRENT FOOD SYSTEM

Not a sustainable system

A lot of international dependence on products

People are not connected to the food:

-not personalization

-no trust

-no sufficient information

Many stakeholders & different data (e.g., health, food, nutrition)

-many data silos

-different semantics

Protecting sensitive information

-following GDPR

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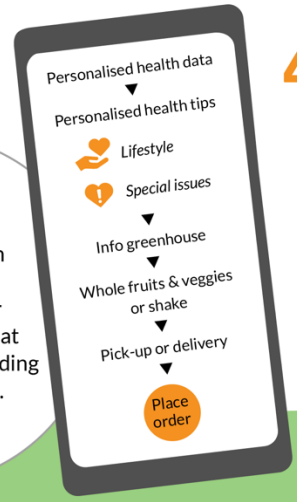
App

Through apps you can add personalised health data and order fruits & vegetables that are customised according to your dietary needs.



Aim of the programme

To develop the next-generation food system by linking consumer wishes in a smart way with production of fruits and vegetables in protected environments thereby increasing human health, sustainability and resilience

Novel food system

Healthy

Sustainable

Resillient

Autonomous production

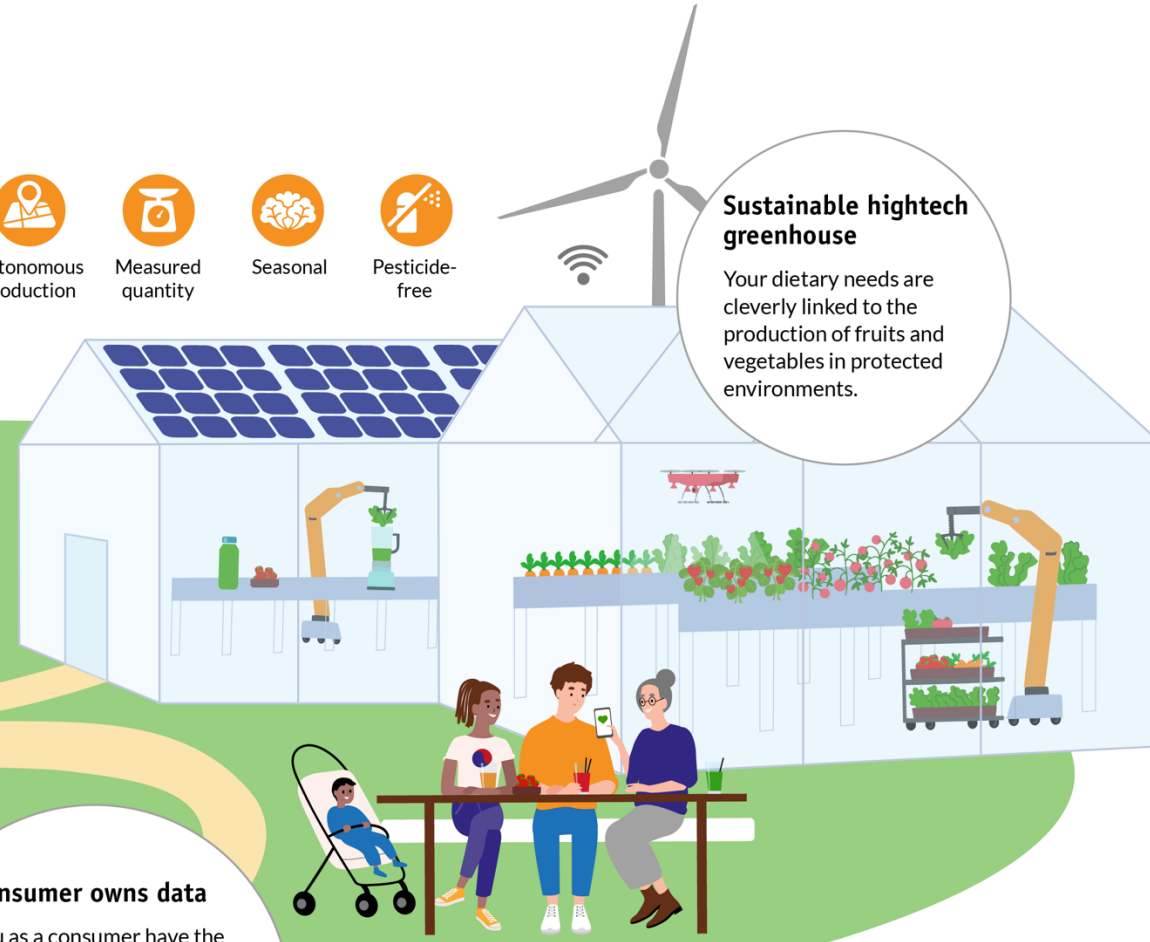
Measured quantity

Seasonal

Pesticide-free

Sustainable hightech greenhouse

Your dietary needs are cleverly linked to the production of fruits and vegetables in protected environments.



Consumer owns data

You as a consumer have the ownership of your own data. The data platform is trusted. You can safely supplement it with health, exercise and fitness data via apps, wearables and IoT devices.

Federated data platform

Business innovations

Smart logistics

Costs & benefits

FIVE CORE GROUPS – INTERDISCIPLINARY RESEARCH

Business Economics Group (Miranda Meuwissen, Max Koppenberg)[1]

Horticulture and Product Physiology Group (Leo Marcelis, Cristina Zepeda)

Technology Policy and Management (Mark de Reuver, Caroline Figueroa, Kathleen Guan)

Innovation, Technology Entrepreneurship and Marketing (Boukje Huijben, Maral Mahdad)

Behavior, Management and Social Sciences (Jos van Hillegersberg, Anand Gavai, Gayane Sedrakyan, Renata Guizzardi - Silva Souza)

[1]In cooperation with the **Operations & Logistics Group** (Karin Pauls)

FIVE INTERCONNECTED THEMES

Max Koppenberg: Economics and resilience of novel food chains

Cristina Zepeda: Crop production in protected environments

Caroline Figueroa: Digital health

Anand Gavai: Digital platform infrastructures & recommenders

Maral Mahdad: Novel business models

ACTORS

- Five 4TU groups: 5 tenure trackers, 5 PhDs, 1 postdoc, 1 data steward, 1 scientific programmer

- Eight NL applied universities: Saxion Enschede, HAN Arnhem/Nijmegen, HVA Hogeschool van Amsterdam, Aeres Dronten, NHL Stenden Emmen, HAS Den Bosch, HU University of Applied Sciences Utrecht, Fontys Eindhoven

- Advisory board: Food & Agri Rabobank, Ridder, Province Overijssel, Glastuinbouw Nederland, AMS (Amsterdam Institute for Advanced Metropolitan Solutions), Promedico, Interpolis Agro – Achmea, Data Science and Information Management WUR

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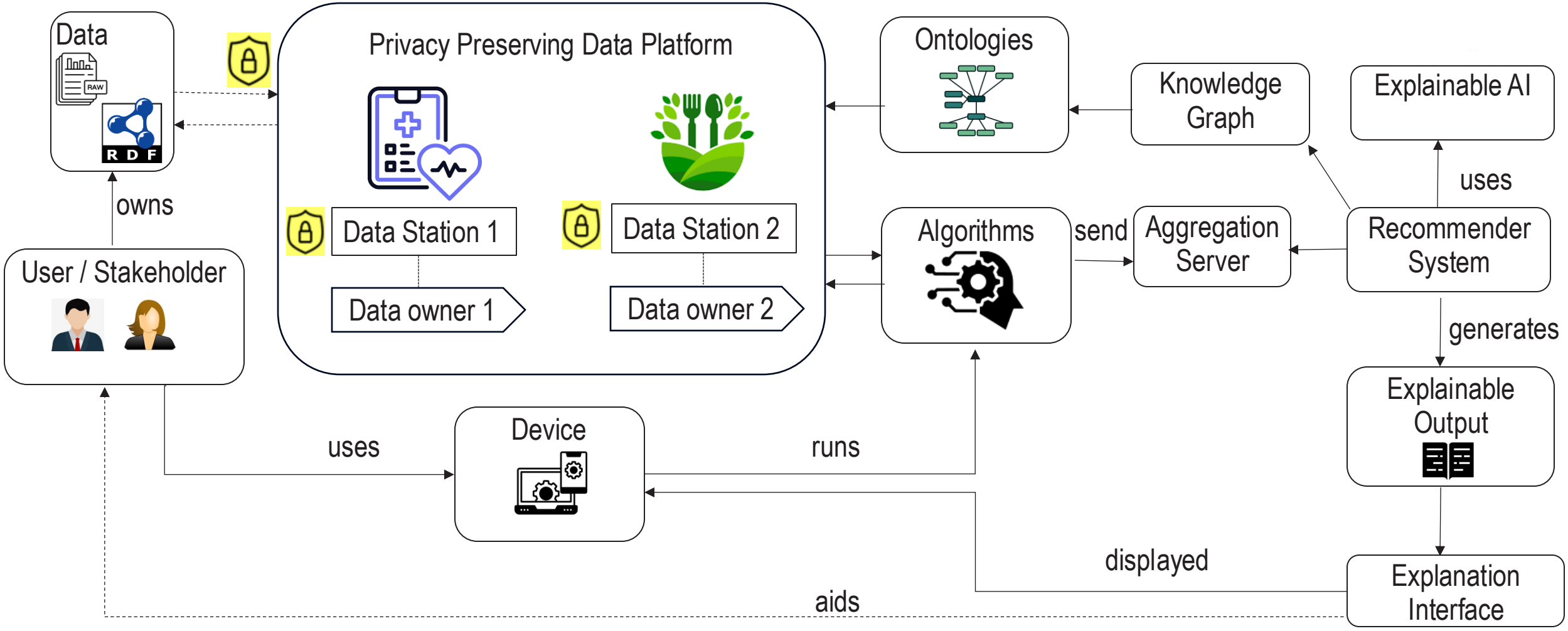
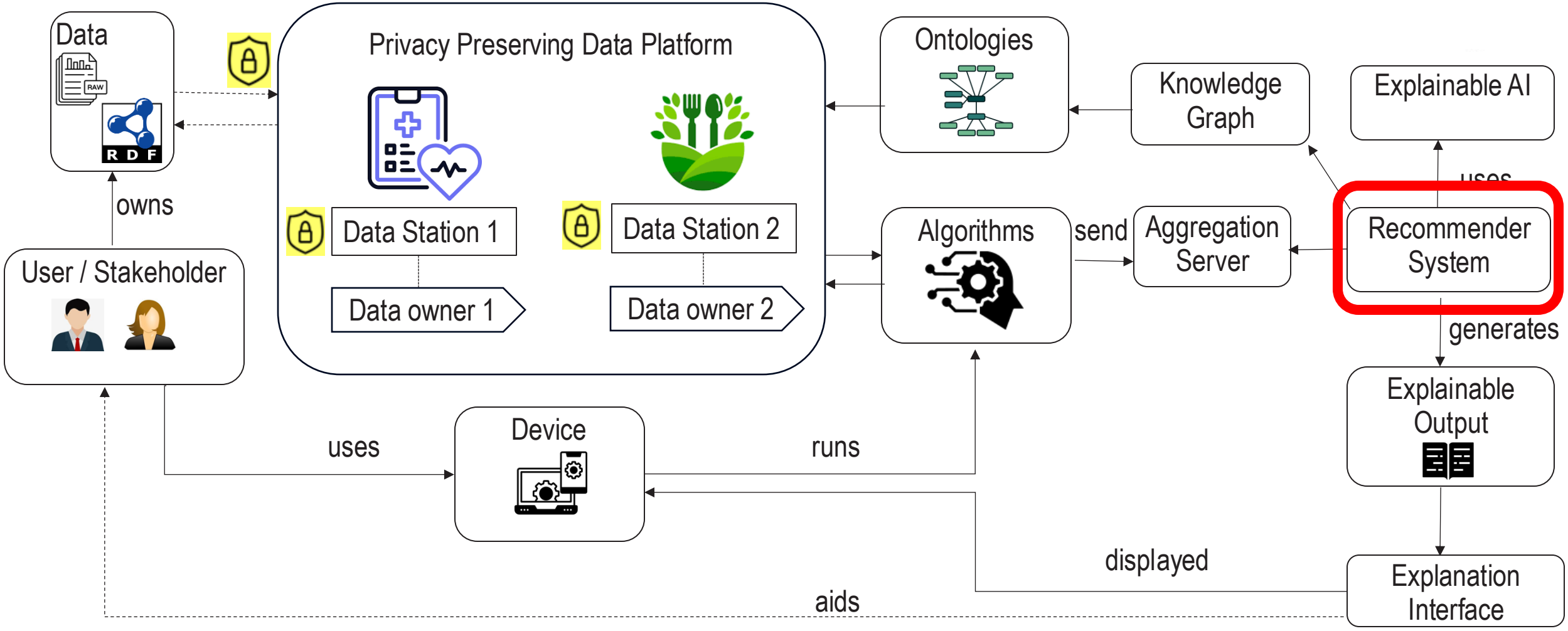
CONCEPTUAL MODEL



CONCEPTUAL MODEL



Challenges with existing standard algorithms

- food choices are inherently diverse and influenced by various factors:
  - taste, prices, availability, healthiness, cultural, dietary, personal factors or restrictions such as allergies
- food recommendations might require additional contextual information other than preferences and historical data
  - financial, seasonal and time constraints (might not be readily available or can be challenging to integrate into standard algorithms)

Challenges with existing algorithms

- are typically designed for single-criteria recommendations and may not effectively handle the complexity of multi-criteria food recommendations

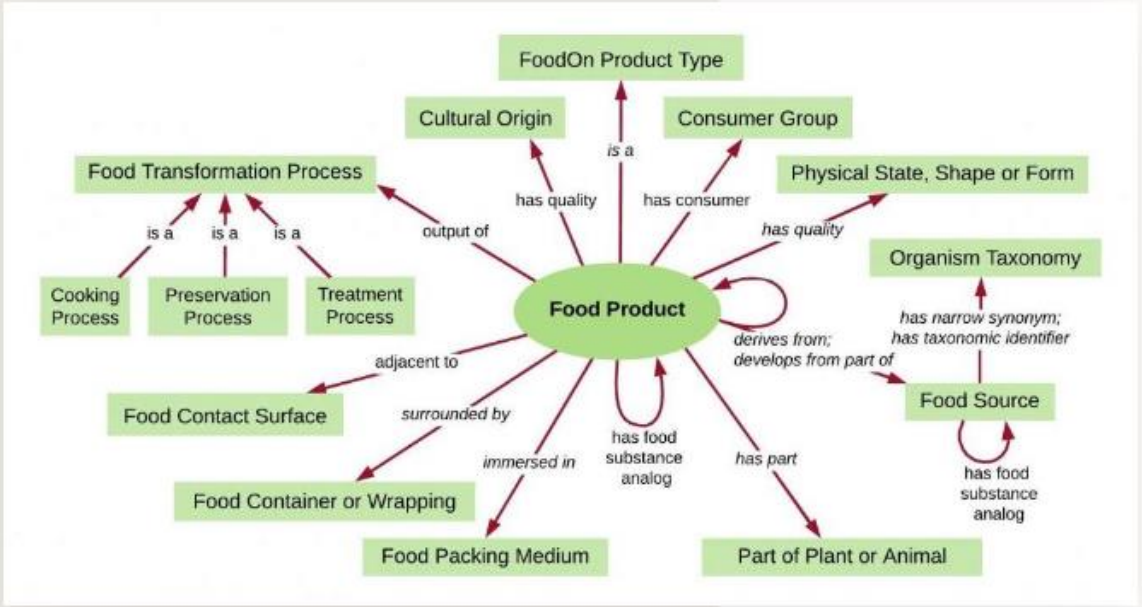
- may not adapt quickly to dynamic changes (e.g. stress – ref. Caroline)

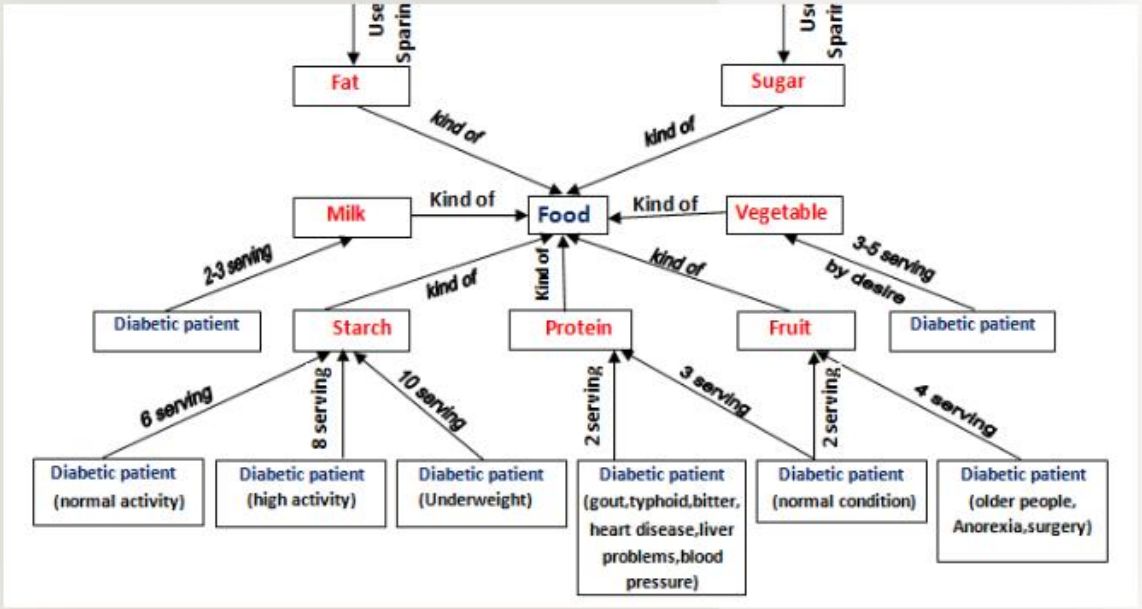
***Example**: a recipe may be relevant for a user however lack of the time or cooking equipment necessary to prepare the meal can make the recommendation unsuitable*

Explainable food recommenders

Explainability can enhance user experience, trust and acceptance by making them **meaningful** to the user

"The meal was recommended because it matches your gluten-free options. This recommendation for a quinoa and roasted vegetable bowl also takes into account your nutritional needs with a blend of vitamins and protein, and features locally sourced vegetables to support your sustainability choices."

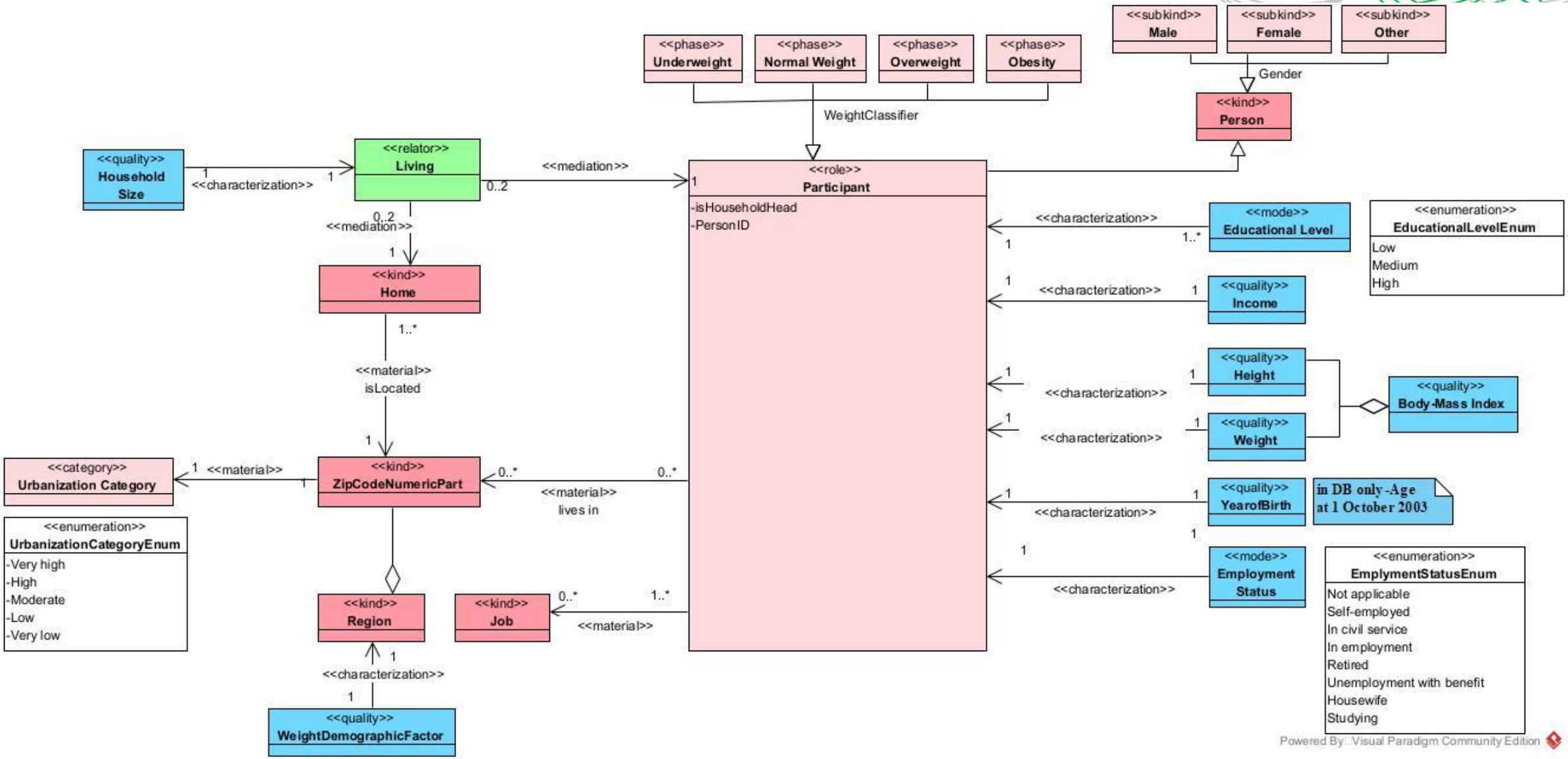




Explainable semantic recommenders

- Semantics can in addition be enhanced by the use of *ontologies*.
- Within the food domain ontologies can be used to create ontology-based user profiles enabling algorithms to understand user preferences, dietary needs, and culinary context and link with ontologies of nutritional data, ingredient compatibility, culinary techniques and their relationships to provide personalized suggestions with enhanced quality and diversity.
- Moreover, ontology-based algorithms can facilitate the generation of transparent, explainable and justified recommendations, fostering user trust and understanding

CONCEPTUAL MODEL: FOOD CONSUMPTION PATTERNS OF DUTCH POPULATION DATASET



OVERVIEW OF THE PLATFORM

PRIVACY-PRESERVING DATA PLATFORM

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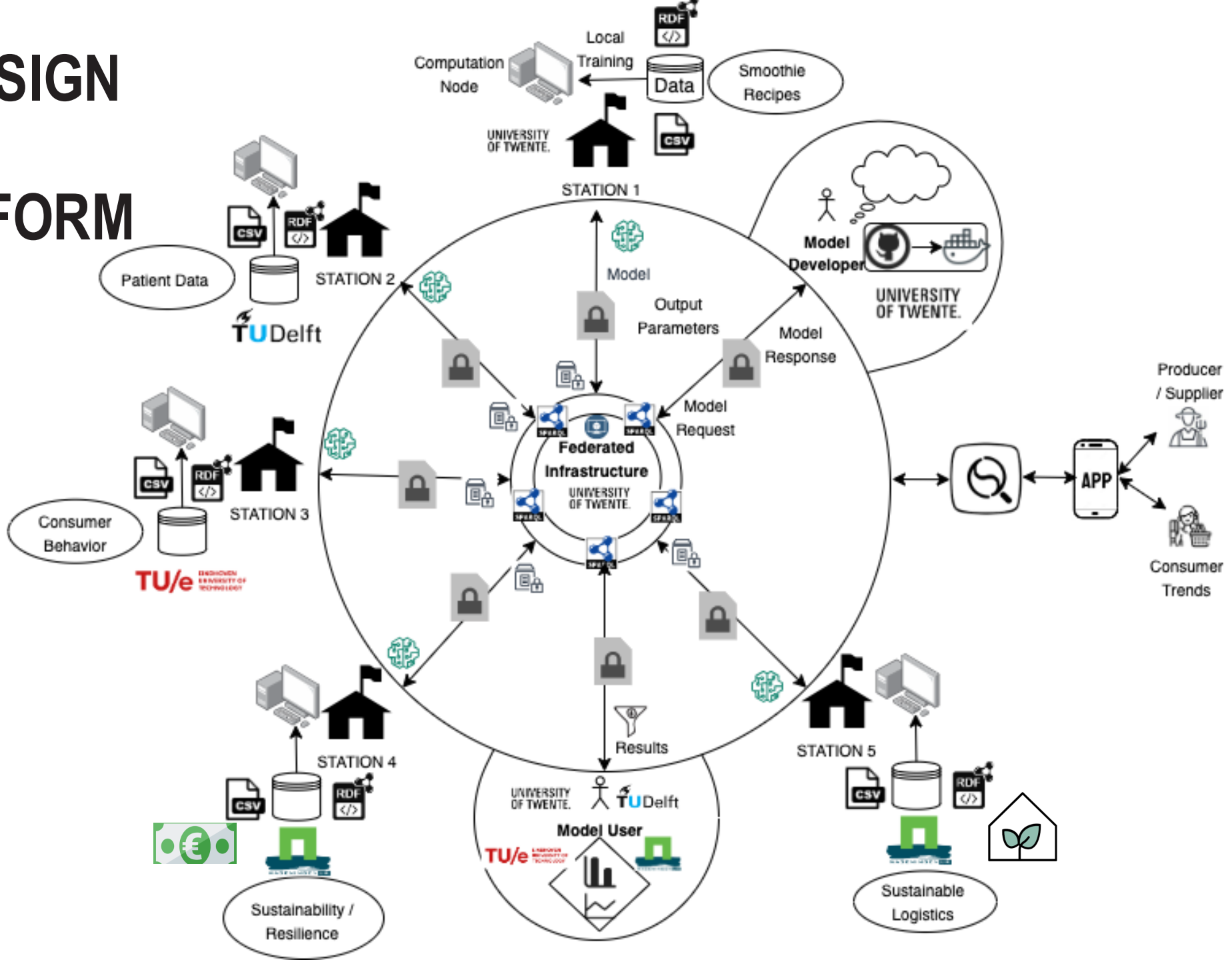
REDESIGN DATA PLATFORM



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MAIN COMPONENTS

Data Station:

- Provides FAIR access to data and metadata
- Allows train (model to access and interface with data)

Data Gateway:

- Authorization and
- Authentication with restricted access to data

Federated Server

Train:

- Interacts with data (these are models that processes data including analysis)

Tracking System:

- The routing of models and transport infrastructure

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