RESEARCH PROGRESS UPDATE
DIGITAL DATA MARKETPLACES

Trusted, fair and economic data sharing enabling value creation for the aerospace industry

SAE International IHVM HM-1 Meeting
April 3rd 2019 Charlotte, NC

Leon Gommans, PhD
Science Officer Air France KLM Group IT
Technology Office R&D
Guest Researcher University of Amsterdam
INTERNET HISTORY EUROPE
AMSTERDAM SCIENCE PARK

1988: The Internet landed in Europe at CWI

1994: The Amsterdam Internet Exchange housed at NIKHEF

Now > 60 datacenters emerged around the Amsterdam Internet Exchange, creating 12,500 jobs*
Digital Reality (3.0B$ >175 DCs)  Equinix (4.4 B$ >200 DCs)

University of Amsterdam Faculty of Science located right in the middle

Data centers are neutral places housing equipment from multiple (cloud) providers in separate 'cages'

* Source 2019 report datacenters and employment, Dutch Datacenter Association
WHAT IS IT ABOUT?

A DIGITAL DATA MARKET PLACE:

• Serves a common benefit no single organization can achieve on its own.

• Is created and governed by an industry consortium as a means to reduce risk, ensuring competition, fairness and trust.

• Supply members advertise their assets, contracts arrange asset access and usage by other members.

• To prevent data asset exposure, members can use a consortium governed infrastructure to execute data science scenario’s

• Allows consortia to implement (digitally) enforceable contracts, whilst supporting dispute resolution by immutable logging.
EXAMPLES OF DATA SHARING
RELEVANT TO OUR INDUSTRY

Improve **passenger experience** at airports

Improve **efficiencies** across multi modal logistic chains

Increase **fleet availability** by improving maintenance scheduling using data to predict maintenance need & optimize planning

Research efforts also consider use-cases in Healthcare, Agriculture, Smart Cities, Public Safety, Cybersecurity, ..
RESEARCH QUESTION
CONTEXT: DATA SCIENCE ALGORITHM DEVELOPMENT

Taking into consideration:
1) The value creation potential of data sharing to increase algorithm accuracy
2) Disproportionate value generation by data platforms creating monopolies

Research question: How can (big) data assets be shared between data suppliers and algorithms developers in
1) A fair and economic way,
2) whilst providing adequate means to reduce risk?
RESEARCHING DATA SHARING SOLUTIONS:
A DIGITAL DATA MARKETPLACE GOVERNED BY A MEMBERSHIP CONSORTIUM

- Algorithm Developers
  - own or third party

- Data supplied by other organizations
- Own Organization Data
- Historic (Big) Data

- Enabling access and use
- Periodic storage: raw or with enhanced quality

- Computer science
- Data science
- Math and statistics

- Decision Support Systems
  - Planning, Prediction, Prevention, Effectiveness, Efficiency, etc.

- (Near) Real Time Operational Data

- Competitive Algorithm Choice

- Own Organization
JOURNEY OF THE DATA SCIENTIST / ENGINEER
ROLE OF THE DIGITAL DATA MARKETPLACE

ACQUIRE MORE AND DIVERSE DATA

USE CASE

BUSINESS CASE go-no go

Go live

SELL PREDICTIVE PRODUCTS

TEAMWORK

IDEA

JOURNEY START

1. DEFINE
2. COLLECT
3. EXPLORE
4. MODEL
5. VALIDATE
6. DATA FLOW
7. AUTO TRAIN
8. CONTINUOUS INTEGRATION
9. FEEDBACK LOOP
10. SETUP MONITORING
11. PREDICT
12. MAINTAIN AND IMPROVE

EXPRESS

flexibility Feasible Model

INDUSTRIALIZE

reliability

PRODUCT

DEFINE (1-3)

What is the end purpose? How will it add value? Use case, data scope and stakeholders identification

EXPERIMENT (4-5)

Collect and explore data, research data science model Prototype, go/nogo to production

INDUSTRIALIZE (6-10)

Deliver the solution in production environment Product GO live

IMPROVE (11-12)

Feedback analysis, A/B testing, and performance monitoring New product releases, business insights

SHARE

NOTE: KNOWLEDGE SHARING IN OTHER PHASES (4,7,9,10) MAY ALSO BE A GOALS OF COLLABORATION IN A MARKETPLACE COMMUNITY.

IDEA

1. DEFINE
2. COLLECT
3. EXPLORE
4. MODEL
5. VALIDATE
6. DATA FLOW
7. AUTO TRAIN
8. CONTINUOUS INTEGRATION
9. FEEDBACK LOOP
10. SETUP MONITORING
11. PREDICT
12. MAINTAIN AND IMPROVE

EXPERIMENT

flexibility.

INDUSTRIALIZE

reliability.

PRODUCT

DEFINE (1-3)

What is the end purpose? How will it add value? Use case, data scope and stakeholders identification

EXPERIMENT (4-5)

Collect and explore data, research data science model Prototype, go/nogo to production

INDUSTRIALIZE (6-10)

Deliver the solution in production environment Product GO live

IMPROVE (11-12)

Feedback analysis, A/B testing, and performance monitoring New product releases, business insights

SHARE

NOTE: KNOWLEDGE SHARING IN OTHER PHASES (4,7,9,10) MAY ALSO BE A GOALS OF COLLABORATION IN A MARKETPLACE COMMUNITY.
Imagine if data scientist can use historic data from 747 aircraft operated by multiple airlines.

The Bleed Air System regulates pressure and temperature of air from a turbine engine needed by other aircraft systems taking care of:
- cabin pressure
- de-icing
- water pressure
- and more..

Flight Deck Effects indicate system functionality decreases and may trigger maintenance actions.

The more Flight Deck Effect occurrences are available, the more likely that a prognostic relation can be learnt.

Near Real Time Data

Data stored in 3 places: KLM, UvA, EQX-SV

Decision Support System

Will a Flight Deck Event occur within the next 10 flights?

Data Science
Training Strategies

Centralized

Raw data transferred from dispersed data zones to a central repository for analysis

Federated

Raw data stays in place. Model trained through orchestration of local (at each data-zone) and global computations
DIGITAL DATA MARKETPLACE GOVERNANCE
A FOUR STEP APPROACH

COMMON BENEFIT
Define and agree common benefit no single organization can achieve on its own.

GROUP RULES
Define consortium rules considering data use, access and benefit sharing.

ORGANIZE TRUST
Organize power and trust as a means to reduce risk for participating members.

IMPLEMENT INFRASTRUCTURE
Research operationalization of Digital Data Marketplace concepts.

ExchangeWell

DEMO
INTRODUCTION

- Organized by SAE ITC, ExchangeWell brings data owners and algorithm developers together in a digital data marketplace that provides the required trust for mutual engagement.
- It enables members to share their data assets in a fair and economic way whilst providing an adequate means to reduce risk.
- Sharing data enables digital transformation of the industry and business value creation.

Objective: Help answer key question:
- Will ExchangeWell as proposed provide value to our industry?
EXCHANGEWELL™
A Program of SAE ITC

A consortium program to provide the means for industry leaders to access industry experts, develop practical experience from pilots, collaborate on pre-competitive research and establish a strategic path forward to effectively implement data management strategies which positively impact and benefit industry.
STAKEHOLDERS

- Regulatory
- Airline/Operator
- Airframer/Integrator
- OEM
- Sub Assembly Manufacturer
- Distributor
- Component/Part Manufacturer
- Standards Organization
- Industry Review Body
- Auditor/Mandated Body
- SAE ITC
- Registrar
- Maintenance
- Training Provider
- IT System and Software Tools Provider
- Data Aggregators and Analyzers
- Insurers
- Legal
- Access Authorizing Agent
- Research/Academics

INTEGRATED PRODUCT CYCLE

- Design/Development
- Recycle/Sunset
- Manufacture/Inspect
- Integrate
- Maintenance/Repair
- Operations
SAE ITC

CONSORTIUM MATURATION PATH

We’re here!
ExchangeWell

IDEA
EXPLORATORY CONVERSATION
CHAMPIONS
SUFFICIENT INTEREST
DISCUSSION OR STEERING GROUP
SITUATION - TARGET - PROPOSAL
ROI / VALUE EQUATION
CONSORTIUM AGREEMENT for STRATEGY GROUP

We’re here!
ARINC IA
DATA EXCHANGE CONCEPT

Global Data Exchange Infrastructure

Autonomous Data Science Platforms

Marketplace A

Marketplace B

Sovereign Data Owners (e.g. Airlines)

amsterdam economic board

AMdEX

THE DATA HYPERMARKET
DIGITAL DATA MARKETPLACE ARCHITECTURE
RESEARCHING IMPLEMENTATION OF ESSENTIAL ELEMENTS

- National Law & Regulations
- Market rules
- Member admission
- Agreement
- Registry
- Centralized Distributed Federated
- Data Exchange Infrastructure
- Data Science Transaction
- Research Testbed
- Global Digital Data Market Infrastructure
- Algorithm Developer
- Accounting & Auditing
- Data supplier(s)
- Digital Data Marketplace Membership Organization
- Digital Data Market
- Digital Data Exchange Infrastructure
- Digital Data Science Infrastructure
- Digital Data Transaction Infrastructure
- Digital Data Archetype
- Digital Data Agreement
- Digital Data Registry
- Digital Data Dispute Resolution
- Digital Data Accounting & Auditing
QUESTIONS
APPENDIX: INFRASTRUCTURE ARCHETYPES
RESEARCHED FOR THEIR APPLICABILITY AT UNIVERSITY OF AMSTERDAM
INFRASTRUCTURE MODELS:  
Traditional
INFRASTRUCTURE MODELS: DMP arranged, between members via datacenter ecosystem