# Agenda – Day 1

10:00-11:00 a.m.
**Welcome and introduction**

11:00-11:30 a.m.
**Introduction to outbreak investigation**
Marion Gottschald (BfR)

11:30-12:30 p.m.
**The challenge to trace the source of contamination in the international food and feed supply chain**
Olaf Mosbach-Schulz (EFSA)

*12:30-1:30 p.m.*
***Lunch break***

1:30-2:00 p.m.
**Introduction to FoodChain-Lab (FCL)**
Armin Weiser (BfR)

2:00-2:30 p.m.
**Live demonstration of FCL**
Armin Weiser (BfR)

2:30-2:50 p.m.
**Hands-on training (chosen tutorials from website)**
Armin Weiser, Alexander Falenski, Marion Gottschald, Marco Rügen (BfR)

*2:50-3:05 p.m.*
***Coffee break***

3:05-4:30 p.m.
**Hands-on training (chosen tutorials from website) (continued)**
Armin Weiser, Alexander Falenski, Marion Gottschald, Marco Rügen (BfR)

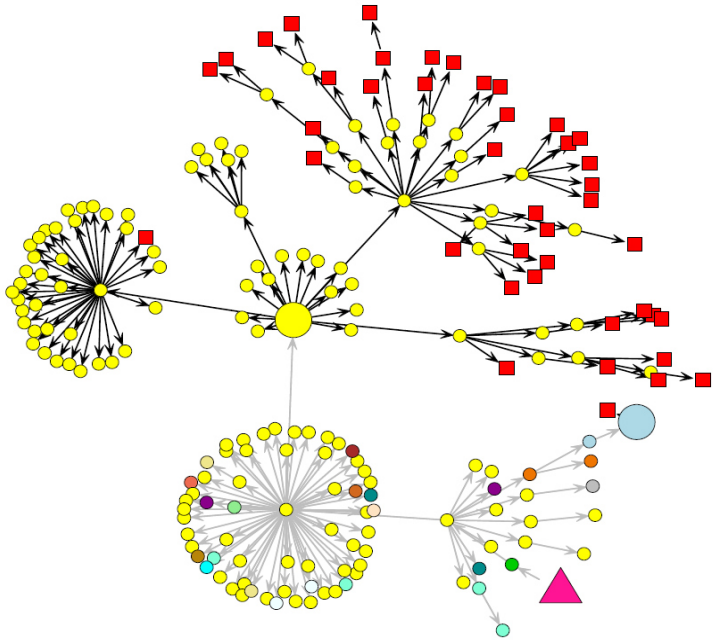
4:30-5:00 p.m.
**Open questions**
All

*from 6 p.m.*
***Drinks and dinner -> Alter Krug Dahlem***

FEDERAL INSTITUTE FOR RISK ASSESSMENT

BfR
Bundesinstitut für Risikobewertung

# Introduction to FoodChain-Lab
# Schematization and Visualization of Food Chains



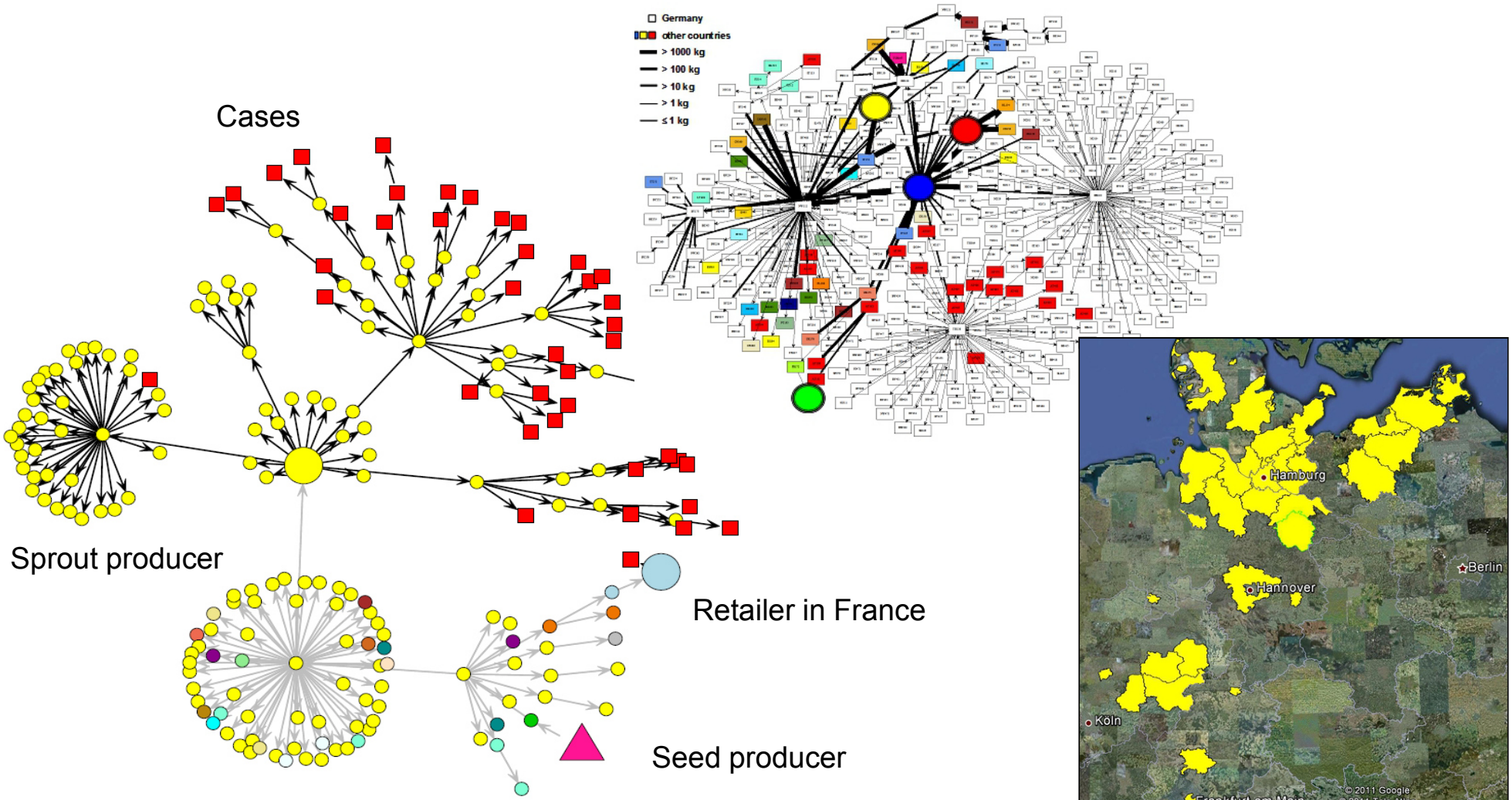
Food Chain Lab

**Armin Weiser, Marion Gottschald, Alexander Falenski, Marco Rügen, Christian Thöns, Matthias Filter, Annemarie Käsbohrer, Bernd Appel, Karsten Nöckler**

# FoodChain-Lab – Why did we do it?

SN Braunschweiger grob
(S. Muenchen)
TH Knackwurst
(Bratwurst)
(S. Muenchen)
Rückruf 6kg per Aushang
Schinken-
SN Teewurst
(S. Muenchen)
SN Zwiebelmettwurst
(Salmonella Gr. C)
Mettbrötchen
Schweinehack
Brustspitzen-fleisch
(negativ)
Hackepeter

# FoodChain-Lab – ad hoc




**After the outbreak = Before the outbreak**

**Weiser et al., 2013**: "Trace-Back and Trace-Forward Tools Developed Ad Hoc and Used During the STEC O104:H4 Outbreak 2011 in Germany and Generic Concepts for Future Outbreak Situations", **Foodborne Pathog Dis. 2013**.

**Weiser et al., 2016**: "FoodChain-Lab: a trace-back and trace-forward tool developed and applied during food-borne disease outbreak investigations in Germany and Europe", **PLoS ONE**.

# SiLeBAT (2010-2014)

## Integration of scientific solutions for

### Prevention & Limitation of damage

**Risikobewertungen (zeitnah und fundiert)**

Probenvorbereitungs- und Nachweisverfahren

Handlungsempfehlungen

Kosten-Nutzen-Analysen

| | |
|---|---|
| Einschätzung der Gefährdungslage | Wissen über Agenzien (Verhalten, Gefährdungspotential) |
| Spezifische Verfahren zur Früherkennung | **Supply Chains and its structures** |
| Vulnerabilität von Warenströmen | Optimale Interventionspunkte |
| | Entsorgung, Dekontamination |
| Schulung, Übungen, Beratung | Freigabe von Produkten |

# FoodChain-Lab
# Past events

19 – 20 March 2015, Berlin Germany

**FoodChain-Lab - An innovative tool for food safety through product chain analyzes**

12 – 13 May 2015, Bern, Switzerland

**Introduction to the FoodChain-Lab software - an innovative tool for food safety through product chain analysis**

12 – 13 November 2015, Berlin Germany

**International FoodChain-Lab Workshop 2015**

8 – 9 February 2016, Berlin Germany

**HoA workshop: Tools supporting food chain safety assessments**

15 – 17 March 2016, Riga, Latvia

**Baltic Countries 2016 Workshop on Crisis preparedness**

2016/2017, NRW, Germany

**Linking FoodChain-Lab to the regional tracing database**

14 – 16 June 2017, London, UK

**Specific FoodChain-Lab Workshop for UK**

# Framework Partnership Agreement
# EFSA and BfR to work jointly on global food safety tools

**Title: Risk Assessment Tools for the Safety of Global Food and Feed Supply Chains (Number: GP/EFSA/AMU/2016/01)**

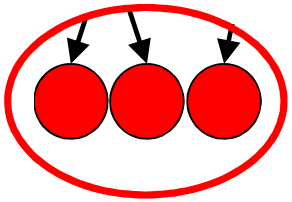
- ED visit to Germany on 30th October 2014
- Framework Partnership Agreement, signed on 8th December 2016

- Description: Trace-back and predictive modelling tools for use during food safety outbreaks and created by scientific teams led by the German Federal Institute for Risk Assessment (BfR) will be further rolled out under a new funding partnership agreed between EFSA and BfR. The two agencies will be able to further benefit from each other's research efforts and avoid duplication of future work programmes.
- Life span: 4 years
- Press releases: https://www.efsa.europa.eu/en/press/news/161208
  http://www.bfr.bund.de/cm/349/efsa-and-bfr-to-work-jointly-on-global-food-safety-tools.pdf

# Szenario:

## Überregionaler (diffuser) Ausbruch

- **Kontamination bei der Produktion/Verarbeitung**
- **Diffuse Verteilung der Fälle**
- **Niedrige Dosis**
- **Niedrige Erkrankungsrate**
- **Komplexe Untersuchung**



**Das Ausbruch Untersuchungsteam sieht nur Krankheitsfälle**

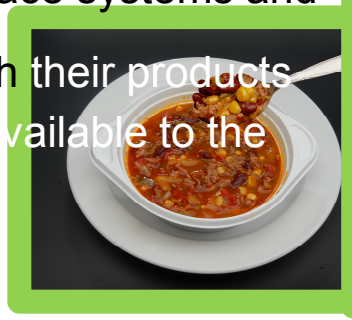
# REGULATION (EC) No 178/2002, Article 18, Traceability

(1) The **traceability** of food, feed, food-producing animals, and any other substance intended to be, or expected to be, incorporated into a food or feed shall be established **at all stages of** **production**, **processing** and **distribution**.

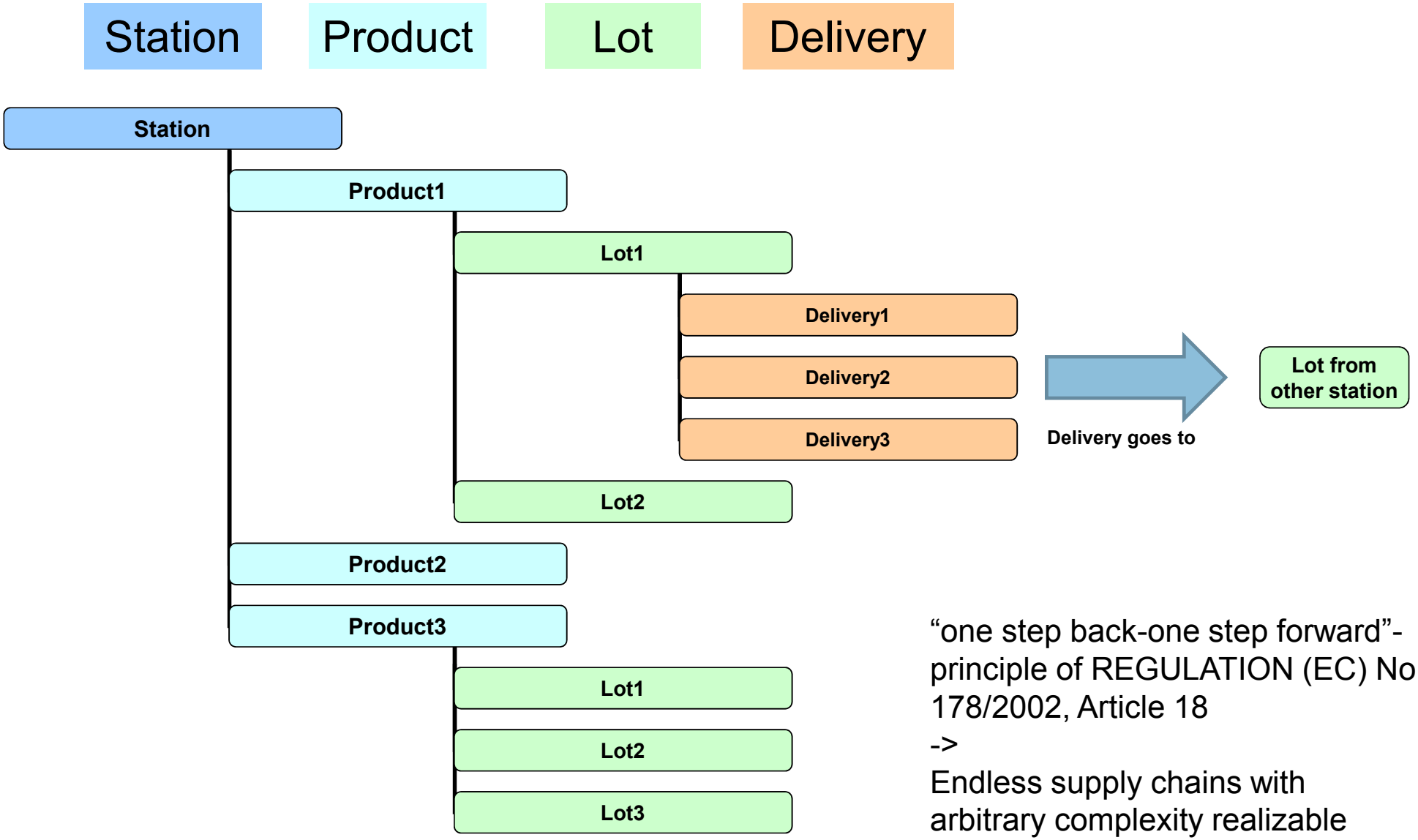
(2) **Food and feed business operators** shall be able to identify any person **from** whom they have been supplied with a food, a feed, a food-producing animal, or any substance intended to be, or expected to be, incorporated into a food or feed.

To this end, such operators shall have in place systems and procedures which allow for this information to be made available to the competent authorities **on demand**.

(3) **Food and feed business operators** shall have in place systems and procedures to identify the other businesses **to** which their products have been supplied. This information shall be made available to the competent authorities **on demand**.



# Database – Structure for Food Chains

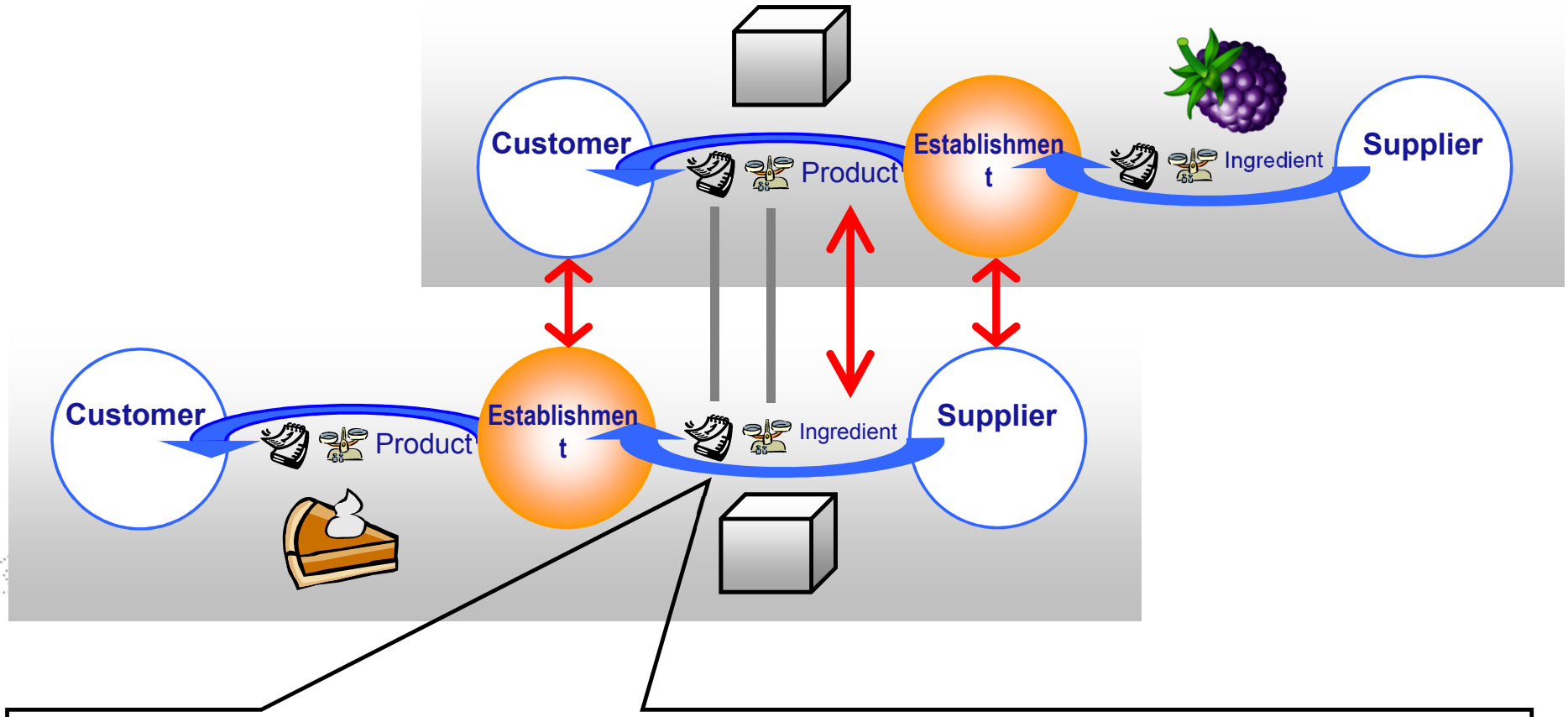



“one step back-one step forward”-principle of REGULATION (EC) No 178/2002, Article 18

->

Endless supply chains with arbitrary complexity realizable

# DATA ANALYSIS: BUILDING THE FOOD SUPPLY CHAIN



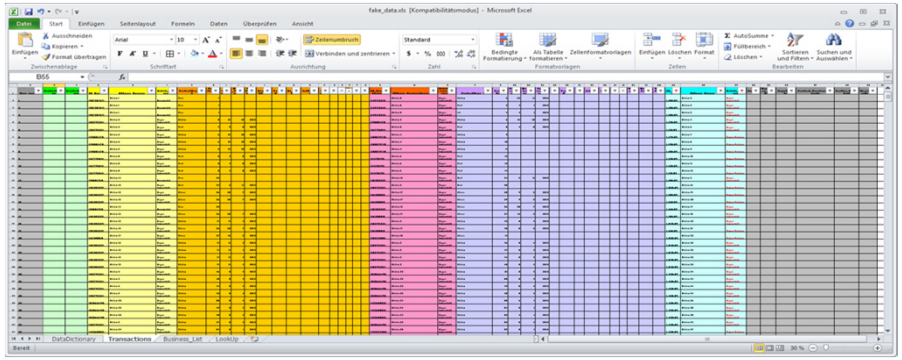

**Identification of common links** by Costumer=EstablishmentA / EstablishmentB=Supplier / Product=Ingredient

**Verification (proof of consistency)** by correct date of delivery / correct amount of the product

Collected were 6227 transactions among 1974 food operators.

# Data gathering – Development of a new “simple” template

**old:**



“one step back-one step forward”-principle of REGULATION (EC) No 178/2002, Article 18

->

Endless supply chains with arbitrary complexity realizable

**new:**

Backtrace_request_3001_Caterer 01.xlsx - Microsoft Excel

Datei | Start | Einfügen | Seitenlayout | Formeln | Daten | Überprüfen | Ansicht

E30

| Reporter Information | | |
|---|---|---|
| Reporting Officer | Reporting Date | Reporting Remark |
| | | |

| Station in Focus: | 3001 | Caterer 01 |
|---|---|---|

**Products Out**

| Product Name | Lot Number | Delivery Date Departure | | | Delivery Date Arrival | | | Unit weigt/vol./pck. | | Recipient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Day | Month | Year | Day | Month | Year | Quantity | Type / Unit | |
| Menü 1 | M01 | 3 | 9 | 2014 | 3 | 9 | 2014 | 62 | Portionen | 9012 |
| Menü 2 | M02 | 3 | 9 | 2014 | 3 | 9 | 2014 | 101 | Portionen | 9008 |

**Lot Information**

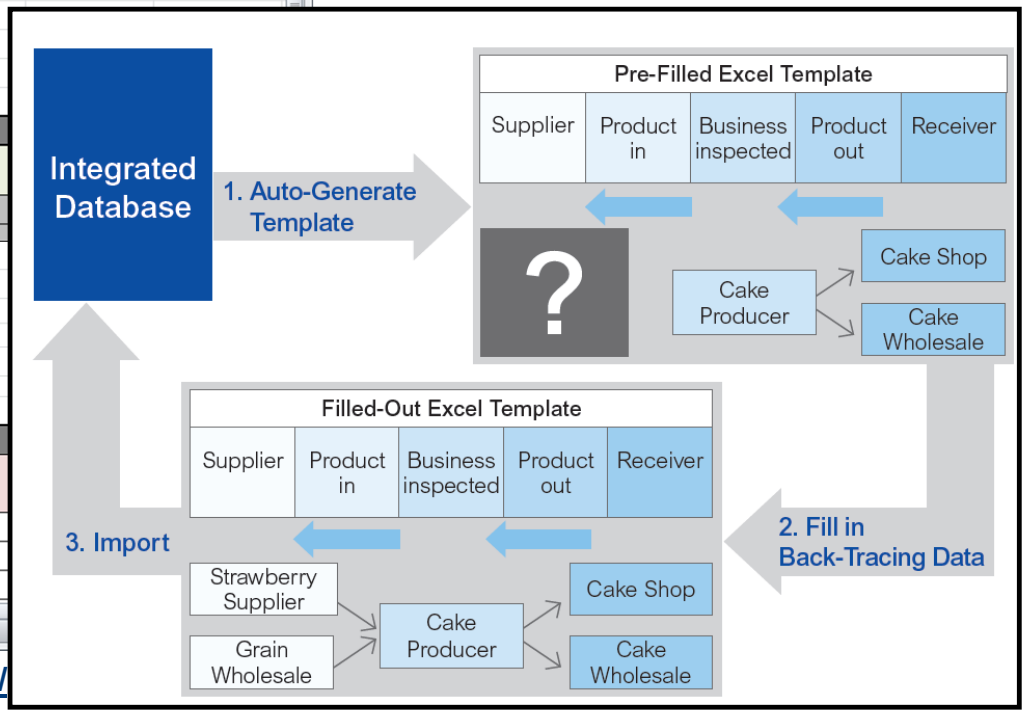
| Lot Number of "Product Out" | Lot size | |
|---|---|---|
| | Quantity | Type / Unit |
| M01 | 900 | Portionen |
| M02 | 900 | Portionen |

**Ingredients for Lot(s)**

| Ingredient Name | Lot Number of Ingredient | Delivery Date Departure | | | Delivery Date Arrival (if departure unknown) | | | Unit weigt/vol./pck. | | Supplier |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Day | Month | Year | Day | Month | Year | Quantity | Type / Unit | |
| | | | | | | | | | | |
| | | | | | | | | | | |

Stations | BackTracing | ForwardTracing_Opt | LookUp | Help

Bereit




**Online Validation:** https://foodrisklabs.bfr.bund.de/templatevalidator/

# Other approaches:

- Direct injection via
  - SQL
  - Alternative Excel sheets
  - Xml structures
  - …

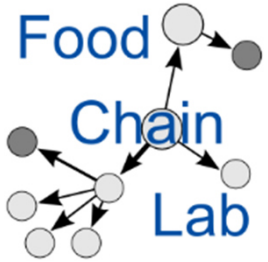
# Another approach:
# COS - Busstop - FoodChain-Lab

- COS collects (NRW-) Tracing Data
- COS is doing validation internally based on existing master data
- COS outputs data into newly defined xml-strukture and sends it into a newly developed webservice
- FCL always looks into the webservice for new data
- FCL analyses data (semi)-automatically
- FCL prepares analysis reports and sends it back to the webservice
- COS fetches the report – management measures or further data collections will be initiated

# Next steps

- Simplify Data Input
  - Allow to import data from other systems (e.g. iRASFF)
  - “Immediate” data injection
- DEMOS – defining a data standard (EU)
- ALB – defining a standard data format (DE)

# What is FoodChain-Lab?




- Open source software

  http://foodrisklabs.bfr.bund.de

- Database for managing food tracing data

- Tool for data cleaning, enrichment & processing
  - Validation (also online: https://foodrisklabs.bfr.bund.de/templatevalidator/ )
  - Cleaning (e.g. Duplicate Detection)
  - Enrichment (e.g. Geocoding)
  - Analysis (Clustering, Tracing, Scoring, etc.)

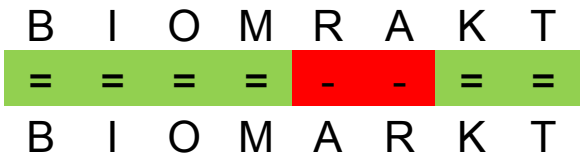
- Tool for visualization and interactive reasoning

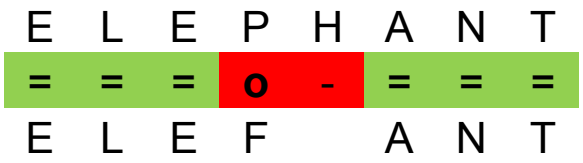
# Data Cleaning – Duplicate Detection

| Company | Street | House Number |
|---|---|---|
| Bäcker Maier | Hauptstr. | 1 |
| Bäcker Meier | Hauptstraße | 1 |

## Levenshtein distance

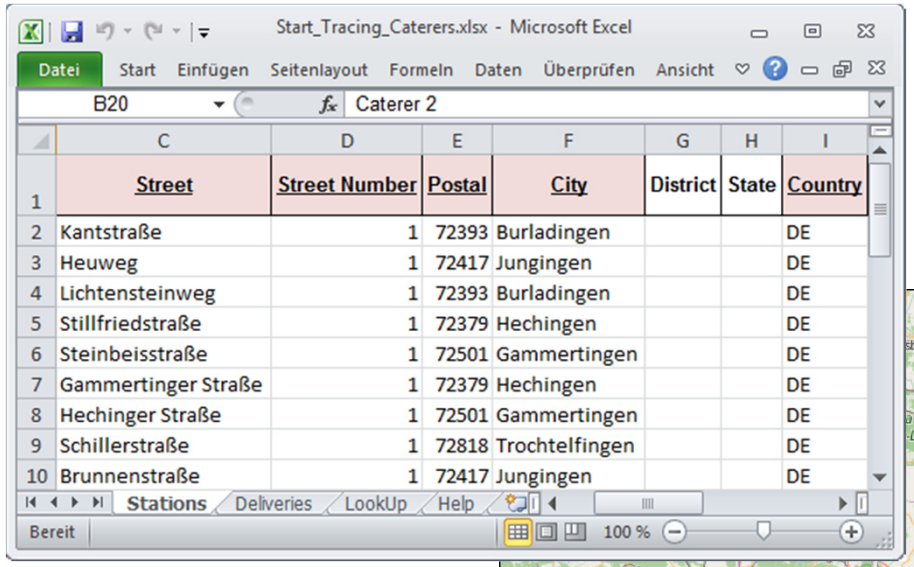
Works well for finding typos



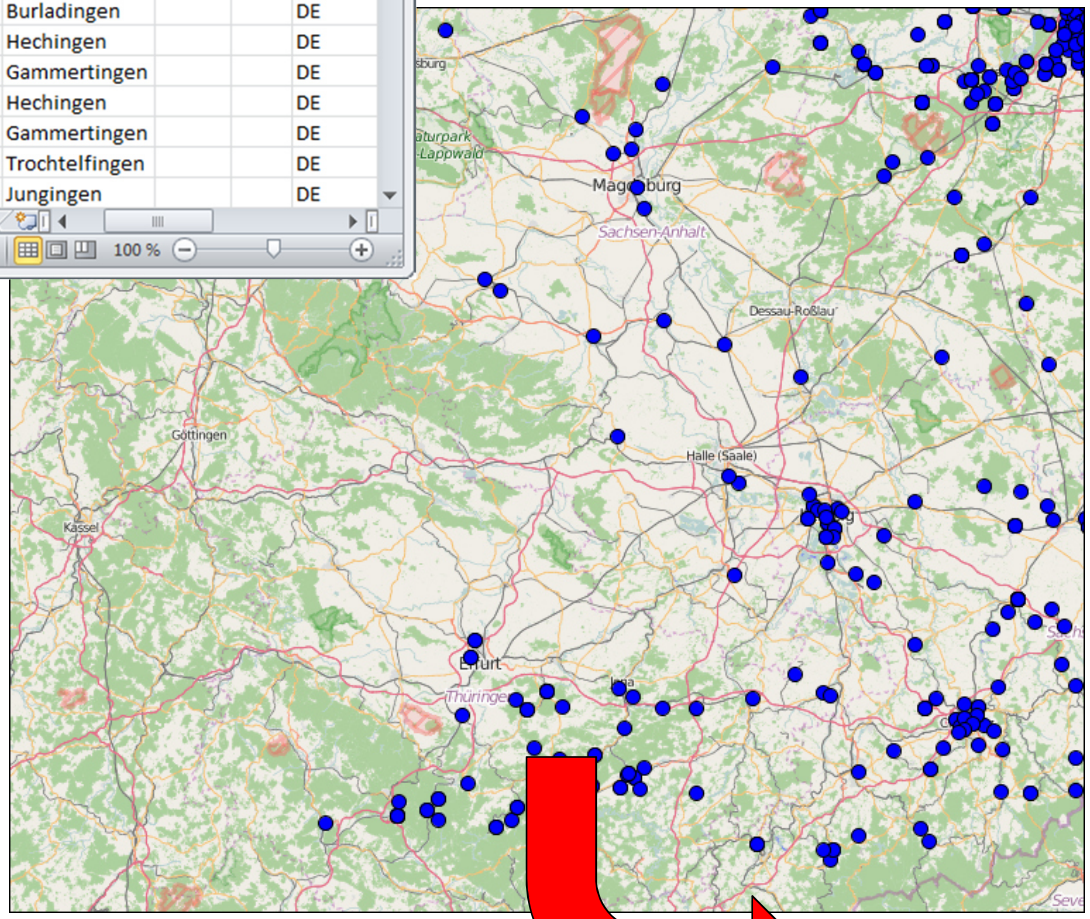



# FoodChain-Lab

## Data Enrichment – Geocoding




| | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|
| 1 | Street | Street Number | Postal | City | District | State | Country |
| 2 | Kantstraße | 1 | 72393 | Burladingen | | | DE |
| 3 | Heuweg | 1 | 72417 | Jungingen | | | DE |
| 4 | Lichtensteinweg | 1 | 72393 | Burladingen | | | DE |
| 5 | Stillfriedstraße | 1 | 72379 | Hechingen | | | DE |
| 6 | Steinbeisstraße | 1 | 72501 | Gammertingen | | | DE |
| 7 | Gammertinger Straße | 1 | 72379 | Hechingen | | | DE |
| 8 | Hechinger Straße | 1 | 72501 | Gammertingen | | | DE |
| 9 | Schillerstraße | 1 | 72818 | Trochtelfingen | | | DE |
| 10 | Brunnenstraße | 1 | 72417 | Jungingen | | | DE |




### Available Providers:

- **(Google)**
  - Web service
- **MapQuest**
  - Web service with open data
- **Bundesamt für Kartografie und Geodäsie**
  - Germany only
- **Photon / Gisgraphy**
  - Locally installable
  - Data stays confidential
  - Unlimited requests

# Tracing Features

**Trace:** path, a contamination can take via the food chain network

**Score:** ~ likelihood a station is involved in the outbreak

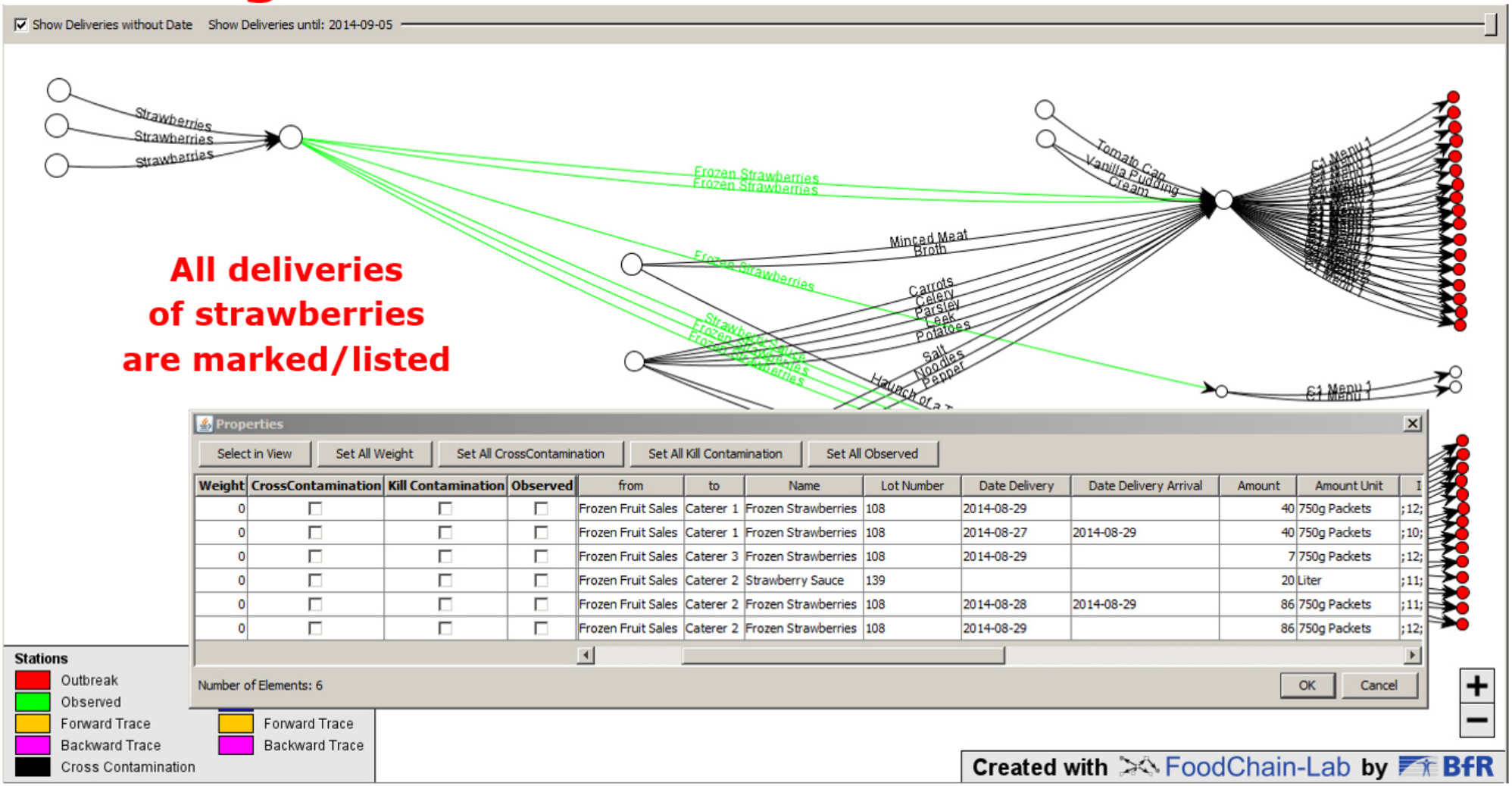
$$\mathrm{Score}(s_i) = \frac{\sum_{j=1}^{n} w_j t_{ij}}{\sum_{j=1}^{n} w_j}$$

| | |
|---|---|
| $s_i$: | Station **i** |
| $w_j$: | Weight of station **j** |
| $t_{ij}$: | 1 if there is trace from station **i** to **j** |
| | 0 otherwise |
| n: | Number of stations |

- Backward / forward “trace” can be visualized
- User can define:
  - Cross Contamination
  - Regional Effects (e.g. environmental contamination)
  - Weights for Outbreak Stations

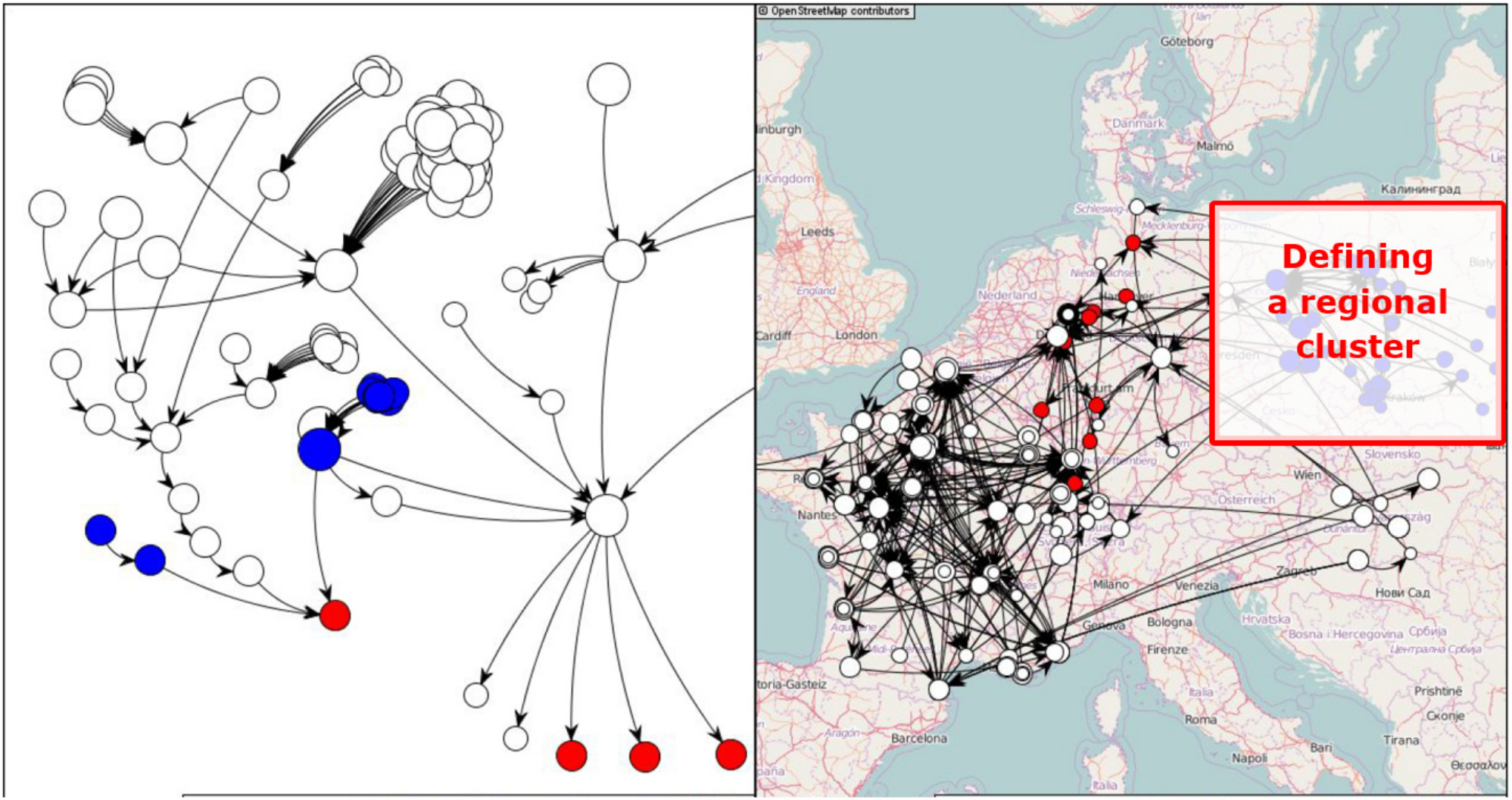
# Graphical surface

## Showing all deliveries of strawberries



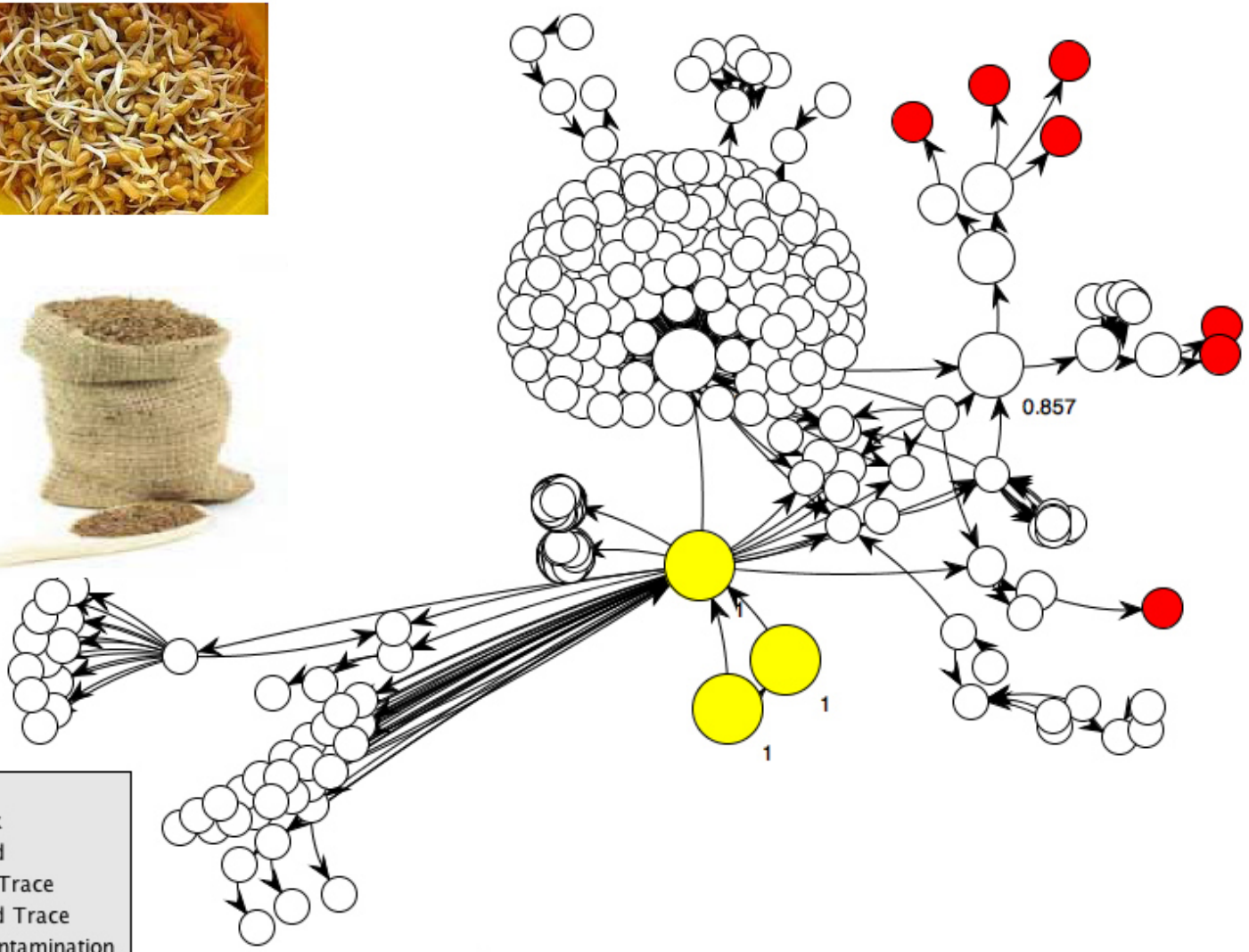
# Mapping & timing

## Switching between network and map vie



# Real world application

## EHEC 2011




Other cases:

DE:
Norovirus 2012

EHEC 2017
Fipronil 2017

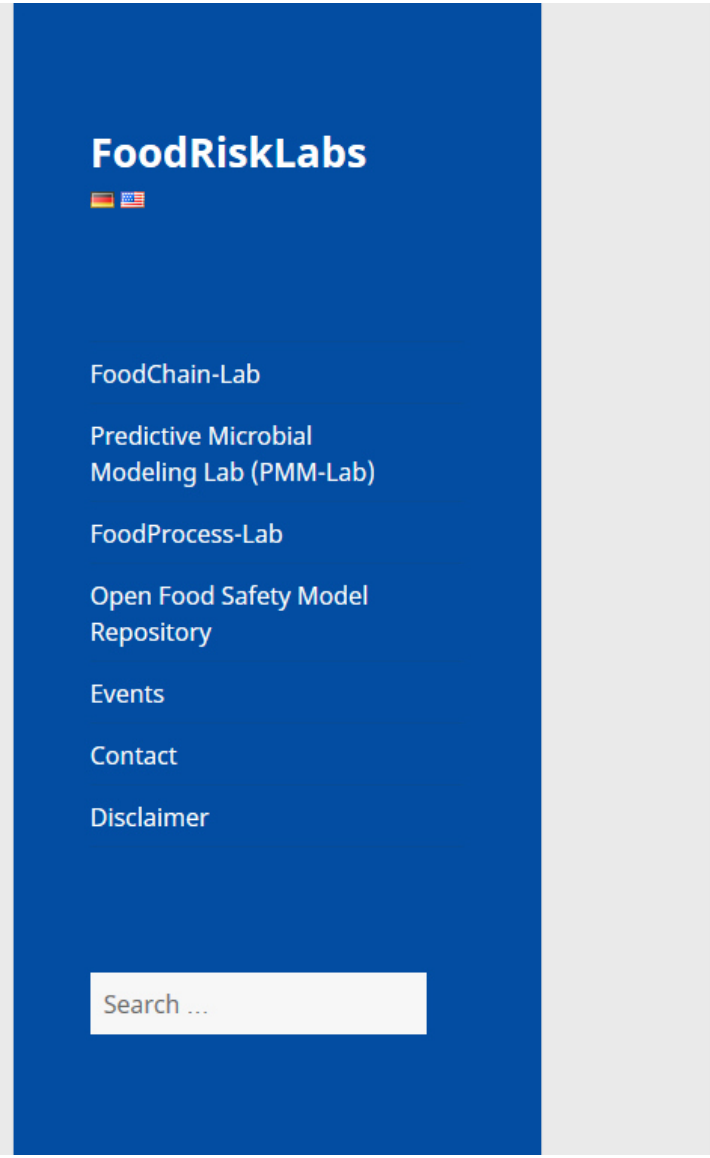
EU:
HAV 2013/14
C. Bot. 2017 (Plötze)
Salm 2017 (Sesam)

UK:
EHEC 2016

# Benefits of using FoodChain-Lab

- All steps integrated in one modular framework
  - Data Management
  - Data Cleaning
  - Data Analysis
- Helps during Outbreak Investigation
  - Assists in Brainstorming / Prioritizing
  - Identifies missing data
  - Tests hypotheses and generates new ones

# https://foodrisklabs.bfr.bund.de



# WI-FI & Pre-Todos

- To gain access to the BfR WLAN please take the following steps:
  - Open the WLAN-icon on your computer and select the wireless network: **BfR**
  - Enter the network password: **BfRvisitor**
  - Open your browser (e.g. Internet Explorer or Firefox)
  - Go to page www.bfr.bund.de
  - You will be requested to register for access to BfR-WLAN
  - Enter the following user name: **FoodchainLab**
  - Enter the following password: **fkubsk**

- Did anyone not succeed in Installation? WIFI working? First thing todo is: Check for updates!
- And: please create a folder where you will put all the files of this workshop into

FEDERAL INSTITUTE
FOR RISK ASSESSMENT

BfR
Bundesinstitut für Risikobewertung

# Thank you for your attention


Armin Weiser

http://foodrisklabs.bfr.bund.de

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