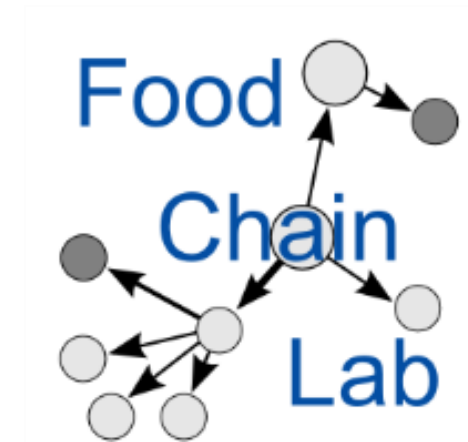
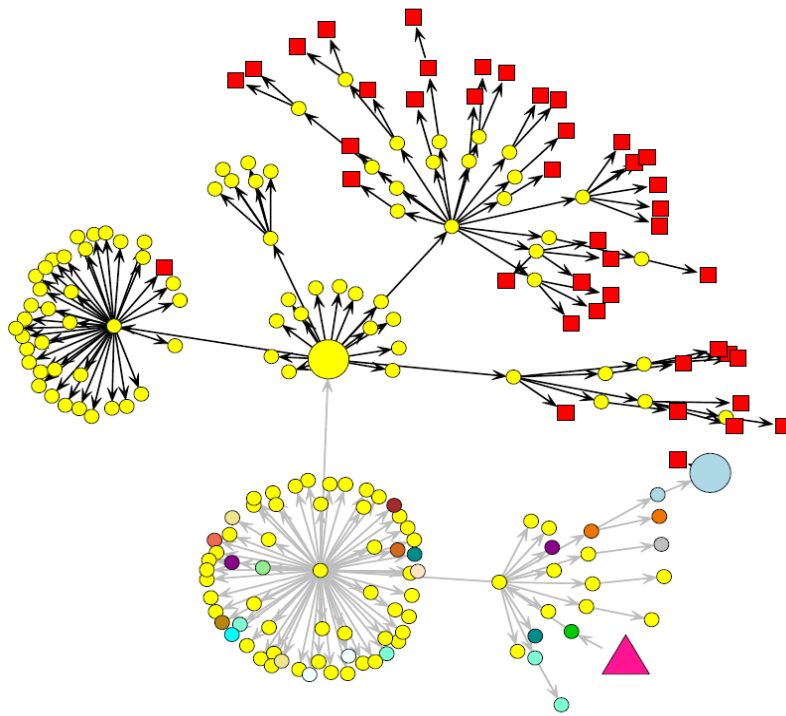


FoodChain-Lab: Tracing software supporting food-borne disease outbreak investigations

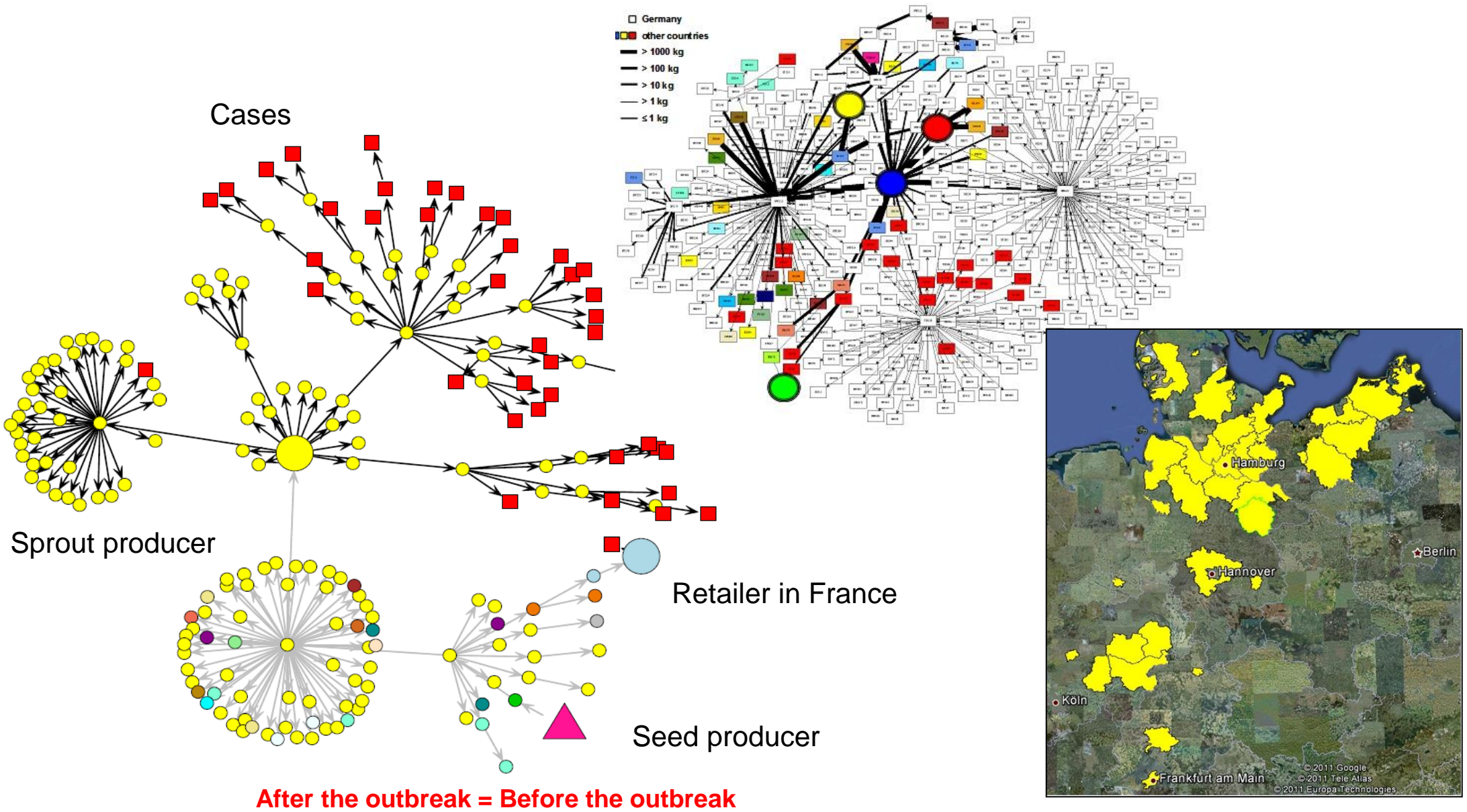


**Armin Weiser, Christian Thöns, Alexander Falenski,
Matthias Filter, Annemarie Käsbohrer, Bernd Appel**

Outline

- Introduction
- FoodChain-Lab
 - Data Collection
 - Analysis and Visualization
 - Live
- Outlook

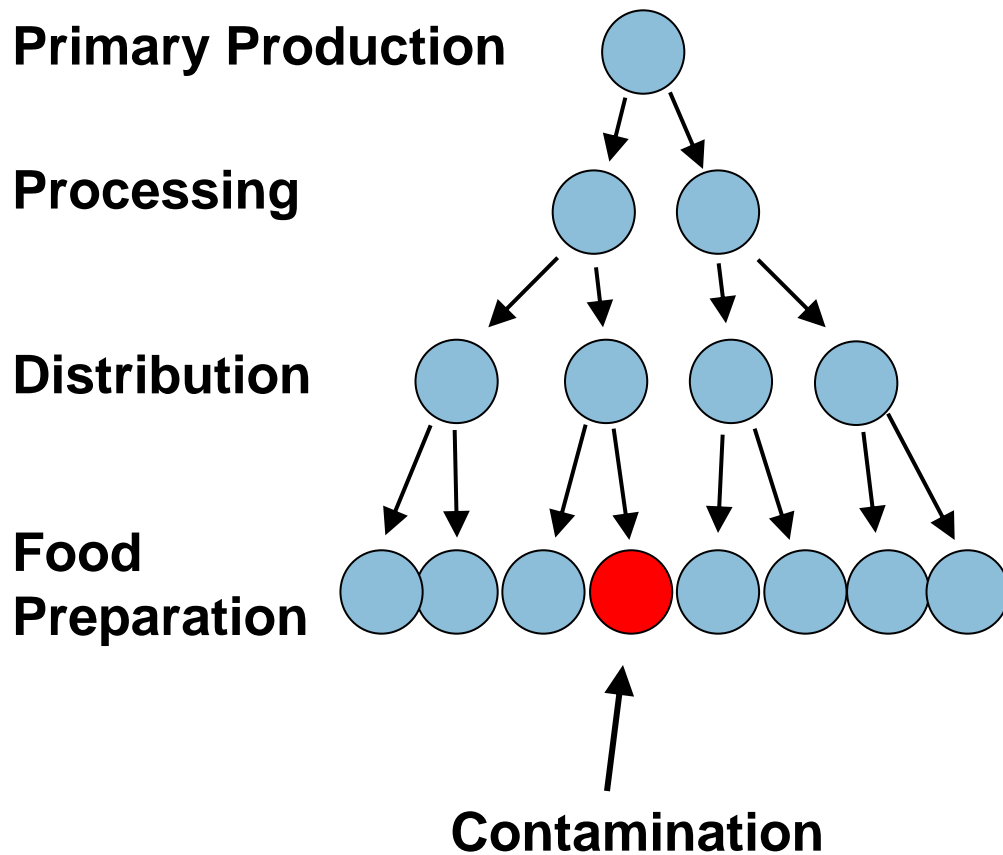
FoodChain-Lab – ad hoc



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.

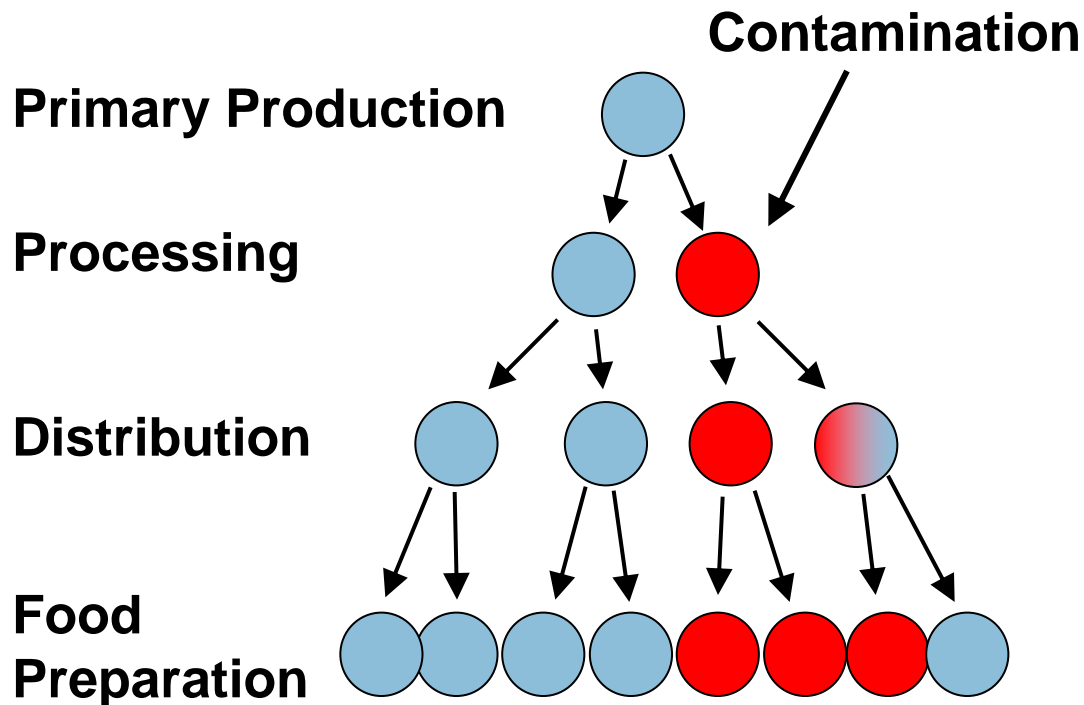
Outbreak Scenario 1:

Restricted to one Location



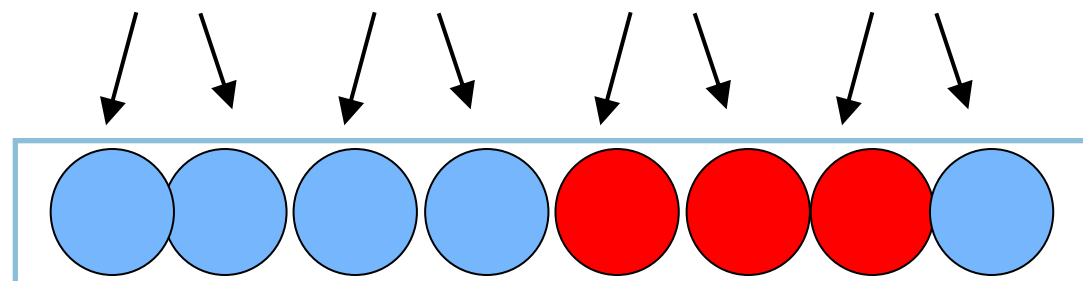
- Often caused by mistake during food preparation
- Acute outbreak
- High dose
- High infection rate
- Local investigation

Outbreak Scenario 2: Affecting Multiple Locations/Countries



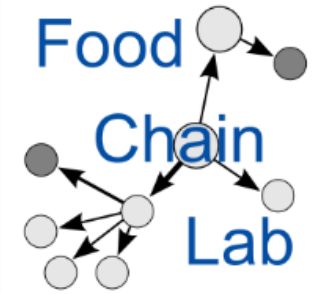
- Contamination during production/processing
- Diffuse distribution of cases
- Low dose
- Low infection rate
- Complex investigation

The outbreak investigation team see:
Cases



??

What is FoodChain-Lab?



- Open source software

<https://foodrisklabs.bfr.bund.de>

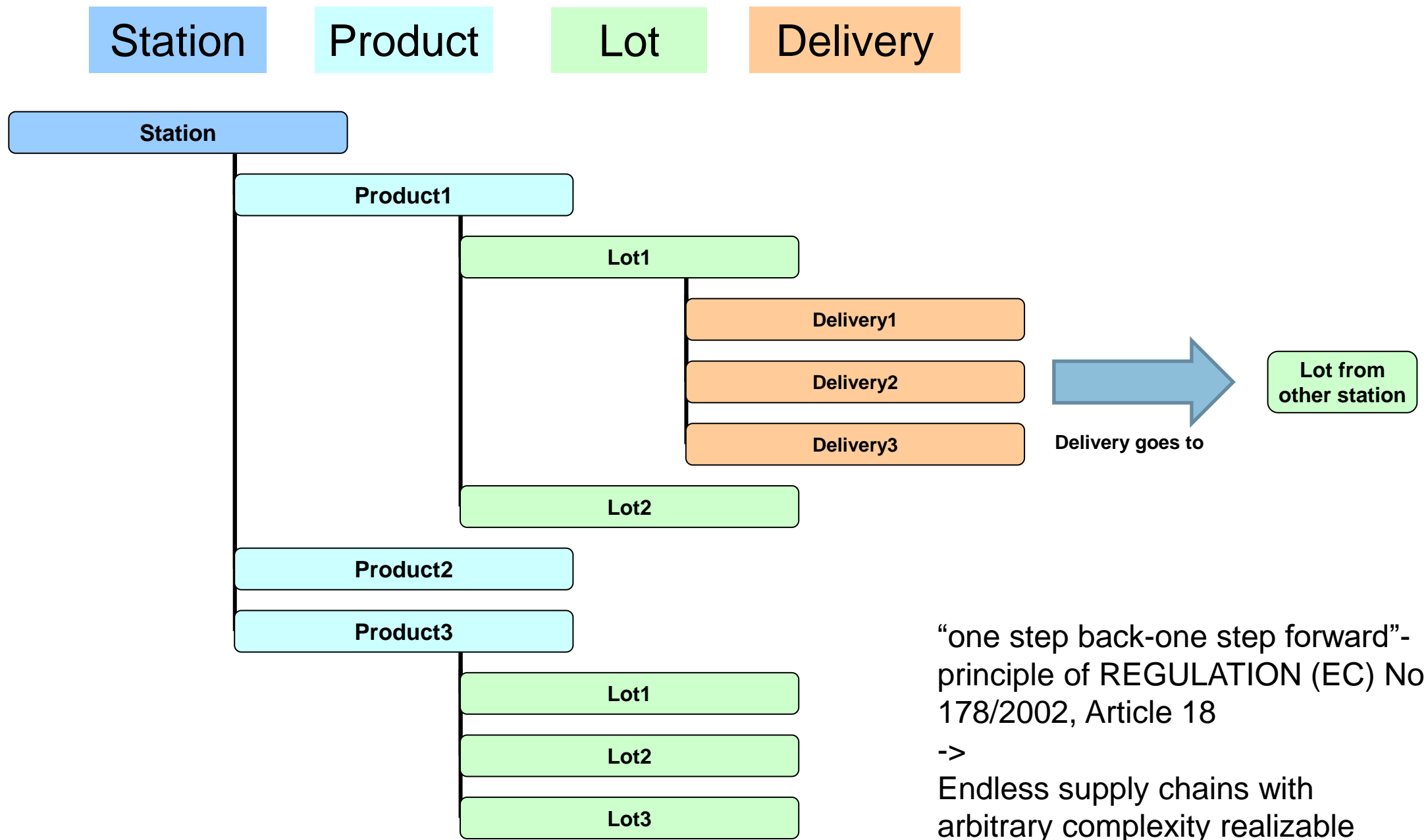
- Database for managing food tracing data

- Tool for data cleaning, enrichment & processing

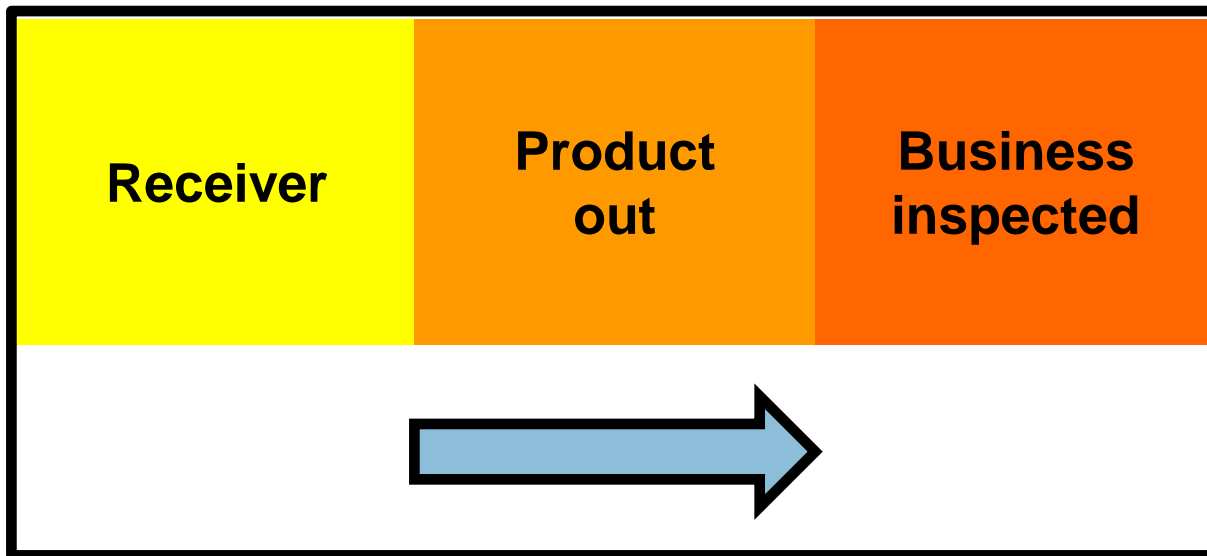
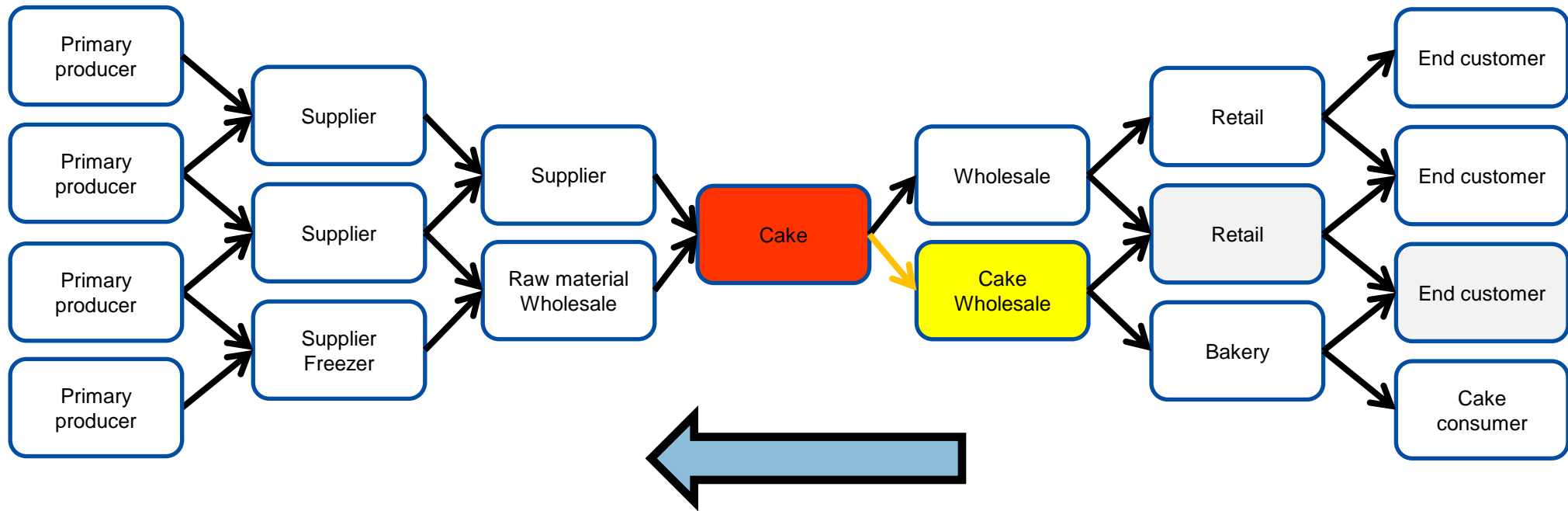
- Validation (also online: <https://foodrisklabs.bfr.bund.de/templatevalidator/>)
- Cleaning (e.g. Duplicate Detection)
- Enrichment (e.g. Geocoding)
- Analysis (Clustering, Tracing, Scoring, etc.)

- Tool for visualization and interactive reasoning

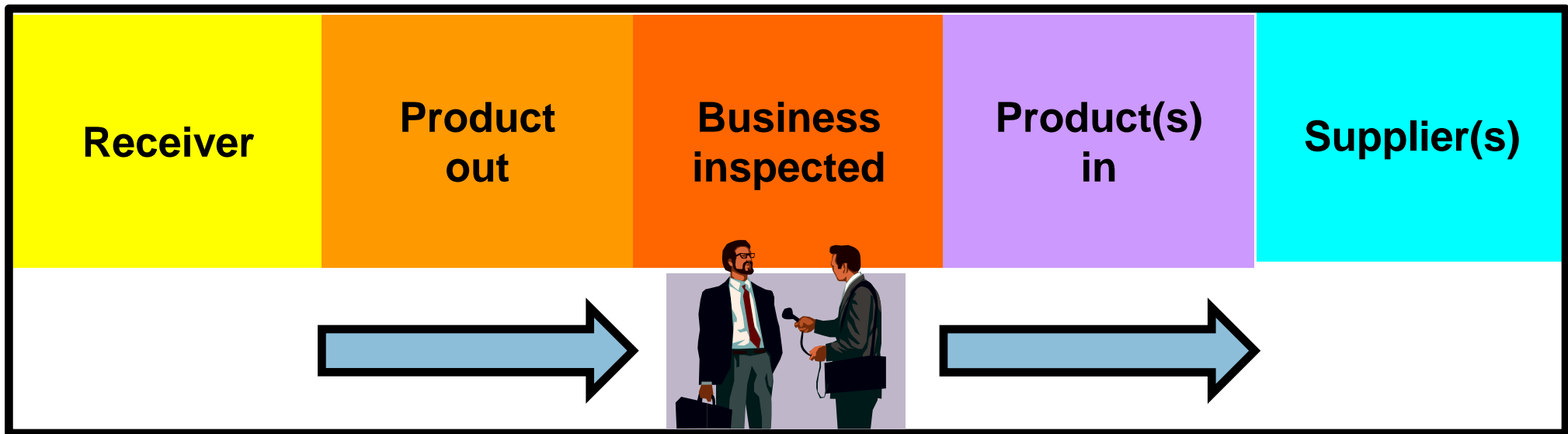
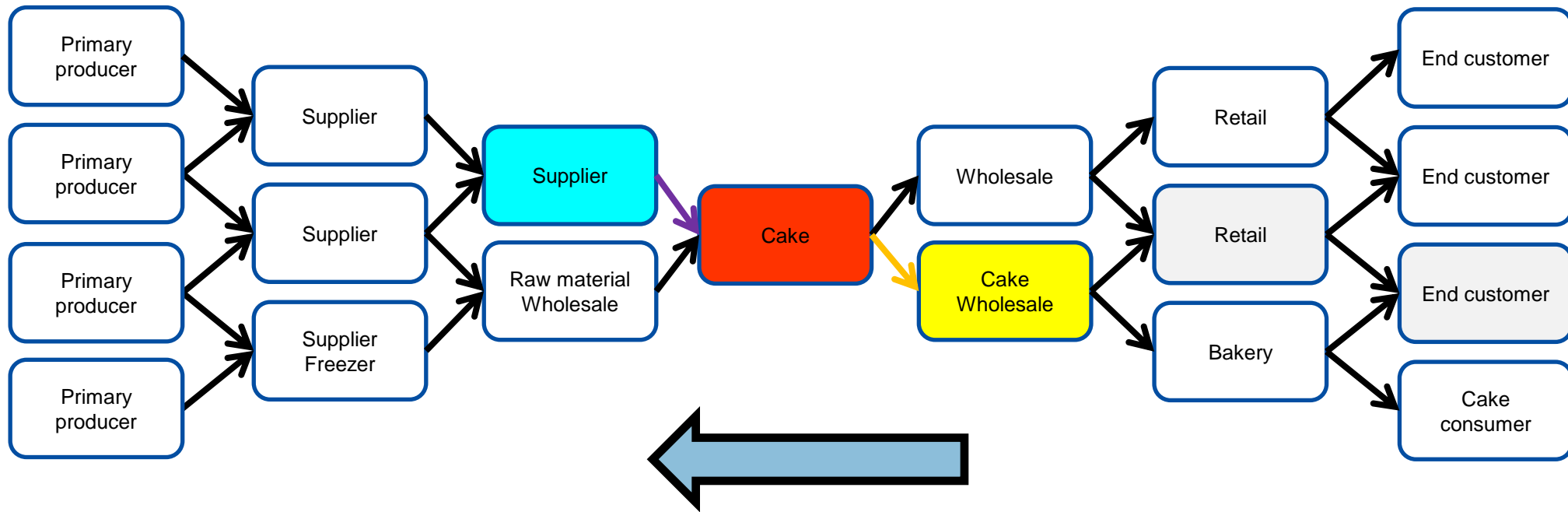
Database – Structure for Food Chains



Principle of tracing back – Data gathering

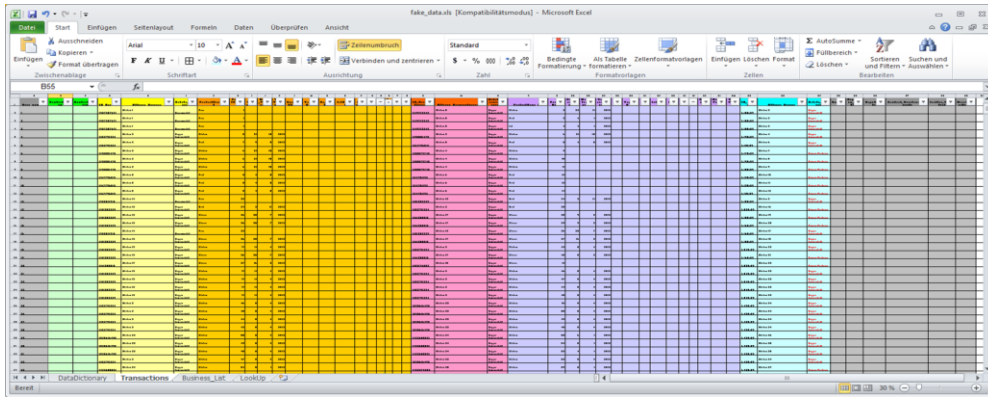


Principle of tracing back – Data gathering



Data gathering – Development of a new “simple” template

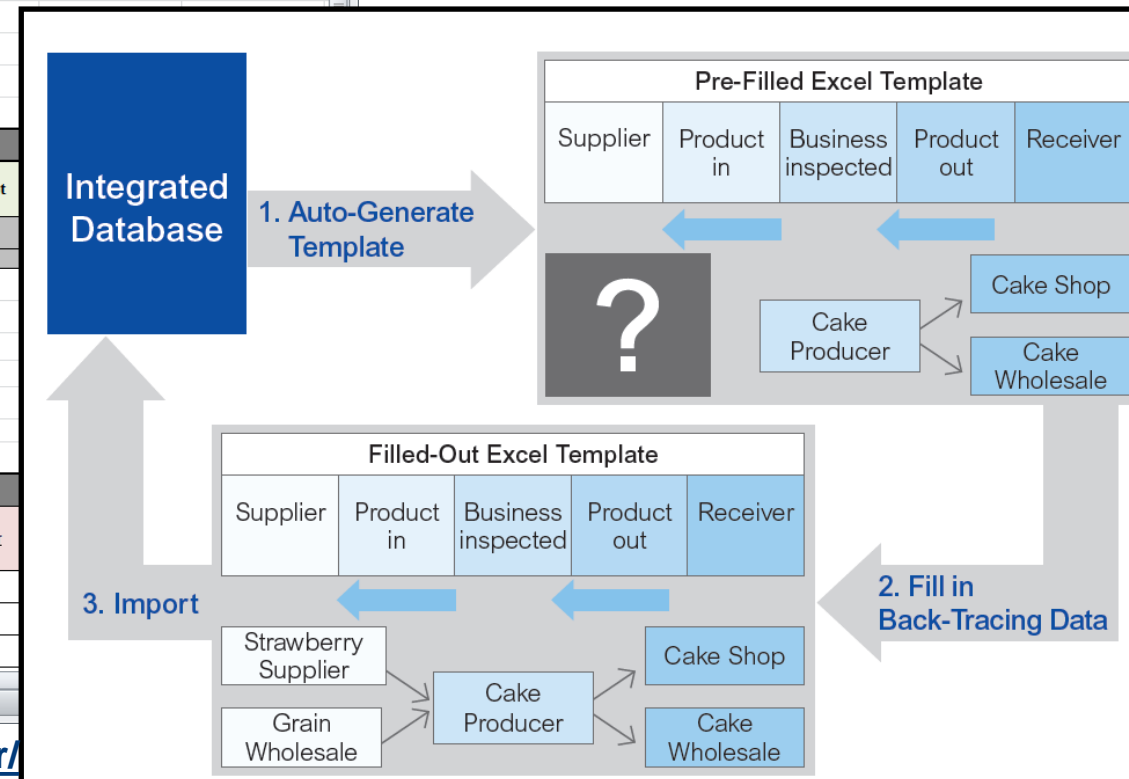
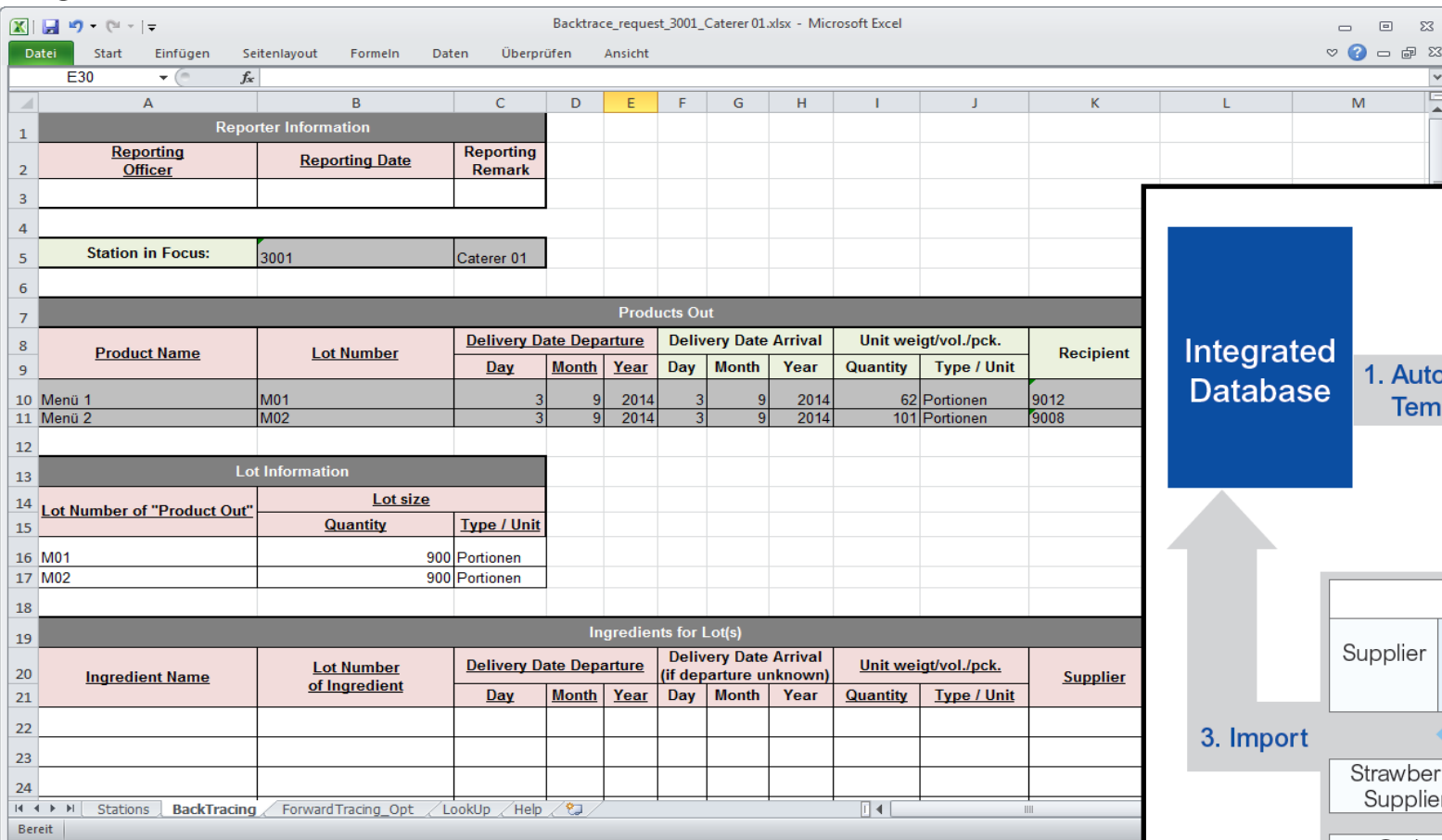
old:



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

-> Endless supply chains with arbitrary complexity realizable

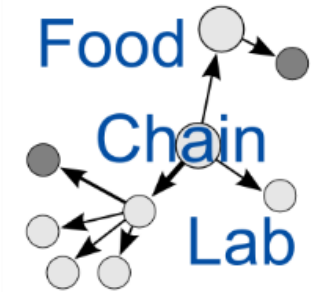
new:



Online Validation: <https://foodrisklabs.bfr.bund.de/templatevalidator/>

FoodChain-Lab

Data cleaning



SimSearch Options

Station: Name: 3 Zip: 1 Street: 3 Number: 1 City: 3 VATnumber: 0

Product: Station: 0 Denomination: 3 Item number: 0

Lot: Article: 0 LotNo: 1 BestBefore: 0 DateManufacturer: 0

Delivery: Lot: 0 DeliveryDate: 0 Recipient: 0

OK Cancel

ID	Address	CompanyID	Type of busin...	VATnumber	Code	IsCase	Number Cases	A
1 30	Salad harvester Ltd Big Street Hometown		horticultural farm			yes		
2 31	Salad harevster Ltd Big Street Hometown		horticultural farm			yes		

Levenshtein distance

M A Y O N N A I S E
 = = = = - = = = =
 M A Y O N A I S E

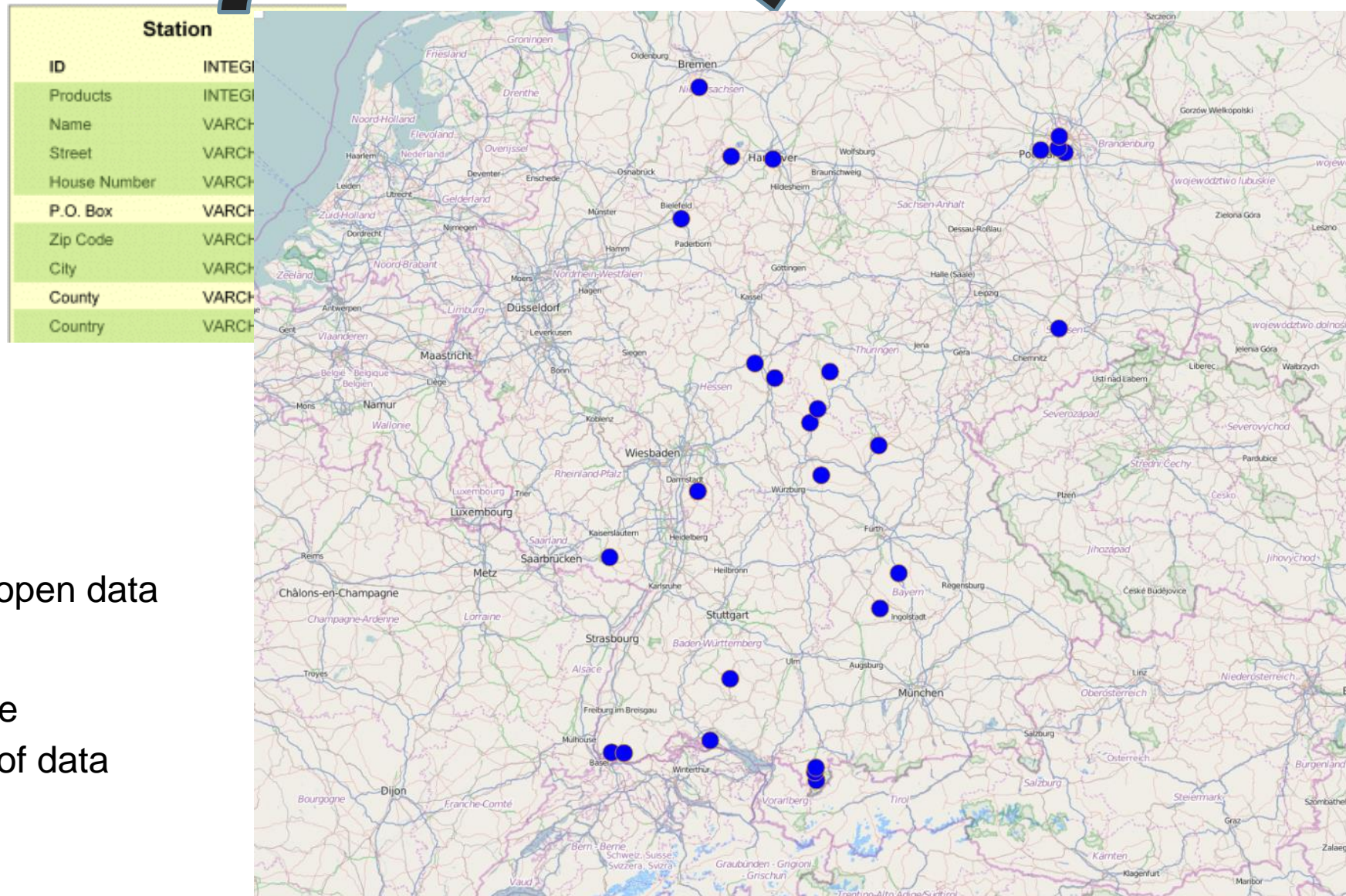
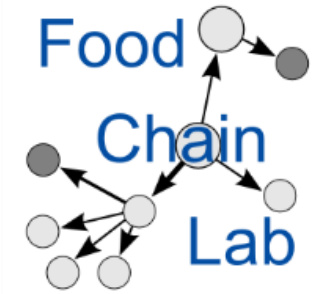
B I O M R A K T
 = = = - - = =
 B I O M A R K T

E L E P H A N T
 = = = o - = = =
 E L E F A N T

Works well for finding typos

FoodChain-Lab

Data Enrichment – Geocoding

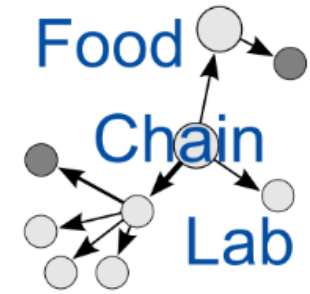


Available Providers:

- (Google)
 - Web service
- MapQuest
 - Web service on open data
- Gisgraphy
 - Locally installable
 - **Confidentiality** of data ensured!
 - No request limit!

FoodChain-Lab

Scoring



Definition:

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

- Visualization of backward / forward “trace”
- Simulations based on
 - Cross Contamination
 - Regional Effects (e.g. environmental contamination)
 - Weights for Outbreak Stations
- Tracing score as simulation result
 - ~ likelihood a station is involved in the outbreak

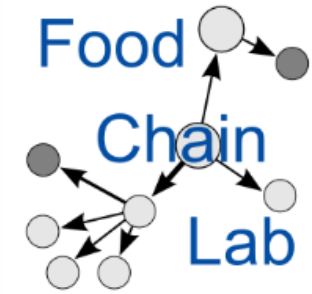
Math:

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

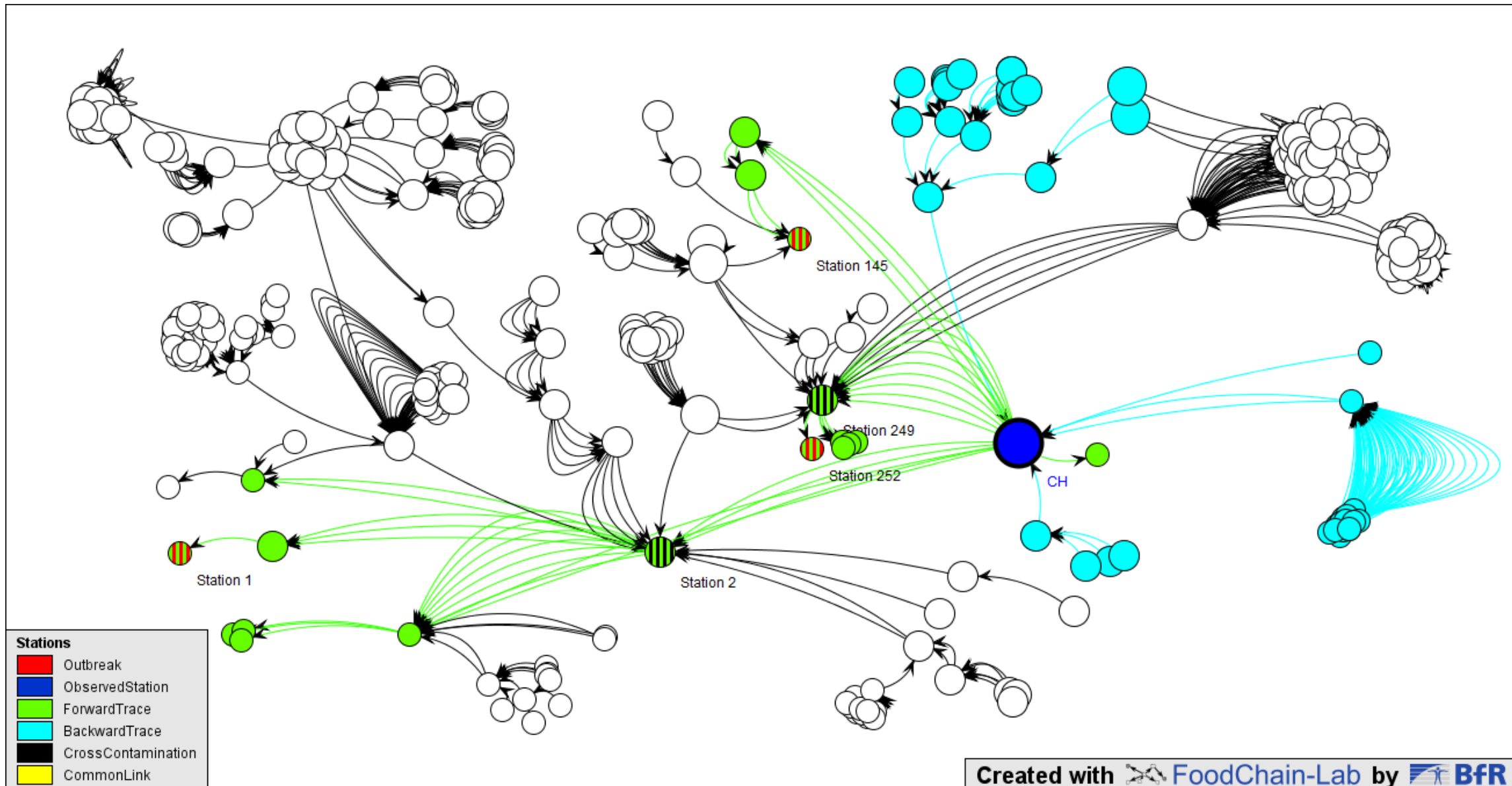
s_i : Station i
 w_j : Weight of station j
 t_{ij} : 1 if there is trace from station i
to j
0 otherwise
 n : Number of stations

FoodChain-Lab

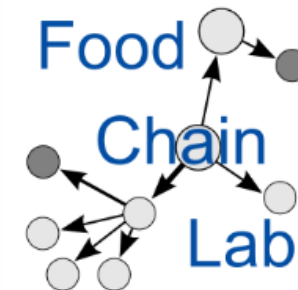
Data visualization of Traces



Traces of the products of the blue station. All 3 outbreak stations (red) are reached by the forward trace (green).

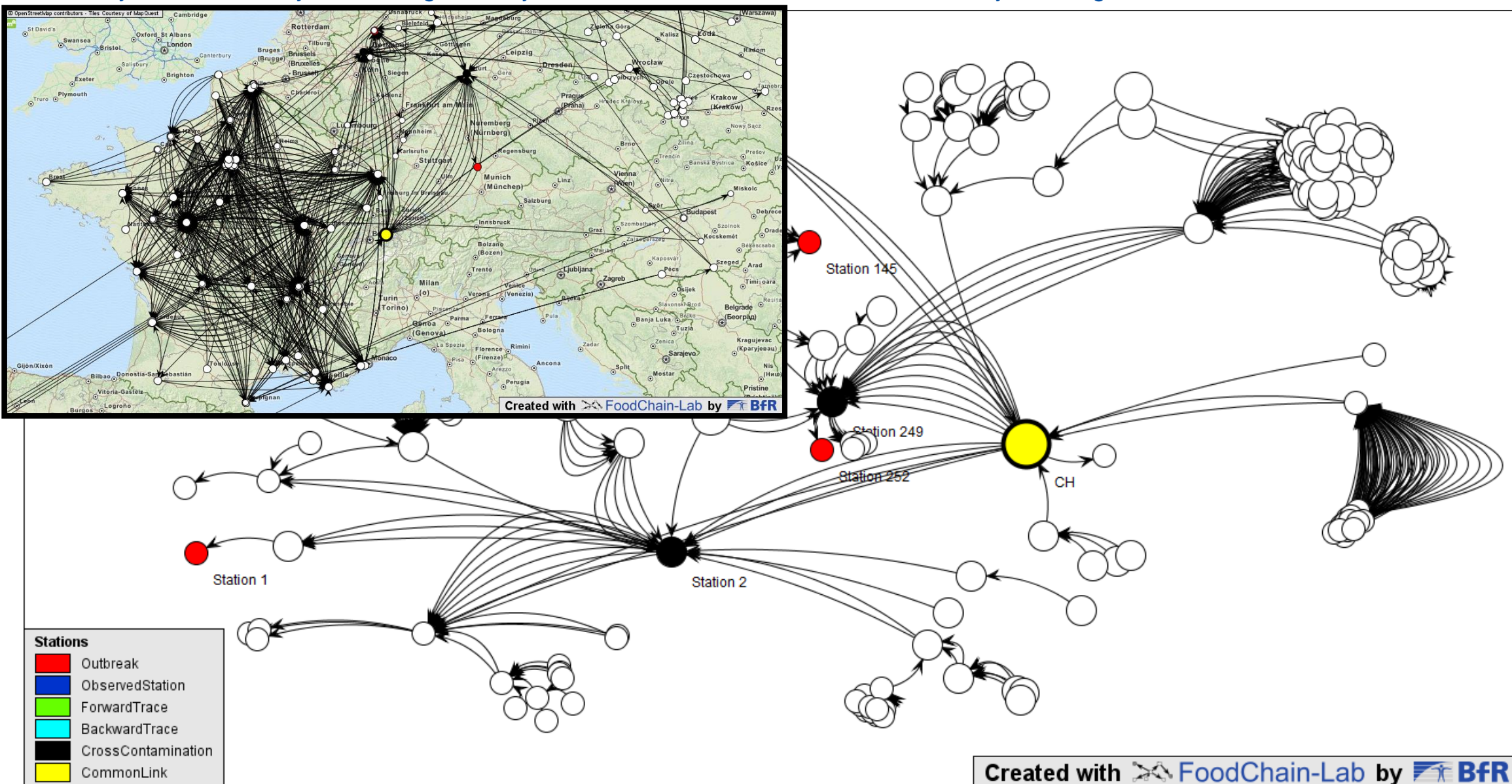


FoodChain-Lab (Geo-) cluster analysis



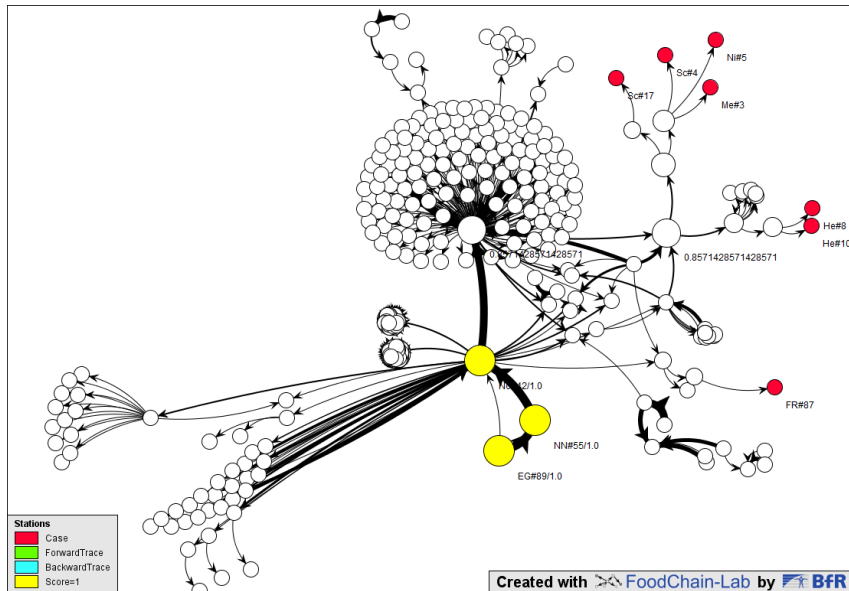
Synchronized network- and map-view.

Manually or automatically defined regions may be treated as one station. This allows analysis of regional causes of the outbreak..

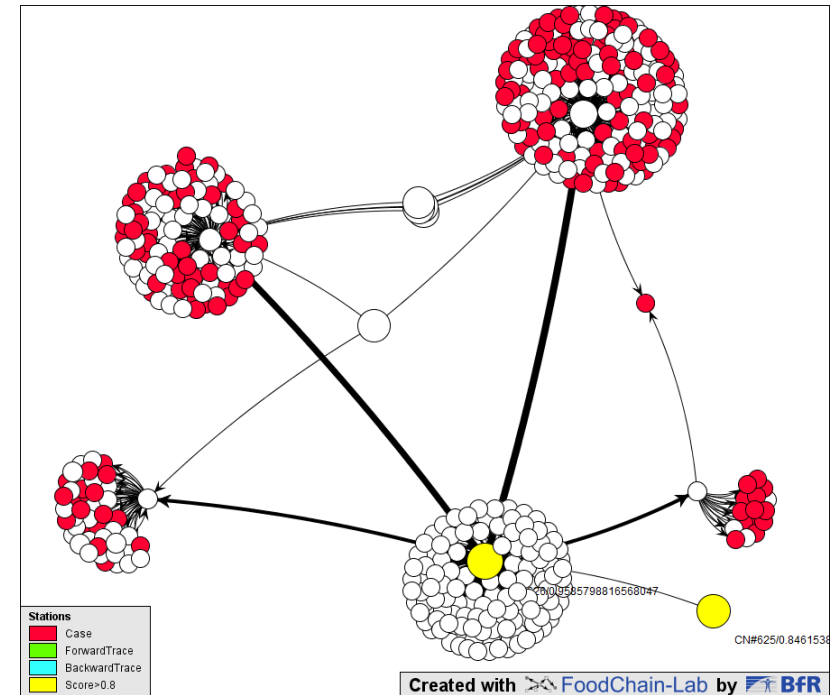


Real world applications

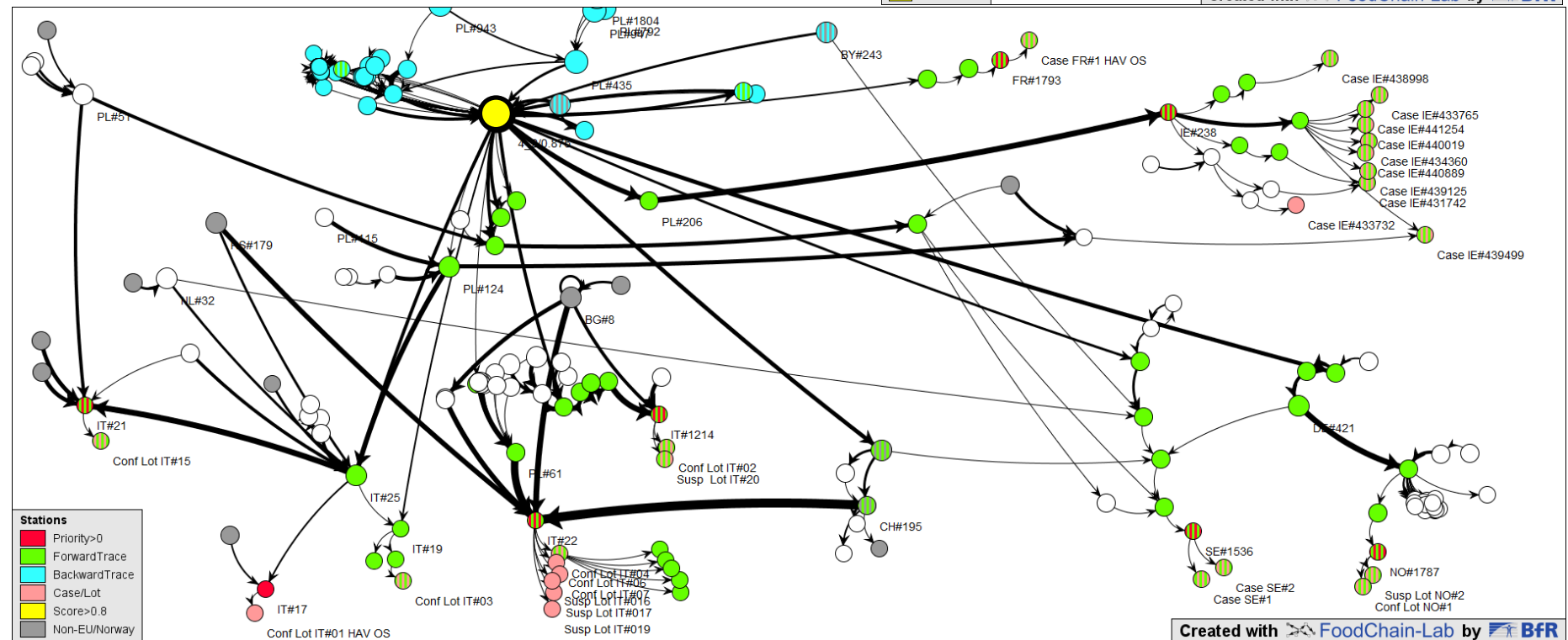
EHEC 2011

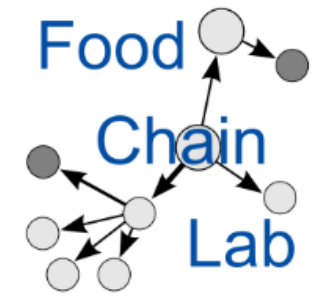


Norovirus 2012



HAV 2013/14





Live...

FoodRiskLabs



FoodChain-Lab

Predictive Microbial
Modeling Lab (PMM-Lab)

FoodProcess-Lab

Open Food Safety Model
Repository

Events

Contact

Disclaimer

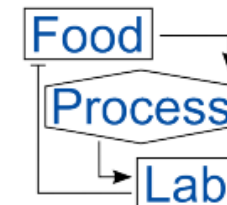
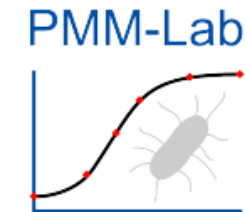
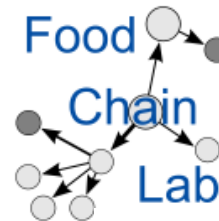
FoodRisk-Labs



FoodRisk-Labs is a portal

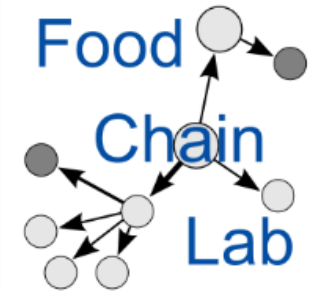
to the following tools

developed by the Federal Institute for Risk Assessment (BfR):



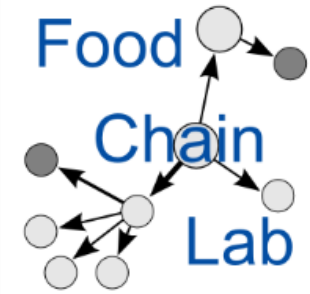
Outlook

Software



- Automation
 - Simulations for various parameters
- Integration
 - Further tools: FoodProcess-Lab, Pmm-Lab, ...
 - Further data: Sample analysis data from laboratories, ...
- Simplification
 - Data collection
 - Handling
- Other
 - Improved Layouts
 - New Retrospective features
 - Support, bug fixes, documentation
 - ...

Outlook Strategy



- Special enhancements on data gathering
 - Centralizing / Cloud service (but still usable for decentral units)
 - Direct on-site data gathering, e.g. via Tablet/Phone
 - Establish data exchange formats between authority -> authority and business -> authority
- Dissemination
 - Workshops with the motive “Train the trainer”
 - MS of EU
 - Other parties?
 - Every day usage? Further application areas?
- Realize (pilot) projects with potential stakeholders?
- Do we need a “Rapid Deployment Team”?



Thank you for your attention

Armin Weiser

<https://foodrisklabs.bfr.bund.de>

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