

New KNIME extensions supporting food safety and foodborne outbreak investigations

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Federal Institute for Risk Assessment

Established 1 November 2002 (its predecessor founded in 1876)

Annual budget: appr. 65 Mio €

Research budget: appr. 6 Mio €

BfR staff: appr. 750 employees (550 working in the scientific field)

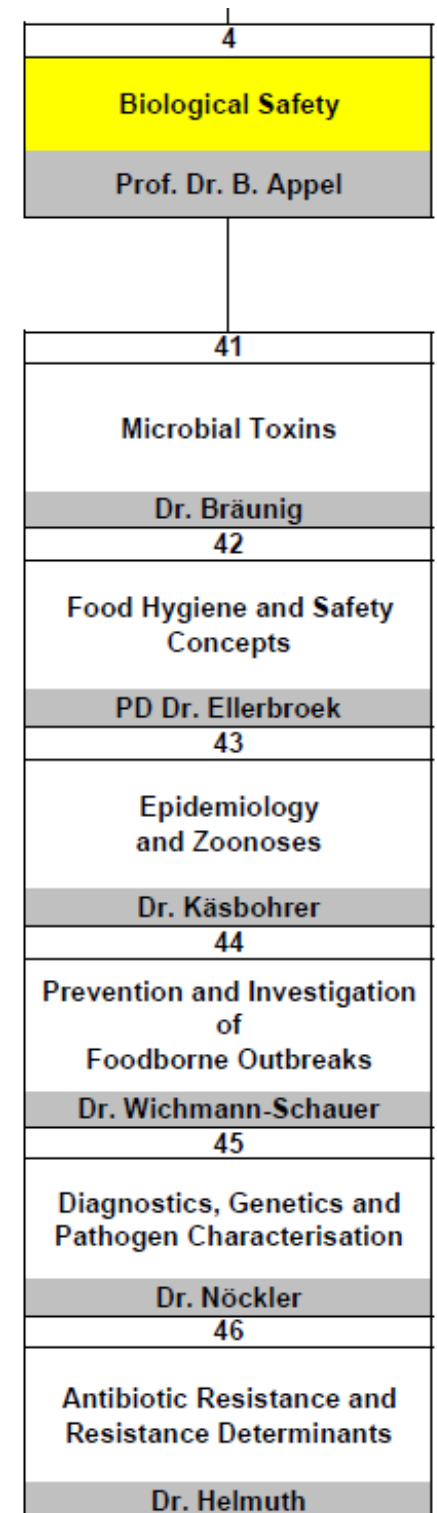
Locations: Berlin (Marienfelde, Jungfernheide)

Main areas of work: Food Safety
Safety of Substances and Preparations
Safety of Consumer Products
Risk-Communication etc.

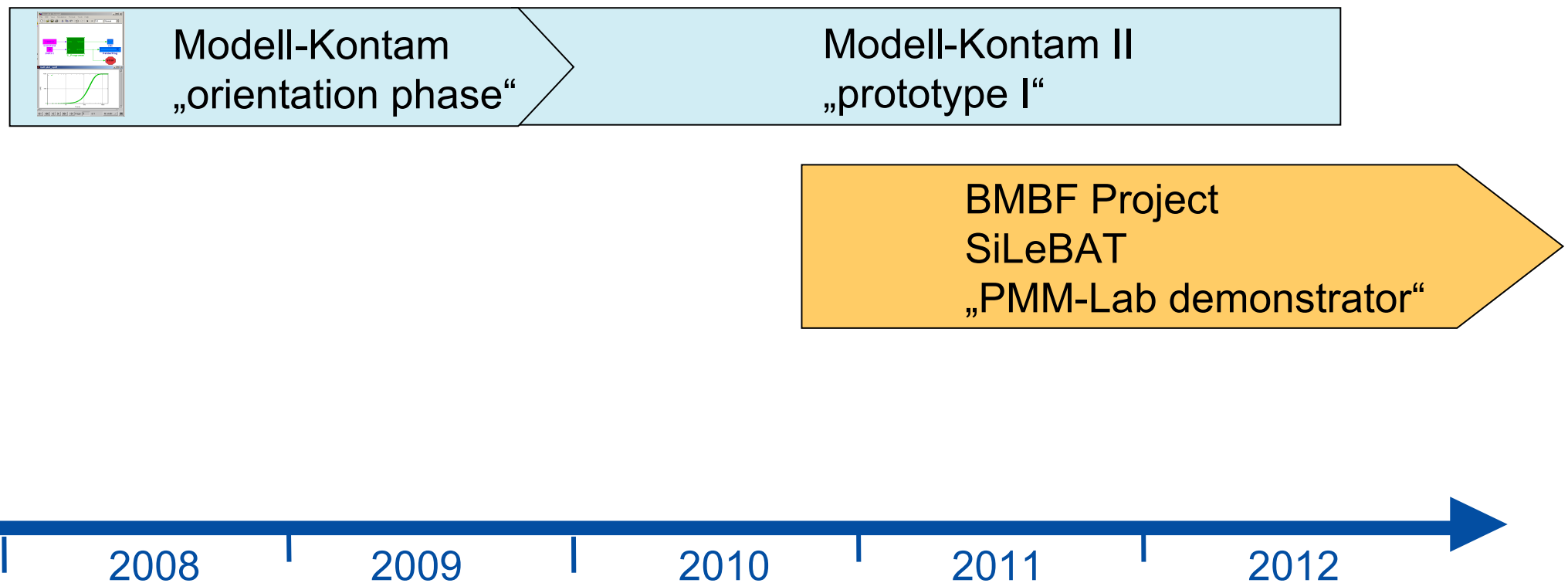
Department „Biological Safety“

Pathogens in working focus:
Salmonella, E.coli (faecal germs),
Mycobacteria, Brucella, Campylobacter,
Listeria, Yersinia, Staphylococci
various parasites, like Trichinella
or Echinococcus and viruses

10 National Reference Laboratories for
various zoonoses pathogens



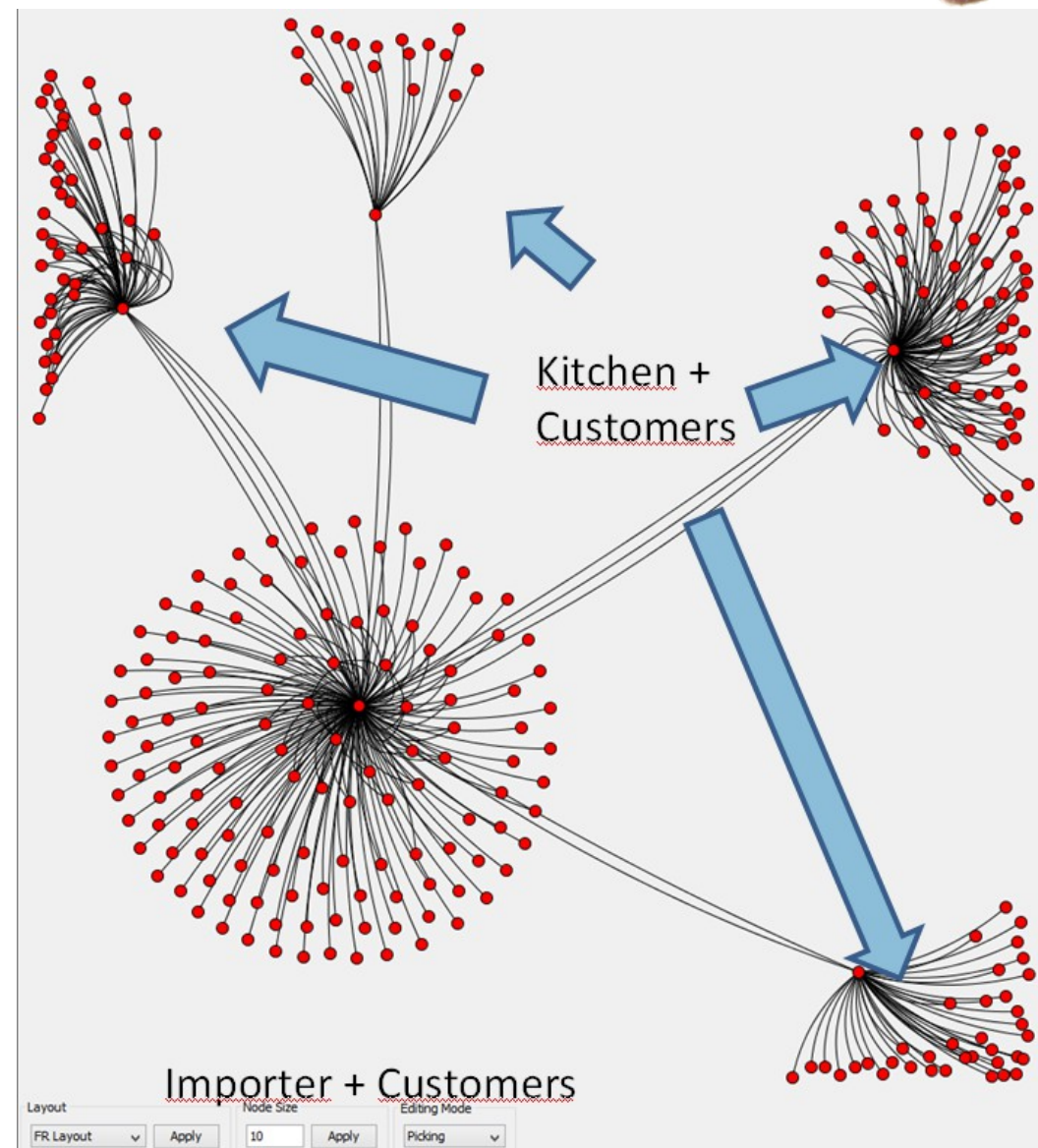
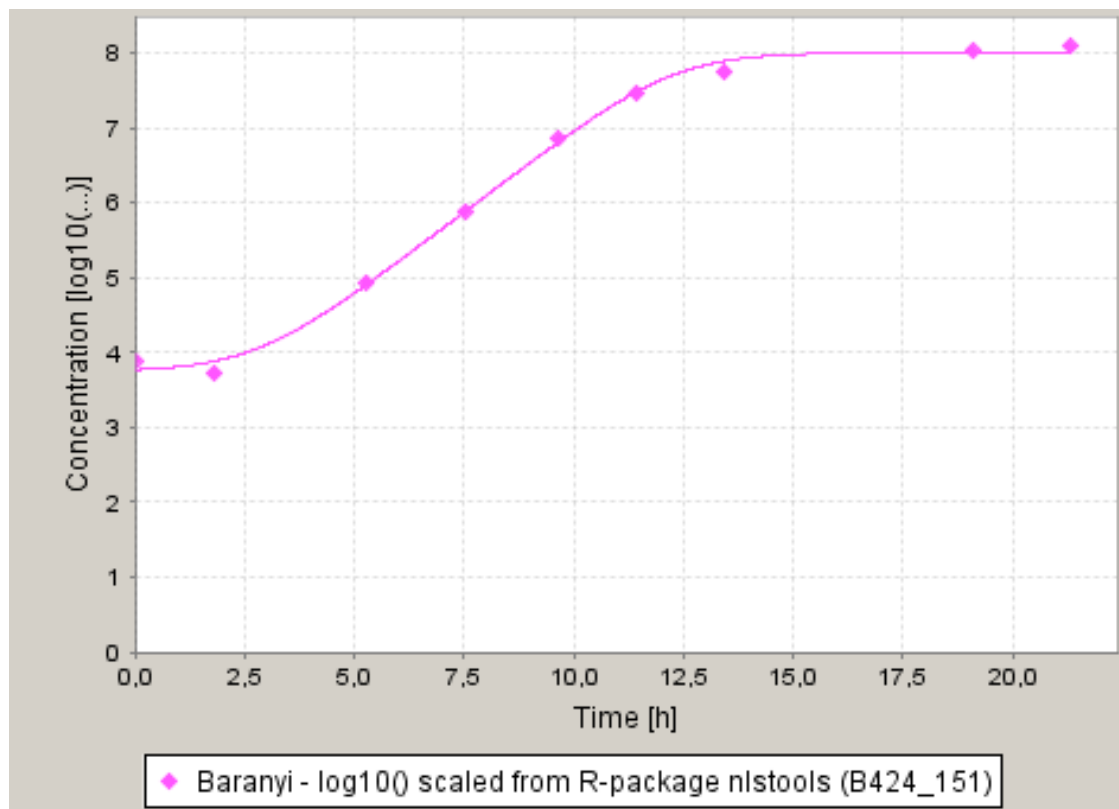
BfR capacity building - Research projects dedicated (in part) to develop software tools





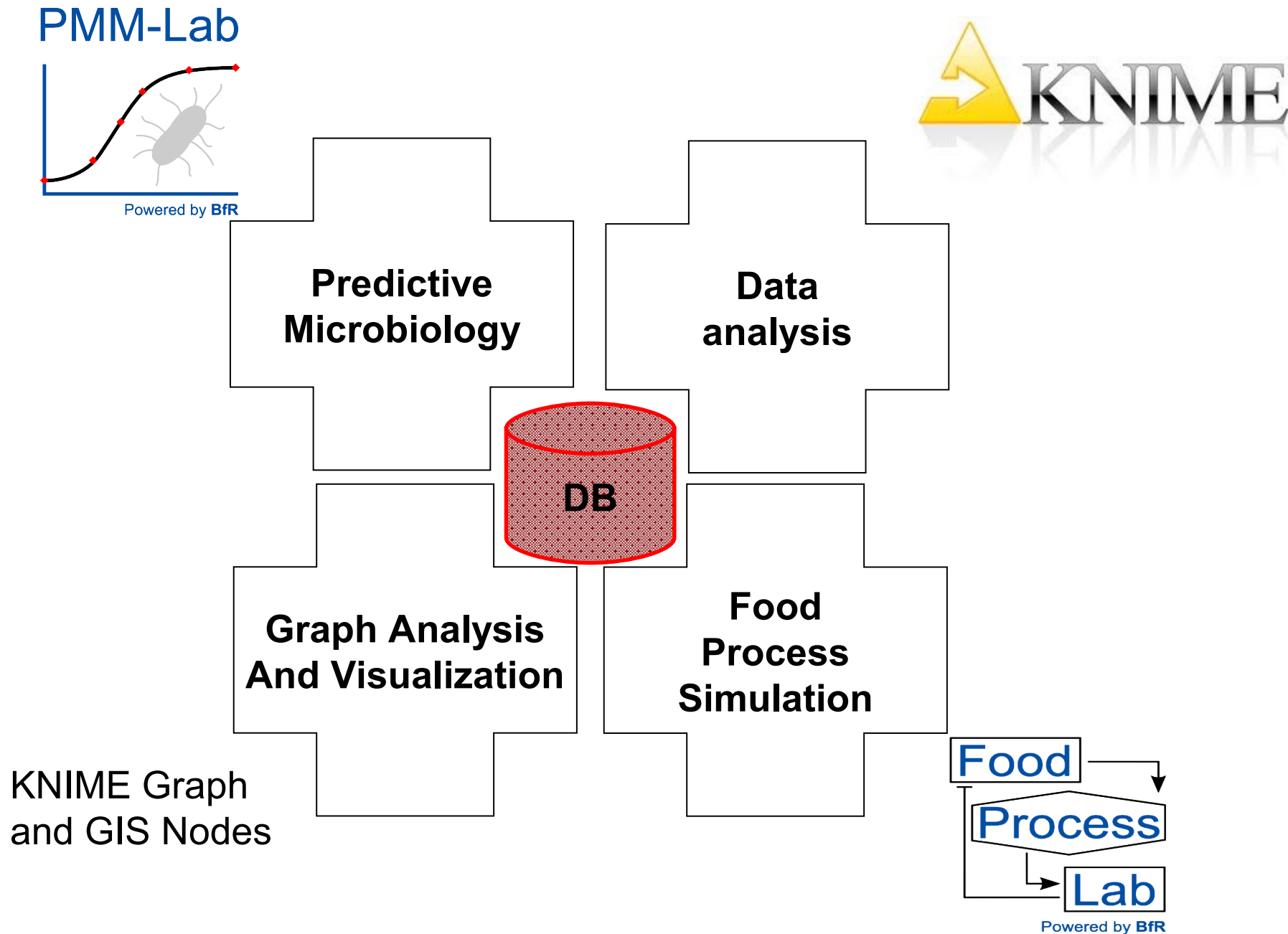
Norovirus Outbreak from Strawberries

Predictive Microbiology

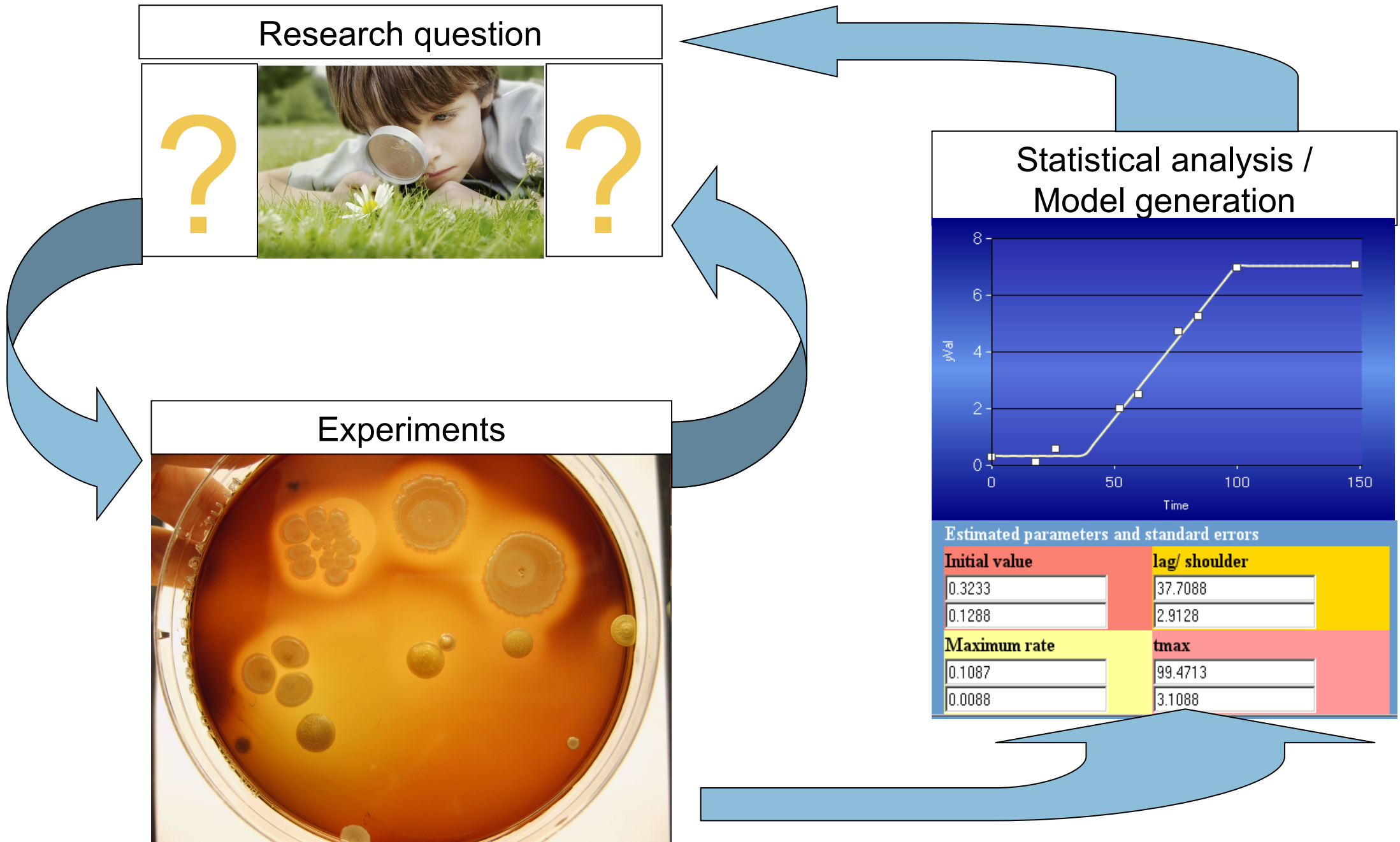


BfR vision -

Integrated community tools for quantitative microbial risk assessments



Predictive microbiology



Available Resources - Predictive Microbiology

Online models

- Pathogen Modeling Program
- ComBase Predictor / Perfringens Predictor
- Sym'Previus
- Seafood Spoilage and Safety Predictor
- Refrigeration Index Calculator
- Shelf Stability Predictor
- Microbial Response Viewer
- Literature
- (PMM-Lab)

Modeling tools

- GInaFiT (Geeraerd et al., 2005)
- DMFit (Baranyi et al., 1994)
- The R Project for Statistical Computing
- Commercial modeling software packages (@Risk, Matlab etc.)
- (PMM-Lab)

Data:

- ComBase DB
- Proprietary (industry) data collections
- Literature
- (PMM-Lab)

Research Objective and Solution

Extending Community Resources in the field of Predictive Microbiology

- Support exploitation of experimental data by **lab scientists** -> Easy to use (easier than R, Matlab)
- Support **transparency** and quality control -> Documentation for all Methods, Formulas are visible
- Support establishment of a community **PMM model database** -> Integrable into proprietary and community resources
- **free of charge** AND **open source**

- Extends KNIME (www.knime.org)
- Hosted on Sourceforge (<https://sourceforge.net/projects/pmmlab>)

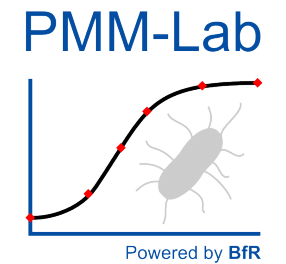


Uses:

- Java
- HSQL database engine (www.hsqldb.org)
- JFreeChart (www.jfree.org/jfreechart)
- JEP Math Expression Parser (www.singularsys.com/jep)



PMM-Lab – How does it look like?



The main workflow in the KNIME interface consists of the following nodes:

- Formula Creator**: Original Formel Leguerinel 2004 Formel 4
- XLS Primary Model Reader**: Original Daten Leguerinel 2004 Table 1
- Model Selection Primary**
- PMM Joiner**
- Model Fitting**: PMM-Lab Fit
- Model View Secondary**

The **Dialog - 0:21 - Formula Creator** window shows the following details:

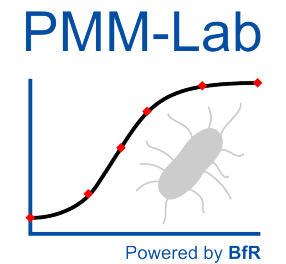
- Model Properties: Model type: secondary
- Formula from DB: Manually defined formula (v1360850637154)
- Formula Name: Manually defined formula (v1360850637154)
- Formula: $D = 10^{-(\log_{10}(D_star) - (T - 121.1) / z_T - \text{abs}(pH - 7) / z_pH)}$
- Parameter Definition Table:

Parameter	Independent	Min	Max
D_star	<input type="checkbox"/>		
T	<input checked="" type="checkbox"/>		
aw	<input checked="" type="checkbox"/>		
aw1	<input checked="" type="checkbox"/>		
aw1_opt	<input type="checkbox"/>		
pH	<input checked="" type="checkbox"/>		
pH1	<input checked="" type="checkbox"/>		
pH1_opt	<input type="checkbox"/>		
z1_aw	<input type="checkbox"/>		
z1_pH	<input type="checkbox"/>		

The **Primary and Secondary Models and Parameters - 0:29 - Model View Tertiary** window shows a graph of Concentration [log10(LU)] vs Time [h]. The graph displays data points (red squares) and a fitted curve (red line). The Y-axis ranges from -0.50 to 4.50, and the X-axis ranges from 0.00 to 0.85. Below the graph, the following parameter values are listed:

- aw: 0.968
- pH_recoveryMedia: 7.0
- Temperature: 100.0
- aw_recoveryMedia: [value obscured]

PMM-Lab – Sourceforge Ticket System (Bugtracker)



Admin Wiki Files Code Tickets Discussion Summary

Search Tickets

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Milestone

1.0 **98**

2.0 **30**

Searches

Alex Open Tick **0**

Armin Open Tic **13**

Changes **128**

Chris Closed Tickets **43**

Tickets

Show deleted tickets

Showing results of 36

#	Summary	Milestone	Status	Owner	Created	Updated	Priority
129	Bug: textChanged is called multiple times for each change	2.0	open	Christian Thöns	22 minutes ago	22 minutes ago	Low
128	java.io.EOFException	1.0	open	Armin Weiser	7 hours ago	7 hours ago	Normal
127	New view for table "estimated models" in DB-GUI	2.0	open	Armin Weiser	4 days ago	4 days ago	Normal
122	Handle DBUUIDs in all reader nodes	1.0	open	Christian Thöns	2013-02-22	2013-02-22	High
121	Enable editing of fields "matrix details, organism details" etc. in Microbial Data Edit	1.0	open	Christian Thöns	2013-02-21	2013-02-21	Normal
118	The integrated catalogue for units is	2.0	open	Armin	2013-02-21	2013-02-21	Normal

Embrace and support community solutions !

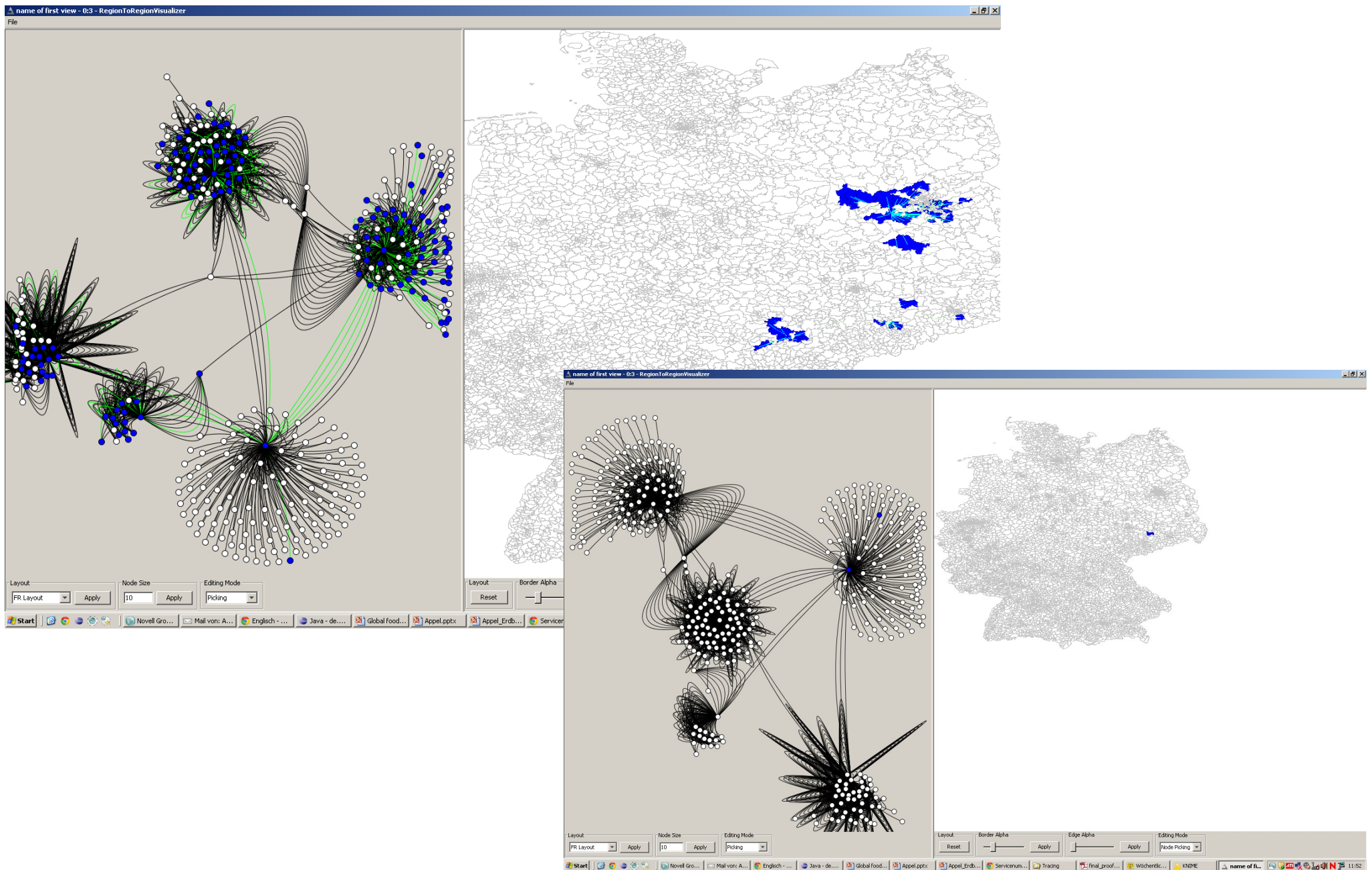
Work together on standardized data exchange formats !

Graph Analysis and Visualization to Identify Source In Food-Related Outbreaks

- Backtracing Algorithms based on certain Articles, Charges, ...
- Powerful Visualization tools to easily find outbreak clusters
- GIS Visualization of the Graph
- Visualization Graph nodes might be published to KNIME Community Repository

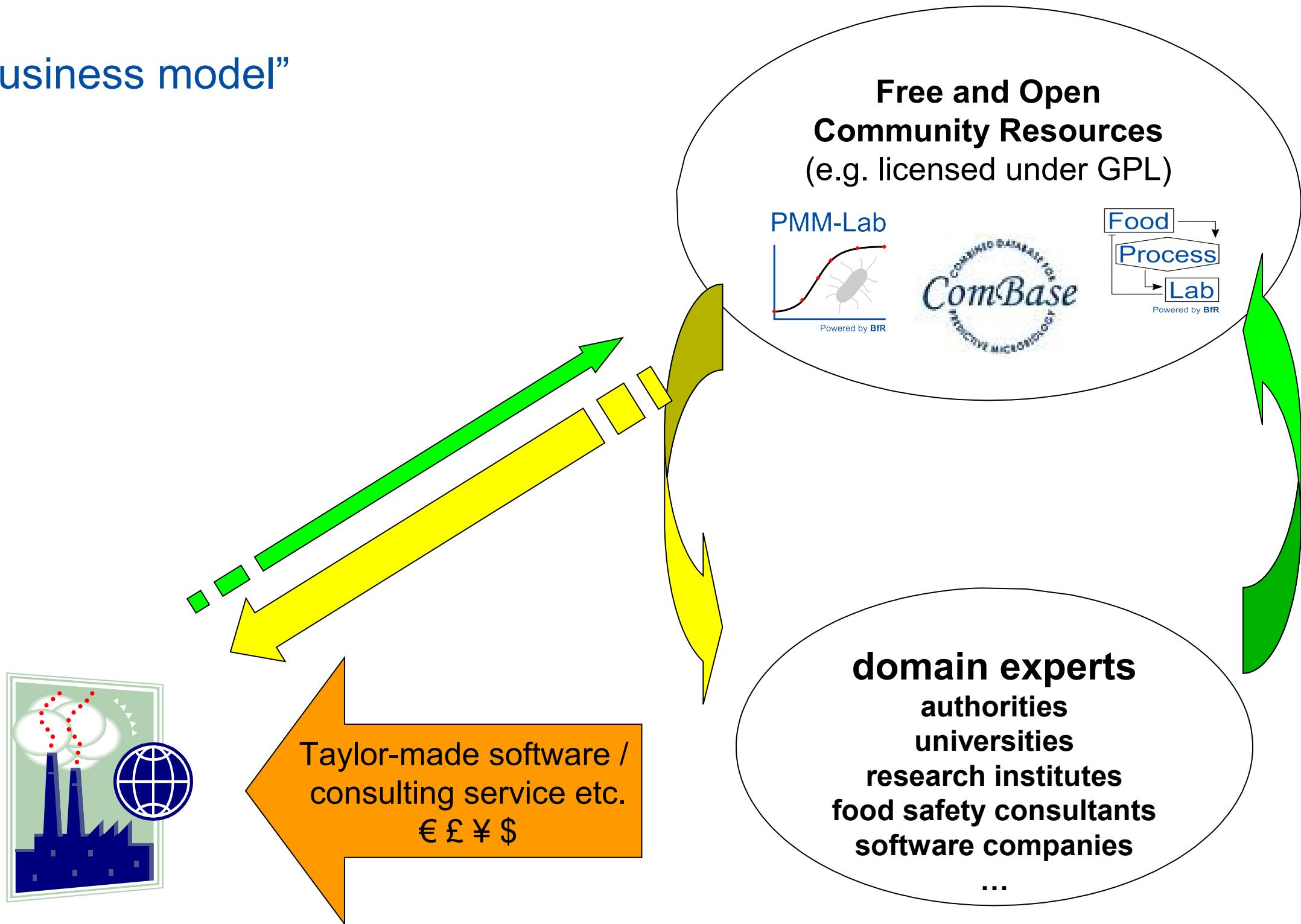
Graph and GIS Nodes - How does it look like?

KNIME Graph and GIS Nodes



Graph and GIS Nodes – live demo

“Business model”



Thank you for your attention

Christian Thöns

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