

# Methods and Services of Data Processing for Data Logged by Automatic Process Data Acquisition Systems



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**Crop Production Engineering**

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# Documentation in crop production – why ?

## Optimised farm management:

- Machinery use
- Ressource Management
- Operational planing

## Optimised crop management:

- Fertilizing / plant protection
- Tillaging
- Site specific farming

**Documentation**

=

**Information**

## Traceability:

- Consumers trust
- Food industry
- Subsidy granting

## Fleet management:

- Joint machinery use
- Machinery rings
- Contractors

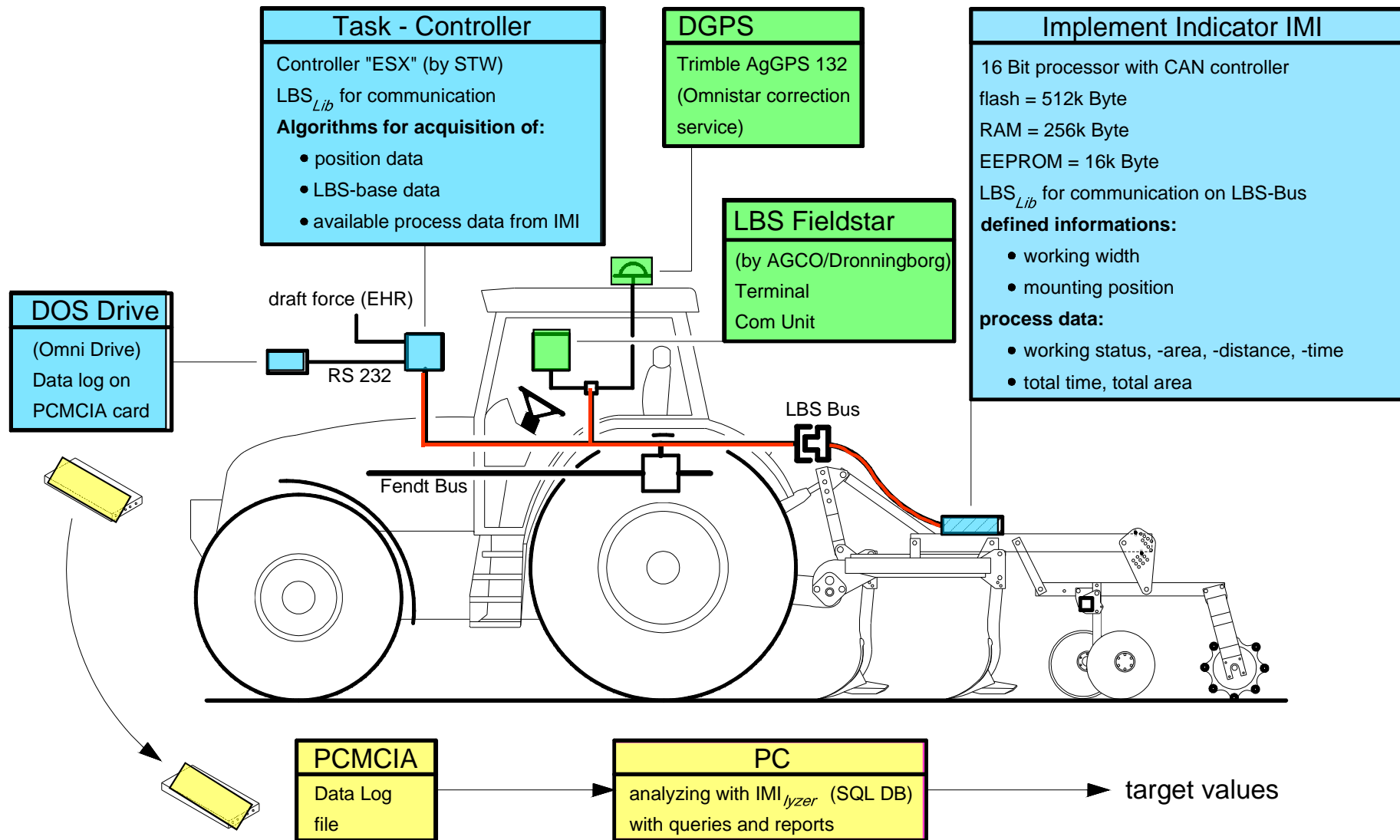
# Requirements of a documentation system

- Stability of data acquisition
- Completeness of data
- Safety of data
- Realtime acquisition
- Georeferenced data
- Easy and quickly to use

**Automatic process data  
acquisition on machinery  
including GPS-positioning**

**Almost automated  
data processing  
on the PC**

# Automated process data acquisition with GPS and LBS



(Auernhammer et al., 2000)

# Automated process data acquisition with GPS and LBS

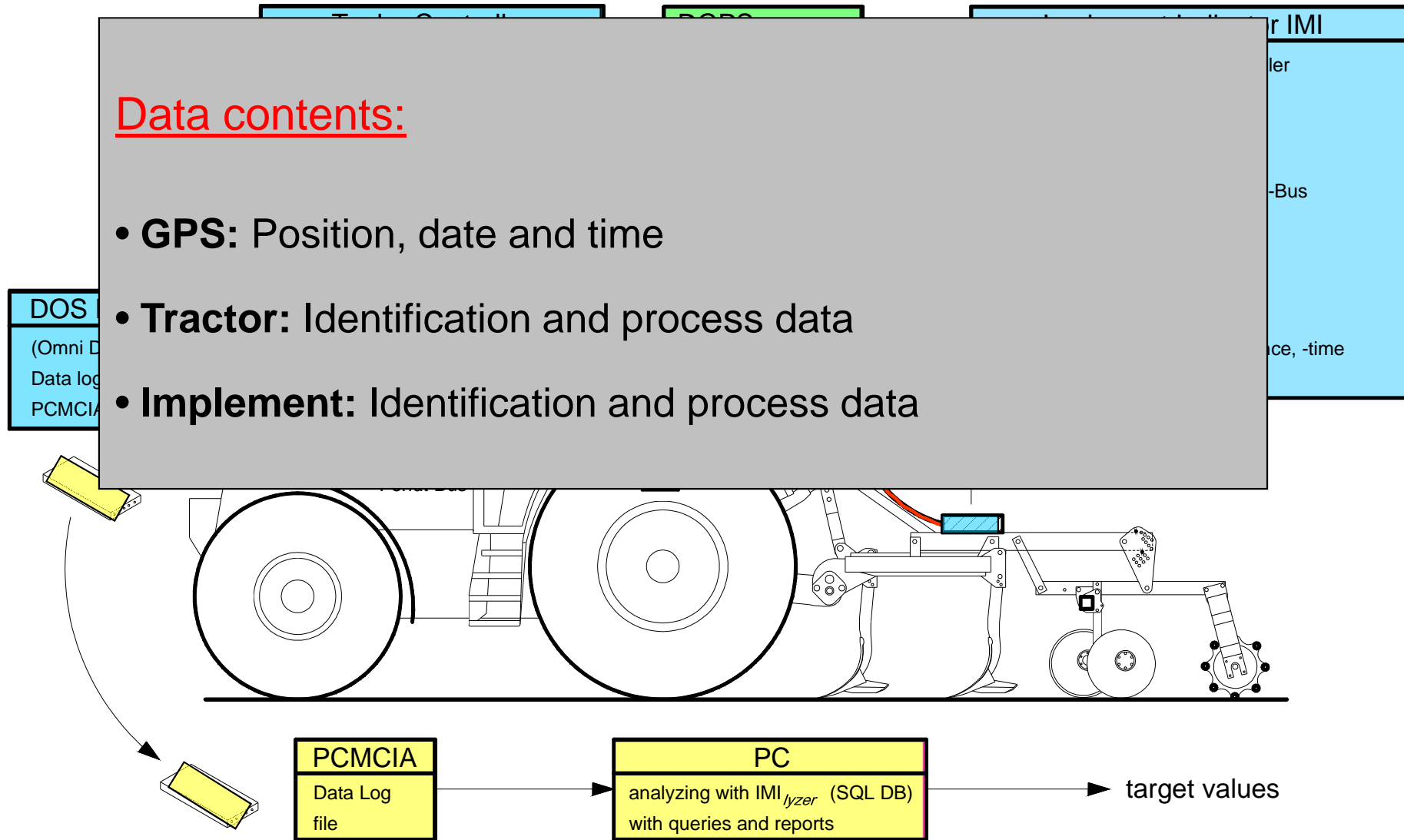
- Communication by the Agricultural BUS-System **LBS** (following the DIN 9684 or ISO 11783 standard)
  - Positioning by the Global Positioning System **GPS**
  - Implement identification and sensor data feed-in by the Implement Indicator **IMI**
  - Tractor identification, data pre-processing and data logging by the **Task controller**
  - Implement controlling by the **LBS-Terminal**
- Recording process data with a frequency of 1Hz

(Auernhammer et al., 2000)

# Automated process data acquisition with GPS and LBS

## Data contents:

- **GPS:** Position, date and time
- **Tractor:** Identification and process data
- **Implement:** Identification and process data



(Auernhammer et al., 2000)

# Electronic data processing – which way to choose ?

## Problems with local software packages on farmers' PCs:

- Software installing and using often needs support
- Software needs to be updated
- Farmers often don't use the software efficiently
- There are various possibilities for making mistakes using the software

## Advantages of a server-sided data processing:

- The data evaluation system can be developed further on without local updates
- Farmers don't have to care about making mistakes at data processing
- Farmers don't have to spend a lot of time to introduce in a software
- Expensive support on the local PCs is avoided

### **DECISION**

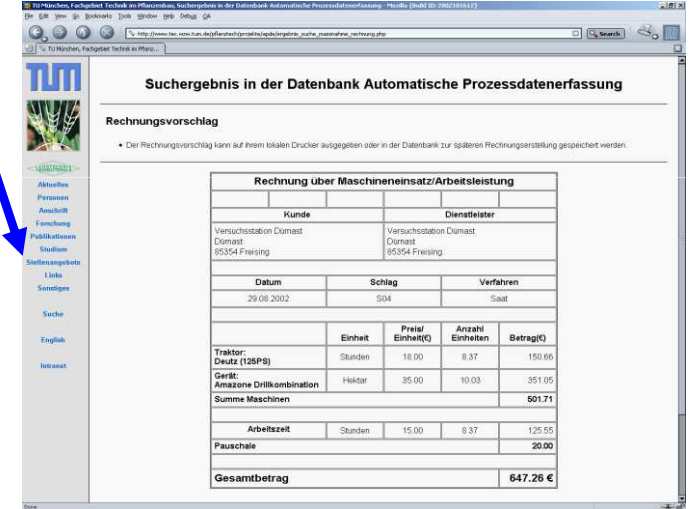
Developing of an 'Internet based data management system'

# The Idea of an Internet based data management system



```
Date, Time, Longitude, Latitude, Driver, Tractor, Speed, Pos. Left, Right, Implement, Work
03.10.2001,17:34:33,10.25254822,49.89058304, w. herbert, CaCs150, 3002, 043, -33.14, -28.80, IMIgrul, 3000
03.10.2001,17:34:34,10.25253296,49.89060593, w. herbert, CaCs150, 3014, 044, -30.73, -29.01, IMIgrul, 3000
03.10.2001,17:34:35,10.25251865,49.89062881, w. herbert, CaCs150, 3010, 041, -31.48, -32.75, IMIgrul, 3000
03.10.2001,17:34:36,10.25250340,49.89065170, w. herbert, CaCs150, 3024, 040, -28.70, -20.93, IMIgrul, 3000
03.10.2001,17:34:37,10.25248914,49.89067841, w. herbert, CaCs150, 2950, 046, -24.75, -23.14, IMIgrul, 3000
03.10.2001,17:34:51,10.25241184,49.89084244, w. herbert, CaCs150, 2423, 102, 65.70, 77.14, IMIgrul, 3000
03.10.2001,17:34:52,10.25240803,49.89082336, w. herbert, CaCs150, 2380, 102, 67.16, 82.57, IMIgrul, 3000
03.10.2001,17:34:53,10.25242043,49.89080048, w. herbert, CaCs150, 2341, 103, 62.48, 67.99, IMIgrul, 3000
03.10.2001,17:34:54,10.25243187,49.89078140, w. herbert, CaCs150, 2356, 100, 64.83, 73.33, IMIgrul, 3000
03.10.2001,17:34:55,10.25244522,49.89076233, w. herbert, CaCs150, 2315, 100, 64.04, 70.60, IMIgrul, 3000
03.10.2001,17:34:56,10.25245667,49.89074707, w. herbert, CaCs150, 2200, 100, 64.29, 71.46, IMIgrul, 3000
03.10.2001,17:34:57,10.25246811,49.89073181, w. herbert, CaCs150, 2032, 100, 63.30, 71.32, IMIgrul, 3000
03.10.2001,17:34:58,10.25247478,49.89072037, w. herbert, CaCs150, 1235, 100, 61.00, 75.36, IMIgrul, 3000
```

Server-sided data processing and keeping



Technik im Pflanzenbau





# Which software components are used for the DMS ?

## Server:

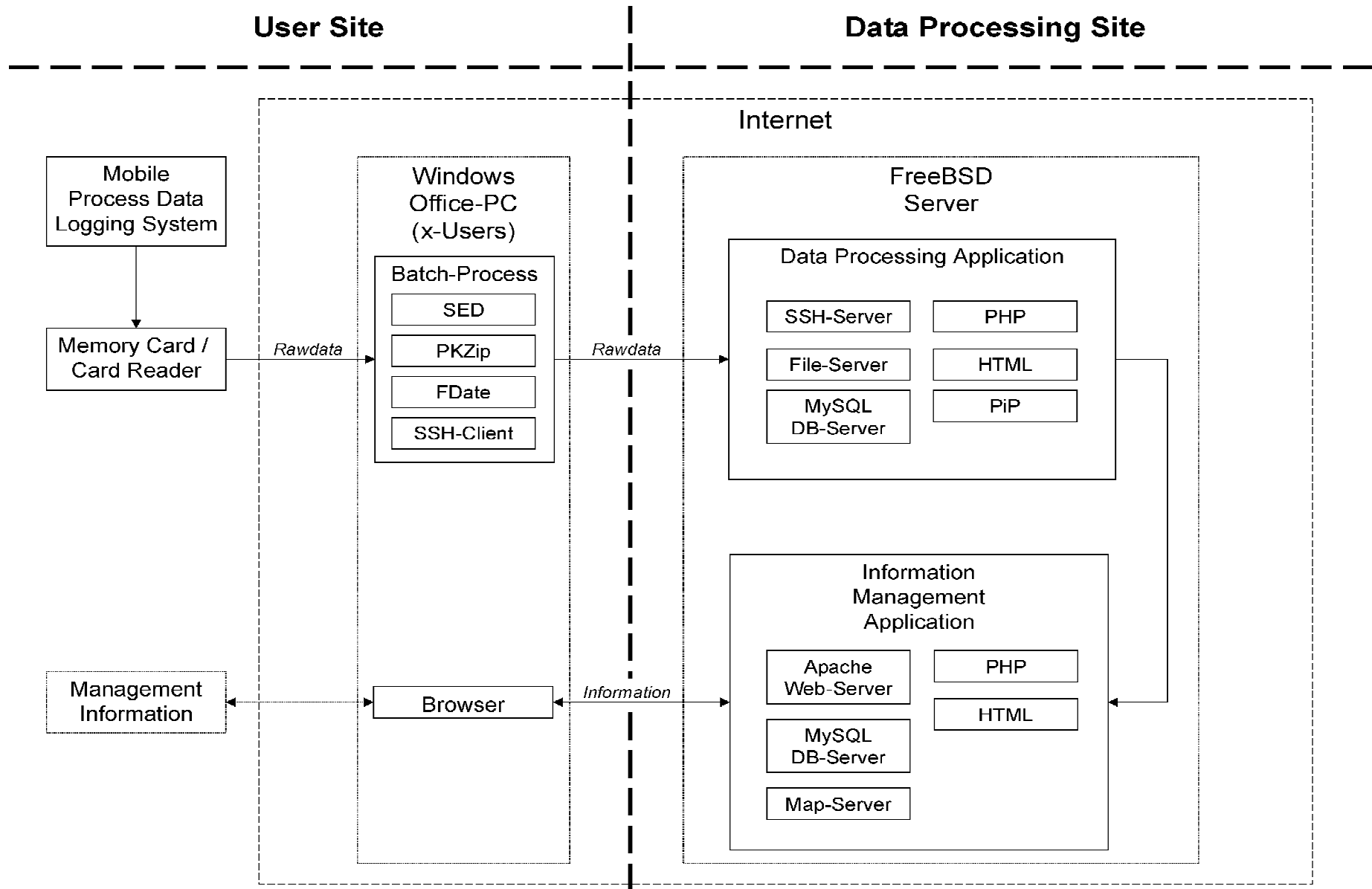
- An UNIX based operating system (Open Source Software)
- A MySQL database system (Open Source Software)
- A PHP parser (Open Source Software)
- A Webserver (Open Source Software)
- Some scripts to include the additional needed data processing functions

## Client:

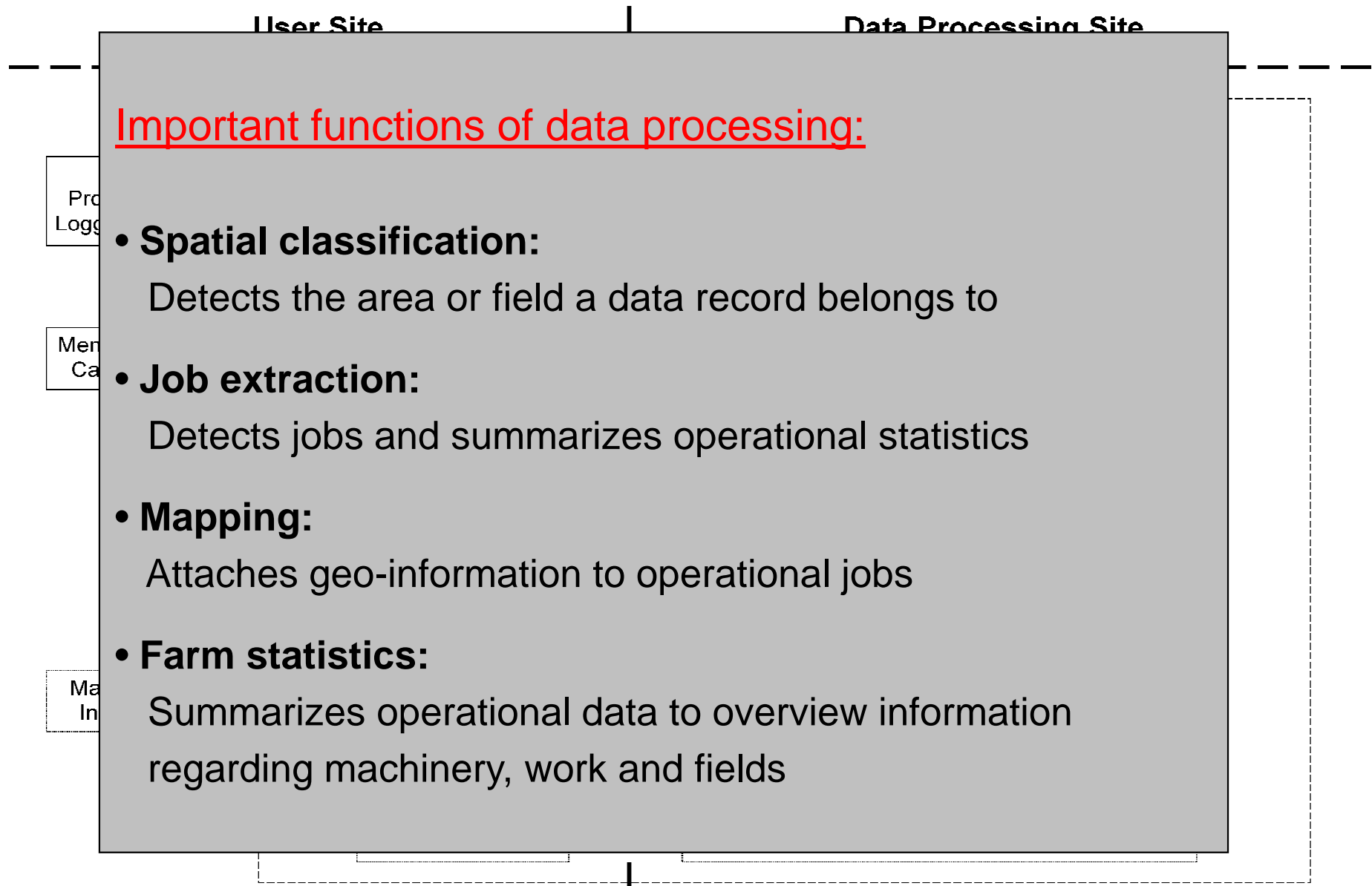
- A common web browser (delivered with the operating system of Windows PCs)
- A small adjusted data transfer tool based on free DOS utilities

**All used software components are for free  
or parts of the existing clients**

# Data flow in the Internet based data management system



# Data flow in the Internet based data management system



# Requirements for providing the information in the Internet

## Safety

- Password protection
- Individual data access
- Protection from data loss
- Secure connections

## Information content

- Sensible information
- Individual adjusted
- Overviews
- Detailed analysis

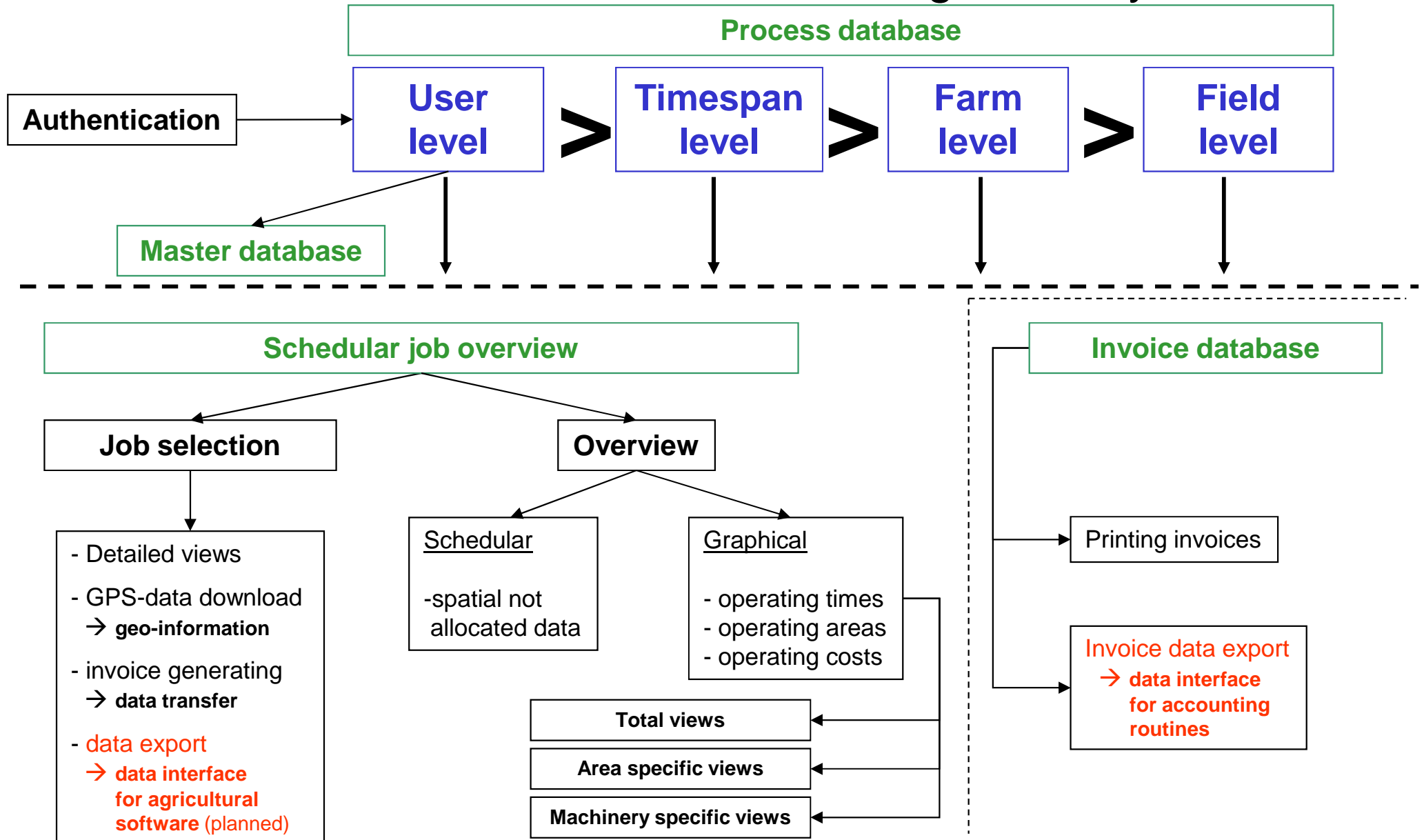
## User interface

- Easy to use for farmers
- Clearly arranged
- Modular structure

## Data interface (data export)

- Geo-data (GIS analyses)
- Operational data (field indices)
- Job data (accounting programs)

# Modular structure of the online data management system



TU München, Fachgebiet Technik im Pflanzenbau, Suchergebnis in der Datenbank Automatische Prozessdatenerfassung - Mozilla Firebird

File Edit View Go Bookmarks Tools Help

http://www.tec.wzw.tum.de/pflanztech/projekte/apde/ergebnis\_suche\_massnahme.php

**Maßnahme**

Betrieb	Versuchsstation Dürnast
Schlag	002
Arbeitsverfahren	primäre Bodenbearbeitung
Datum	22.08.2003
Uhrzeit	14:38 - 17:16
Traktor	Deutz (165PS)
Gerät	4-Schar Volldrehpflug
Fahrer	Denk
Schlaggröße [ha]	4.5300
Einsatzfläche [ha]	2.47
Kraftstoffverbrauch [l]	n.b.

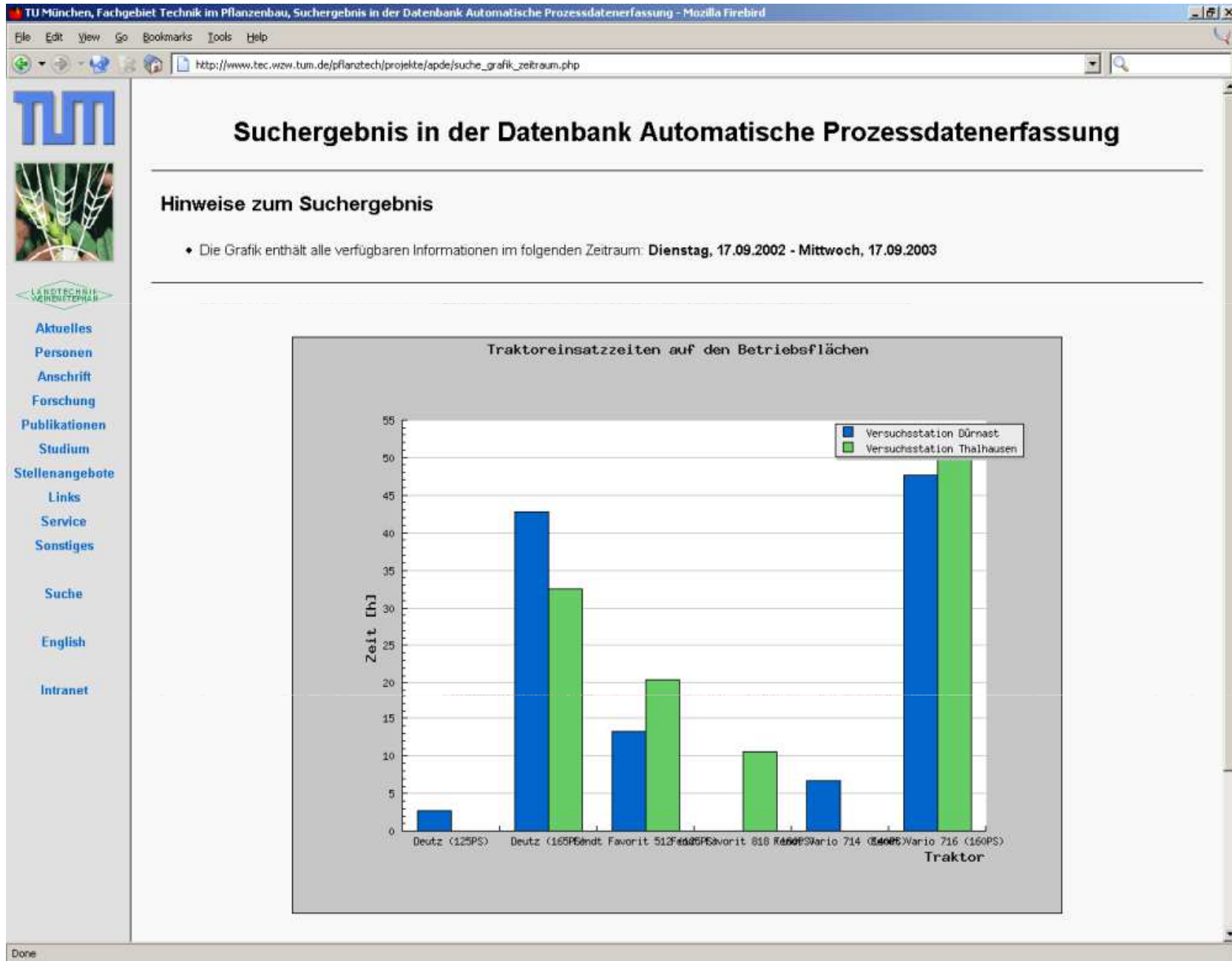
**Arbeitserledigung**

	Gesamt	Arbeit	Wenden	Stand
<b>Arbeitszeit [h]</b>	2.11	1.47	0.30	0.35
<i>Anteil</i>	100%	70%	14%	16%
<b>Arbeitsgeschwindigkeit [km/h]</b>	5.1	5.53	2.99	
<i>Standardabweichung</i>	2.9	2.91	1.54	
<b>Arbeitsweg [km]</b>	10.86	9.90	0.96	
<i>Anteil</i>	100%	91%	9%	
<b>Kraftstoffverbrauch [l/h]</b>	n.b.	n.b.	n.b.	n.b.
<b>mittlerer Zugkraftbedarf [kN]</b>		46.01		
<i>Standardabweichung</i>		11.26		

**Leistungs- und Umweltindizes**

	Gesamt	Arbeit	Wenden	
<b>Flächenleistung [ha/h]</b>	1.18			
<b>spezifischer Arbeitszeitaufwand [h/ha]</b>	0.85	0.59	0.12	
<b>spezifischer Arbeitsweg [km/ha]</b>	4.39	4.00	0.39	

Done



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# Conclusions

- Documentation will be the base of many agricultural applications in the future
- Automatic data acquisition is the fit way to realize a spatiotemporal high-resolution and safe documentation
- The huge amount of raw data needs to be processed by a easy to use and safe data processing system
- An Internet based data management system can provide safety and effective information management for the farmers - avoiding problems with local installed software
- In the project on hand a first approach has been realized using just free software components
- The system should be developed further on and standards for data interfaces should be defined
- Reservations of the farmers regarding the server-sided data processing could be decreased by publishing more information and education



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