NJF seminar 411 - InfoXT system design and functionality

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Introduction

Technical design

Technical implementation

Summary
Technical results of the InfoXT project

- The requirements of an FMIS for precision agriculture
  - The requirements of the stakeholders
  - Technical requirements
  - Usability requirements
- A software architecture for a modern FMIS for precision agriculture
  - Intended to make the information systems of precision agriculture available to all farmers
- A partial proof-of-concept implementation of the architecture
Requirements and focus of the InfoXT system architecture

- Precision agriculture for all farms
  - FMIS for traditional agriculture are commercial systems
- Availability
  - The system should be available beyond the farm office
- Connectivity
- Usability
  - Separate interfaces for different situations
  - Farmer should not be concerned with updates, maintenance or backups
- Privacy and data access management
  - Crucial when employing contractors
- Close to real-time communications with the tractor-implement for field operations
Overall description of the InfoXT system architecture

- Web application with additional connectivity
- Several interfaces
  - Including interfaces unrelated to Web applications
- Direct communication with the ISO 11783 Task Controller (TC)
- Little to no on-site data storage for farms
- Focus on precision agriculture
  - Storage and management of GIS data
- GIS data is the greatest differentiating factor between a traditional FMIS and an FMIS for precision agriculture
Stakeholders

- The farmer
- The provider of the FMIS
- The developer of the FMIS
- The maintainer of the FMIS
- Contractors
- Authorities
- Customers of the farm
- Suppliers of the farm
- Service providers
- Manufacturers of farming equipment
Overview of the InfoXT system architecture

- The farm
- PC
- Mobile terminal
- TC
- Farm based sensors
- Authorities
- Partners of the farm
- External services and databases
- Advisors
- Internet
- FMIS
Interfaces of the InfoXT system architecture

- Human interfaces
  - XHTML browser interfaces for the farmer
    - For both desktop and mobile use
  - ISO 11783 Task Controller interface for use in the tractor
  - Interfaces for the authorities, contractors and partners

- Service interfaces
  - SOAP interface for Web services
  - Other services
    - Data transfer in XML, plain text or other formats

- Farm based sensors are considered services
More detailed view of the InfoXT system architecture
Tractor-end (ISO 11783)
Functionality of the InfoXT system architecture

▶ The FMIS has to communicate with everyone
  ▶ And manage any data transformations
  ▶ A shared language, such as AgroXML, would greatly benefit this
▶ The system must support load balancing
  ▶ Most operations on GIS data are computationally expensive
▶ The system could be implemented on top of an existing traditional FMIS
▶ The system has to be modular with open interfaces
▶ The system must have data abstraction to allow interfaces for different programming languages
Application logic of the InfoXT system architecture

Internet

Application logic

- XHTML
- TCP/IP file transfer for external services
- SOAP
- ISOBUS communication
- XSLT, XML transformations
- Plain text generators
- Plain text parsers
- GIS transformations
- Authentication objects
- General FMIS objects or an adapter library
- GIS objects
- Data access management for load balancing

Communication

Data transformation

Class library

Load balancing

Databases
Internal structure of the InfoXT system architecture

- The system is divided to four layers
  - Communication
    - Transfer of data to and from the system
  - Data transformation
    - Transformation between the internal FMIS representation and external formats
  - Class library
    - Data abstraction that can be provided in several programming languages
  - Load balancing and data access management
- The architecture is highly modular
- The Data abstraction and data access management enable integration on to an existing system
Focus and purpose of the technical implementation

- The technical implementation is a partial proof-of-concept implementation of the entire system
  - Extending the functionality provided by the AGRIX and FARMIX projects
  - Focused on the implementation of precision agriculture
- The implementation of a fully functional FMIS was beyond the scope and resources of the InfoXT project
  - Requires a large commercial software project
- The tractor-end implementation should be lightweight
  - Limited computational capacity
  - Difficulty of implementation on a special platform
Elements of the technical implementation

- The implementation is divided to a client and a server
  - Communication is done over a simple protocol on top of TCP/IP
  - Most of the application logic is in the server
- Features supported by the server
  - Transfer of files
    - Mostly operational plans and reports
  - The setting and retrieval of free-form values
- The server-end of the implementation is based on an open-source platform and implemented using open-source tools
- The client-end, on the ISO 11783 Task Controller, functions on the Microsoft Windows platform
A critical view of the InfoXT system architecture

- The FMIS is the central element of the system
  - Essentially a single point of failure but can be technically made reliable
- Functionality of the entire system depends on the availability of an Internet connection
  - There are usually several forms of Internet connection available
  - Most problems can be amended by using local copies of critical files
- Web application interfaces lack the sophistication of “real” GUIs
  - Web applications provide a sufficient and a continuously improving interface
Conclusions

- The information systems of precision agriculture can be implemented with existing technologies
  - And made available to all farmers
- A Web application FMIS would appear to be very close to an optimal solution
  - Considering features, availability and usability
- Close to real-time communication between the TC, FMIS and services can be achieved
  - Enables real-time decision support and adjustments
End of the presentation

Questions?