Building rich GIS solutions to automate network statement process for utilities

Jakub Bican

Technical manager of GIS division at CAD Studio a.s.

Class Summary

Learn key steps and aspects of building a rich GIS solution for utility providers using Enterprise Industry Models of AutoCAD Map 3D and Infrastructure Map Server. One of the top benefits of the solution is to use it to automate network statement provisioning.

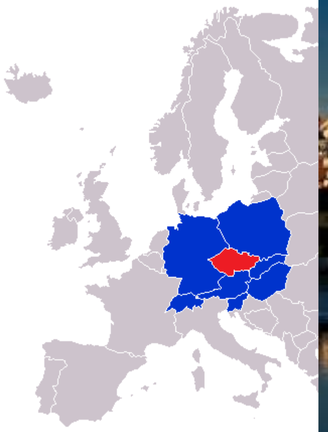
Learning Objectives

At the end of this class, you will be able to:

- Understand and evaluate the general benefits of using Enterprise Industry Models in GIS systems for utilities
- Identify key implementation aspects of a GIS system for large utilities
- Describe important requirements and steps to automate network statement process
- Understand the benefits of network statement automation

Speaker information

- CAD Studio a.s.
  - Autodesk Platinum Partner
  - Major Autodesk VAR in Central Europe
  - Over 60 professionals in 6 locations



- Jakub Bican
  - Technical manager of GIS division (13 developers)
  - Project management, pre-sales activities
  - Background in academic and SW development

References in this lecture

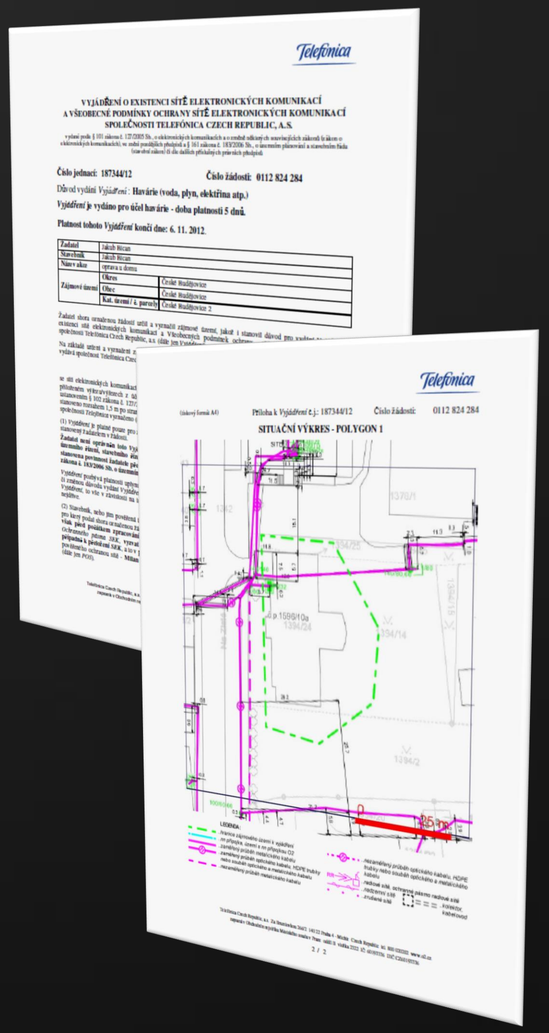
- AQUASERV ENERGIE AG BOHEMIA s.r.o.
  - Shared solution for several water and waste-water utilities
  - Well shaped utility GIS based on standard models
  - Over 11,000 km’s of network, 10 operators, 400 users

- Telefónica O2
  - Major provider of TELCO services in the Czech Republic (and Europe)
  - Super-sized web presentation and analytical system
  - Many integrated systems and data sources
  - Over 600 GB spatial database, 2,000 users, 300 TB Web licenses, 12 servers

What are Network Statements?

“call before you dig”

A document with information about utility networks that exist in specific areas, containing the rules and conditions for activities related to the network and areas around the network.



For example, you need it

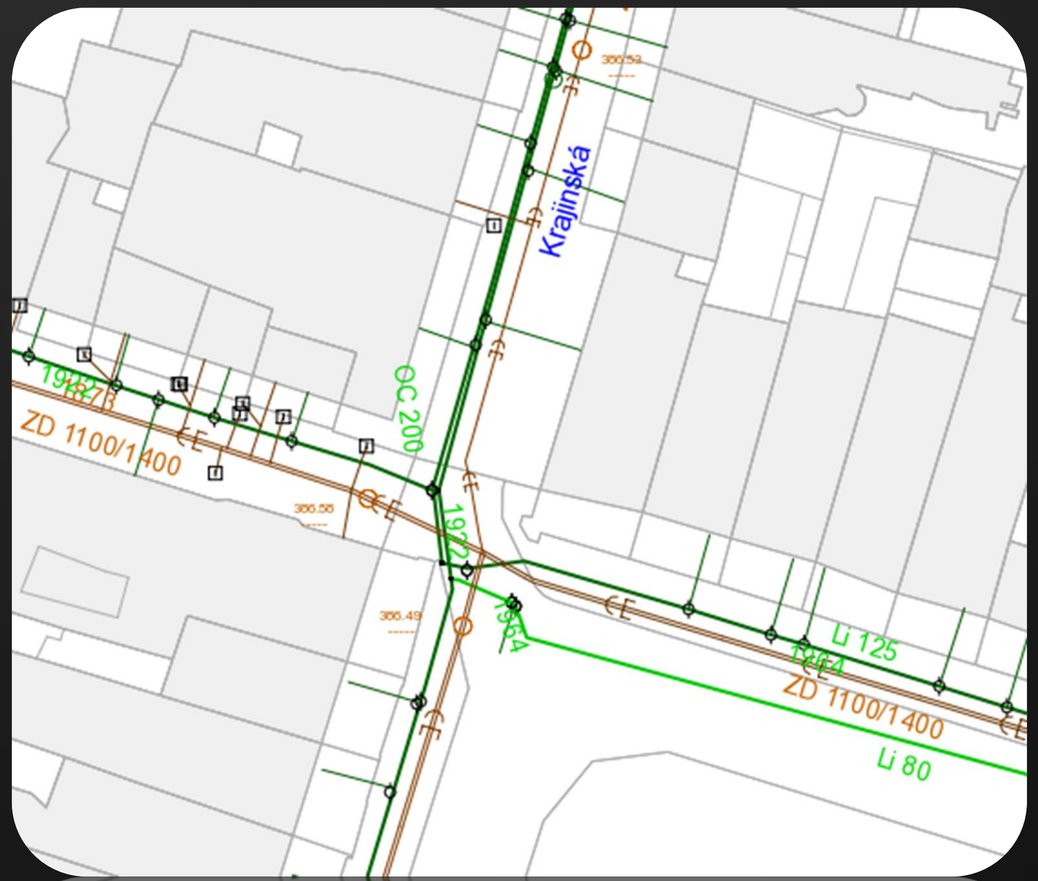
- To connect to the network
- To get new building permit
- Emergency situations
  - Real example

Building utility GIS

Utility GIS – what is it for?

GIS systems are key for any utility providers

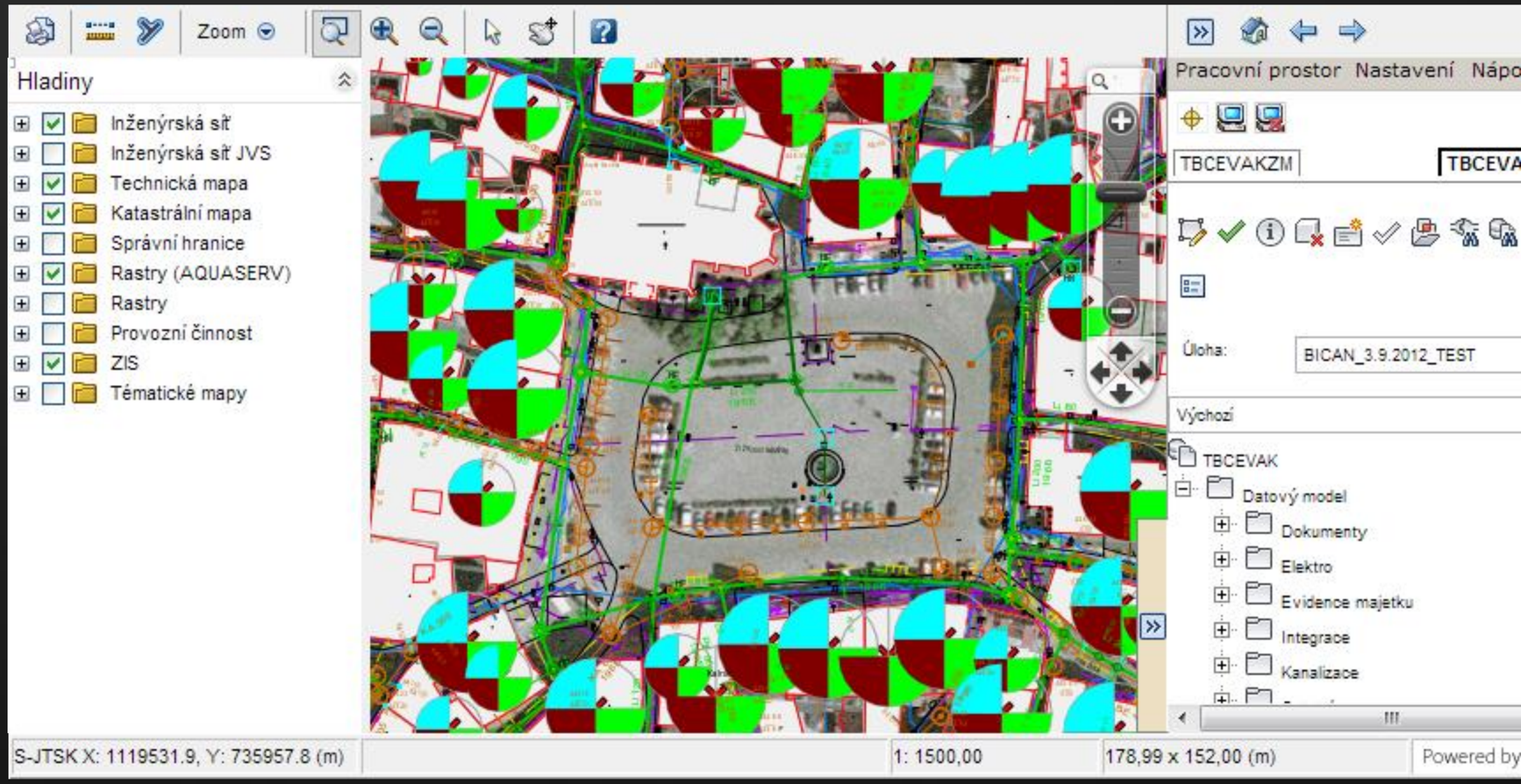
- Asset management
- Maintenance
- Operational support
- Capacity control
- Investment
- External relations
  - Network statement provisioning



Key features

- Data
- Data
- Data
- Data
- Data
- Data
- Data

- Access to data
- Some functions



Data … you need it!

- GIS data is always “the family silver” of any solution
  - *The worst concerns in Aquaserv was always data, its quality, its structure in the new solution and the completeness of its migration from old data sources. (Far behind was 5% system instabilities.)*
  - *Authors of the most polished data sets were always those, who cared about the migration result the most.*

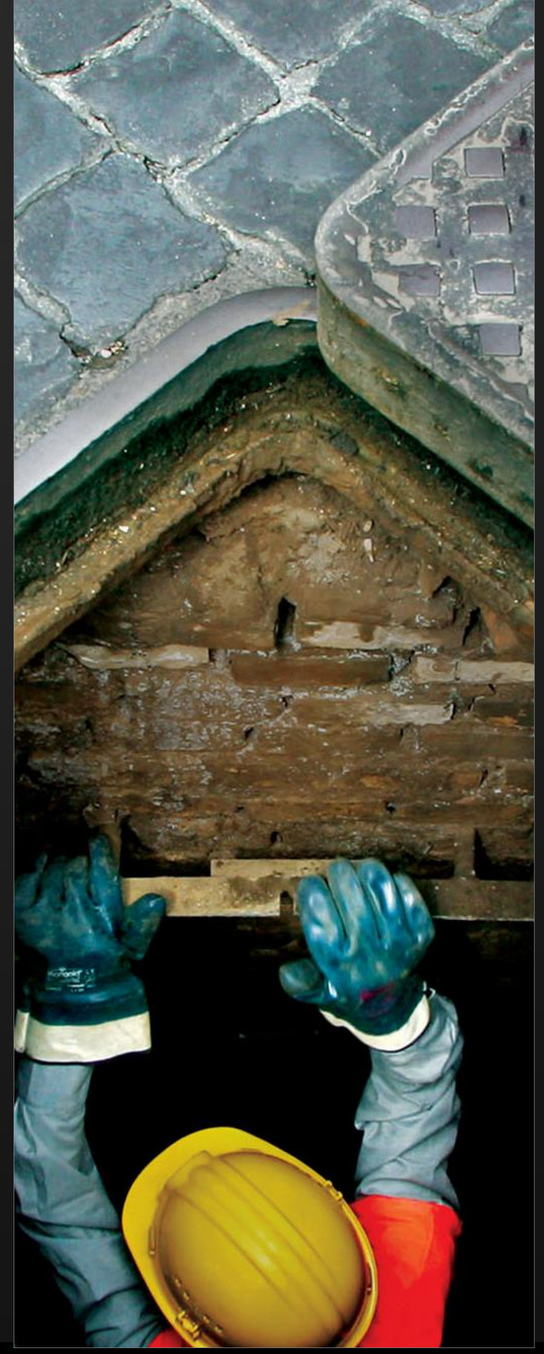
- GIS data requires much higher effort and investment than any software solution that contains them
  - *Through the first 3 years, the implementation costs (including licenses) were only about 20% of overall solution cost. The rest is data!*

GIS implementation

- Almost never from scratch

- It is necessary to replace
  or even re-implement current solutions

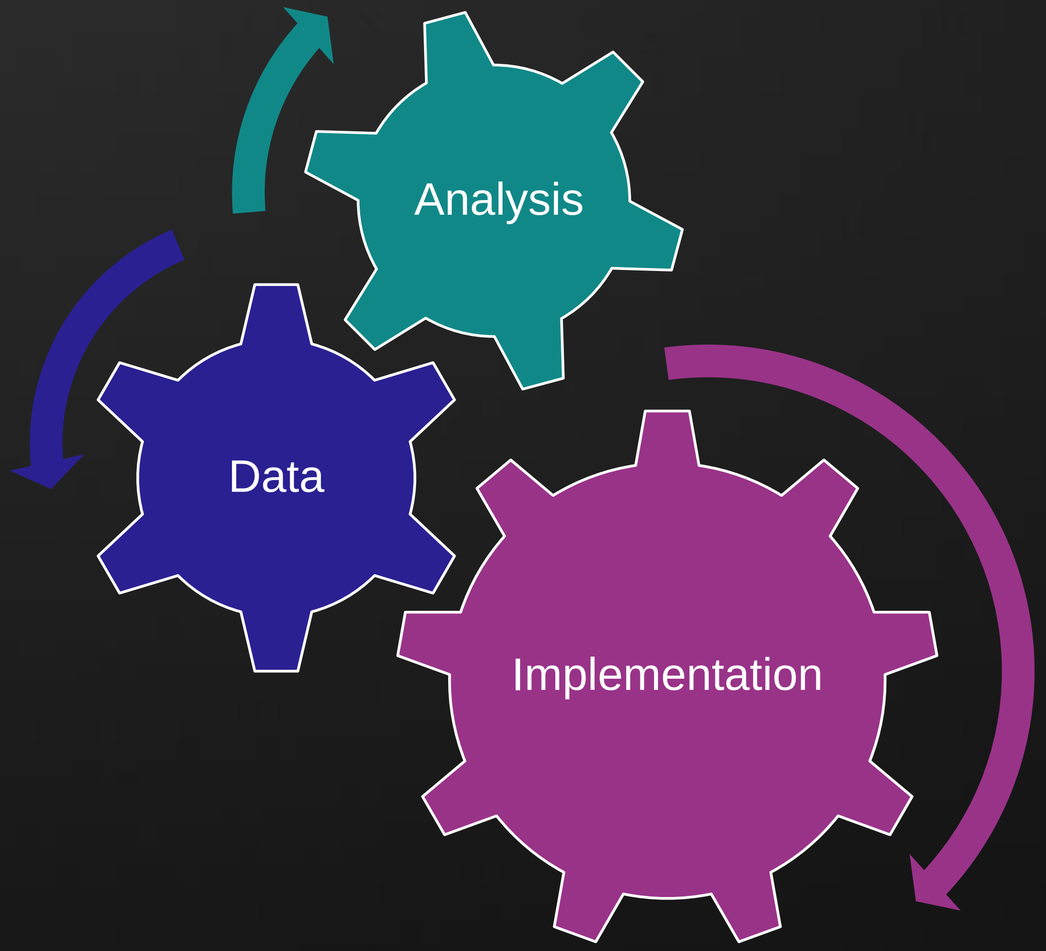
  … or at least implement current data



Implementation steps and activities

- Requirements specifications
- Analysis – solution proposal
- Deployment of system components and basic configuration
- Data model implementation
- Display model implementation
- Functions implementation
- Data migration
- User access and other configuration

… list in no particular order



“Agile” implementation: iterate

1. Start with basic implementation
   - Cover only selected main agenda and main data
   - Give access to users as soon as possible
   - Let them use, work, collect experience

2. Iterate
   - Get feedback
   - Validate previous implementation
   - Use experience and feedback to design next features

3. Iterate…

Analysis

A. Map current situation
   1. Describe all data sources
   2. Describe all user interactions with current system
   3. Describe all interfaces to other systems, data exchanges, etc.
   4. Describe all additional requirements

… try to capture priorities and importance

B. Layout the future
   - One-by-one, take each feature described in the first phase and describe its appearance in the new solution

Current solutions: hindrance or beneficial?

- Mixture of inconsistent drawing and database data in various formats
- Out-dated applications without support and with highly customized or exotic modules

…even .NET Reflector may fail

- Users can describe their current work only on top of the current experience and current solutions

- Users, admins and manages have few real pains that force them to change the solution – track them carefully

Aquaserv implementation process

5 companies sharing the same solution

- Every member of the group had a different geospatial solution
  - Typically Microstation-based
  - Various databases and extensions
  - Different data models
- Autodesk Topobase was chosen to be the target platform (in a competition)
  - Initial analysis – approved by all group members
  - Technology verification, test data migrations (TB 2009)
- Multi-phase implementation over a 2 year period

Aquaserv’s project details

- Issues
  - Bad communication and relations between the grouped companies
  - VERY DIFFICULT negotiation to merge all solutions into one shared
  - Personal interests of responsible employees, lack of cooperation
  - Platform problems (finally solved with TB 2011sp2)

- Special situations
  - GIS obligations from network owners = customer requirements badly adopted by customers themselves

Re-design functions and agenda

- **Never agree to *“just re-implement current solution using the new technology”***
- Use current agenda related to GIS and re-design the functions with respect to Enterprise Industry Models technology
  - Huge effort to convince users to accept different solution
  - Optimal utilization of the technology
  - Low implementation costs
  - Maximum benefit from Subscription

- Convince managers first…

Data migration

- Already displayed: the highest value of ANY solution
- Compared to fact: the worst activity to estimate

- Bad data is a major show-stopper for any advanced function or agenda
  - Topologies
  - Automated processes
  - Integrations

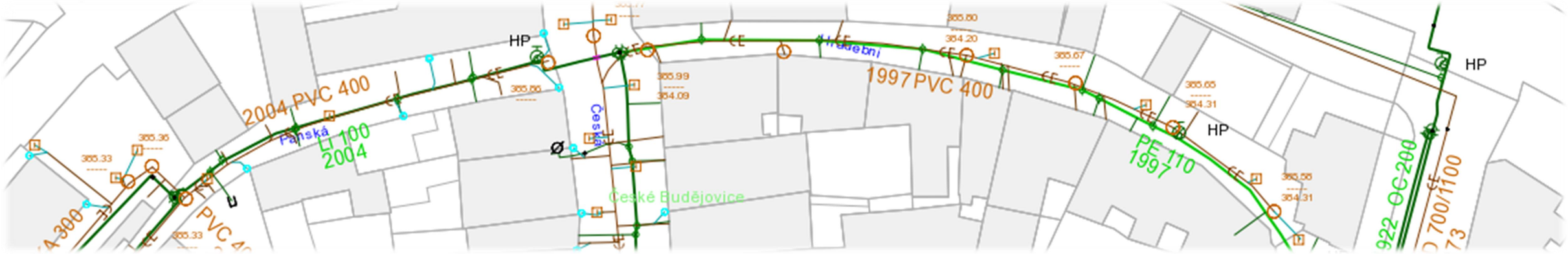
- Bad data also discourages users, especially if they feel they lost some

… we are often asked to re-try looking up a dataset in 5 year old files

Aquaserv implementation details

- Standard WA and WW models used and extended
  - To match all requirements
  - To capture all original data

- Custom functions implemented on top of Autodesk API
  - e.g. Extended Plot, UI Tweaks, Rules, Import/Export tools, Job tools,…



Aquaserv data migration

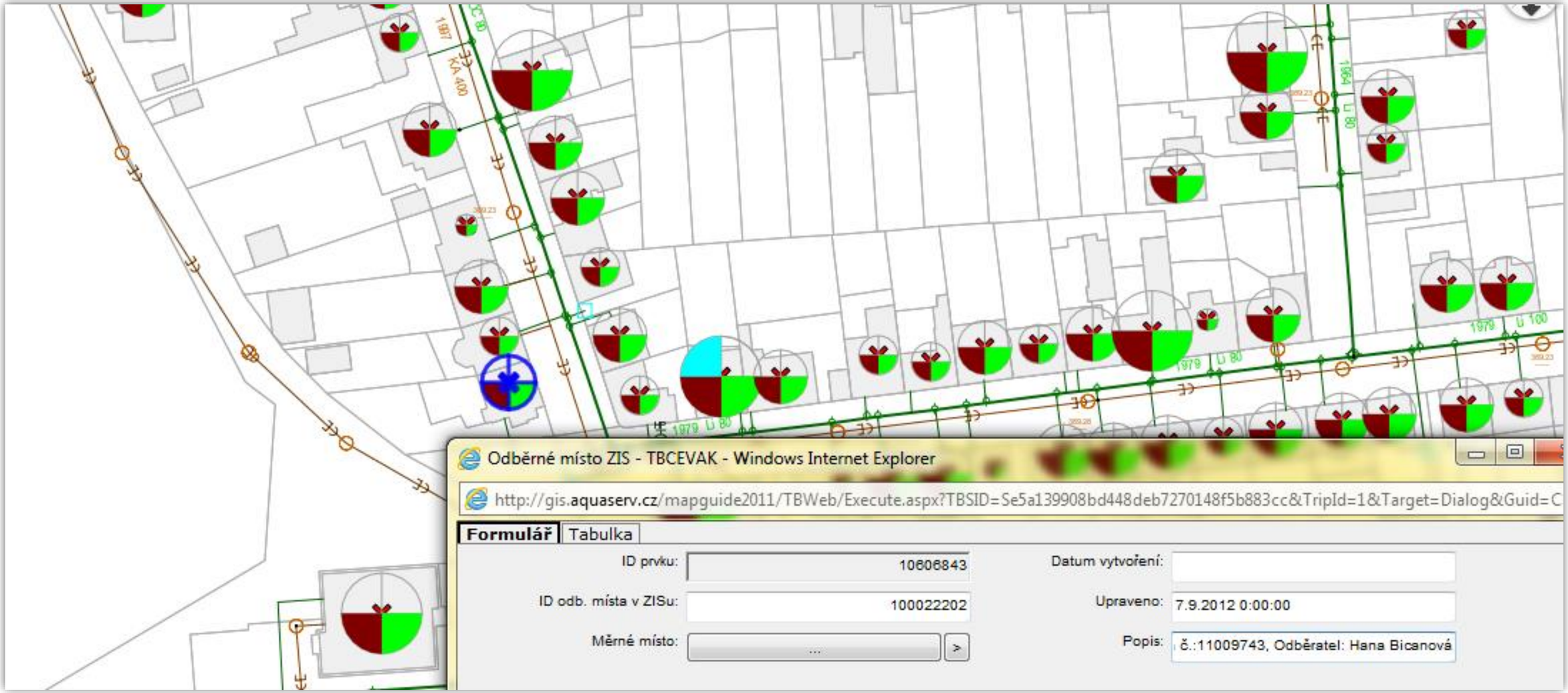
- DGNs and other drawings imported using Map 3D tools into DWG
  - MSLINKs and other attributes into object data
- Custom tool Map2TB (CAD Studio) uses Expression Evaluator to map drawing entities to TB Feature attributes
- DB attributes imported into auxiliary Oracle schemes
  - MS SQL, DBF's, MDB's, …
- MSLINKs and other IDs used to associate attribute data to features
  - Custom SQL programming and mapping

Aquaserv integration interfaces

- Web services directly connected to Oracle or based on Autodesk API
- Job-enabled

- Integration to Customer management and Maintenance systems
  - Data synchronization
  - Calling functions of other systems
  - Open GIS and let it zoom to specific feature, open form, etc.

Integration with customer management system



Utility GIS Summary

Benefits of Enterprise Industry Models

- Easy administration
- Change data model and functions on-the-go

  => “Agile” implementation is easy

  => Adjustable for various data sources

- Closely tied CAD and GIS
- New data import tools in 2013
- Open solution based on open technologies

Data model management

Use Structure Editor and then deploy model on any environment

- GENX files
- Structure plugin

Enables generalized modules and solutions.

It is possible to use Microsoft Team Foundation Server to manage lifecycle of modules as well as data model plugins and templates. This includes automated deployment and testing techniques on full GIS solutions.

Do not miss the opportunity to …

Review structure and quality of data

- *Simplify or generalize data model*
- *Harmonize and unify data sources and base datasets*

Review functions and agenda

- *Cleanup agenda and workflows*
- *Use priorities*

Support self-administration

- Improves knowledge of the technology
- Improves understanding of implementers view

- Creates opportunities for solution development beyond knowledge of original implementer
- Builds community of power users that may help to resolve problems in future and help with new business

Aquaserv benefits

- Several companies are sharing the same solution and infrastructure
- Better functions for reduced costs
- Data cleanup
- Easy communication with partners

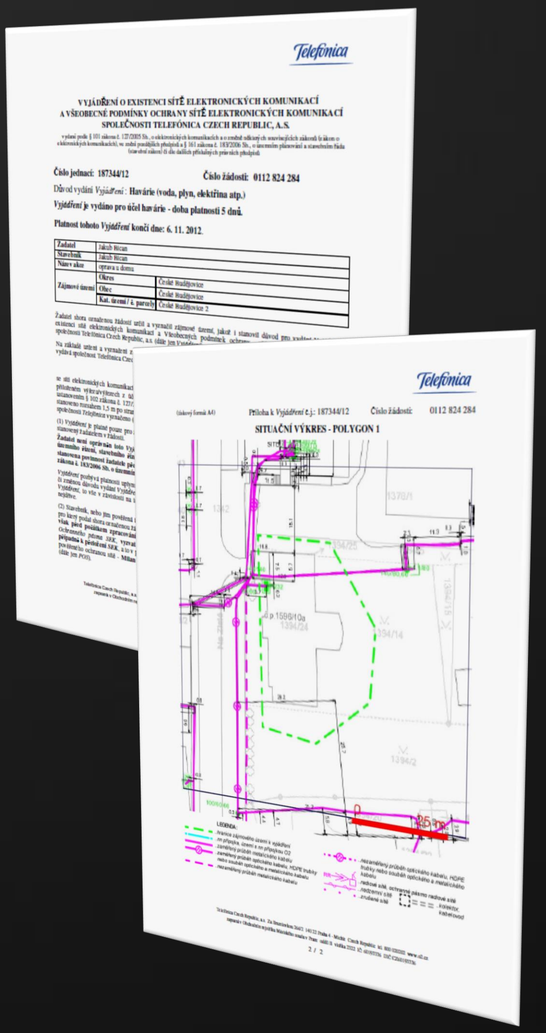
- Open system means
  - Easy access for any employee => responsibility for data => better data
  - Easy integration of customer management and maintenance systems

- **Increased value of any investment into network and data**

Network statement provisioning

What is a Network Statement?

A document with information about utility networks that exist in specific areas, containing the rules and conditions for activities related to the network and areas around the network.



In the Czech Republic (and other countries as well)

- Certain rules given by law
- Important agenda for utilities
- Required by building authorities for building permits

Current situation – public

You have a building project. Usually, you need to:

1. Put together a list of all the utilities related to the project
2. Personally visit each utility provider and fill out the request forms
3. Some providers accept electronic mail requests while others need a hard copy
4. Wait until the statement is worked out
5. Pick-up the statement or receive it by mail
6. Bring collected statements back to the building authority

Current situation – utility company

- Employing many people only for map plotting and word template filling
  - Not focusing on the primary business
- Getting inadequate network statement requests
  - Producing inadequate network statements
- Acquiring data and tools only to ease people’s work on top of network data for activities that can be easily automated

Possible benefits of automation

- Ease and accelerate process for public as well as provider
  - Automate hundreds to thousands of network statements each month
- Reduce costs on both sides
  - Reduce non-business activities
- Increase value for public and local municipalities
  - Service for voters

… the circular is the electronic request, not the customer

How to automate

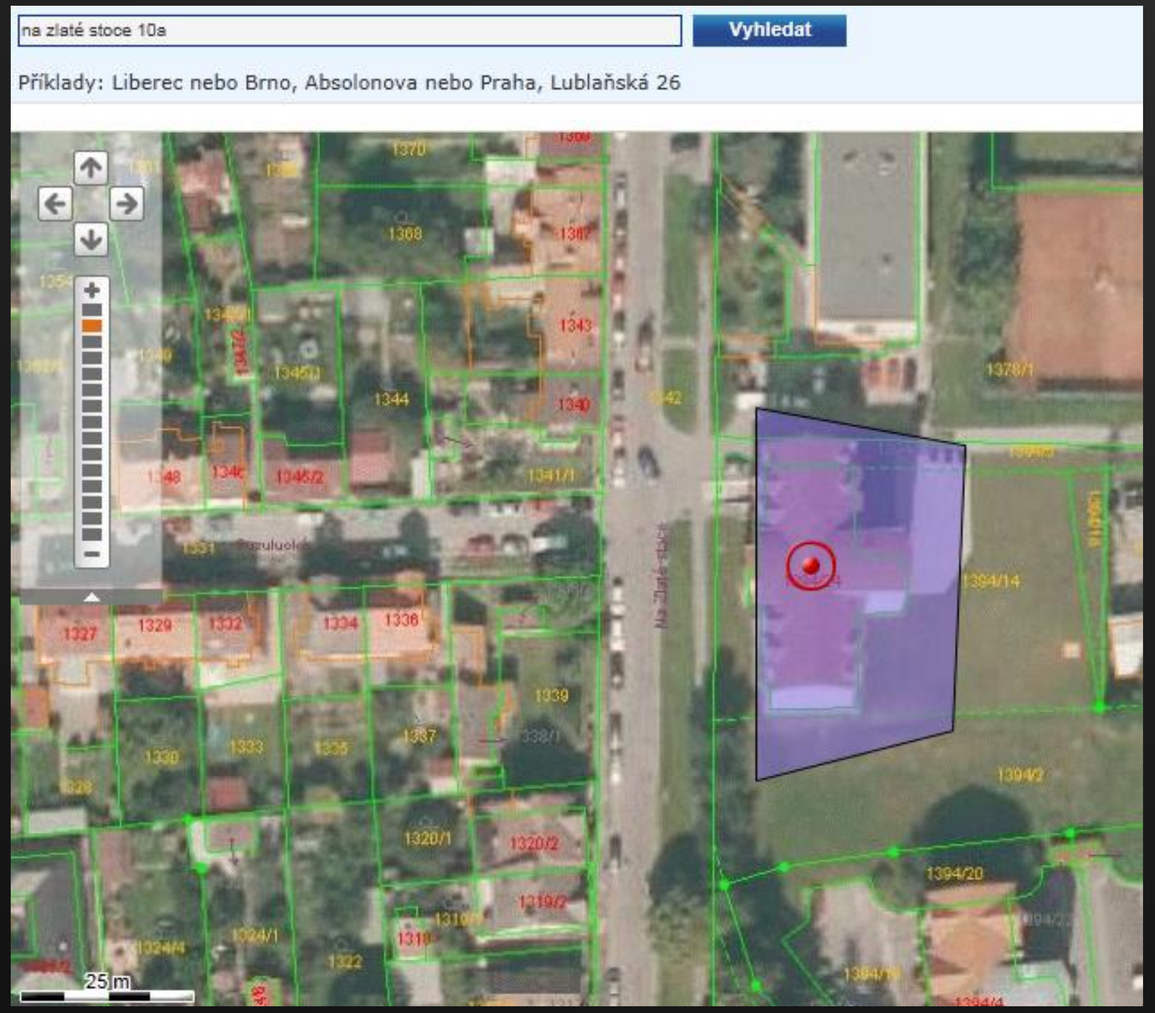
1. Make requests electronic and automate the gathering process
2. Automate easy statements: “without collision”
3. Automate all/most statements
   - Based on data quality

Optional: automate and optimize internal processes

Electronic communication:

- Statement request
- Statement response

Automate statement request gathering



- Public web page
  - Compulsory fields
    - Name, Address, Reason, …
  - Region of Interest (ROI) polygon
- Push record to GIS DB
  - Evaluation
  - Further processing

Replace physical or manual request process, structure data.

Request evaluation automation

- Simple GIS task: *„Check ROI polygon against spatial database.“*

- Possible results:
  - No Collision / Collision / Type of collision
  - Map (network statement attachment)

- **Automation IS POSSIBLE, the key is the legal conditions of the statement**

Automation stages

- Incoming electronic requests need to be FIRST

  … the request accuracy and completeness is the customers responsibility

- Other steps may follow in various forms
  - *E.g. automation with manual confirmation of all/some statements*

- Internal automation depends on usable systems implemented in the company
  - Internal mail
  - CRM, …

The 1st pioneer: Telefónica O_2 Czech Republic

- Handles approx. 12,000 requests per month
- Can automate 98% of all requests

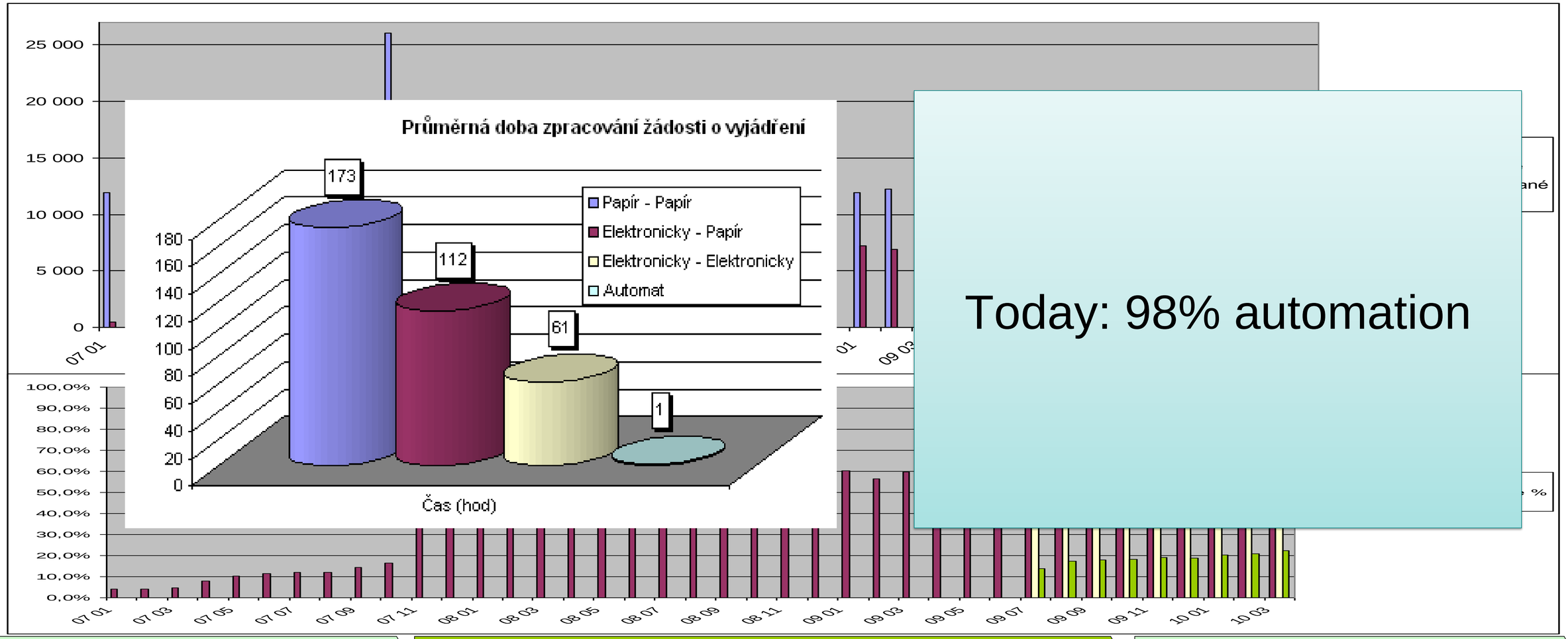
- Project started in 2007
- Fully implemented in 2011

- **Shows that IT IS POSSIBLE**
- Initiates the same activities in other large companies

Telefónica O_2 project details

- **Web tool to draw ROI**
  - From 3% to 50% of electronic requests
  - Internal process still the same, saves costs on accepting requests
- **Electronic output**
  - People get used to electronic statements
  - Internal saving on sending mail and personnel allocation
  - Simplified emergency situations for partners
- **No-collision automation**
  - Accurate or approximated data in most regions
  - Further personnel reallocation
  - Speed-up of many responses
- **Full automation**
  - Based on increasing data quality

Telefónica O_2 progress



Today: 98% automation

Příjem | Zpracování | Odeslání

Telefónica O_2 automation benefits

- Decisions based on real data, qualified management of the process
- Automation percentage: 98%
- Average response time improved from 20 days to 1 hour (!)
- Decreased total costs by approx. 1.5 mil EUR per year
- Fewer employees and departments with useless agenda and tools
  - *Qualified personnel focused on qualified work (not printing maps)*
  - *Disabled paging systems at the local offices*
  - *Before automation: 120 employees full time*
  - *After automation: 20 employees part-time allocated to this agenda*

- **Example result…**

Request gathering portal

- Web application tier
  - Request gathering
  - Further communication

- Key features
  - Easy ROI polygon drawing on simple map
    - General map for large scale navigation
    - Orthophoto + Cadastral map for small scale polygon drawing
  - Full-text address and cadastral search
  - Integration with partners

Be careful with precision and base layers accuracy

Portal architecture

1. Web presentation layer
   - Web form for filling-in request fields
   - Map drawing window
   - CAPTCHA, etc.

2. Portal core
   - Gets the request and distributes it to all the channels

3. Interfaces
   - GIS, mail, partners, …

Data provisioning

Same infrastructure and portal solution can be used for data provisioning

- Data export as a part of request evaluation in GIS
- Portal application can manage storage and file handling

Can be used for other agenda as well

- General data provisioning

Partner integration

Use open format to send/receive network statement requests from other utility partners in the same location.

- Just one form for all utilities

- Two possible solutions
  - Share one portal
  - Connect multiple portals

- Be careful with coordinate systems and base datasets
  - To evaluate against correct data

Summary

Lecture summary

- GIS implementation on top of Industry Models technology
  - Identification of important aspects
  - Data-centric agile approach

- Network Statement Provisioning automation
  - Definition of process and steps
  - Benefits for utility companies, customers, public and municipalities

- Real examples and experience
  - Aquaserv
  - Telefónica O_2 Czech Republic

Q&A