

An Extranet Waste Inventory Application

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Abstract

Effective tracking of waste management activities greatly enhances governments' ability to increase citizens' awareness and to develop environment policies. Tracking in turn relies on accurate data acquisition and exploitation. This paper details and illustrates the key features of APLID, the canton of Geneva's Extranet waste inventory application. Developed with Open Source software, APLID allows all concerned actors to enter, update and visualize their waste data into a centralized database, and the canton of Geneva to issue annual statistical reports in support of political decision-making towards sustainable development.

1. Introduction

Municipal, industrial/commercial and construction waste represent a growing concern in large urban settings, especially in under-developed countries (Onibokun, 1999; McMichael, 2000; Dana, 2002). Although better armed to address the problem, industrialized nations are not exempt of the problem as waste production continues to increase. In Switzerland, for example, the amount of municipal waste quadrupled from 1950 to 1989, and despite economic difficulties and recycling efforts since 1990, each individual still produces over 1kg of waste daily. A similar figure applies to most other Western European countries (DME, 1990). Under such conditions, inadequate waste management leads both to serious environmental consequences and health hazards for local populations.

Conscious of the fact that effective waste management plays a key role in improving public awareness and in initiating sustainable environmental policies (e.g., see DEWO, 1995; EPWM, 2003), the canton of Geneva has been a pioneer in this area, in both theory and practice. For several years, Geneva has been operating an effective policy of selective waste collection and recycling, which both preserves the

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environment and reduces incineration costs for municipalities. In 2002, one third of Geneva's household waste was recycled (Déchets GE, 2003).

Each year, in compliance with the applicable legislation (L1 20.01, 1999), the canton of Geneva's office for waste management (GEDEC) compiles an exhaustive inventory of all waste produced, received and treated within its boundaries, organized in types of products, types of origin and types of treatment. Such an inventory requires close collaboration with various actors in the canton, namely local municipalities, which are responsible for most public waste collections, and enterprises specialized in the transport and/or treatment of waste.

In order to simplify this inventory process and to expand interactivity with the other key players/partners, the canton of Geneva mandated ELCA Informatique SA to develop *APLID (Application Inventaire des Déchets)*, an Extranet application designed to allow the consolidation of and interaction with data supplied on-line, via a Web interface, by local municipalities and enterprises. All data are historized in a database, allowing the tracking of trends and evolution over time. APLID includes graphical display capabilities, such as histograms, to quickly visualize this information on screen.

This paper gives an overview of the main features of APLID.

2. Waste inventory application (APLID)

The waste inventory application was developed under the supervision of GEDEC to make the production of accurate annual waste statistics easier for the canton of Geneva. In addition, it was designed with the objective that data providers could also benefit from it, mainly through statistical tools that allow them to get an overview of their own waste management activities. (Note, specific dangerous wastes are managed at the federal level with another application.)

Up to last year (2003), data acquisition was performed via paper questionnaires, which were sent into GEDEC for consolidation. The data was managed with different legacy tools (MS Excel[©] and FileMaker[©], in particular). This process delayed the production of statistics, as well as increased the risk of error due to the required double data entry (municipalities or enterprises, and GEDEC), non-enforced data coherency and some redundancy.

Today, APLID is a Web application built on the development framework of the canton of Geneva's Center for Information Technologies (CTI), which provides an uniform, secure online interface for all its users. The CTI's J2EE development framework takes advantage of Borland[©] Application Server and provides tools to structure, industrialize and streamline development. The web part of the CTI framework makes intensive use of the "Struts" Open Source framework for the presentation layer. The business layer is encapsulated in EJB and the persistence tier is held by an Oracle[©] database.

Municipalities and enterprises log in to the system with an user name and password, and are granted access only to their own data via a dedicated module.

GEDEC's employees have administrator rights, allowing them to manage municipalities and enterprises, to update code lists and labels. Historic data has been made available with the same format. All required global statistics and reports are produced with a standard reporting tool that generates the statistical reports without new formatting tasks.

2.1 Municipalities

In the Swiss decentralized political system, municipalities are in charge of the collection of household wastes. This includes the mixed wastes that are transported to an incineration plant as well as the waste fractions that are collected separately for recycling.

Geneva's municipalities are therefore in possession of all of the information relative to the types and quantities of household waste that are produced in the canton as well as to the costs that are related to their management.

As explained above, municipalities used to provide this information to GEDEC through paper forms that had then to be typed in a database management program. With APLID, they now have the ability of accessing their inventory account directly through the Internet. Once they are logged in, users are presented a personalized welcome page ("Home") with a list of options to choose from (see Figure 1):

1. **Inventaire des déchets** (Waste inventory)
Function allowing the user to check, type in or edit the data of his/her municipality for the current waste inventory.
2. **Statistique** (Statistics)
Function allowing the user to display the waste statistics of his/her municipality, either over a chosen year or on one particular type of waste over all the registered years.
3. **Comparatif** (Comparison)
Function displaying the statistics of the different municipalities that have validated their data.
4. **Contacts**
Standard Web site option for viewing details of how to contact GEDEC.
5. **Aide** (Help)
Function displaying a help file (PDF document) with a detailed description of APLID functions.

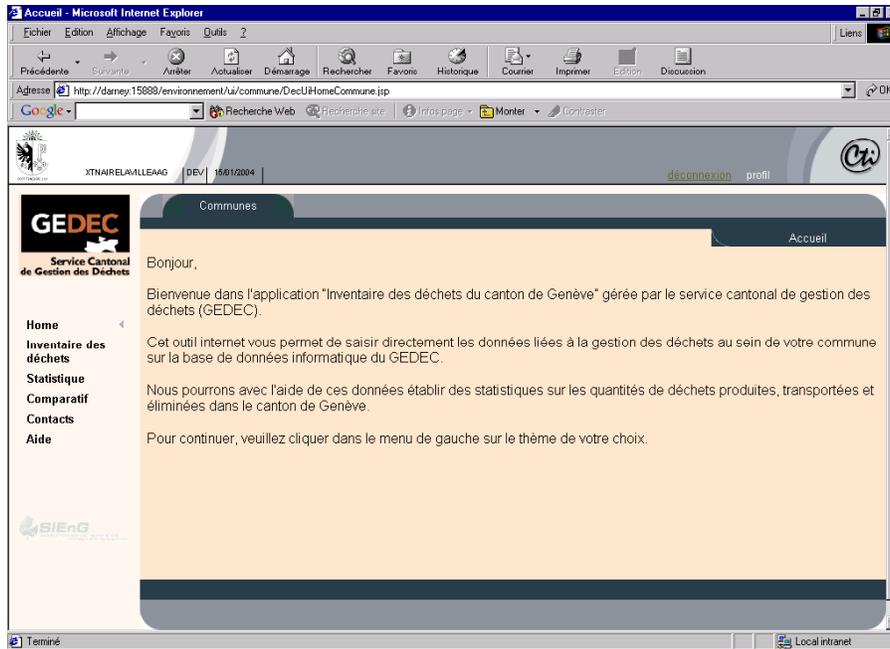


Figure 1
APLID's Home Page for Municipalities

When typing in new data with the "Waste **inventory**" function, the user is shown, if it exists, a summary of all types of waste collected during the previous year together with transporter and destination information, as a reference (see Figure 2).

When the user selects one of the types of waste his/her municipality usually collects, the system creates a new record for the current period, with weight and costs initialized to 0 (see Figure 3). This function is intended to make the input of a set of data over a new period much faster: indeed, a municipality that manages the same types of waste from one year to another (which is usually the case) only has to load available historical data (darker line background color on screen) and update the quantities as well as the costs related to the period that is being typed in.

Liste des Déchets de la commune

Commune : **Eldorado**

Année de l'inventaire : [Validation 2004](#) [Validation GEDEC](#) [Enlever l'historique](#)

Catégorie de déchet (↑↓)	Entreprise de transport	Destination	Tonnage	Stat
C10 Ordures ménagères mélangées	Serbeco	SIG - Les Cheneviers	93.20	<input checked="" type="checkbox"/>
C31 Papier / carton	Commune	Retripa Papirec	7.85 8.45	<input checked="" type="checkbox"/>
C32 Bouteilles en PET	Abbé	Agema	165.00	<input checked="" type="checkbox"/>
C12 Autres déchets urbains mélangés	Abbé	ADLP et Dépannage	0.00	<input checked="" type="checkbox"/>
C20 Déchets de cuisine	Retripa	Retripa	0.00	<input checked="" type="checkbox"/>
C23 Déchets de cuisine et jardin mélangés	Commune	Site de Châtillon (compostage)	0.00	<input checked="" type="checkbox"/>
C30 Verre	Transvoirie	Serbeco	0.00	<input checked="" type="checkbox"/>
C36 Aluminium et fer-blanc mélangés	Commune	Jaeger et Bosshard	0.00	<input checked="" type="checkbox"/>
C37 Textiles	Coordination cantonale	Satex	0.00	<input checked="" type="checkbox"/>

Figure 2
Sample Municipality's Waste List

Fiche d'un déchet

Commune : **Eldorado**

Du 09.09.2004 *au 09.09.2004

*Catégorie de déchet : C10 Ordures ménagères mélangées ?

*Infrastructure de collecte : Porte à porte [modifier](#)

*Entreprise de transport : Serbeco SA ?

Autre :

*Destination : SIG - Les Cheneviers ?

Autre :

Tonnage : 0.0 [Modification du cumul](#)

(Tonnage du 01.01.2004 au 09.09.2004 : 93.20)

Plusieurs destinations

Coûts et revenu annuel (TVA incluse) : réel évalué

Coût du transport : 0.0

Coût du traitement : 0.0

Revenu / Recette : 0.0

Remarque :

Pris en compte pour les statistiques

Figure3
Sample Input Screen for an Existing Waste Type for Municipalities

Once the input of data over the selected period is completed and verified, the municipality's user has to validate it. During the validation process, a number of checks are performed on the data. In particular, significant variations from the previous year (managed via thresholds) are flagged (e.g., Variation > 10% on C10) so that the user may either confirm or make the necessary corrections. Once the validation process is complete, the data can only be modified with GEDEC administrator's rights.

When editing an existing record, the year-to-date total may be updated to reflect errors that may have been detected since the last entry period. The unit type for quantities is a parameter of the system, which is set by the user when a waste record is created.

The users are also able to specify unregistered enterprises they work with. The GEDEC administrator can then define the new enterprise in the database.

By selecting the "**Statistique**" option, municipalities can view simple reports, in the form of online generated bar charts, of their waste management by year and by waste type (see Figure 4). The CTI Web Framework takes advantage of the Cewolf Open Source Library to allow dynamic generation of complex charts. These reports can be exported in CSV format so that they can be further customized in tools such as MS Excel.

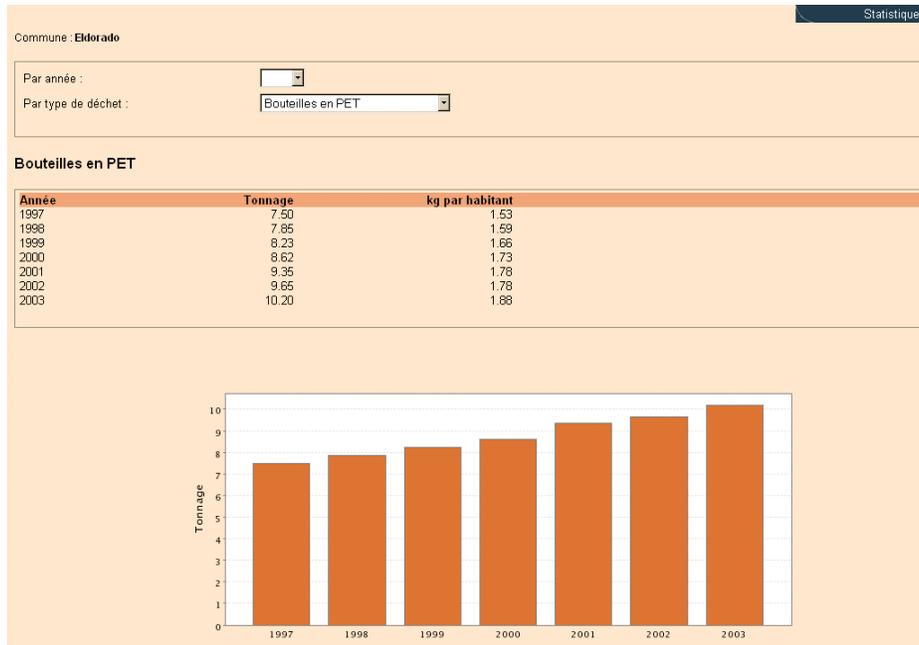


Figure 4
Sample Online Statistics and Chart

When selecting the "**Comparatif**" option, the user generates a list of all the municipalities that have validated their data with the type of wastes and the related quantities each of them has collected. The quantities are given per person, in order to make comparison possible. This report can also be exported as a CSV file.

2.2 Enterprises

The notion of enterprise applies both to those who transport waste and those who treat or eliminate it. Enterprises are under legal obligation to supply information on quantities, origin, destination and/or waste treatment they are involved in.

The enterprise module is very similar to the municipality module, except that no comparison function is available for obvious reasons of business confidentiality.

Using the "**Inventaire des déchets**" option, the input, editing and validation process follow the same logic as for municipalities (see Figure 5).

The screenshot shows a web-based form for entering waste data for an enterprise. The form is titled "Fiche d'un déchet" and "Entreprise : Déchets SA". It contains the following fields and options:

- Du: 31.01.2004
- *au: 31.01.2004
- *Catégorie de déchet: A30 Verre
- *Provenance: Entreprise GE
- Destination¹: Serbeco SA
- Autre:
- *Tonnage: 0.0 (with a link for "Modification du cumul")
- (Tonnage du 01.01.2004 au 31.01.2004 : 1.00)
- Plusieurs destinations
- Traitement¹: Déchets d'entreprises recyclés
- Remarque:
- Pris en compte pour les statistiques

Figure 5
Sample Input Screen for an Existing Waste Type for Enterprises

Again, year-to-date totals may be edited and various units selected at record creation time. Simple reports by year and waste type are also available.

Treatment enterprises are also able to indicate the amount of the various fractions they produce as a result of their industry.

2.3 GEDEC

GEDEC administers the system. GEDEC employees can manage all accounts with a CTI Web application. APLID also allows employees to update various code lists (e.g., postal codes, countries, types of treatment, conversion units, etc.) and to search for and manage all information related to municipalities and enterprises. As an illustration, we show the interface for municipalities (see Figure 6).

Fiche d'une commune

*Nom : Aire-la-Ville

Service :

*Adresse : Rue du Vieux-Four 37

*No postal : 1288 Aire-la-Ville

*Contact : Monsieur D. NOVELLE

Téléphone : 022 757 48 29

Fax : 022 757 48 32

Email : info@aire-la-ville.ch

Adresse internet : http://www.aire-la-ville.ch/

Numéro d'ordre : 2

ID Service : 22

Valide

Figure 6
Administration Interface for Municipality Management

Since GEDEC is responsible for the consistency of the waste statistics for the canton of Geneva, its employees have to countercheck every input once it has been validated by the data provider (municipality or enterprise).

Thanks to administration rights, GEDEC is also able to act as a substitute for any of its partners in the case some of them would not use APLID to supply their data.

Finally, a series of reports have been designed with Cognos Impromptu[©], thus completely automating the production of annual statistics. The reports are accessed directly in the Cognos tool. An example of report is shown in Figure 7.

2.4 SIG Interface

Geneva's Industrial Services (SIG), the largest waste data provider in the canton of Geneva, are equipped with their own information management system. Using APLID's user interface would result in duplication of work for SIG's employees.

Hence, a special data exchange protocol has been set in place. On demand from GEDEC, SIG generate a formatted file summarizing its waste treatment activities. This file can then be uploaded by APLID via FTP, parsed and formatted. Specific Impromptu[©] reports are generated and data is inserted in GEDEC's database.

3. Conclusion

This paper gives a brief account of APLID, the canton of Geneva's Open Source waste inventory Extranet application. Overall, APLID is an effective tool for global waste inventory. It provides all partners, collectors, transporters and recyclers, direct Web access to the canton's database to enter new data and compile useful reports.

Furthermore, thanks to APLID, the canton of Geneva's office for waste management is able to move its activities up the value chain. Instead of spending its time in error-prone data entry, the GEDEC can free more time to check and validate the data entered by its partners, as well as create, produce and analyse more useful statistics. These in turn can be used both by the partners to assess their performance and by the Canton's decision makers to orient its policy in terms of sustainable development.

Liste des déchets par types de traitement					
Traitement	Type de déchet	Destination	Commune GE	Entreprise GE	Total
2 Déchets communaux recyclés...	A50 Autres métaux...	Thévenaz-Leduc SA	557.84		557.84
Total (A50 Autres métaux) :			9'660.88		
	A61 Bois naturel	Verdonnet Bouchet, Ets	11.00		11.00
Total (A61 Bois naturel) :			11.00		
	A62 Résidus de bois	Verdonnet Bouchet, Ets	66.00		66.00
Total (A62 Résidus de bois) :			66.00		
	A63 Bois usagé	SIT - Mortara	3'167.00		3'167.00
Total (A63 Bois usagé) :			3'167.00		
	A99 Autres	GZM-Lyss	1'285.53		1'285.53
Total (A99 Autres) :			1'285.53		
Total (2 Déchets communaux recyclés) :			67'897.75		

Figure 7: Sample Impromptu Statistics Report

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