

CiViTAS
Cleaner and better transport in cities

ARCHIMEDES

AALBORG • BRIGHTON & HOVE • DONOSTIA-SAN SEBASTIÁN • IAŞI • MONZA • ÚSTÍ NAD LABEM

Donostia – San Sebastian

T74.1 Bus Management System in Donostia-San Sebastian

Donostia – San Sebastian

October 2009



THE CIVITAS INITIATIVE
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Author	Javier Vallejo
Quality Control	Elisabeth Jorge
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1. Introduction

1.1 Background CIVITAS

CIVITAS - cleaner and better transport in cities - stands for City-VITALity-Sustainability. With the CIVITAS Initiative, the EC aims to generate a decisive breakthrough by supporting and evaluating the implementation of ambitious integrated sustainable urban transport strategies that should make a real difference for the welfare of the European citizen.

CIVITAS I started in early 2002 (within the 5th Framework Research Programme);
CIVITAS II started in early 2005 (within the 6th Framework Research Programme) and
CIVITAS PLUS started in late 2008 (within the 7th Framework Research Programme).

The objective of CIVITAS-Plus is to test and increase the understanding of the frameworks, processes and packaging required to successfully introduce bold, integrated and innovative strategies for clean and sustainable urban transport that address concerns related to energy-efficiency, transport policy and road safety, alternative fuels and the environment.

Within CIVITAS I (2002-2006) there are 19 cities clustered in 4 demonstration projects, within CIVITAS II (2005-2009) 17 cities in 4 demonstration projects, whilst within CIVITAS PLUS (2008-2012) 25 cities in 5 demonstration projects are taking part. These demonstration cities all over Europe will be funded by the European Commission.

Objectives:

- to promote and implement sustainable, clean and (energy) efficient urban transport measures
- to implement integrated packages of technology and policy measures in the field of energy and transport in 8 categories of measures
- to build up critical mass and markets for innovation

Horizontal projects support the CIVITAS demonstration projects & cities by:

- Cross-site evaluation and Europe wide dissemination in co-operation with the demonstration projects
- The organisation of the annual meeting of CIVITAS Forum members
- Providing the Secretariat for the Political Advisory Committee (PAC)
- Development of policy recommendations for a long-term multiplier effect of CIVITAS

Key elements of CIVITAS

- CIVITAS is co-ordinated by cities: it is a programme “of cities for cities”
- Cities are in the heart of local public private partnerships
- Political commitment is a basic requirement
- Cities are living ‘Laboratories’ for learning and evaluating

1.2 Background ARCHIMEDES

ARCHIMEDES is an integrating project, bringing together 6 European cities to address problems and opportunities for creating environmentally sustainable, safe and energy efficient transport systems in medium sized urban areas.

The objective of ARCHIMEDES is to introduce innovative, integrated and ambitious strategies for clean, energy-efficient, sustainable urban transport to achieve significant impacts in the policy fields of energy, transport, and environmental sustainability. An ambitious blend of policy tools and measures will increase energy-efficiency in transport, provide safer and more convenient travel for all, using a higher share of clean engine technology and fuels, resulting in an enhanced urban environment (including reduced noise and air pollution). Visible and measurable impacts will result from significantly sized measures in specific innovation areas. Demonstrations of innovative transport technologies, policy measures and partnership working, combined with targeted research, will verify the best frameworks, processes and packaging required to successfully transfer the strategies to other cities.

1.3 Participant Cities

The ARCHIMEDES project focuses on activities in specific innovation areas of each city, known as the CIVITAS corridor or zone (depending on shape and geography). These innovation areas extend to the peri-urban fringe and the administrative boundaries of regional authorities and neighbouring administrations.

The two Learning cities, to which experience and best-practice will be transferred, are Monza (Italy) and Ustí nad Labem (Czech Republic). The strategy for the project is to ensure that the tools and measures developed have the widest application throughout Europe, tested via the Learning Cities' activities and interaction with the Lead City partners.

1.3.1 Leading City Innovation Areas

The four Leading cities proposed in the ARCHIMEDES project are:

- Aalborg (Denmark);
- Brighton & Hove (UK);
- Donostia-San Sebastian (Spain); and
- Iasi (Romania).

Together the Lead Cities in ARCHIMEDES cover different geographic parts of Europe. They have the full support of the relevant political representatives for the project, and are well able to implement the innovative range of demonstration activities proposed.

The Lead Cities are joined in their local projects by a small number of key partners that show a high level of commitment to the project objectives of energy-efficient urban transportation. In all cases the public transport company features as a partner in the proposed project.

2. Donostia – San Sebastian

The city of Donostia -San Sebastian overlooks the sea and, with a bit more than 180,000 inhabitants, keeps a human scale. Some people consider the balanced combination of small mountains, manor buildings, and sea as the setting for one of the most beautiful cities in the world. We have a tradition in favouring pedestrians, cyclists and public transport.

For about twenty years, the city has been enforcing a strong integrated policy in favour of pedestrians, bicycles and public transport. Considering walking and cycling as modes of transport, has led to the building of a non-motorised transport network for promoting this type of mobility around the city.

Likewise, the city has extended its network of bus lanes. The city holds one of the higher bus -riding rates, with around 150 trips per person per year.

2.1 Objectives in CIVITAS

The CIVITAS project is a perfect opportunity to expand our Sustainable Urban Transport Strategy. With the package of CIVITAS measures Donostia-San Sebastian wants to:

- Increase the number of public transport users
- Decrease the number of cars entering in the city centre
- Increase the use of the bicycle as a normal mode of transport
- Maintain the high modal share of walking
- Reduce the number of fatal accidents and accidents with heavy injuries
- Reduce the use of fossil fuels in public transport.

3. Background to the Deliverable

The present deliverable refers to Measure number 74, Bus Management System in Donostia – San Sebastian.

As part of this measure CTSS-DBUS has been working on the Task 8.9: Bus Management System.

Within this task CTSS-DBUS has to implement a new HSDPA-3G communication system between buses and the central information system, and also has to implement a new expert planning and fleet management system for the CTSS-DBUS fleet, personnel and public transport network.

3.1 Summary Description of the Task

The public transport company CTSS-DBUS will introduce a new fleet management system that will enable the company to respond adequately to the mobility needs of the users.

This measure will allow CTSS to rationalise its costs to make public transport more competitive compared to the private car.

The new system is compiled of state-of-the-art expert planning and fleet management systems. The communication between the central information systems and the buses is based on HSDPA-3G technology.

4. Bus Management System

4.1 Description of the Work Done

CTSS-DBUS has tested, improved and implemented the new communication HSDPA-3G system.

CTSS-DBUS has defined and implemented an expert planning and fleet system that meet the company's requirements. This expert planning system is related to the buses and drivers needed to provide the bus service offer defined by the Town Hall.

Historically, up to this moment, this work has been done by expert employees that optimise the number of drivers and buses needed. The results of this planning are excellent but the weak point is that it takes a long time to complete and also a big risk because everything depends on only one expert employee, with a lot of difficulties to train new workers in this job due to the difficulty and the specialisation of the task.

After analysing the market, CTSS-DBUS has purchased and implemented an expert planning and fleet management system that doesn't depend on one employee. It is a system that can be used by several employees, so that CTSS-DBUS can have more flexibility and will be easier to train other employees in the future. The expert planning and bus management system is completely integrated with the GPS system.

4.2 Summary of Activities Undertaken

HSDPA-3G COMMUNICATION SYSTEM

At the same time as implementing the security cameras system implementation in the CTSS-DBUS fleet (ARCHIMEDES Measure 16), the HSDPA-3G communications between the buses and the control centre was also implemented.

This type of communication is absolutely necessary to have an acceptable quality of the security camera videos recorded onboard the buses and transferred on-line to the control centre – see deliverable T16.2/16.3 for more information.



HSDPA-3G modem included in the advanced computer for video administration and managing (onboard the bus)

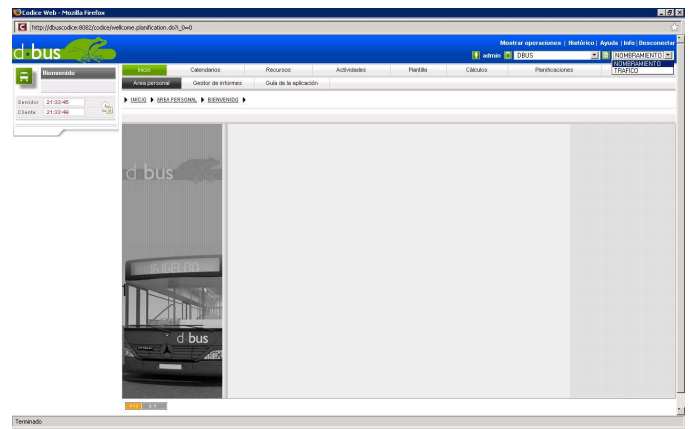
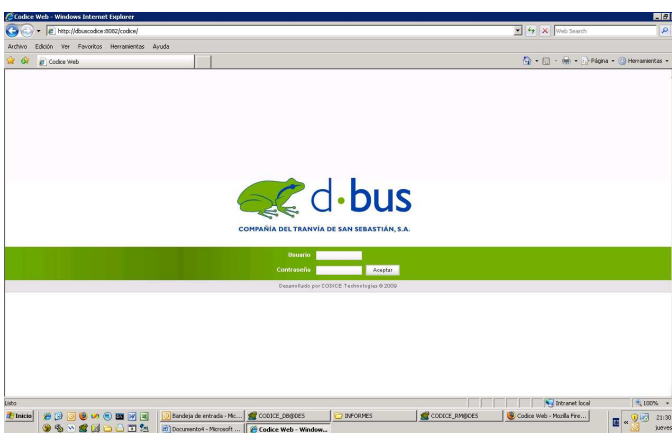


On-line video visualization of the bus in the control centre transferred by HSDPA-3G communications

NEW EXPERT PLANNING AND FLEET MANAGEMENT SYSTEM

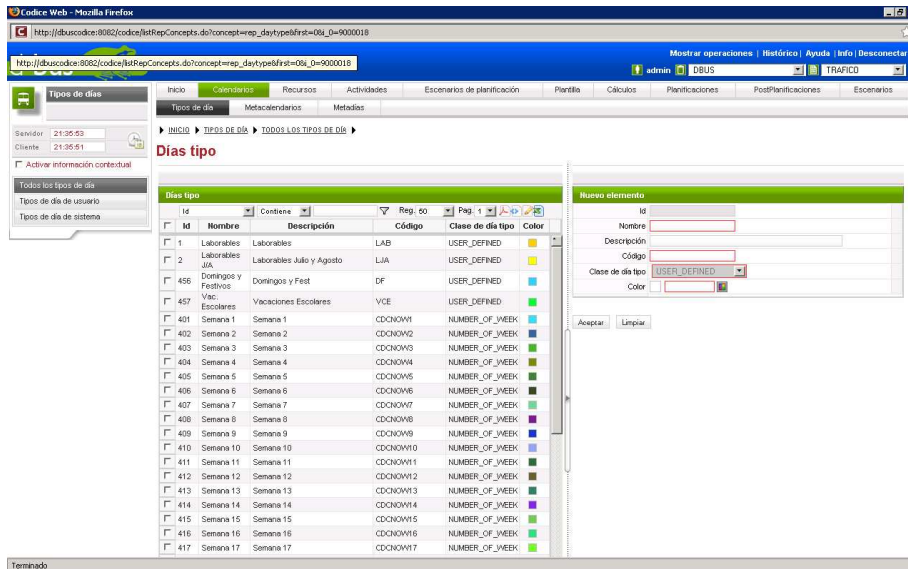
CTSS-DBUS has defined and implemented an expert planning and fleet system that meet the company’s requirements. This expert planning system is related to the buses and drivers needed to provide the bus service offer defined by the Town Hall.

This expert planning system is installed on a server and can be used from any computer using both Mozilla Firefox and Internet Explorer navigators. So it is not necessary to install the application in every computer of the planning department, and it is also possible to operate with these systems from an employee’s home, if necessary.



CTSS-DBUS has a different bus service offer for each of the following types of day:

- Winter weekdays
- Winter Saturdays
- Winter Sundays & Holidays
- School holidays on winter weekdays (Christmas, Easter, last week of June and first week of September)
- July and August weekdays
- July and August Saturdays
- July and August Sundays & Holidays



For each of these types of day, it is necessary to calculate the buses' schedules and the drivers' timetables, following the requirements of the CTSS-DBUS Labour Agreement.

Up to this moment, an expert employee has historically managed the drivers' timetable solutions for each day type. This is a big and difficult task that has to be completed accurately to optimize the resources, and well in advance for the optimisation to be put into practice. It was also a big risk that only one person was trained in this manual planning system. That is the main reason to search the market for an expert planning and fleet management system.

With this new system, all the planning data and solutions will be completed using a computer and also more employees can be trained to use it.

Before the calculation of the best solution for the drivers' timetable, it is necessary to input all the trips of the buses offered to the travellers on every line. These data can be introduced easily in the system using a special input application.

The screenshot shows the 'd-bus' web application interface. The main window displays a list of activities under the heading 'Actividades Task End'. The table below shows the data for these activities:

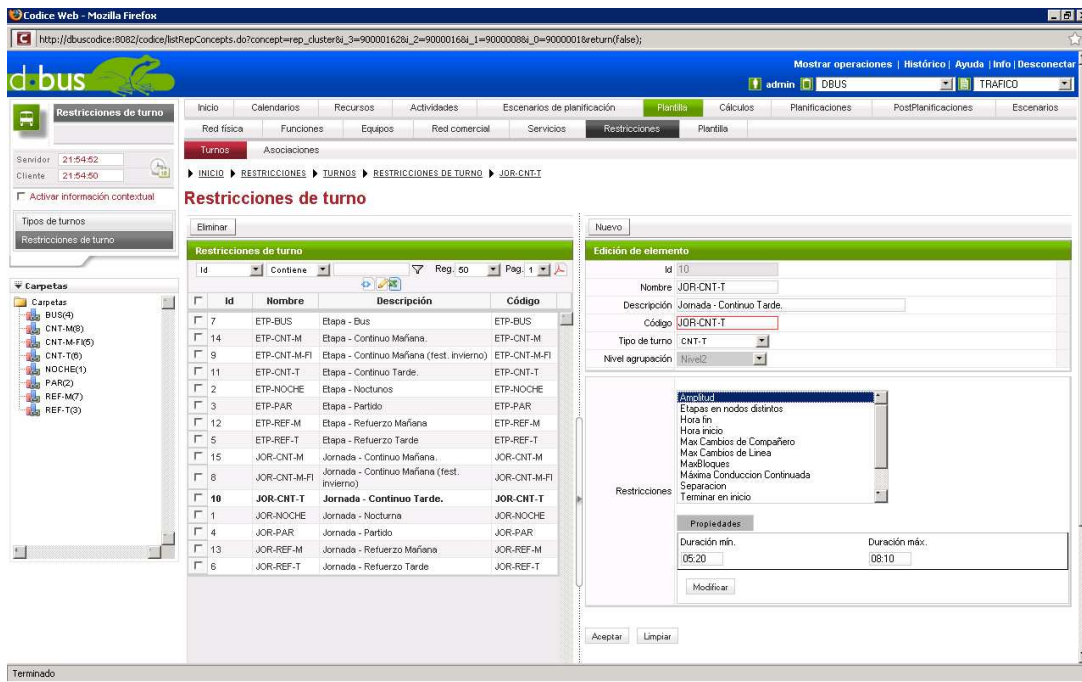
Id	Nombre	Código	Origen	Destino	Equipo	Tipo de servicio	Estructura	Ritinerario	Inicio mínimo	Inicio máximo	Inicio óptimo	Fin mínimo	Fin máximo	Fin óptimo
538	1-1601-07	1-1601-07	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	07:05:0	07:05:0	07:05:0	07:30:0	07:30:0	07:30:0
507	1-1601-07	1-1601-07	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	07:30:0	07:30:0	07:30:0	08:05:0	08:05:0	08:05:0
553	1-1602-07	1-1602-07	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	07:35:0	07:35:0	07:35:0	08:00:0	08:00:0	08:00:0
523	1-1602-08	1-1602-08	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	08:00:0	08:00:0	08:00:0	08:35:0	08:35:0	08:35:0
539	1-1601-08	1-1601-08	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	08:05:0	08:05:0	08:05:0	08:30:0	08:30:0	08:30:0
508	1-1601-08	1-1601-08	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	08:30:0	08:30:0	08:30:0	09:05:0	09:05:0	09:05:0
554	1-1602-08	1-1602-08	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	08:35:0	08:35:0	08:35:0	09:00:0	09:00:0	09:00:0
524	1-1602-09	1-1602-09	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	09:00:0	09:00:0	09:00:0	09:35:0	09:35:0	09:35:0
540	1-1601-09	1-1601-09	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	09:05:0	09:05:0	09:05:0	09:30:0	09:30:0	09:30:0
509	1-1601-09	1-1601-09	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	09:30:0	09:30:0	09:30:0	10:05:0	10:05:0	10:05:0
555	1-1602-09	1-1602-09	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	09:35:0	09:35:0	09:35:0	10:00:0	10:00:0	10:00:0
525	1-1602-10	1-1602-10	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	10:00:0	10:00:0	10:00:0	10:35:0	10:35:0	10:35:0
541	1-1601-10	1-1601-10	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	10:05:0	10:05:0	10:05:0	10:30:0	10:30:0	10:30:0
510	1-1601-10	1-1601-10	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	10:30:0	10:30:0	10:30:0	11:05:0	11:05:0	11:05:0
556	1-1602-10	1-1602-10	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	10:35:0	10:35:0	10:35:0	11:00:0	11:00:0	11:00:0
526	1-1602-11	1-1602-11	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	11:00:0	11:00:0	11:00:0	11:35:0	11:35:0	11:35:0
542	1-1601-11	1-1601-11	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	11:05:0	11:05:0	11:05:0	11:30:0	11:30:0	11:30:0
511	1-1601-11	1-1601-11	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	11:30:0	11:30:0	11:30:0	12:05:0	12:05:0	12:05:0
557	1-1602-11	1-1602-11	BOUL	CAMP	EQP-BUS-C	EXP	16	REC-LAB08	11:35:0	11:35:0	11:35:0	12:00:0	12:00:0	12:00:0
527	1-1602-12	1-1602-12	CAMP	BOUL	EQP-BUS-C	EXP	16	REC-LAB08	12:00:0	12:00:0	12:00:0	12:35:0	12:35:0	12:35:0

The interface also includes a sidebar with navigation options like 'Inicio', 'Calendarios', 'Recursos', and 'Actividades'. A right-hand panel shows the 'Edición de elemento' form for a selected activity, with fields for 'Nombre', 'Código', 'Origen', 'Destino', 'Equipo', 'Tipo de servicio', 'Estructura', and 'Ritinerario', along with time selection options for 'Inicio' and 'Fin' (mínimo, máximo, óptimo).

Another set of inputs are the Labour Restrictions. There are 3 different types of shifts for the drivers:

- Continuous Morning Shifts
- Continuous Afternoon Shifts
- Split Shifts

Each kind of shift types has their own conditions that have to be introduced in the system.



Restricciones de turno

Id	Nombre	Descripción	Código
7	ETP-BUS	Etapa - Bus	ETP-BUS
14	ETP-CNT-M	Etapa - Continuo Mañana.	ETP-CNT-M
9	ETP-CNT-M-FI	Etapa - Continuo Mañana (fest. invierno)	ETP-CNT-M-FI
11	ETP-CNT-T	Etapa - Continuo Tarde.	ETP-CNT-T
2	ETP-NOCHE	Etapa - Nocturnos	ETP-NOCHE
3	ETP-PAR	Etapa - Partido	ETP-PAR
12	ETP-REF-M	Etapa - Refuerzo Mañana	ETP-REF-M
5	ETP-REF-T	Etapa - Refuerzo Tarde	ETP-REF-T
15	JOR-CNT-M	Jornada - Continuo Mañana.	JOR-CNT-M
8	JOR-CNT-M-FI	Jornada - Continuo Mañana (fest. invierno)	JOR-CNT-M-FI
10	JOR-CNT-T	Jornada - Continuo Tarde.	JOR-CNT-T
1	JOR-NOCHE	Jornada - Nocturna	JOR-NOCHE
4	JOR-PAR	Jornada - Partido	JOR-PAR
13	JOR-REF-M	Jornada - Refuerzo Mañana	JOR-REF-M
6	JOR-REF-T	Jornada - Refuerzo Tarde	JOR-REF-T

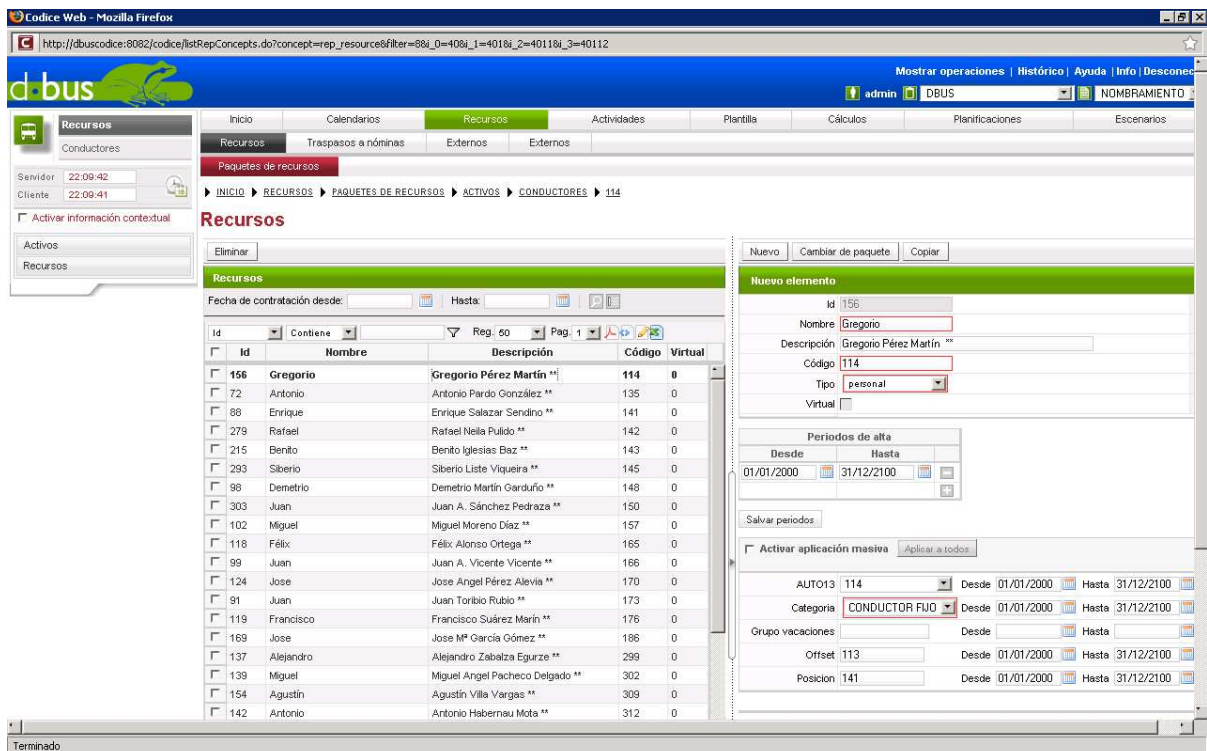
Nuevo elemento

Id: 10
 Nombre: JOR-CNT-T
 Descripción: Jornada - Continuo Tarde.
 Código: JOR-CNT-T
 Tipo de turno: CNT-T
 Nivel agrupación: Nivel2

Propiedades

Duración mín.: 05:20 Duración máx.: 08:10

The details of individual drivers must also be introduced in the system, and their holidays, rest days, etc.



Recursos

Id	Nombre	Descripción	Código	Virtual
156	Gregorio	Gregorio Pérez Martín **	114	0
72	Antonio	Antonio Pardo González **	135	0
88	Enrique	Enrique Salazar Sendino **	141	0
279	Rafael	Rafael Nells Pulido **	142	0
215	Benito	Benito Iglesias Baz **	143	0
293	Siberio	Siberio Liste Viqueira **	145	0
98	Demetrio	Demetrio Martín Garduño **	148	0
303	Juan	Juan A. Sánchez Pedraza **	150	0
102	Miguel	Miguel Moreno Díaz **	157	0
118	Félix	Félix Alonso Ortega **	165	0
99	Juan	Juan A. Vicente Vicente **	166	0
124	Jose	Jose Angel Pérez Alevia **	170	0
91	Juan	Juan Toribio Rubio **	173	0
119	Francisco	Francisco Suárez Marín **	176	0
169	Jose	Jose Mª García Gómez **	186	0
137	Alejandro	Alejandro Zalbalza Egorze **	299	0
139	Miguel	Miguel Angel Pacheco Delgado **	302	0
154	Agustín	Agustín Villa Vargas **	309	0
142	Antonio	Antonio Habernau Mota **	312	0

Nuevo elemento

Id: 156
 Nombre: Gregorio
 Descripción: Gregorio Pérez Martín **
 Código: T14
 Tipo: personal
 Virtual:

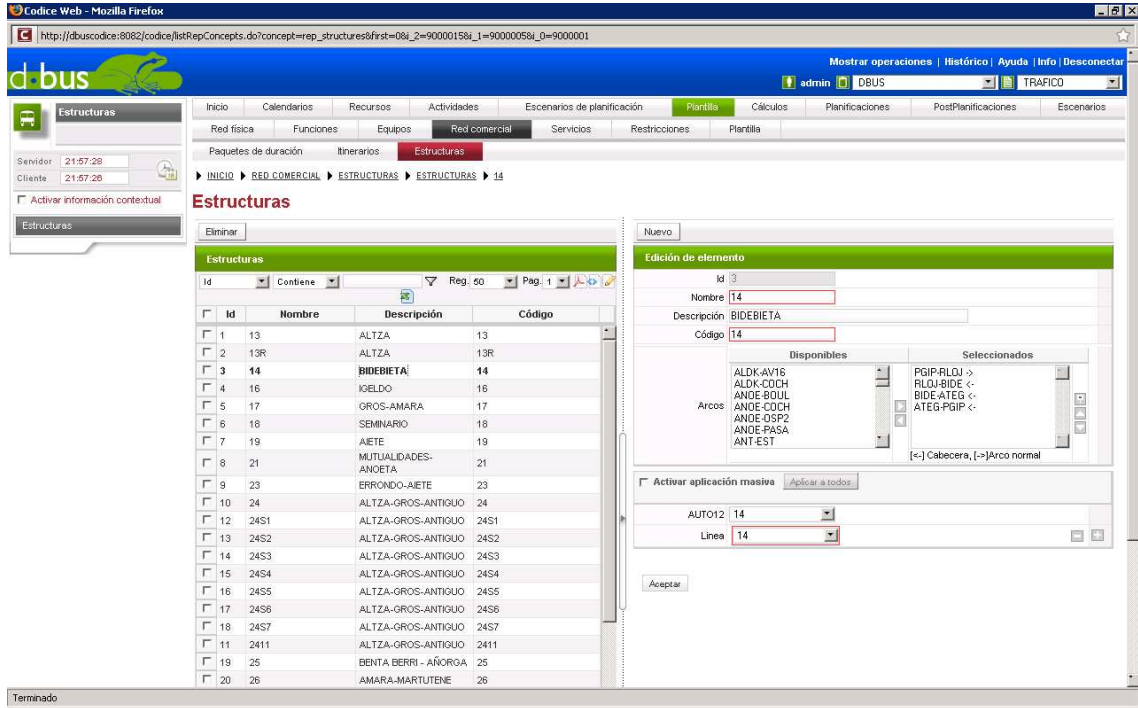
Periodos de alta

Desde: 01/01/2000 Hasta: 31/12/2100

Activar aplicación masiva: Aplicar a todos

AUT013: 114 Desde: 01/01/2000 Hasta: 31/12/2100
 Categoría: CONDUCTOR FUJO Desde: 01/01/2000 Hasta: 31/12/2100
 Grupo vacaciones: Desde: Hasta: Offset: 113 Desde: 01/01/2000 Hasta: 31/12/2100
 Posición: 141 Desde: 01/01/2000 Hasta: 31/12/2100

It is also necessary to introduce the bus network: lines, line routes, bus stops and points for driver replacement.



Estructuras

Id	Nombre	Descripción	Código
1	13	ALTZA	13
2	13R	ALTZA	13R
3	14	BIBEBIETA	14
4	16	IOSELDO	16
5	17	GROS-AMARA	17
6	18	SEMINARIO	18
7	19	AETE	19
8	21	MUTUALIDADES-ANOETA	21
9	23	ERRONDO-AETE	23
10	24	ALTZA-GROS-ANTIGUO	24
12	24S1	ALTZA-GROS-ANTIGUO	24S1
13	24S2	ALTZA-GROS-ANTIGUO	24S2
14	24S3	ALTZA-GROS-ANTIGUO	24S3
15	24S4	ALTZA-GROS-ANTIGUO	24S4
16	24S5	ALTZA-GROS-ANTIGUO	24S5
17	24S6	ALTZA-GROS-ANTIGUO	24S6
18	24S7	ALTZA-GROS-ANTIGUO	24S7
11	2411	ALTZA-GROS-ANTIGUO	2411
19	25	BENTA BERRI - AÑORGA	25
20	26	AMARA-MARTUTENE	26

Edición de elemento

Nombre: BIBEBIETA
 Descripción: BIBEBIETA
 Código: 14

Arcos:

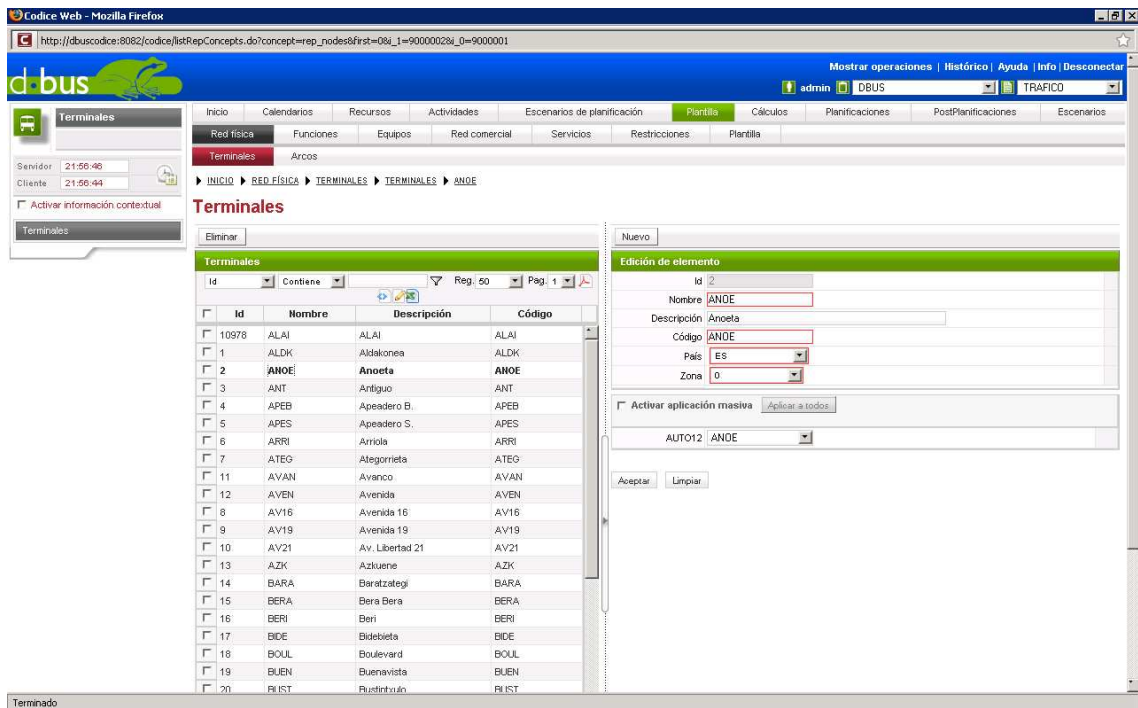
Disponibles	Seleccionados
ALDK-AV16	PGIP-PLQJ >
ALDK-COCH	PLQJ-BIDE <
ANDE-BOUL	BIDE-ATEG <
ANDE-COCH	ATEG-PGIP <
ANDE-OSPO	
ANDE-PASA	
ANT-EST	

ACTIVAR APLICACIÓN MASIVA [Aplicar a todos]

AUTO12: 14
 Línea: 14

Aceptar

CTSS-DBUS different lines



Terminales

Id	Nombre	Descripción	Código
10978	ALAI	ALAI	ALAI
1	ALDK	Aldakonea	ALDK
2	ANOETA	Anoeta	ANOETA
3	ANT	Antiguo	ANT
4	APEB	Apeadero B.	APEB
5	APES	Apeadero S.	APES
8	ARRI	Arriola	ARRI
7	ATEG	Alegorrieta	ATEG
11	AVAN	Avanco	AVAN
12	AVEN	Avenida	AVEN
8	AV16	Avenida 16	AV16
9	AV19	Avenida 19	AV19
10	AV21	Av. Libertad 21	AV21
13	AZK	Azkuene	AZK
14	BARA	Baratzategi	BARA
15	BERA	Bera Bera	BERA
16	BERI	Beri	BERI
17	BIDE	Bidebieta	BIDE
18	BOUL	Boulevard	BOUL
19	BUEN	Buenavista	BUEN
20	PLIST	Plustintzuán	PLIST

Edición de elemento

Nombre: ANOETA
 Descripción: Anoeta
 Código: ANOETA
 País: ES
 Zona: 0

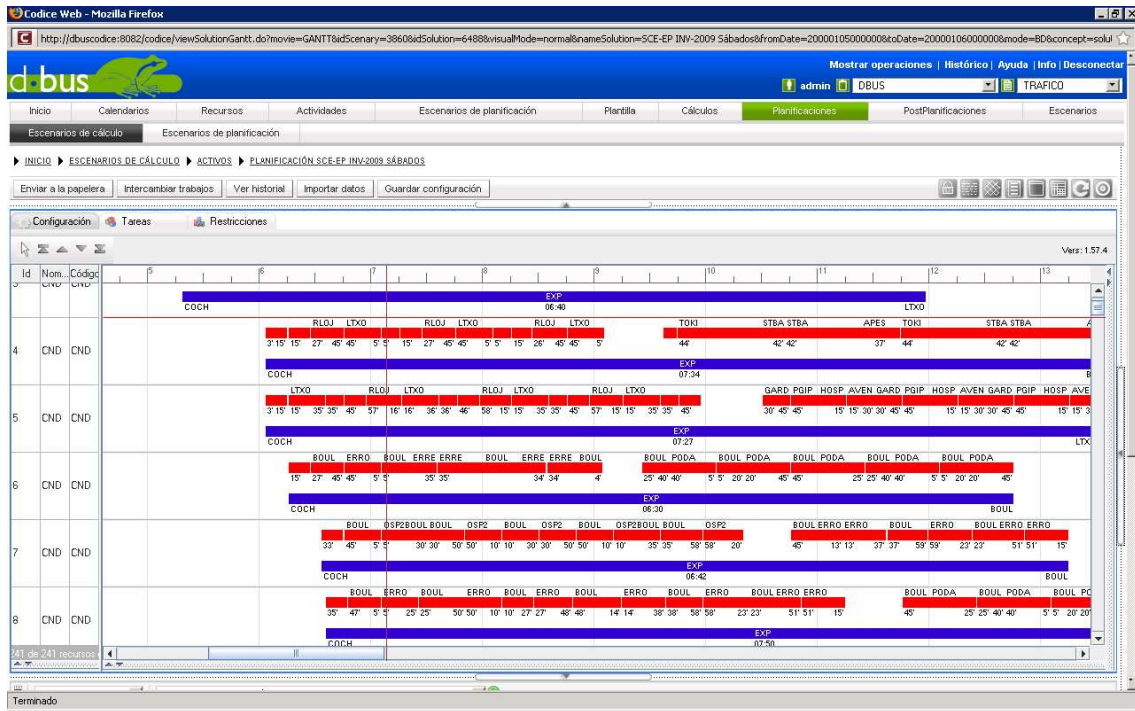
ACTIVAR APLICACIÓN MASIVA [Aplicar a todos]

AUTO12: ANOETA

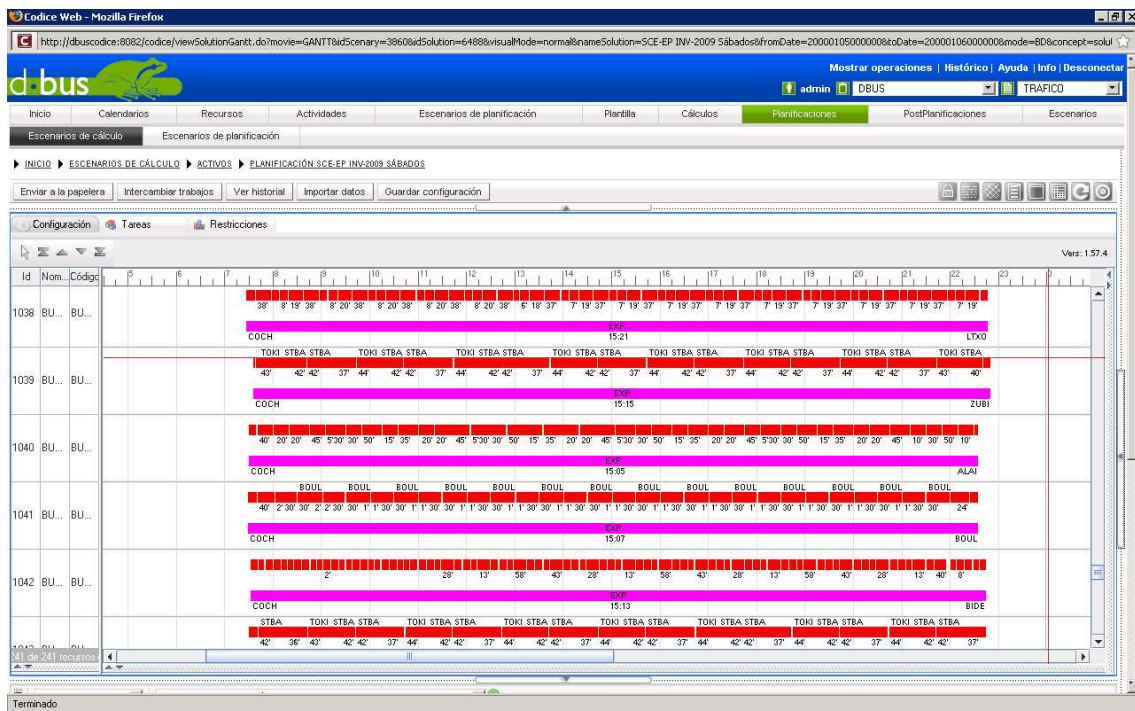
Aceptar Limpia

CTSS-DBUS bus stops

Once all the inputs are introduced, the system calculates the best solution for the drivers' timetable, optimising the total number of shifts and service hours.



The system also gives the optimum solution for the buses timetable.



Spreading the solution of the different day types for the whole year, the system gives the schedule for every driver about the working shifts for every day.

ID	Contiene	Reg	Psg	Inicio	Fin	Func.	Código	Nombre
84069	Gamma_7h3034-16	16/12/2008 20:00	16/12/2008 22:00	CNT	Base	Base	TR	
84067	Gamma_7h3032-14	16/12/2008 20:00	16/12/2008 22:00	CNT	Base	Base	TR	
84730	Gamma_7h3034-16	17/12/2008 18:00	17/12/2008 19:30	CNT	Base	Base	TR	
84728	Gamma_7h3033-14	17/12/2008 18:00	17/12/2008 19:30	CNT	Base	Base	TR	
42309	AM-M01	23/12/2008 05:00	23/12/2008 12:45	MAINT	CDG	CDG	TR	
42310	AM-S01	24/12/2008 16:15	24/12/2008 24:00	MAINT	CDG	CDG	TR	

4.3 Problems Identified

Some difficulties appeared in order to include the labour restrictions within the definition of the specifications for the expert planning systems. These difficulties have been solved through the involvement of the existing CTSS-DBUS planning employees in the process so that the existing knowledge is used and the expert planning systems collects all the specifications needed using all the labour restrictions.

4.4 Risks and Mitigating Activities

HDSPA-3G communication systems are not commonly being used by bus companies. CTSS-DBUS has been one of the first companies in Spain to use this communication system. After 9 months of performance, the results are satisfactory.

4.5 Dissemination Activities

Because this is very much an internal element of a wider system upgrade this element has not been publicised publicly at this stage, unlike the security and traveller information system upgrades.

4.6 Future Plans

Extend the new communication HDSPA-3G system to the rest of the fleet - at the moment, only the buses with the security cameras system have this communication system operative.

Extend the training of the expert planning and bus management system so that employees can develop their job in a better way.

Evaluation of the new management system will continue through the next 2 years and will be reported as part of the ARCHIMEDES evaluation process.