ADAPTATION OF C2IEDM FOR CIVIL CRISIS MANAGEMENT

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Research Project

- Title: C4ISR Multimedia applied to emergency management.

  Ref: TIN2004-03588
- **Objectives**:
  - To apply the command and control military technology in an innovative way to the civil environment.
  - The project is focused in the application of this mature military technology to the civil environment mainly in a field with high social impact, the civil crisis management (e.g. terrorist attacks, industrial accidents, big fforest fire or floods, etc). The developed system is based on C2IEDM.

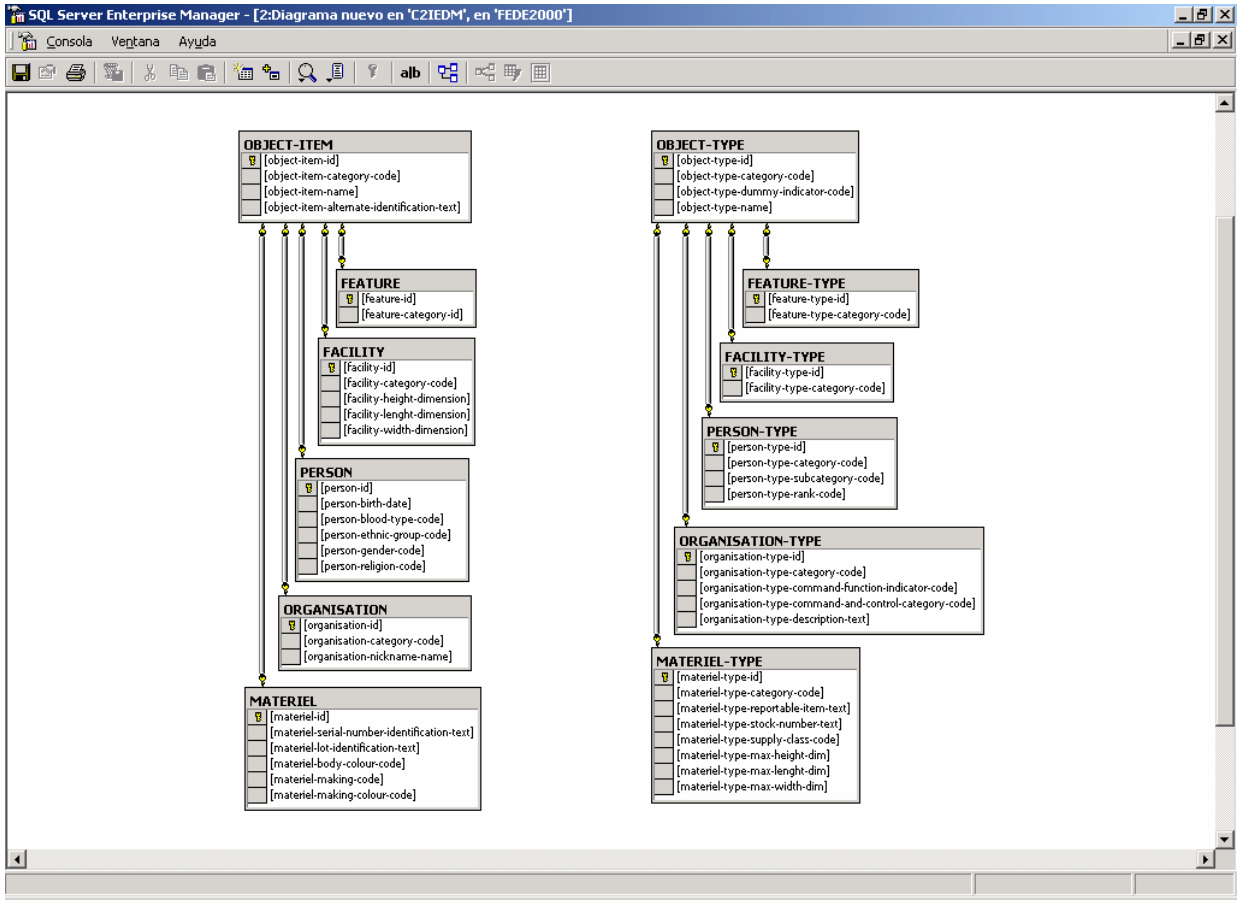
C2IEDM - Overview

- ✓ The C2IEDM defines in a standardiced way, the unique information susceptible to be exchanged for a C2 national system.
- ✓ The C2IEDM is the core of Multilateral Interoperability Program (MIP) solution for achieving interoperbility among different C2I national systems.
- ✓ The C2IEDM enable the information exchange betwen C2I systems allowing to the user to decide what information is exchaged to whom it flows, and when.

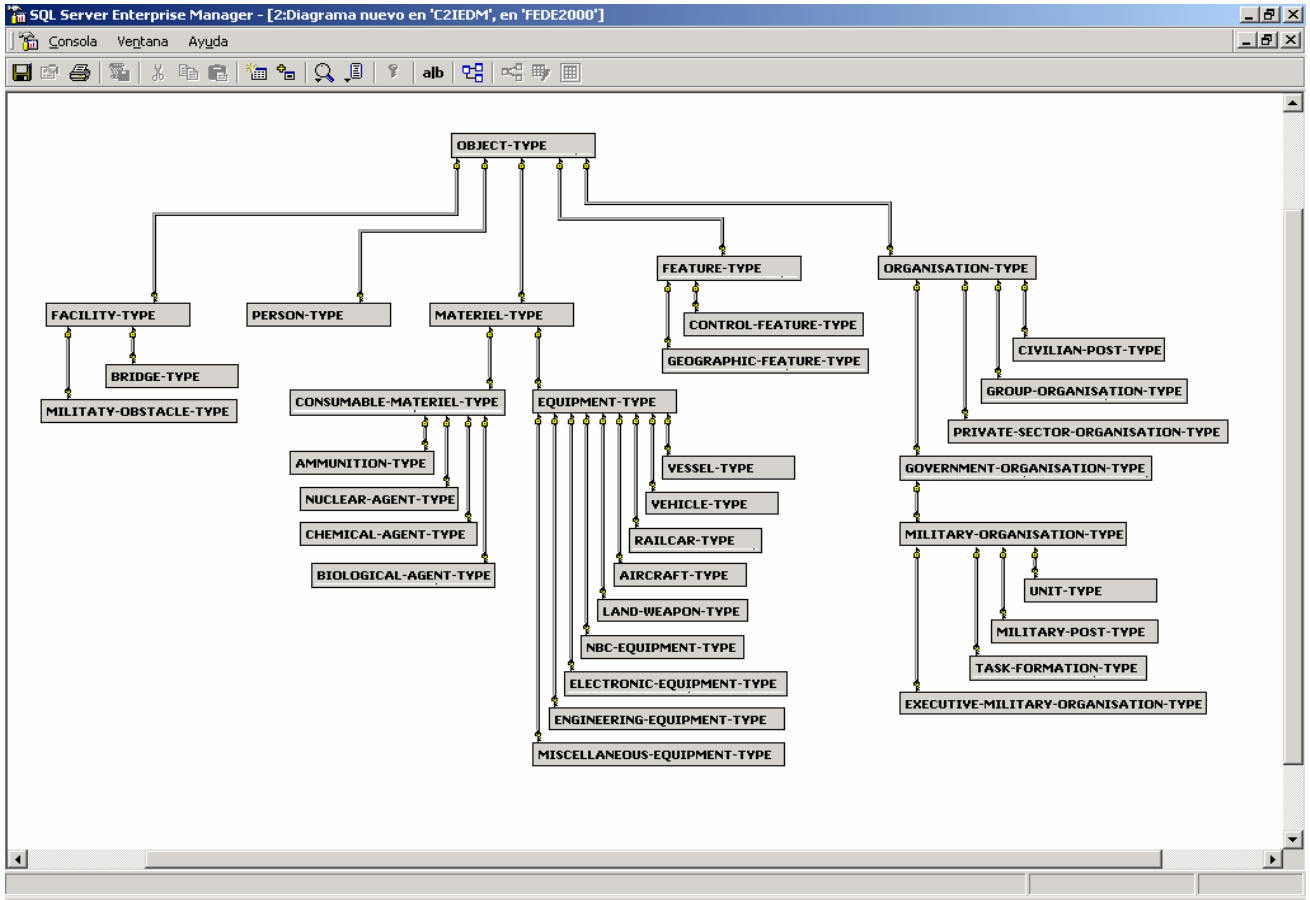
C2IEDM - Overview

- In the C2IEDM the objects have to be classified taken into account the following premises; who are the actors who use the objects and which objects are available for being used in each moment. The C2IEDM encompasses two object categories:
  - Item: Objects what can be identified individually; (by name: i.e. Lieutenant John Smith, Second Armoured Division, by call sign or serial number or license plate or passport number, and so on).
  - Types: Objects which represent properties of groups or classes; (a tank, a ship, an M1A2 tank, a helicopter, a howitzer, a rifle, an armoured brigade, a light infantry battalion, an infantryman, a refugee).
- Both categories are used in parallel as basic structural elements of the C2IEDM. The two structures are related to each other. Data characteristics are entered either on the item side or the type side as appropriate. Any characteristic described on the type side also applies to the item when the item is assigned a type classification. The linkage from item to type is a mandatory issue in the model.

C2IEDM – O_Item and O_Type Hierarchy



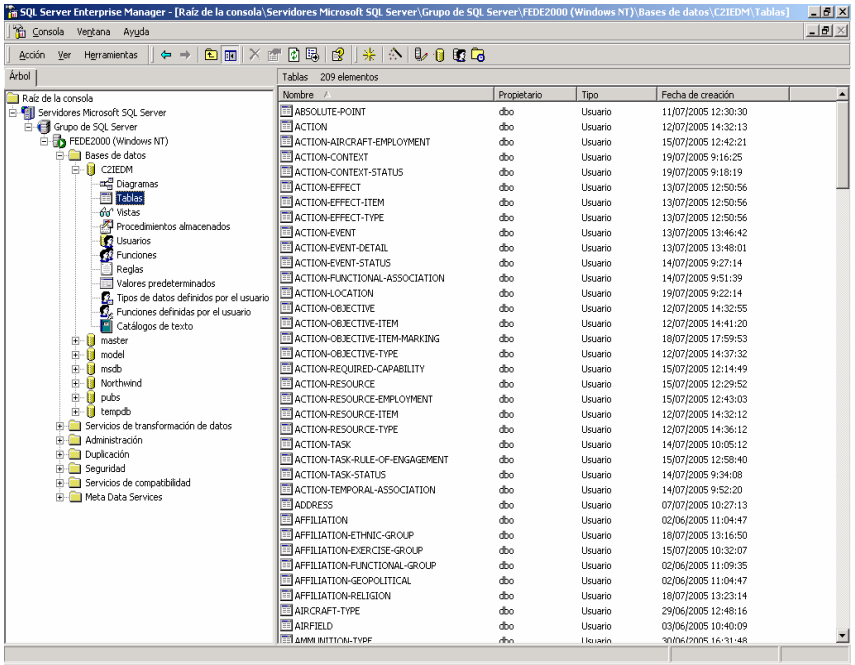
C2IEDM – Object_Type Hierarchy

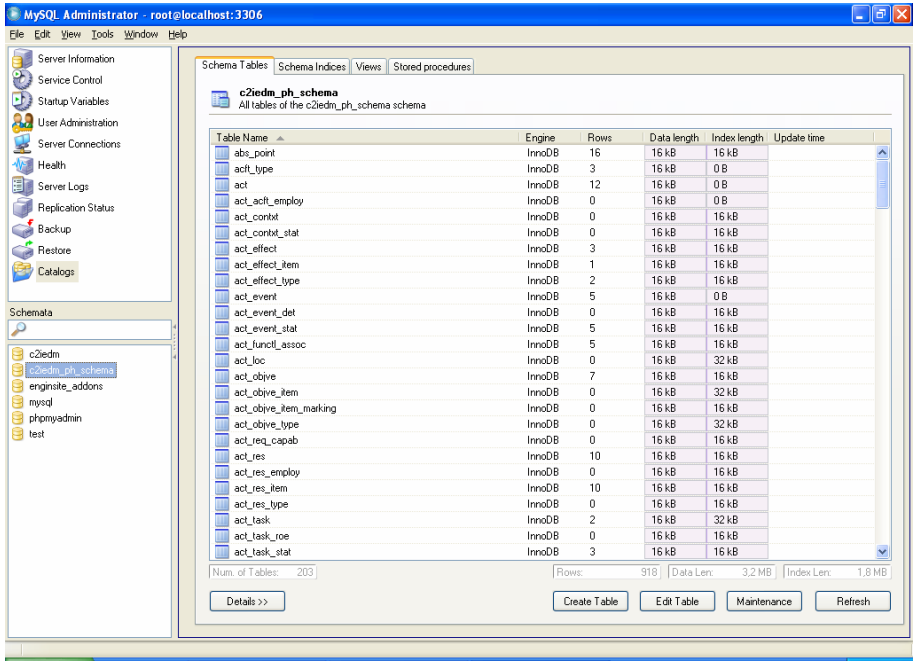


C2IEDM Prototype Implementation

- Two implementations of the C2IEDM physical schema have been performed by UPV. The first one has been implemented through Microsoft SQL Server 7.0 and the other one has been implemented through MySQL version 4.0.24. Both implementations include the 203 tables which form the C2IEDM with their relationships according to the 6.15c C2IEDM version
- In the MySQL version the table names, attributes, data size and type of each data have been implemented following exactly the notation of Annex I of the version 6.15c of the C2IEDM
- In the Microsoft SQL Server 7.0 a more “didactic” version of the physical schema has been performed since such as the table names as the attributes have been written without abbreviations in order to be clearly understandable by users belonging to target groups (policemen, firemen, sanitary staff, civil authorities) and also for performing clear examples for them.

C2IEDM Prototype Implementation



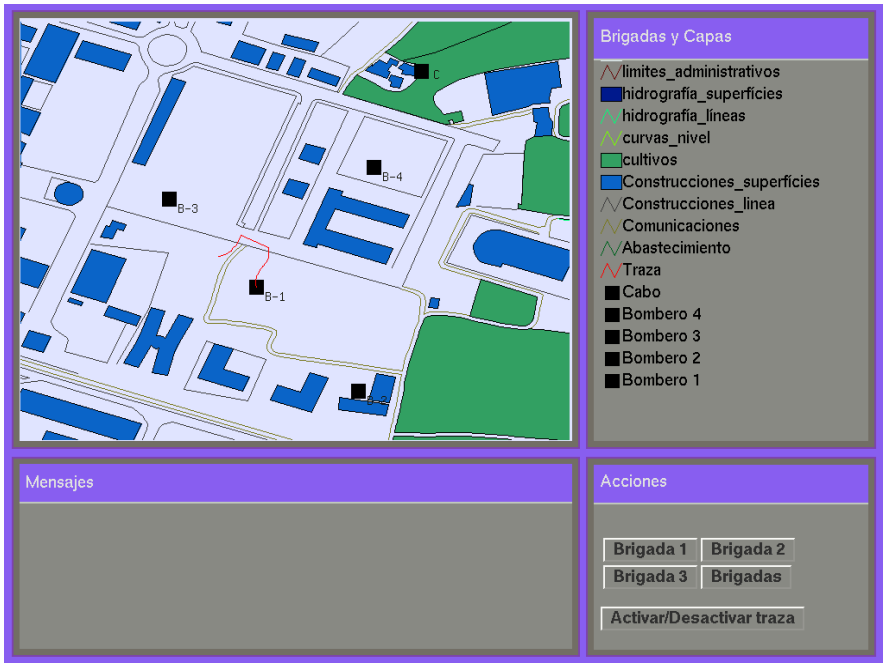


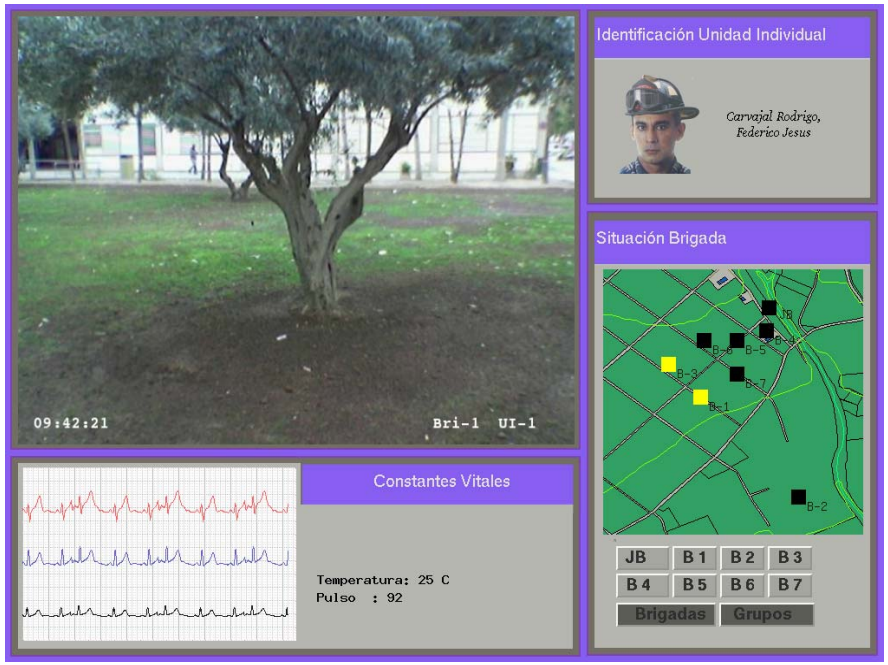
C2IEDM Civil use

- ✓ UPV has developed a Civil Command Control Computer communications and Information Systems C4IS based on C2IEDM.

- ✓ In C4ISR Multimedia project a command and control system for civil environment has been developed following NATO and DoD standarts.

C2IEDM Civil use





C2IEDM Civil use

SQL Server Enterprise Manager - [2:Datos en tabla 'LOCATION' en 'C2IEDM' en 'FEDE2000']

Consola Ventana Ayuda

location-id	location-category-code
4	SURFACE
6	SURFACE
346	POINT
612	POINT
613	POINT
666	LINE
675	LINE
682	SURFACE
694	SURFACE
701	POINT
702	POINT
703	POINT
777	POINT
999	POINT
1810	POINT
1812	POINT
3112	POINT
3211	POINT
3212	POINT
3213	POINT
3214	POINT
3215	POINT
3216	LINE
3217	SURFACE
3311	POINT
3312	POINT
3313	POINT
3314	SURFACE
5514	SURFACE
7001	LINE
7002	LINE
7003	LINE
8901	SURFACE
9400	SURFACE
13801	GEOMETRIC-VOLUME
13807	GEOMETRIC-VOLUME
13809	GEOMETRIC-VOLUME

C2IEDM Civil use

SQL Server Enterprise Manager - [2:Datos en tabla 'LINE-POINT' en 'C2IEDM' en 'FEDE2000']

Consola Ventana Ayuda

line-id	line-point-index	line-point-sequence-quantity	line-point-point-id
3216	461	1	3211
3216	462	2	3212
3216	463	3	3213
3216	464	4	3214
3216	465	5	3215
7001	1	1	346
7001	2	2	613
7001	3	3	1810
7001	4	4	346
7002	1	1	1812
7002	2	2	612
7002	3	3	999
7002	4	4	1812
7003	1	1	3112
7003	2	2	613
7003	3	3	777

SQL Server Enterprise Manager - [2:Datos en tabla 'LINE' en 'C2IEDM' en 'FEDE2000']

Consola Ventana Ayuda

line-id
3216
7001
7002
7003

C2IEDM Civil use

SQL Server Enterprise Manager - [2:Datos en tabla 'POINT' en 'C2

Consola Ventana Ayuda

point-id	point-category-code
346	ABSOLUTE-POINT
612	ABSOLUTE-POINT
613	ABSOLUTE-POINT
701	RELATIVE-POINT
702	RELATIVE-POINT
703	RELATIVE-POINT
777	ABSOLUTE-POINT
999	ABSOLUTE-POINT
1810	ABSOLUTE-POINT
1812	ABSOLUTE-POINT
3112	ABSOLUTE-POINT
3211	ABSOLUTE-POINT
3212	ABSOLUTE-POINT
3213	ABSOLUTE-POINT
3214	ABSOLUTE-POINT
3215	ABSOLUTE-POINT
3311	ABSOLUTE-POINT
3312	ABSOLUTE-POINT
3313	ABSOLUTE-POINT

SQL Server Enterprise Manager - [2:Datos en tabla 'ABSOLUTE-POINT' en 'C2IEDM' en 'FEDE2000']

Consola Ventana Ayuda

absolute-point-id	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate	absolute-point-angular-precision-code	absolute-point-vertical-distance-id
346	30350	-98518	Tenth of a minute	11003
612	30720	-98588	Tenth of a minute	11001
613	30290	-98580	Tenth of a minute	11003
777	30674	-98639	Tenth of a minute	11001
999	30360	-98658	Tenth of a minute	11001
1810	30150	-98538	Tenth of a minute	11003
1812	30860	-98671	Tenth of a minute	11001
3112	30290	-98631	Tenth of a minute	11002
3211	30258	-98563	Tenth of a minute	11001
3212	30569	-98774	Tenth of a minute	11001
3213	30548	-98632	Tenth of a minute	11001
3214	30125	-98746	Tenth of a minute	11001
3215	30987	-98999	Tenth of a minute	11001
3311	35264	-92369	Tenth of a minute	11002
3312	35335	-92584	Tenth of a minute	11002
3313	35471	-92789	Tenth of a minute	11002

C2IS INTEROPERBILITY;INFORMATION EXCHANGE

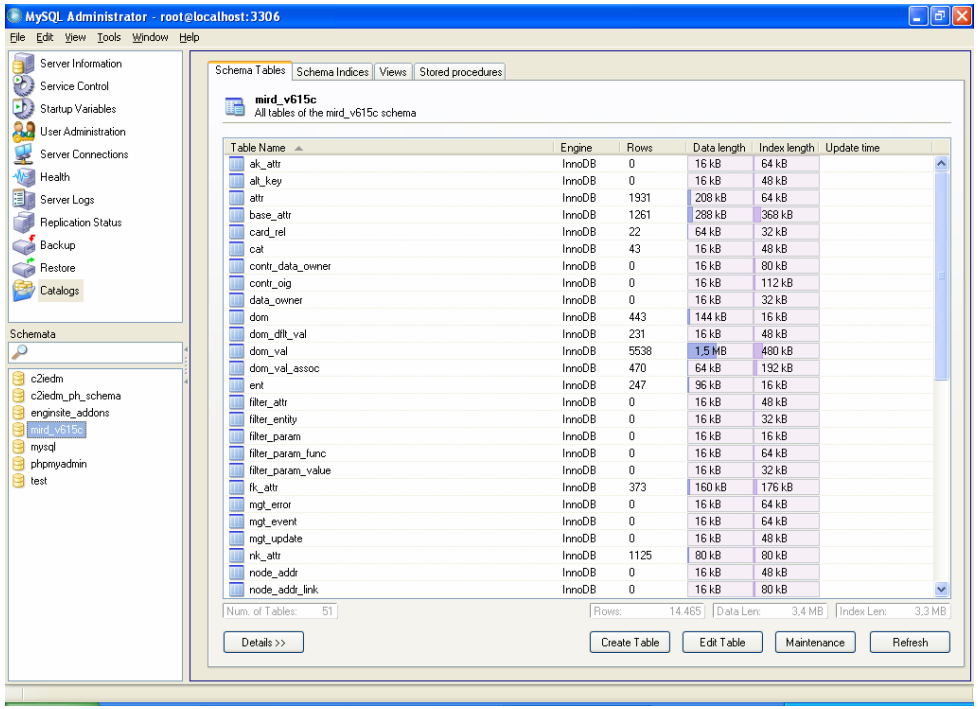
- The MIP has specified the following information exchange mechanisms:

- The Message Exchange Mechanism (MEM) which consists of a suite of formatted messages derived from the C2IEDM that conform to AdatP-3 Part 1, plus guidelines for their use.

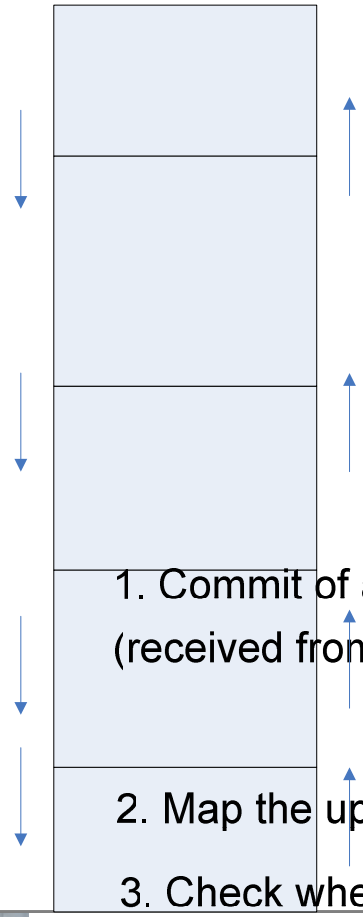
- The Data Exchange Mechanism (DEM) is an automatic data push mechanism that co-exists with the MEM. When a C2 application changes the state of information that it holds, and which is recognised by the DEM, this information is automatically replicated to all other cooperating systems that have agreed to exchange this information

C2IS INTEROPERBILITY;INFORMATION EXCHANGE

- ✓ The DEM application is managed through the DEM data base. This data base is provided by MIP in MS Access format and it is composed by 51 tables. Through these tables the whole interoperability process is managed.



C2IS INTEROPERBILITY;INFORMATION EXCHANGE



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C2IS INTEROPERBILITY;INFORMATION EXCHANGE

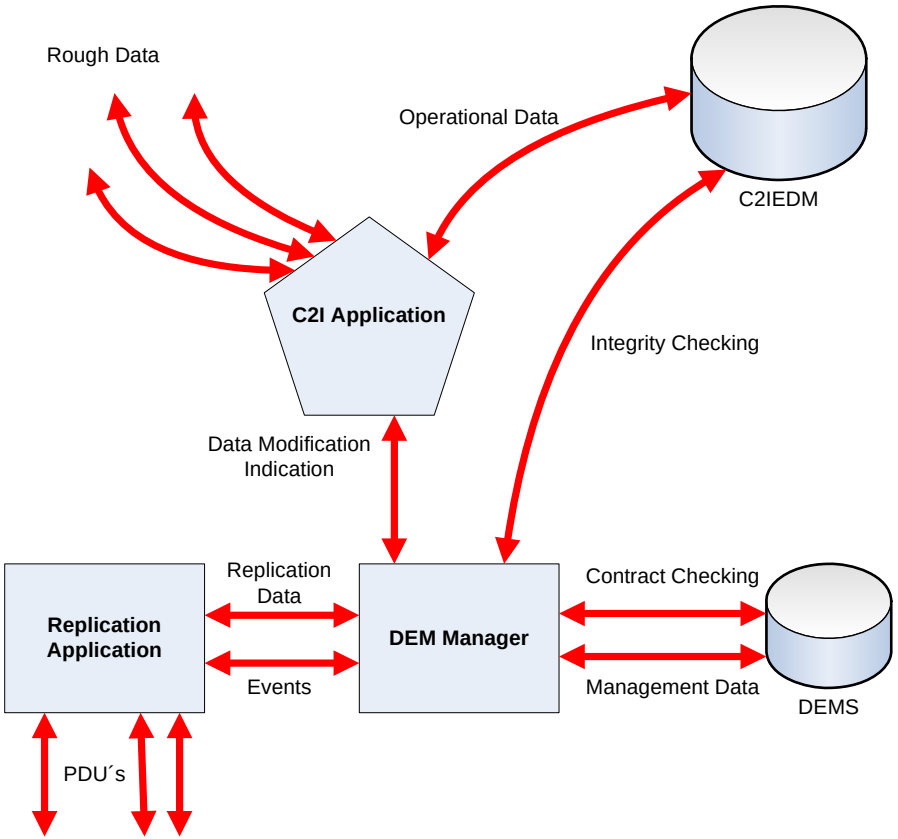
- The following illustrates how a PDU is successively encapsulated at each layer:
  - a). Operational or Management Data: Example: X01 or M01
  - b). Packaged inside an R_DATA PDU: Example: R05{X01}
  - c). Packaged inside an A_DATA PDU: Example: A05{R05{X01}}
  - d). Packaged inside a TFMAN PDU Example: T03{A05{R05{X01}}}

C2IS INTEROPERBILITY;INFORMATION EXCHANGE

- In the interoperability process which is being implemented by UPV there are two main modules which have to be taken into account.
- The first one is the replication application module which manages the replication protocols to be used in order to establish a connection between the corresponding nodes and maintaining it during the data exchange session. This module has to manage the events launched by the C2I application and to process the protocol data units (PDU's) received from other nodes.
- The second one is the DEM manager module which is in charge to the DEM database managements which includes information ownership management, contract management and so on. This second module is composed by several sub modules which manage the different parts of the DEM database.

C2IS INTEROPERBILITY;INFORMATION EXCHANGE

- ✓ Once the physical connection is established through the information stored in NODE-ADDRESS and NODE-ADDRESS-LINK tables, the exchange of messages based on protocol data units (PDU´s), between the corresponding data provider (DP) and data receiver (DR) will start in order to begin the replication session.



Conclusions

- ✓ The presented research has been funded by the Spanish government through the TIN2004-03588 project founded by the Spanish Ministry of science and education and FEDER founds. The following steps on that research will be to fine adapt the C2IEDM to the data modelling of the actors involved in the crisis management in order to profit fully all its data management features. To provide interoperability mechanisms to the developed C2I applications and simulation capabilities and providing the developed system with quick deployment and robustness features in order to optimize its quick deployment and reliability in case of civil crisis.