Multilingual Vocal Access to Databases: the Central Role of Ontology Management in VocaBase

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Main Topics

1. A little bit of our history...
2. Vocal Access to Databases: some of the issues
3. Ontology, why?
4. Short demonstration: +32 2 351 8243
5. It is all about Modelling

1. A little bit of our history...

From Text databases to Knowledge Management

- 1979: Badaduq: Bibliographical Database on VAX
- 1984: Adapt: Databases conversions
- 1986: Seconde 4GL: Medical Databases on PC Networks
- 1989: Multilingual Thesaurus Management
- 1990: CD-ROM applications (full text databases)
- 1996: Web applications: dictionaries, catalogues
- 1997: Legal documents publishing
- 1998: GenIdex: Thesaurus indexation analysis
- 1999: NetAgora: Internet communities Management
- 2001: KronoLex: History of Applicable Legal Texts
- 2002: VocaBase: Vocal Access to Databases
- 2003: Endorsing Java and Protégé to rewrite our product line

VocaBase

Interactive **V**oice **R**esponse application allows multiple users to browse **large indexes and databases** in **natural language**

2. Vocal Access to Databases: some of the issues

Vocal Application Server,
On Line Internet Community Server,
CD-Rom Application
Printed Catalogue:
A perfect case for device independent
Database Publishing

- Database Publishing is Knowledge Publishing
- Limitations of Vocal interface
- The case for Dialog Modelling
- The Interaction from User point of view
- ... from Application point of view
- Ontology = Thesaurus + Data + Rules

Database publishing is Knowledge publishing

- Knowledge is information with a goal
- Knowledge value is proportional to goal value: data has an acquisition cost but no intrinsic value!
- Nothing is published without a goal and...
  Nobody reads a publication without a goal
- Publication must be adapted to data available but even more to the goals of publishers and users
- → Publication must be continuously (re)modelled
- *Protégé is a very flexible modelling tool also able to manage data (instances)...*

Knowing Users

- Whatever the Information System is, it will involved in "conversations" with users.
- The system and the user have pre-cognitions about each other and the dialogue is supposed to change these pre-cognitions (on both side): each party should ideally adapt to each other. *Humans do, computers rarely and should.*
- To justify the existence and the development of the system, the benefits that have been delivered to users must be measured.
- The user needs to feel that the system cares about him and that it remembers what have been exchanged in previous conversations.

Limitations of Vocal interface

- 10 characters per seconds in **both** directions
- Only a limited number of choices can be remembered and considered in parallel by the users (3 to 5 at most)
- Efficiency of the conversation must be maximal to keep user interest
- Clear and intuitive user guidance: the user should easily understand what he can do
- Limited information transfer while keeping maximum value for the user
  = **maximisation of Knowledge exchanged**

User’s point of view

- User needs Knowledge (information for his goals)
- Recursively, User defines his goals while acquiring knowledge.
- User gradually learns about the vocal application and about its content.
- User « models » the application’s behaviour to predict it and to deduct its abilities.

Interaction from Application point of view

- The goals of the Application must be very well defined by the Publisher.
- The Application should « model » user's behaviour by acquiring information about his actions and about the satisfaction of his goals.
- The Application should adapt itself to capabilities and goals of each User.
- The Application should provide statistics in relation with Publisher’s goals.

Adaptation of the User Interface

For Screen or Vocal applications

1. "Topic of the day" which gives information about features not experienced by the user but somewhat linked to features he already used
2. Reduced number of options presented first (like newer MS-Windows applications)
3. Pre-opening of instances of data frequently or recently accessed
4. Messages about new information available for some of the sub-Classes frequently accessed
5. Evolution of current user transactions
6. Windows sizes and positions for the different instance types and classes displayed
7. For vocal systems, we need numerous other features (verbosity, confidence level of recognition, etc.)

3. Ontology, why?

- Information systems are better built if they model databases, users and their dialogues in a very flexible way.
- Ontology is about organising (thesaurus: meta-information), collecting (instances) and managing (rules) knowledge (information with a goal).
- Ontology Management Softwares, based on Java, like Protégé 2000, therefore are very flexible tools to design and to implement Information systems.

Ontology = Thesaurus **+ Data + Rules**

- A Thesaurus permits to organise all the concepts a user may use within an application.
- For each concept, the whole terminology is gathered:
  - Synonyms at different levels of equivalence *(Boat, Ship, Sailing ship*)
  - Multilingual Translations *(Bateau, Boot, Ship, Barca, etc.)*
  - Phonetic Information
- Users' requests become Searches by Concepts, whatever terminology they used.

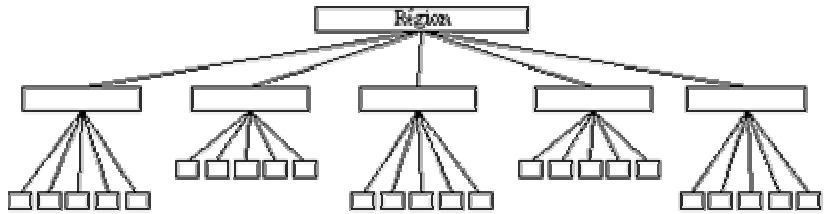
Phonetic Information

The following can be well managed thanks to the Thesaurus:

1. **TTS = Text to Speech Synthesis**
   - Phonetic spelling of Proper names with unusual pronunciations
   - Determinants for different situations encountered in generated sentences *(by boat, on a ship)*
2. **ASR = Automatic Speech Recognition:**
   - Phonetic transcription such as the one for TTS
   - Grammar for names with different forms in users utterances *[(sail[ing])|steaming](ship|boat)*

Ontology = Thesaurus **+ Data + Rules**

- A Multilingual Thesaurus complies to standard ISO 5964



- A Thesaurus permits to build generalisation hierarchies from the gathered concepts.
- Poly-hierarchies are often useful.
- *Classes and subclasses in Protégé*

Ontology = **Thesaurus** + Data + **Rules**

- The "instances" in the Ontology provide "solutions" to the users, solutions made of explanatory texts (which can be eared by phone) and transaction possibilities (send an SMS, make a reservation, transfer the call, etc.).

- Each solution (instance) is indexed using a combination of concepts chosen in the hierarchies from the Thesaurus.

- A given combination has to be used by a minimal number of instances: for a precise need, there must be specific solutions.

- The application has to provide different means for the user to find a solution by naming it directly or by choosing with the assistance of the indexes.

Ontology = **Thesaurus + Data +** Rules

- At each step of a dialog with an user, GenIdex (a VocaBase module) analyses the subset of the database that may interest the user.

- Then, GenIdex generates propositions to the user, made from the most pertinent index choices in that database subset.

- From there, we want to add Rules to model in depth the details of a dialog. Rules would define dialog's actions based on information from the database and about the user. *Jess?*

4. Short Demonstration: +32 2 351 8243

- **« CapLiberté »: 237 tourist activities in France**
- **Current VocaBase Studio: http://www.vocabase.com**
- **Listening and visualising a short dialog**

« CapLiberté »

237 tourist activities in France

- France (237)
  - Alsace (20)
  - Ardèche (18)
  - Bretagne (27)
  - Charente (27)
  - Corse (24)
  - Côte Bretonne (30)
  - Côte d'Azur (21)
  - Côte d'Opale (14)
  - Isère (9)
  - Provence (17)
  - Somme (18)
  - Vendée (15)

- Activity (237)
  - Leisure (76)
    - Animations (10)
      - o casino (1)
      - o Festivals (1)
      - o Long-distance riding (1)
      - o Parades (3)
      - o show (3)
      - o Traditional celebrations (2)
    - Excursion (14)
      - o Boat excursions (11)
      - o Touristic trains (3)
      - o walk in carriage ()
    - Leisure Centre (11)
      - o Funfairs (3)
      - o leisure parc (1)
      - o Wildlife parks (4)
      - o health center (3)
    - Walk (47)
      - o Cycling (4)
      - o guided tour (9)
      - o short walk (34)
  - Nature (89)
    - Natural Places (61)
      - o Caves (5)
      - o Gorges (10)

Current VocaBase Studio:
http://www.vocabase.com

Address http://www.vocabase.com/cgi-bin/apptest/html/cgint.exe?1&tmpl=top&ulang=EN#

Qui sommes-nous? Contact VocaBase VocaBase Studio

Available design tools

VocaBase studio

VocaTest

FR - EN - NL

Your data
1) Structure
2) Download
3) Verification
4) Propositions
5) Dialogue
6) ASR
7) Tests

Web test
Phone test
Merlin Test

- Hi! You are in communication with a vocal server for tourist information. Please, press the "Star" key to skip the following introduction.
- I will propose you 237 activities.
- Would you like to go,
  to Charente,
  to Cote Bretonne,
  in Brittany,
  or in another region of France,
- You can say 'help' or press the # for getting help
- (*Language* - *Fr* - *En* - *Nl*)

Speech text to synthesise

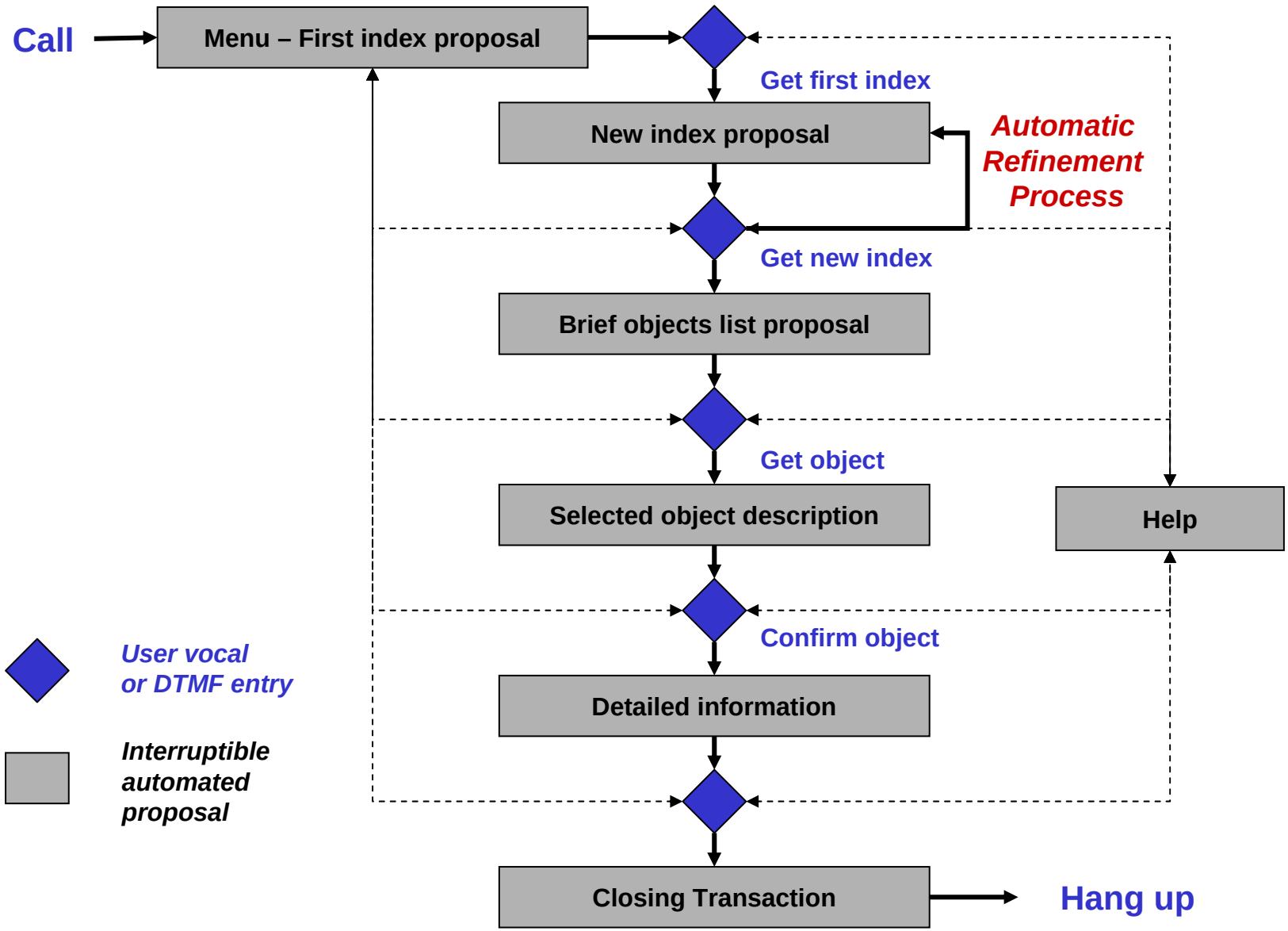
Choices to recognise and touch tones options

- [1]: Charente
- [2]: Breton coast
- [3]: Brittany
- [4]: in another region of France
-
- France;
  - Alsace;
  - Charente;
  - Corse;
  - Provence;

up back

Share your comments

Done Internet


Call
Menu – First index proposal
Get first index
New index proposal
Automatic Refinement Process
Get new index
Brief objects list proposal
Get object
Selected object description
Help
Confirm object
Detailed information
Closing Transaction
Hang up
User vocal or DTMF entry
Interruptible automated proposal

Current VocaBase Studio:
Data and Dialog Management

VocaBase Studio - VocaTest - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://www.vocabase.com/cgi-bin/apptest/html/cgint.exe?1&tmpl=top&ulang=EN#

Qui sommes-nous? Contact VocaBase VocaBase Studio

VocaBase studio

VocaTest

FR - EN - NL

Your data

1) Structure

2) Download

3) Verification

4) Propositions

5) Dialogue

6) ASR

7) Tests

General structure of your data

How does it work?

1. Select all the languages in which your data is translated.
2. Insert your object type in each language. You must only have one object type (possible adjustment if required). In our application example, the objects are "activities".
3. Insert the names of your different types of indexes in each language. You can have a maximum of 4 different indexing types. In our application example, we have taken three indexes: "regions", " types of activity " and the " target group ".
4. Validate.
5. Go then to the "loading" page to load the files containing your data, into VocaBase™ Studio, taking the available example file as a model.

Requested information

Language

☑ French ☑ English ☑ Dutch ☐ Italian ☐ German ☐ Spanish

Name of your objects

French : Activités

English : Activities

Dutch : Activiteit

Names of the different indexes of your objects

Index Nr	1	2	3	4
French :	Types d'activité	Régions	Public	Date

up back

Share your comments

Internet

Start

VocaBase Studio - Voc...

5:55 PM

Listening and Visualising a short dialog

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Hi! You are in communication with a vocal server for tourist information.

I can propose you 237 activities.

Would you like to go,
to Brittany,
to Charente,
to Corse,
to Cote Bretonne,
or in another region of France

You can say 'help' or press the # for getting help

-I would like to go to Corse

You have selected Corse.,

There are now 24 activities left that may interest you.

Do you prefer,
the Panorama,
or other types of Leisure,
the Sports,
the Historical Monument,
or other types of Visits,

Otherwise, say 'return' or press the zero to return to your previous choice.

-*What about the sports ?*

You have selected Sports.,
There are now 13 activities left that may interest you.

Do you prefer,
the Walk,
the Trekking,
the Water Sports,

-*Tell me about scuba diving.*

You have selected Scuba diving.,
There are now 4 activities. Here is the list:

First activity,
The Propriano beach

Second activity,
Diving and rest at Ajaccio

Third activity,
Rambling and discovery in Corsica

Fourth activity,
Diving at the Rousse island

Choose one of these Activities :

1: Propiano

2: Ajaccio beach

3: discovering Corsica

4: diving at the island

-*I prefer the fourth activity*.

You chose :

Diving at the Rousse island

Well known seaside resort, the Rousse island offers numerous water sports to be done alone or with the family. A diving school organises excursions for children only, they are protected by professionals. You can also dive at night and do a lot of exploring, from starters to confirmed divers.

Return to your previous choice or choose another of those activities,
1:propiano,
2:ajaccio beach,
3:discovering corsica

5. It is all about Modelling...

Models for:

- Data
- Terminology
- Phonetic Information
- Users characteristics
- Dialogs
- Processes

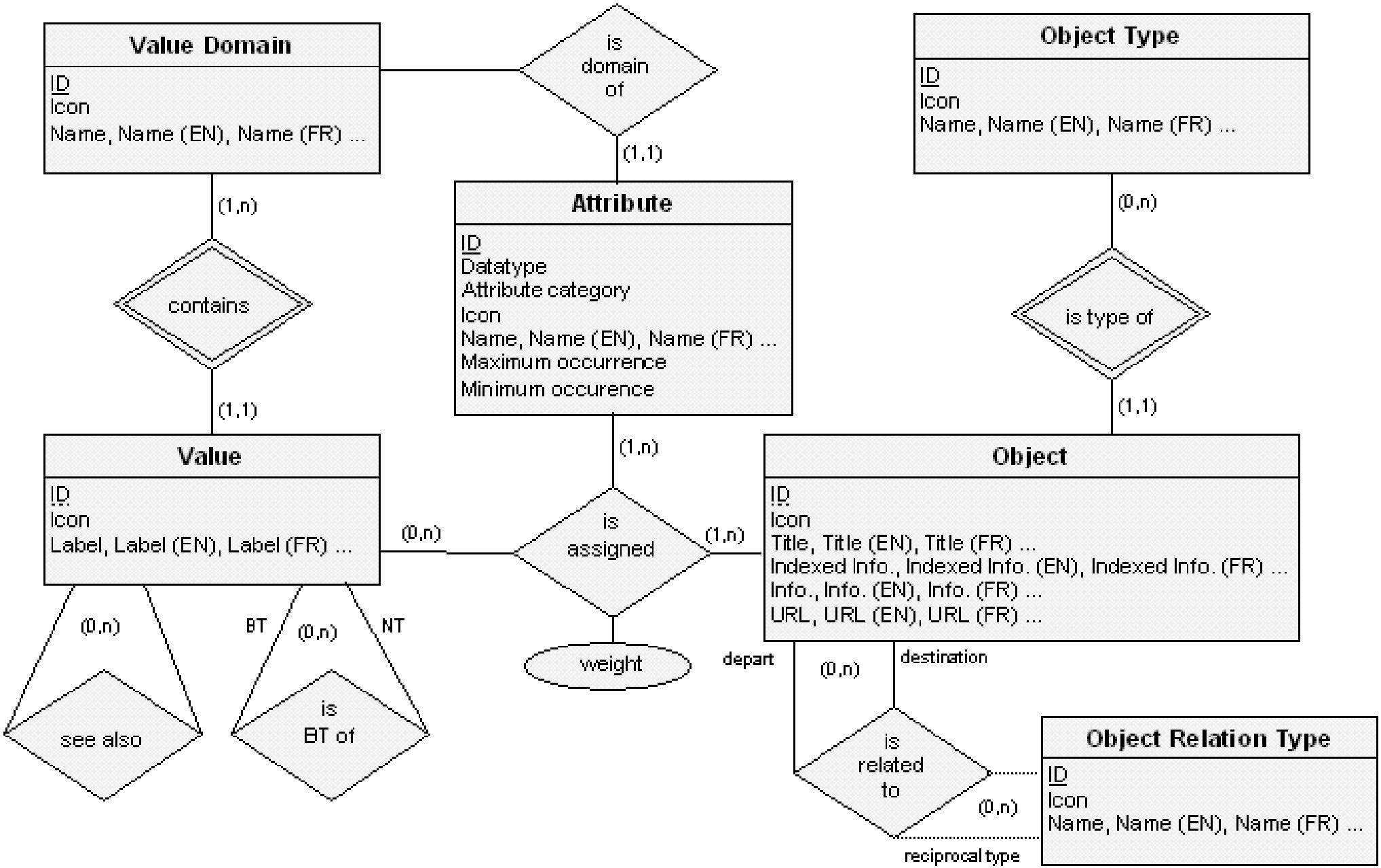
So it is a job for Protégé…

- Instance for each entry in the Catalogue
- Slot (field) for each information of an instance
- Relations between instances
- Classes and subclasses for the different types of slots collecting terms (each term is an instance) and phonetic information
- Classes and subclasses for the Catalogue Indexes
- Classes and instances to categorise users and collect information about them
- Instances to collect measures and to record steps of the dialog in each telephone sessions
- Rules for dialog management based on this data

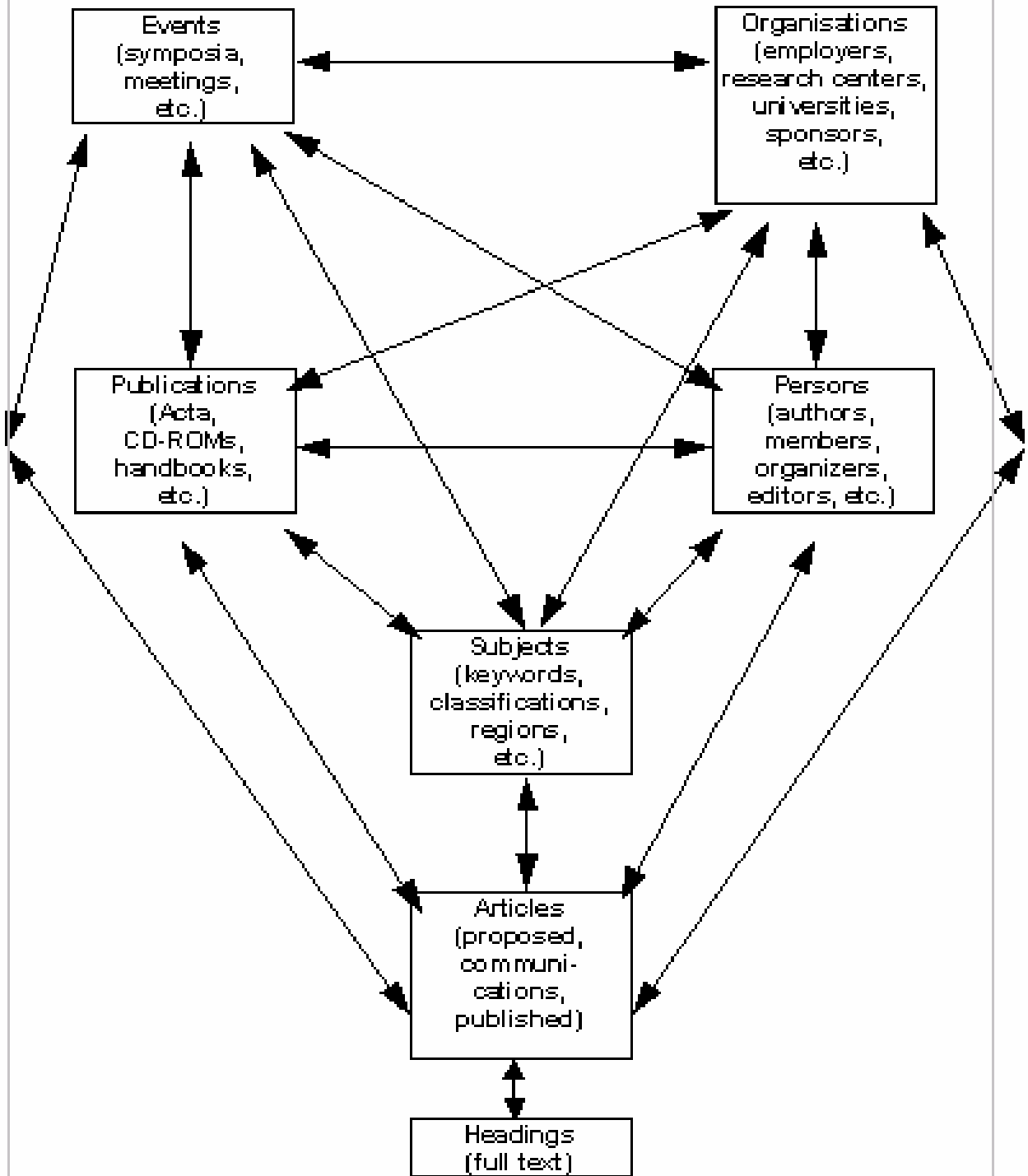
Database Modelling

- Most « catalogues » (products, books, records, travels, FAQs, etc.) have rather similar *overall* data models
- Linked information (transaction data) is varying much more from one application to another
- In an Ontology managed with Protégé 2000, you can model and store:
  1. the classes of information available in the system
  2. the classes of (trans)actions available in the system
  3. most of the instances (data) available to the users.
- Other data sources needed by transactions are easily available using Java integration tools.

Generic Database Structure



Example of a Specific Database Structure



Terminology Management

- For each concept used to retrieve data (entry in the index), specify the « accepted term » (normalised spelling) to name it.
- Translate those terms in all languages of the application
- Insure to have the correct determinants (« in », « on », « about », etc.) for the different sentences which may use the accepted terms
- Gather all other terms a user may use which are synonyms, antonyms, quasi synonyms, etc.
- Hierarchies (generalisations) must be understandable from the user's point of view (top classes must be the most evident: generalisation by abstraction has to be avoided)

User’s Profile

1. User’s basic information collected to complete transactions (name, address, etc.) [instances of user data]
2. Information classes and/or actions (classes) which are **allowed / known / effectively used** (time ranges, frequencies, other user benefit measures) [links from users to classes with associated measures]
3. Sessions (conversations) made by the user with the system and ability/interests measurements (topics searched, "errors" made, recognition confidence levels, repetitions needed, etc.) [instances of session data linked to user and to classes involved in the session]

The profile information being included in the model from the beginning, application development including "user tracking" is then not much more efforts than developing an application "amnesic" about its users.

Global Dialog Modelling

- VocaBase/GenIdex logic is based on the classical « Information Retrieval » procedure which aims at identifying, for each dimension (index), the concepts corresponding to user's needs (at the right level of genericity): this logic is very efficient for most searches in « catalogues ».
  This is a data driven dialog model…
- We have to enrich this model to better take into account the user's profile (previous sessions, recognition confidence levels, etc.) while keeping low the parametrisation efforts for new applications.

Detailed Dialog Modelling

- Most systems model the vocal dialogs with flowcharts which must be regularly revised: this is good for simple dialogs or for « welcome » dialogs (when very few user adaptation is needed)
- We want to build a « Dialog Engine » where all the dialog details (user adaptation, error recovery, transaction specifics, etc.) are solved by (Jess?) rules applied on Database and Users data

Process Modelling

- Users' Transactions are often interacting with other computer systems. The Vocal Server is part of a global process.
- Transactions need and generate data which should be modelled as part of the Ontology (catalogue or user profiles).
- Process information is often kept in other systems (SQL tables, Web Services, etc.)
- (Jess?) Rules should define Process constraints and reflect them in the generated dialogs
- VoiceXML files can be used for specific details (e.g. getting a credit card number, a phone number, etc.)

Development Agenda

- Up to end of october 2003: Voice XML generation from a Protégé Ontology (« Information Retrieval » dialog logic)
- Up to end of 2003: Integration with a Content Management System like OpenCMS
- 2004: Implementation of User Adaptation (Jess?);
  Integration of a good search engine;
  Scalability and Optimisation
  (size of data, time to process)