



Metamodeling

*What is Metamodeling?
Dimensions on Metamodeling
Requirements on Metamodels
The Information Resource Dictionary
Standard (IRDS)
Repositories*



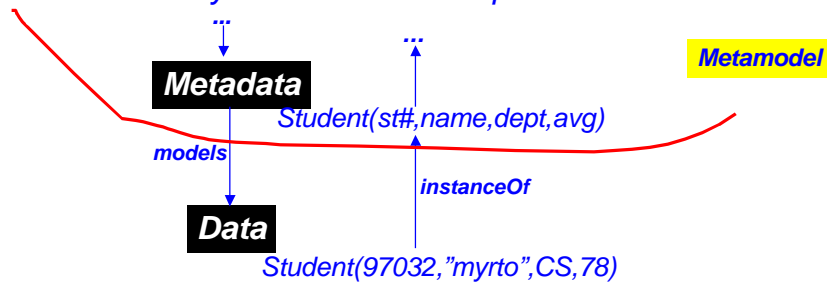
What is Metamodeling?

- “Meta” means literally “after” in Greek.
- Meta-related themes have fascinated people throughout the centuries, e.g., [Hofstadter79] [Gaarder94]
- In Computer Science, the term is used heavily and with several different meanings:
 - ✓ In Databases, metadata means “data about data” and refer to data dictionaries, repositories, etc.;
 - ✓ In Programming Languages, metainterpreter is an interpreter of a (program) interpreter [Smith84]
 - ✓ In Conceptual Modeling, metamodel is a model of a data model, e.g., an E-R model of the relational model, or an ER model of the ER model.



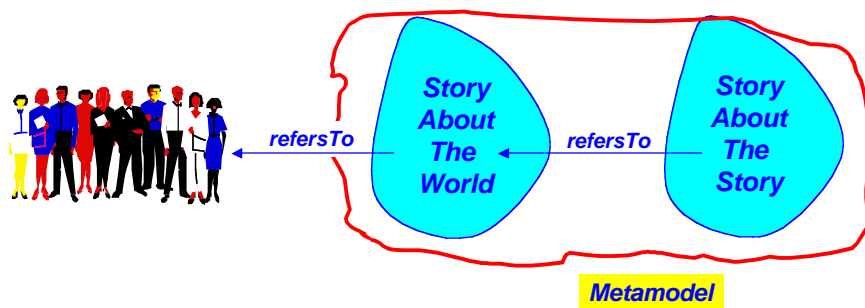
Metamodeling

- Data is modelled by metadata (“schemas”, “classes”,...) which are parts of the metamodel; these units are instances of meta²data which are parts of a metamodel, etc.
- We’d like to have metamodels which are self-descriptive to an arbitrary level of self-description.



Another Dimension of Metamodeling

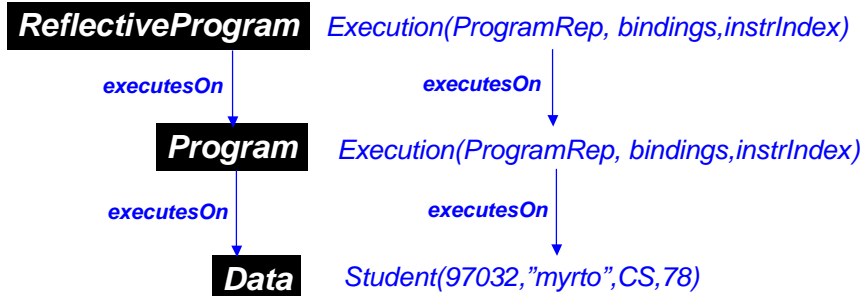
- The world is modelled by a story; the story is modelled by a metastory...[Gaarter94]





...and Another...

- A program execution operates on data; a metaexecution operates on a program execution,....[Smith84]



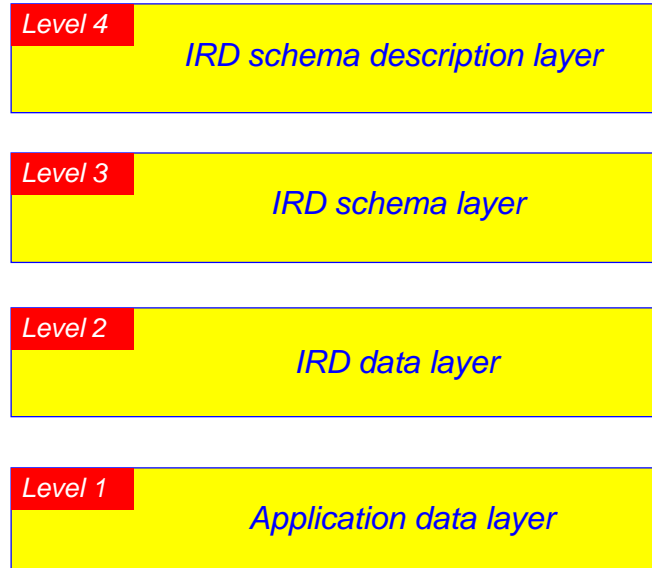
Requirements on Metamodeling Notations

- Should be capable of describing other conceptual models, e.g., the ER model, or SADT.
- Support facilities for defining primitive concepts, such as entity, activity, goal within the metamodel.
- Offer support for modeling multiple, possibly contradictory perspectives, e.g., Maria at different times, from different viewpoints;
- Support variable granularity descriptions, as with geographic information;
- Support a variety of referential relationships, such as defines, denotes, mentions, includes, etc.



IRDS - Information Resource Dictionary Standard

- Data dictionary standard, since 1988 (ANSI X3.138)
- Technology-independent standard, akin to ER model.
- Proposes 4 different levels of data:
 - ✓ Bottom level -- application data, e.g., software code;
 - ✓ Level 2 -- data dictionary for application data, e.g., identifiers for procedures, variables, data types, etc.
 - ✓ Level 3 -- schema for the data dictionary, e.g., what is a procedure (in the programming language the code is written in), what is a variable,...
 - ✓ Level 4 -- different types of IRDS schemas, e.g., programming language schemas vs requirements modeling ones.

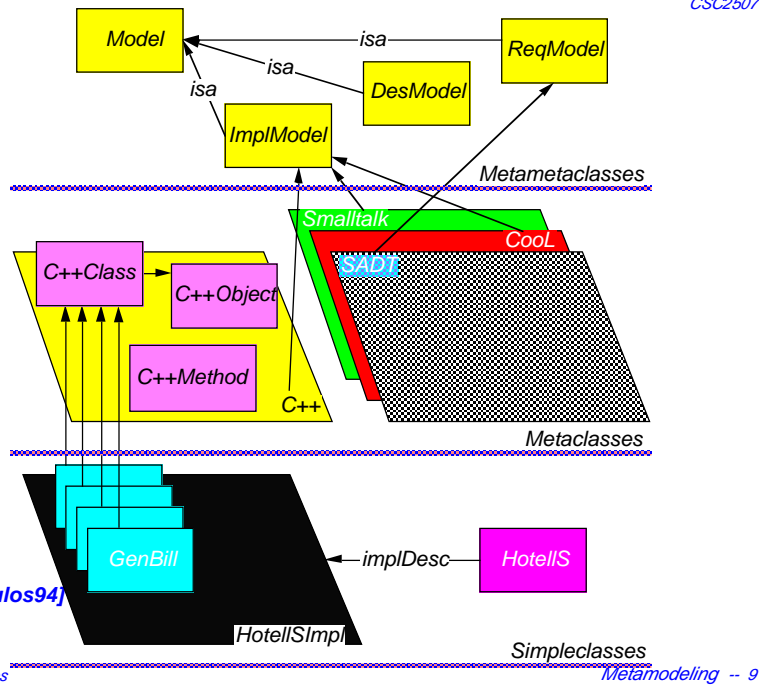




Telos
version
of levels
2-4

[Constantopoulos94]

© 2004 John Mylopoulos



Metamodeling -- 9



Repositories

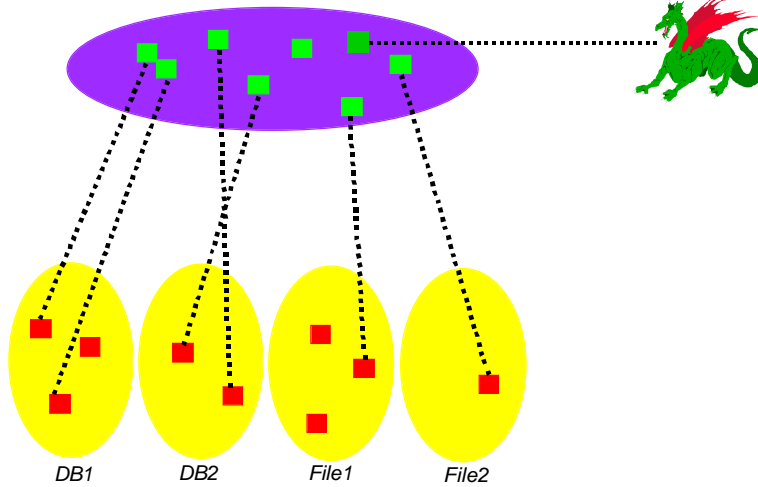
- A (data) repository stores and manages information about one or more data sources.
- A repository system consists of a conceptual model (often akin to ER model), a model base (information/data/knowledge base, operations for doing retrievals, updates, check-in/check-out, etc).
- There are many commercial repository products,
 - ✓ Many are hard-coded meta-models (commodity tools)
 - ✓ Most run on RDBMSs (Platinum, SAP, Oracle, MS, ...)
 - ✓ Some based on proprietary DBMS (Softlab, Viasoft)
 - ✓ A few run on OODBs (IBM, Unisys)

© 2004 John Mylopoulos

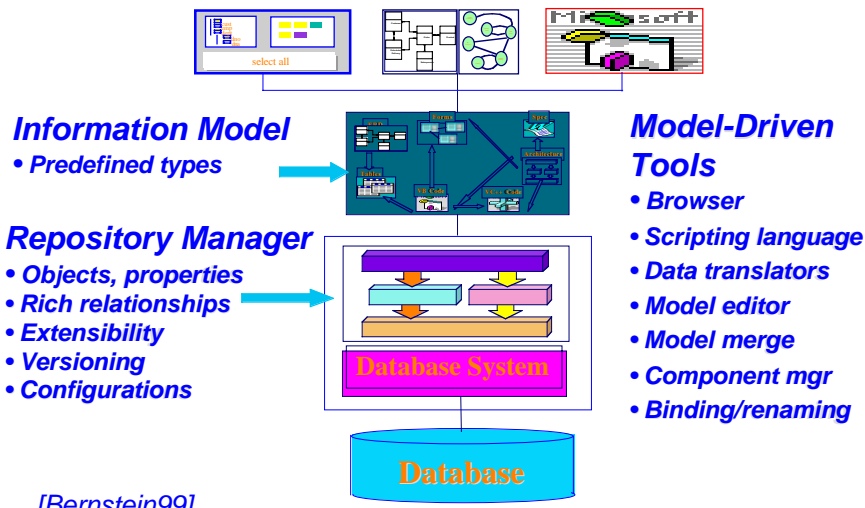
Metamodeling -- 10



Repositories as Metadata Managers



A Repository Product



[Bernstein99]



References

- [Bernstein99] Bernstein, P., "Using Meta-Data to Conquer Database Complexity", Colloquium presentation, University of Toronto, October 1999; <http://www.research.microsoft.com/~philbe>.
- [Gaarder94] Gaarder, J., *Sophie's World*, Farrar, Straus and Giroux Inc., 1994.
- [Hofstadter79] Hofstadter, D., *Godel, Escher, Bach: An Eternal Golden Braid*, Vintage Books, 1979.
- [Smith84] Smith, B. C., "Reflection and the Semantics of Lisp", *Proceedings of the Eleventh Annual Conference on Principles of Programming Languages (POPL)*, Salt Lake City, 23-35, 1984.