What Goes Around Comes Around

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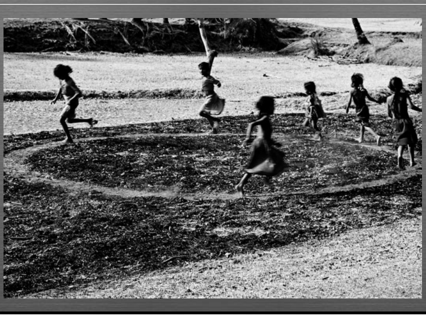


Summary

- 9 epochs in database research:
  - Hierarchical, Network, Relational, Entity-Relationship, Extended Relational, Semantic, Object-oriented, Object-Relational, Semi-structured.
- We are repeating old ideas.
- We are failing to learn from old mistakes.

Hierarchical (IMS) (late 60s-70s)

Pros:

- facilitates simple data manipulation language (DL/I)

Cons:

- Information is repeated
- Existence depends on parents
- no physical data independence (can't tune physical level without tuning app)
- Not much logical data independence either (can't tune schema without changing app (think views))

Lessons From Hierarchical:

Lesson 1. Physical and logical data independence are highly desirable

Lesson 2. Tree structured data models are very restrictive

Lesson 3. It's a challenge to provide sophisticated logical reorganizations of tree structured data

Lesson 4. Record-at-a-time user interface forces manual query optimization (hard!)

Directed Graph (CODASYL) (70s)

Pros:

- Yeah! Graphs, not trees!
- Can model many-to-many relationships

Cons:

- Still no physical data independence.
- Much more complex than IMS
- Lesson 5: Directed graphs are more flexible than hierarchies, but more complex
- Lesson 6: Loading and recovering directed graphs is more complex than hierarchies

Discussion

Do you agree with the claim that the only two "new" concepts developed in the last 20 years were:

1. code in the database and
2. schema last applications?

Relational (70s-early 80s)

Pros:

- Store the data in a simple data structure
- Access through a high level set-at-a-time DML
- No need for a physical storage proposal

Lots of good arguing by various sides "the great debate"

Non-technical factor: CODASYL systems were not portable → not porting to first microprocessors (VAX) (whoops)

Lessons from Relational:

Lesson 7: Set-at-a-time languages are good; offer improved physical data independence

Lesson 8: logical data independence is easier with a simple data model than with a complex one

Lesson 9: Technical debates are usually settled by the elephants of the marketplace, and often for reasons not related to technology

Lesson 10: query optimizers can beat all but the best record at a time DBMS application programmers

Entity-Relationship (70s)

- Response to normalization
- Standard wisdom: create table, then normalize. Problems for DBAs:
  1. Where do I get initial tables
  2. Can't understand functional dependences
- Lesson 11: Functional dependencies are too difficult for mere mortals to understand. Another reason for KISS

Extended Relational (80s)

- How many features must relational databases have…
  - Set valued attributes
  - Aggregation
  - Generalization
  - And many, many more

Lesson 12: unless there is a big performance or functionality advantage, new constructs will go nowhere

Semantic (late 70's and 80's) (SDM)

- Similar ideas, but more radical; change whole model to be semantically richer.
- Lots of machinery, little benefit. Died without a trace.

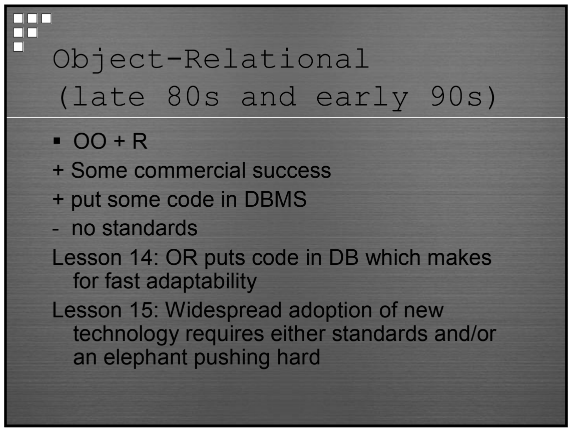
Object-oriented (late 80's and early 90's)

+Support OO languages

-market failure: no leverage, no standards, some versions had reliance on C++

Lesson 13: Packages will not sell to users unless they are in "major pain"

Lesson 14: Persistent languages will go nowhere without support of PL community



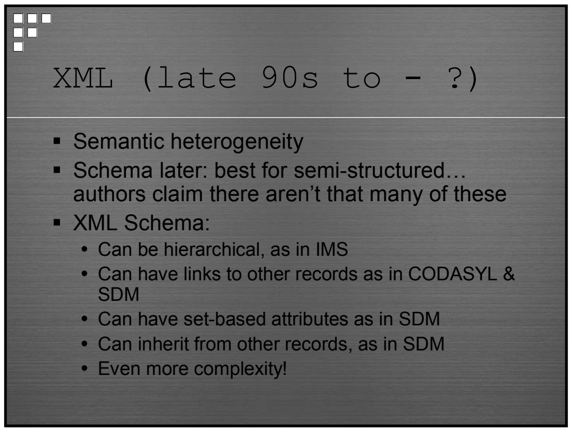
Object-Relational (late 80s and early 90s)

- OO + R

+ Some commercial success
+ put some code in DBMS
- no standards

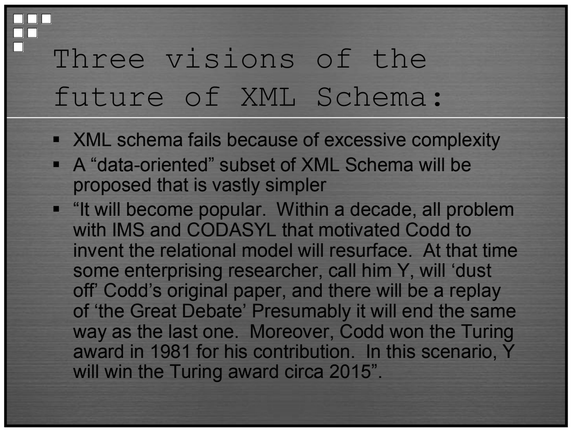
Lesson 14: OR puts code in DB which makes for fast adaptability

Lesson 15: Widespread adoption of new technology requires either standards and/or an elephant pushing hard



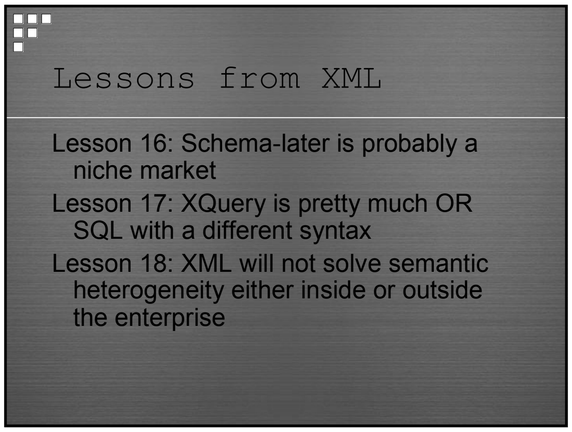
XML (late 90s to - ?)

- Semantic heterogeneity
- Schema later: best for semi-structured… authors claim there aren't that many of these
- XML Schema:
  - Can be hierarchical, as in IMS
  - Can have links to other records as in CODASYL & SDM
  - Can have set-based attributes as in SDM
  - Can inherit from other records, as in SDM
  - Even more complexity!



Three visions of the future of XML Schema:

- XML schema fails because of excessive complexity
- A "data-oriented" subset of XML Schema will be proposed that is vastly simpler
- "It will become popular. Within a decade, all problem with IMS and CODASYL that motivated Codd to invent the relational model will resurface. At that time some enterprising researcher, call him Y, will 'dust off' Codd's original paper, and there will be a replay of 'the Great Debate' Presumably it will end the same way as the last one. Moreover, Codd won the Turing award in 1981 for his contribution. In this scenario, Y will win the Turing award circa 2015".

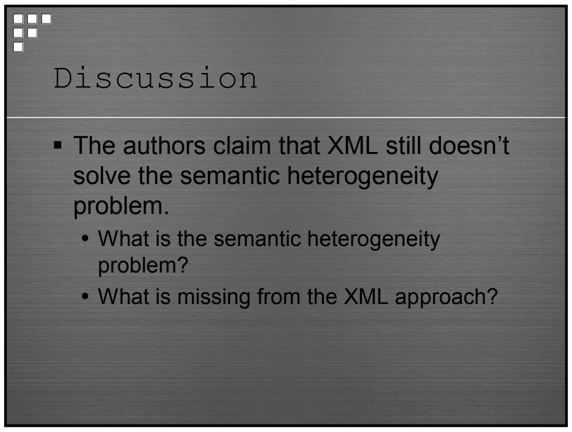


Lessons from XML

Lesson 16: Schema-later is probably a niche market

Lesson 17: XQuery is pretty much OR SQL with a different syntax

Lesson 18: XML will not solve semantic heterogeneity either inside or outside the enterprise



Discussion

- The authors claim that XML still doesn't solve the semantic heterogeneity problem.
  - What is the semantic heterogeneity problem?
  - What is missing from the XML approach?