

# DATABASE MANAGEMENT SYSTEMS



AN OVERVIEW OF DBMS

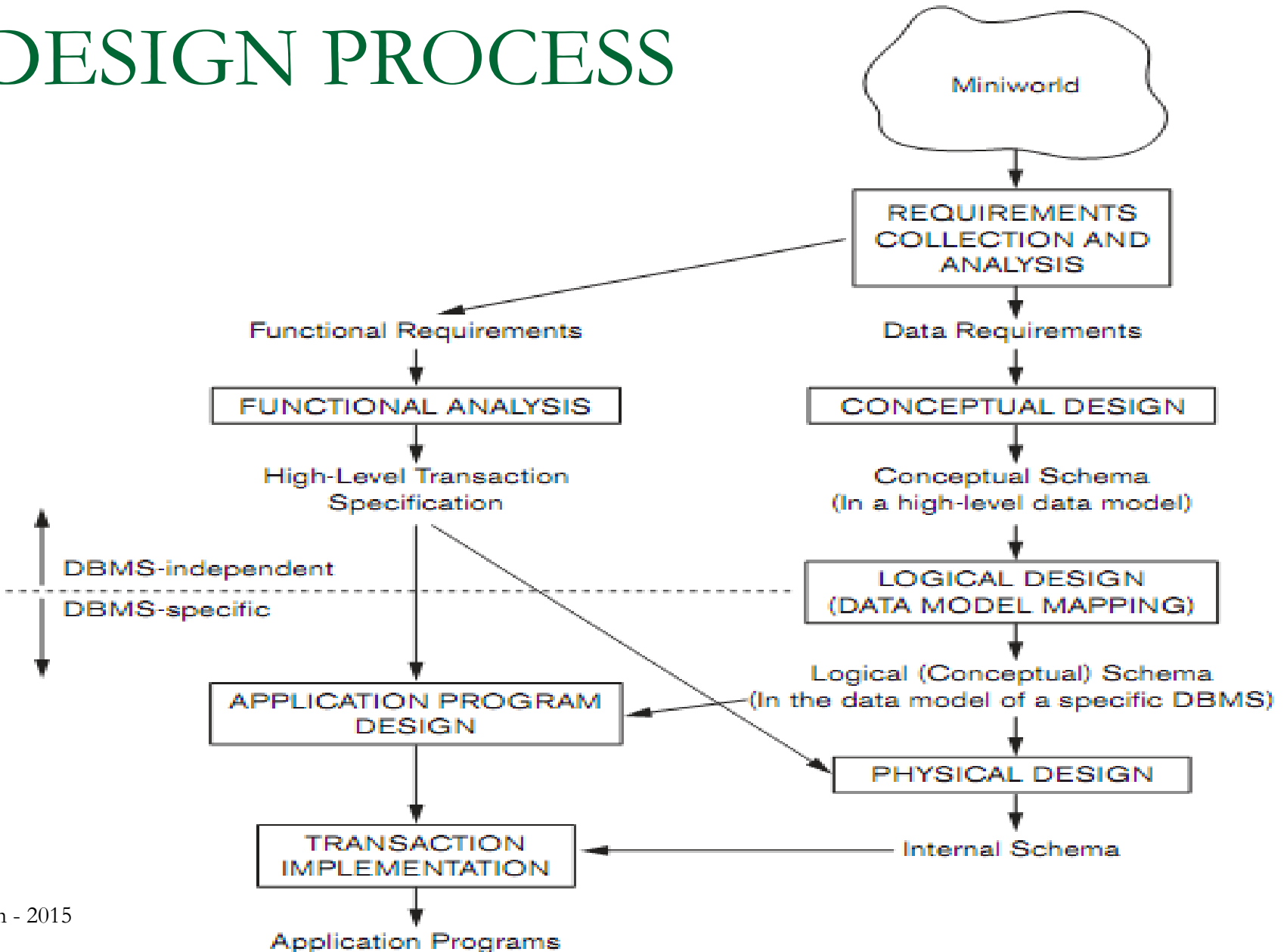
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# DATABASE SYSTEMS REMARKS

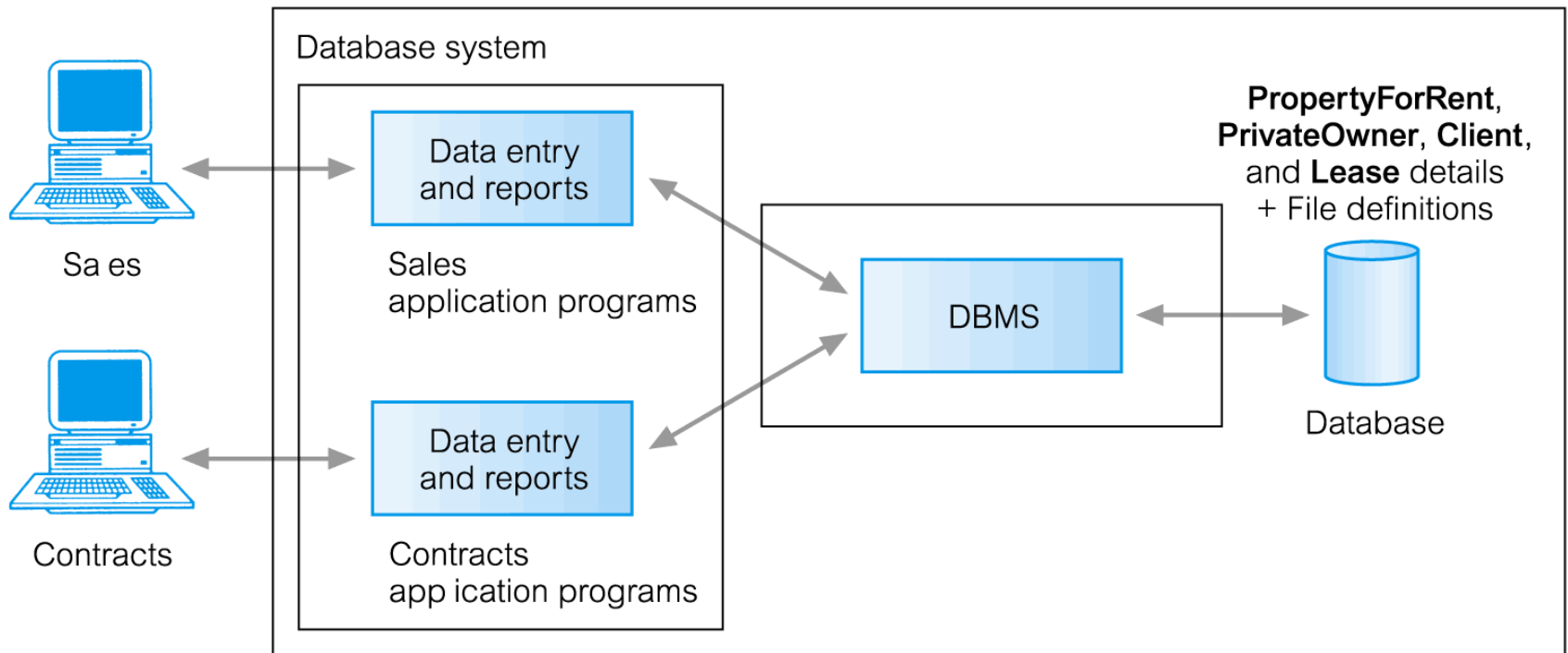
- Key concepts
- Database design process
- DBMS
- SQL
- Relational algebra

# OVERVIEW OF DATABASE DESIGN PROCESS



# KEY CONCEPTS

1. **Data**
2. **Information**
3. **Metadata**
4. **Database (DB)**
5. **Database Management System( DBMS)**
6. **Database System (DBS)**
7. **Data Model**
8. **Database Schema**
9. **Database State**
10. **Relation**
11. **Relation Cardinality**
12. **Relation Degree**
13. **Database Normalization**
14. **Primary key, candidate key, superkey, foreign key, partial key, surrogate key**



**PropertyForRent** (propertyNo, street, city, postcode, type, rooms, rent, ownerNo)

**PrivateOwner** (ownerNo, fName, lName, address, telNo)

**Client** (clientNo, fName, lName, address, telNo, prefType, maxRent)

**Lease** (leaseNo, propertyNo, clientNo, paymentMethod, deposit, paid, rentStart, rentFinish)

# WHAT IS A DBMS?

- **DataBase Management System (DBMS):** a **general-purpose software system** that facilitates the processes of **defining**, **constructing**, **manipulating**, and **sharing** databases among various users and applications (or a software system that enables users to define, create, maintain, and control access to the database)
- A DBMS is a powerful tool for creating and managing large amount of data efficiently and allowing it to persist over long periods of time safely.

# DBMS CAPABILITIES

The capabilities that a DBMS provides the user are:

- **Persistent Storage.** A DBMS supports the storage of very large amounts of data that exists independently of any processes that are using the data.
- **Programming Interface.** A DBMS allows the user to access and modify data through a powerful query language.
- **Transaction management.** A DBMS supports concurrent access to data, i.e., simultaneously access by many distinct processes (called transaction) at once. To avoid some of the undesirable consequences of simultaneous access, the DBMS supports:
  - isolation
  - atomicity
  - resiliency

# HISTORY OF DATABASE SYSTEMS AND DBMS



1960s: Flat-File, Hierarchical, Network Databases.

1970s: Relational DBMS – RDBMS)

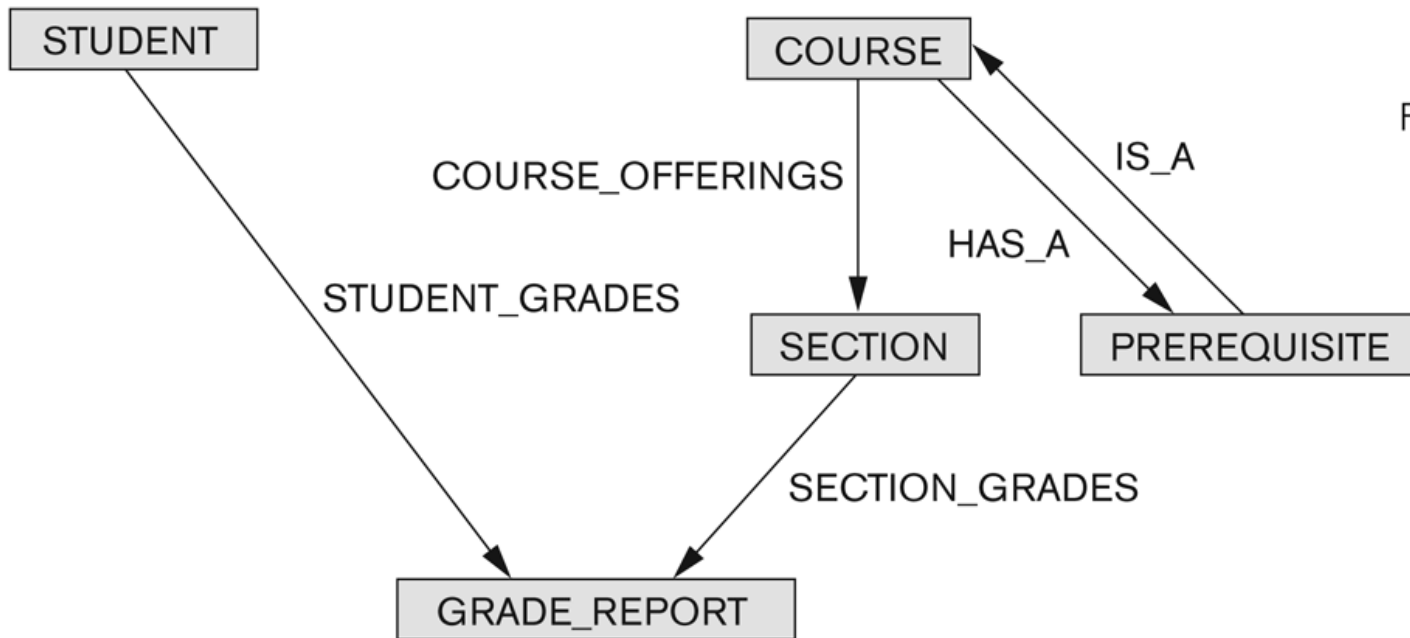
1980s: Object-Oriented, Distributed DBMS

1990s: Object-relational model) – ORDBMS, OLAP, data mining, data warehouse, multimedia DB

2000s: XML DB, bioinformation, data stream, sensor network, NoSQL



# EXAMPLE OF NETWORK MODEL SCHEMA



**Figure 2.8**

The schema of Figure 2.1 in network model notation.

# EXAMPLE OF RELATIONAL MODEL SCHEMA

## COURSE

Course_name	Course_number	Credit_hours	Department
Intro to Computer Science	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database	CS3380	3	CS

## SECTION

Section_identifier	Course_number	Semester	Year	Instructor
85	MATH2410	Fall	04	King
92	CS1310	Fall	04	Anderson
102	CS3320	Spring	05	Knuth
112	MATH2410	Fall	05	Chang
119	CS1310	Fall	05	Anderson
135	CS3380	Fall	05	Stone

## GRADE\_REPORT

Student_number	Section_identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

## PREREQUISITE

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

**Figure 1.2**  
A database that stores  
student and course  
information.

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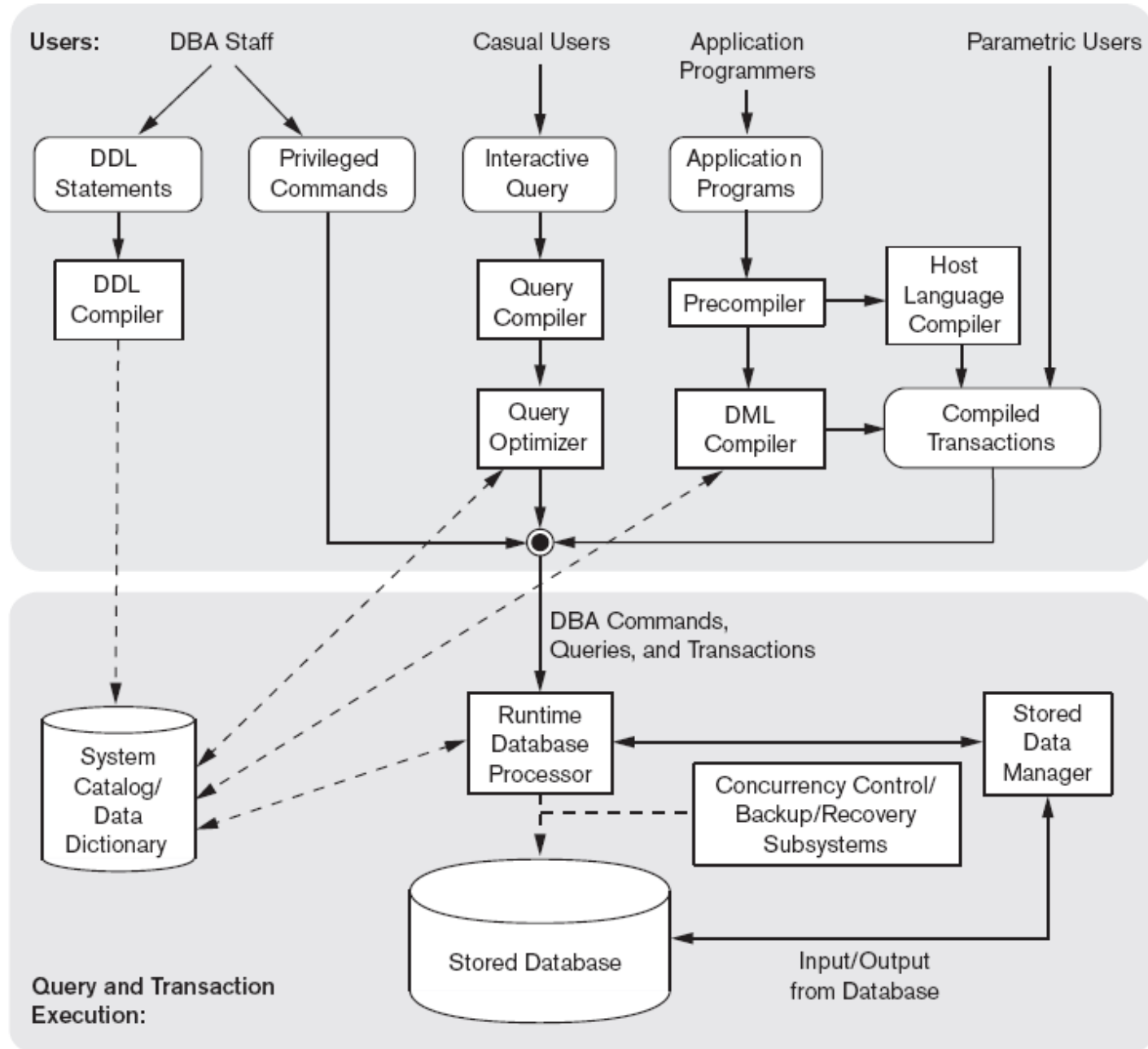
# THE DATABASE SYSTEM ENVIRONMENT (1 / 2)

- **DBMS component modules**
    - **Buffer management**
    - **Stored data manager**
    - **DDL compiler**
    - **Interactive query interface**
      - **Query compiler**
      - **Query optimizer**
    - **Precompiler**
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## THE DATABASE SYSTEM ENVIRONMENT (2/2)

- **DBMS component modules**
    - **Runtime database processor**
    - **System catalog**
    - **Concurrency control system**
    - **Backup and recovery system**
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**Figure 2.3**  
Component modules of a DBMS and their interactions.

# (RELATIONAL) DBMSs IN PRACTICE

- MySQL
- Oracle
- MS SQL Server
- IBM DB2
- ...



# DISCUSSION



WHAT'S MORE?



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# SQL

- SQL review
- Relational Algebra



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# REFERENCES

1. R. Elmasri & S.B. Navathe, AddisonWesley, Fundamentals of Database Systems, 7th Edition, 2016.
2. H. G. Molina, J. D. Ullman, J. Widom, Database System Implementation, Prentice-Hall, 2000.
3. A. Silberschatz, H.F. Korth & S. Sudarshan, Database Systems Concepts, 6th Edition, McGraw-Hill, 2006.
4. H.G. Molina, J.D. Ullman & J. Widom, Database Systems – The Complete Book, PrenticeHall, 2002.
5. T. Connolly & C. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, 6<sup>th</sup> Edition, Addison-Wesley, 2015.

# QUESTIONS AND ANSWERS



Picture from: <http://philadelphiaculpturegym.blogspot.com/2013/09/save-date-free-talk-and-q-on-affordable.html>