Ministry of Higher Education and Scientific Research
Djilali BOUNAAMA University - Khemis Miliana(UDBKM)
Faculty of Science and Technology
Department of Mathematics and Computer Science

Chapter 1

Introduction & Basics

AIBD-M1-UEF22 : Advanced Databases

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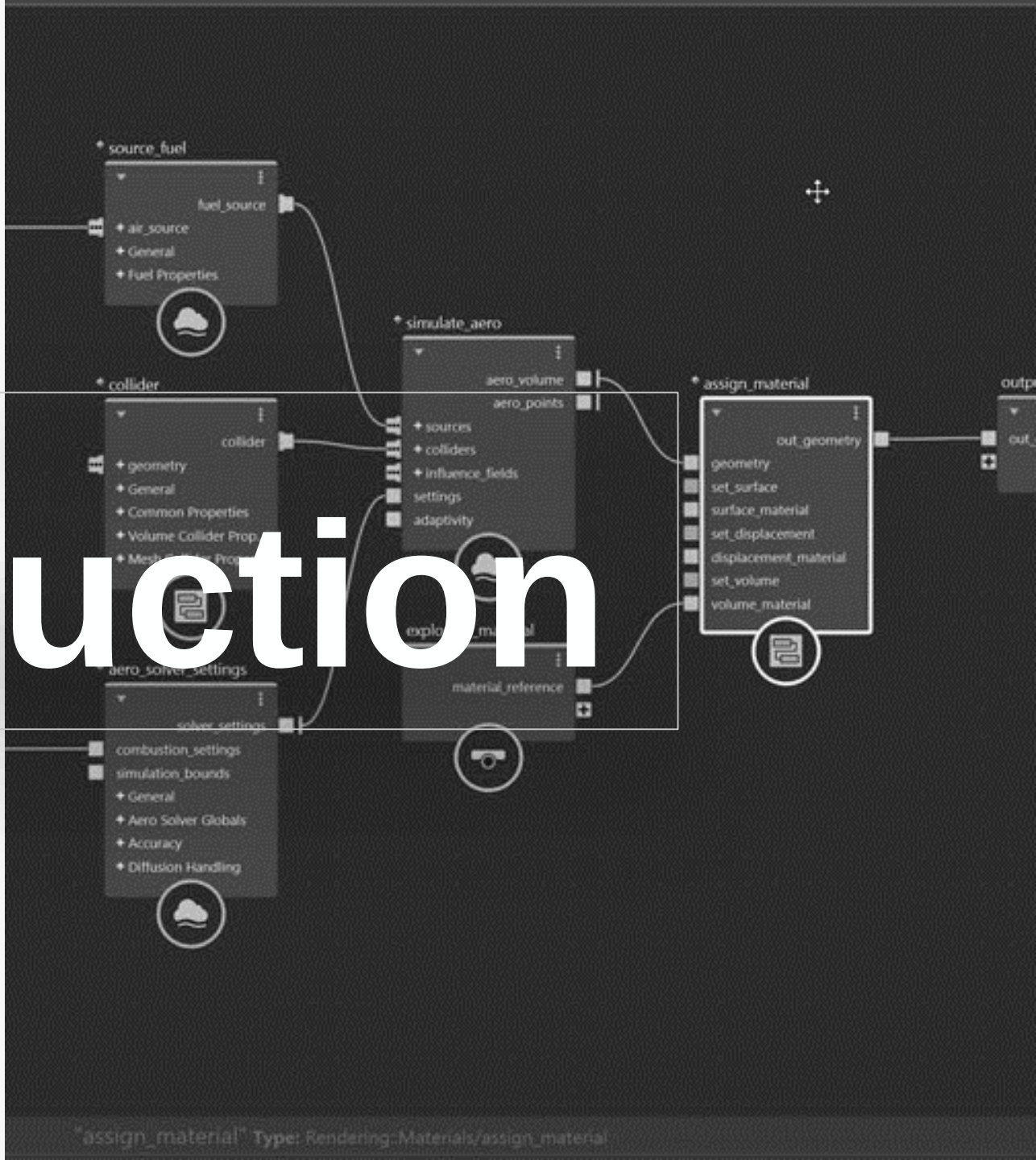
Course Topics

1. Introduction
2. Definitions & Basics
3. Data Model
4. SQL
5. References

Introduction



Curriculum

1- Semestre 1 :

Unité d'Enseignement
UE fondamentales
UEF11(O/P)
Algorithmique Avancée et Complexité
Optimisation Combinatoire
UEF12(O/P)
Apprentissage Automatique
Intelligence Artificielle : Principes et Applications
UE méthodologie
UEM11(O/P)
Analyse de Données
Introduction aux Sciences de Données
UE découverte
UED11(O/P)
Cybersécurité
UE transversales
UET11(O/P)
Anglais Scientifique
Total Semestre 1

2- Semestre 2 :

Unité d'Enseignement
UE fondamentales
UEF21(O/P)
Apprentissage Profond
Méta-heuristiques et Algorithmes évolutionnaires
UEF22(O/P)
Bases de Données Avancées
Data Mining
UE méthodologie
UEM21(O/P)
Ingénierie du logiciel
Business Intelligence et Visualisation de données
UE découverte
UED21(O/P)
Internet des Objets
UE transversales
UET21(O/P)
Méthodologie de la Recherche Scientifique
Total Semestre 2

3- Semestre 3 :

Unité d'Enseignement
UE fondamentales
UEF31(O/P)
Apprentissage Profond Avancé
Big Data et Cloud Computing
Technologies des Agents
UE méthodologie
UEM31(O/P)
Vision par Ordinateur et Traitement d'Image
Traitement Automatique du Langage Naturel
Web Sémantique et Données Liées
UE découverte
UED31(O/P)
Introduction à la robotique
UE transversales
UET31(O/P)
Entrepreneuriat et Startup dans le Numérique
Total Semestre 3

Objectives

- ✓ Present the architecture and internal functioning of current DBMS
- ✓ Introduce modern techniques, methods and results of field of DB.
- ✓ New data management techniques are also covered such as: Object-Relational BDs, NoSQL and Cloud databases.

Recommended prior knowledge

- ✓ Databases
- ✓ Advanced Algorithmics and Complexity (Trees)

Content of this course

1. **Chapter 1. Introduction**
   - Relational DBMS
   - SQL language
2. **Chapter 2. Data Storage and Index Structures**
   - Storage media (Structures, RAID, Cache, etc.)
   - Indexes (Structures, types: B B+ Bitmap, management)
3. **Chapter 3: Query Optimization**
   - Basic operations (joins…)
   - Interpretation of queries
   - Query optimization (Query tree, Rule-based, Cost-based)

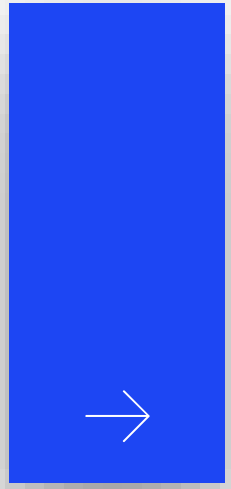
Content of this course

4. **Chapter 4: transaction management and concurrency**
   - Transaction
   - Serializability
   - Concurrency management (Two-phase locking, Stamping)
5. **Chapter 5: Object-Relational Databases**
   - Presentation of the Object model
   - Presentation of the Object-Relational model
6. **Chapter 6: NoSQL Databases**
   - Big Data (No SQL…)
   - Main NoSQL DB models (Key-Value, column, graph)

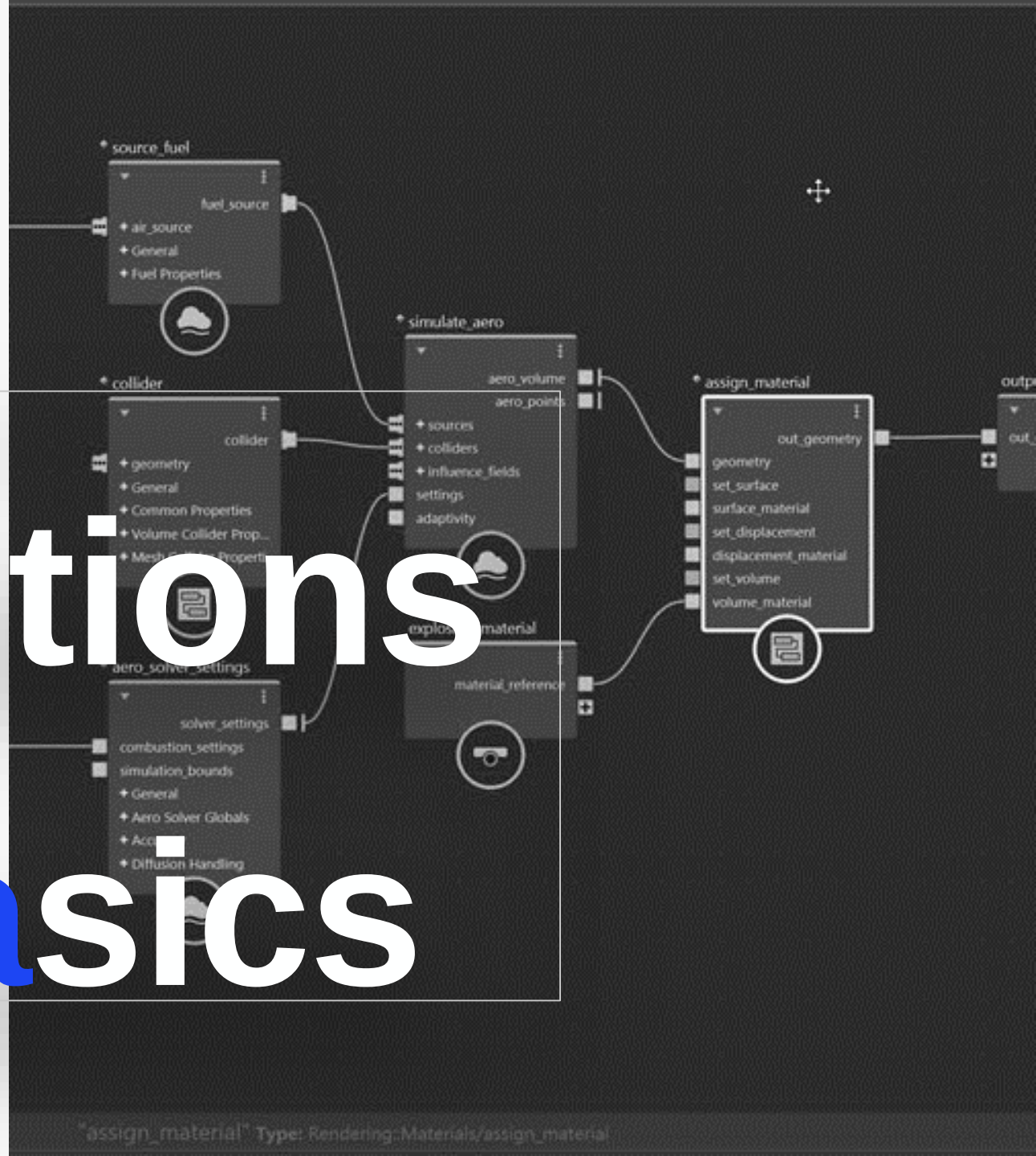
Content of this course

7. Chapter 7: Cloud Databases

- BDD as Service (advantages, types, etc.)
- Operation (handling, migration, etc.)



Definitions & Basics



Database

- ✓ Collection of consistent and structured data (persistent data) used by computer systems.
- ✓ Collection of highly structured and persistent data whose structure is defined in a schema using a data definition language.
- ✓ The data and schema are managed using software called a database management system (DBMS).

database management system (DBMS)

- ✓ A set of computer software used to manipulate databases.
- ✓ It is used to perform ordinary operations such as consulting, modifying, constructing, organizing, transforming, copying, saving or restoring databases.
- ✓ It is often used by other software as well as administrators or developers.

Objectives of DBMS

✓ ***Physical Independence***

- ❑ Concept of relationship which defines the data structure
- ❑ The structure for implementing a relationship is the table on which access paths (indexes) will be defined.

✓ ***Logical independence***

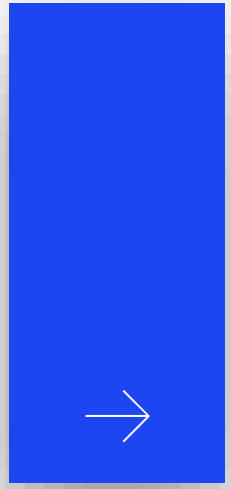
- ❑ The DBMS must authorize several user views on the base
- ❑ Possible thanks to the concept of views

Objectives of DBMS

- ✓ ***Evolution of the DB***
  - ❑ Evolution of data : Insertion, Deletion, Modification
  - ❑ Evolution of the schema: Addition, deletion of attributes, Addition of a new relation.
- ✓ ***Data consistency***
  - ❑ Data integrity
  - ❑ Data in a database must satisfy invariants called integrity constraints.

Administrator

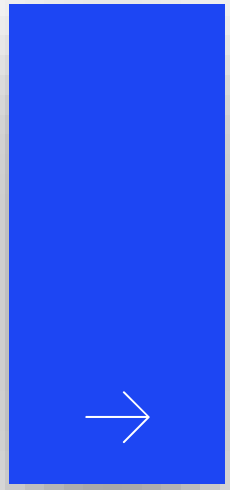
- ✓ ***install the DBMS***
  - ❑ server, clients, application tools
- ✓ ***create the database and develop it***
  - ❑ define the logical and physical storage organizations
  - ❑ define the data storage resources
- ✓ ***register and manage users***
  - ❑ create roles, user profiles
  - ❑ assign appropriate roles to users



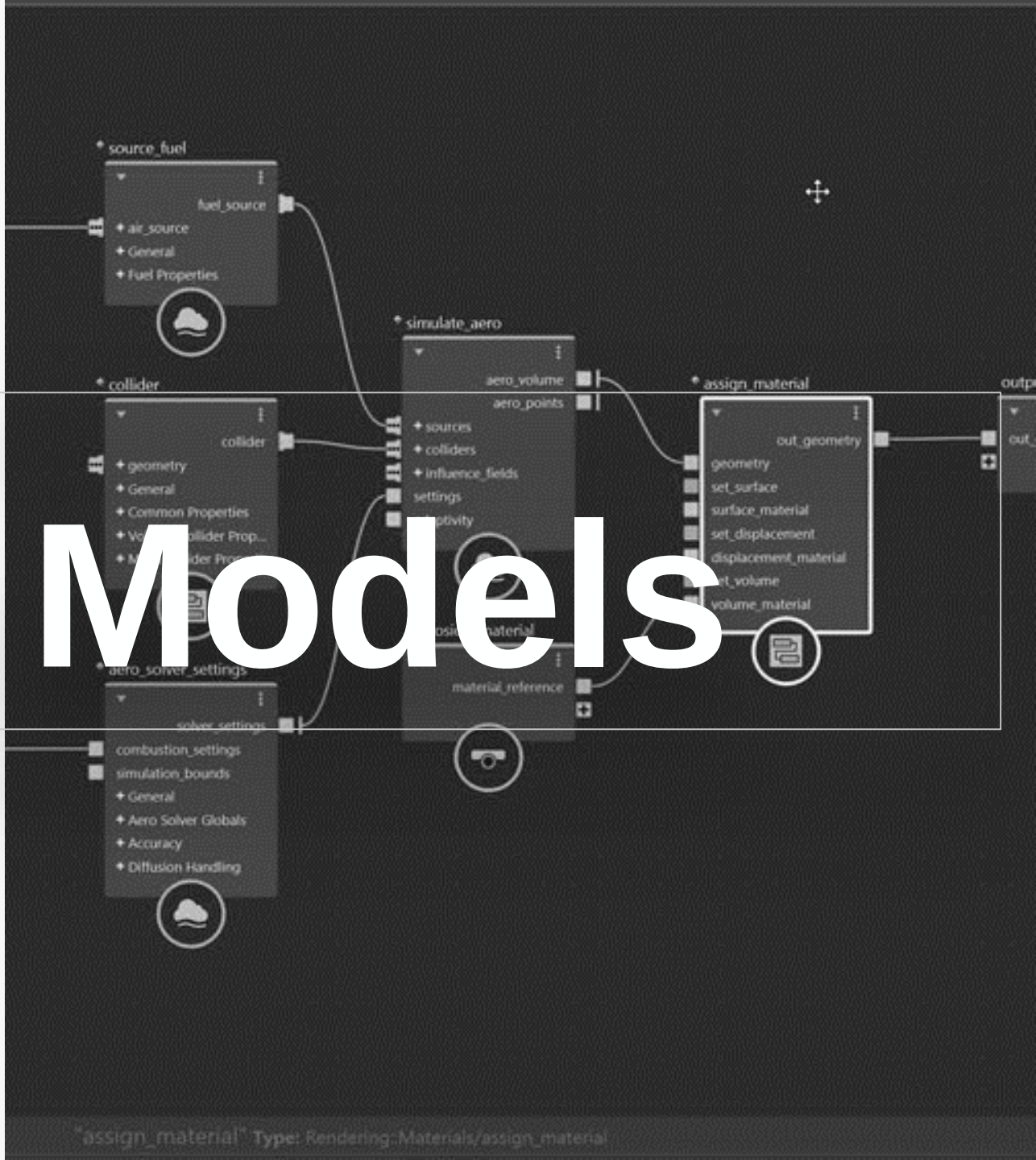
Administrator

- ✓ ***ensure data security and consistency***
  - ❑ define backup strategies (backup, restoration, archiving)
  - ❑ manage access to data
- ✓ ***maintain good performance (or improve it)***

- ✓ ***allow the exchange of Base <-> Exterior data***
  - ❑ Export/import, SQLloader



Data Models


source_fuel
fuel_source
air_source
General
Fuel Properties
simulate_aero
aero_volume
aero_points
sources
colliders
influence_fields
settings
assign_material
out_geometry
geometry
set_surface
surface_material
set_displacement
displacement_material
volume_material
collider
collider
geometry
General
Common Properties
aero_solver_settings
solver_settings
combustion_settings
simulation_bounds
General
Aero Solver Globals
Accuracy
Diffusion Handling
material_reference
"assign_material" Type: Rendering/Materials/assign_material

Design, Development, Use, Administration

1. *Conceptual stage :*

- Design and Modeling of databases
- Use of
  - Methods, Models, Formalisms
  - Entity-Association Model E/R / Model Extended Entity-Association
  - Object Models, UML Formalism
- Tools:
  - Power AMC,
  - Power Designer
  - WinDev,
  - Oracle Designer Rational Rose

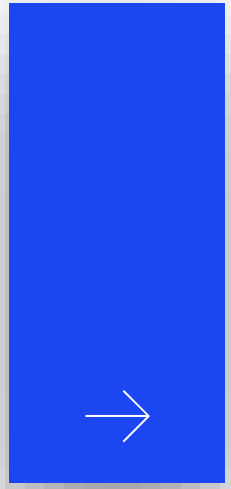
Design, Development, Use, Administration

3. *Physical stage :*

- ❑ Relational DBMS / Object-Relational DBMS / Object-Oriented DBMS
- ❑ Languages (SQL, PL/SQL, PRO*C, JDBC, Java, ...)
- ❑ Optimizations (Grouping, Indexes, ...)
- ❑ Administration
- ❑ Tools
  - ➢ Oracle , DB2, My SQL 4

4. *Software*

- ➢ DBMS, Interfaces & Hardware

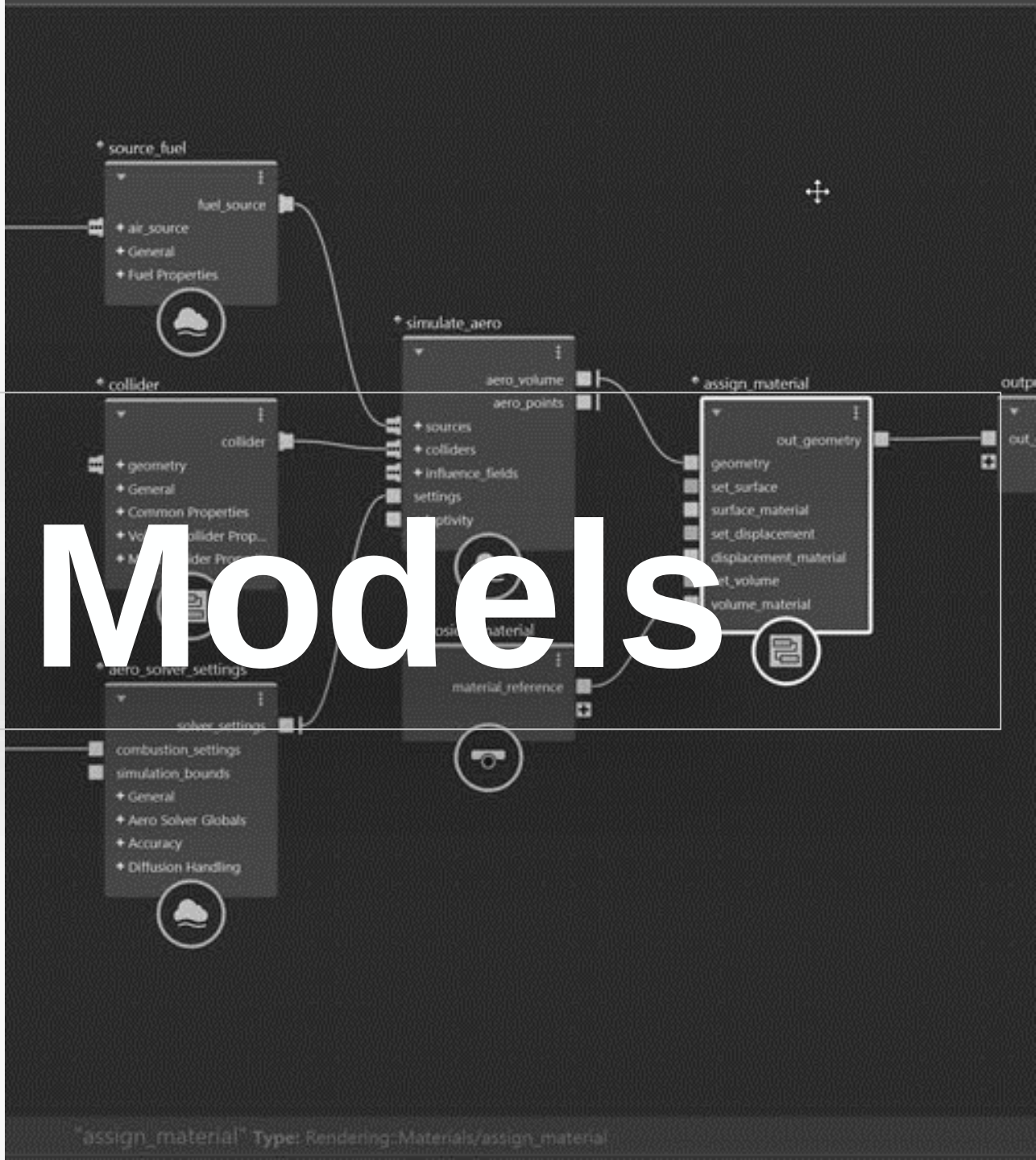


Design, Development, Use, Administration

2. *Logical stage :*

- ❑ Implementation of a database Relational Model / Mod Object-Relational Model / Object Model
- ❑ Optimization of the schema (Normalization, Denormalization, etc.)

Data Models


source_fuel
fuel_source
air_source
General
Fuel Properties
simulate_aero
aero_volume
aero_points
sources
colliders
influence_fields
settings
assign_material
out_geometry
geometry
set_surface
surface_material
set_displacement
displacement_material
volume_material
collider
collider
geometry
General
Common Properties
aero_solver_settings
solver_settings
combustion_settings
simulation_bounds
General
Aero Solver Globals
Accuracy
Diffusion Handling
material_reference
"assign_material" Type: Rendering:Materials/assign_material

Design, Development, Use, Administration

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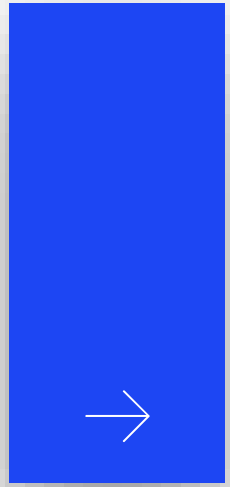

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