Data Model:
Standardized representation of data elements and how they are related to one another.

Abstraction:
Information representation that is similar to its meaning (semantics) while hiding the implementation details.

To be most useful to the data user, a data model should provide an abstraction that represents how the user thinks of the data, not how it is stored.

Rule of Least Power:
Use the least powerful language suitable for expressing information on the World Wide Web
- Tim Berners-Lee, World Wide Web Consortium

- Powerful languages inhibit information reuse.
- The less powerful the language, the more you can do with the data stored in that language.
- Use a scalable language so it can be extended with more powerful features.

Domain Specific Data Model
Standard data representation designed to serve the users of a particular scientific community.
- Tend to be very powerful/expressive so they can adequately represent the details needed by all users in that scientific domain.
- Often too complex to be used interoperably by others outside of that domain.

Multi-Dimensional Array Data Model
Data represented as rigid grids of primitive values.
- Largely influenced by the storage implementation as opposed to data semantics.
- Higher level abstractions require “conventions” or additional metadata.

Relational Data Model
Data represented as tables (relations) of primitive values, as used by relational databases.
- Largely influenced by the storage implementation as opposed to data semantics.
- Higher level abstractions require multiple tables and complex join logic.

Functional Data Model (as UML) plus extensions demonstrating more powerful abstractions.

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Functional Data Model
Abstraction that represents data as any combination of only three variable types:

- **Scalar**: A single variable
- **Tuple**: A group of variables
- **Function**: A mapping from one variable to another

- Captures the functional relationship semantics that are inherent in scientific data.
- Mathematical model that is scientific domain agnostic and lends itself to mathematical operations:
  - arithmetic that can be used directly to perform computations with datasets
  - algebra that can be used to symbolically manipulate datasets
- Function “evaluation” that supports: sampling, resampling/regridding, currying
- Ideally situated in the power hierarchy to be expressive enough to be useful yet simple enough to be highly reusable across scientific disciplines.
- Can be as expressive as needed with complex composition of the three variable types (at the risk of reducing reusability).
- Can scale by extending base types to add semantics. Basic tools can still use the data in terms of the base types.
- Universal: Can be used to model (describe) any data.
- Enables unified interface to access and operate on disparate data sources.

Functional Data Model (as UML) plus extensions demonstrating more powerful abstractions.