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Interdependency and Infrastructure

Lecture 4 – Logical Modeling of Interdependency

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Overview

- Previously…
- The Path Ahead
- Definitions
- Rules
- Visual Representation
- Framework
- Examples
- Tools
- Value
- Beyond the Examples

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Previously…

- Discussed the Axioms of (Inter)dependency
- Reviewed a Sample Case
- Reviewed Modeling
- Reviewed Simulation Techniques to Apply Models

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The Path Ahead

- Application of (inter)dependency to information so as to be able to ‘tell a story’ about
  - an asset
  - an infrastructure
  - a ‘disruptive effect’
  - different forms of relationship among these
  - a combination of any of the above
- Developing an expression of (inter)dependency and association begins with
  - definitions

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Definitions

- Dependency
- Interdependency
- Association

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Definitions

Dependency

- **B is dependent on A if the states of B S(B) are *directly* determined, influenced, controlled or supported by A**

A → B

Morning Cup of Coffee → Me

(Condition: someone else makes the coffee)

Fuel (supply) → Generation Plant

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Definitions

Interdependency

- **B is interdependent with A if the states of B S(B) are directly determined, influenced, controlled or supported by A *and vice versa***
  - **Mutually dependent**

A ↔ B

Morning Cup of Coffee ↔ Me

(Condition: No one else to make the coffee)

Pipeline ↔ Port

Telecommunications ↔ Electric Power

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Definitions

Association

- A is *associated* with B
  - If A and B are connected or accompany one another
  - Usually occurs in the absence of a dependency

A – B

Generation Plant – Service Territory

Chemical Plant – Evacuation Routes

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Rules

- Placing rules on (inter)dependencies and associations implies knowledge of characteristics of those elements containing (inter)dependencies and/or associations
  - Meta-information
  - Spatial
  - Temporal
- Rules can be developed to reflect these

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Rules

- Logical
  - Based purely on meta-information
    - OR(), AND(), C()
- Spatial
  - Based purely on location
    - N(), B(), W(), WA()
- Combinatorial
  - Joins elements of both spatial and logical rules
- What about temporal?

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Visual Representation

- A visual means of representing (inter)dependence and association is necessary to information exchange
- As with all things, there are many ways to do this, each of which has its pros and cons
  - We'll highlight two here

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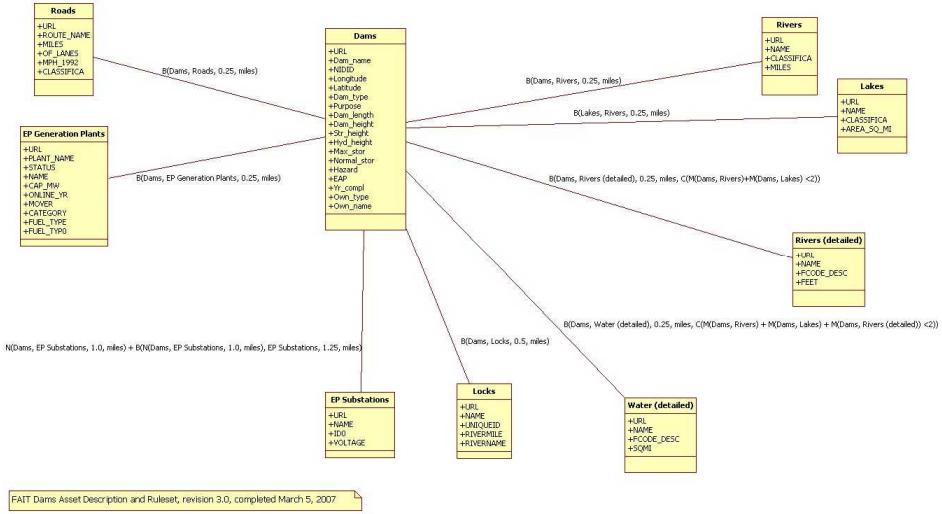
Visual Representation

Connected Network

- **Pros**
  - **Shows full range of connectivity among elements at the scale chosen**
- **Cons**
  - **Lacks temporal element of connectivity, unless you show it as an animation**



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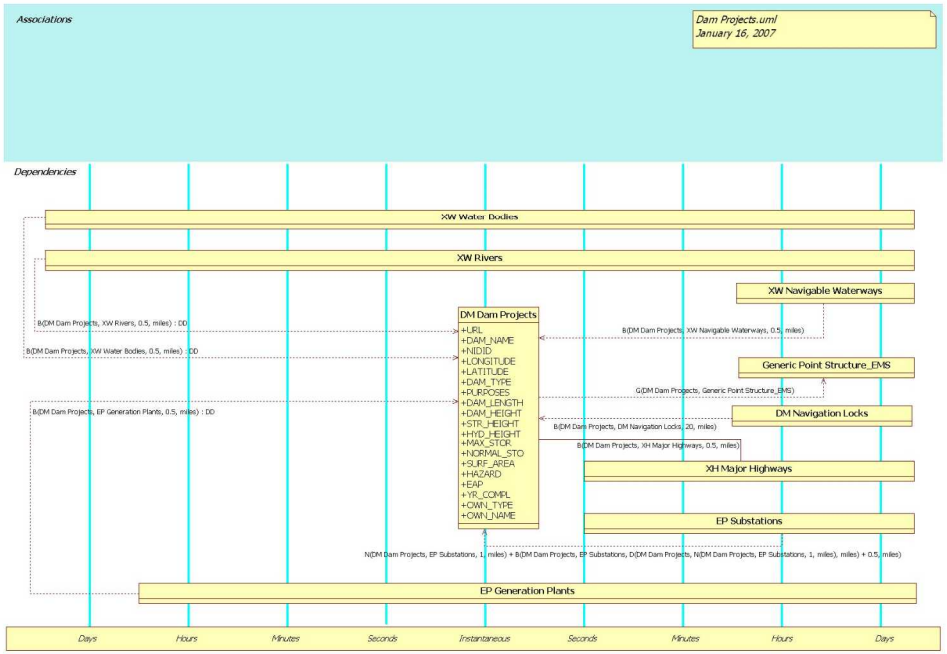
Visual Representation

Temporal x-centric Diagram

- **Pros**
  - **Element-centric focus (asset, asset class, sector, grouping, etc) with temporal declaration of rules between elements**
- **Cons**
  - **Doesn't allow for full connectivity in the same way as Connected Network**



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Framework

- UML
  - Gives us all the elements we need
    - Graphical representation of elements
    - Graphical representation of dependency, association built in
    - *Object oriented*
  - Can literally be used for anything

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Examples

- Infrastructure
- Assets
- Ourselves and Our Worlds

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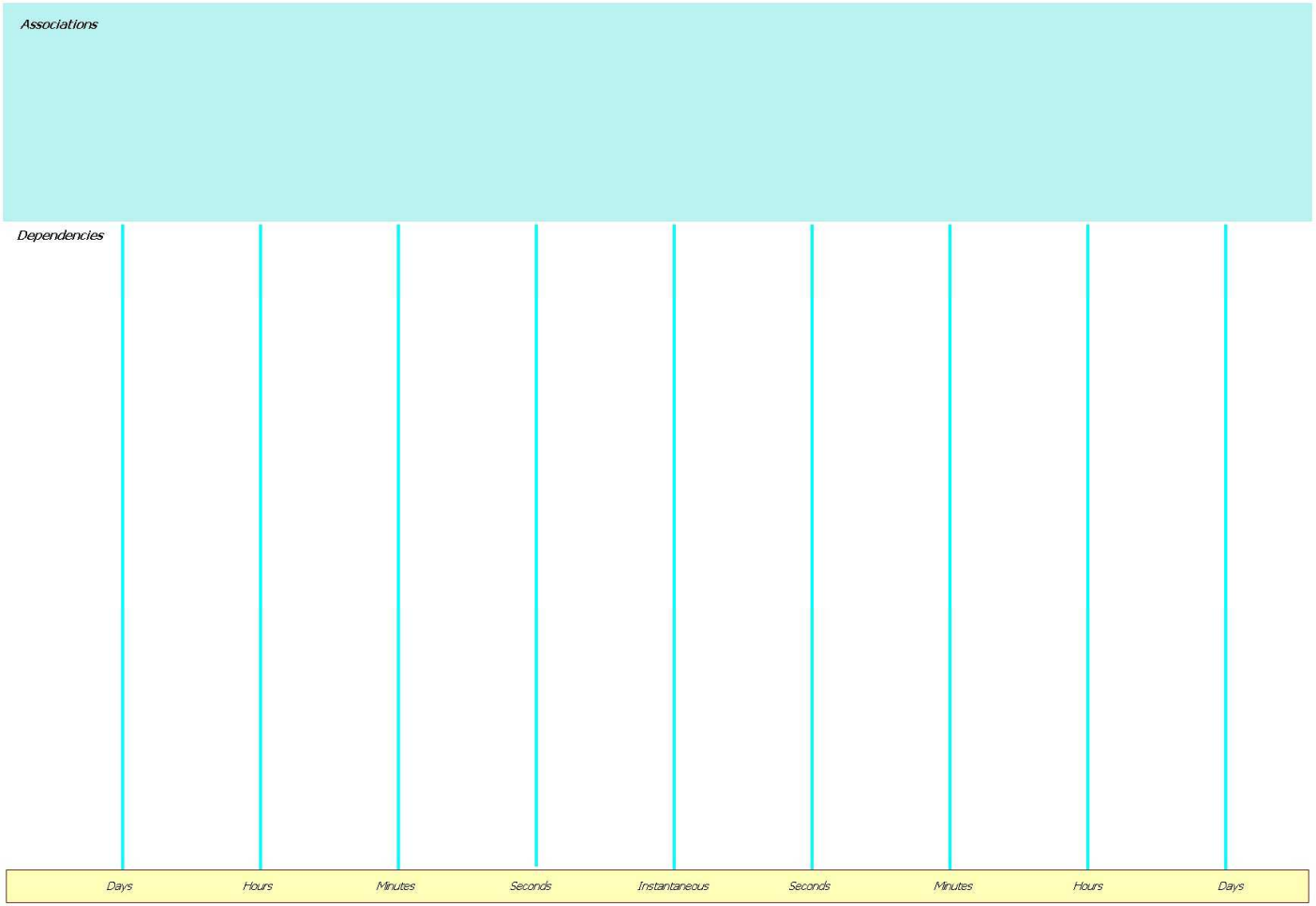
Examples

Infrastructure



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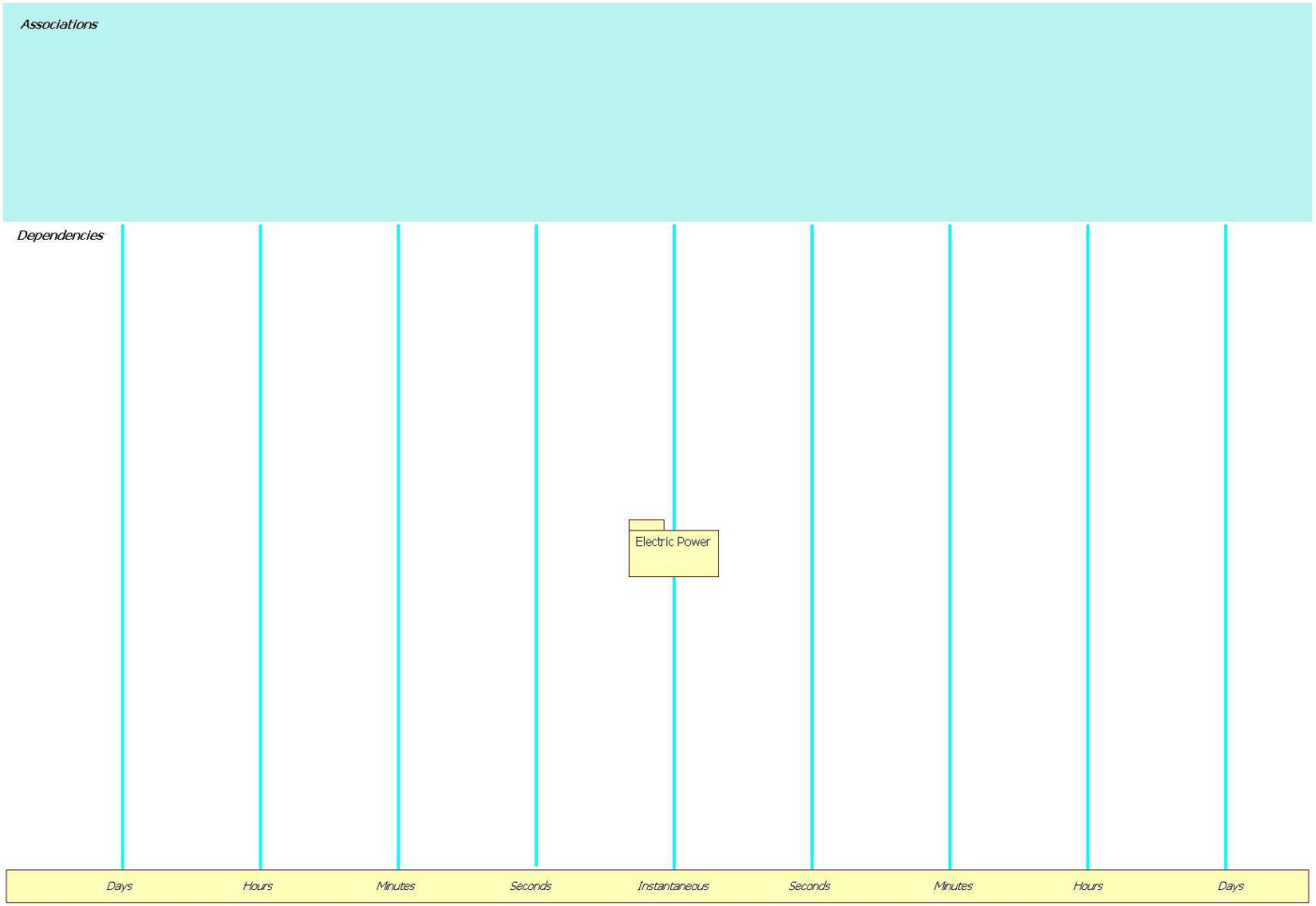
Examples

Infrastructure



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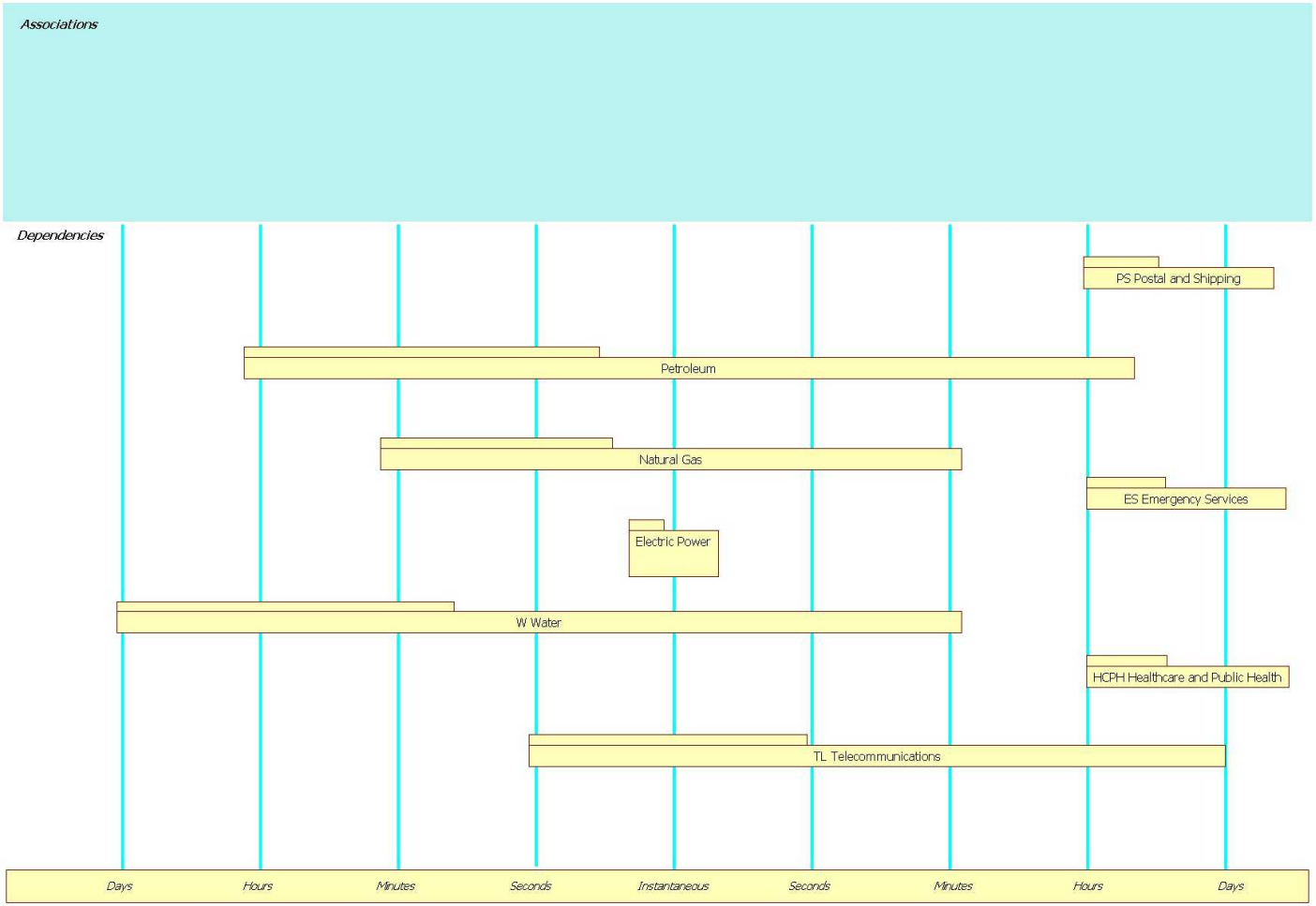
Examples
Infrastructure



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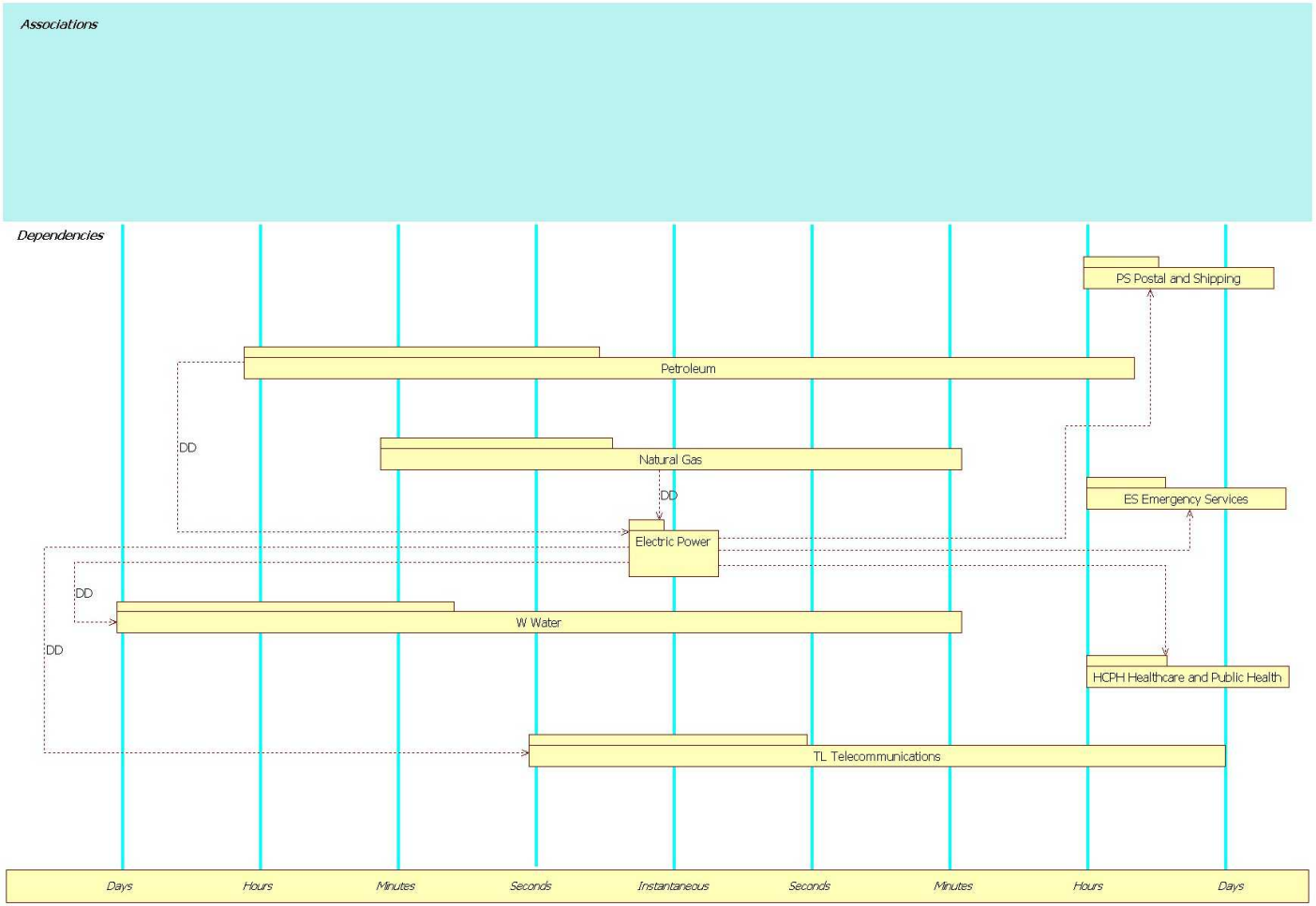
Examples

Infrastructure



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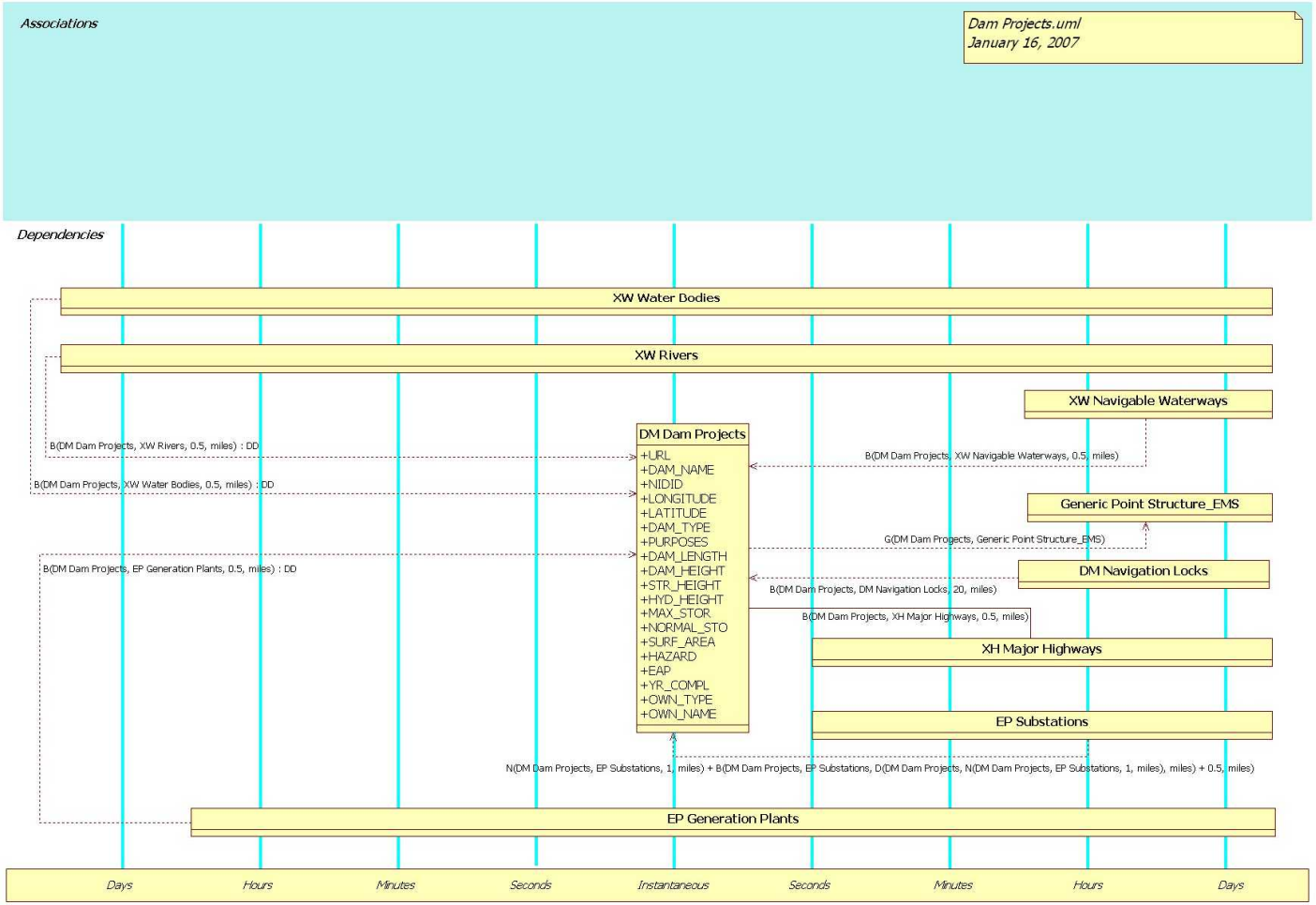
Example
Assets



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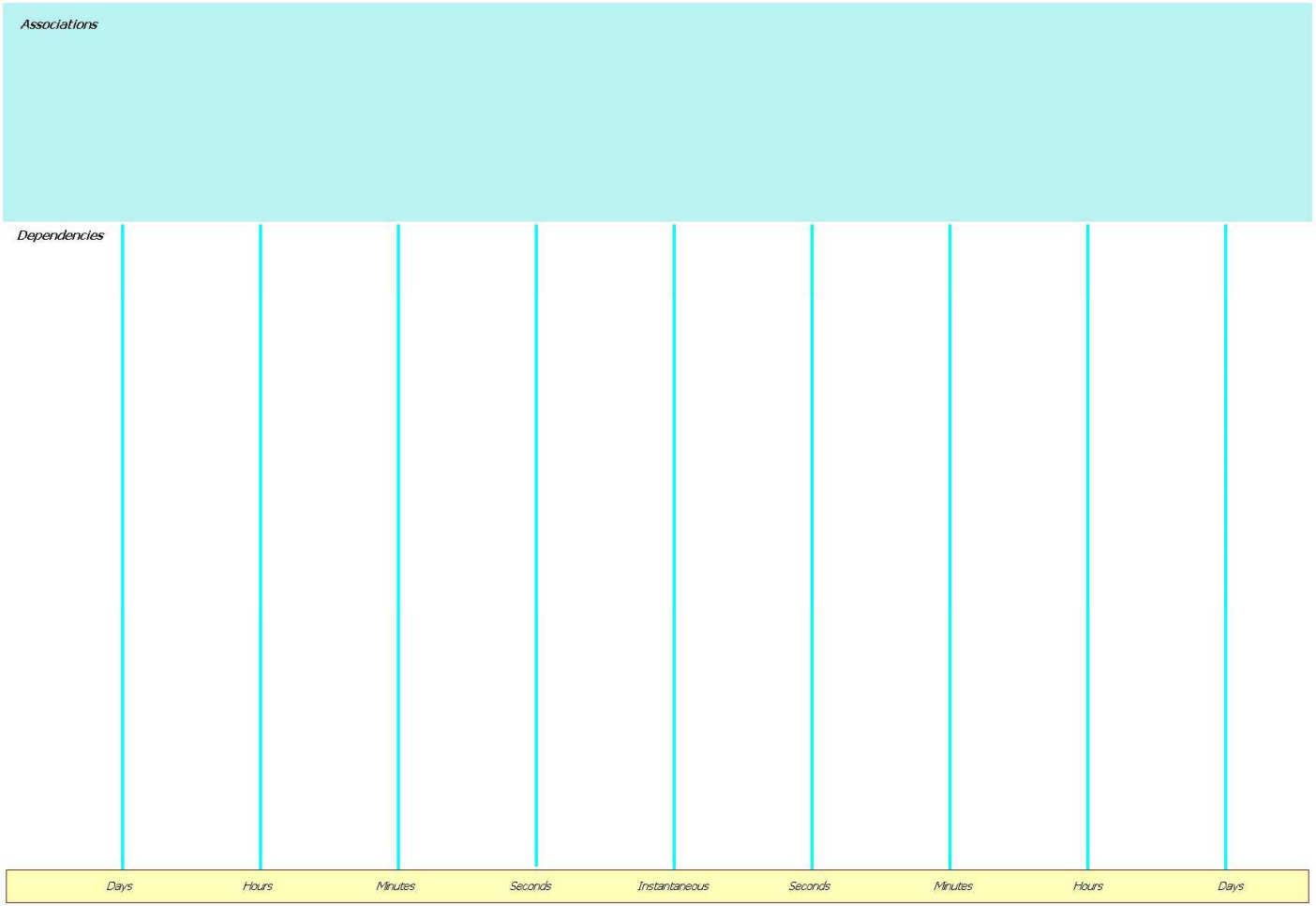
Example

Ourselves and Our Worlds



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Tools

- Plenty available
  - Rational Rose
  - Violet
  - Eclipse UML2Tools
  - Many others
- My tool of choice?
  - StarUML

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Value

- Why do I need all of this?
- Helps me understand my world from a known point of reference
- If I build it right it will be applicable to more than a local world view
- Helps me communicate in a common language with code jockeys who implement my crazy ideas

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Beyond the Examples

- Launch into demonstration

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