**Lustre, a Synchronous Dataflow Language**

**Verimag Laboratory**

### Main Characteristics

- Generalization of Synchronous Circuits, where wires can hold any data types
- Logical discrete time
- High-level parallel specifications compiled into sequential code
- Correct-by-construction aspects:
  - No loop → compile-time bound on execution time
  - No recursive data structures (e.g., list) → compile-time bound on memory usage
  - Static Scheduling → no deadlock between tasks, no critical race
  - Deterministic behavior: What You Simulate Is What You Embed (WYSIWYE)

### An example: detecting rising edges

```plaintext
node edge(x:bool) returns(e:bool);
let
e = x -> x and not pre x;
tel
```

### The Lustre Industrial History

- 1979-1984: first versions of Lustre
- 1986: the SAGA tool (based on Lustre) is created to develop the monitoring and emergency stop system of a nuclear plant
- 1986: a similar tool, SAO, was used to develop the fly-by-wire and flight control of the Airbus A320
- 1993: creation of Verimag, as an “unité mixte industrielle” with Verilog, which combined SAO and SAGA to create SCAD
- 2001: SCAD is acquired by Esterel Technologies
- 2012: SCAD is acquired by Ansys
- Nowadays, SCAD is one of the standard languages for safety-critical systems

### Lustre Spotlight

- **Ansys**
- **SCAD**
- **Lacid-synchro**
- **Heptagon**
- **Abroad**
- **France**
- **Tools**
- **Model-Checkers**
- **Automated Testing**
- **Compilers**
- **Abstract Interpretation**

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**Diagram:**

- Diagram depicting the relationships between Lustre and various tools and teaching locations within France and abroad.