Functional Size of Real-Time Software

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Agenda

A - Project history

B - Lessons from previous attempts

C - Full Function Points (FFP)

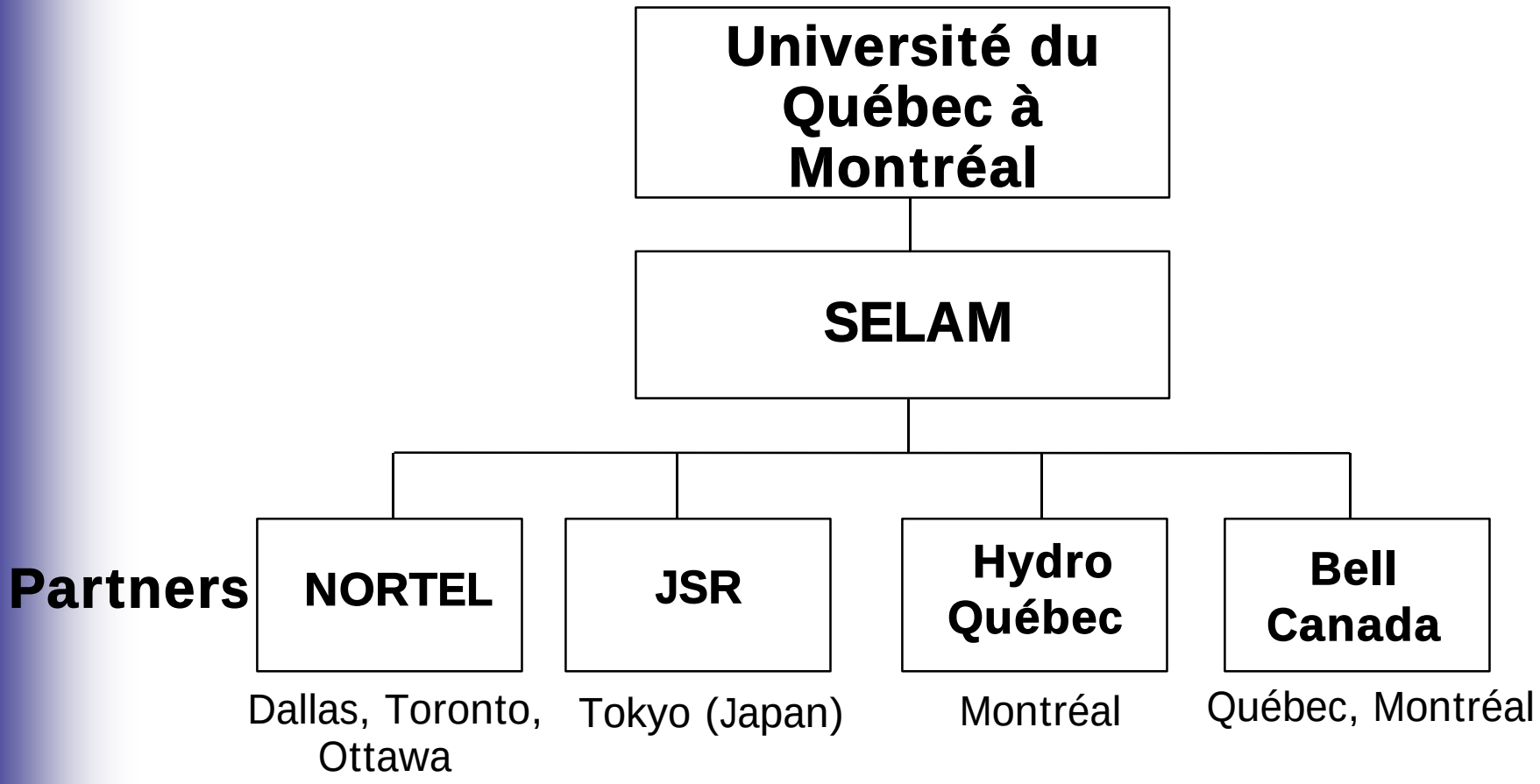
D - Industry field tests (North America & Japan)

E - Conclusion

A - Project Objectives

- Measure **adequately** the functional size of real-time software
- ISO compliant
- Facilitate migration path and ease of transition for organizations with historical databases (IFPUG)

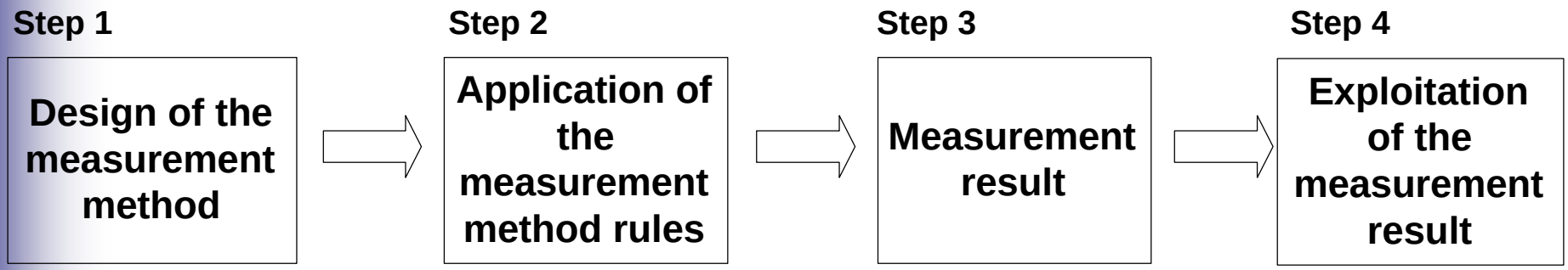
A - Project Structure



A - Project Steps (1995-1997)

- Project initiation:
  - Identification of industrial partners
  - Analysis of previous attempts
- Design of measurement structure
- Field tests - North America & Japan:
  - Observations & feedback
  - Partner sites reports

A- Project Scope



1) Before measuring, you need a measurement method
2) The rules of the measurement method are applied to software (or piece of software)
3) Output of Step 2 is a result (it should be auditable)
4) The result is exploited (quantitative or qualitative)

A- Research Strategy

Project strategy accepted by research partners:

- Phase A (95-97):
  - Step 1: Measurement Design
  - Step 2: Measurement in practice
- Phase B (98+):
  - Step 3 : Results analysis
  - Step 4: Productivity, Estimation & Quality Models

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B - FPA Limitations for Real-time Software

FPA limitations recognized by the research & practitioners communities:

- **Conte (1986)**
- **Jones (1988-...)**
- **Symons (1988)**
- **Ince (1991)**
- **Grady (1992)**
- **Whithmire (1992)**
- **Kan (1993)**
- **Hetzel (1993)**
- **Murali (1997)**
- **Etc.**

B - FPA Limitations for Real-time Software

Does not capture well real-time functional characteristics:

- Large number of sub-processes
- Many transient data
- Many control functions

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C - Full Function Points (FFP) for Real-time Software

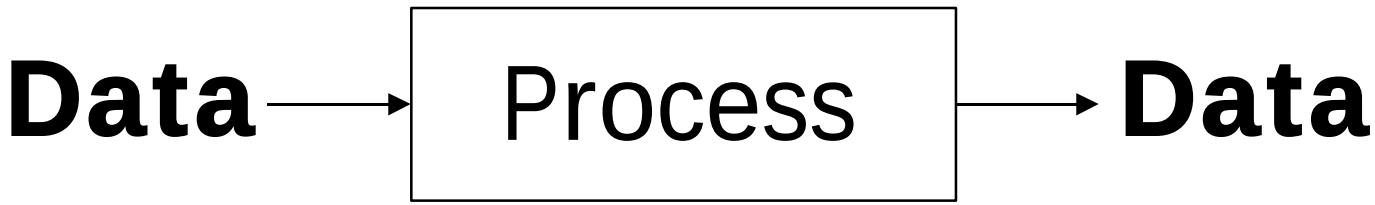
- Key Concepts
- Example
- Why FFP is easier

C - Key Concepts

- **Generic Process**

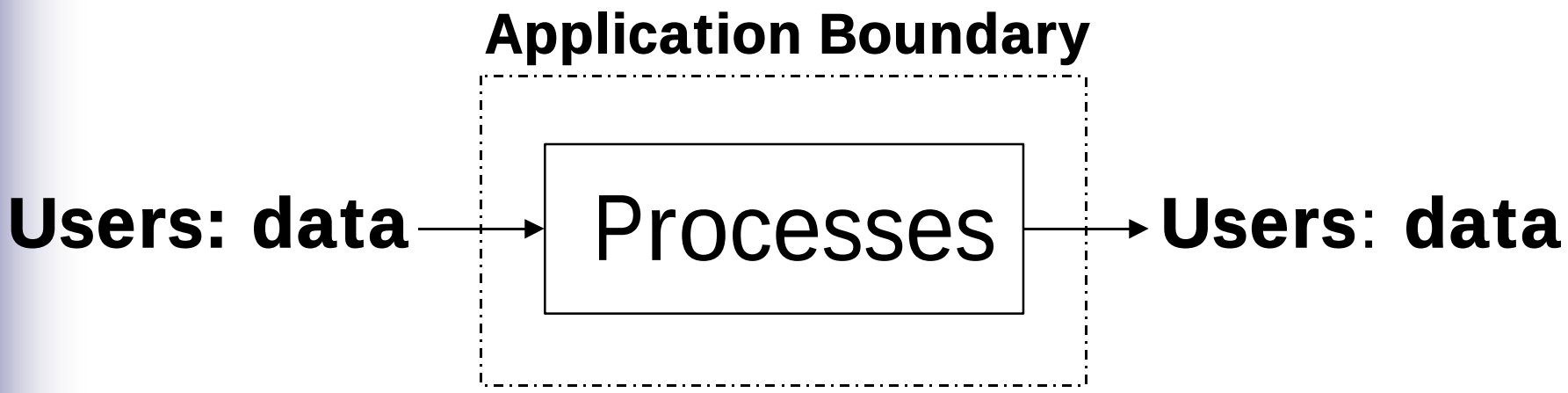
C - Key Concepts

- **Software Process:**



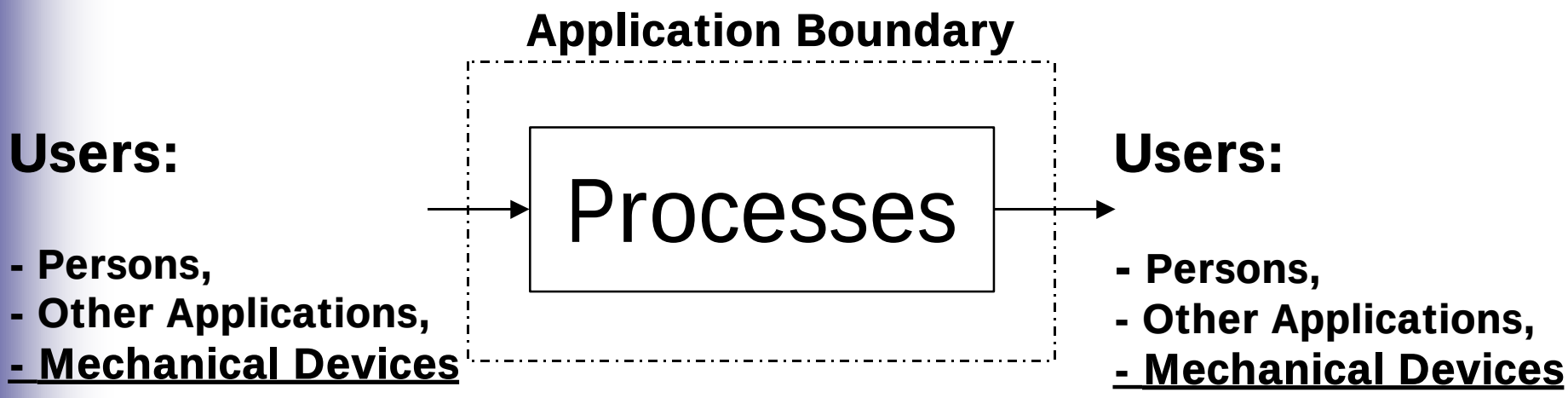
C - Key Concepts

- **Measured Software Processes:**

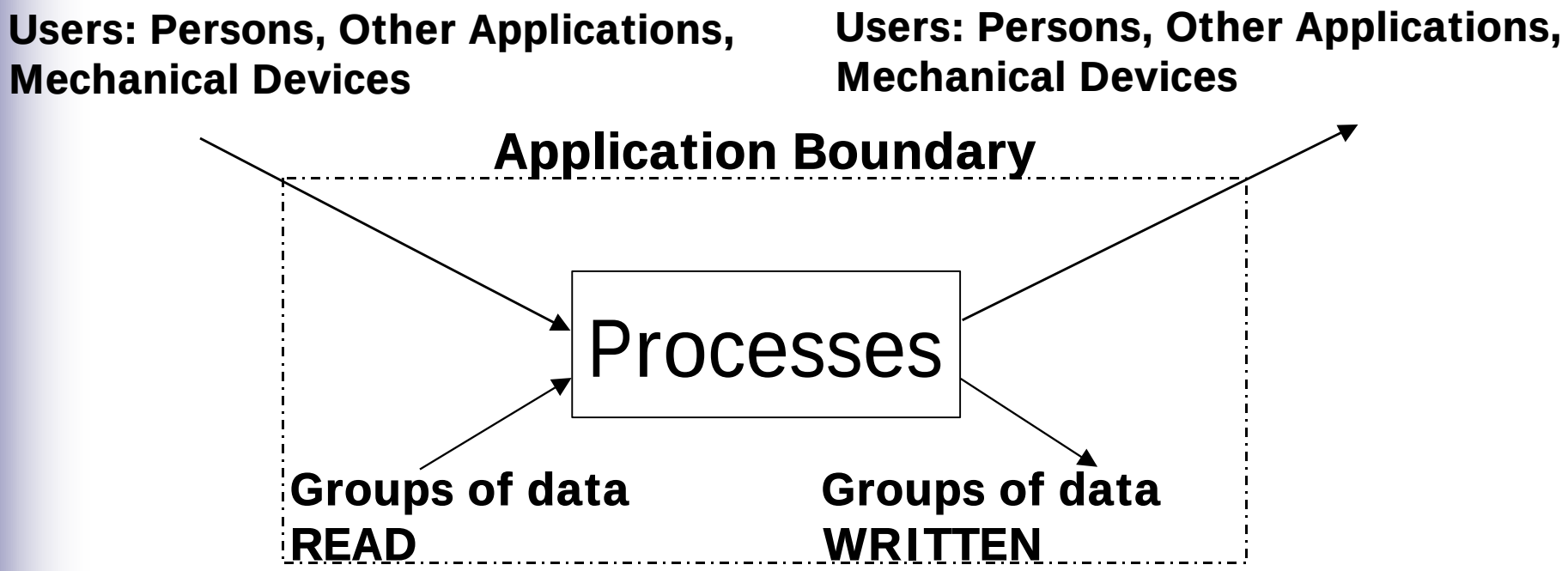


C - Key Concepts

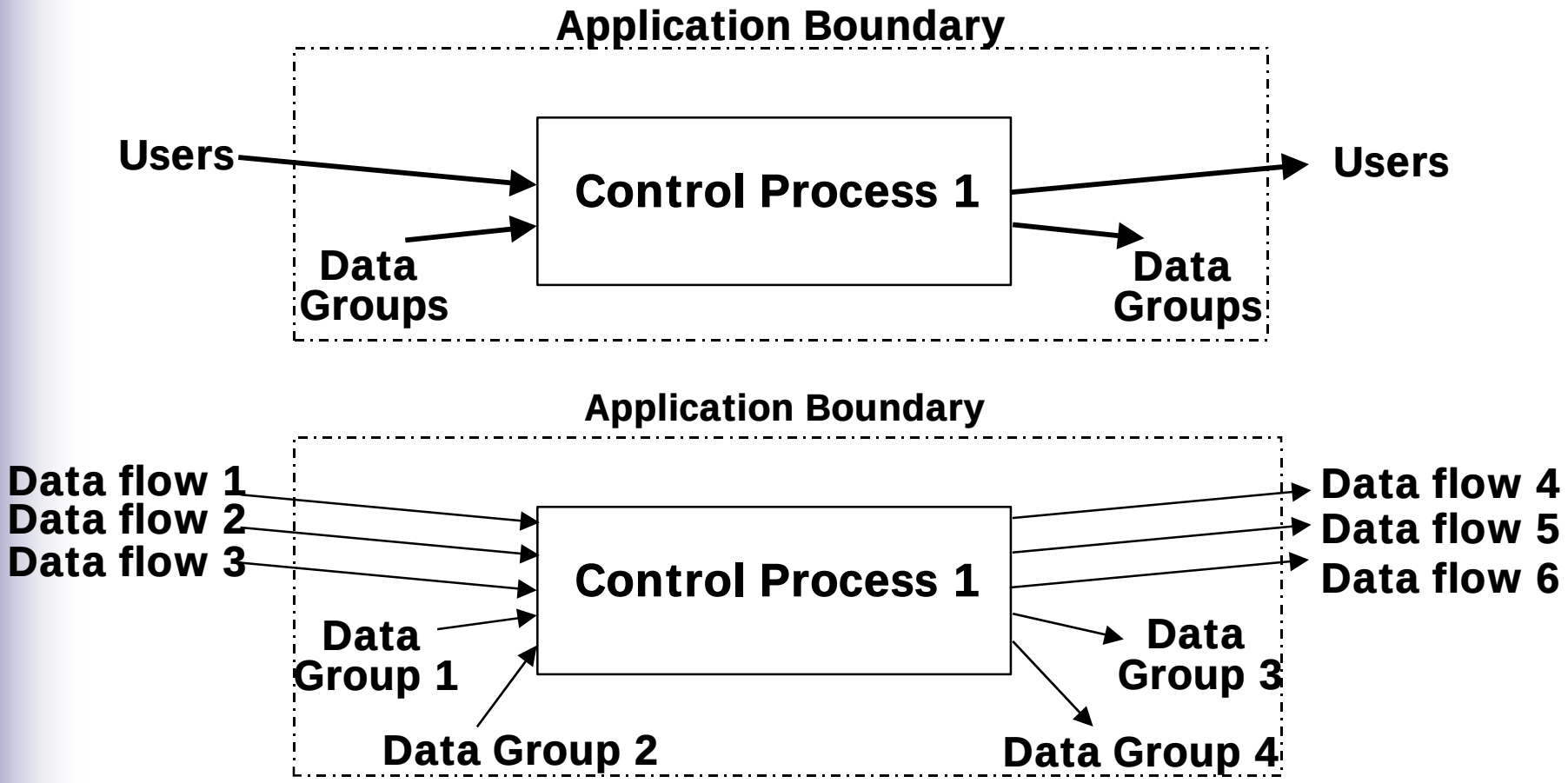
- **REAL-TIME Software Processes:**



C - Model of Real-time Software



C- Model with multiple sub-processes



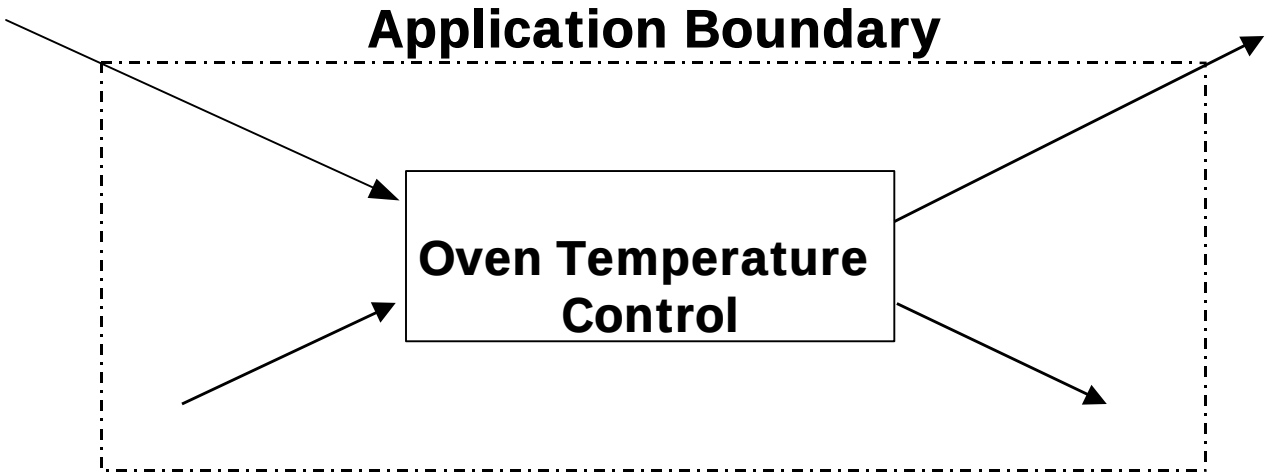
C - Example Requirement Specifications

Oven Temperature Control

1. The Oven Temperature is **received** from a sensor
2. A message is **sent** to the oven heating element, turn on or turn off depending on Oven Temperature and **Desired Temperature**
3. A new entry is created in the **Message Log** (for diagnostic purposes)

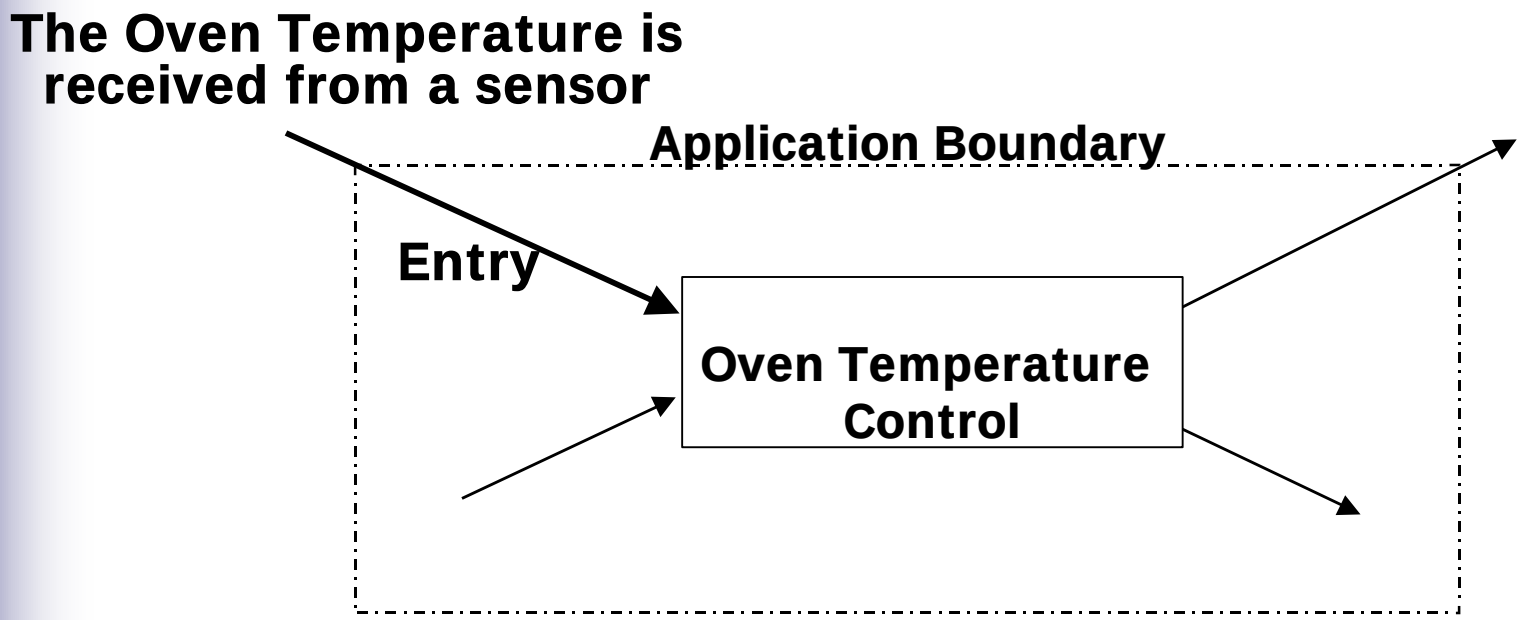
C - Process Identification

All processing associated with a unique trigger: "Temperature is received from the sensor"



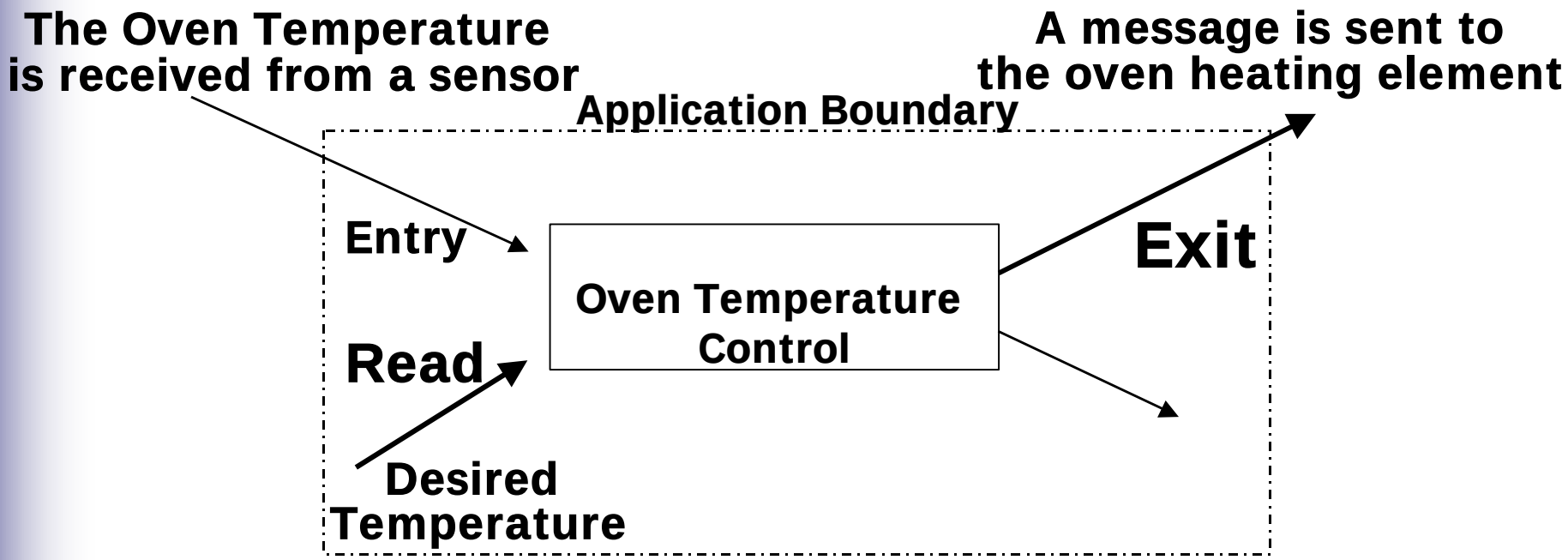
C - Sub-process Identification

Requirement specification 1:
“The Oven Temperature is received from a sensor”

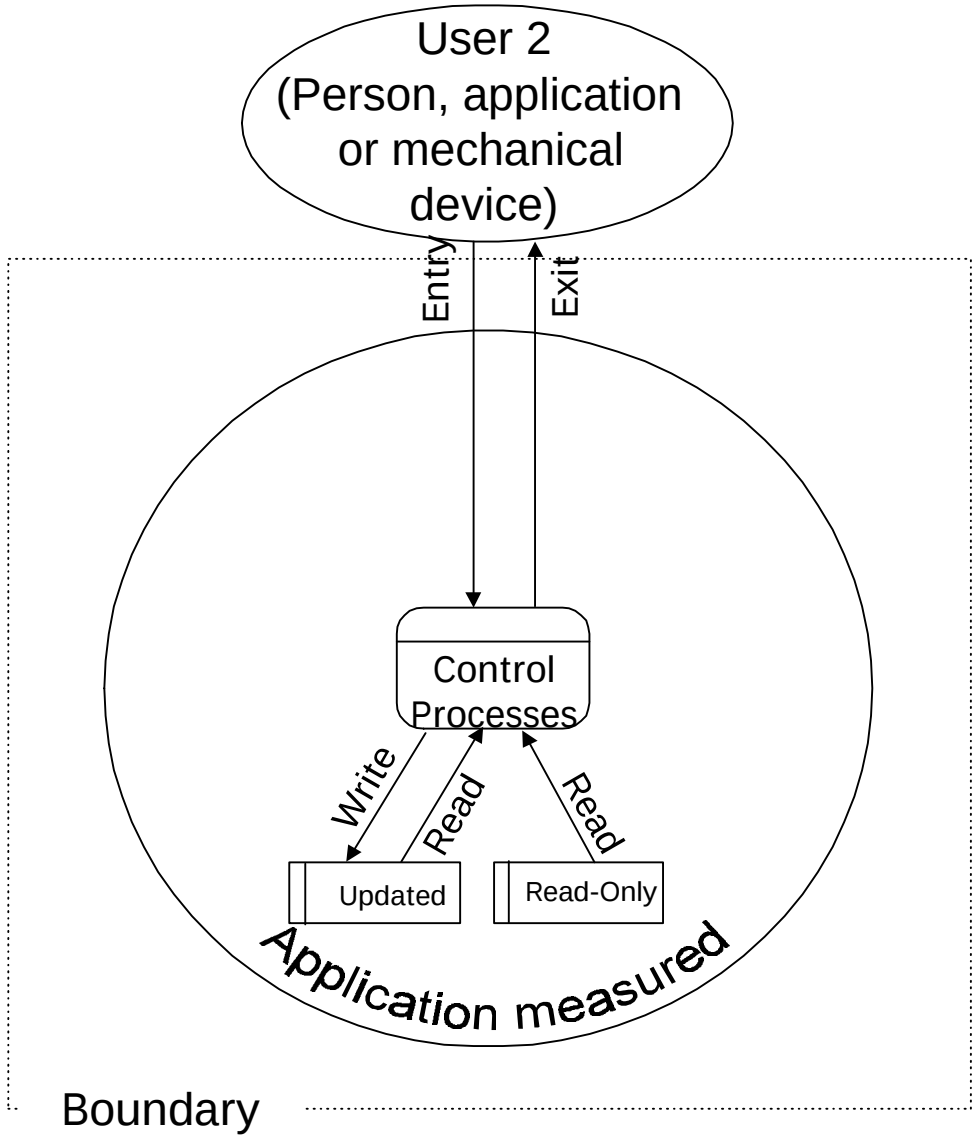


C- Sub-process Identification

Requirement specification 2:
"A message is sent to the oven heating element, turn on or turn off depending on Oven Temperature and Desired Temperature"



C- FFP Measurement Model



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D - Industry Field Tests

North America:

- Tests with researchers
- USA: Richardson (Texas)
- Canada: Toronto, Montréal, Ottawa, Québec

Japan:

- Independent field tests

D- Field tests in Japan

Description:

- Business: Real-time software for the automotive industry in Japan including fuel injection systems

D- Field tests in Japan

STEPS:

1. Construction and measurement of a Case Study (Rice Cooker)
2. Measurement of small software in-house samples with «FFP» (Jan-Apr 1997)
2. Visit to research team to verify measurement results and rules interpretation (May 1997)
3. Expansion of the testing to larger in-house software (June 1997)

D- Field tests in Japan

SAMPLES:

Characteristics of real-time software tested:

- Few IFPUG-Inputs and IFPUG-Outputs
- Few Files in boundary
- Some processes with **a few** sub-processes and some processes with **a lot** of sub-processes to control objects. Control dimension is essential
- Many very simple formula because of the very tight cycle time constraints

D- Field Tests in Japan

RESULTS

Criteria 1: To measure **WELL** real-time software functional size at our corporation

- In large test: FFP takes into account 79 sub-processes out of 81 expected to be measured.
- Measurement coverage rate: 97%

(2 sub-processes not measured with FFP: internal algorithms)

D- Field tests in Japan

OBSERVATIONS

Parallel tests with IFPUG method:

- IFPUG method provides a size similar to FFP in SMALL samples,

  but

- DOES NOT scale up to LARGE software as well as expected from a user functional viewpoint (in JSR environment, and confirmed later in further industrial tests).

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E - CONCLUSION

- Re-design criteria met
- Deliverables
- Closing Remarks

E- Re-design Criteria Met

Criteria No. 1:

- Practitioners agree that Functional Size **ADEQUATELY** captured for real-time software
- Verification method: field tests feedback
  (Further verification required with methods yet to be developed in the field of software metrics!)

E- Re-design Criteria Met

- **Measurement** criteria:
  - Current practices of documenting
  - Concepts & vocabulary in real-time software
  - Procedures to ensure: repetitiveness, ease of use
- **Strategic** criteria:
  - Alignment with ISO framework in-progress
  - Facilitate migration path for IFPUG

E- Deliverables

- FFP: Documented and in the public domain
- "*Full Function Points: Counting Practices Manual*"
  - Concepts & Definitions
  - Measurement Structure
  - Measurement Rules
  - Examples

E- Other Deliverables

Project Services:

- Case Studies
- Validation procedures
- FFP Training Services
- FFP Measurement Support

E- International Recognition

- International Software Benchmarking Standards Group (ISBSG): adopted as a new functional size standard for real-time software
- Japan: being promoted to the national JFPUG
- Germany, Australia, France, Netherlands, Canada
- Inquiries: South America and Asia

E- Next Steps: Research Project

Phase B:

- Degree of repetitiveness
  - IFPUG/M.I.T. - type studies required
- Usefulness of FFP in productivity, estimation and quality models
  - Research requirements: FFP measurement of completed projects WITH effort data in semi-controlled environments at industrial sites

Phase C: Automation

- Industry partners required

E- Closing Remarks

- The problem of the relevance of measuring real-time software with Function Points has been known for at least 10 years!
- Who has put money and resources on the table to contribute to the development of a solution?

E- Closing Remarks

Thanks to the consortium partners:

- SELAM. NORTEL, JSR, BELL and Hydro-Québec for their:
  - $$$$
  - Time
  - Access to their software
  - Access to their staff
  - Their most valuable feedback

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Questions Period