SCIENCE*SPRING*DAY

FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

DEPARTAMENTO DE INFORMÁTICA

Correct and Secure Global Software Infrastructures via Logics and Types

SOFTWARE SYSTEMS / PLASTIC Team

CENTER FOR INFORMATICS AND INFORMATION TECHNOLOGIES

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Objectives

How can we detect and eliminate software bugs? Modern computing systems are based on Web services, which rely on **complex communication protocols**. Ensuring that these interacting programs have no bugs is **very challenging**.

Our goal is to produce **tools** that help software developers in verifying that communicating programs are **correct**. In particular, we focus on **type systems**, a technique used to detect errors in programs before they are executed.

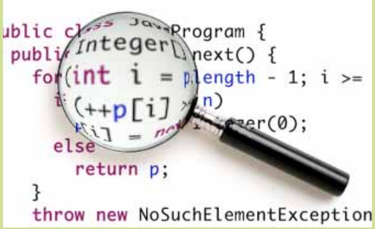
We investigate how **logics** can help us in developing more precise type systems. We will be able to eliminate subtle programming errors, and to enforce enhanced **correctness properties**.

Methodology

We develop our type systems on top of **process calculi**, small programming languages which capture essential aspects of **concurrent, interacting programs**.

Process calculi provide an **adequate framework** to write sophisticated programs and, more importantly, to **formally reason** about their correctness and security properties.

By building upon process calculi foundations, **transferring** our logic-based type systems techniques to conventional programming languages becomes feasible.
In this way, **rigorous mathematical foundations** guide the development of effective, practical techniques for programmers.



```
ublic class JavaProgram {
 public Integer[] next() {
   for(int i = p.length - 1; i >=
     if (++p[i] > n)
       p[i] = new Integer(0);
     else
       return p;
   }
   throw new NoSuchElementException
```

Expected Results

1. New high--level **specification languages** suited to represent communication-based programs. These languages should be sufficiently formal so as to admit tractable analysis (using type systems, for instance) but also sufficiently concrete so as to provide **realistic programming abstractions**.

2. New **type systems** for the specification languages described above. Based on logical principles, such type systems will be able to specify and enforce **security and correctness properties**.

3. Prototype **implementations** of tools allowing the specification, programming and verification of modern distributed systems.

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