Pervasive Computing Systems (PCS)

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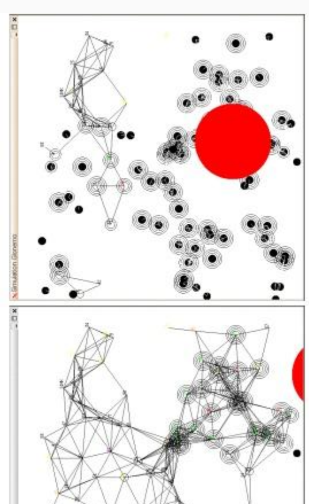
Pervasive Computing Systems: a Broad Spectrum of Applications

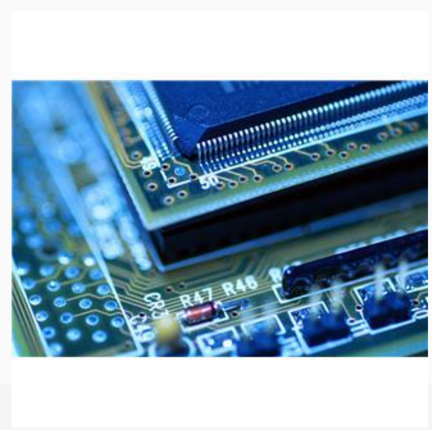
Very big and dynamic systems

(cloud and grid computing)

Very integrated and constrained systems

(systems-on-a-chip, sensor networks, embedded control systems)





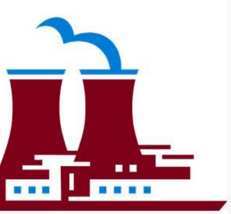
Pervasive Computing Systems: Common and Transverse problems

– Constraints *(time, memory, consumption)*

Leading to cross-layer design, multi-criteria offline optimization and/or dynamic online control

– Programming models, implementation and deployment tools, validation, correctness-by-construction, control algorithms

– Virtual prototyping and performance evaluation via modeling and simulation



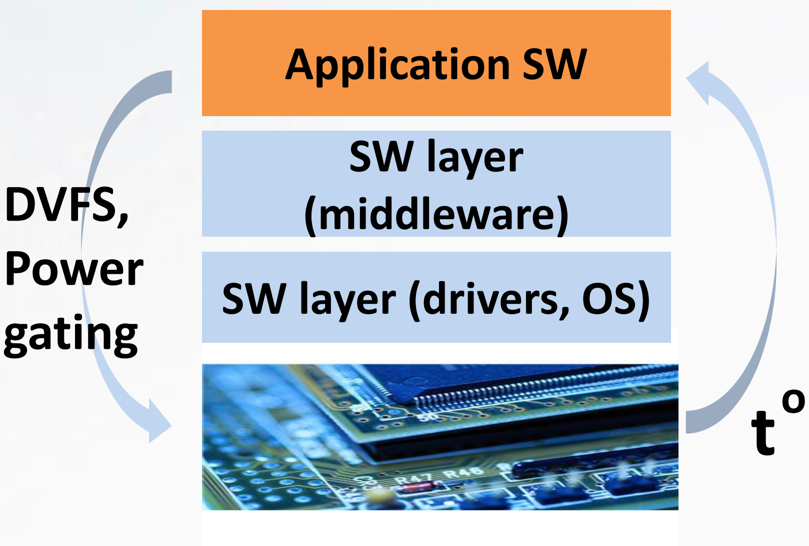
– Safety, security, fault-tolerance, robustness, predictability, quality of service

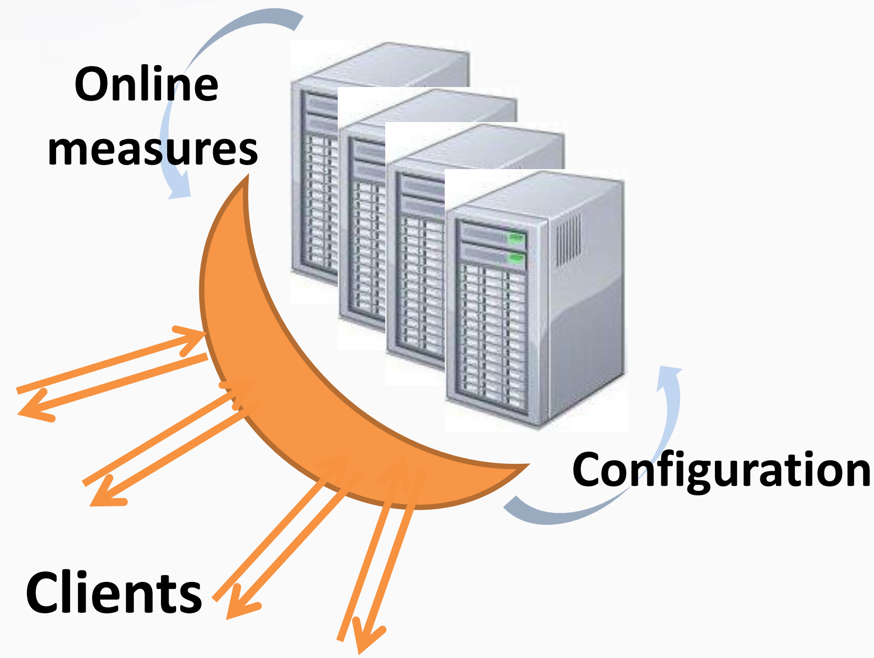
Strengths of PERSYVAL-Lab

- Research Groups covering all the needs: mathematics, control theory and signal processing, hardware and software design
- Close contact with:
  - *Industrial partners in Minalogic and outside*
  - *Several master curricula at Univ. of Grenoble*

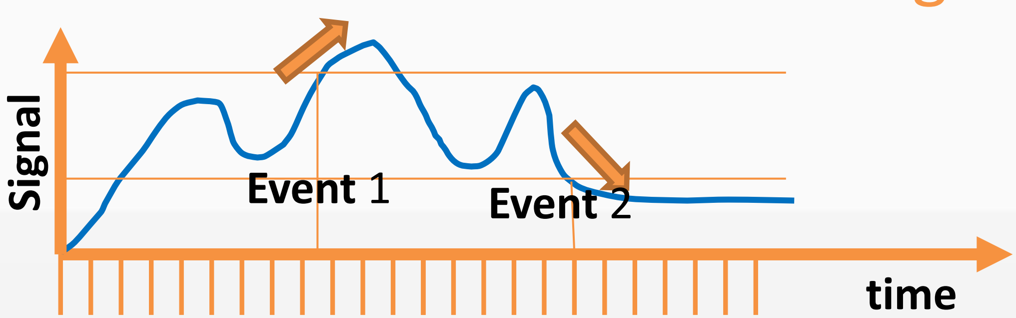
… Focus on three examples for which the strengths of Persyval are useful…
(not exhaustive)

Optimized Behavior with Constraints: Hardware/Software/Control





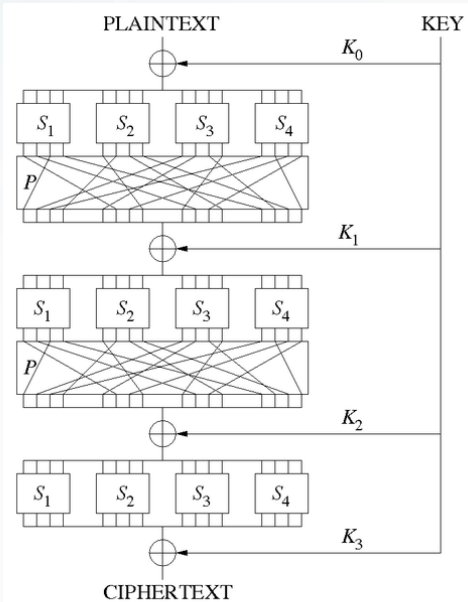
From time-based to event-based signal processing and control



- Less work, lower consumption
- No need for time synchro.

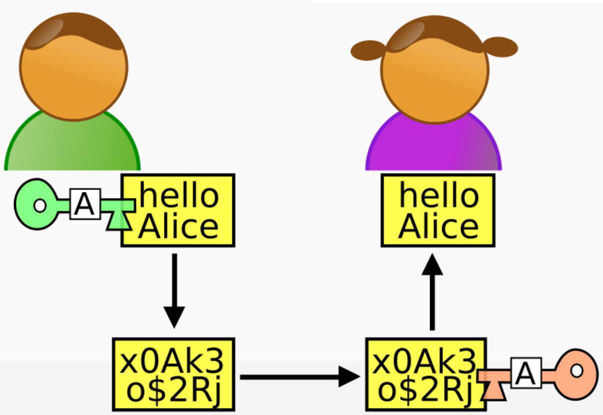
Security: From Mathematics to Hardware and Software Components

Cryptographic schemes



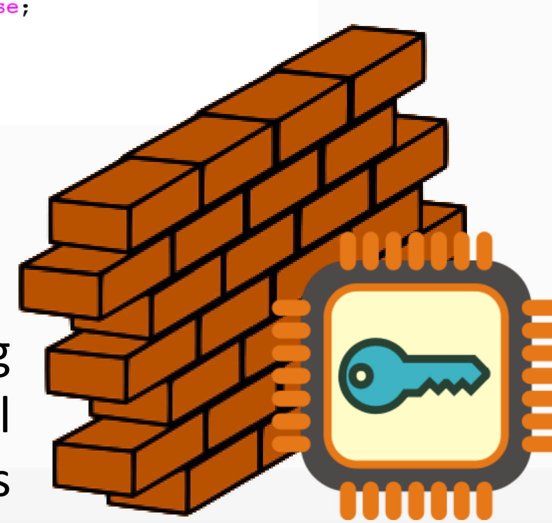
Safe SW implementations

```c
/* Miller-Rabin primality test  */
bool Miller(long long p,int iteration){
    if(p<2){ return false; }
    if(p!=2 && p%2==0){ return false; }
    long long s=p-1;
    while(s%2==0){ s/=2; }
    for(int i=0;i<iteration;i++){
        long long a=rand()%(p-1)+1,temp=s;
        long long mod=modulo(a,temp,p);
        while(temp!=p-1 && mod!=1 && mod!=p-1){
            mod=mulmod(mod,mod,p);
            temp *= 2;
        }
        if(mod!=p-1 && temp%2==0){
            return false;
        }
    }
    return true;
}
```

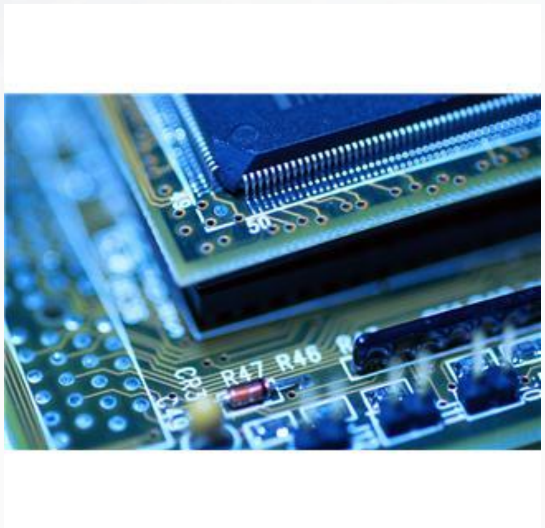


Security protocols

HW resisting to physical attacks



Computing Power vs Predictability: Conflicting Objectives?



Multi and manycore architectures deliver *Average* performance

The Holy Grail:

HW architectures +
SW layers +
Programming model and compilation

Guaranteeing:
Time predictability and
Isolation of functions

Inertial unit,
Engine control:
400 kLoC of SW
for which predictability is needed

PERSYVAL-Lab

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