UNIVERSIDAD COMPLUTENSE MADRID

Plataforma unificada de simulación secuencial, paralela y distribuida. Aplicación a la gestión de nodos de irradiación solar.

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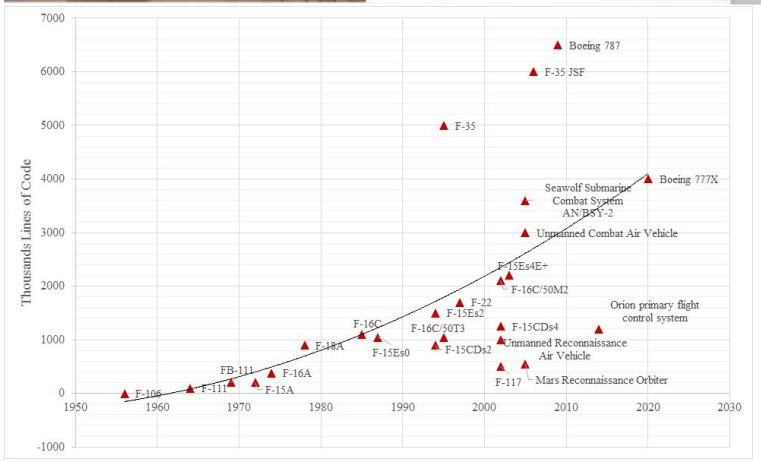
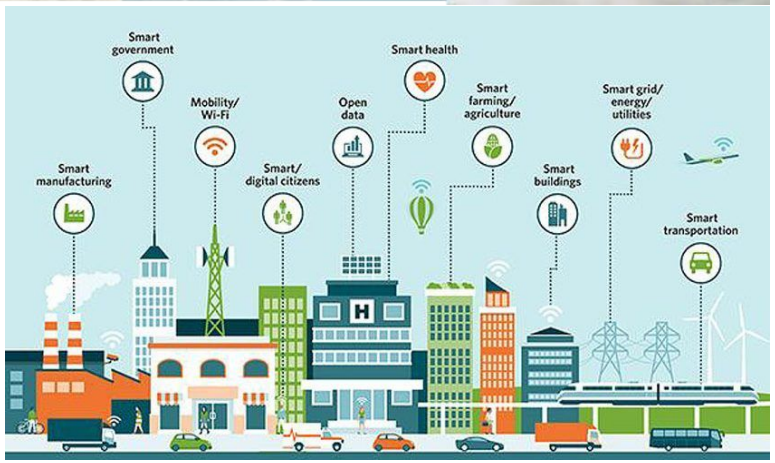
Introducción y motivación



Complejidad vertical

Modeling and simulation ***is a vital ingredient in creating the connected elements at the heart of*** ***Complex Systems.*** *It can support early evaluation and optimization of designs and ongoing verification as changes occur—to make sure the right product is developed and delivered with the required speed and quality. [**IBM**]*

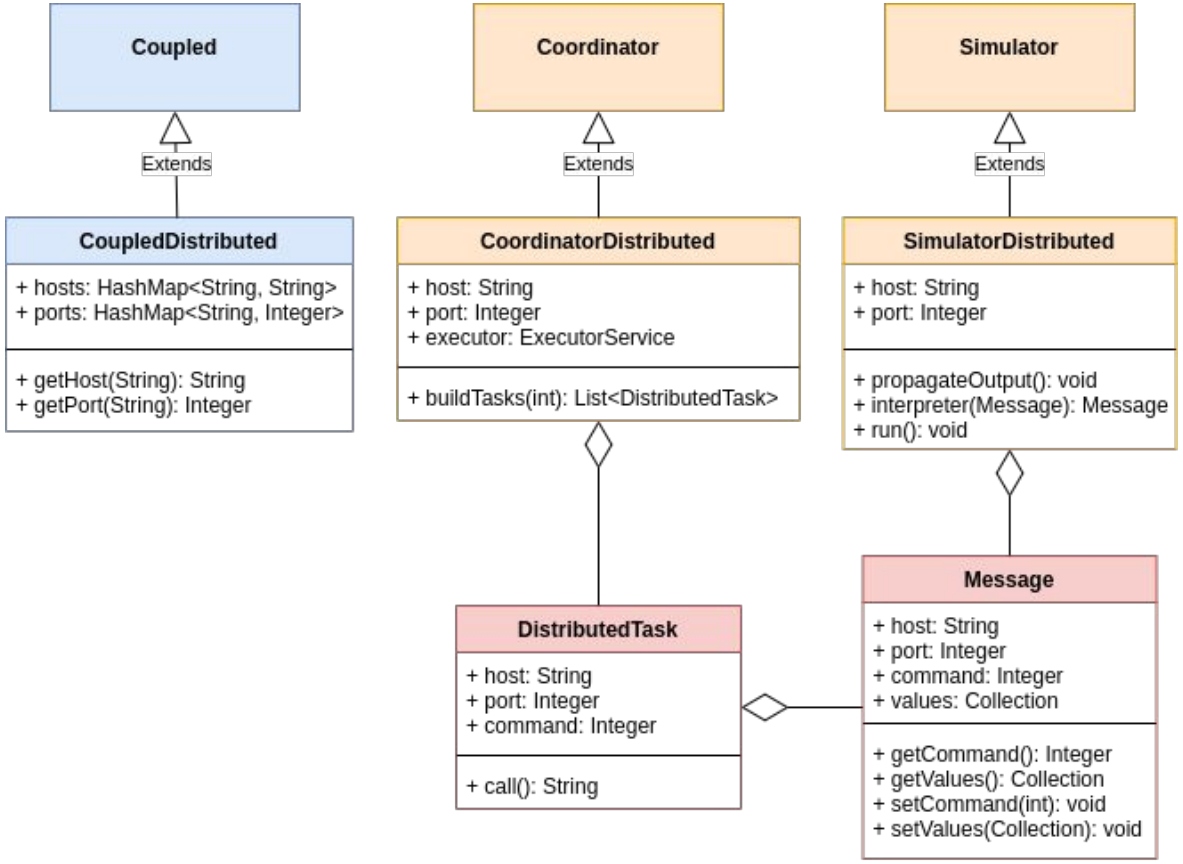


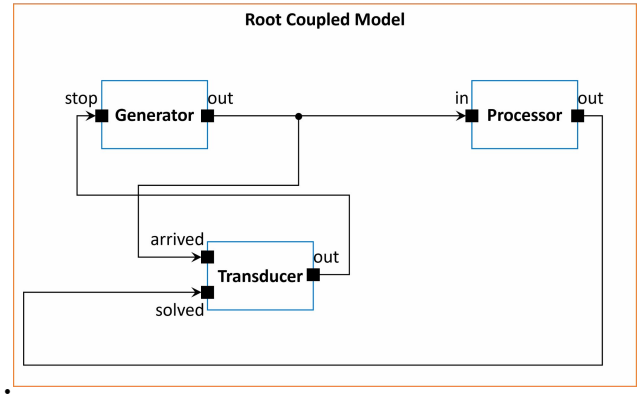
Complejidad horizontal

El uso de un ***formalismo M&S*** *permite implementar de forma precisa modelos de sistemas complejos, definiendo* ***consistencia***, ***completitud***, ***correctitud***, *y* ***verificación***, *mucho más allá que cualquier modelo ad-hoc. En nuestro caso elegimos* ***DEVS*** *porque:*

- *Permite un diseño modular y jerárquico*
- *Lidia bien con escalabilidad y reusabilidad*
- *Provee de una semántica clara para el comportamiento de los modelos*
- *Separa conceptualmente la especificación, implementación y simulación del modelo*

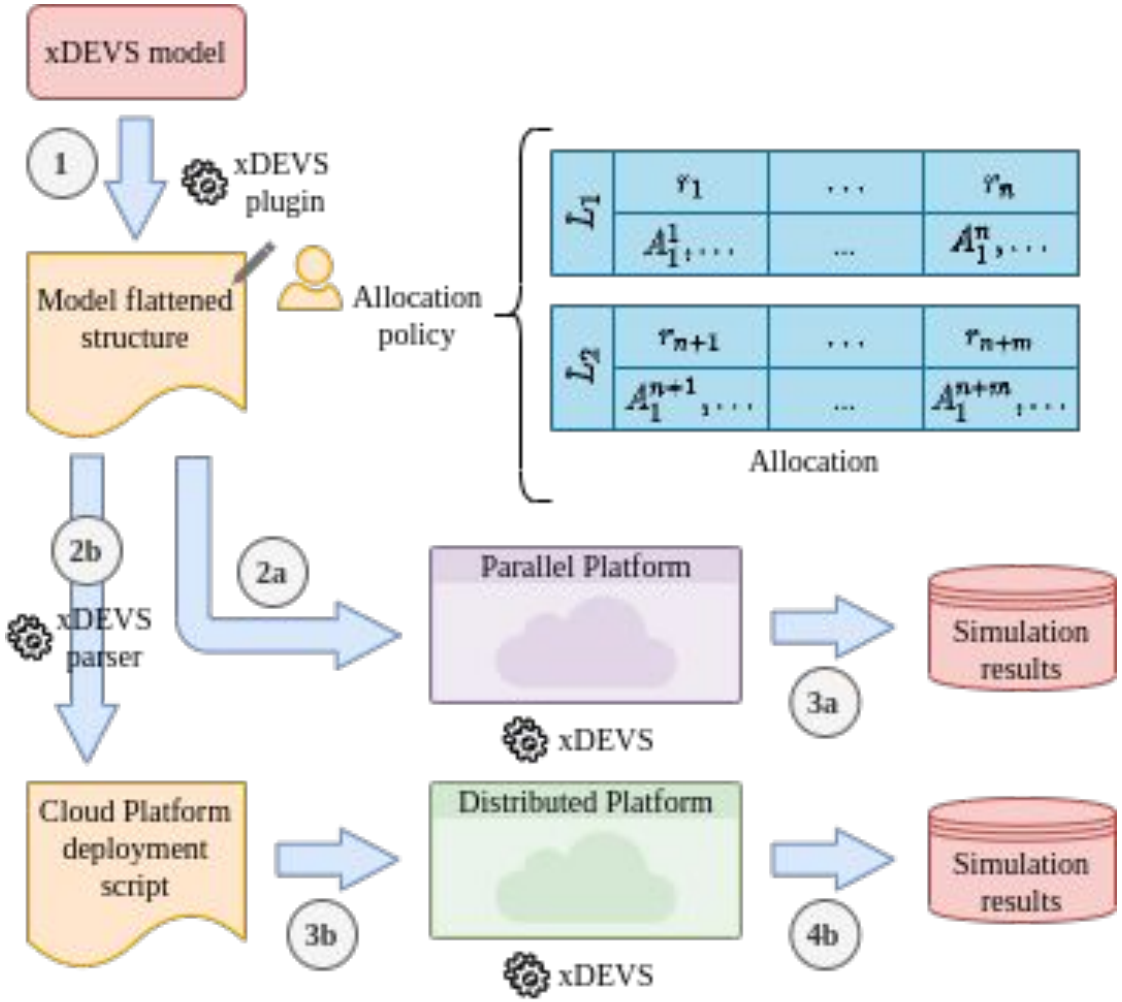
Plataforma unificada de M&S: clara y simple



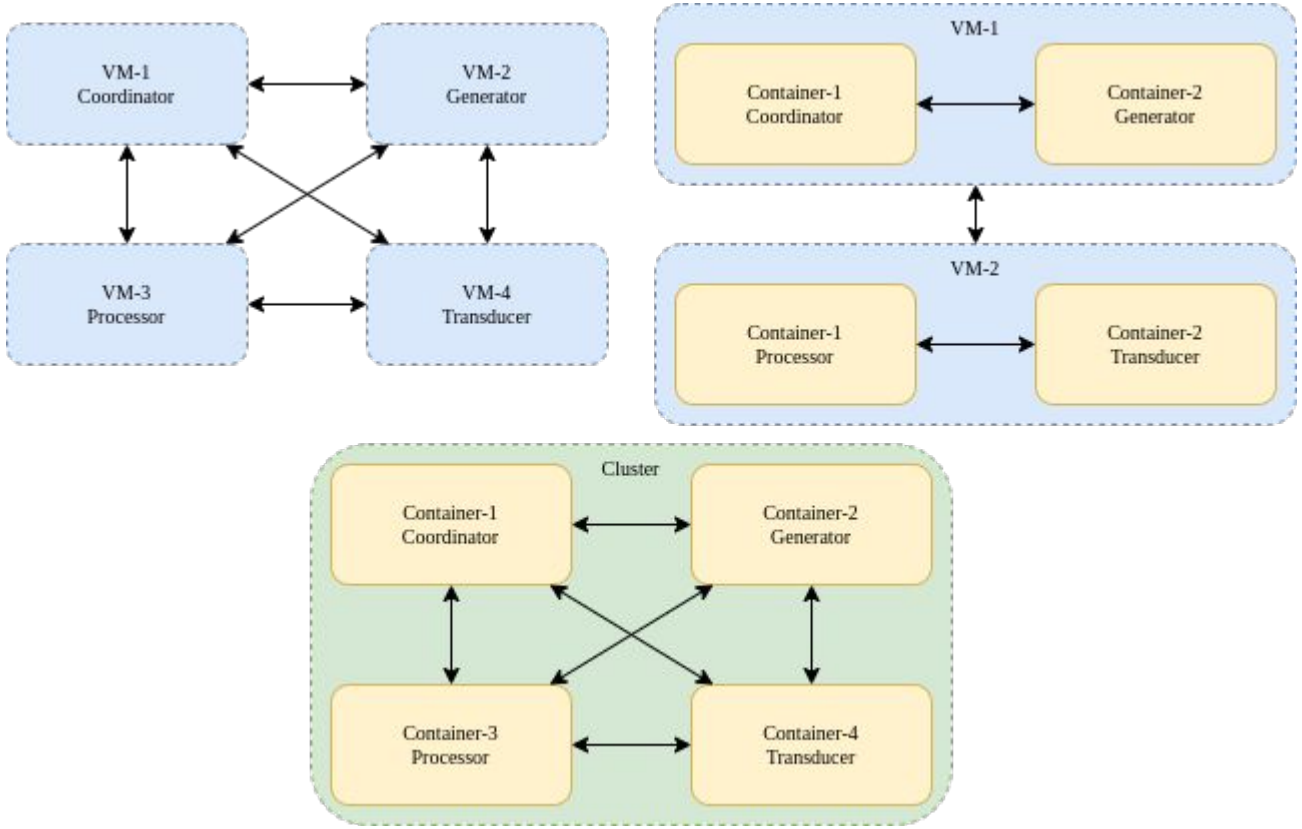



```
Coupled model = new Coupled(gpt.xml);
// Sequential execution:
Coordinator cs = new Coordinator(model);
cs.simulate(30.0);
// Parallel execution:
CoordinatorParallel cp = new CoordinatorParallel(model);
cp.simulate(30.0);
$ # Distributed execution:
$ # Simulation Entity 1, generator
$ java -cp xdevs.core.simulation.SimulatorDistributed gpt.xml generator
$ # Simulation Entity 2, processor
$ java -cp xdevs.core.simulation.SimulatorDistributed gpt.xml processor
$ # Simulation Entity 3, transducer
$ java -cp xdevs.core.simulation.SimulatorDistributed gpt.xml transducer
$ # Simulation Entity 4, run the Coordinator
$ java -cp xdevs.core.simulation.CoordinatorDistributed gpt.xml
```

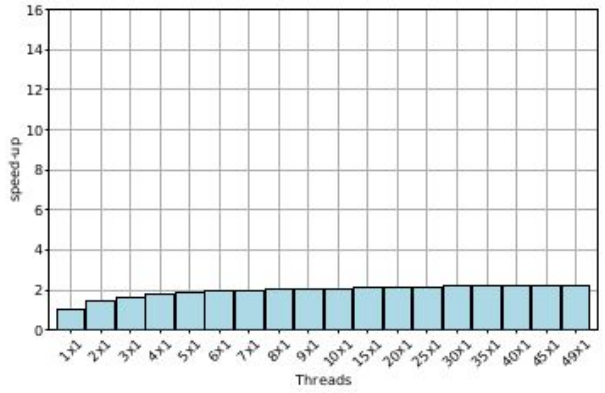
Flujo de ejecución



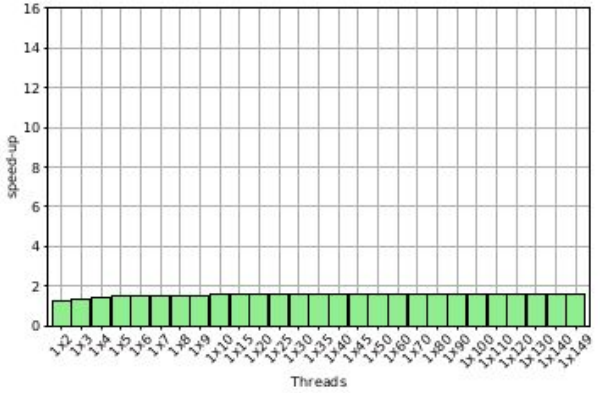
Posibilidades de despliegue distribuido



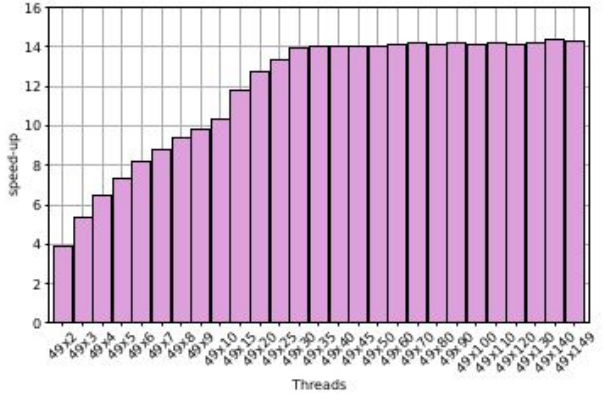
Evaluación



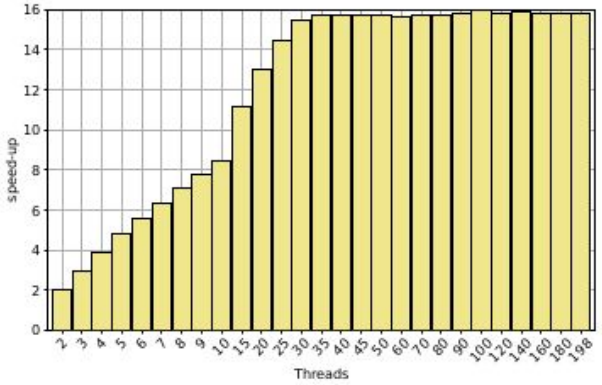
(a) Threads for slow models



(b) Threads for fast models



(c) Sub-optimal approach



(d) Balanced distribution

Figure 12: Resources (threads) distribution and speedups for the 32 vCPU parallel simulation.

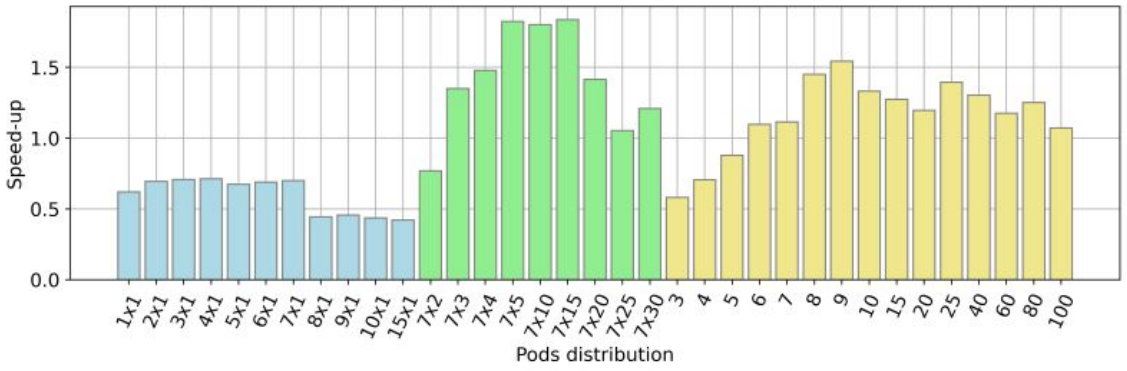


Figure 13: Distributed simulations speed-ups depending on the number of pods ($L_1 \times L_2$).

	Sub-optimal	Balanced	$/month
Parallel 4 vCPU	3.88	3.91	168.38
Parallel 32 vCPU	14.33	15.94	1413.63
Distributed 8 × 4 vCPU	1.84	1.45	1347.01

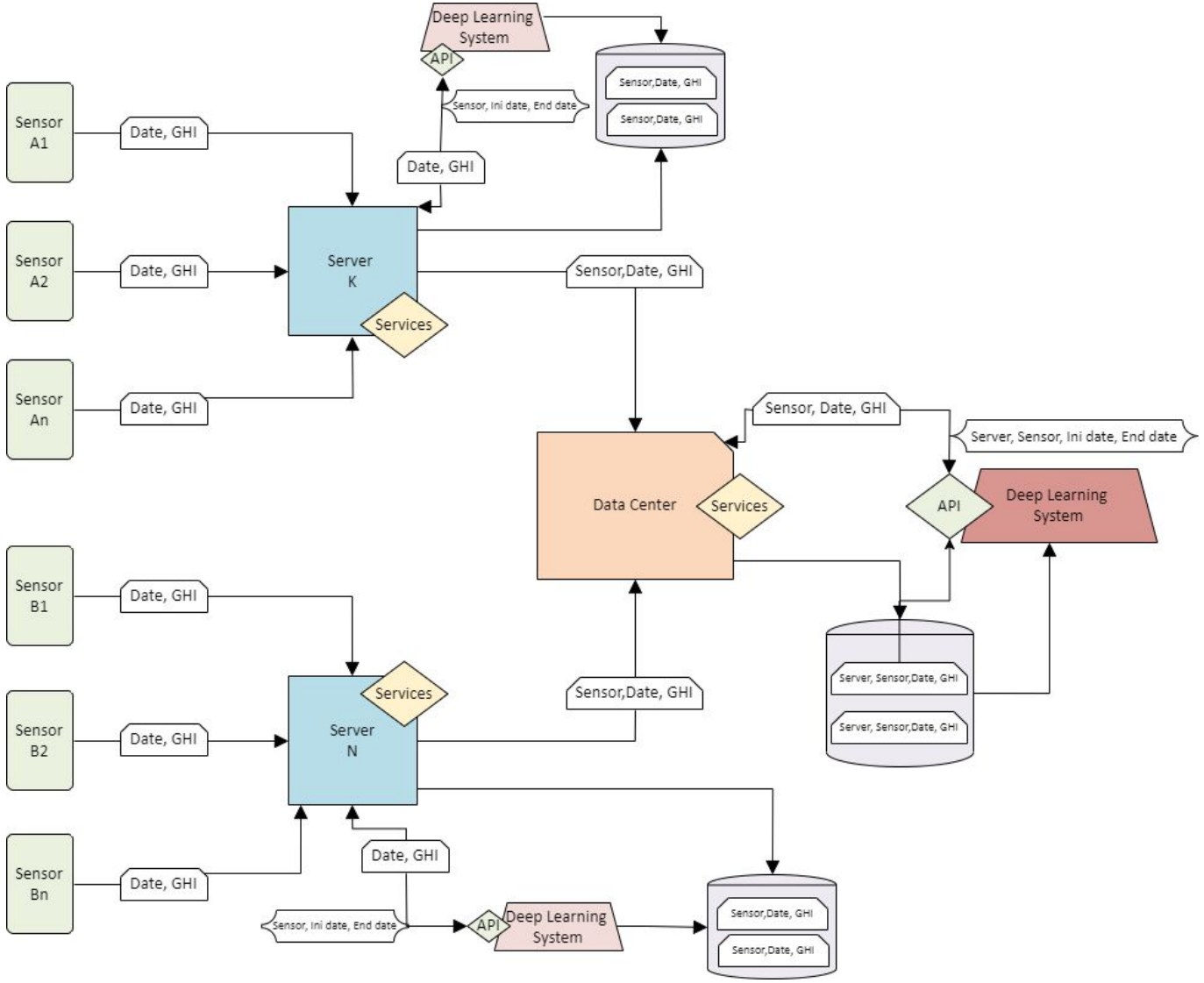
Table 2: Maximum speedup and monthly cost of the parallel and distributed simulations.

Parallel architectures are faster, cheaper, and the deployment quite straightforward …

Why do we need distributed architectures?

(Distributed) embedded systems

Caso: gestión integrada de despliegue de nodos de irradiación solar



Ruegos y preguntas