

Real-Time Systems

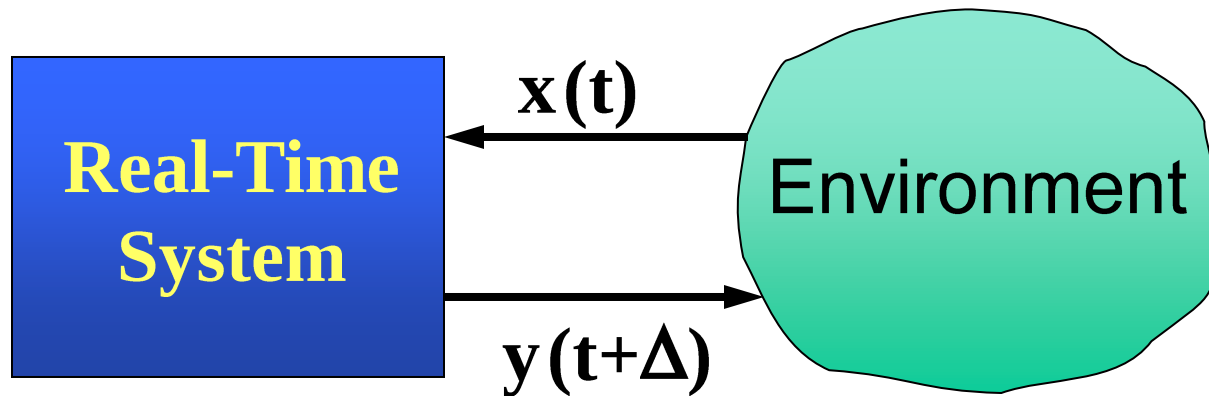
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Real-Time Systems

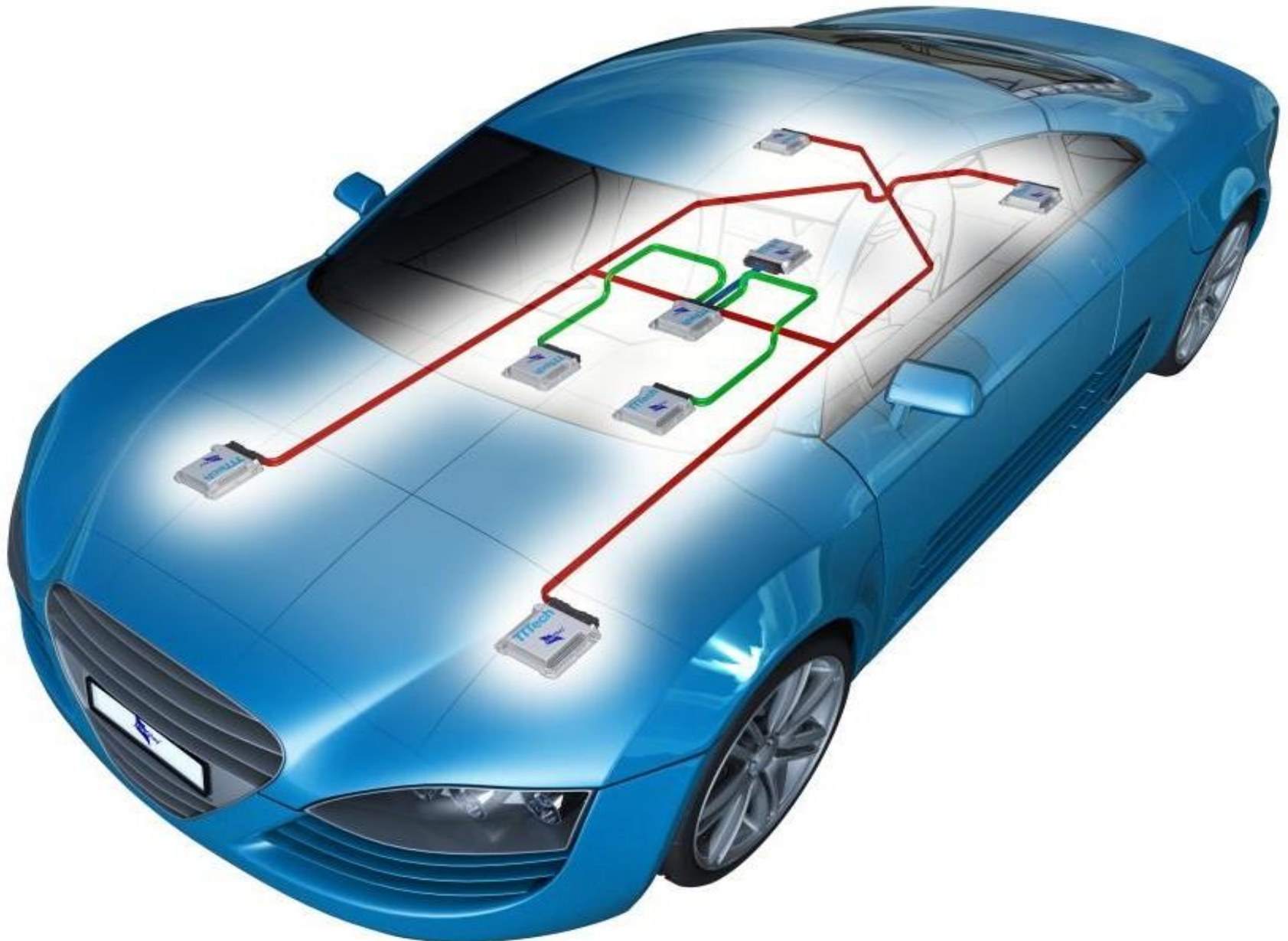
Real-time systems are computer control systems that must react with specified timing constraints.



Railway switching systems



Automotive systems



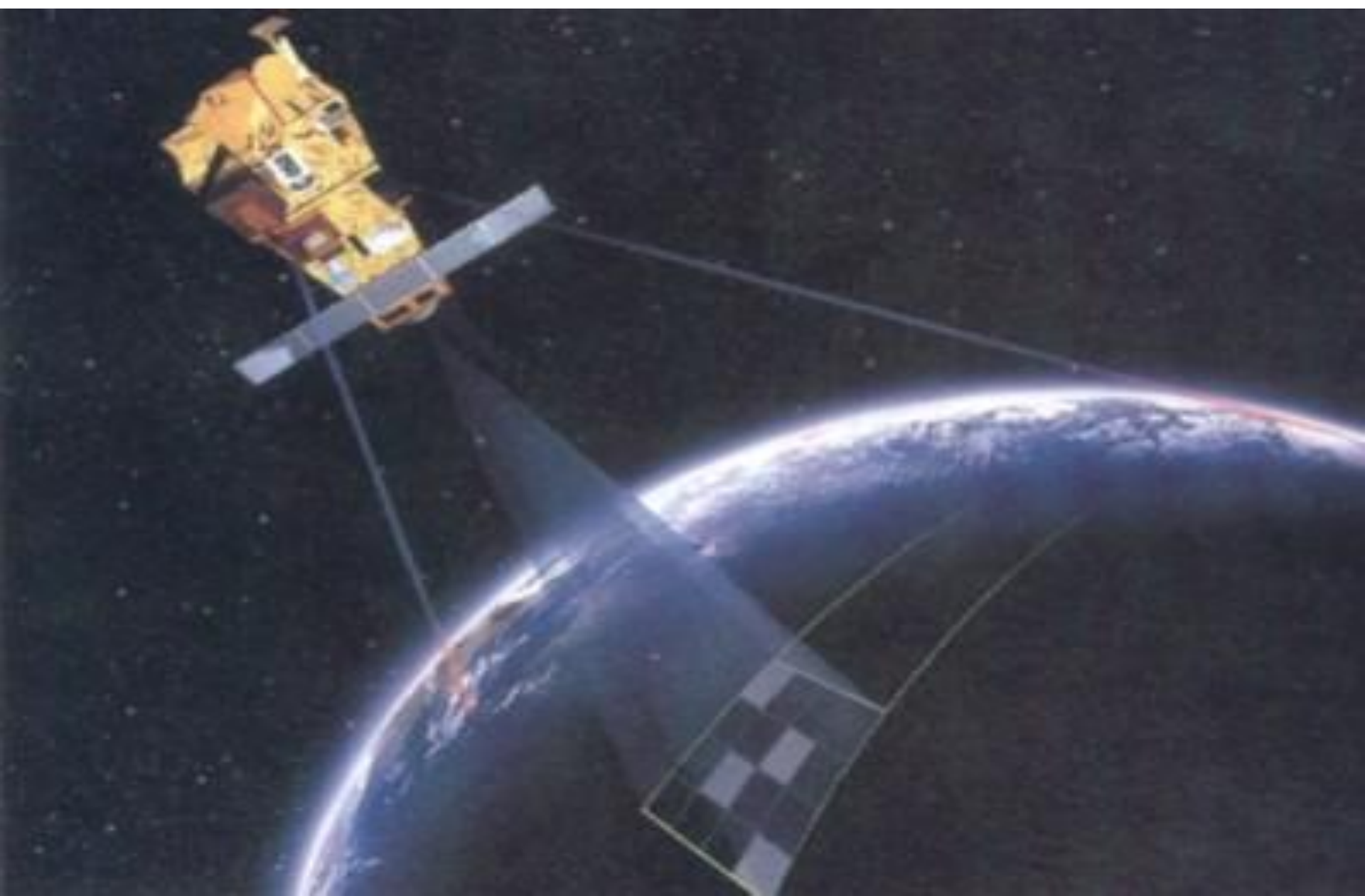
Flight control systems



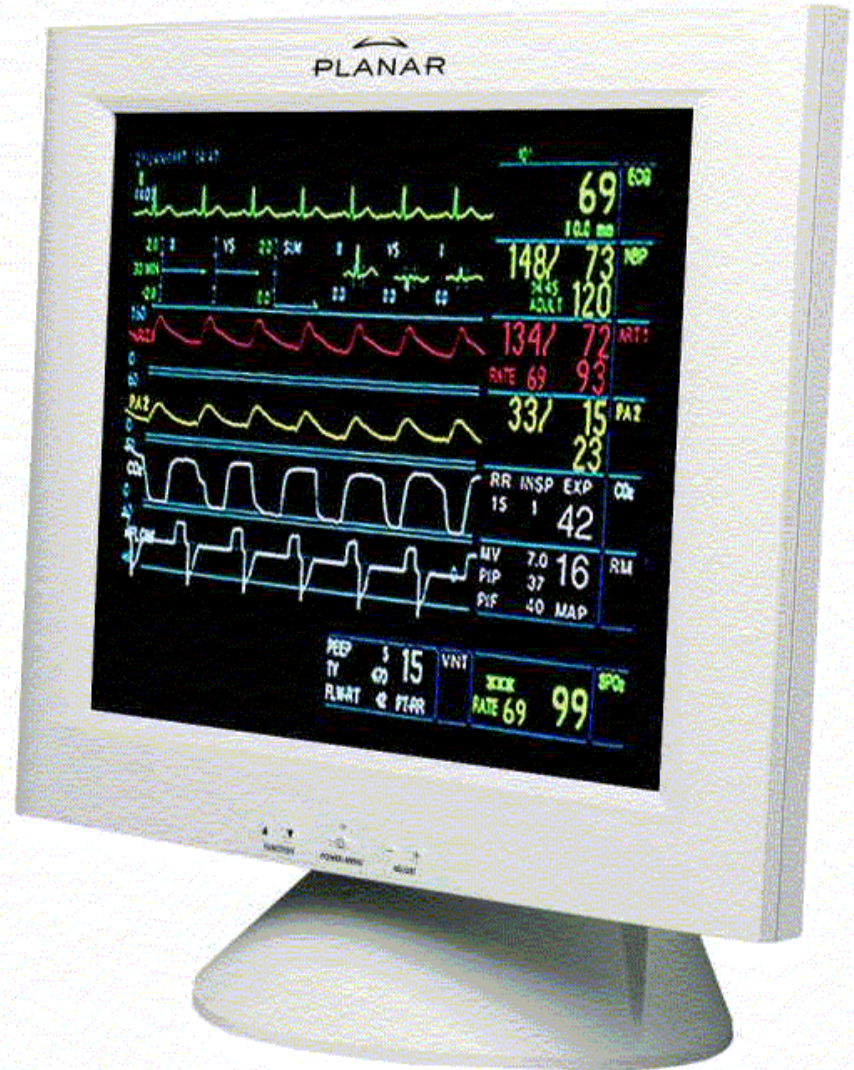
Air traffic control



Telecommunication systems



Patient Monitoring Systems



Flight simulators



Robotics



AIBO - Sony



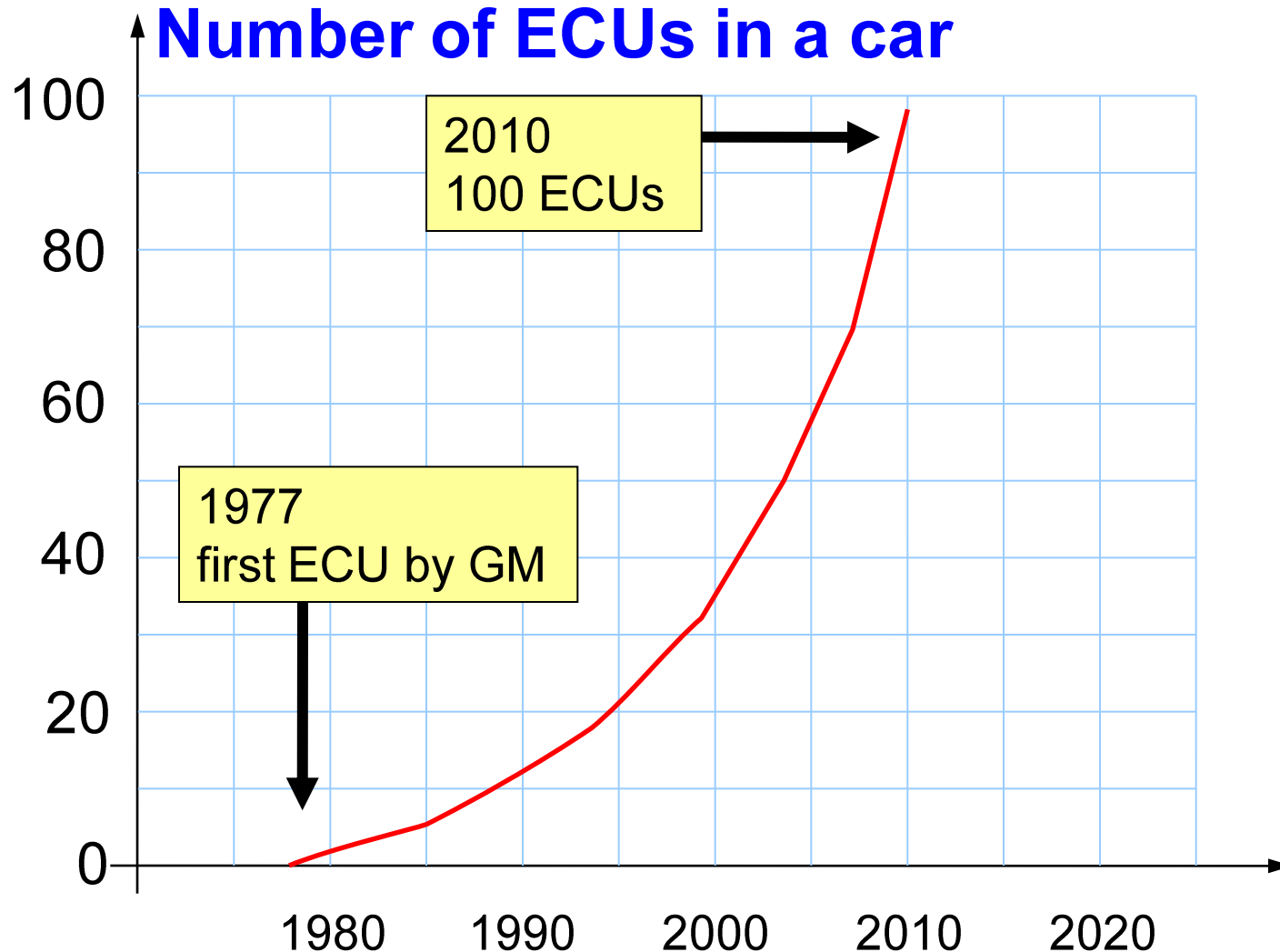
... and many others



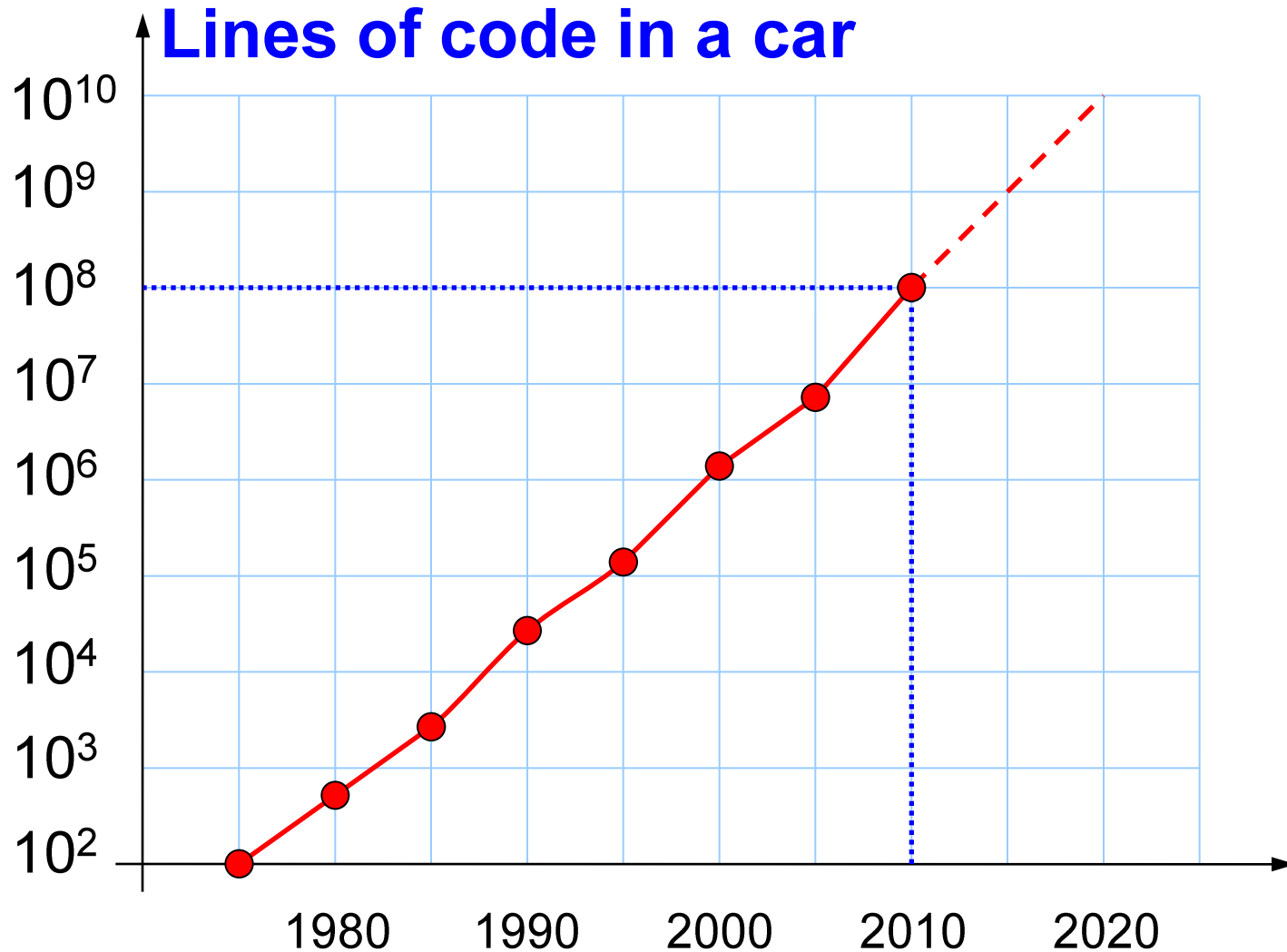
What's special in Embedded Systems?

FEATURES		REQUIREMENTS
Scarce resources (space, weight, time, memory, energy)	➔	High efficiency in resource management
High concurrency and resource sharing (high task interference)	➔	Limit interference by temporal isolation
Tight environment interaction	➔	High predictability in the response time
High variability on workload and resource demand	➔	Robustness (Overload handling and adaptivity)

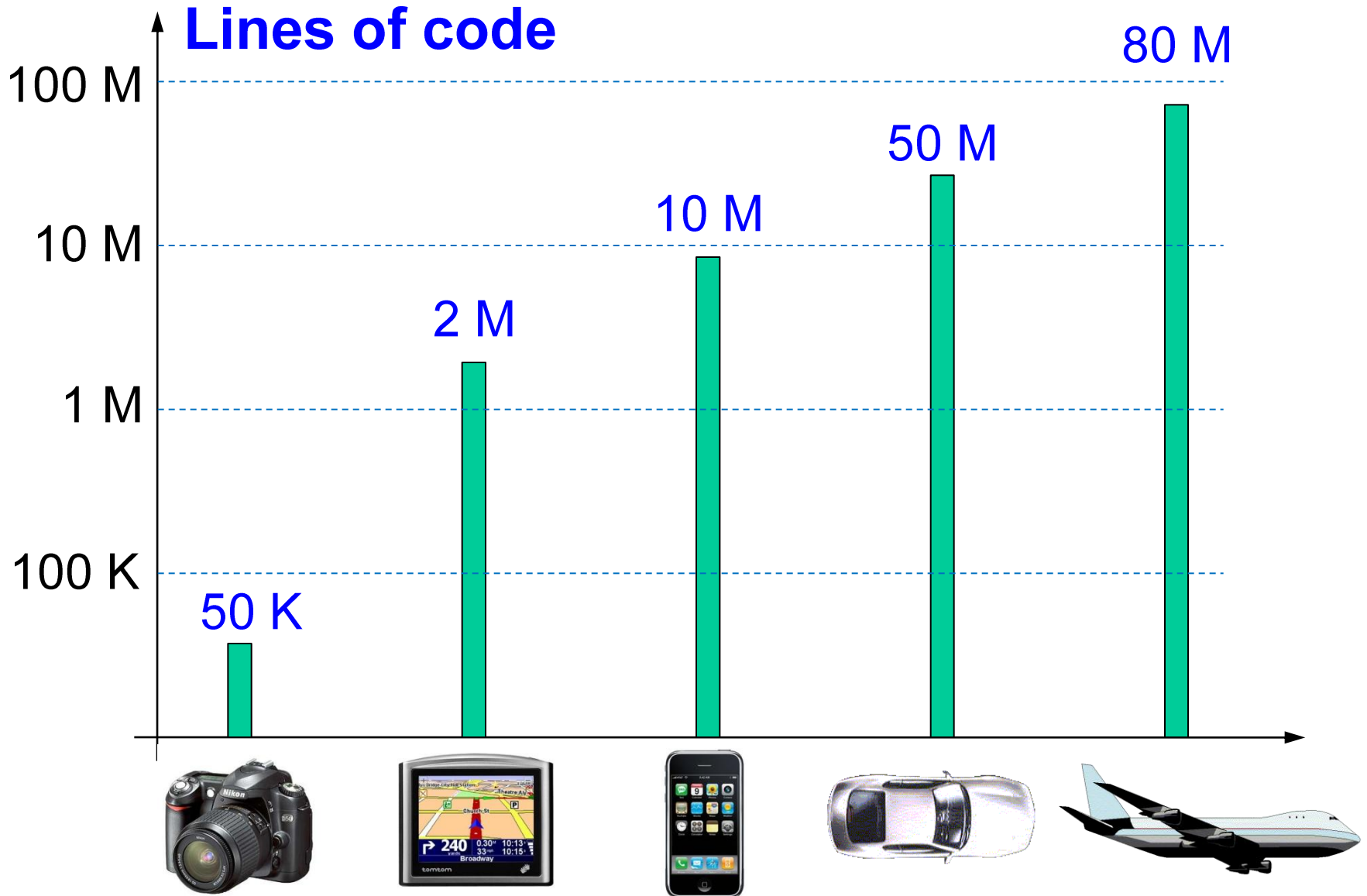
Increasing Complexity



Increasing Complexity



Today's Complexity



Cell phone applications



Objective of the course

- Study software methodologies and algorithms to increase predictability in computing systems.
- We consider time-critical computing systems consisting of several concurrent activities subject to with timing constraints.
- How to model real-time activities to describe features and constraints a few set of parameters.
- How to analyze a real-time system to predict worst-case response times and verify feasibility under a set of constraints.

Course Outline - 1

- Basic concepts
- Where timing constraints come from?
- Worst-case reasoning
- Feasibility Analysis
- Periodic task handling and analysis
- Aperiodic server mechanisms
- Accessing shared resources

Course Outline - 2

- Predictable communication mechanisms
- Overload management
- Increasing flexibility
- Developing real-time applications
- Examples of real-time kernels

Text books



Hard Real-Time Computing Systems

Giorgio Buttazzo, Springer 2005

Sistemi in Tempo Reale

Giorgio Buttazzo, Pitagora 2006



Final Exam

written test