



Multicore architecture based product platforms

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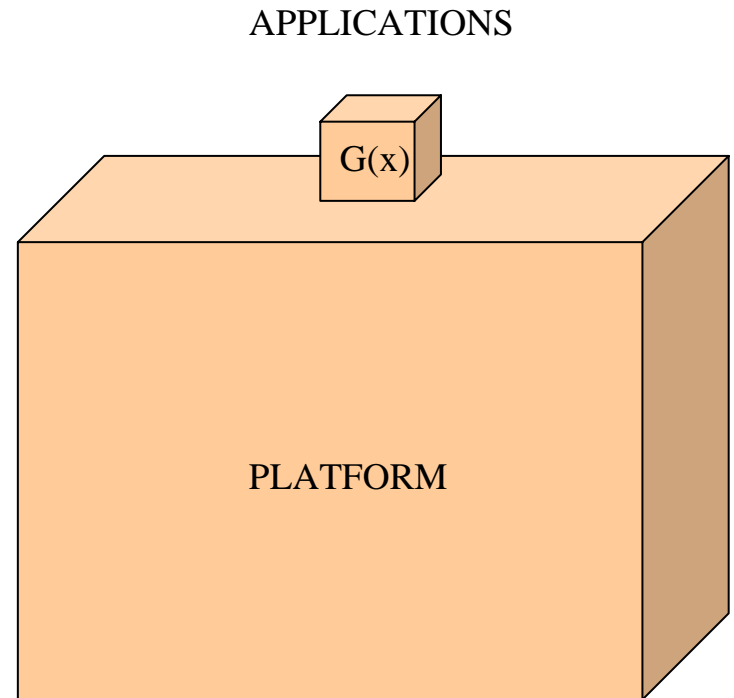
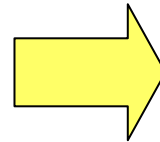
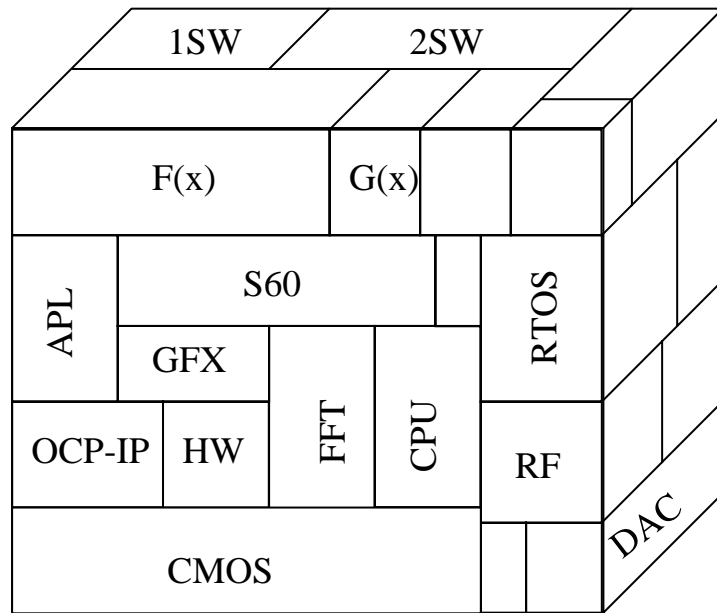
TOPICS

- Why to design and use multiprocessor platforms
- What are multiprocessor platforms
- Basic idea of platform-based design
- Most important platform-based design challenges
- Conclusions

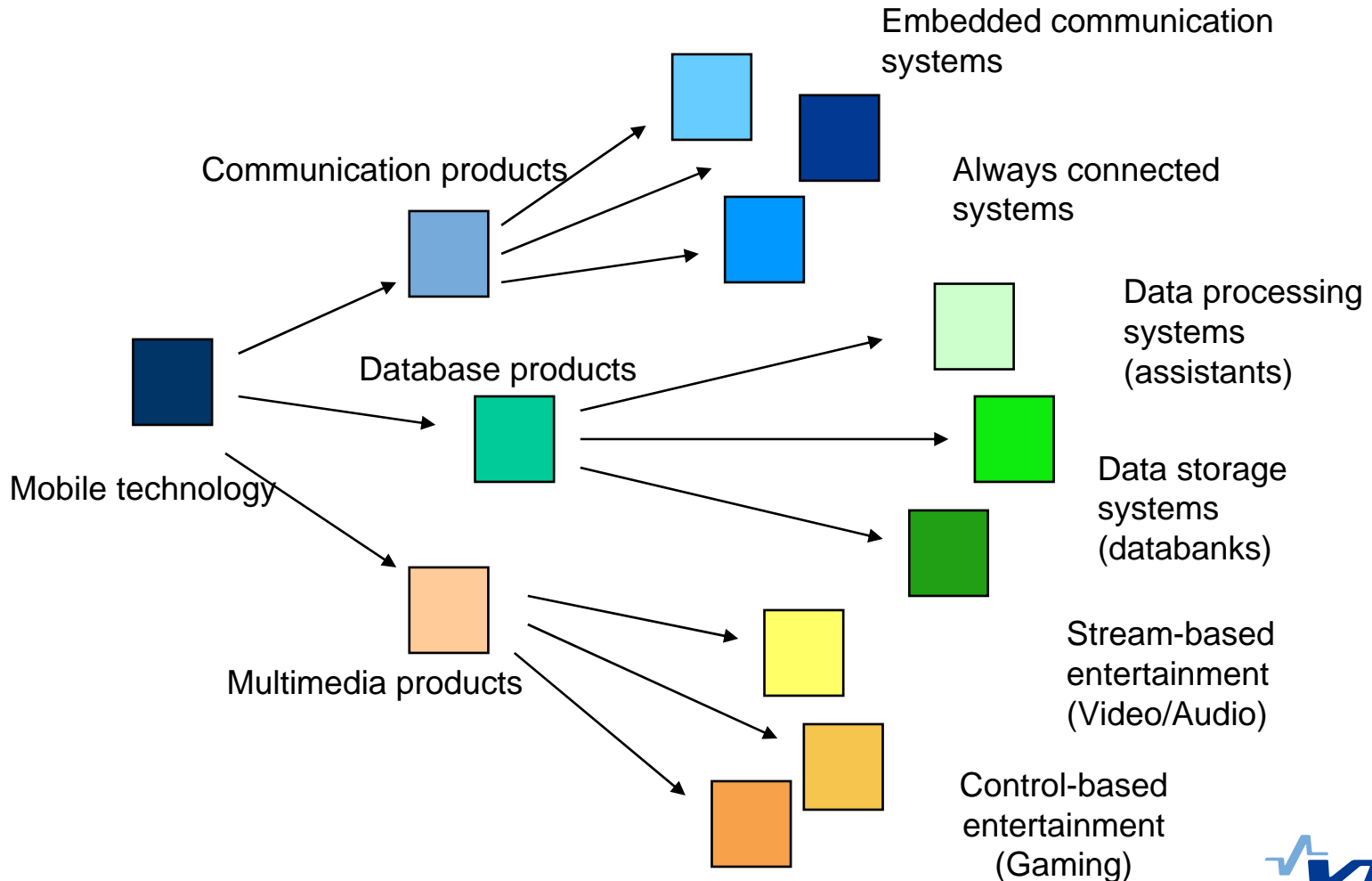
TECHNOLOGY TRENDS

- Moore's Law about capacity of ICs
 - Dedicated HW is too expensive technology for all the capacity: reuse, programmability, configurability
 - Single sequential instruction stream processors have reached their limits: extra pain -> no gain
 - Signal delays introduce new problems for computing platform architectures
- Design productivity gap
 - Design complexity exceeds design capacity
 - Design time exceeds economical capacity
- Energy efficiency is becoming major design target

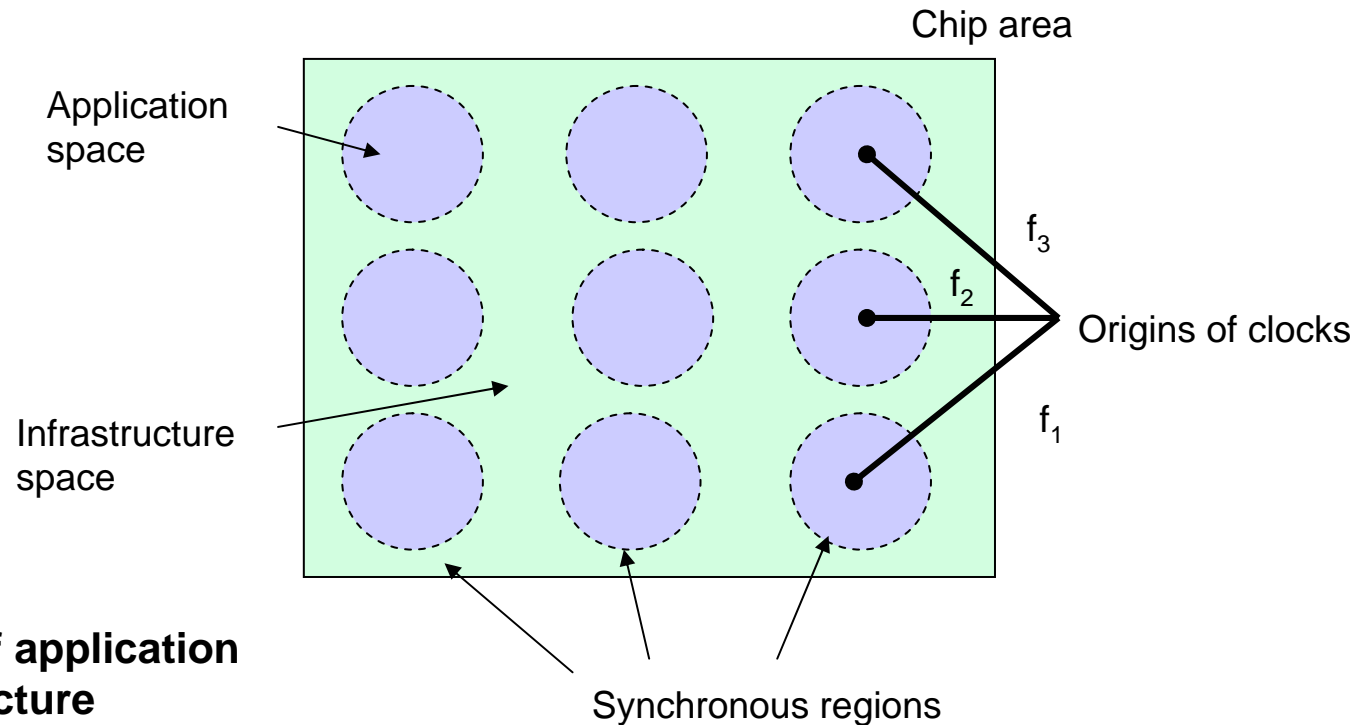
SOLUTION FOR DESIGN PRODUCTIVITY - REUSE



EFFICIENT REUSE NEEDS TARGETS: PRODUCT FAMILY DESIGN



SOLUTION FOR CAPACITY EXPLOITATION - PARTITIONING



**Separation of application
and infrastructure**

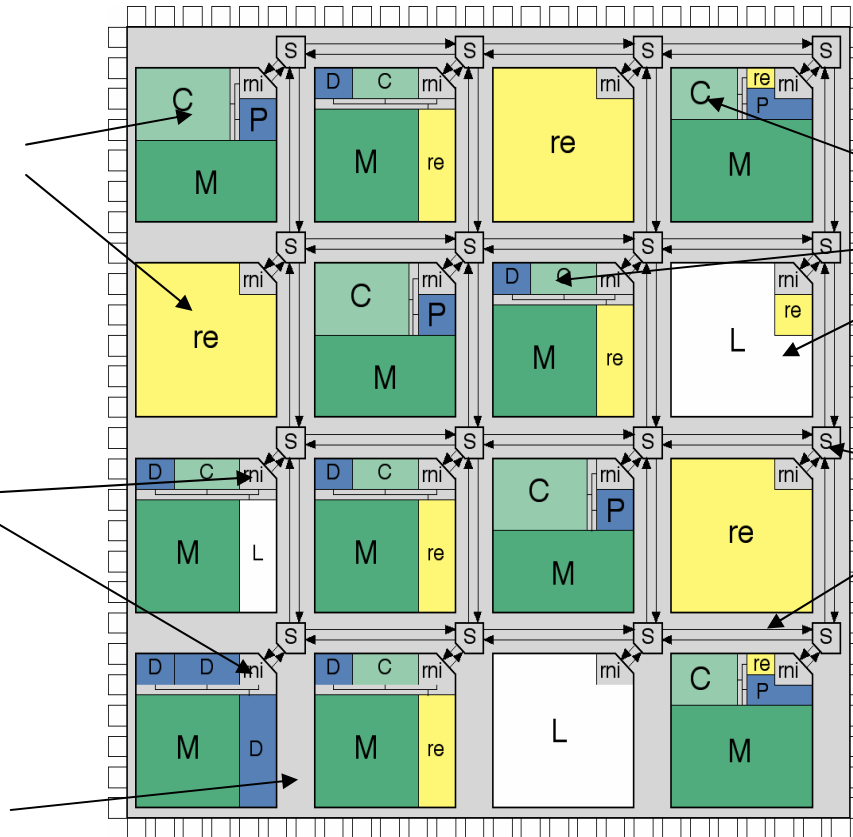
**Globally Asynchronous,
Locally Synchronous
architecture (GALS)**

“DISTRIBUTED INTEGRATED EMBEDDED SYSTEMS” - BENEFITS

General-purpose or reconfigurable computing resources

Possibility to switch off parts that are not currently needed

Very efficient exploitation of silicon capacity, huge computation power, energy efficiency



Optimized architectures (performance, power) for specific tasks

Asynchronous communication network

EXAMPLES OF MULTICORE ARCHITECTURES

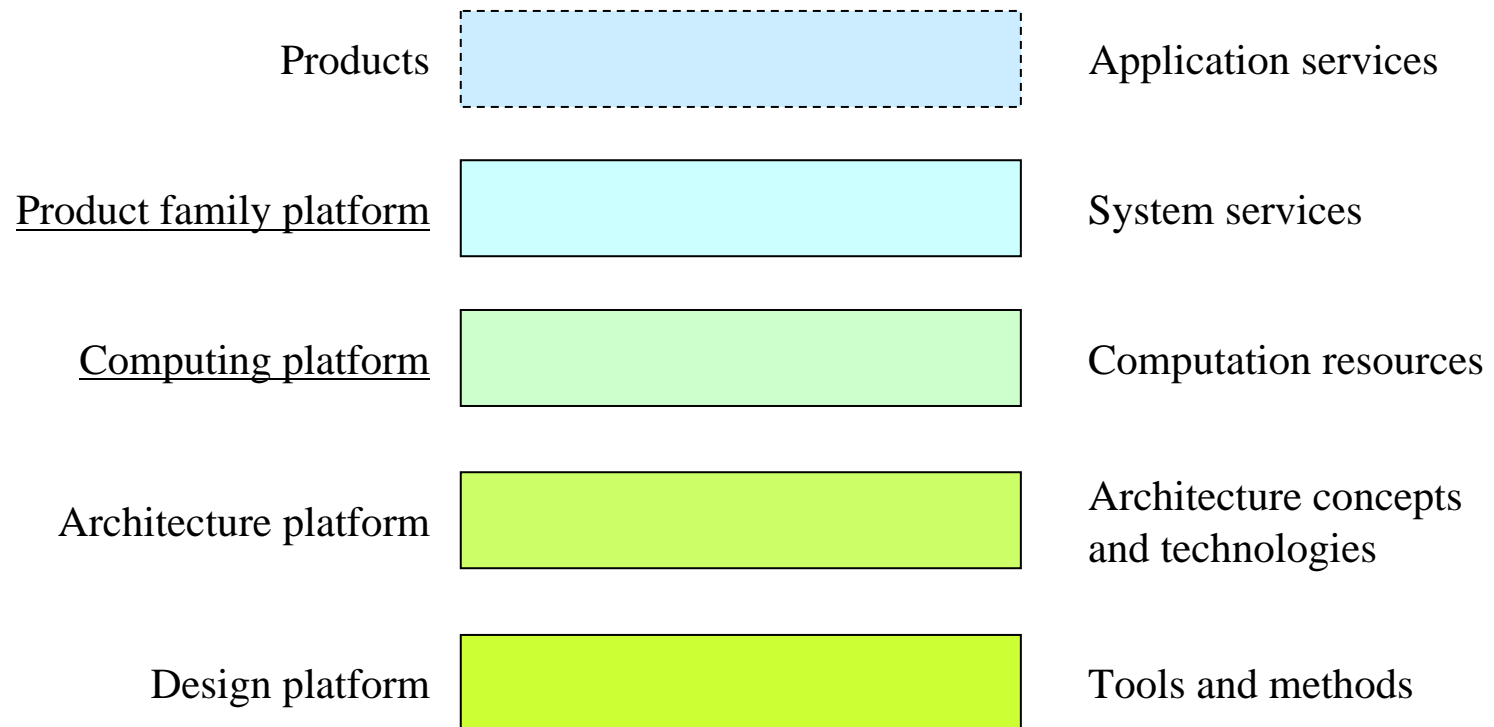
- Intel IXP2850 Network Processor
 - Data packet processing device with XScale RISC core and 16 microengines
- Philips Nexperia Digital Video Platform
 - with 32-bit CPU, Trimedia VLIW processor, shared SDRAM and several HW accelerators
- Texas Instruments OMAP2 architecture
 - ARM RISC core, DSP core, graphics core, video accelerator and advanced interconnect
- PicoChip PC102 communications processor
 - Processing array with 322 processors, 160MHz, 197 GIPS, 3,3 Tbit/s bandwidth
- IBM Cell (for PlayStation3)
 - Dual-threaded PowerPC core and 8 specialized mini-computers, 4 GHz, 234 Million transistors, 256 Gflops

PLATFORM

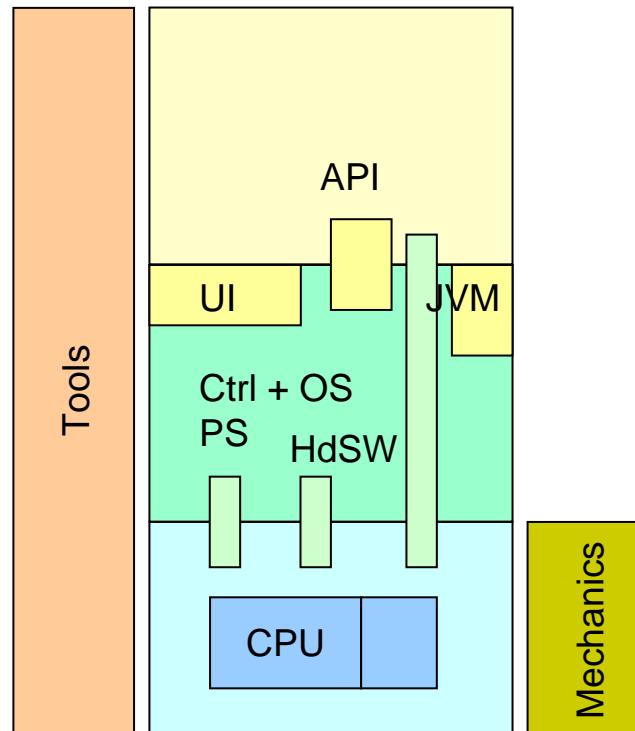
An integrated and managed
set of common features,
upon which a set of products
or product family can be built.

(VSIA Taxonomy)

PLATFORM LAYERS – DIFFERENT ABSTRACTION LEVELS



PLATFORMS ARE HETERONEOUS COMBINATIONS OF ELEMENTS



Product platform

Application platform

Software platform

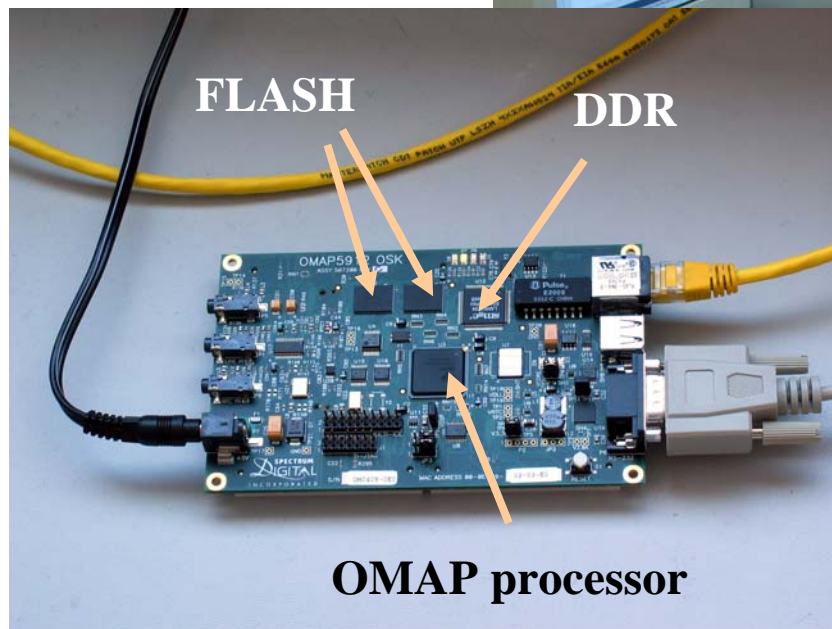
Computation platform

Communication platform

HW platform

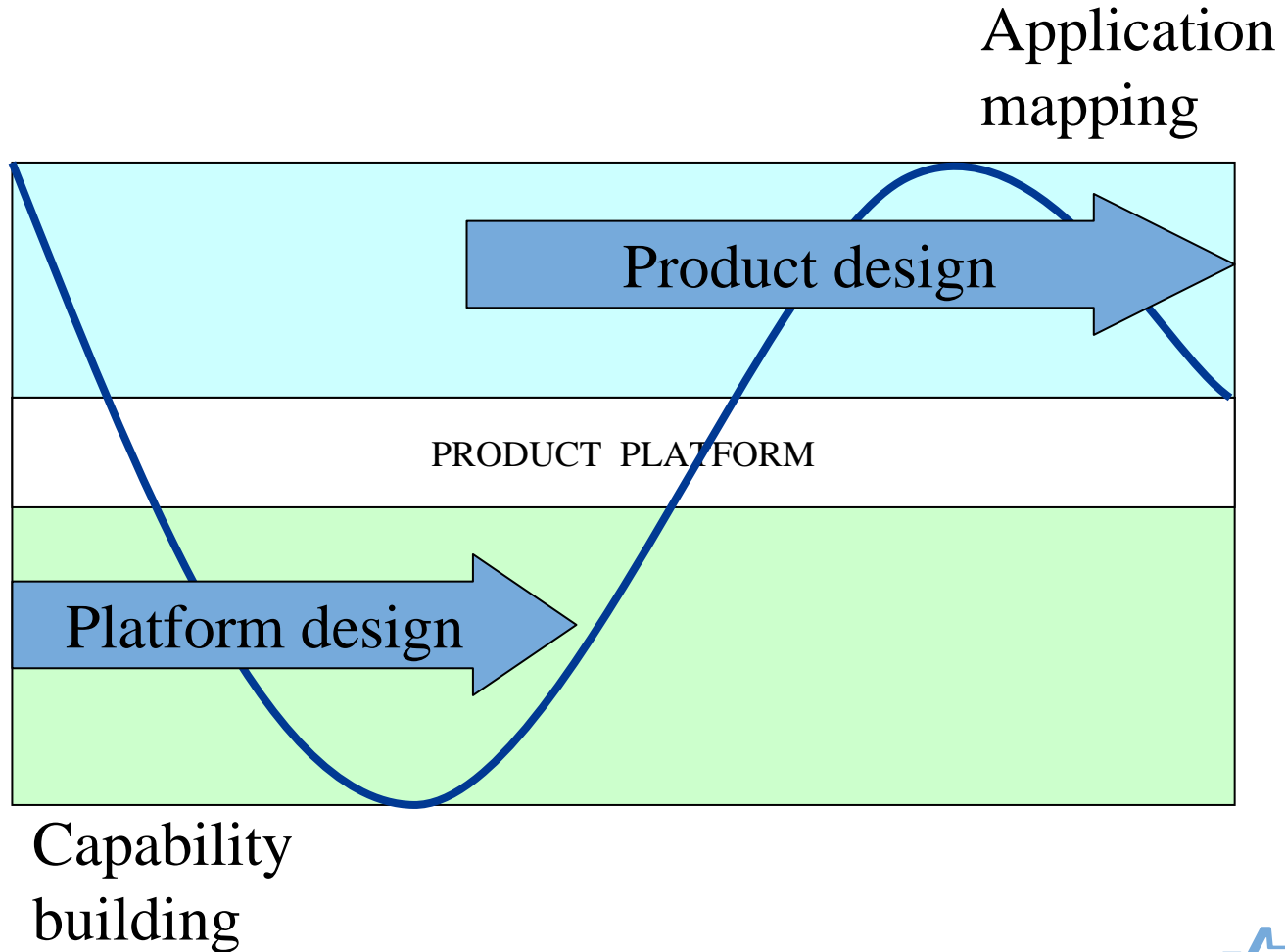
OMAP COMPUTING PLATFORM

ARM +
DSP core



Linux OS + DSP Bios
Linux-based development tools

PLATFORM-BASED DESIGN



CHALLENGES FOR PLATFORM DESIGNERS

**Understanding
the role of the
platform in a
product**

Encapsulation
Interfaces
Design for reuse

**Understanding
the trade-offs**

Capability vs. Efficiency
Generality vs. Performance
Cost vs. Usability

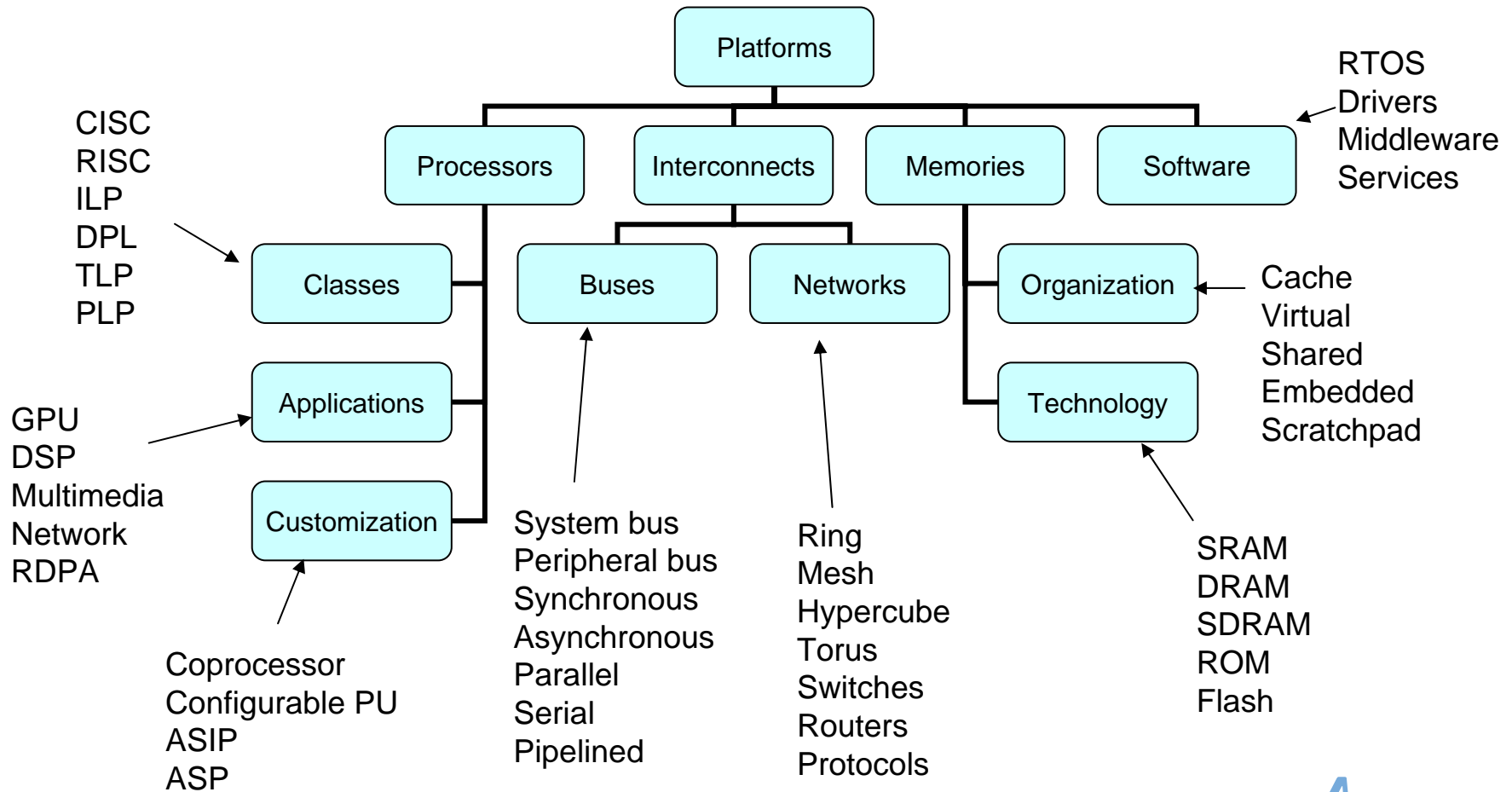
**Understanding
the platform based
development of
the products**

Building on the top of platform
Abstraction for decision support
Evaluation for validation
IPR Reuse

CHALLENGES IN USING MULTICORE PLATFORMS

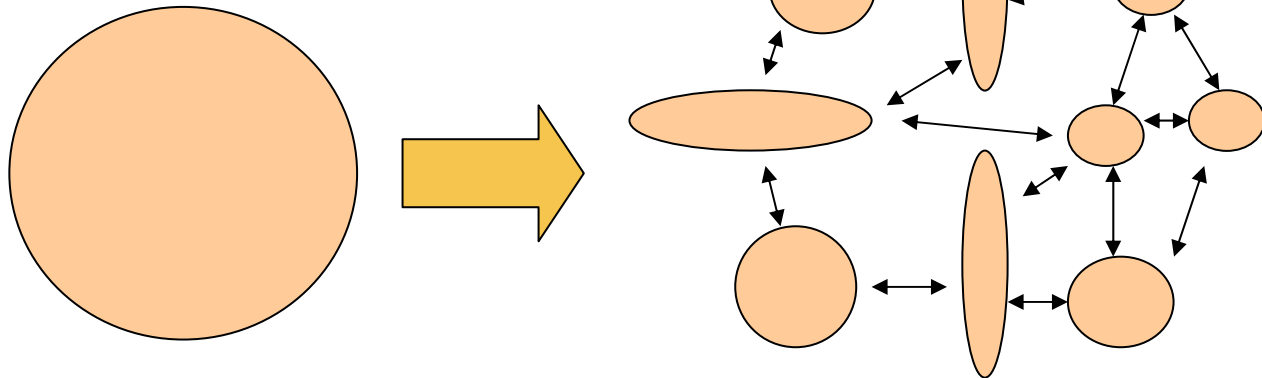
- **Heterogeneous** design environment
 - Different types of processing elements, interconnects and memory organizations
 - Variety of design practices, methods, tools, and processes
- **Complexity**
 - Number of alternative system architectures increases rapidly
 - Amount of time per alternative for analysis reduces significantly
- New **design methods**
 - Partitioning of applications and scaling of architectures
 - Mapping of applications and selection of processing units
 - Performance evaluation

HETEROGENEITY AND COMPLEXITY: BUILDING BLOCK ALTERNATIVES



PARTITIONING OF APPLICATION

Application



The challenges:

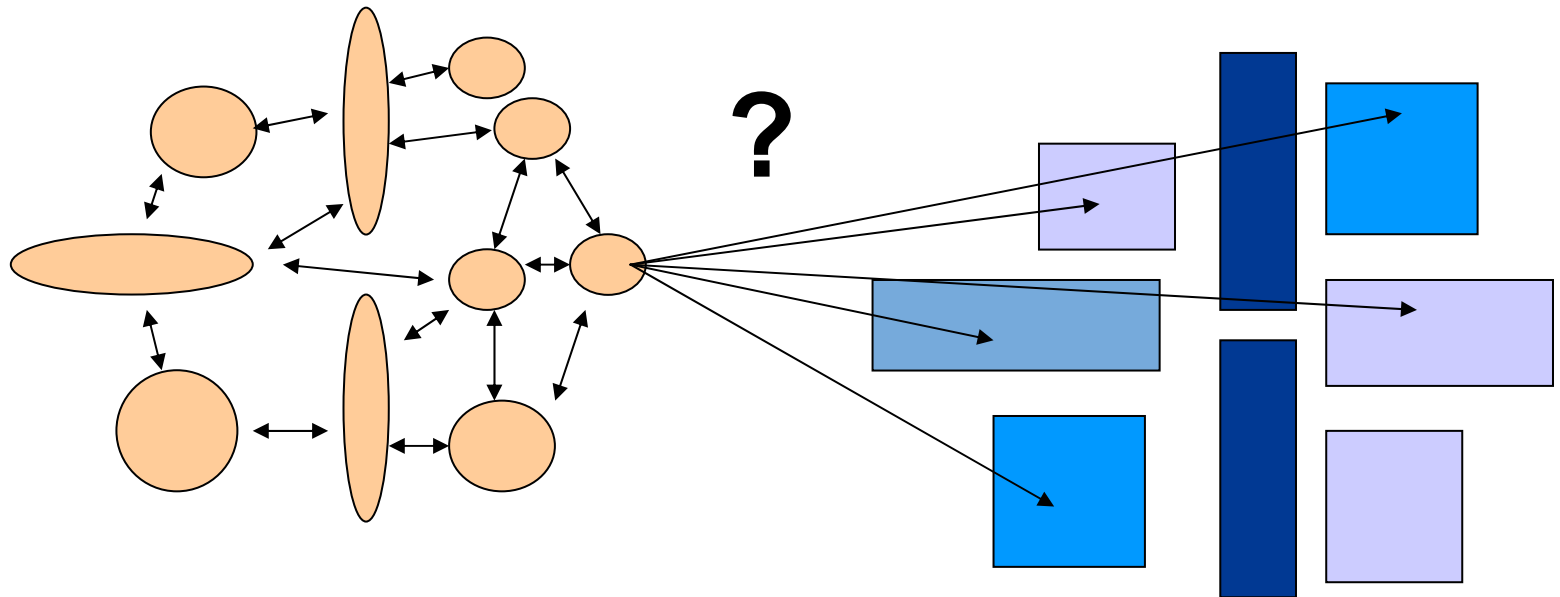
How to model the application?

How to model platform SW?

How to define the sizes of blocks?

How to evaluate the effects of new interfaces?

MAPPING ALTERNATIVES



Quality of an individual function?
The effect to overall performance?

PERFORMANCE EVALUATION OF SYSTEM ARCHITECTURE

The challenges:

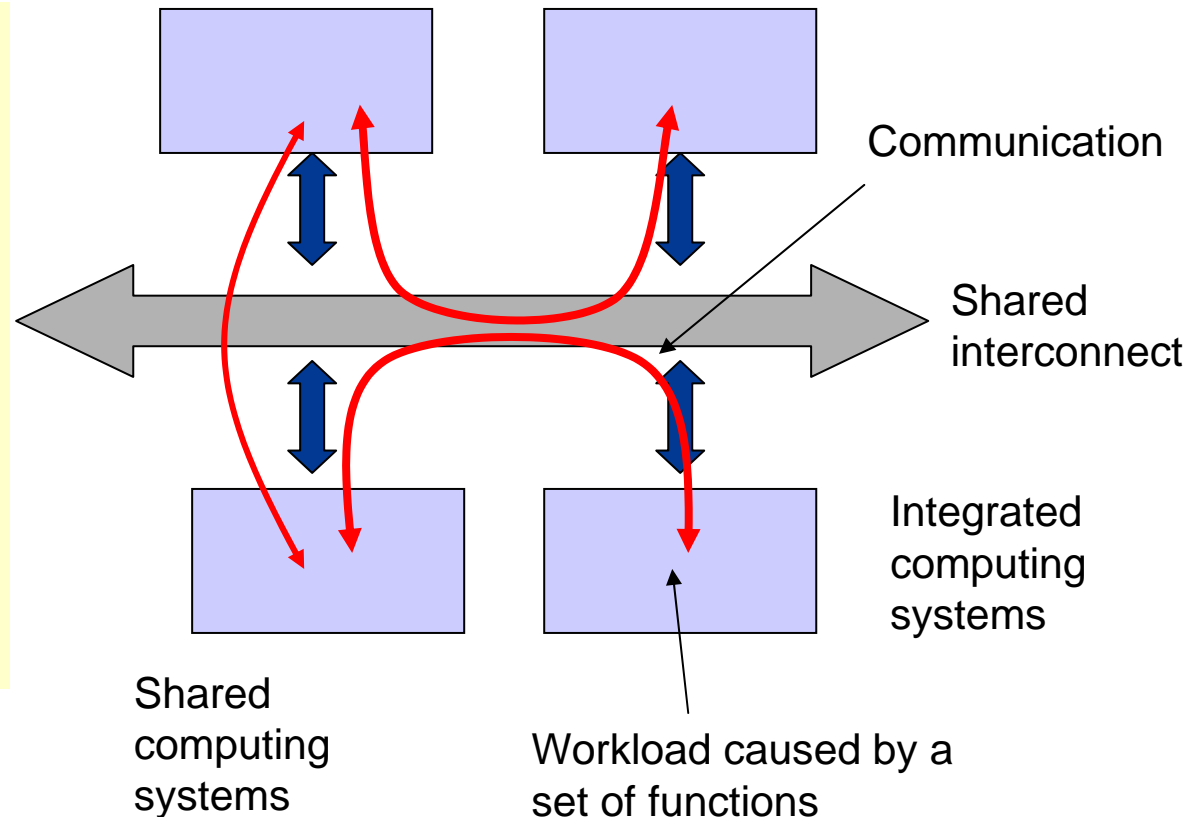
Abstraction level and accuracy.

How to generate workload models?

How to define interfaces between workload and capacity models.

Evaluation performance using simulation.

Modeling effort.



SUMMARY AND FUTURE DIRECTIONS...

- Multicore platforms are the obvious solution!
 - More capacity
 - High performance
 - Energy efficiency
- Using multicore product platforms requires
 - Capability to manage a variety of methods and techniques
 - New ways to evaluate the system partitioning
 - New approaches for early evaluation of mapping quality
 - Better means for performance evaluation
- Platforms will develop towards more complex architectures with built-in reconfigurability
 - ASIP clusters, reconfigurable memory organizations, reconfigurable instruction sets, on-chip networks, etc.

Thank you.

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