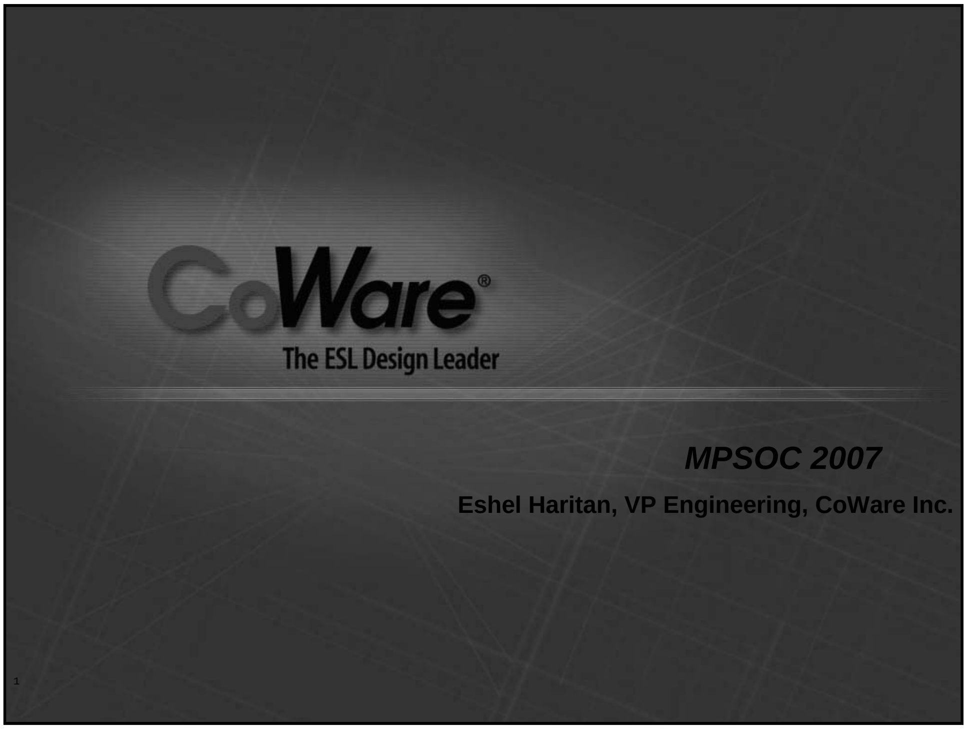

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MPSOC 2007

Eshel Haritan, VP Engineering, CoWare Inc.

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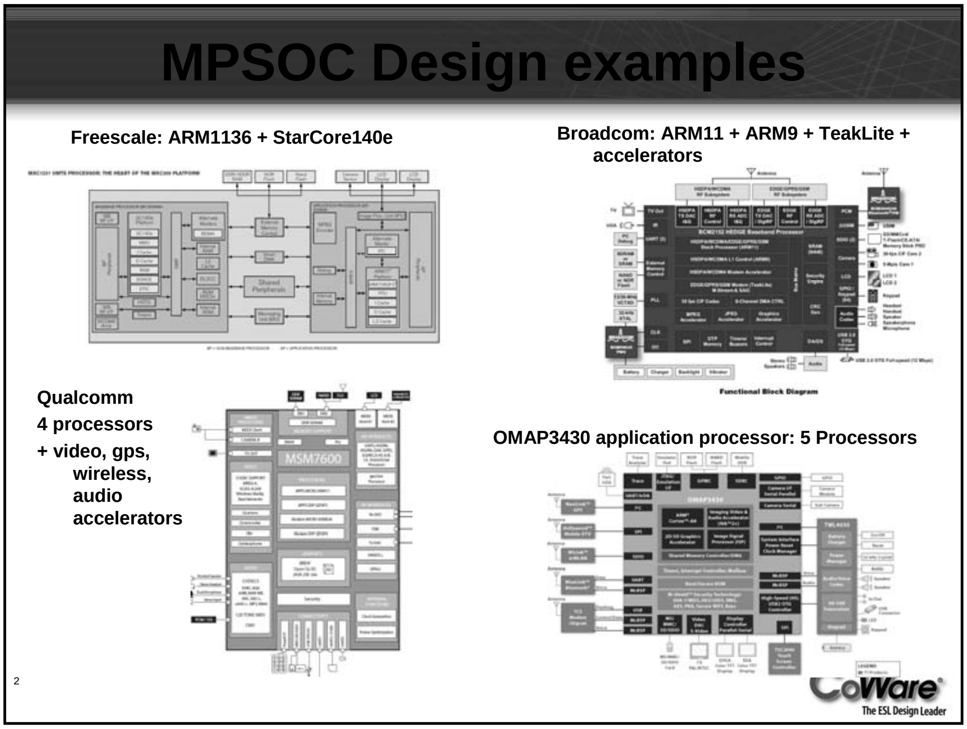

MPSOC Design examples

Freescale: ARM1136 + StarCore140e

Broadcom: ARM11 + ARM9 + TeakLite + accelerators

Qualcomm
4 processors
+ video, gps, wireless, audio accelerators

OMAP3430 application processor: 5 Processors

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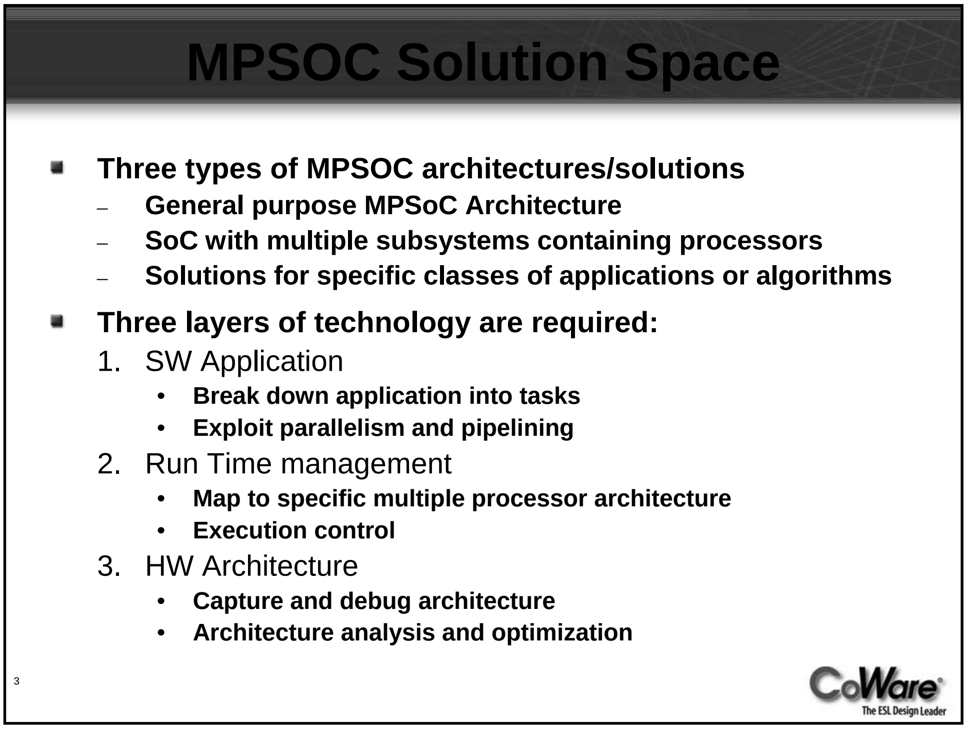

MPSOC Solution Space

- Three types of MPSOC architectures/solutions
  - General purpose MPSoC Architecture
  - SoC with multiple subsystems containing processors
  - Solutions for specific classes of applications or algorithms
- Three layers of technology are required:
  1. SW Application
     - Break down application into tasks
     - Exploit parallelism and pipelining
  2. Run Time management
     - Map to specific multiple processor architecture
     - Execution control
  3. HW Architecture
     - Capture and debug architecture
     - Architecture analysis and optimization

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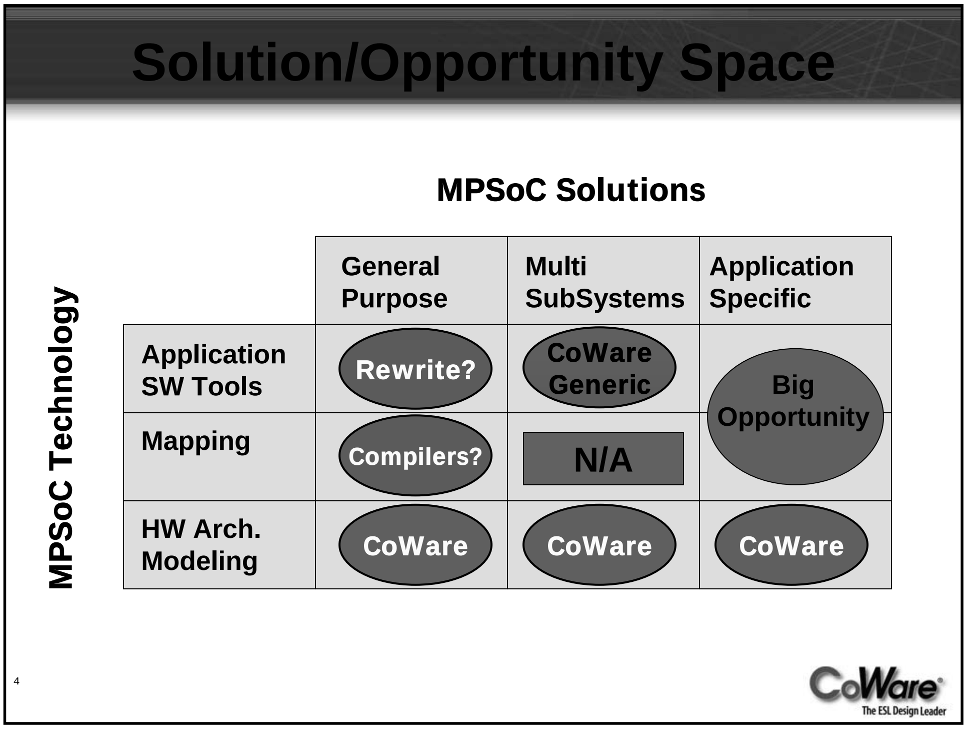

Solution/Opportunity Space

MPSoC Solutions

MPSoC Technology

	General Purpose	Multi SubSystems	Application Specific
Application SW Tools	Rewrite?	CoWare Generic	Big Opportunity
Mapping	Compilers?	N/A	
HW Arch. Modeling	CoWare	CoWare	CoWare

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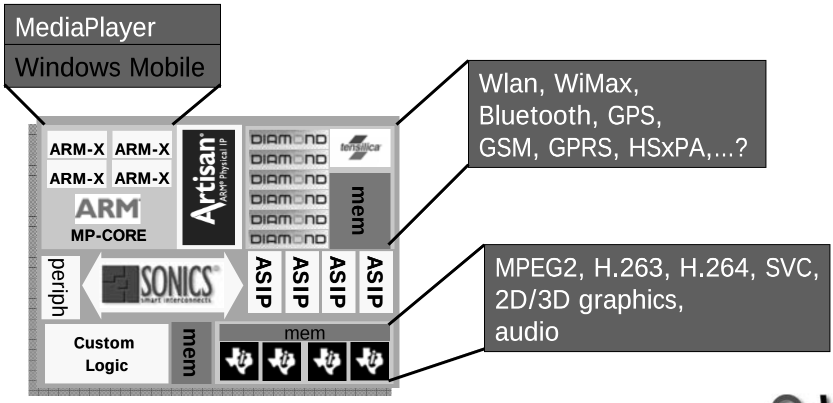
MPSOC challenges

- **Application and SW tools**
  - **How to develop SW for multi-core?**
  - **How do I debug the SW?**
  - **How can I reuse the SW in a next design?**
  - **How can I integrate with a general purpose OS?**
  - **How to keep SW developers efficient?**
- **Mapping**
  - **How to optimize the SW (or guide the compiler)?**
  - **How do I move data from core to core?**
- **HW architecture modeling**
  - **What cores to use?**
  - **How to share data between cores?**
  - **How to optimize the architecture?**

MPSOC problem

- **How to implement different algorithms on an integration of several multi-core clusters (homogeneous or heterogenous) and integrate with application OS**

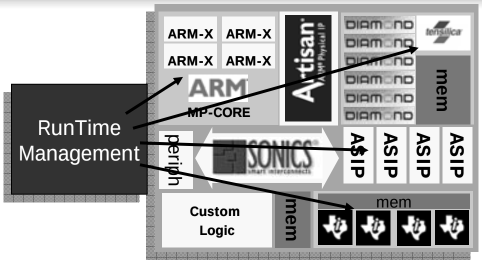


Wlan, WiMax,
Bluetooth, GPS,
GSM, GPRS, HSxPA,...?

MPEG2, H.263, H.264, SVC,
2D/3D graphics,
audio

MPSOC Solution

1: RunTime Management



- **To get a single application running on a multi-core cluster we need:**
  - **Workload distribution**
    - Load balancing or other resource sharing mechanisms
  - **Synchronisation**
    - Workload executed on multiple program engines (program counters)
      - Handle workload dependencies and data communication & synchronisation
  - **Implementation:**
    - ASIP or MCU with custom instructions to reach performance
    - Extra attention to handle data communication over memory subsystem

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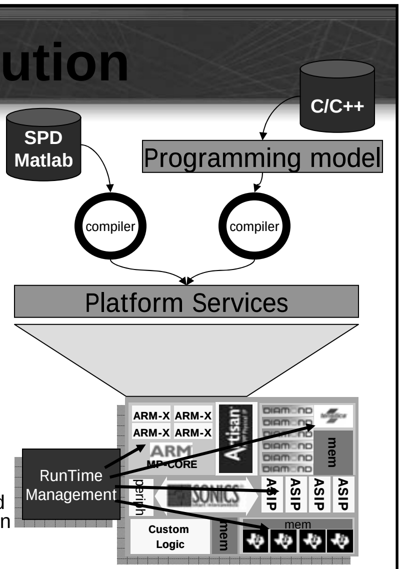
MPSOC Solution

2: Algorithm to Platform Mapping



- **To take an algorithm and implement it on a multi-core cluster we need**
  - **Programming model that enables to reuse existing C/C++ code**
    - Additional user guidelines in C/C++ to guide mapping process
  - **Platform Services**
    - The set of features of the RunTime management, interconnect and memory subsystem that are accessable from SW and that can be used to implement the application on a MPSOC cluster
  - **Implementation**
    - Mapping is done through compiler tools that take the annotated C/C++ code and transform and optimize it for the platform services
    - Platform Services is an embedded SW library build for the platform

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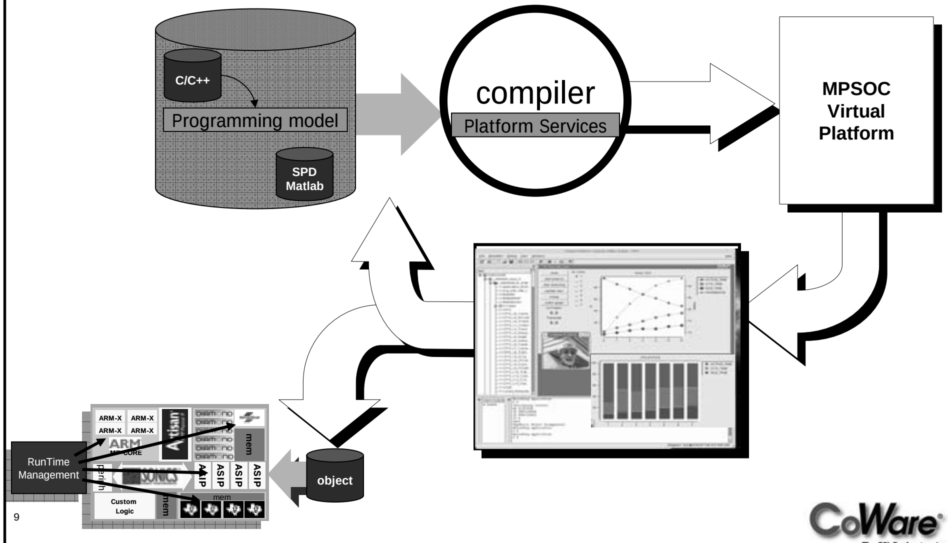
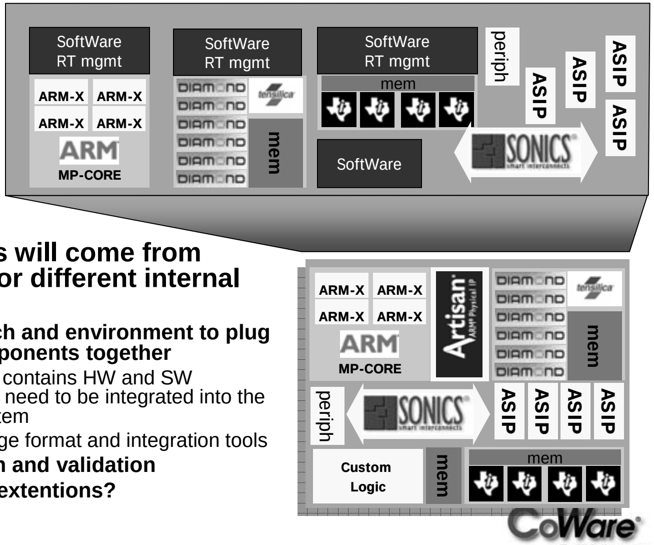
MPSOC Solution

3: Debug and exploration environment

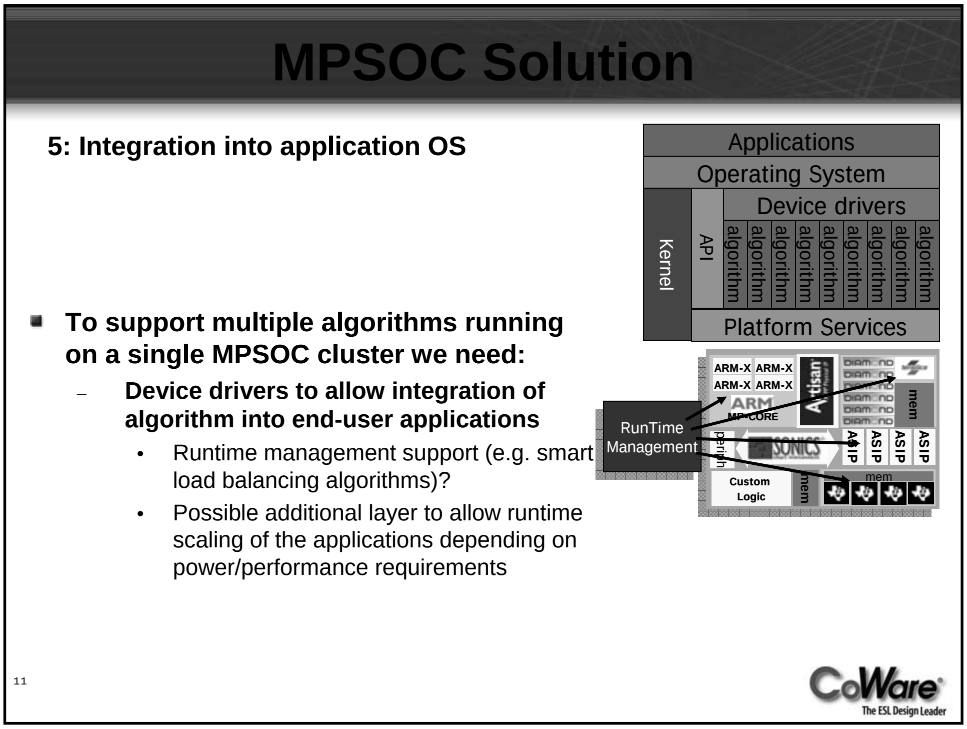


MPSOC Solution

4: Enable Reuse and Integration into Platform



- **Multi-core clusters will come from different vendors or different internal teams**
  - **Need an approach and environment to plug and play all components together**
    - A component contains HW and SW elements that need to be integrated into the complete system
    - Need exchange format and integration tools
  - **HW/SW codesign and validation**
  - **IP-XACT SPIRIT extentions?**



MPSOC Solution

5: Integration into application OS

- **To support multiple algorithms running on a single MPSOC cluster we need:**
  - **Device drivers to allow integration of algorithm into end-user applications**
    - Runtime management support (e.g. smart load balancing algorithms)?
    - Possible additional layer to allow runtime scaling of the applications depending on power/performance requirements

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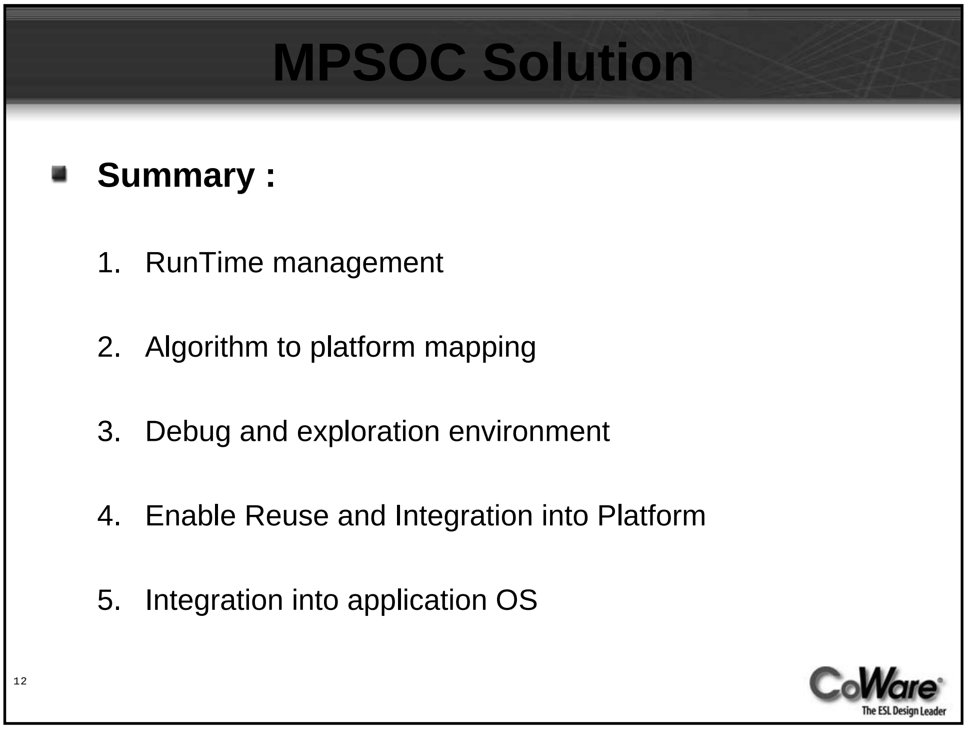

MPSOC Solution

- **Summary :**

1. RunTime management
2. Algorithm to platform mapping
3. Debug and exploration environment
4. Enable Reuse and Integration into Platform
5. Integration into application OS

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