SoC Platforms of the Future: Challenges and Solutions

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What is Next SoC Paradigm Shift?

System function

- System-level expertise
- S/W expert
- Platform programming

Prog. Models

H/W-S/W architecture

- Domain-specific platform expertise
- Fast platform derivatives

RTL to Layout

- Component expertise
- Process differentiators (BiCMOS, RFCMOS, eDRAM, eFlash)

System Applications

- Audio codecs
- Video codecs
- Still image processing
- Communication stacks

months

2005: Platform "Insulation"

Architecture Platforms

- Hard-disk drive platform
- Set-top box, DVD, HDTV
- Mobile multimedia
- Image processing platform

years

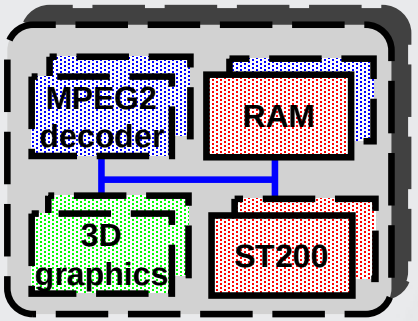
1995: RTL, ISA "Insulation"

Component IP

- Value-add cores, IP
- Commodity cores: GPP, DSP, MCU, Bus
- Libraries: Cells, memories, I/O

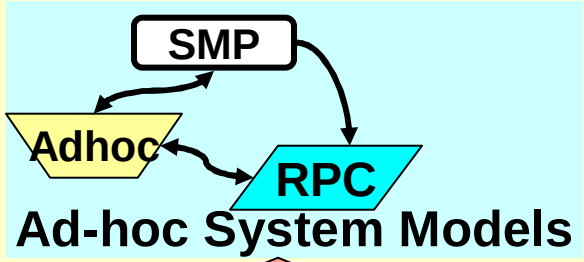
year

1985: Cell Library "Insulation"



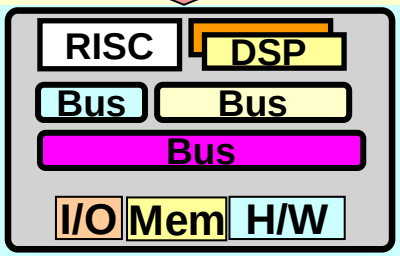
Objectives

From:



Ad-hoc System Models

Growing Gap



Heterogeneous SoC

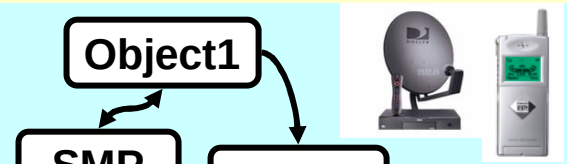
Growing Gap

Platform Programming Models

Structured Programmable Platforms

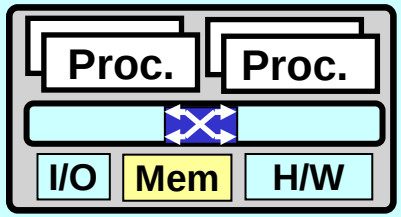
Fast transfer of innovation to product

To:



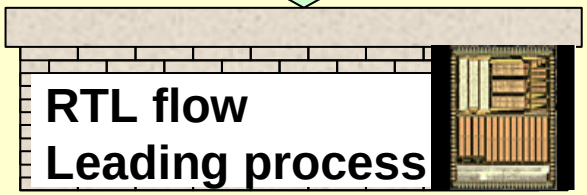
System Applns.

Exploration Mapping Tools

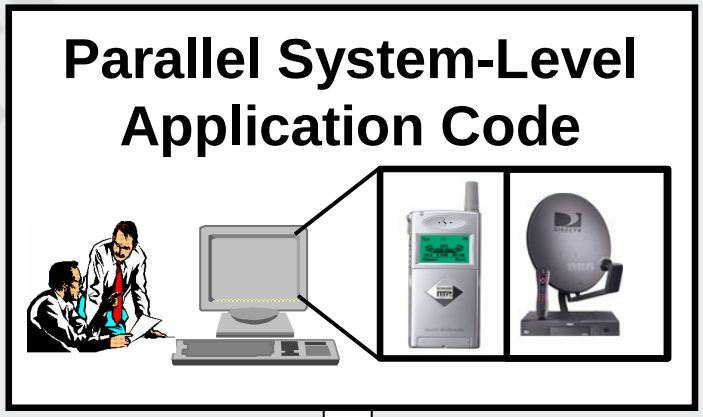


MPSoC Architecture

Regular Architectures DFM

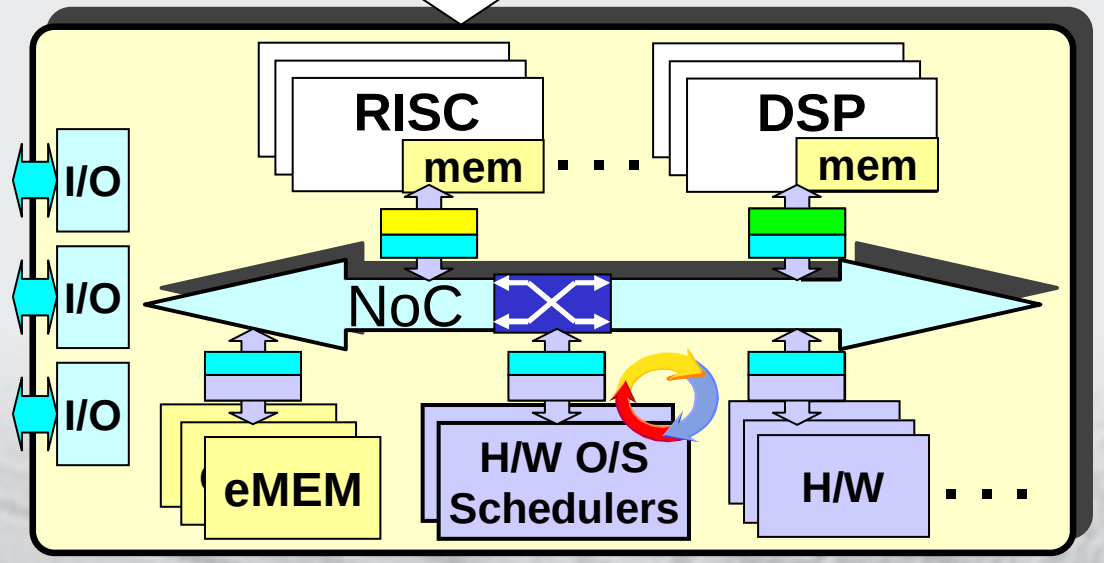


MultiFlex MP-SoC Platform Tools



- Two parallel Programming Models
  - DSOC: Object-Oriented Message passing
  - SMP: Shared memory

Application to platform mapping



- Fine grain parallelism
- H/W message passing, IP Plug and Play
- H/W MP-O/S scheduler accelerators

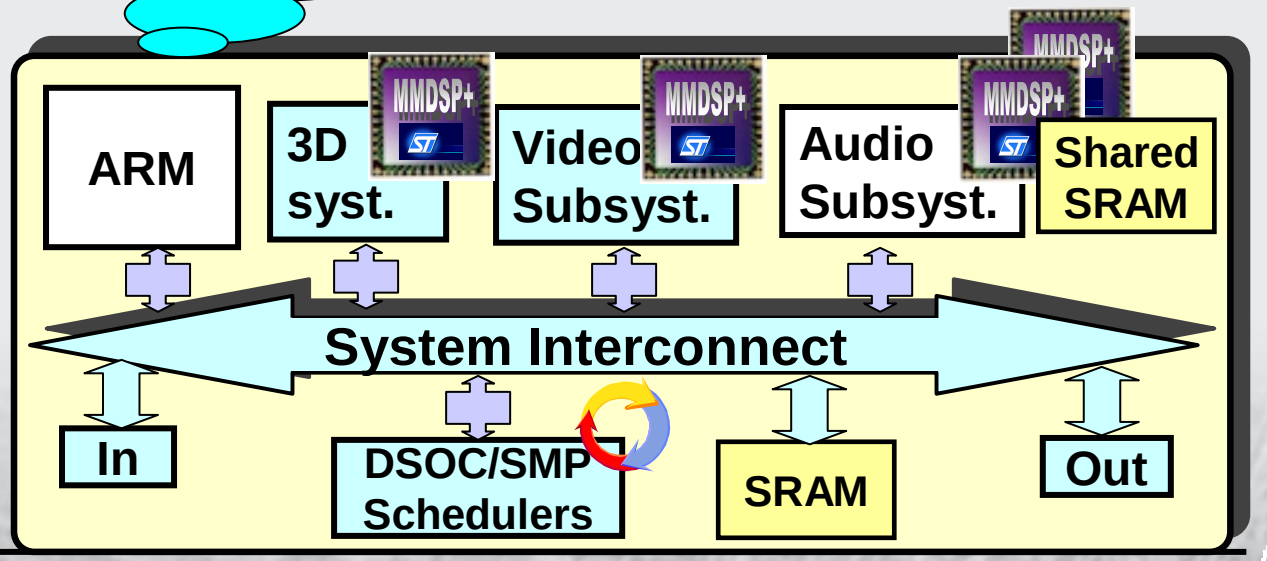
MultiFlex MP Applications

- Packet processing
  - 2.5/10 Gbps IPv4 packet forward, traffic manager
  - Presented at previous MPSoC's

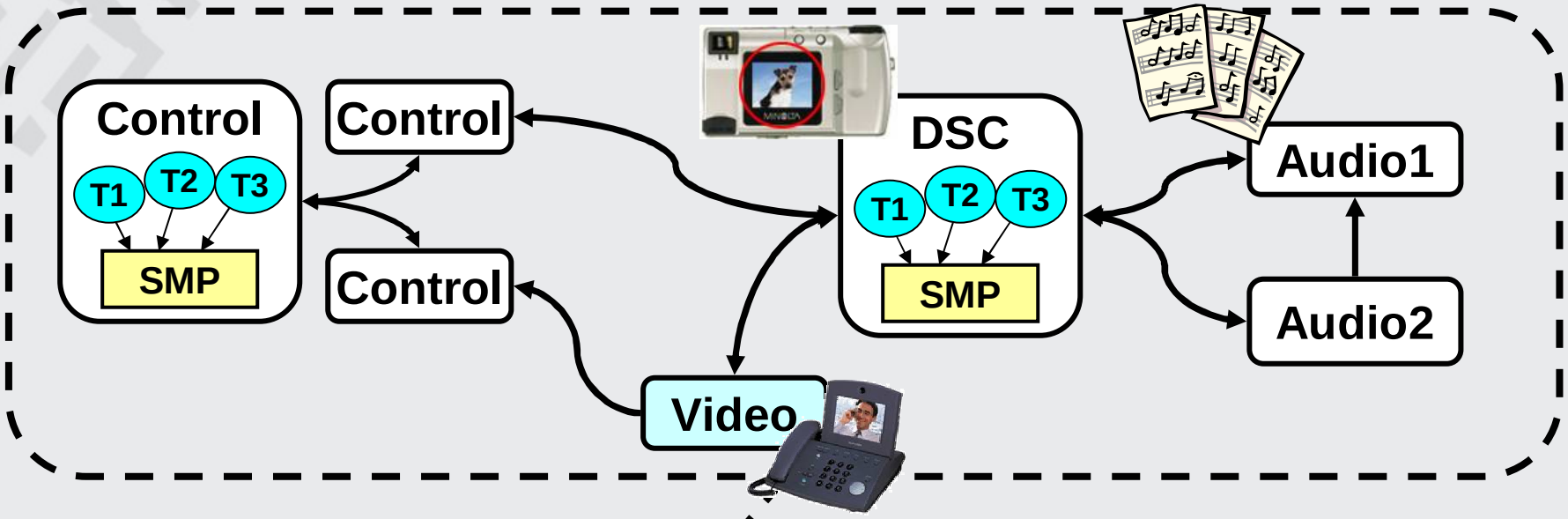
- Next-generation Nomadik
  - Heterogeneous platform, O/S interoperability
- Video codec exploration (R&D program)
  - MPEG4 VGA (30fps), H.264 VGA/XVGA
  - Small grain, mixed SMP/DSOC

- 3G basestation (feasibility studies)
  - Layer 1 modem: channel coding, (de)interleaving, CRC attachment, rate matching, (de)spreading
  - Heterogeneous platform, O/S interoperability

Nomadik Mobile M-Media Platform



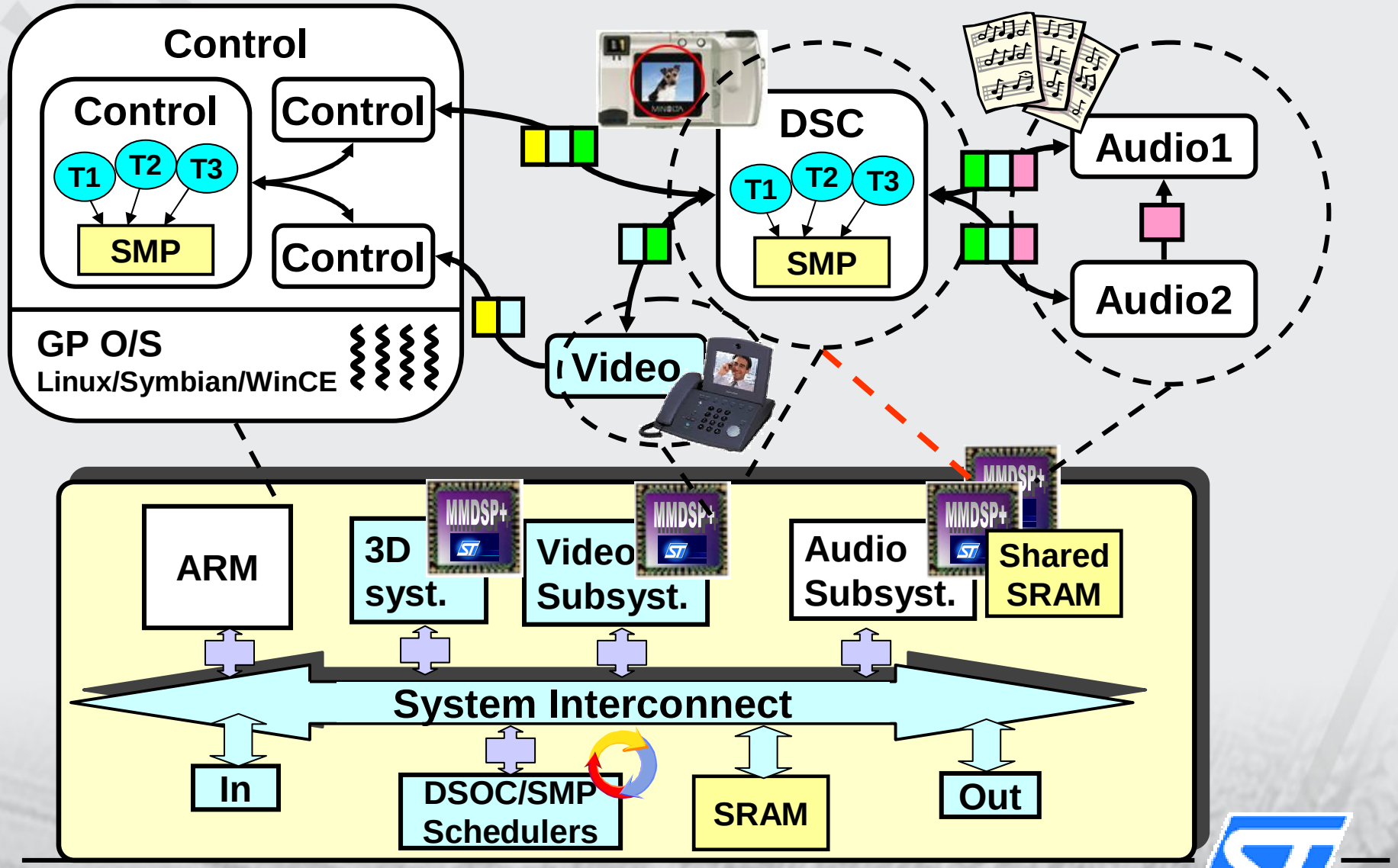
Nomadik Platform Mapping (1)



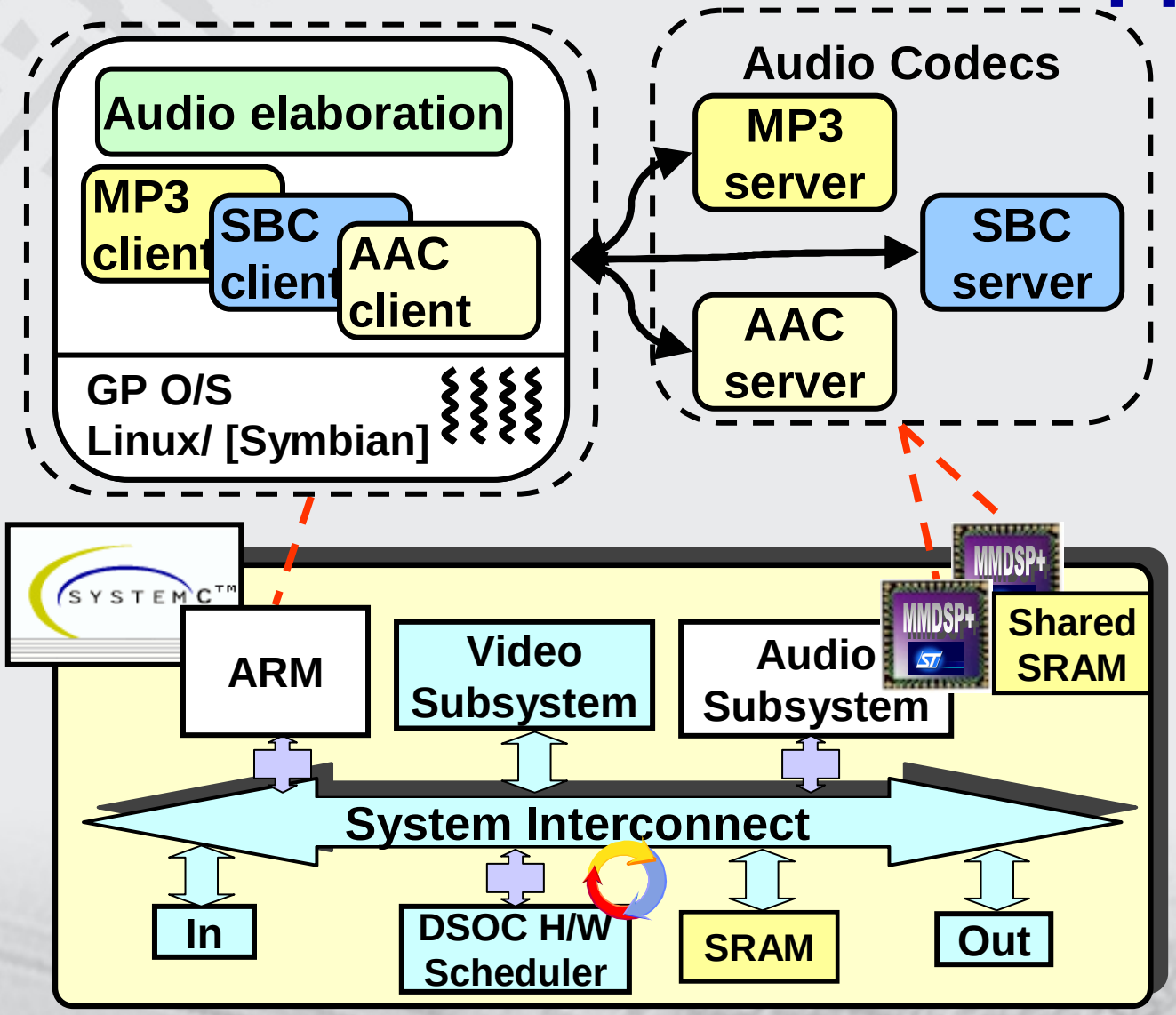
Host (Linux/Unix)

- High-level communicating parallel application objects
  - Platform independent
- Map onto host GP O/S to validate HL function and parallelism

Nomadik Platform Mapping (2)



Nomadik Audio Mapping

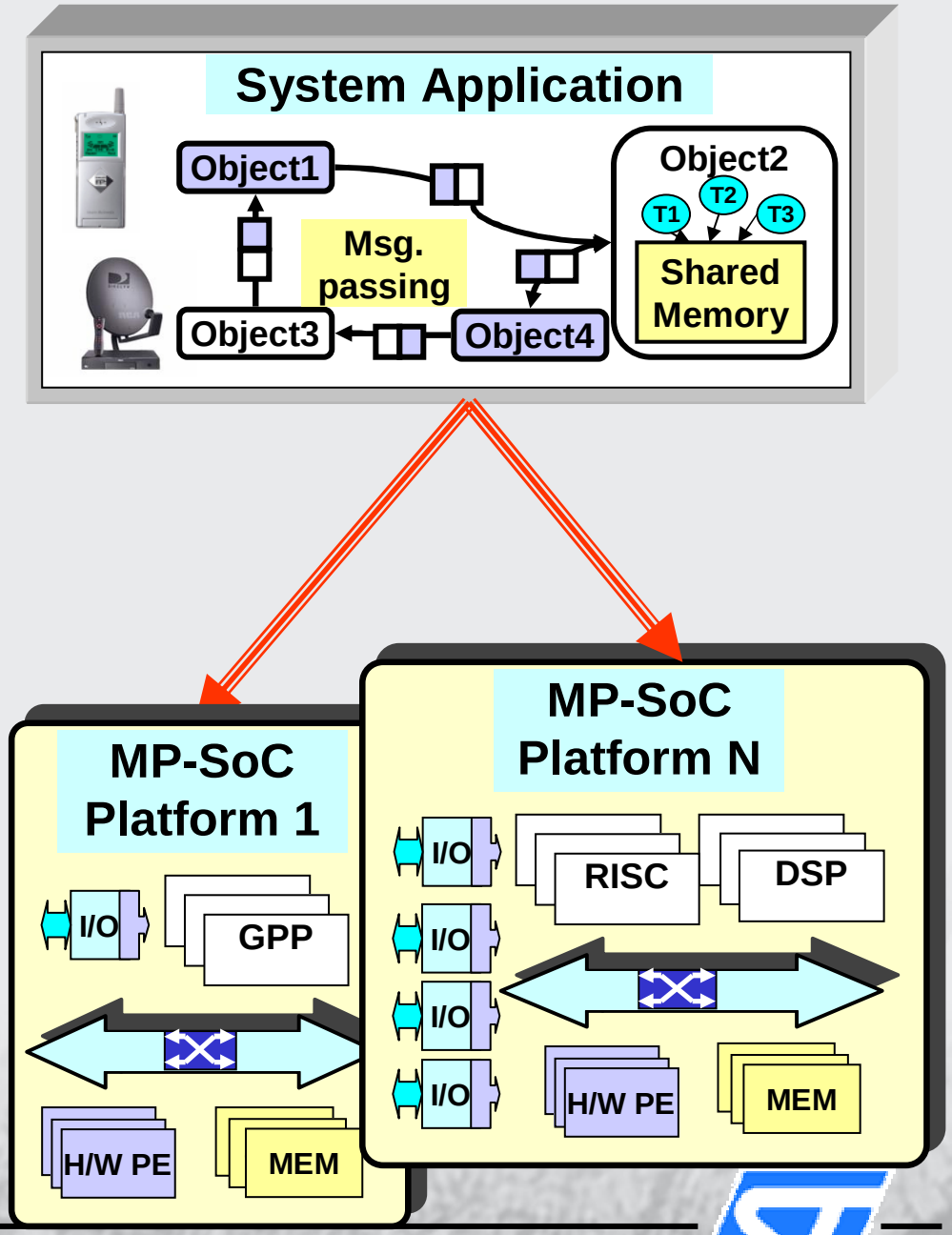


- ‘DSOC’ O-O msg. passing progr. model
- Mapped on Nomadik2 demo platform
- Elaboration on ARM/Linux
- Audio DSP on 2x MMDSP’s
- ***1.97X speedup***

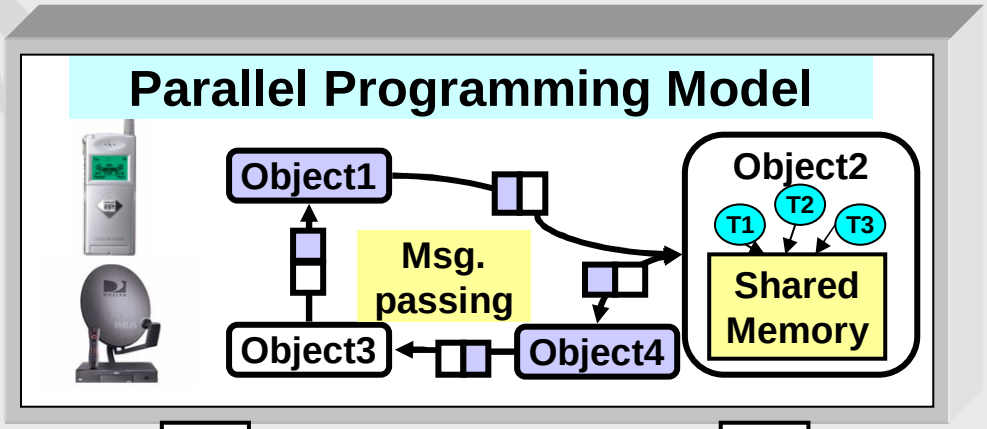
Value-added

- Platform independent S/W
  - S/W reuse across multiple products
- Platform scalability
- Exploit fine-grain parallelism
- High PE utilization

- Architecture exploration
- Programming productivity

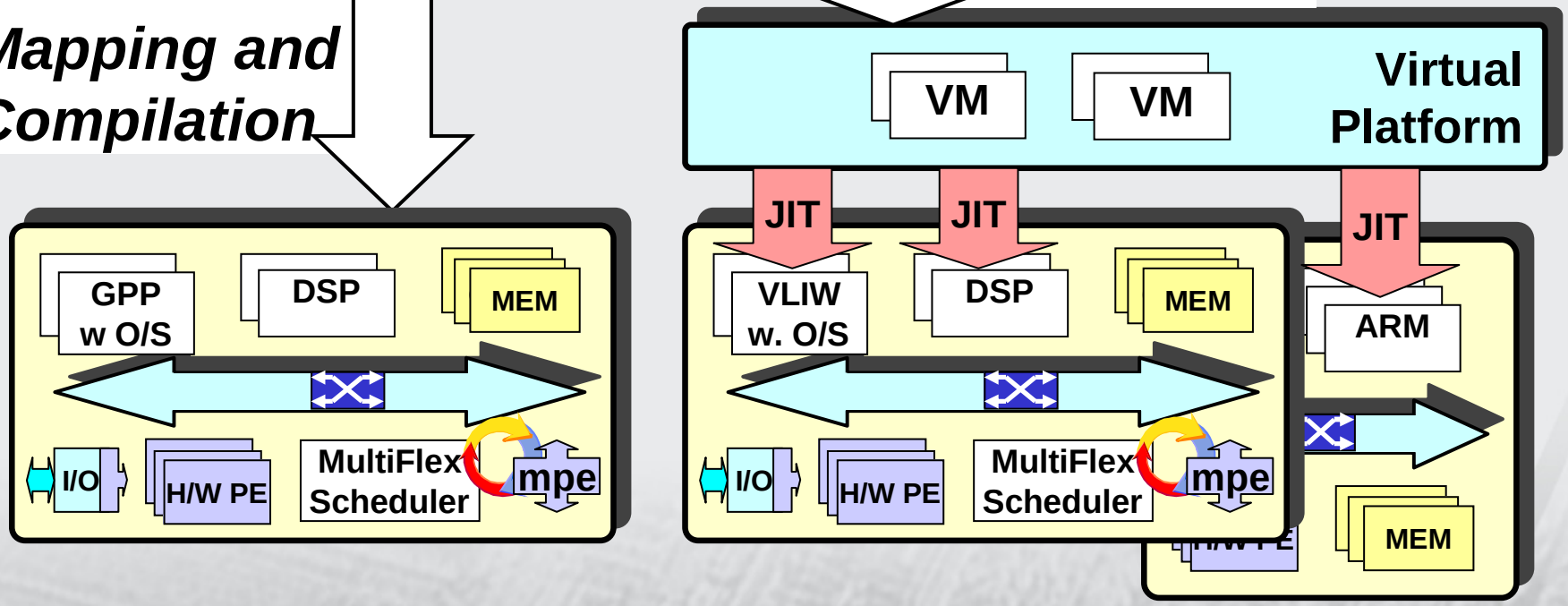


Outlook: Virtual Platforms

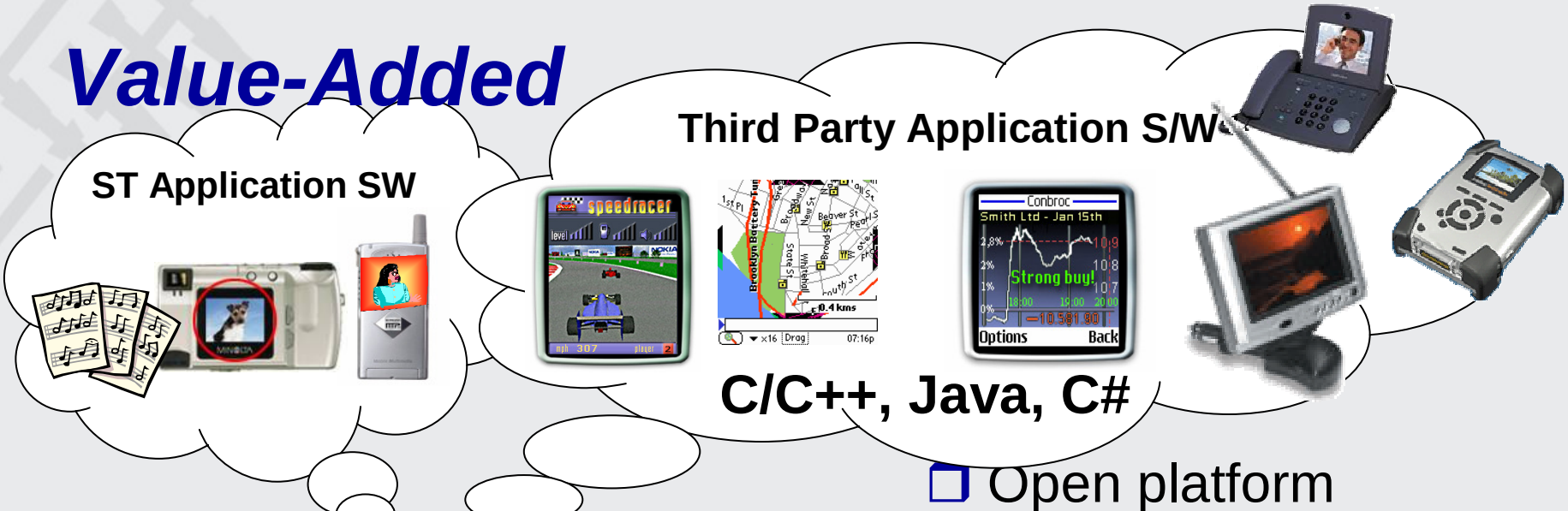


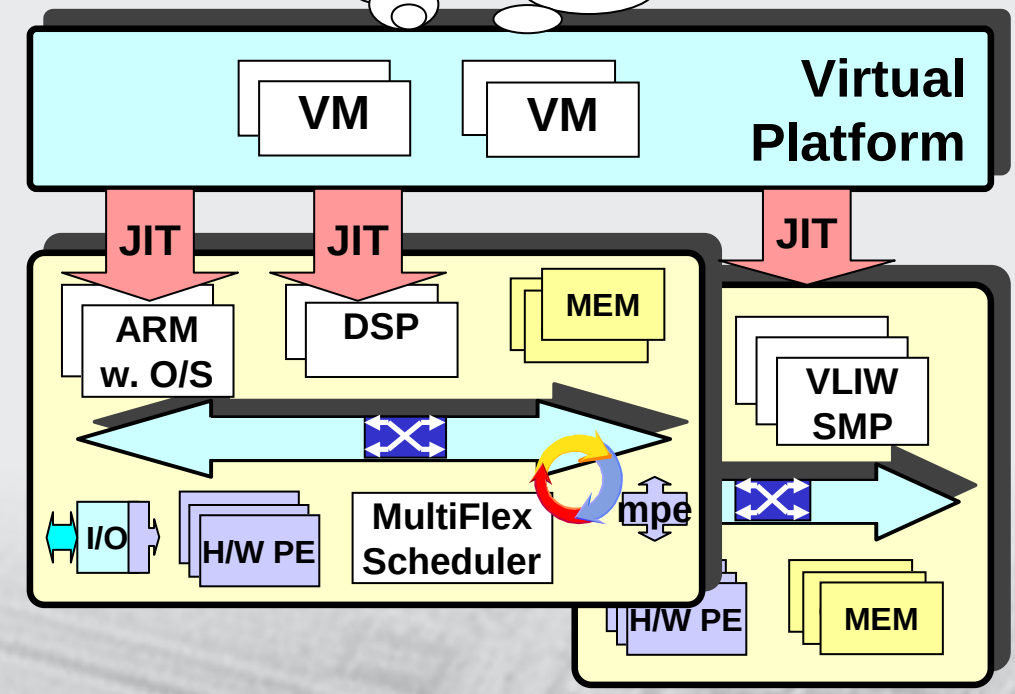
Static Mapping and Compilation

Virtualization



Value-Added





- Open platform
  - Access to wide range of applications
- Plug & play on multiple platforms
  - Multi-language
  - No recompilation
- VM encapsulation
  - Security, Reliability