

学习周报No.4 简报

白洋

2017.09.29

work of this week

1. 论文阅读 (ing)

A Survey and Comparative Study of Hard and Soft Real-Time Dynamic Resource Allocation Strategies for Multi-/Many-Core Systems

AMIT KUMAR SINGH, University of York and University of Southampton

PIOTR DZIURZANSKI, University of York and Staffordshire University

HASHAN ROSHANTHA MENDIS and LEANDRO SOARES INDRUSIAK, University of York

- 综述
- 发表在 *ACM Computing Surveys (CSUR)*, 2017
- 顶刊, SCI 1区
- 阅读进度 略读

- 论文对软/硬实时多核/众核系统上资源动态分配问题做了综述和比较研究。
- 比较着重在时间和能量优化方面的比较研究, 其涉及的体系结构及资源控制机制包括
 - target architecture including: homogeneous and heterogeneous
 - resource control mechanism: centralized or distributed
- 未来趋势及开放挑战:
 - Hybrid Resource Allocation
 - Large-Scale Many-Core Architectures
 - Joint Consideration of Computation and Communication Loads
 - Multi-Objective Resource Allocation

work of this week

1. 论文阅读 (ing)

A Survey and Comparative Study of Hard and Soft Real-Time Dynamic Resource Allocation Strategies for Multi-/Many-Core Systems

AMIT KUMAR SINGH, University of York and University of Southampton

PIOTR DZIURZANSKI, University of York and Staffordshire University

HASHAN ROSHANTHA MENDIS and LEANDRO SOARES INDRUSIAK, University of York

• 思考总结:

- 1. 动态资源调度: 在嵌入式计算、高性能计算领域均是日益热门研究, 其中嵌入式更难, 因为动态资源调度所需计算量较大
- 2. 多核的资源分配问题-->资源包括计算资源 通信资源 存储资源等->很多研究归结为任务的计算和通信资源分配问题
 - 当不对核间通信单独研究的情况下, 此问题也符合DAG模型->因此这篇综述的相关研究的方法思想有借鉴意义
 - 在ACPS内部, 抽象来看, 我们是把系统看作是多个单核ECU的集群, 通过一定的网络拓扑连接, 任务通信物理层面是网络通信
 - 在多核/众核研究中, 整体是多个核心组成的”集群”, 片上网络进行连接, 任务通信物理层面是片上网络
- 3. 虽然ACPS系统内部各ECU是分布式, 但目前现有文献中展现出来的总体调度、控制的方式仍是“Centralized”而不是“Distributed”, 这是由于其所依托的车内系统体系结构仍是目前主流的“基于中央网关的异构网络互联的分布式系统”
- 4. 对应3, 在这篇综述里, 有关硬实时要求的全部都是Centralized、软实时有部分 Distributed

Resource allocation (mapping) problem

- 资源分配问题定义: A resource allocation (mapping) process **defines assignment and ordering of the tasks and their communications onto resources** of a multi-/many-core system **in view of some optimization criteria such as compute performance and energy consumption**
- 资源分配问题示例:

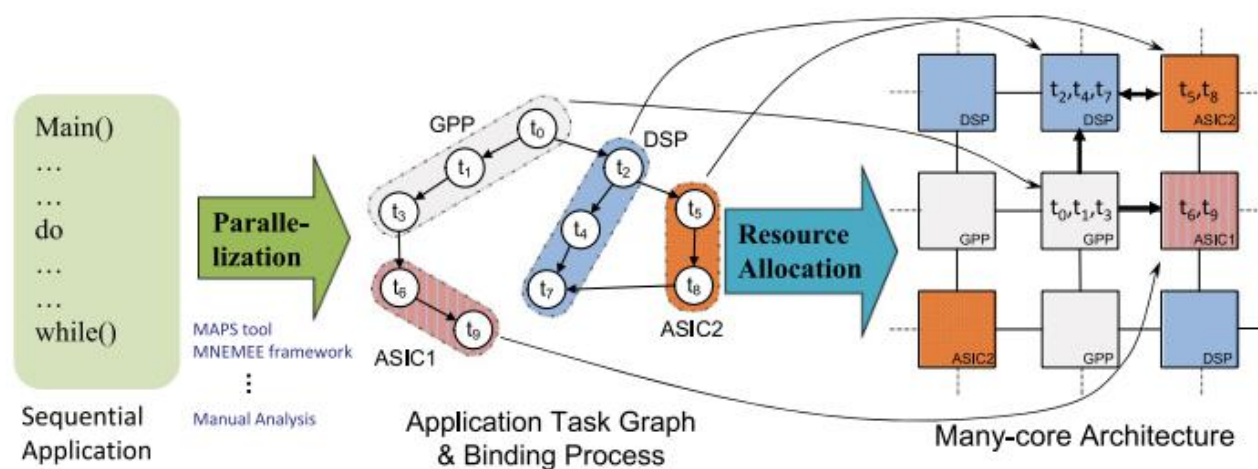


Fig. 1. Resource allocation on a many-core system.

这就是ACPS的系统自适应要解决的问题

Dynamic Resource allocation (mapping) problem

- The resource allocation process is carried out either at **design time (statically)** or **runtime (dynamically)**. 分静态、动态
- 静态资源分配的缺陷: they cannot **handle dynamic workloads and changing environments**, for example, adding a new application into the system at runtime. (这同样是ACPS目前的资源分配方法面临的问题)
- 动态资源分配是指: Dynamic resource allocation approaches can handle the aforementioned issues, as the assignment of tasks and their communications on the multi-/many-core system resources **is done at runtime**.
- 同时很多系统中, 动态资源分配也需要实时: Real-time dynamic resource allocation is desired in systems where performance (timing) constraints need to be satisfied to fulfill safe system operations (e.g., **in automotive engine management**, operating medical equipment, and flight control software) and end-user demands (frame rate in video processing).

Dynamic Resource Allocation Problem and Challenges

- 计算耗时：资源分配问题一般认为是NP难
- 运行时配置：satisfy performance requirements of each application when various combinations of simultaneously active applications, referred to as use-cases, need to be supported into the system at runtime.
- 对application的领域知识(application domain knowledge)的了解能够使得动态资源配置更有效，但获取领域知识比较复杂和困难。

Dynamic Resource Allocation Strategies

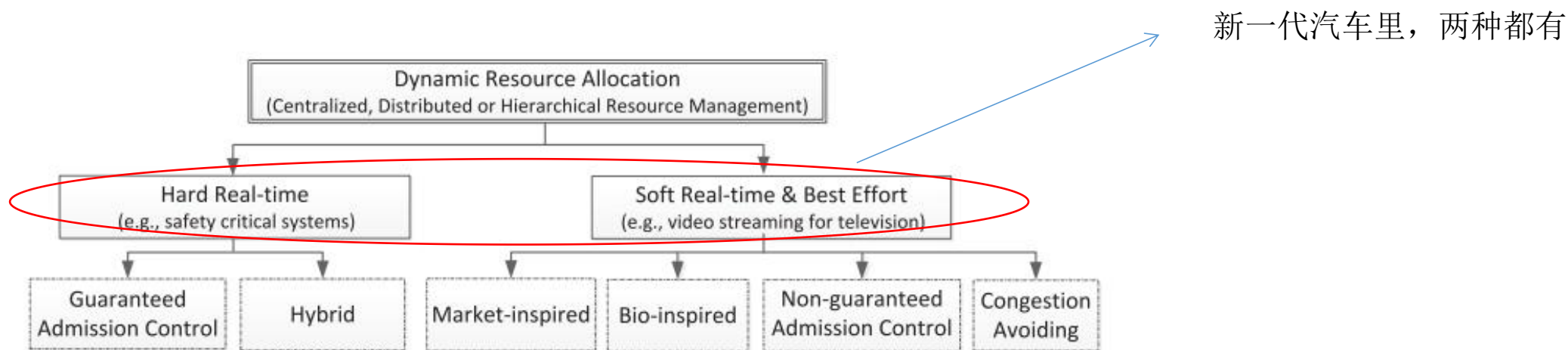


Fig. 2. A taxonomy of dynamic resource allocation strategies.

后续内容则是依据上表分类，对现有研究工作进行综述和对比。

Upcoming trends and challenges

- Hybrid Resource Allocation
- Large-Scale Many-Core Architectures
- **.Joint Consideration of Computation and Communication Loads**
- **Multi-Objective Resource Allocation**