A Dynamic Load Balancing Mechanism for Data Stream Processing on DDS Systems

Dissertação de Mestrado

Dissertation presented to the Programa de Pós-Graduação em Informática of the Departamento de Informática, PUC-Rio as partial fulfillment of the requirements for the degree of Mestre em Informática.

Advisor: Prof. Markus Endler

Rio de Janeiro
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Rafael Oliveira Vasconcelos

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Abstract


This thesis presents the Data Processing Slice Load Balancing solution to enable dynamic load balancing of Data Stream Processing on DDS-based systems (Data Distribution Service). A large number of applications require continuous and timely processing of high-volume of data originated from many distributed sources, such as network monitoring, traffic engineering systems, intelligent routing of cars in metropolitan areas, sensor networks, telecommunication systems, financial applications and meteorology. The key concept of the proposed solution is the Data Processing Slice (DPS), which is the basic unit of data processing load of server nodes in a DDS Domain. The Data Processing Slice Load Balancing solution consists of a load balancer, which is responsible for monitoring the current load of a set of homogenous data processing nodes and when a load unbalance is detected, it coordinates the actions to redistribute some data processing slices among the processing nodes in a secure way. Experiments with large data stream have demonstrated the low overhead, good performance and the reliability of the proposed solution.

**Keywords**

Load Balancing; Data Stream Processing; DDS; SDDL; Publish/Subscribe; Autonomic Computing.
Resumo


Esta dissertação apresenta a solução de balanceamento de carga baseada em fatias de processamento de dados (Data Processing Slice Load Balancing solution) para permitir o balanceamento de carga dinâmico do processamento de fluxos de dados em sistemas baseados em DDS (Data Distribution Service). Um grande número de aplicações requer o processamento contínuo de alto volume de dados oriundos de várias fontes distribuídas, tais como monitoramento de rede, sistemas de engenharia de tráfego, roteamento inteligente de carros em áreas metropolitanas, redes de sensores, sistemas de telecomunicações, aplicações financeiras e meteorologia. Conceito chave da solução proposta é o Data Processing Slice, o qual é a unidade básica da carga de processamento dos dados dos nós servidores em um domínio DDS. A solução consiste de um nó balanceador, o qual é responsável por monitorar a carga atual de um conjunto de nós processadores homogêneos e quando um desbalanceamento de carga é detectado,协调em ações para redistribuir entre os nós processadores algumas fatias de carga de trabalho de forma segura. Experimentos feitos com grandes fluxos de dados que demonstram a baixa sobrecarga, o bom desempenho e a confiabilidade da solução apresentada.

**Palavras-chave**

Balanceamento de carga; processamento de fluxo de dados; DDS; SDDL; Publish/Subscribe; computação autônômica.
Contents

1 Introduction 12
   1.1 Motivation 12
   1.2 Problem Statement 13
   1.3 Objective and Contributions 15
   1.4 Organization 16

2 Background 17
   2.1 DDS 17
   2.2 SDDL 20
   2.3 Load Balancing in Middleware 21
      2.3.1 Classification of Load Balancing Algorithms 21
      2.3.2 Elements of a Dynamic Load Balancing Algorithm 23
      2.3.3 Virtual Servers 24
   2.4 Autonomic Computing 24
      2.4.1 MAPE-K Loop 26

3 Data Processing Slice Load Balancing 28
   3.1 Data Processing Slice 30
   3.2 Assignment Function 33
   3.3 DPS Solution 34
   3.4 Load Balancing Process 36
   3.5 Discussion 38

4 Implementation 39
   4.1 MAPE-SDDL 40
List of Figures

Figure 1 – Publication and Subscription Models [18] 18
Figure 2 – DDS System Architecture [16] 18
Figure 3 – Content Filtered Topic example [20] 19
Figure 4 – SDDL Architecture [26] 21
Figure 5 – Load balancing hierarchy [29] 22
Figure 6 – Taxonomy of dynamic load balancing algorithms [35] 23
Figure 7 – General properties of Autonomic Computing [47] 25
Figure 8 – MAPE-K control loop [49] 26
Figure 9 – DPS Load Balancing Architecture 28
Figure 10 – Example of data item objects 31
Figure 11 – A possible DPS flow and distribution 32
Figure 12 – DPS state transitions 32
Figure 13 – An example of Assignment Function applied upon data item 33
Figure 14 – Interactions between clients, Processing Nodes and Load Balancer 35
Figure 15 – Data flow before, during and after the Load Balancing Process 36
Figure 16 – Implementation architecture 39
Figure 17 – LoadBalancingAlgorithm interface 42
Figure 18 – Application listener interface 45
Figure 19 – Methods to create a Topic, Content Filtered Topic and Data Reader 45
Figure 20 – Slice transitions on a PN 47
Figure 21 – Interface Description Language (IDL) of the CacheTopic 48
Figure 22 – Generated CacheTopic Java Class 49
Figure 23 – Evaluation application topics 51
Figure 24 – Deployment of the evaluation application 52
Figure 25 – Deployment of the Virtual Machines 53
Figure 26 – Throughput over the time of the experiment (DI/s X seconds) 55
Figure 27 – CPU usage over the time of the experiment (% X seconds) 56
Figure 28 – Round-trip Delay over the time of the experiment (RTD in seconds X time in seconds) 57
Figure 29 – Mean throughput (DI/s) comparison among DPSLB solution and another without Load Balancing 59
Figure 30 – Mean Round-trip Delay comparison among DPSLB solution and another without Load Balancing 59
Figure 31 – Padres architecture [27] 63
Figure 32 – REVENGE high-level architecture [66] 64
Figure 33 – Multi-domain REVENGE distributed architecture [66] 64
List of Tables

Table 1 – Physical Machine specifications used in the experiment 54
Table 2 – Impact of the Load Balancing Process on RTD and throughput 60
Table 3 – Load Balancing Process overhead for different the numbers of Slices and data item production rates 61