Simulation of Data Flow Architecture in Parallel Environment

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Introduction

- What is data flow architecture
- Coordinating processors
- Programming model of DF KPI architecture
- Simulation of DF KPI architecture
- Migration to parallel environment
- Using the GRID for simulation
Data Flow Architecture

Interconnection network

CP

Data queue unit

Instruction store

Frame store

CP - coordinating processor

CP

CP

HOST

Specialised I/O

Information technology
Program writing

- Description of problem
- Space partitioning problem (BSP Trees)
- Using functional languages
- Functional language HASKELL
- Building data flow graph DFG
- Simple transformation from Haskell to DFG
Example of Haskell code

```
normalize :: Vector -> Vector
normalize v = ( Vector x y z)
  where
    dist = length v
    x = vector_X v / dist
    y = vector_Y v / dist
    z = vector_Z v / dist

length :: Vector -> Double
length v = sqrt(vector_X v * vector_X v +
     vector_Y v * vector_Y v +
     vector_Z v * vector_Z v)
```
DFG of function **Normalize**

```
<table>
<thead>
<tr>
<th>Normalize</th>
<th>ACCEPT</th>
<th>ACCEPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOAD #2</td>
<td>GET #1</td>
<td>GET #2</td>
</tr>
<tr>
<td>CONS_ARRAY #3</td>
<td>DEF_FADR #length</td>
<td>GET #3</td>
</tr>
</tbody>
</table>
| APPLY | LOAD | /
| SET #1 | SET #2 | SET #3 |
| RET |

```

Machine code:

```
LOAD #2
CONS_ARRAY #3
DEF_FADR #length
GET #1
GET #2
GET #3
APPLY
LOAD
/
SET #1
SET #2
SET #3
RET
```
DGF of function \texttt{Lenght}

Example of Haskell source code:

\texttt{lenght :: Vector -> Double}

\texttt{lenght v = sqrt( \( \text{vector}_X v \times \text{vector}_X v + \text{vector}_Y v \times \text{vector}_Y v + \text{vector}_Z v \times \text{vector}_Z v \))}
Simulation tasks

- Emulation of instruction set
- 32 instructions (operators)
- 5 stages in coordinating processor
- Memory system – DQU, FS, IS
- Matching vector – MV
- Structures (array, list, tree)
Migration to parallel environment

- The precise simulator it is possible to obtain by using:
  - Grid solution
  - Cluster solution
  - Tightly coupled multiprocessor computer

- Coordinating processors = one node

- Communication traffic between coordinating processors
Questions?

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