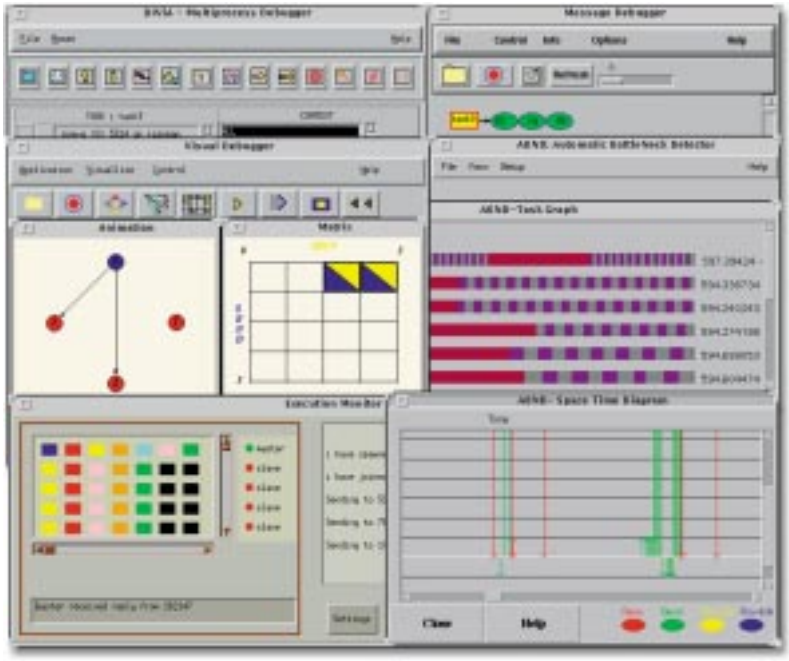
DIViA Overview

Portable Parallel Debugging Environment



DIViA – Debugger with Integrated Visualizer and Analyzer

INTRODUCTION

DIViA*(Debugger with Integrated Visualizer and Analyzer) is an advanced portable and flexible parallel debugging environment. It consists of a coherent set of tools that help programmer in both correctness and performance debugging. Its constituent tools can also be used as independent individual tools.

In addition to conventional logical debugging extended to parallel debugging, DIViA correctness debugger also facilitates visual and message debugging. DIViA performance debugger helps in detecting the communication bottlenecks and in quantifying performance in terms of both computation and communication to help the user fine-tune the parallel application.

DIViA is a complete debugging environment for enterprises that need to develop parallel application using message-passing paradigm. Its software architecture provides uniform interface to message passing programs written using various standard communication interfaces and makes it independent of the underlying processor architecture. It works with both PVM and MPI and debugs C or Fortran language parallel applications.

DESCRIPTION

DIViA debugging environment consists of :

- Correctness Debuggers
  - Multiprocess Debugger
  - Message Debugger
  - Visual Debugger
  - Execution Monitor
- Performance Debuggers
  - Automatic Communication Bottleneck Detector
  - Profile Visualizer

HIGHLIGHTS

- *Portability* – Provides Communication layer neutrality and processor architecture independence.
- *Collective Control* - Allows control of the execution of tasks as related groups.
- *Message Debugging* – Allows to inspect, modify, reorder and block messages.
- *Execution Visualization* - Provides multiple views of the execution of the parallel application.
- *Performance Analysis* - Allows quantification of performance in terms of computation, communication and synchronization overheads.
- *Communication Bottleneck Detection* – Supports analysis and detection of communication bottlenecks.

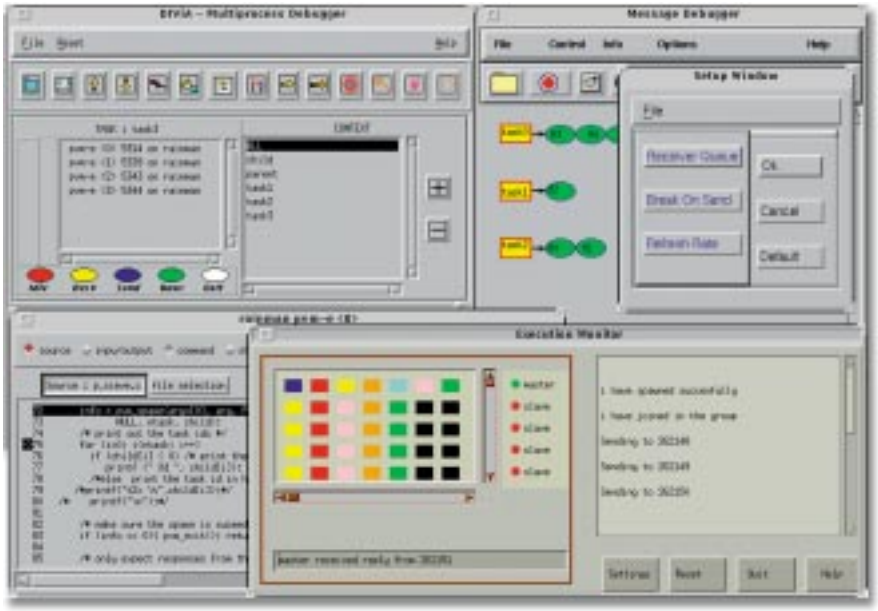
CORRECTNESS DEBUGGING

Correctness debugging of any program involves detection and fixation of causes (bugs), which result in incorrect behaviour of the program. In addition to the sequential program related problems, message passing (MP) parallel programs get affected by the synchronization between different constituent tasks and correctness of communication - both in terms of message data and order - and contention for shared resources if any.

Often the causes for an incorrect MP program behavior are interrelated in complex fashion and detecting the root cause needs filtering out all the secondary causes. In addition to the conventional logical debugging, DIViA correctness debugger introduces what we call *Message Debugging* and *Visual Debugging*. It also facilitates a mechanism of *Grouping Tasks* by means of which multiple tasks can be viewed as a single entity and a sequential debugger command can be issued to all constituents tasks of the group. These aspects of DIViA correctness debugger makes it well suited for MP programs.

Multiprocess Debugger

- Ability to debug constituent tasks of a parallel and distributed application from a single control point.
- Support for dynamic generation of task groups.
- Parallel analog to frequently used sequential debugger commands.
- Communication and execution oriented process status display.
- Selective debugger control of dynamically created tasks.
- Symbolic, interactive source code debugger for individual task.
- Flexible usage through pushbuttons and commands.



Correctness Debugging Tools

Message Debugger

- Inspection of messages and their contents from sender's and receiver's perspectives.
- Modification of selected message contents.
- Stopping user specified tasks when an event like departure or receipt of a message occurs.
- Reordering of the messages that are in the queue.
- Freezing and thawing of user specified messages.
- Message coloring based on user's specifications like message type.
- Multitude of usage through variety of user interface objects.

Visual Debugger

- Visual portray of various communication events in an abstract manner.
- Three different visual display windows; *Communication Animation, Space Time Diagram* and *Communication Matrix*.
- Focus on order of interprocess communication through Communication Animation.
- Quick glance of communication volume to help user locate communication hotspots.
- Communication status display of the constituent tasks.
- Display speed control with communication events history.
- Provision for pause, single step and rewind of application.
- On-line/off-line modes of operation.
- Textual monitoring of message specifications.
- Flexible usage through various user interface objects.

Execution Monitor

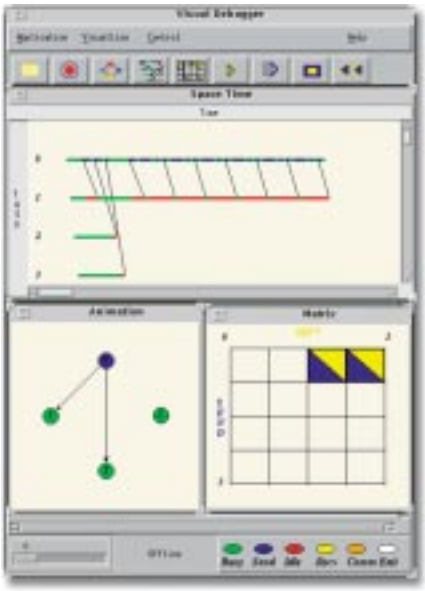
- Execution flow monitor of sequential as well as parallel applications.
- Visual and textual monitoring

PERFORMANCE DEBUGGING

Performance tuning of message passing parallel applications is a challenging task. DIViA helps users to tune their application by identifying both computation and communication bottlenecks.

Through Profile Visualizer one can easily detect the computational bottleneck region by systematic hierarchical analysis of the heap of profile data generated by parallel programs.

The other major cause of performance degradation is the message communication cost. Detecting the source of a communication bottleneck conventionally needed browsing through all the communication events in a parallel program, with the help of event traces and visualization tools. Since this is not practical in most real parallel programs, DIViA provides automatic detection of communication bottlenecks. It adopts a two-pass trace collection and filtering technique to zero in on the bottleneck regions. It also provides ways of visualizing the bottleneck regions graphically and provides means to relate the causes of performance degradation to their sources.



Correctness Debugging Tools

Performance Debugging Tools

Profile Visualizer

- Hierarchical data representation.
- Different performance analysis views using Task Graph, Gantt Chart and Source Code View.
- User selectable filters to mask irrelevant data.

Communication Bottleneck Detector

- Automatic Communication Bottleneck Detection.
- Provision to hierarchically pinpoint the actual region of bottleneck.
- Minimum perturbation to the user application because traces are generated only for the selected task and selected regions.
- Task Graph to know the details of each task's communication.
- Space Time Diagram to see the communication events in the bottleneck region.
- Source Code View corresponding to the event in the bottleneck region.
- Task Hierarchy Graph to know the parent-child relationship.
- Minimum analysis time because of the bucket generation concepts.
- No huge tracefiles even for large user applications.
- Static instrumentation method to collect event traces.
- Independent trace collection and analysis.

AVAILABILITY

Supported Hardware	:	Workstation Clusters
Supported Operating System	:	Solaris 2.5 and above
User Interfaces	:	GUI
Supported Languages	:	C & Fortran
Prerequisite Software	:	Java, X/Motif, MPI/PVM

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