

SCOPE OF THE EVALUATION

- **TEST THE TOOLSET WITH A SIGNIFICANT APPLICATION (DATA HANDLING SW)**
- **PORTING THE APPLICATION FROM MIL-STD-3-1750 TECHNOLOGY INTO ERC32 TECHNOLOGY**
- **INVESTIGATE THE ERC32 Ada PROGRAMMING MODEL**

EXERCISED ITEMS

- **ERC32 Ada Compilation System**
- **ERC32 Linker**
- **ERC32 Target Simulator**
- **HRT Development Model and HRT Tools**

EMPLOYED RESOURCES

- **Evaluation period :
from October to December 1997**
- **Partecipation to the "ERC32 Ada Technology
Training" course held in ESTEC on October
1997**

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SAMPLE APPLICATION

- **Data Handling SW** (an early version of XMM CDMU Standard Application SW)
- **language :**
Ada and Assembly(2.5%)
- **code size :**
41000 word [16bit] (33000 words of user code)
- **technology :**
MIL-STD-3-1750 TLD (version 96T009) on Sun/Solaris 2.5
- **Ada Programming Model :**
Syngle-Process Cyclic Scheduling

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COMPILATION PHASE : REMARKS ON THE ACS COMPILER

- the assembly parts were not converted in ERC32 assembly
- use of the Command Line Interface mode because faster than the Graphical User Interface
- some TLD warnings about **UNCHECKED CONVERSION** became compilation errors (the UCs were widely used in the application)
- many "type representation clauses" became no longer valid due to passing from 16 bit to 32 bit architecture (awaited)

COMPILATION PHASE : REMARKS ON THE ACS COMPILER

- the "pragma PACK" was signalled as compilation error when used for record types
- the "renames" declarations were signalled as compilation error
- a workaround adopted to solve problems of TLD compiler revealed to be not necessary ("if ..elsif" sequence to replace "case" Ada statement where the case expression was an enumerative type that had an enumeration clause applied to it)

EXECUTABLE CODE PHASE : REMARKS

- **ABOUT THE TOOLSET**

- difficulties in using the Microtec Linker due to ESTEC Firewall access procedure
- very low rate when working on ESTEC host via remote login

- **ABOUT THE APPLICATION**

- size budget for the ERC32 and the MIL-STD-3-1750 TLD technologies
 - » code size incremented by 130%
 - code (RTS) 8177 --> 36475 [word 16bit]
 - code (user) 32377 --> 56816
 - constant(RTS) 708 --> 1543

ERC32 Ada PROGRAMMING MODEL

- **guidelines for the new model construction**
 - the procedures which were set running by the Cyclic Scheduler were redefined as "cyclic task"
 - the procedures linked to the interrupt handlers were redefined as "interrupt sporadic task"
 - no element of the application were implemented as "software sporadic task"
- **some errors in the reference documentation**
 - Template for Interrupt Sporadic Task in Toolset User Manual

ERC32 Ada PROGRAMMING MODEL : COMPILATION PHASE

- **HRT options for the compiler for the Worst Case Execution Time Estimation (WCETE)**
- **Ada code restrictions requested by WCETE processing**

ERC32 Ada PROGRAMMING MODEL : COMPILE PHASE

- **Restrictions on commonly used Ada statements**
 - assignment to array elements in slice mode
 - assignment to an array in block mode (i.e. not element by element)
 - assignment to a field of a variable of "record with discriminant" type
 - "if" statement on a field of a variable of "record with discriminant" type
 - assignment to variable of "record" type

ERC32 PROGRAMMING MODEL : EXECUTABLE CODE PHASE

- **SIZE BUDGET FOR THE TWO MODELS**
 - code size [16bit word] incremented by 32%
 - code (RTS) 36475 --> 62623
 - code (user) 56816 --> 60724
 - constant(RTS) 1543 --> 1540

ERC32 PROGRAMMING MODEL : SCHEDULABILITY ANALYSIS

- **ESF file** : (obtained by the Binder)
- **UCF file** : (no-ATAC , priority range from 1 to 63 , clock frequency = 14 Mhz , no wait states)
- **RTS characteristic file** (included in the toolset)
- **RESULTS AND REMARKS**
 - the thread set was declared not schedulable
 - **UCF** : modification on the deadline data to obtain a schedulable thread set
 - **SA** terminated with
****ERROR****:Thread.Response_Time(WCCT)
not documented in the user manual
 - a bug in the **SA** tool uncovered !

ERC32 PROGRAMMING MODEL : SCHEDULER SIMULATOR

- **BRIEFLY EXERCISED JUST TO FEEL THE
USER INTERFACE**
- note :
SS did not revealed any missed deadline for the
thread set which SA was not able to process.

ERC32 ADA SYMBOLIC DEBUGGER

- **Ada Symbolic Debugger implemented by**
 - **AdaProbe**
 - **ERC32 Target Simulator configured as an extension of AdaProbe**
- **Installation problems in configuring the two packages (Aonix and Spacebel) to work properly. (Lack of details in the installation documentation)**

ERC32 ADA SYMBOLIC DEBUGGER

- **exercised on the application with no Ada-tasking**
- **exercised the typical debugger functions**
 - breakpoint management
 - control of execution
 - manipulation of data objects
 - manipulation of memory at low level
 - use of command files for the debugging session setup
- **not exercised**
 - tasking display
 - observation of program execution through watchpoints
 - Runtime tracing of scheduling activity

ERC32 ADA SYMBOLIC DEBUGGER : REMARKS

- the "STEP into" command does not work on the assembly code of an Ada statement expansion
- it is not possible to access a variable by directly input its name; it needs to open a file where the variable is referenced;
- there is no way to recall commands
- the following typical simulation
"from a breakpoint, the user want to restart the application from the beginning of a parameterless subprogram in order to debug it without any care to restarting from the breakpoint" revealed long, tedious and tricky (setting of PC and NPC registers)
- in LOW.LEVEL TRANSPARENT the answer to low level TS commands were badly placed in the Adaprobe window

ERC32 TARGET SIMULATOR : REMARKS

- Very short activity on the standalone mode
 - exercised to verify the allocation in memory of some variable of record type to which representation clause had been applied

CONCLUSIONS

- **Toolset elements fairly exercised**
 - Target Simulator
 - Ada Symbolic Debugger
 - Ada Program Library System
 - Schedulability Analyser
 - Scheduler Simulator
- **Toolset elements not exercised**
 - Aonix - batch tools (REFORMAT , XREF , MAKE)
- **Comparision with the TLD technology inspired most of the remarks**

RECOMMENDATIONS

- Improve the user documentation
- Make available the Kernel and Runtime sources
- Improve the Ada Symbolic debugger user interface
- Improve WCETE functionality with respect to the Ada restrictions