## ARM DDT Debugger

2020



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#### **ARM DDT**

- Parallel debugger (based on gdb)
- Cross-platform for multiple server and HPC architectures
- Native parallel debugging of Python applications
- Has market leading memory debugging
- Outstanding C++ debugging support
- Complete Fortran debugging support
- Has an offline mode for debugging non-interactively
- Handles and visualizes huge data sets





#### Installation Download the remote client

- DDT is the parallel debugger part of ARM Forge.
- Installations of Forge on the cluster: module avail forge
- Use of the DDT Debugger is easiest through the remote client
  - − GUI runs on the local desktop or laptop  $\rightarrow$  responsive
  - Clients available for Windows, Linux and Mac OS/X
  - <u>https://developer.arm.com/tools-and-software/server-and-hpc/downloads/arm-forge</u>
  - You need the same minor version as the Forge installation on the cluster!
  - Currently version 20.1
  - No administrator access required

#### Installation Load the private key in your SSH Agent

- ► SSH Agent:
  - Windows: Pageant
  - Linux & Mac OS/X: ssh-add ~/.ssh/id\_hlrn



#### Setup Configure remote launch

- Click ,Configure...'
- Then click ,Add`

Arm DDT - Arm Forge 2	D.1	_		×
<u>File Edit View Control Tools</u>	<u>W</u> indow <u>H</u> elp			
<b>arm</b> Forge	<u>R</u> UN Run and debug a program.			
arm DDT	ATTACH Attach to an already running O <u>P</u> EN CORE Open a core file from a previous			
arm MAP	MANUAL LAUNCH (ADVANCEI Manually launch the backend OPTIONS			
	Remote Launch: Off			
Support Tutorials	HLKN-1V BEININ			
arm.com				
8 Remote Client ?				
			Arm Forg	e 20.



#### Setup Settings for blogin.hlrn.de

- Connection name: HLRN-IV Berlin
- Host name: <u>zzatodonn@blogin.hlrn.de</u>
- Remote installation directory: /sw/tools/allinea/forge-20.1.3



#### Setup Settings for glogin.hlrn.de

- Connection name: HLRN-IV Göttingen
- Host name: <u>zzatodonn@glogin.hlrn.de</u>
- Remote installation directory: /sw/tools/allinea/forge-20.1.3





#### Starting to debug an application Loading your private key

- On Windows: start Pageant
- Add key to your login to the SSH Agent
  - ssh-add in Linux or Mac OS/X
  - ,Add keys' in Pageant
- Make sure that you logged in before on the system through Putty or SSH and accepted the fingerprint.

The authenticity of host 'blogin.hlrn.de (130.73.234.7)' can't be established ECDSA key fingerprint is SHA256:pNGlm//LyjJZi6tX0mz5SPSs4IBkuyJI/iWI10JbhgE. ECDSA key fingerprint is MD5:e5:51:66:4e:b9:aa:78:0e:9b:5c:41:4a:2e:58:da:f3. Are you sure you want to continue connecting (yes/no)?

#### Starting to debug an application Connecting your remote client to the cluster

- Start DDT remote client
- Select ,HLRN-IV Berlin' or ,HLRN-IV Göttingen' under Remote launch
- ARM DDT is connected to the cluster and waits for connection requests.



#### Starting to debug an application Modifying your job script

- Load the forge software in your job script: module load forge/20.1.3
- Prefix your srun or mpirun/mpiexec command with ddt --connect:

ddt -connect srun app



## Starting to debug an application Starting your job

- Submit the job
  - Use the test queues, if possible: maximum 8 nodes, 1 hour walltime
- Remote client shows a popup to accept a Reverse Connect Request:

FORGE Rev	verse Connect Request	?	$\times$				
1	A new Reverse Connect request is available from bcn1004 for Arm DDT.						
	Command Line:connect srun ./lbtest						
	Do you want to accept this request?						
	Help Accept Reject						

#### Starting to debug an application Enable optional features

PORCE Run	? ×					
Run: srun ./lbtest	Details					
Command: srun ./Ibtest						
OpenMP	Details					
	Details					
Plugins: none	Details					
<u>H</u> elp Options	Run Disconnect					

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ile <u>E</u> dit <u>V</u> iew <u>C</u> ontrol <u>T</u> ools <u>W</u> indow <u>H</u> elp		
🕨 🗉 🔁 🛟 🦚 🖼 🖬 🖬 🖬 🖬 🕹		
Current Group: All Focus on current:  Group C Process C Thread	Step Threads Together	
NI 0 1 2		
Create Group		
Project Files Fortran Modules I Ibtest.f90 🛛		Locals Current Line(s) Current Stack
roject Files <b>F</b> × 56 use mpi_f08		Current Line(s)
earch (Ctrl+K) S8 type (loadbalance)	) :: lb	Name Value
Application Code 59 class (looper), al.	ocatable :: lp	
Headers 60 type(loopje) :: .	ptype	
E Sources 61 real, dimension(	,:), pointer :: bla	
getnuma.c     G3 integer (kind=MP)	ADDRESS KIND) :: bs	
init_loopje     64 integer myrank, r	pisize, remoterank	
<pre>     loopje         65         type(MPI_Comm)::</pre>	comm	
- M loopje_mod 66 double precision	t0,t1	
- ® x2 68 call MPI Init		
I loadbalance.f90     Comm=MPI_COMM_WOI	LD	
70 call MPI_Comm_ram	k(comm,myrank)	
71 call MPI_Comm_si:	e(comm,mpisize)	
73 allocate (bla (10,	0))	
74 bla=4	- / /	
75		
76 ! Somehow, this is	not passed correctly with gfortran 7.3.1	
77 : ID=IOADDAIANCET_ 78 bs=4096	Constructor(1p, Comm, 4096_MP1_ADDRESS_KIND)	
79 print*,"alloc loo	pje"	
80		*
81 allocate (loopie	• In) Evaluate	
Input/Output Breakpoints Watchpoints Stacks (Air) Tracepoints Trac tacks (All)		Value
Processes Threads Function		Tuide
3 + testib (ibtest.f90:68)		
3 ips_ptl_pollintr		
		Ready Connected to: (via tunnel) blogin7:4201 -> bcn1004



# Interactive debugging session



#### Getting started, User guide, Tutorials, Video library

https://developer.arm.com/tools-and-software/server-and-hpc/debug-andprofile/arm-forge/arm-ddt

#### E.g.:

"Visualizing data with DDT" "Memory debugging" "Debugging CUDA and OpenACC"



# Thank you for your attention!

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### Questions?

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# Interactive debugging session

- Explain screen:
  - main source,
  - buttons,
  - files,
  - stack/line vars,
  - lower left: tabs for parallel stack trace, breakpoints, output, ..
  - Lower right: evaluate, useful for long expressions
- Step
- Set myrank to 99
  - This can be useful to check what happens for a different value.
- Step
- Explain sparkline for variable myrank.
- 22 | dd-mm-yyyy | © Atos For internal use



- Step into loadbalancer constructor
- Run until numa\_shared\_,
- Only select 1 process and "step into", show C code
- Show stacks, with different paths for processes
  - This is very useful if your application hangs. It quickly shows processes in a different code path
- Analyse arrays
- Evaluate expressions
- Set breakpoints
- View the MPI message queue

