A Seamless Tool Access Architecture from ESL to End Product

Albrecht Mayer (Infineon Microcontrollers) S4D Conference

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Never stop thinking

Tool Access Architecture (TAA)



(infineon



	ESL Model	HDL Simulation	FPGA Prototype	Silicon /Device	Target System
Software Development	X	(X)	X	X	X
Silicon Debug				X	(X)
Silicon Validation Tests Develop.	(X)	(X)	(X)	X	
Debug of Tool Chain	(X)	X	X	X	

TAA Independence



- Operating system of host (Windows, Linux, etc.)
- Core type (TriCore[™], 8051, etc.)
- Physical interface of device (JTAG, CAN, etc.)
- SoC architecture
- Device access hardware
 - □ Physical connection (Ethernet, USB, etc.)
 - \Box Low cost \leftarrow range \rightarrow high end
 - □ Virtual and abstract for ESL-model (C-model)
 - Simulated for HDL simulator

Multi-Device, Multi-Core System





Tool I/F



Multi-Vendor IP-Model (ESL) System











Tool

Core specific Layer

Client Socket Layer

TCP/IP (remote or local)

Server Socket Layer

Device specific Layer

USB or Ethernet

Access HW

JTAG, CAN, etc.

Device





Infineon's DAS

- Device Access Server
- Introduced in 2000
- www.infineon.com/DAS

DAS

DAS Basic Considerations:

- 1. Abstraction of physical interface
- 2. Bandwidth ok, latency an issue
- 3. Encapsulate dependencies on device and physical interface type
- 4. Robustness is key



DAS Mission





Multi-Device Operation







Multi-Device Use Case Example



Parallel device analysis setup with up to 16 individual DAS device connections (JTAG over USB miniWigglers).

Devices under analysis are outside of this picture.

Multi-Tool Operation







Remote Debugging Use Case Example (1/2)





Remote Debugging Use Case Example (2/2)

- Board shown on previous slide had a tricky bug which couldn't be found for weeks
- Found this bug within hours by remote debugging using the DAS multi-tool, multi-device feature
- Unified tooling to debug all system components: Debugger → TAA → SoC → Board



Abstraction of Device and Connection





Debugger with ESL Model

H Step H	Over 4 N	est 🥑 Return	CUp DGo	II Break 2	Mode Find	E Billion	ister					1210
ddr/line	code la	abel anenoni	c	coment	1		DB	1	BB	8	SP> 04660850	
21	int main (w	////// oid) cut = 0:			ì	SV - SV - RV - SRV -	D1 D2 D3 D4 D5	0000000F 0000000F 000003C8 1010E003	和 紀 利 所	8 D4983818 D8982884 F9982818 FFFFFFFF	+84 4E823082 +80 F8058888 +80 F8057844 +18 F86F7844 +18 F86F7849	
104883818 22 104883818	eeba int	ain: mov16 i = 0; mov16	dB, 8x49 d15, 8x49		_	IO 2 IS I GH G CIE C	D6 D7 D8 D9	8 8 8	AG A7 A8 A9	A8881308 F888218C 8 8	+18 826F6848 +10 F2858887 +28 226F6844 +24 FF858889	
24 : 0408381C : 0408381E	8982 1230	(i-0; i< 50000; mov16 j16	1++) d9,8xd8 8xD48803842			EDC 1	D18 D11 D12 D13	8 8 8 8	A18 A11 A12 A13	AFFFC944 D400828E B 0	+28 20829074 +20 FE820F37 +38 9074FFR5 +34 FFR5000A	
26 14883828 27 14883822	18C2 FR3E8R38	cnt = cnt + add16 if(cnt3;1000 mov	1; dB,8bd 0) d15,8bdEB	; cnt,1		PIPN 8	D14 D15 PSM PCXI	8 89888591 99408995	R14 R15 PC ISP	8 9 04883818 8199	+38 D3826058 +30 0091E482 +48 D009D888 +44 F8051FCC	
D4883826 D4883828 D488382C D4883828	RLARFOAD BEAR REFECE	dvinit mov16.a dvstep loco15	e8,d8,d15 a15,8x3 e8,e8,d15 a15,8x04083820	; e0,cmt,d	15		FDX LCX	00010000E 00910000	ICR BIV BIV	8 9 A3993120	+48 11820044 +4C 90000078 +58 907FF918 +54 8000008	
04083832 04083836 04083838	BEDBFBGB 1FBZ F4F6	dvad j nov16 jnz16	e8,e0,d15 d15,d1 d15,8x04883848									2
29 04883838 04883830 04883848 04883842	8482 FFE2FF6D 19C2 FC750088	wri call addt6 nov u	te_wessage(cnt);	: discut : write.am : 1.1	ssape							
P : D4083838 29 P : D4083838 P : D408383C P : D4083848 P : D4083842	F4F6 8482 FFE2FF6D 19C2 FC358888	juzi6 wri novi6 call add16 nov.u	d15,0x040030400 te_wessage(cnt); d4,d5 0x04003000 d5,0x1 d15,0xd350	i di.ent i urite.ne i 1.1	ssage	1						

TRACE32 Config String: sys.mcd McdServerName="C-Model TriCore"



Debugger with Real Device

- DAND - I	Over + Next	Peter I	Up Go	II Break Z Mode	Find	R.flep	ster					10
dr/line	code lab	el menonic		connent	100	0 -	D9	1	BB.	8	SP> 04660850	
:D4883816 21	int main (void	//////////////////////////////////////				V - SV - AV - SAV -	D1 D2 D3 D4	888D8888 888D888F D68883C8 1818E883	自1 自2 自3 自4	8 D4883818 D8882884 F8882818	+84 4E823082 +86 F8658888 +80 F8657844 +18 F8657844	
D1883818	anaz nair	1: mov16	dB,868		- 10 B	10 2	DG	8	AG	A8881308	+18 826FA948	
22	int i	- 0;				IS I	D7	8	87	F888218C	+1C F2858887	
:0408301A	REDA	m0v16	015,8x8		- 1	GH G	D8	8	88	8	+28 226FA044	
24	for (i-0: i< 50000;	1++)			CTC 1	D18	a	818	REFEC944	+28 28829874	
1408381C	8982	mov16	d9,8bd8				D11	8	A11	D40082BE	+2C FE828F37	
1488381E	1230	J16	8×D4883842			IE -	D12	8	812	8	+38 9074FFA5	
26		and a cost a	1.			CPPN 0	D13	8	A13	8	+34 FFR5880A	
14883828	1802	add16	dB.Bct	: cut.1		P.1P.8. 6	D14	8	015	8	+38 D3829050	
27		if(cnt%1000	0)		101		PSM	00000001	PC	D4883818	+18 00090688	
:D4883822	FREEBREER	BOV	d15,0x3EB				PCXI	884D888F	ISP	8198	+44 F0051FCC	
14883826	191A8F040	dvinit	e0,d0,d15	; e0.cnt.d15			FCX	SUBDERE .	ICR	H	+48 11829844	
104883820	REFERCE	duration in	21b, 80, 515				- LUX	66319669	BIV	00000100	ALL SERVICES	
RENERRAL	FEFC	100016	a15,8x0488382C						1114	HOURD LOB	154 9299298	
104003032	REDEFREE	dvad j	e8,e8,d15			1						- 2
:D4883836	1F8Z	mov16	d15,d1									_
EPHONOMOUS	1-91-6	Juz16	015,0004003040		_							
29	1000	writ	te_message(cnt);									
1488383A	6482	m0v16	d4,d8	; d4,cmt								
D488383C	FFE2FF6D	call	8xD49833888	; write_message								
P4883848	19CZ	add16	03,80	1.1.1	14							
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TRACE32 Config String: sys.mcd McdServerName="UDAS"



Debugger with Real Device over XCP

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00r/11ne P1040830916	int main (void)	nic /////	Connent		SV -	08 D1 D2 D3 D4	eeebaeeF beebaaca 1910E983	101 112 113 114 114	8 04003818 08082804 F0082818	SP3 046H0850 +84 4E823082 +86 F8058888 +80 F8058888 +80 F86F7844 +18 F86F8379	
P: 04083010 22 P: 04083010	ellez Reba	main: movi6 nt i = 0; movi6	d 8,850 d15,058			IO 2 IS I GH G CDE C	DG D7 D8 D9	8 8 8 8	AG AG A7 A8 A9	A02013D0 F800210C 0 0	*14 F2050808 *18 826F6848 *10 F2858887 *28 226F6844 *24 FF858889	
24 P:0408381C P:0408381E 25	8982 1230	or (1-0; 1< 5000 mov16 j16	0; 1++) d9,858 8xD4883842 + 1:		- 1	EDC 1	D18 D11 D12 D13	8 8 8	A18 A11 A12 A13 A14	AFFFC944 D40082BE B B	+28 20829074 +20 FER20F37 +38 9074FFR5 +34 FFR5000A +20 FFR5000A	
*: D4083820 27 *: D4083822	18C2 FREERIB R100F040	add16 if(cnt\$10 mov	dB,@c1 00 0) d15,@c3EB	; cnt,1	_	P 1PR	D15 PSM PCXI	8 80888181 80408885 80908885	A15 PC ISP	0 04003818 8190	+38 D3629656 +30 8891E482 +48 D009D888 +44 F8851FCC +48 118250844	
* 04083820 * 04083820 * 04083838 * 04083838 * 04083832	3FR8 88F8F86B FEFC 88D8F86B	nov16 dvste loop1 dvad	.a a15,863 p e8,e8,d15 6 a15,8:0488382 e8,e8,d15			U	LCX	88918888	BIV BIV	0 00000100	+4C 90000278 +58 907FF918 +54 00000208	2
14883838 29	F4F6	jnz16	d15.0xd400304	•								
104883830 104883830 104883848 104883842	FFE2FF6D 19C2 FC35RMBB	add16 mov.u	69,05 8x04883888 69,8x1 d15,8xC358	; write_messa ; 1,1	ge L							

TRACE32 Config String: sys.mcd McdServerName="UDAS" McdAccHw.Port=1802 McdAccHw.Address="192.168.40.16"



Debugger with HDL Simulator

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Step	Over	Next	Perlum	Cup	▶ Go	II Break	Mode	Find	1 Biffe	gister					
dr/line	code	Tabel	enceion	C		connent			8 -	DB	1	- AB	8	SP> 046A005D	13
· P4003015	1111		//////	1111				-	Ľ	D1	SUBDISCON.	81	D. COLORIDA	+01 4E823082	8
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21	·	int ent	- 0:						PDC 0	D5	16102603	05	FFFFFFFF	+14 F2958008	2
DARGER18	RHR2	main:	mov16	dB.86	8			- 10 C	10 2	DG	8	86	08881308	+10 82659848	2
22		int i -	0:					_	IS I	07		87	FSRR21RC	+1C F2858987	í
:04883818	REDA		mov16	d15.8	Hist				GU G	08	8	88	8	+28 226F6844	6
								_	CDE C	D9	8	89	R	+24 FF858889	i
24	1	for (i-	0; i< 50000	; 1++)					CDC 1	D18	8	818	REFEC944	+28 28829874	1
:D400301C	8982		mov16	d9,8x	8					D11	8	A11	D4888ZBE	+2C FE828F37	1
: 0408301E	1230		j16	8×D48	03842				IE .	 D12 	8	812	8	+38 9874FFA5	i
		0	State State and	and a state					CPPN	0 D13	8	At3	8	+34 FFA5000R	1
26			cnt = cnt +	1 1;					P IPN	Ø D14	8	814	8	+38 13829858	1
: D4083628	1802		add16	dB, 8b	1	; cnt,1				D15	8	815	8	+3C 8891E482	8
27			11(cnt)(1000	J 0)	Contract In					PSH	RENAMER1	PC	D4883818	+41 DD09DENN	1
· PHERIM22	- H.B. BH. IB		INDV	(115,6	N.S.B.B	1 - 0	1.115			PCXI	6640666	1SP	8166	144 F8851FCC	
194003625	BTHG 040		avinit	66,00	-015	1 66100	0.015			1 CH	GOOTGOOD	1LM	M D	+18 11820019 +40 00000070	
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: 14883836	1582		movit	d15.0	1				<u> </u>			_			-
:04883838	E4E6		ing 16	d15.8	04883848										
			1					-							
29	Contraction of the		HE	ite_sess:	ge(cnt);										
:D488383A	8482		m0v16	d4,d8		1 04,01	it.								
:D488383C	FFE2FF60	i	call	RxD48	63996	; write	message								
:04883848	1902		add16	69,87	1	1.1.1		1.12							
:04003042	FC3500BB		180V.U	d15,8	DACENSIA			التر							
1.425.2769.5		/		200022				2 2							
	5,900														

TRACE32 Config String: sys.mcd McdServerName="UDAS" McdAccHw.Port=1784 McdAccHw.Address="mucsfbali13.muc.infineon.com"

Summary



- A seamless TAA from ESL to end product is needed
 - □ Reuse of tests, tools and know-how
 - Execute tasks earlier
 - \rightarrow Cost and risk reduction
- TAA needs to reflect "independence of" requirements

Infineon's TAA:

- □ Tool interface DAS → MCD API
- □ Broad productive use for silicon
- Emerging use or at least demonstrated for other "targets"

We commit. We innovate. We partner. We create value.



Never stop thinking