tCAM-refinstruction-intel-en.doc



# tCAM IP Search Replace Demo Instruction

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## tCAM IP Search Replace Demo Instruction

Rev1.01 2-Jun-2023

This document describes the instruction to demonstrate the operation of tCAMIP on Arria10SoC development board. This demonstration shows search/replace text function by using tCAMIP on A10SoC board via 10 Gigabit Ethernet communication.

### 1 Environment Setup

To operate tCAMIP Search Replace demo, please prepare following test environment.

- 1) FPGA development boards (Arria10SoC development board)
- 2) Test PC with 10 Gigabit Ethernet connector.
- 3) Micro USB cable for JTAG connection between FPGA development board and Test PC
- 4) 10Gb Ethernet cable.
- 5) Quartus Prime for programming FPGA, installed on Test PC
- 6) File "tCAMIPSearchReplacePack.zip" that included Test Application named "tCAMIP Search Replace" and configuration file named "tCAMIPRef\_time\_limited.sof". (to download this file, please visit our web site at www.design-gateway.com)

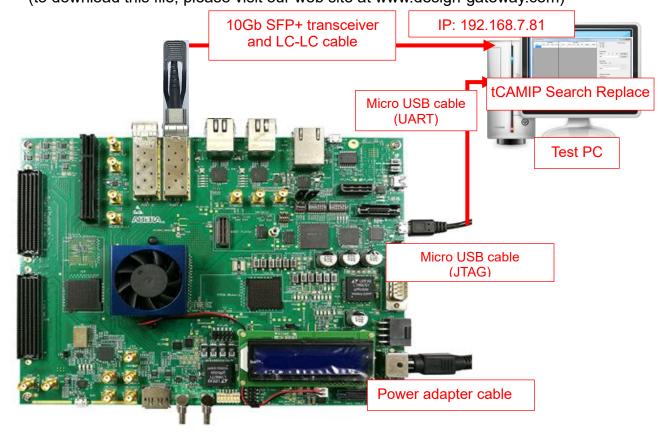


Figure 1-1 tCAMIP Reference Design demo on Arria10SoC board



## 2 PC Setup

Before running demo, please check the network setting on PC. Ethernet setting is shown as follows.

## 2.1 IP Setting

📮 Local Area Connection 2 Properties 📃 💌	Internet Protocol Version 4 (TCP/IPv4) Properties
Networking Sharing	General
Connect using: 10-Gb LAN connection	You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
<u>C</u> onfigure	Obtain an IP address automatically
This connection uses the following items:	Use the following IP address:
Client for Microsoft Networks	IP address: 192.168.7.81
<ul> <li>Process Packet Driver (NPCAP) (Wi-Fi)</li> <li>Process Packet Driver (NPCAP)</li> </ul>	Subnet mask: 255 . 255 . 255 . 0
<ul> <li>QoS Packet Scheduler</li> <li>File and Printer Sharing for Microsoft Networks</li> </ul>	Default gateway:
<ul> <li>✓ Internet Protocol Version 6 (TCP/IPv6)</li> <li>✓ Internet Protocol Version 4 (TCP/IPv4)</li> </ul>	Obtain DNS server address automatically
< III +	O Use the following DNS server addresses:
Install	Preferred DNS server:
Description	Alternate DNS server:
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.	Validate settings upon exit Advanced
OK Cancel	OK Cancel

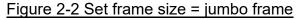


- 1) Open Local Area Connection Properties of 10-Gb connection, as shown in the left window of Figure 2-1.
- 2) Select "TCP/IPv4" and then click Properties.
- 3) Set IP address = 192.168.7.81 and Subnet mask = 255.255.255.0, as shown in the right window of Figure 2-1.



## 2.2 Speed and Frame Setting

🖟 Local Area Connection 2 Properties 🛛 🔍	Local Area Connection 2
Networking Sharing Connect using: Intel(R) Ethernet Server Adapter X520-2 This connection uses the following items: Client for Microsoft Networks Client for Microsoft Networks Client for Microsoft Networks Npcap Packet Driver (NPCAP) (Wi-Fi) Npcap Packet Driver (NPCAP) QoS Packet Scheduler Shile and Printer Sharing for Microsoft Networks Internet Protocol Version 6 (TCP/IPv6) Internet Protocol Version 4 (TCP/IPv4) Internet Protocol Version 4 (TCP/IPv4)	Local Area Connection 2       S3         You have made changes to the properties of this connection.       If you proceed your changes will be lost.         Do you wish to proceed?       Yes         Yes       No         Intel(R) Ethernet Server Adapter X520       erties         VLANs       Boot Options       Driver         General       Link Speed       Advanced
Install         Properties           Description         Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.           OK         Cancel	Settings:     Value:       Interrupt Moderation     2
	Jumbo Packet         Large Send Offload V2 (IPv4)         Large Send Offload V2 (IPv6)         Locally Administered Address         Log Link State Event         Offloading Options         Performance Options         Jumbo Packet         Enables Jumbo Packet         Enables Jumbo Packet capability for TCP/IP packets. In situations         w here large packets make up the majority of traffic and
	additional latency can be tolerated, Jumbo Packets can reduce CPU utilization and improve wire efficiency. NOTE: Changing this setting may cause a momentary loss of connectivity. Usage Considerations
	OK Cancel



- 1) On Local Area Connection Properties window, click "Configure" as shown in Figure 2-2.
- 2) On Advanced Tab, select "Jumbo Packet". Set Value to "9014 Bytes" for Jumbo Frame support or set value to "Disabled" for non-Jumbo Frame support, as shown in the bottom window of Figure 2-2.



3) On Link Speed, select "10 Gbps Full Duplex" for running 10-Gigabit transfer test, as shown in Figure 2-3.

Teaming       VLANs       Boot Options       Driver       Details         General       Advanced       Link Speed       PROSet Advanced         Itel(R)       PROSet Version:       25.0.0.1000         Link Status       Intel(R) PROSet Version:       25.0.0.1000         Speed       10.00 Gbps Full Duplex       Intel(R)         Speed and Duplex:       3       Diagnostics         10 Gbps Full Duplex       3       Diagnostics         Speed and Duplex Setting: By default, Intel® adapters are set to automatic ally detect and negotiate speed and duplex settings. A setting other than Auto Negotiation restricts what the adapter advertises during auto-negotiation.       Image: Speed information icon         This icon is displayed when the device is not linked at its maximum capable speed. In that case, if your device is set to       V         OK       Cancel	Intel(R) Ethernet Server Adapter X520-2 Properties							
Intel(R) PROSet Version: 25.0.0.1000     Link Status     Speed:     10.00 Gbps Full Duplex     Speed and Duplex:     10 Gbps Full Duplex     Diagnostics     Identify Adapter     Identify Adapter     Speed and Duplex Setting: By default, Intel® adapters are set to automatic ally detect and negotiate speed and duplex settings. A setting other than Auto Negotiation restricts what the adapter advertises during auto-negotiation.     Image: Information icon   This icon is displayed when the device is not linked at its maximum capable speed. In that case, if your device is set to								
10 Gbps Full Duplex       Diagnostics         Identify Adapter         Identify Adapter         Speed and Duplex Setting: By default, Intel® adapters are set to automatically detect and negotiate speed and duplex settings. A setting other than Auto Negotiation restricts what the adapter advertises during auto-negotiation.         Image: Information icon         This icon is displayed when the device is not linked at its maximum capable speed. In that case, if your device is set to	Intel(R) PROSet Version: 25.0.0.1000							
Speed and Duplex Setting: By default, Intel® adapters are set to automatically detect and negotiate speed and duplex settings. A setting other than Auto Negotiation restricts what the adapter advertises during auto-negotiation.								
to automatically detect and negotiate speed and duplex settings. A setting other than Auto Negotiation restricts what the adapter advertises during auto-negotiation. Information icon This icon is displayed when the device is not linked at its maximum capable speed. In that case, if your device is set to	Identify Adapter							
maximum capable speed. In that case, if your device is set to	to automatically detect and negotiate speed and duplex settings. A setting other than Auto Negotiation restricts what the adapter advertises during auto-negotiation.							
OK Cancel								
	OK Cancel							

Figure 2-3 Set link speed = 10 Gbps



- 4) On PROSet Advanced Tab, select "Performance Options" and click "Properties" button.
- 5) Set "Interrupt Moderation Rate" = OFF.

Intel(R) Ethernet Server Adapter X520-2 Properties	Performance Options
General Advanced Link Speed PROSet Advanced  Advanced Adapter Settings	Direct Cache Access Flow Control Interrupt Moderation Rate Low Latency Interrupts Receive Buffers Transmit Buffers Use Default
Settings:	Interrupt Moderation Rate
Locally Administered Address Log Link State Event Offloading Options Priority & VLAN Receive Side Scaling Receive Side Scaling Queues	This sets the rate at which the controller moderates or delays the generation of interrupts making it possible to optimize network throughput and CPU utilization. The Adaptive setting adjusts the interrupt rates dynamically depending on traffic type and network usage. Choosing a different setting may improve network and system performance in certain configurations.
Performance Options Configures the adapter to use settings that can improve adapter	
configures the adapter to use settings that can improve adapter performance.	
OK Cancel	

#### Figure 2-4 Interrupt Moderation Rate

- 6) Select "Low Latency Interrupts" and click "Properties" button.
- 7) On "Low Latency Interrupts" window, select "Use Low Latency Interrupts" and click "OK" button.
- 8) Click "OK" button to save and exit all setting windows.

Performance Options	Low Latency Interrupts
Settings:       Properties         Direct Cache Access       Properties         Flow Control       6         Interrupt Moderation Rate       6         Interrupt Moderation Rate       6         Interrupt Steerey Interrupts       7         Rables adapters to bypass interrupt moderation and immediately generate an interrupt when certain TCP packets arrive, allowing the system to handle the packet more quickly. Certain applications will have faster access to network data because of the reduced data latency.         Image: Notes:       •         If this ontion is enabled system CPI Interrupt       Gancel	Vise Low Latency Interrupts         Ise Low Latency Interrupts         Ise for packets with TCP PSH flag         Use for these TCP ports:         Add New Port:         Add         Remove         Configures which packets bypass interrupt moderation and trigger immediate interrupts.         Use for packets with TCP PSH flag will trigger an immediate interrupt. The PSH flag will trigger an immediate interrupt. The PSH flag is set by the sending device.         Use for these TCP ports:         Every packet received on the         OK

Figure 2-5 Use Low Latency Interrupts



#### 2.3 Power Option Setting

- 1) Open Control Panel and select Power Options as shown in the left window of Figure 2-6.
- 2) Change setting to High Performance as shown in the right window of Figure 2-6.

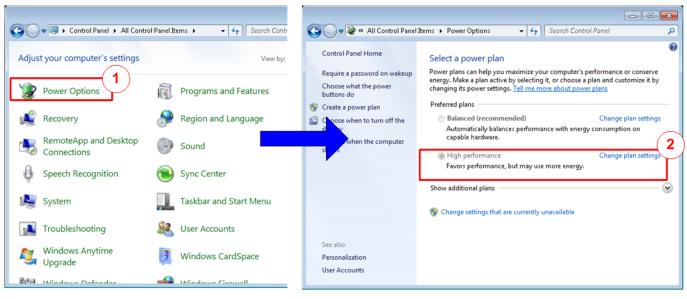


Figure 2-6 Power options



## 3 FPGA board setup

- 1) Make sure power switch is off and connect power supply to FPGA development board.
- 2) Connect USB cable between FPGA board and PC via micro USB
- 3) Connect 10Gb Ethernet cable (10 Gb SFP+ DAC (Length<1m), AOC or SFP+ transceiver with LC-LC cable) between FPGA board and PC.

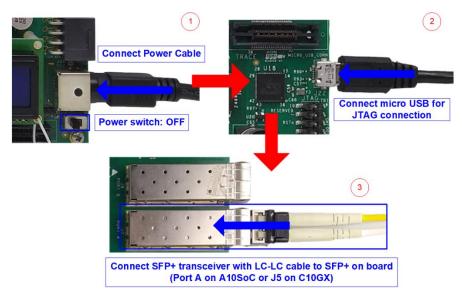


Figure 3-1 Power, Ethernet, and micro USB cable connection

- 4) Power on system.
- 5) For Arria10 SoC board, set programmable clock to 322.265625 MHz by using "Clock Control" application as following step.
  - a) Open "Clock Controller" application.
  - b) Select Si5338 tab (U50) and set CLK3 frequency = 322.265625 MHz.
  - c) Click "Set" button and wait until the application is active again.
  - d) Close Clock controller application.

O Clock Cont	roller A	rria10 So	oC board	
Si5338(U42)	5i5338(U49) Si	b 5338(U50)	)	
Register			icy (MHz)	Disable All
CLK0	125.000000	CLK0	125.000000	Disable CLK0
CLK1	270.000314	CLK1	270.000314	Disable CLK1
CLK2	99.999806	CLK2	99.999806	Disable CLK2
CLK3	322.265625	CLK3	322.265625	Disable CLK3
F_vco: 2578	.125000 MHz Default	Read	C Set	Import
Messages				
Connected	i to the tai	rget		

Figure 3-2 Reference clock programming



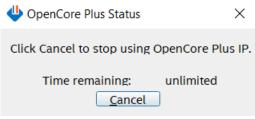
- 6) Open QuartusII Programmer to program FPGA through USB-1 by following step.
  - e) Click "Hardware Setup..." to select USB-BlasterII [USB-1].
  - f) Click "Auto Detect" and select FPGA device. (10AS066N3).
  - g) Select FPGA device icon.
  - h) Click "Change File" button, select SOF file in pop-up window, and click "open" button
  - i) Check "program"
  - j) Click "Start" button to program FPGA and wait until Progress status is equal to 100%

📩 Hardware Setup	USB-Blasterll [USB-1]					Mode:	JTAG		~	Prog		100% (Succe	essful)
Enable real-time	ISP to allow background pr	ogramming when av	vailable							(	j <b>J</b>		
⊮ <sup>™</sup> Start	File	Device	Checksum	Usercode	Program/ Configure	Verify	Blank- Check	Examine	Security Bit	Erase	ISP CLAMP	IPS File	
i <sup>ste</sup> Stop ∰ Auto Detect	<none> <pre>c_files/tCAMIPTest <none> </none></pre></none>	10AS066N3F40 SOCVHPS 5M2210Z 5M2210Z	1E621AF0 00000000 00000000 00000000	FFFFFFF <none> <none> <none></none></none></none>		i							
Add File	·)												
P Change File.	h)												
• Add Device			<b>—</b>				]						
‡ <sup>1</sup> ம் Down	10AS066N3F40	SOCVHPS		12210Z	5M22102								
		g											

Figure 3-3 FPGA Programmer



7) When configuration is completed, Quartus will show popup message of OpenCore Plus as shown in Figure 3-4. Please do not press cancel button, because NiosII in tCAMIP will stop running.



#### Figure 3-4 OpenCore Plus Status

- 8) When configuration is completed, user can check status LEDs on board as Figure 3-5
  - LED0 is turned on when hardware reset switch "S10" is push.
  - LED1 is turned on when TOE10GIP is ready for data transfer.
  - LED2 is turned on when tCAMIP is initialized successfully.
  - LED3 is turned on when software open connection to A10SoC board.

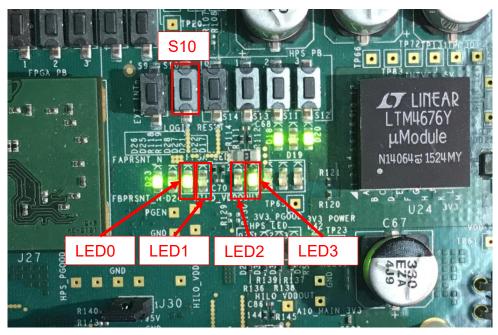


Figure 3-5 LED[3:0] status on board



## 4 tCAMIP Search Replace demo software

tCAMIP Search Replace demo software is designed to do search/replace text function by using space bar to be delimiter. tCAMIP Replace button is search and replace text by using tCAMIP on A10SoC board via 10 Gigabit Ethernet.

### 4.1 Demo software interface description

🖳 tCA	MIP Search Replace				×
Conn Conn C					
Search white White nurse horse Horse Horse three city duty Duty busy easy Busy bury vary very Busy bury vary very Buny deny Deny Many lady	Replace           word001           word002           word003           word004           word004           word007           word008           word008           word0010           word0101           word011           word011           word0112           word0113           word016           word015           word016           word017           word018           word020           word021           word022           word023           word024           word025           word026	word013 word014 word015 word016 word017	word003 word004 word005 word006 b word007 word010 word010 word011 word012 word013 word013 word013 word014 word015 word016 word016 word016 word017 word018 word019 word019 word020 word020 word020 word022 word023 word024 word025		<

Figure 4-1 Software interface

Figure 4-1 shows tCAMIP Search Replace user interface and the description is shown as below.

- a) Input source text for search. ("input.txt" is sample text)
- b) Output result text after replace.
- c) Connect/Disconnect with A10SoC board via 10 Gigabit Ethernet.
- d) Software Replace, this button will search and replace text with software.
- e) tCAMIP Replace, this button will be sent source text via 10 Gigabit Ethernet to search and replace text by using tCAMIP.

#### 4.2 Search and Replace sample table

Please refer sample table of search and replace word in file "SampleTable.txt".

#### 4.3 Sample text

"SampleText.txt" is prepared for sample of input source text. Figure 4-2 shows sample result using "SampleText.txt"

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🖳 tCAMIP Search Replace		- 🗆 X						
tCAMIP Search Replace 177414 / 177414 Disconnect tCAMIP Replace								
[Sample Text]	^	[Sample Text]	^					
There was once a young Shepherd Boy who tended his sheep at the foot of a mountain near a dark forest. It was rather lonely for him all day, so he thought upon a plan by which he could get a little company and some excitement. He rushed down towards the village calling out Wolf, Wolf. And the him, and some of them stopped with him for a consideration time. The that a few days afterwards he tried the same trick, and again the villi. But shortly after this a wolf actually did came out from the forest and and the boy of course cried out wolf, wolf" still louder than before. But the villagers, who had fooled twice before, thought the boy was nobody stirred to come to his help. So the wolf made a good meal of OK Moral of the story "Liars are not believed even when they speak the truth."		There was once a young Shepherd Boy who tended his sheep at the foot of a mountain near a word225 forest. It was rather lonely word579 word636 all day, word697 word705 thought upon a plan word703 which word705 could word538 a little company and word420 excitement. word712 rushed down towards the village calling word544 Wolf. Wolf. And the villagers word423 word544 word699 meet him, and word420 of them stopped word282 word636 word579 a consideration time. This pleased the boy word697 word102 word102 a word514 days afterwards word705 tried the word416 trick, and again the villagers word423 word699 his help. word557 shortly after word133 a word315 actually did word423 word544 from the forest and began word699 wory the sheep, and the boy of course cried word544 wolf, wolf" still louder word157 before. word557 the villagers, who had fooled twice before, thought the boy was again deceiving them, and nobody stired word699 word422 word699 his help. word715 the word315 made a good meal off the boy's flock.						
The Public Health Ministry's Department of Medical Sciences (DMS) on Monday assured the public of its Covid 19 testing capability as the country prepares for fresh infections now that most businesses have reopened. The director general of the DMS, Opas Kankawinphong, on Monday outlined what the public health community was doing to prepare for a second wave of coronavirus infections even though the country has had no local cases for more than 50 days.	~	Moral of the story "Liars are word533 believed even when they speak the truth." The Public Health Ministry's Department of Medical Sciences (DMS) on Monday assured the public of the Covid 19 testing capability as the country prepares word579 fresh infections word509 word102 word030 businesses word327 reopened. The director general of the DMS, Opas Kankawinphong, on Monday outlined word107 the public	~					
Figure 4-2 Sample result using "SampleText.txt"								



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## 5 Revision History

Revision	Date	Description
1.01	5-Mar-2021	Revise
1.00	25-Aug-2020	Initial version release
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