PC-Cluster 架設圖解教學 作業系統-linux-openSuSE 11.2

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1. 環境介紹:

(1)OS: openSuSE 11.2 64bit GNIME Desktop-English
(2)Computer 數量: Master 一台(主機名稱: master)、Node 一台(主機名稱: node2)
(3)Master 有兩張網路卡,對外爲固定 IP,對內爲虛擬 IP: 192.168.1.1

2. 架構圖:



3. 各種 Server 介紹:

(1) DHCP Server → 可製造虛擬 ip 分配給 Nodes

(2) NFS Server→可開放本機的磁碟給 Nodes 存取

(3) NIS Server→可將本機的帳號分享至其他 Nodes

(4) SSH Server→開放 SSH 遠端連線功能,當中 Master 的功能為對外連線,而 Nodes 的功能則為和 Master 溝通的橋樑

*NIS Server 的功能是將帳號分享給其他的 Slave,若你的 Nodes 很少,亦或是帳號只有一個,功能確實不大,不用安裝也可架起 Cluster,但若你的(Nodes)很多,帳號又不只一個的時候,NIS Server 確實扮演著重要的角色。

* DHCP Server 並非必要,可以手動設定 IP 位置。

*本篇文章粗體即為終端機下輸入的指令。

* 筆者在大專期間,實驗室需要,自行上網查詢相關資料(如:鳥哥的私房菜、Marty's Linux Cluster 架設日誌等...)而在實驗室架 設出基本的 cluster,經過一段時間的磨練和成長,解決了一些零零散散的問題,累積心得進而寫出這邊 cluster 架設教學文章, 不過學海無涯,深深感到自己對 linux 系統的了解只是滄海一粟,若在下述中有任何的錯誤或改進,歡迎來信共同討論和進步, 以下是小弟的聯絡方式。

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4. 設定 Master:

(1) 設定NFS Server

<1>利用「Install Software」功能,搜尋「nfs」,安裝「yast2-nfs-server」。

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<2>利用「YaST」功能,進入NFS Server 設定。



<3>依照下圖畫面設定,並選擇「Next」,其中 domain name 可自行設定,此處採預設狀態。



<4>選擇欲分享出去的目錄,以下以/home 為範例,輸入完分享目錄,會出現設定參數選項,「Host Wild Card」預設為「*」,表示分享給任何一台電腦,而「Options」在 cluster 架設中,我們習慣將預設的「ro,root_squash」改為「rw,no_root_squash」,見下圖。

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(2) 設定DHCP Server

<1>利用「Install Software」搜尋「dhcp」,安裝「yast2-dhcp-server」。



<2>利用「YaST」設定 DHCP Server, 見下圖。



<3>在設定時,若遇到套件不足,openSuSE 會相當人性化的告知,並詢問您是否需要安裝,選擇「Install」即可。

Dead frewall actions		s superuser)		
Read DNCP server Read DNS server these p dhcp-se	(as superuser) × ackages need to be installed: rver	stem Log	Vendor Driver CD	
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<4>開始進行設定,Master有兩張網路卡,選擇對內那張設定為DHCP Server,並開啓此Server在防火牆的通路(由於我們在安裝時,已經對內那張網路卡的防火牆關閉,所以其實此舉動無異議)。

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			and remain	_	PROB SUPERING		
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<5>設定好 DHCP Server 的內容,「Domain Name」可自行設定,「Primary Name Server IP」設定為對內網路卡的 IP(我們之前以將 其設定為 192.168.1.1),「Gateway」設定和「primary Name Server IP」相同,詳見下圖。

LDAP Support		s superuser)		×
Domain Name:	NTP Time Server:	stem Log	Vendor Driver CD	
localhost	Driet Resure		9	
rimary Name Server IP:	Ennt Server:			
192.168.1.1	NAME Conver	DN	Modem	
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Help	Windows Domain Me Novell AppArmor	Back Next pry	ᇌ NS Clent म्बी- Samba Server	
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<6>設定您欲創造的虛擬 IP 範圍,此處我們設定為 192.168.1.2~192.168.1.100,見下圖。

ubnet Information					
				24	
		192.168.1.254			
Address Range Eirst IP Address:		Last IP Address:			
192.168.1.2		192.168.1.100			
Default:	Units:	Max	imum:	Units:	
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<7>選擇開啓即啓動 DHCP Server,並可利用「DHCP Server Expert Configuration」更準確的設定那台 Node 的 IP 指定為多少,依據本人經驗,嚴格指定每台 Node 分配到的虛擬 IP,在整個 cluster 會較穩定,因此建議大家執行此步驟。



(3) 設定NIS Server

<1>利用「Install Software」搜尋 nis,並安裝「yast2-nis-server」。



<2>在「YaST2」中,設定「NIS Server」。



<3>選擇「Install and set up an NIS Master Server」,並將自動開始安裝不足的套件。



<4>「NIS Domain Name」可自行設定,詳細如下圖設定。

		Company of the		
NIS <u>D</u> omain Name		rankerman.)		
localdomain				
This host is also a NIS glient		stem Log	Vendor Driver CD	
Active Slave NIS server exists				
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Allow changes to passwords		mote Administration (v		
		IS Server	Hostnames	
Open Port in Brewall Frewall Details		rberos Client	LDAP Browser	
rewall port is open on selected interfaces			**	
Other glob	al settings	ul Server	(Network Services (xinetd)	
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3 000	🔊 Add Profile Wizard	AppArmor Control Panel	AppArmor Reports	
	Delete Profile	📑 Edit Profile	Manually Add Profile	
	👫 Update Profile Wizard			
4.png	Security and Users			
	100	@		

<5>Maps 使用預設即可,若遇到預設為全部沒有打勾的情況,可以選擇「Abort」,再重頭設定一次,而「Install and set up an NIS Master Server」會變成「Reconfigure NIS Master Server」,繼續上述步驟後,Maps 即會出現如下圖的預設值。

NIS Server Maps Setup -	YaST (as superuser)	- 0 ×		
NIS Server Maps Setup with this dialog, adjust which maps will be a	available.			
Maps:				
auto-master ethers group hosts		i superuser)		
netgrp netid networks passwd netican		stem Log	Vendor Driver CD	
protocols		214	Modern	
services		mote Administration (V		
		25 Server	Hostnames	
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2.png	- Samba Server	🤠 Windows Domain Member		
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3.png	🔊 Add Profile Wizard	AppArmor Control Panel	AppArmor Reports	
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	👫 Update Profile Wizard			
4.png	Security and Users	<u>^</u>		
	Firewall	(M) Local Security	.🛄 Suda	
👱 Computer 🛛 🧭 YaST Control Center (🚺 NIS Server Maps Setu		4, <u>N</u> U	Mon Jul 5, 10:46 AM 📓

<6>先將預設的兩組資料刪除後,再選擇「Add」,並編輯「Netmask」為 255.255.255.0,「Network」為 192.168.1.0(由於我們的主機對內 IP 為 192.168.1.1,因此我們對內整個網域即為 192.168.1.0)。(PS.圖中兩筆預設記得刪除,否則搭配 MPICH2 時會有問題)

	Network			(superuser)		
.0.0.0	0.0.0.0					^
		Edit netmask	eruser) × and network	stem Log	Vendor Driver CD	
		255.255.255.0		DN	Contract Modern	
		192.168.1.0	ancel	mote Administration (V		
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Help	2.png 3.png	3	Abort Head Abort Head Add Profile Wizard Celete Profile Update Profile Wizard	S Server Enish P Configuration Windows Domain Member M AppArmor Control Panel Stdt Profile	 NIS Cleat Proxy AppArmor Reports Manually Add Profile 	
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(4)Master額外設定

<1>由於SSH Server 在安裝 openSuSE 即設定開啓(openSuSE11.2 預設為關閉,安裝時請自行打開),因此此處跳過,有關SSH Server 更詳細教學,可參考「鳥哥的 Linux 私房菜」。

<2>先以 root 登入,執行 vi /etc/hosts,設定如下圖(由於此處我們 Master 對內虛擬 IP 為 192.168.1.1,而 node2 對內 IP 為 192.168.1.2)。

192.168.1.1 master 192.168.1.2 node2

<3>大致上 Master 的設定就結束了!!

5. 設定 Nodes:

(1) 設定hosts

以 root 登入,執行 vi /etc/hosts,設定如下圖。

192.168.1.1 master 192.168.1.2 node2

(2) 設定NFS Client

<1>利用「YaST2」選擇「NFS Client」。



<2>利用「Add」設定,將 Master中的硬碟空間載入到本機(此處即為 node2)上,其中「NFS Server Hostname」設定為 Master 的 IP,「Remote Directory」為 Master 分享的資料夾名稱,「Mount Point (local)」為掛載到本機的位置(可跟本機資料夾相同,會蓋過去)。



(3) 設定NIS Client

<1>利用「YaST2」設定「NIS Client」。



<2>如下圖設定,記得「NIS Domain」要和當初設定 Master 中 NIS Server 對應,「Addresses of NIS servers」輸入 Master 對內虛擬 IP(此處即為 192.168.1.1),「Start Automounter」記得打勾。



<3>此時會和開機時自動預設帳號有衝突,可自行選擇是否要取消自動登入預設帳號。

Do not use MiS		as superuser)		
Use NIS				-
5 client				
Netconfig NIS Policy: Custom		frared Device	Joystick	
Default Po	os superuser) X	rinter	Scanner	
NIS Domain localdomai Addresses	login feature is enabled for user hep. bled. atic login?	V Card		
192.168.1. Brgadcast		ig, Fing	Vendor Driver CD	
Additional NIS Domains				
EDBORD D PRESS PRESS VICTORS VI		SDN SDN	Modem	
🗑 Open Port in Firewall 🛛 Freegal Ce	tale .	BDN emote Administration (V	Modern	
🕲 Open Port in Firewall 🛛 Erogal Da Firewall port is open on all interfaces	rait	BEdt 3DN emote Administration (V	Modem .	
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S Open Port in Firewall Energial Du Frewall port is open on all interfaces Start Automounter	rals. I [®] Egport	BDN emote Administration (V CSI Initiator DAP Client	Modern Mai Server	
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Open Port in Firewall Frequel Con Frewall port is open on all interfaces Start Automounter elp	raik ■ Espert ● Abort ● Back ● InTP Configuration ■ Windows Domain Member Novell AppArmor	DN emote Administration (V aCSI Initiator DAP Client DAP Client FS Client FS Client	Modern Kerberos Client Mail Server Mail Server Mai Server Samba Server	
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(3)測試Nodes設定是否成功

<1>測試 NFS Server,在終端機下執行 df,若出現如下圖訊息,即表示成功。

	h	ep@linux-q	pma:~		-					
File Edit View Terr	ninal Help									
Directory: /home/hep/Desktop										
Fri Mar 5 14:44:00 CST 2010										
hep@node2:~/Desktop	> cd									
hep@node2:~> df										
Filesystem	1K-blocks	Used	Available	Use%	Mounted on					
/dev/sda2	74848828	3378240	67668408	5%	/					
udev	767008	824	766184	1%	/dev					
gvfs-fuse-daemon	114034816	3421376	104820800	4%	/home/hep/.gvfs					
/dev/sr0	4392280	4392280	0	100%	/media/CDROM					
/dev/sdb1	312568640	65556020	247012620	21%	/media/Transcend					
192.168.1.1:/home	114034816	3421376	104820800	4%	/home					
hep@node2:~>										

<2>使用 Master,建立一個測試帳號(ex. Sam),輸入 ssh node2,此時尙須輸入密碼(後面教學即將設定成無需密碼),輸入密碼 登入至 node2 的終端機,輸入 su Sam,並輸入密碼,若可成功切換使用者帳號,表示 NIS Server 以正常運作。

6. 設定 ssh 免密碼登入:

由於 ssh 除了主機對外的遠端連線外, cluster 內部溝通, 亦適用 ssh(有些教學使用 rsh, 效果相差不遠), 因此對於內部網域的 ssh 連線, 必須設定成不需密碼登入, 方可使 MPICH、MPICH2 等平行化資料庫運作。

(1) 在 Master 上, 輸入 ssh-keygen - t rsa, 接下來的問題皆按 Enter 即可, 回到指令列後, 輸入下列指令。

(2) cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys(記得我們當初有把 master 的 home 分享並蓋過 node2 的 home, 否則要在更複雜)。

(3) 設定完成,可以在測試利用 ssh 連至 node2,看是否需要密碼,若已經不需使用密碼,表示成功!!

(4) 每個使用者,皆須執行此設定,該帳號才可以免密碼登入,也就是說有幾個使用者,就要設定幾次。

7. 額外設定:

其實我們的 cluster 已經設定完成, cluster 只是將很多電腦串在一起,若程式的 code 沒有寫入平行的相關語法,其實 cluster 就完全是一台基本的電腦,並不會因為串了很多台 nodes,就跑的特別快,因此我們架設最主要的目的,就是建立一個平行處理的系統平台,再搭配 MPICH2 等資料庫,以達到平行的效果,此步驟的設定,是筆者自己在架設過程中,碰到問題查資料所獲得的經驗,也就是必須把 Master 和 nodes 中的/etc/hosts 設定的很精確,如下圖

Master :

127.0.0.1	localhost
140. 192.168.1.1 192.168.1.2 192.168.1.3 Nodes :	master master master master node2 node3

 127.0.0.1
 localhost

 192.168.1.1
 master

 192.168.1.2
 node2 node2

 192.168.1.3
 node3

如此一來,再使用 MPICH2 時才不會出現類似下列的錯誤 mpdboot_xxxhost (handle_mpd_output 386): failed to handshake with mpd on slave1; recvd output={}

8. 附錄

我們推薦一種分散式的 shell,在 Suse 中,可使用「安裝軟體」來進行安裝,其名稱叫作「pdsh」,在做一些集體的指令,比如說 全部 node 都要重開機,即非常方便。

pdsh 使用方法:pdsh - R ssh - w <你的 nodes 主機名稱> 指令;下面為 Example

pdsh - R ssh - w node2, node3, node4 reboot

則你的 node2~node4 都會執行 reboot 這個命令。