J,;6%*%Z%l!<%F%#%s%0%7%9%F%`Colonia $N
6&M-%a%b%j4IM}H=$N%(%_%e%l!<%?
The Shared Memory Management of Distributed Operating System Colonia and Emulator for the Shared Memory Management

;3E:Gn;K(Hiroshi YAMAZOE)

J?@.9G/27n14F|(Feb. 14 1997)

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8=:_Ia5Z7F$$$kJ,;6%7%9%F%`$G$O!"7W;;5!;q8;$N6&M-$,C#@.$5$l$F$$$k$,!"F0:n$5$;$k$3$H$N$G$-$k%"%W%j%1!<%7%g%s$ODL>o0l$D$N%W%m%;%C%5$K$h$kC`<!=hM}G"$k!#%"%W%j%1!<%7%g%s$rJ#?t$N%W%m%;%C%5$KhC$FJBNs$K<B9T5;h&H7Fb!"7W;;5!4V$NDL?.$,CY$/!"JBNs=hM}$KhkBgI}$J9bB.2=$O4|BTG-$J$$!#

$=$3$G2f!9$O!"JBNs%"%W%j%1!<%7%g%s$N<B9T$r;X8~7?J,;6%7%9%F%`H7$F!V3%s%T%e!<%?!&3%m%K!<!W$rDs0F$9$k!#%3%s%T%e!<%?!&3%m%K!<$O!"5i$K0LCVF)2a@-!"F0E*Ii2YJ,;6Kh$k7W;;5!;q8;$NM-8zMxMQ!"J#?t$N%f!<%6$X$NE,@Z$J;q8;$NDs6!$JIN<B8=$rL\I8$H9k!#

%3%s%T%e!<%?!&%3%m%K!<K*1kDL?.<jCJH7FO!"<g$K6&M-%a%b%j$rMQ$$$k!#6&M-%a%b%j$r%Y!<%9$H7?%7%9%F%`$G$O!"%G!<%?DL?.$O%a%b%j$KBP$9$k%"%/%;%9$H$7$F07$o$l!"%*%Z%l!<%F%#%s%0%7%9%F%`$N2p:_$J7K9bB.$+$D0BA4$JDL?.$,2DG=G"$k!#

K\8&5fGO!"9bB.%M%C%H%o!<%/$G7W;;5!$r7k9g7?6&M-%a%b%j%Y!<%9$N%o!<%/%9%F!<%7%g%s%/%i%9%?$r7A@.$7!"$=$N>e$K%*%Z%l!<%F%#%s%0%7%9%F%`Colonia $rEk:\$7$?%3%s%T%e!<%?!&%3%m%K!<$r3+H/9k!#

Colonia GO!"9bB.$JJBNs<B9T$r<B8=9k$?$a$N<B9T%b%G%k$H7F?7$7$/!V%_%C%7%g%s!&%f%K%C%H%b%G%k!W$rF3F~$9$k!#%_%C%7%g%s$H$O%f!<%6$,%7%9%F%`$KEjF~$9$k0l$D$N;E;v$NC10L$G$"$j!"%f%K%C%H$H$O%7%9%F%`$,%_%C%7%g%s<B9T$KhkIi2Y$r3F%W%m%;%C%5$KJ,;6$9$k$?$a$NJBNs<B9T$NC10LG"$k!#%f%K%C%H$O$=$l$>$lFHN)7?2>A[%a%b%j6u4V$r;}$D$?$a!"J#?t$N7W;;5!$KJ,;6$7$F$bITI,MW$JDL?.$r9T$o$:$KFHN)7FF0:nG-$k!#%f%K%C%H$O0lIt$N%a%b%jNN0h$rB>$N%f%K%C%H$H6&M-9k3H$G6(D4F0:n$r9T$&!#

K\9FGO!"%3%s%T%e!<%?!&%3%m%K!<K*1k:G$b=EMW$JDL?.<jCJG"$k6&M-%a%b%j$r<B8=9k$?$a$N4IM}5!9=$N@_7W$H3+H/!"$JiS$KColonia $r4{B8$N%*%Z%l!<%F%#%s%0%7%9%F%`>e$GF0:n$5$;$k$?$a$N%(%_%e%l!<%?$N3+H/KD$$$F=RYk!#

0lDN7W;;5!Fb$N%W%m%;%C%54V$G0lDNJ*M}%a%b%j$r6&M-$9kK$O!"J#?t$N2>A[%Z!<%8$,0l$D$NJ*M}%Z!<%8$r;X9h$&$K%Z!<%8%F!<%V%k$rJ];}$9lP$h$$!#$?$@$7!"J*M}%Z!<%8$+$i2>A[%Z!<%8$rF3$/$?aN5U0z$-%Z!<%8%F!<%V%k$O!"J#?t$N2>A[%Z!<%8$r;X9?$a%j%9%H9=B$$rHk!#0lJ}!"J#?t$N7W;;5!4V$G%a%b%j$r6&M-$9$k:]$O!"$"$k7W;;5!Fb$N%a%b%j$K<BBNrCV-!"B>$N7W;;5!$O%M%C%H%o!<%/rDL7F=$N<BBN$r;2>H9k!#<BBN$r;}$?$J$$7W;;5!$O!"I,MW$K1~8F<BBN$NFbMF$r<+7W;;5!Fb$N%a%b%j$K%-%c%C%7%s%0$9$k3H$G!"%a%b%j%"%/%;%9$N9bB.2=$r?^$k!#

5i$KK\8&5f$G$O!"3+H/$9$kColonia $N%a%b%j4IM}5!9=$N<BAu!"I>2A$r9T$&$?$a!"4{B8$N%*%Z%l!<%F%#%s%0%7%9%F%`>e$K!"6&M-%a%b%j4D6-$rDs6!$9$k%(%_%e%l!<%7%g%s4D6-$r9=C[$7$?!#%(%_%e%l!<%?$O!"Colonia $N%+!<%M%k$N$&$A%?%$%^3d$j9~$_$d%G%#%9%Q%C%A$J$I!"%O!<%I%&%'%"$K4X$o$kItJ,$HF1$8F/$-$r2L$?$7!"Colonia $N%+!<%M%k!"$*$h$SColonia >e$N%f%K%C%H$O!"4{B8$N%*%Z%l!<%F%#%s%0%7%9%F%`>e$N%W%m%;%9$H7FF0:n9k!#%f%K%C%H$KAjEv$9$k%W%m%;%9$r8rBe$GF0:n$5$;$k3HKh$j!"%f%K%C%H$NJB9TF0:n$r<B8=$9$k!#$^$?!"%f%K%C%H$4HK%W%m%;%9H7$FFHN)$9k3HG!"%f%K%C%H$,8GM-$N2>A[%a%b%j6u4V$r;}$D3H$r%(%_%e%l!<%H$G$-$k!#

Abstract

Although distributed systems which are spread today enable users to share computer resources, an application program usually can be executed only sequentially by one processor in those systems. Even if several processors execute an application program in parallel, the speed of the execution is not much faster than the execution by one processor, for the late communication between machines.

Then we propose a computer system named "computer colony", which is oriented for the parallel processing of an application program. In addition, the goals of a computer colony are the transparency of the location, the effective utilization of computer resources by dynamic load balancing, and the suitable supply of resources for multi users.

The primary method for communication in a computer colony is shared memory. In systems based on shared memory, the communication of data is treated as the access to memories, and users can communicate fast and safely without interference by operating systems.

We develop a computer colony, which consists of a workstation cluster made of computers connected with fast networks on the basis of shared memory, and an operating system named "Colonia" which works on that workstation cluster.

We import a new executive model named "Mission-Unit model" into Colonia for the fast parallel processing. A "mission" is a task thrown by users into a system, and a "unit" is a part of a mission divided for the system to distribute the load of the mission among processors. Because each unit has its own virtual memory space, it can work independently on separated machines without unnecessary communication. A unit shares a part of its virtual memory space with other units and cooperates with them.

This paper shows a design and development of the management mechanism for shared memory which is the most important method for communication in a computer colony, and a development of an emulator for Colonia to work in an existing operating system.

To keep page tables in which several virtual pages point to a physical page makes a physical memory shared among processors in a machine. Each entry in a reverse page table which shows virtual pages pointed to by a physical page, however, has to keep a list structure because it points to several virtual pages. On the other hand, it lets memories shared among several computers that a real content is located on a memory of a computer, and other computers access that content through networks. Those computers, if needed, keep a cache of the real content on their own memory.

We are developing Colonia with an emulator in an existing operating system in order to implement and evaluate the memory management of Colonia. The emulator works as if it were a part of the kernel of Colonia related with hardwares, such as timer interrupt or dispatch. The kernel of Colonia and units on Colonia act as processes on the emulator. The emulator let units work concurrently by making processes for units work in turn. Besides, the emulator provides each unit its own virtual memory space by making them independent as a process.

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1 O8aK

:G6a!"%Q!<%=%J%k%3%s%T%e!<%?$d%o!<%/%9%F!<%7%g%s$JIN7W;;5!K*$$$F!"%^%$%/%m%W%m%;%C%5$N@-G=8~>e$KH<$&9bB.2=!">.7?2=!"Dc2A3J2=$,?J$s$G$$$k!#3liN7W;;5!$r%M%C%H%o!<%/$G7k9g7FJ,;6%7%9%F%`$r9=@.$9k3HG!"7W;;5!$NMxMQ2ACM$,hj8~>e9k!#

J,;6%7%9%F%`$G$O!"%G%#%9%/$d%W%j%s%?$J$I$N<~JU5!4o$O6&M-$5$l!"%f!<%6$O%7%9%F%`NI$NC<Kv$rMxMQ7F$b!"F1$8;q8;$,MxMQ$G$-$k!#$=$7F^$?!"%M%C%H%o!<%/>e$NJL$N7W;;5!$KF~CFJL$N;E;v$r5;$k!"$H$$$&3HbG$-$k!#

7+$7!"0l$DNBg-$J;E;v$NIi2Y$rJ#?t$N7W;;5!$KJ,;6$5$;$FJBNs<B9T5;$k!"$H$$$&3HKJkH!"8=:_Ia5Z7F$$$kJ,;6%7%9%F%`KOLdBj$,$"$k!#%M%C%H%o!<%/$rDL7F$NDL?.$OdO$jCY1d$,Bg$-$/!";v<B>e:YN3EY$NJBNs<B9T$OG-$J$$!#

$=$3$G2f!9$O!"JBNs%"%W%j%1!<%7%g%s$N<B9T$r;X8~7?J,;6%7%9%F%`$H$7$F!"!V3%s%T%e!<%?!&%3%m%K!<!W$rDs6!$9$k!#$3$l$O!"3F7W;;5!$r9bB.%M%C%H%o!<%/$G7k9g$7$?%O!<%I%&%'%"$N>e$K!"%=%U%H%&%'%"$H$7$F%*%Z%l!<%F%#%s%0%7%9%F%`$rEk:\$7$?$?!"Am9gE*$J4D6-$G$"$k!#

K\8&5fGO!"%O!<%I%&%'%"4D6-H7FO6&M-%a%b%j%Y!<%9$N%o!<%/%9%F!<%7%g%s%/%i%9%?!"%=%U%H%&%'%"4D6-H7FOJBNs%"%W%j%1!<%7%g%s$N<B9T$r;X8~7?%*%Z%l!<%F%#%s%0%7%9%F%`"Colonia" KhCF!"%3%s%T%e!<%?!&%3%m%K!<$r9=@.$9$k!#

DL?.%W%m%H%3%kH7$F6&M-%a%b%j$rMQ$$$kMxE@H7FO!"<!NbN,5s2ilk!#

- DcB.$JI/O %P%9$r2p7?F~=PNOL?NaGOJ/!"%a%b%j%"%/%;%9L?Na$GDL?.$,9T$($k!#hC$F!"%7%9%F%`$KMM!9$J%"!<%-%F%/%A%c$N%^%7%s$,:.:_$7Fb!"DL?.$K4X$7$FE}0l$7$?07$$$,G-$k!#
- ITEv$J%"%/%;%9$O2>A[%a%b%jKBP9$k5-21J]8n0cH?$H7F07olk?$a!"DL?.$K$*$1$k%;%-%e%j%F%#$NJ]$,MF0W$G$"$k!#
- 0J>e$NM}M3$Khj!"%*%Z%l!<%F%#%s%0%7%9%F%`$,2p:_$9$k>lLL$,>/J/!"9bB.$JDL?.$,G-$k!#

2f!9$O!"Colonia $N3+H/$K$"$?$j!"Cf?4$HJk%^%$%/%m%+!<%M%k$NItJ,$r;n83F0:n$5$;$kY/!"4{B8$N%*%Z%l!<%F%#%s%0%7%9%F%`$K$*$$$F%(%_%e%l!<%?$r3+H/$7!"$=$l$rMxMQ$7$F%^%$%/%m%+!<%M%k$NF0:n$r<B8=$7$F$$$k!#K\9F$G$O!"%3%s%T%e!<%?!&%3%m%K!<$N35MW!"Colonia $K$*$$$F=EMW$JF/$-$r2L$?$96&M-%a%b%j4IM}$N<BAuJ}K!$KB3$-!"Colonia $r4{B8$N%*%Z%l!<%F%#%s%0%7%9%F%`>e$G3+H/$9k?aN%(%_%e%l!<%?KD$$$F=RYk!#

2 %3%s%T%e!<%?!&%3%m%K!<$N35MW

K\>OGO!"%3%s%T%e!<%?!&%3%m%K!<$N@_7WL\I8$*hS!"$=$l$r<B8=$9k?aN%O!<%I%&%'%"4D6-$N9=@.$H%=%U%H%&%'%"4D6-G"$kColonia $N9=@.$K$D$$$F=RYk!#

2.1 %3%s%T%e!<%?!&%3%m%K!<$N@_7WL\I8

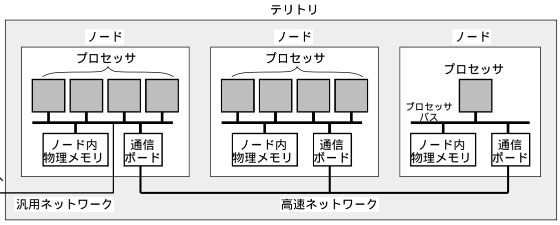
!V3%m%K!<!W(colony) HO!"1Q81$G!V2BN!W$r0UL#9kC181G"$k!#!V2BN!W$H$O@8J*MQ81$G!"J#?t$N8DBN$,7k9g7F@83h$7!"8_$$$K6(D4$7$F$"$?$+$bC10l$N8DBN$Nh&KUk^$&$bNr$$$&!#

2f!9$O!"J#?t$N7W;;5!$,!V2BN!W$N4H$/6(D4$7!"C10l$N9b@-G=7W;;5!$H7F07$($k%7%9%F%`$r9=C[$9kY$/!"!V3%s%T%e!<%?!&%3%m%K!<!W$rDs0F$9$k!#$=$NGX7J$K$"$k@_7WL\I8$O!"<!$Nh&JbNG$"$k!#

JBNs%"%W%j%1!<%7%g%s$N<B9T 9bB.$J%M%C%H%o!<%/$dJBNs<B9T$r;X8~7?<B9T4D6-$r3+H/$7!":YN3EY$NJBNs<B9T$r<B8=9k!#K\8&5f$N:G$bBg$-$JL\I8G"$k!#

7W;;5!;q8;$NM-8zMxMQ %M%C%H%o!<%/>e$GIi2Y$,JP$k$?$a$K0lIt$N7W;;5!$,$[Hs$IMxMQ$5lJ$$>uBV$r2sHr$7!"Ii2Y$r%M%C%H%o!<%/A4BN$GJ?6QE*$KJ,;6$5$;$k!#

0LCVF)2a@- %f!<%6$OMWAG%^%7%s$N0LCV$dIi2Y$N>u67KD$$$F0U<1$9$kI,MWOJ$/!"%7%9%F%`A4BN$KBP7F;E;v$rEjF~$9lP<+F0E*$KIi2Y$rJ,;6$5$;$k!#



?^1: %3%s%T%e!<%?!&3%m%K!<$N%M%C%H%o!<%/9=@.

%^%k%A%f!<%64D6- J#?t$N%f!<%6$,%7%9%F%`$K=hM}G=NO$NMW5a (QoS:Quality of Service) $r=P$7!"G-k@1=lK1~8?=hM}G=NO$r%f!<%6$,F@ilkh$&!"7W;;5!;q8;$rE,@Z$KJ,G[$9$k!#

2.2 %M%C%H%o!<%/9=@.

JBNs%"%W%j%1!<%7%g%s$N8zN($h$$<B9TKO!"9bB.$JDL?.$,IT2D7gG"$k!#$=3G2f!9$O!"J*M}%a%b%j6u4V$X$N%a%b%j%"%/%;%9$GD>@\DL?.G-kh$&$K9k$?$a9bB.$JDL?.$rDs6!9k6&M-%a%b%j%Y!<%9$N%M%C%H%o!<%/$rDs0F$7!"$=N?aN@lMQDL?.%\!<%I$r3+H/$9$k!#

%3%s%T%e!<%?!&3%m%K!<$N%O!<%I%&%'%"4D6-$O!"9bB.%M%C%H%o!<%/$G7k9g$7$?7W;;5!72$G9=@.5lk,!"$=$N9=@.C10LH7FO!"<!Nh$&$JbN$,$"$k!#$3N7$/$_$r?^1$K<($9!#

%W%m%;%C%5 %W%m%;%C%5$O!"%"%/%F%#%S%F%#$K3djEvF$k7W;;5!;q8;$N:G>.C10LG"$k!#%?%$%`%9%i%$%9$KhjJ#?t$N%"%/%F%#%S%F%#$KHy>/;~4V$:$D%W%m%;%C%5$,3d$jEvFilk!#

%N!<%I %N!<%I$O!"0l$D$NJ*M}%a%b%j$r6&M-9k%W%m%;%C%5$N=89g$G$"$k!#%M%C%H%o!<%/>e$N0lBf$NMWAG%^%7%s$,%N!<%I$G$"$j!"3NCf$KEk:\$5lk%W%m%;%C%5$OC1?t$G$bJ#?t$G$b9=$o$J$$!#%N!<%I$OB>$N%N!<%IHNDL?.$r9T$&$?$a!"$=$l$>$l@lMQDL?.%\!<%I$rAuHw$7$F$$$k!#9YFN%N!<%I$K%G%#%9%/!"%3%s%=!<%kF~=PNO!"30ItXNHFMQ%M%C%H%o!<%/$rAuHw$9kI,MWO$J$$!#

%F%j%H%j %M%C%H%o!<%/$G7k9g$5l?%N!<%I=89g$NA4BN$r%F%j%H%j$H$$$&!#%f!<%6$O86B'$H7F%F%j%H%jKBP7$F;E;v$rEjF~$7!"%N!<%I$d%W%m%;%C%5C10L$NI;2YJ,;6$OColonia $,<+F0E*$K9T$&!#

%3%s%T%e!<%?!&3%m%K!<K*1k%O!<%I%&%'%"4D6-$O!"C<E*$K8@$($P7W;;5!;q8;$N=89gBN$G$"$k!#2f!9$O!"%3%s%T%e!<%?!&%3%m%K!<$r9=@.$9$k%N!<%I$K$D$$$F!"FCDj$N5!<o$d>r7o$O5,Dj$7$J$$!#L?Na%;%C%H$NO[$J$k%W%m%;%C%5$,:.:_7?%3%s%T%e!<%?!&3%m%K!<$b9=C[$9k3H,G-$k!#

2.3 6&M-%a%b%j$HDL?.%\!<%I

=>Mh$N%M%C%H%o!<%/$OI/O %P%9rDL7$F%W%m%;%C%5$K@\B3$5$l$F$$$k$?$a!"%"%/%;%9N?SKI/O $r0w$&7%9%F%`%3!<%k$rH/9T$7$F%*%Z%l!<%F%#%s%0%7%9%F%`$K@)8f$r0\$9I,MW$,$"$j!"$^$?%M%C%H%o!<%/<+BN$,9bB.Gb!"DcB.$JI/O %P%9$rDL2a7J1lPJiJ$$$?$a!"$I$&$7FbDL?.;~$N%*!<%P%X%C%I$,Bg$-$/Jk!#

3lKBP7%3%s%T%e!<%?!&3%m%K!<$O!"9bB.$JDL?.$r9T$&%O!<%I%&%'%"4D6-H7$F!"I/O $d%7%9%F%`%3!<%k$r;Ho:$K%a%b%j%"%/%;%9$N$_$GDL?.$,$G$-$k%$%s%?%U%'!<%9$r%f!<%6$KDs

6!$7!"6&M-%a%b%j$r<B8=9k!#3N$?$a!"@lMQDL?.%\!<%I$r%W%m%;%C%5%P%9$KIU2C$7!"J*M}%a%b%j6u4V$KBP9k%"%/%;%9$rD>@\%M%C%H%o!<%/$K@\B3$9$k!#

%f!<%6$,%a%b%j$K%"%/%;%9$9$k:]KO!"%f!<%6$O2>A[%"%I%l%9$rMQ$$$F%"%/%;%9$9$k0LCV$r;XDj$9$k!#2>A[%"%I%l%9$O MMU(Memory Management Unit: %a%b%jJ]8n%f%K%C%H) KhCFJ*M}%"%I%l%9$KJQ49$5$l!"$=$NJ*M}%"%I%l%9$GJ*M}%a%b%j6u4V$K%"%/%;%9$9$k!#J*M}%"%I%l%9$,%N!<%IFb%a%b%j$KBP1~$9$k>l9g$O!"3NCJ3,$G%N!<%IFb%a%b%j$KD>@\%"%/%;%9$9$k!#BP1~7J$$>l9g$O!"DL?.%\!<%I$,%W%m%;%C%5%P%9$rN.$l$kJ*M}%"%I%l%9$r8+$FDL?.$NI,MW@-$r8!=P$7!"%"%/%;%9$9$kY-<BBN$r;}$D%N!<%IKBP7$F<B:]$NDL?.=hM}$r9T$&!#

MMU $,J*M}%"%I%l%9$KJQ49$9$kCJ3,$G!"2>A[%a%b%j6u4V$4HN5-21J]8n@)8f$O9T$olF$*$j!"%*%Z%l!<%F%#%s%0%7%9%F%`$N2p:_$Khk%*!<%P%X%C%IJ7$KDL?.$N0BA4@-$,J]>Z$5lk!#3N$?$a!"DL?.5!9=$r%f!<%6$K2rJ|G-!"9bB.$JDL?.$,<B8=G-$k!#

2.4 %*%Z%l!<%F%#%s%0%7%9%F%`Colonia $N35MW

9bB.$JDL?.$rDs6!9k!"6&M-%a%b%j%Y!<%9$N%M%C%H%o!<%/$H$$$&%O!<%I%&%'%"$r:GBg8B$K3hMQ9kKO!"%*%Z%l!<%F%#%s%0%7%9%F%`$K$h$k;Y1g$,I,MW$G$"$k!#0J2<!"%*%Z%l!<%F%#%s%0%7%9%F%`Colonia $,;}$D<g$J@_7W>e$NFCD'$r<($9!#

DL?. Colonia K*1kDL?.$N%W%j%_%F%#%V$H7F$O!"6&M-%a%b%j$H%7%0%J%kNFsD$rDs6!$9$k!#DL>o$N%G!<%?DL?.KO6&M-%a%b%j$rMQ$$$k!#6&M-%a%b%j$rMQ$$$k3H$G9bB.$+$D0BA4$JDL?.$,<B8=$G$-!"0[5!<o4V$G$bE}0l$5l?%$%s%?%U%'!<%9$GDL?.$,9T$($k!#$^$?!"%7%0%J%k$OHsF14|%$%Y%s%H$r8zN(h/EAC#9k$?$a$KMQ$$$ilk!#3lirAH$_9g$o$;$FMxMQ9k3H$G%a%C%;!<%8DL?.$r<B8=9k3HbG$-$k!#

%_%C%7%g%s!&f%K%C%H%b%G%k Colonia GO!"0lDN%W%m%0%i%`$KA jEv$9$k<B9TC10L$H7F!V%_%C%7%g%s!W$rMQ0U$7!"0lDN%_%C%7%g%s$r?k9T$9k?aN:YJ,2=7?JBNs<B9T$NC10L$H7F!V%f%K%C%H!W$rDs6!$9$k!#%f%K%C%H$O$=$l$>$lFHN)7?2>A[%a%b%j6u4V$r;}$D$,!"I,MW$J%3!<%I$d%G!<%?$O%_%C%7%g%sA4BN$G6&M-$7!"A4BN$G6(D4$7$?F0:n$rHk3H$,$G$-$k!#b7!"2>A[%a%b%j6u4V$,%"%/%F%#%S%F%#$4HKFHN)$;$:K9YF6&M-7F$$$k$H!"%"%/%F%#%S%F%#$,JL%N!<%I$KJ,$+lF$$$k>l9g!"%a%b%j%"%/%;%9$4$H$KDL?.$r9ToMPJiJ$$!#7+$7!"%_%C%7%g%s!&f%K%C%H%b%G%kGOI,MW$JItJ,$@$16&M-$7$FDL?.$r9T$&$,!"%f%K%C%HFbItGN=hM}$ODL?.$r9To:$K9bB.$K<B9TG-$k!#

%^%$%/%m%+!<%M%kJ}<0 2f!9$O!"%*%Z%l!<%F%#%s%0%7%9%F%`Colonia $r!V^%$%/%m%+!<%M%kJ}<0!W$G9=@.$9$k!#$3$NJ}<0$G$O!"%7%9%F%`$N5!G=$ND12C!&HD%$,!"%7%9%F%`%5!<%P$rJQ99$9$9$k$@$1$G9T$($k!#$^$?!"%G%#%9%/$dHEMQ%M%C%H%o!<%/$J$I$NM-L5$K1~$8$F%7%9%F%`%5!<%P$rDI2C9k3H$G%7%9%F%`9=@.$rJQ99$9$9k3H,G-$k!#

%F%j%H%j!&9%1%8%e!<%j%s%0 %F%j%H%jA4BN$rBP>]$H7?%9%1%8%e!<%j%s%0$r<B8=$9$k!#%f!<%6$,%F%j%H%jKBP7$FEjF~$7$?;E;v$r!"$=$N;~E@GN3F%N!<%I$NF0E*$JIi2Y>u67$d%N!<%I4V5wN%$+$iH=CG$7$FF0E*$KIi2YJ,;6$9$k!#$^$?!"FCDj$N%N!<%I$K%f%K%C%H$,=8Cf$7$F$$$kh&$J>l9g$O!"B>$N%N!<%I$K%f%K%C%H$r0\Aw$9$k!#$3NH$-!"%f!<%6$,%_%C%7%g%s4H$KMW5a$9$kQoS rG$-k@$1K~B-G-kh$&$JIi2YJ,;6$r9T$&!#Nc$($P!"%j%"%k%?%$%`@-$,MW5a5l$k%^%k%A%a%G%#%"BP1~$N%"%W%j%1!<%7%g%s$r<B9T$9kH$-

$O!"%"%W%j%1!<%7%g%s$K$*$1$k;~4V$NN.1K=hM}$,DI$$IU$/$h$&$J@-G=$r%7%9%F%`$OD s6!9k!#

0J2<!"Colonia $,Ds6!$9$kJBNs%"%W%j%1!<%7%g%s$N<B9T$r;X8~$7$?<B9T%b%G%k$G$"$k%_%C%7%g%s!&%f%K%C%H%b%G%k!"$*$h$S%_%C%7%g%s!&%f%K%C%H$N4VGN%a%b%j$N6&M-J}K!$K$D$$$F=RYk!#

2.4.1 %_%C%7%g%s!&%f%K%C%H%b%G%k

0lDN;E;v$NIi2Y$rJ#?t$N%W%m%;%C%5$KJ,;6$7$FJBNs<B9T5;kK$O!"0l$D$N;E;v$rJBNs<B9T2DG=$JC10L$K:YJ,2=9kI,MW$,$"$k!#8=9T$N%*%Z%l!<%F%#%s%0%7%9%F%`$K$*$$$FDs6!$5$l$kJBNs<B9T%b%G%k$K$O!"<g$K<!$NFs<oN`$,$"$k!#

- 0lDN%W%m%;%9$r0l$D$N;E;v$K3djEvF!"$=$NCf$GJ#?t$N%9%l%C%I$r@8@.$7!"JBNs<B9T5;$kJ}K!!#%W%m%;%9$4HK8GM-$N%"%I%l%96u4V$r;}D,!"$=$lO9YF$N%9%l%C%I$K$*$$$F6&DLG"$j!"%9%l%C%I$4HN8GM-6u4V$O;}$?$J$$!#3N$?$a!"UL$N%a%b%j$KJ,;6$7$?:]K9YF$N%a%b%j%"%/%;%9$K$D$$$FDL?.$r9T$oMPJi$J$$!#
- %W%m%;%9%0%k!<%W$r0l$D$N;E;v$K3djEvF!"J#?t$N%W%m%;%9$rJBNs<B9T5;$kJ}K!!#JBNs<B9TC10L$4HK8GM-6u4V$r;}$D$,!"$=li$N4V$N%G!<%?8r49$O%W%m%;%94VDL?.$HJj!"$^$?%"%I%l%96u4V$,A4$/0[Jk$?$a%a%b%jKBP9$k=hM}$,HQ;(KJ$j%*!<%P%X%C%I$,Bg$-$$!#

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%f%K%C%H %f%K%C%H$O!"%_%C%7%g%s$r:YJ,2=7?!"%G%#%9%Q%C%A$NC10L$G$"$k!#%f%K%C%H$OJL!9$N%W%m%;%C%5$KJ,$+$l!"JBNs$KF0:n9k!#%_%C%7%g%s@8@.;~$K!Vk!<%H%f%K%C%H!W$H8FPl$k%f%K%C%H$,0l$D@8@.$5$l!"I,MW$K1~8FDI2C@8@.5l$k!#8GM-$N%a%b%j6u4V$r;}$D$,!"0lIt$r%_%C%7%g%sA4BN$G6&M-$9$k!#

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%_%C%7%g%sFb6&M-NN0h$O!"$9YF$N%f%K%C%H$K$*$$$FF1$82>A[%"%I%l%9$KG[CV5l$k!#$hCF!"IN%f%K%C%HGbF1$8%]%$%s%?$GF1$8FbMF$r;X$9$3$H$,$G$-$k!#7+$7!"0[$J$k%_%C%7%g%s$N4V$G%G!<%?$r6&M-9k$H!"F1$8%"%I%l%9$K6&M-%a%b%jNN0h$,3NJ]G-$kJ]>Z$O$J$$$?$a!"0lHL$K6&M-%a%b%jNN0h$O0[$J$k2>A[%"%I%l%9$K3djEvFil$k!#%_%C%7%g%s!"%f%K%C%H$,J#?t$"$k>l9g$N2>A[%a%b%j6u4V$N4X78$r?^2$K<($9!#

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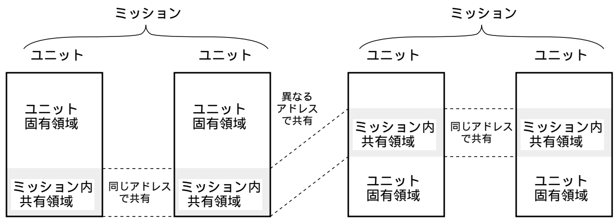

?^2: %_%C%7%g%s!"%f%K%C%H$H2>A[%a%b%j6u4V

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%f%K%C%H$N@8@. %k!<%H%f%K%C%H$,%f%K%C%H@8@.$N%7%9%F%`%3!<%k$rH/9T9k3H$G!"$=$NB>$N%f%K%C%H$,@8@.$9$k!#@8@.$5l?%f%K%C%H$,$5iKJL$N%f%K%C%H$r@8@.7Fbh$$!#3NH-!"%_%C%7%g%s@8@.;~$K;XDj$5l?%a%b%jNN0h$r%_%C%7%g%sFb6&M-NN0h$H7F9YFN%f%K%C%H$G6&M-$9$k!#%f%K%C%H$,F0:n9k%N!<%I$O!"%9%1%8%e!<%i$,Ii2Y>u67$dQoS $K1~$8$F7hDj$9$k!#0lHL$K!"F10l%_%C%7%g%sFb$N%f%K%C%H$O8_$$$K6[L)$KO"Mm$G$-$kh&$K!"%M%C%H%o!<%/>e$N5wN%$,6a$$%N!<%I$KG[CV$5lk!#

%f%K%C%H$N0\Aw FCDj$N%N!<%I$KIi2Y$,=8Cf9k$H!"%9%1%8%e!<%i$OF0E*Ii2YJ,;6$r9T$&$?$a!"%f%K%C%HN&$A$$$:l+$rB>$N%N!<%I$K0\Aw$9$k;X<($r=P$9!#0\Aw$KH<CF!"%f%K%C%H8GM-NN0h$NFbMF$rE>Aw9kI,MW$,$"k,!"0\Aw;~K9YFE>Aw9kNGOJ$/!"6&M-$K4X9k@_Dj$@$1$7$F$*$/3H$G!"0\Aw8e$N9bB.$J<B9T:F3+$,<B8=G-$k!#0\Aw@h$G%f%K%C%H8GM-NN0hKBP7$F%"%/%;%9$,$"$C$?$H$-$K!"0\Aw85$+$iFbMF$rE>Aw$9lP$h$$!#

2.4.2 %a%b%j6&M-N?aN<jB3$-

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F10l%_%C%7%g%sFb%f%K%C%H4V$N%a%b%j6&M- F10l%_%C%7%g%sFbN9YF$N%f%K%C%H$O!"%_%C%7%g%sFb%G!<%?NN0h$r4^$`0lDj$N%a%b%jNN0h$rI,$:6&M-$9$k!#$3lr%_%C%7%g%sFb6&M-NN0h$H$$$&!#3N%_%C%7%g%sFb6&M-NN0h$N3+;O%"%I%l%9$d%5%$%:$O!"%_%C%7%g%sFb%G!<%?H7$F%_%C%7%g%s@8@.;~$KDj5A5l$F$$$k!#%f%K%C%H@8@.;~KO3liN%_%C%7%g%sFb%G!<%?$,;2>H$5$l!"%_%C%7%g%sFb6&M-NN0h$,<+F0E*$K3NJ]$5lk!#5i$K%f%K%C%H@8@.8e$K%7%9%F%`%3!<%k$rH/9T$7$FF0E*$K%_%C%7%g%sFb6&M-NN0h$rDI2C$9k3HbG-$k!#$3lb%_%C%7%g%sFb$N%f%K%C%H$9YF$K6&M-$5lk%a%b%jNN0hG"$k!#

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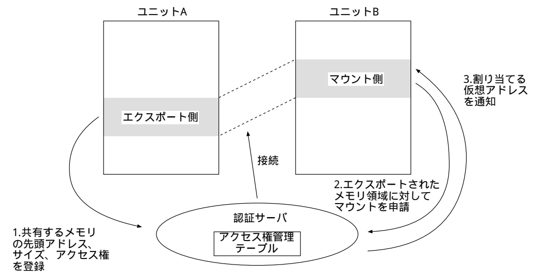

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7?$$>19gJI$O!"$3$N%G!<%?$X$N%]%$%s%?rEO;Ph$$$3HKJk!#

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%_%C%7%g%s$,0[$JlP%f!<%6$,0[$J$k2DG=@-$b$"$j!"6&M-%a%b%jNN0h$r3d$jEvFk2>A[%"%I%l%9$rE}0l$G$-$k$H$$$&J]>ZOJ$$!#hC$F!"F1$8%*%V%8%'%/%HGb0lHLK=$NB8:_$9$k%"%I%l%9$O%_%C%7%g%s4H$K0[$J$j!"%]%$%s%?Kh$k<u$1EO7OG-$J$$!#

$^$?!"%(%/%9%]!<%H5l$?%a%b%jNN0h$KBP7F!"ITEv$J%f!<%6$,%^%&%s%H7F%*%V%8%'%/%H$rGK2u$9kNrKI0$?$a!"%^%&%s%HA`:n$K4X$7$F%"%/%;%98"@)8f$r9T$o$J$/$F$O$J$i$J$$!#$3$N%"%/%;%98"@)8f$O%7%9%F%`%5!<%P$N0l$DG"$kG'>Z%5!<%P$,9T$&!#Nc$($P!"%f%K%C%HA $,$b$D%a%b%jNN0h$r%f%K%C%HB $H6&M-$9kK$O!"<!$Nh&$J<j=g$rF'$`!#

1. %(%/%9%]!<%HB&$N%f%K%C%HA $,G'>Z%5!<%P$K6&M-9k%a%b%jNN0h$H%"%/%;%98"$rEPO?9k!#
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3. G'>Z%5!<%P$O%"%/%;%98"$rH=Dj7F!"%"%/%;%92DJi%f%K%C%HB $K@\B35v2D$H3djEvF$k%"%I%l%9$rM?$($k!#

3N7/$_$r?^3$K<($9!#3Nh&$K@\B3$,40N;9l$P!"6&M-%a%b%j$KBP9k%"%/%;%9$O%a%b%j%"%/%;%9L?Na$@1Gh/!"G'>Z%5!<%P$b4XM?$7$J$$!#$^$?!"%(%/%9%]!<%HB&$H%^%&%s%HB&$H$$$&4X78$bDL?.;~$K$O0U<1$7$J$$!#

%(%/%9%]!<%H$H%^%&%s%H$Khk%a%b%j$N6&M-$O!"<g$K0[$J$k%_%C%7%g%s$N%f%K%C%HI&7G9Tol$k!#$3lO!"%5!<%P7?%"%W%j%1!<%7%g%s$H%/%i%$%"%s%H7?%"%W%j%1!<%7%g%sHN%G!<%?8r49JI!"=>Mh$N%W%m%;%94VDL?.$KAjEv9k:n6H$r9T$&NKMQ$$$ilk!#7+$7!"$3$NJ}<0$G6&M-9k%f%K%C%H$O0[$J$k%_%C%7%g%s$KB0$5$J1lPJiJ$$$H$$$&5,B'OJ$/!"F1$8%_%C%7%g%sNCfN%f%K%C%HI&7G6&M-9k3H$d!"F1$8%f%K%C%HNCfG6&M-9k3H$b5v$5lk!#hC$F!"JL$N%"%I%l%9$GF1$8%*%V%8%'%/%H$K%"%/%;%9$9k?aK3NJ}<0$rMQ$$$k3H$,$G$-$k!#

3 6&M-%a%b%j4IM}

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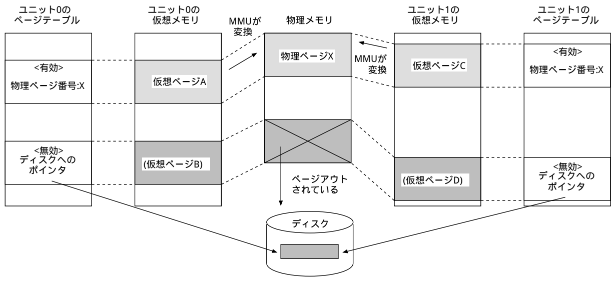

?^4: %Z!<%8%F!<%V%k

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K\>OGO!"%N!<%IFb$*$h$S%N!<%I4V$G$N6&M-%a%b%j4IM}$N<BAuJ}K!KD$$$F=RYk!#

3.1 %N!<%IFbGN%a%b%j6&M-

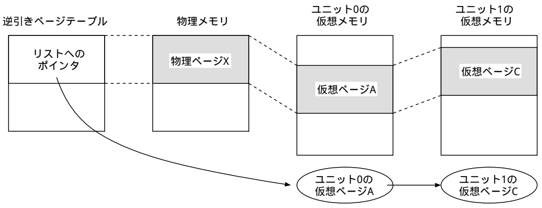
DL>o!"2>A[%a%b%j4IM}KO!"<!NFsD$N%F!<%V%k$,I,MWG"$k!#

%Z!<%8%F!<%V%k 2>A[%Z!<%8$+$iJ*M}%Z!<%8XNBP1~$r5-21

5U0z$-%Z!<%8%F!<%V%k J*M}%Z!<%8$+$i2>A[%Z!<%8XNBP1~$r5-21

%Z!<%8%F!<%V%k$O%f%K%C%H$,8GM-$K;}$D2>A[%a%b%j6u4VKBP7$F!"$INh$&$KJ*M}%a%b%j6u4V$,3d$jEvFilF$$$k$+$r5-21$9$k!#%Z!<%8%F!<%V%k$ODL>oMMU $,2>A[%"%I%l%9$+$iJ*M}%"%I%l%9$NJQ49r9k?aK;2>H9kNG!"$=$N9=B$$O%"!<%-%F%/%A%c$K0MB8$9$k!#?^4$K%Z!<%8%F!<%V%k$H!"$=l,<($92>A[%Z!<%8$HJ*M}%Z!<%8$NBP1~$NNc$r<($9!#3NNcGO!"0[Jk%_%C%7%g%s$KB0$9$k%f%K%C%H$,!"0[Jk2>A[%Z!<%8A,C $KF101$NJ*M}%Z!<%8X $r3d$jEvFF$$$k!#3NH-$O!"%Z!<%8%F!<%V%k$K$OM-8z%U%i%0$HJ*M}%Z!<%8HV9f$,=q$+lF$$$k!#2>A[%Z!<%8B,D $K3d$jEvFilF$$$kFbMF$O%Z!<%8%"%&%H$5lF$*$j!"%Z!<%8%F!<%V%kKOL58z%U%i%0$H%Z!<%8%"%&%H$5l?FbMFXN%]%$%s%?$,=q$+$l$F$$$k!#%Z!<%8%$%s$N:]$K!"$3$N%]%$%s%?KhCFJ*M}%a%b%j$KE>Aw$9kY$-FbMF$N0LCV$rF@$k!#%Z!<%8%"%&%H$O!"$3NNcG$O%G%#%9%/$KBP7F9TCF$$$k$,!"3.2.39`$G=RYkh&$KB>%N!<%I$NJ*M}%a%b%j$K%Z!<%8%"%&%H$9k3HbG-$k!#

5U0z$-%Z!<%8%F!<%V%k$O!"J*M}%Z!<%8$,$I$N2>A[%Z!<%8$K;HMQ5l$F$$$k$+$r5-21$9$k!#0lHL$KJ*M}%Z!<%8$OJ#?t$N2>A[%a%b%j6u4V$K3djEvFilF*$j!"5U0z$-%Z!<%8%F!<%V%k$OJ#?t$N2>A[%Z!<%8$r<($5J1lPJi$J$$$N$G!"<B:]$O%j%9%H9=B$$X$N%]%$%s%?$r5-21$7$F$$$k!#6&M-7F$$$k%Z!<%8$r%Z!<%8%$%s!"$"$k$$$O%Z!<%8%"%&%H7?:]$K!"%Z!<%8U%)%k%H$r5/$3$7$?%f%K%C%H0J30$N%Z!<%8%F!<%V%k$bJQ99$7J1lP!"%Z!<%8$NFbMF$N@09g@-$,$HlJ$/$J$j!"8m$C$?FbMF$K%"%/%;%9$9$k2DG=@-$,$"$k!#%Z!<%8%$%s$KH<$&%Z!<%8%F!<%V%k$NM-8z2=!"$*$h



?^5: 5U0z$-%Z!<%8%F!<%V%k

$S%Z!<%8%"%&%H$KH<$&%Z!<%8%F!<%V%k$NL58z2=$N:]$K$O!"$3$N5U0z$-%Z!<%8%F!<%V%k$r;2>H$7F9YF$N2>A[%Z!<%8$NM-8z2=!"L58z2=$r9T$&!#?^4$KBP1~$9$k5U0z$-%Z!<%8%F!<%V%k$r!"?^5$K<($9!#

3.2 %N!<%I4VGN%a%b%j6&M-

%N!<%I4V$NDL?.$r07$&DL?.%\!<%I$O!"?^1Nh$&$K%W%m%;%C%5%P%9KDJ,CF$*$j!"%"%/%;%9$,9T$olkJ*M}%"%I%l%9$r8+$k3H$,$G$-$k!#J*M}%"%I%l%9$,%N!<%IFb%a%b%j$KBP7FM-8zG"lP%N!<%IFb%a%b%j$K%"%/%;%9$9k,!"L58zG"lPDL?.%\!<%I$,B>%N!<%I$H$NDL?.=hM}$r9T$&!#DL?.%\!<%I$O!"J*M}%Z!<%8$NC10L$G%N!<%I4VGN6&M-$r<B8=$9$k!#J*M}%Z!<%8$K$O!"<!$N3<oN`$,$"$k!#$3li$r?^6$K<($9!#

%[!<%`%Z!<%8 J*M}%a%b%j$,<BAu$5$l$F$$$kJ*M}%"%I%l%9$K0LCV$7!"%a%b%j>e$K%G!<%?$N<BBN$,B8:_$9$k!#%N!<%I4V6&M-$N:]$K$O!"B>$N%N!<%I$,%M%C%H%o!<%/$rDL$7$F%[!<%`%Z!<%8$K%"%/%;%9$9$k!#%[!<%`%Z!<%8$,$"$k%N!<%I$r!V%[!<%`%N!<%I!W$H$$$&!#

%@%_!<%Z!<%8 J*M}%a%b%j$,<BAu$5lF$$$J$$J*M}%"%I%l%9$K0LCV$7!"D>@\$N%"%/%;%9OG$-$J$$!#%@%_!<%Z!<%8KBP9$k%"%/%;%9$,$"$k$H!"DL?.%\!<%I$,8!=P$7!"BP1~$9$k%[!<%`%Z!<%8$K%"%/%;%9$9$Y$/%N!<%I4VDL?.$r9T$&!#%@%_!<%Z!<%8$KBP9k%"%/%;%9$O!"I,MW$J%"%I%l%9N_KBP9$k%j%b!<%H%"%/%;%9$HJj!"%-%c%C%7%s%0$O9T$o$J$$!#3N$?$aJ*M}%a%b%j$,05Gw$5lk3HOJ$$!#

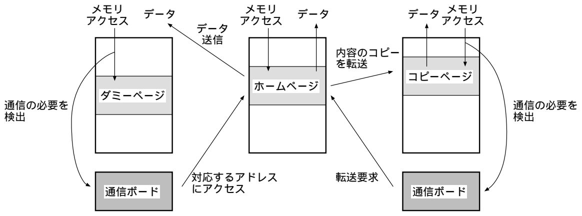
%3%T!<%Z!<%8 J*M}%a%b%j$,<BAu$5lF$$$kJ*M}%"%I%l%9$K0LCV$7!"%[!<%`%Z!<%8$NFbMF$r%-%c%C%7%s%0$9$k!#L58z$G$"$k$H$-$K%"%/%;%9$9$k$H!"%@%_!<%Z!<%8$K%"%/%;%9$7$?$H$-$HF1MM$K%j%b!<%H%"%/%;%9$r9T$$!"%[!<%`%Z!<%8$NFbMF$rE>Aw9k!#3l$,9T$olF$$$k%Z!<%8KD$$$F$O!"J*M}%a%b%j$KBP7FE,@Z$J%3%R!<%l%s%9@)8f$r9T$&!#

DL?.%\!<%I$O!"%W%m%;%C%5%P%9$KN.lkJ*M}%"%I%l%9$,%@%_!<%Z!<%8$"$k$$$O%3%T!<%Z!<%8$r;X$7$F$$$k3H$r8!=P$9kH!"%[!<%`%Z!<%8KBP7$F%j%b!<%H%"%/%;%9$r9T$&!#

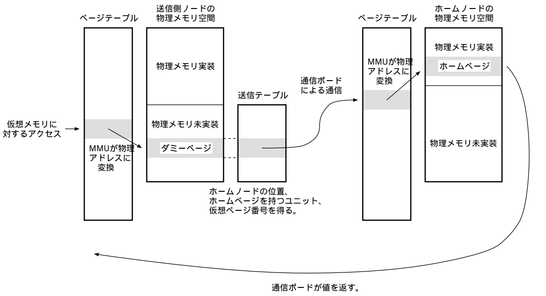
3.2.1 %@%_!<%Z!<%8$H%[!<%`%Z!<%8

%@%_!<%Z!<%8KBP9$k%a%b%j%"%/%;%9$O!"$=$N%N!<%I$NDL?.%\!<%I$+$i%M%C%H%o!<%/$rDL7F%[!<%`%N!<%I$NDL?.%\!<%I$KEA$($i$l!"%[!<%`%Z!<%8XN%"%/%;%9KCV-49$($ilk!#

%[!<%`%N!<%I$K$*$l$k%[!<%`%Z!<%8$N;XDj$K$O!"2>A[%Z!<%8$rMQ$$$k!#3l$O!"J*M}%Z!<%8$G;XDj7F$b!"%[!<%`%N!<%I$K$*$$$F%Z!<%8%"%&%H$,9T$olkH=$N0LCV$,FCDjG-J/Jk$?$aG"$k!#2>A[%Z!<%8$+$iJ*M}%Z!<%8$X$NJQ49$OdO$j%Z!<%8%F!<%V%k$rMQ$$$k$,!";2>H$9Y-%Z!<%8%F!<%V%k$rFCDj$9$k



?^6: %[!<%`%Z!<%8!&%@%_!<%Z!<%8!&%3%T!<%Z!<%8



?^7: %@%_!<%Z!<%8$H%[!<%`%Z!<%8

$?$a!"$=$N%Z!<%8%F!<%V%k$r;}$D%_%C%7%g%s$*$h$S%f%K%C%H$r;XDj9k!#

%M%C%H%o!<%/rDL7$?%a%b%j%"%/%;%9$N<j=g$O<!$NDLjG$"$k!#3Nh&9r!"?^7$K<($9!#

1. %f!<%6$O%f%K%C%H$K3djEvFil$?2>A[%"%I%l%9$KBP7F%"%/%;%9$r9T$&!#
2. %W%m%;%C%5$NMMU $,%Z!<%8%F!<%V%k$r;2>H$7!"2>A[%"%I%l%9$rJ*M}%"%I%l%9$KJQ49$7$F%W%m%;%C%5%P%9$KN.$9!#
3. %W%m%;%C%5%P%9$KN.$l$?J*M}%"%I%l%9$,!"%[!<%`%Z!<%8$r;X$7$F$$$l$P%N!<%IFb%a%b%j$KBP$7$F%"%/%;%9$,9T$o$l$k$,!"%@%_!<%Z!<%8$r;X$7$F$$$l$P!"%W%m%;%C%5%P%9$K$D$J$,$C$F$$$kDL?.%\!<%I$,$=$NJ*M}%"%I%l%9$r=&$$!"%[!<%`%N!<%IXNDL?.$r9T$&!#
4. DL?.%\!<%I$,Aw?.%F!<%V%k$r;2>H$7!"%@%_!<%Z!<%8$KBP1~9k%[!<%`%N!<%I$N0LCV!"@\B3@h$N%f%K%C%H!"$=$N%f%K%C%H$,;}$D2>A[%a%b%j6u4V$K$*$l$k2>A[%Z!<%8HV9f$rF@$F!"%[!<%`%N!<%I$K%"%/%;%9MW5a$r=P$9!#
5. %[!<%`%N!<%I$NDL?.%\!<%I$,MW5a$r<u?.$7!";XDj$5$l$?%f%K%C%H$N%Z!<%8%F!<%V%k$r;2>H$7$F%[!<%`%Z!<%8$NJ*M}%Z!<%8HV9f$rF@$k!#$3NH$-!"%Z!<%8%U%)%k%H$,5/3l$PDL>o$HF1$8$h$&$K%Z!<%8%s%0$d%F!<%V%k$NJQ99$,9T$olk!#
6. %[!<%`%Z!<%8$KBP$9$k%"%/%;%9$,9T$o$l$k!#FI$_9~$_MW5a$G$"$l$P!"%[!<%`%Z!<%8$NFbMF$rFI$_!"DL?.%\!<%I$,%@%_!<%Z!<%8B&$X:F$S%M%C%H%o!<%/rDL7$F%G!<%?$rE>Aw9k!#

%@%_!<%Z!<%8$+$i%[!<%`%Z!<%8$r;2>H$9$k:]$K$O!"%"%/%;%9$7$?%"%I%l%9$K4X$7$F$N$_%[!<%`%N!<%IGN%"%/%;%9$r9T$$!"<+%N!<%I$NJ*M}%a%b%j>e$K%[!<%`%Z!<%8$NFbMF$r%-%c%C%7%s%0

7J$$! #3N$?$a! "<+%N! <$IFb%a%b%j$r@aLs9k3H$,$G$-! " =q$-9~$_@1MQ$N%Z! <8JIKET9g$,NI$$! #7+$7! "U*M}%a%b%j >e$K%-%&%C7%s%0O7$J$$$,! "%W%m%;%C%5B&$N%-%&%C7%e%a%b%j $K%-%&%C7%s%0$r9TCF$$$k$?$a! "% [! <% `%Z! <$8B&$KJQ99$,$"$C $?>l9g$JIK! "%-%&%C7%e$N%3%R! <%1%s%9@)8f$,I,MWKJ$k! #

DL>o! "%N! <IFbN%W%m%;%C%54VGN%3%R! <%1%s%9@)8f$O%O ! <%I%&%'%"$,9T$&! #$7$+$7! "%N! <$I4V$N%3%R! <%1%s%9@)8f$O Colonia $,9T$oMPJi$J$$! #01DN2r7h: vH7$F! "%G%#%1%/ %H%jJ}<0$,9M$ (i1$k! #$3$1$O! "%N! <$I4V$N6&M->uBV$r5-21$9 $k%G%#%1%/%H%j$rJ]; }9k3H$G%3%R! <%1%s%9@)8f$r9T$&$b$N G"$k! #

3.2.2 %3%T! <%Z! <%8$H% [! <% `%Z! <%8

%@%_! <%Z! <%8Kh$k%j%b! <%H%"%/%;%9$O! "I,MW$J%G! <%?$N$_$N %"%/%;%9G"$j! ">/NL$N%G! <%?DL?.G"1P%M%C%H%o! <%/$NIi C4$O7Z$$! #7+$7! "F1$8% [! <% `%Z! <%8$KBP$7$FIQHK$K%"%/%;%9 $,$"$k>l9g$K$O! "%M%C%H%o! <%/$rDL$7$?%j%b! <%H%"%/%;%9$NI } I |$H$J$j! "%*! <%P%X%C%I$,Bg$-$$! #$=$3$G! "%@%_! <%Z! <%8$H$O JL$K%3%T! <%Z! <%8$rMQ0U$9$k! #%3%T! <%Z! <%8$KBP$7$F%"%/%;%9 $9$k: ]$K! "% [! <% `%Z! <%8$NFbMF$r<+%N! <IFbN%a%b%j$K%-%&%C %7%s%0$7F*$/$3HG! "IQHK$J%j%b! <%H%"%/%;%9$r%m! <%+%k%" %/%;%9KCV-49$($k3H$,$G$-$k! #$?$@$7! "% [! <% `%Z! <%8$K@\ B3$9$k$^$G$N<j=g$O3.2.1 9 `$G=RY?%@%_! <%Z! <%8$N>l9g$HF1 MMG"$k! #

%3%T! <%Z! <%8$K% [! <% `%Z! <%8$NFbMF$r%-%&%C7%s%0$9k3$H $G! "%3%T! <%Z! <%8$N%3%R! <%1%s%9@)8f$,I,MW$KJk! #$3$1KO! " %@%_! <%Z! <%8$r07$&:]KI,MWHJk! "%W%m%;%C%5$4$H$N%-%&%C %7%e$N%3%R! <%1%s%9@)8f$K2C$ ($F! "%N! <$IFb%a%b%j$NL58z2=$J Ir<B9T7J$1$1PJiJ$$! #

3.2.3 %Z! <%8%s%0$N3HD%

Colonia GO! "%M%C%H%o! <%/rDL7$?DL?.$N$?$a$K! "% [! <% `%Z! < %8! "%@%_! <%Z! <%8! "%3%T! <%Z! <%8$H$$$&%Z! <%8$N07$$J}$rMQ0U 7F$$$k$,! "$3$1$K1~8F%Z! <%8%s%0$N07$$J}$b0 [$JCF$/$k! # $=$1$>$1$KBP1~$9$k%Z! <%8%s%0$NJ}K!$r<!$K=RYk! #

- % [! <% `%Z! <%8 %Z! <%8%"%&%H$N:]$K$O! "%G%#%9%/$@1GJ/%M%C %H%o! <%/rDL7$FB>%N! <$I$NJ*M}%a%b%j$KBP7F$b9T$& 3H$,$G$-$k! #3NJ}K!Kh$j! "%G%#%9%/$r; }$?$J$$%N! < %IGb%Z! <%8%"%&%H$r9T$&3H$,$G$-$k! #|/O $r2p$7$? %G%#%9%/$X$N=q$-=P7hjb! "9bB.%M%C%H%o! <%/$r2p$7$? B>%N! <$I$NJ*M}%a%b%j$X$N=q$-=P7NJ}$,9bB.$G$"$k! #$^ $?! "BP1~$9$k%@%_! <%Z! <%8$d%3%T! <%Z! <%8$r; }$DJI! "$= $N%Z! <%8$rMxMQ9k%f%K%C%H$,F0:n$7$F$$$k%N! <IXE>Aw 9k3H$G! "E>Aw@h$G$N%f%K%C%H$NF0:n$,9bB.2=$9k3$H $,4 |BT$G$-$k! #B>%N! <IK$"$k%Z! <%8$r%Z! <%8%$%s9k:] KO! "FC$KI,MW$,J1$1$PE>AwO;$:! "%@%_! <%Z! <%8$"$k $$$O%3%T! <%Z! <%8H7$FO7$&! #
- %@%_! <%Z! <%8 %Z! <%8%$%s! "%Z! <%8%"%&%H$H$b! "07$&%Z! <%8>e $K<B:]$NFbMF$OB8:_$7$J$$$N$G! "%a%b%jE>Aw$OI,MW$J$$! # %Z! <%8%"%&%H$N:]$K$O! "% [! <% `%Z! <%8$rFCDj9k3H$,$G $-$kh&$K! "Aw?.%F! <%V%k$NFbMF$KAjEv$9kbNr%Z! <%8 %F! <%V%k$KJ]B8$7F*$/! #
- %3%T! <%Z! <%8 %@%_! <%Z! <%8$HF1$8$/! "% [! <% `%Z! <%8$K<B: ]$N FbMF$,B8:_$9$k$?$a! "%G%#%9%/$X$N%Z! <%8%"%&%H$OI,MW$J $/! "% [! <% `%Z! <%8$rFCDj9k$?$a$N>pJs$N$_J]B8$9$1$P$h $$! #$?$@$7! "% [! <% `%N! <$I$K$*$$$F% [! <% `%Z! <%8$,%G%#%9 %/$K%Z! <%8%"%&%H$5$1$F$$$kH-KO! "%3%T! <%Z! <%8$r

% [! <% `%Z! <%8$KJQ99$7$F<+%N! <$I$N%G%#%9%/$K%Z! <%8%"%& %H9k3H$b9M$(i1$k! #

4 % (%_%e%1! <%?$N9=@.

2f! 9$,%3%s%T%e! <%?! &%3%m%K! <$r3+H/$9$k>e$GI,MWJN$O%=%U %H%&%'%"$G$"$k%*%Z%1! <%F%#%s%0%7%9%F%`Colonia $H! "%O! <%I %&%'%"$G$"$k%DL?.%\! <%IG"$k! #DL?.%\! <%I$N2L$?$9Y-Lr3d $O! "$*$*$^$+$K$O9bB.$J%N! <$I4VDL?.$G$"$k$,! ">\: Y$J%$%s%? %U%'! <%9; EMM$O9b%1%Y%k$N%N! <$I4VDL?.$N; EMM$K9go;J1$1 PJiJ$$! #

hC$F! "Colonia $r%"! <%-%F%/%A%c%H%s0MB8ItJ,$H%"! <%-%F %/%A%c0MB8ItJ,$KJ,$1! "$^$:%"! <%-%F%/%A%c%H%s0MB8ItJ,$+$i3+ H/$7Dc%1%Y%kItJ,$KBP9kMW5ar^Ha$?$N$A! "$=$NMW5a$rK~ $?$9h&$K%"! <%-%F%/%A%c0MB8ItJ,$HDL?.%\! <%I$r3+H/$9kH $$$&J}?K$r: NMQ$9$k! #

Colonia $N%"! <%-%F%/%A%c%H%s0MB8ItJ,$,F0:n$9kK$O! "%O! < %I%&%'%"$H%"! <%-%F%/%A%c0MB8ItJ,$,I,MW$G$"$k$,! "8=CJ3,$G O=NIAi$b4 0@.$7$F$$$J$$$?$a! "$=1KBeokbN$,I,MW HJ$k! #K\8&5fGO! "4 {B8$N%*%Z%1! <%F%#%s%0%7%9%F%`$N>e$G %"! <%-%F%/%A%c0MB8ItJ,$H%O! <%I%&%'%"$N% (%_%e%1! <%?$rMQ0U $7! "$=$N>e$G%"! <%-%F%/%A%c%H%s0MB8ItJ,$rF0:n$5$;$k3H$G3+ H/$r?Jak! #

K\8&5fGO: G=*E*$KSun Microsystems <R$N%o! <%/%9%F! < %7%g%sSPARC station 20 N_$G%o! <%/%9%F! <%7%g%s%/%i%9%? $r9=@.$7! "$=$N>e$G%*%Z%1! <%F%#%s%0%7%9%F%`Colonia $rF0:n 5;$k! #$=N?aN3+H/4D6-H7FO! "SPARC station 20 $N >e$GF0:n9kSolaris $rMQ$$$k! #8=:_! "Solaris >e$GF0:n$9$k% (%_%e%1! <%?$HColonia $N%"! <%-%F%/%A%c%H%s0MB8ItJ,$r9g$o$;$F 3+H/7F$$$k! #

% (%_%e%1! <%?$rMxMQ$9k3HKhC$F! "%_%C%7%g%s! &%f%K%C %H$NF0:n$d@8@.! "6&M-%a%b%j4 IM}JI! "%^%$%/%m%+! <%M%k$N<g MW$J5 !G=$rSolaris >e$G<B8=$G$-$k! #3Nh&K7$F3+H/$7$? %"! <%-%F%/%A%c%H%s0MB8ItJ,$O! "$ [HsI=N^$^4 0@.I$KAH$_ 9~$s$G; HMQ$G$-$k! #

K\>OGO! "% (%_%e%1! <%?$rMQ$$$?Colonia $N3+H/J}?K$H% (%_%e%1! <%?$NF0:n8 6M}$K$D$$$F=RYk! #

4.1 Colonia $N3+H/J}?K

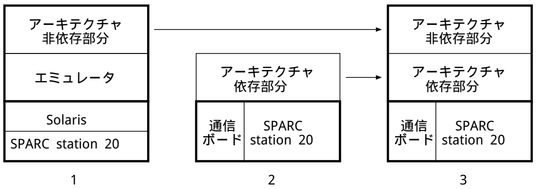
K\8&5fGO! "Colonia $N%"! <%-%F%/%A%c0MB8ItJ,$H%O! <%I%&%' %"$N% (%_%e%1! <%?$rMQ$$$k3H$G! "<!$Nh&$J<j=g$GColonia $r3+H/$9$k! #$3Nh$&$9$r?^8$K< ($9! #

1. % (%_%e%1! <%?$rSolaris >e$GF0:n5;! "$=$N>e$G%"! <%-%F %/%A%c%H%s0MB8ItJ,$r3+H/$9$k! #
2. SPARC station 20 >e$GD>@\F0:n$9$k%"! <%-%F%/%A%c0MB8 ItJ,$r3+H/$9$k! #F1; ~$KDL?.%\! <%I$N3+H/$b?Jak! #
3. % (%_%e%1! <%?ItJ,rO$:$7! "%"! <%-%F%/%A%c%H%s0MB8ItJ,$H %"! <%-%F%/%A%c0MB8ItJ,$r7k9g$5$;$k! #

3. K*$$$FG-k@$1JQ99$;$:$K7k9gG-kh$&$K! "1. $G %"! <%-%F%/%A%c%H%s0MB8ItJ,$H% (%_%e%1! <%?$N6hJL$rL@3N$K$7! " 2. $G%"! <%-%F%/%A%c%H%s0MB8ItJ,KBP9$k%"! <%-%F%/%A%c0MB8It J,$N%$%s%?U%'! <%9$,% (%_%e%1! <%?$HF1$8; EMM$KJkh&$K3+ H/$9kI,MW,$"$k! #

Colonia K*$$$F$O! "%"! <%-%F%/%A%c%H%s0MB8ItJ,$H%"! <%-%F %/%A%c0MB8ItJ,$,2L$?9Y$-Lr3d$O! "$=$1$>$1<!Nh$&$KJk! #

- %"! <%-%F%/%A%c%H%s0MB8ItJ, %9%1%8%e! <%j%s%0! "KB9T2DG=%-%e! < A `: n! "%Z! <%8%s%0$N; X< (! "6&M-%a%b%j4 IM}$K4X$9$k%F! <%V



?^8: Colonia $N3+H/J}?K

%kA`:n!"%_%C%7%g%s!&f%K%C%H$K4X$9$k%G!<%?9=B$$N4IM}!"%(%/%9%]!<%H/%^%&%s%HJ}<0$K$h$k6&M-4X78$N4IM}!"%7%9%F%`%3!<%k$N<uM}$J$I

%"!<%-%F%/%A%cOMB8ItJ, %?%$%^3d$j9~$_$N4IM}!"%N!<%I4VDL?.!"2>A[%a%b%j6u4V$HJ*M}%a%b%j6u4V$N%^%C%T%s%0!"%G%#%9%Q%C%A!"I/O $ND>@\A`:n!"%G%#%9%/$X$N%Z!<%8%"%&%H!"%G%#%9%/$+iN%Z!<%8%$%s!"%f%K%C%H$NO\Aw$J$I

%(%_%e%l!<%?$O%"!<%-%F%/%A%cOMB8ItJ,$,2L$?$9Y-Lr3d$rSolaris $GMQ0U$5lF$$$k%i%$%V%i%jEy$rMQ$$$F?k9T9k!#Ld BjHJkN$O!"%f%K%C%H$N%G%#%9%Q%C%A$H!"2>A[%a%b%j6u4V$HJ*M}%a%b%j6u4V$N%^%C%T%s%0$G$"$k!#

Colonia K*$$$F$O!"%f%K%C%H$,$=$l$>$lFHN)7?2>A[%a%b%j6u4V$r;}$A!"3djEvFil$?;~4V$@$1%W%m%;%C%5$rMxMQ9k3H$,$G$-$k!#MxMQ4|4V$,=*N;$9kH!"%W%m%;%C%5OJLN%f%K%C%H$K<B9T$r0\$9$,!"$3NH$-2>A[%a%b%j6u4V$r@ZjBX(!"J]B8$7$F$$$?%3%s%F%/%9%H$rI|5"$7J1lPJi$J$$!#3l$rD>@\9T$&KO%"%;%s%V%jKh$kFC8"L?Na$,I,MWKJk?$a!"4{B8$N%*%Z%l!<%F%#%s%0%7%9%F%`>e$G%f!<%6$,<B9T9k3HOG$-$J$$!#

3l$rSolaris >e$G<B8=9k$?$a!"%f%K%C%H4H$K%W%m%;%9$rBP1~E1$k!#%W%m%;%9$OFHN)7?2>A[%a%b%j6u4V$H%3%s%F%/%9%H$r;}D?$a!"$3lr@ZjBX(lP%f%K%C%H$N@Z$jBX$($r%(%_%e%l!<%HG-$k!#F1;~$KF0:n9k%f%K%C%H$O0l$DG"k,!"3l$O!"0l$D$N%W%m%;%9$N$_$rF0:n5;!"B>$N%W%m%;%9$ODd;_5;k3HG<B8=9k!#

0lDN%W%m%;%9NCfGJB9TF0:n5;$k%^%k%A%9%l%C%I$bSolaris >e$GMxMQ2DG=$G$"$k$,!"$3lO$"$/$^$G$b%W%m%;%9$O0lDG$"$j!"%9%l%C%I$=$l$>$l$,FHN)$7$?2>A[%a%b%j6u4V$O;}$?$J$$$?$a!"%9%l%C%I$G%f%K%C%H$r%(%_%e%l!<%H$9k3HOG-$J$$!#

>e$K=R$Y$?!"%f%K%C%H$4HKJL%W%m%;%9$r@8@.$9kH$$$&J}K!$G%3%s%F%/%9%H%9%$%C%A$r%(%_%e%l!<%H$9kH$-!"%^%$%/%m%+!<%M%k$r2TF/$5$;$kJ}<0KO!"<!$N2<dN`$,9M$($ilk!#

- 3F%W%m%;%9$4$H$KF1$8%3!<%I$N%^%$%/%m%+!<%M%k$r4X?t$H7FIU2C7F2TF/5;$kJ}<0!#%^%$%/%m%+!<%M%k$,07$&JQ?t$O6&M-%a%b%j$rMQ$$$F9YFN%W%m%;%9K*$$$F0lCW5;$k!#%f%K%C%H$+$i%^%$%/%m%+!<%M%kXNMW5a$,!"C1$J$k4X?t8F$S=P7G9Tolk?$a!"%7%9%F%`%3!<%k$N<B8=$,MF0W$G$"$k!#

- %^%$%/%m%+!<%M%k$NF/$-$r9k%5!<%P%W%m%;%9rJLK5/$3$9J}<0!#%^%$%/%m%+!<%M%k$N<BBN$O0l$DG"k?$a!"JQ?t$N6&M-$r9M$(kI,MWO$J$$!#%f%K%C%H$+$i%^%$%/%m%+!<%M%k$X$NMW5a$K$O!"%W%m%;%94VDL?.$r9ToJ$/$FOJiJ$$!#

%W%m%;%9$4$H$K%^%$%/%m%+!<%M%k$,IUB0$9$kJ}<0$G$O!"DL>o%f%K%C%H$H%^%$%/%m%+!<%M%k$N4V$N%W%m%;%94VDL?.$OITMWG"$k!#$7$+$7!"6&DL9kJQ?tr9YF$N%W%m%;%9$K$*$$$FF10l%"%I%l%9$K3d$jEv$F!"F1$8%]%$%s%?$GF1$8JQ?t$r;X9h$&$K7J1lPJiJ$$$J$I!"0l$D$NF/$-r9$k%^%$%/%m%+!<%M%k$N<BBN$,J#?t$"$k3HKhCFHQ;($J=hM}$,I,MWG"$k!#$^$?!"$3N3HKhC$F!"%(%_%e%l!<%?$r@Z$jN%$7$F%"!<%-%F%/%A%cOMB8ItJ,$r7k9g5;kH$-$KJQ99$9$kI,MW$,@8$8$k!#$hCF!"%^%$%/%m%+!<%M%k$N<BBN$r0l$DK7!"0l4S7?@)8f$r9T$&$?$a$K!"%^%$%/%m%+!<%M%k$r%5!<%P%W%m%;%9$H7FF0:n5;$kJ}<0$r:N$k!#

4.2 %(%_%e%l!<%?$N<BAu

%(%_%e%l!<%?GO!"%^%$%/%m%+!<%M%k$r%W%m%0%i%`server!"$=$N>e$GF0:n$9$k%f%K%C%H$r%W%m%0%i%`user H7$FF0:n$5$;$k!#Colonia $N%"!<%-%F%/%A%cOMB8ItJ,$Oserver MQ%(%_%e%l!<%?$*$h$Suser MQ%(%_%e%l!<%?$KJ,3d7F$=$l$>$l$N%W%m%0%i%`$KIU2C9k!#3N7/$_$r!"?^9$K<($9!#

%f%K%C%H4V$G6&M-$7J1lPJi$J$$J*M}%a%b%j$O!"%G%#%9%/>e$N%U%!%$%kpmemory H7$F<BBN$r;}$D!#Solaris $GDs6!$5lk4X?tmmap[1] $rMQ$$$F!"2>A[%"%I%l%9$K%U%!%$%kpmemory $NFCDj$NItJ,$r%^%C%W$9k3HG!"MMU $,<+F0E*$K2>A[%"%I%l%9$rJ*M}%"%I%l%9$KJQ49$9$7$F%"%/%;%9$9$kF0:n$r%(%_%e%l!<%H9k!#

2>A[%"%I%l%9$H%U%!%$%kHN%^%C%T%s%0$O!"2>A[6u4V$4$H!"$9Jo$A%W%m%;%9$4HKFHN)7F$$$kNG!"server $O%W%m%;%9user K*1k%^%C%T%s%0$rD>@\JQ99$9k3HOG-$J$$!#3N$?$a!"JQ99$9$kI,MW$,@8$8$?>l9g$O!"server $Ouser $K3d$j9~$_$r$+$1$F%^%C%T%s%0$rJQ99$5$;J1lPJi$J$$!#

<!$K!"user $Hserver $=$l$>$l$N%(%_%e%l!<%?$NF/$-$r<($9!#

user MQ%(%_%e%l!<%?

- %Z!<%8%U%)%k%H$r8!=P$72>A[%a%b%j4IM}%k!<%A%s$N;X<($r<u1kY/server $K%a%C%;!<%8$rAw$k!#

- server $+$i$N%a%C%;!<%8$K=>CF!"%U%!%$%k$H$N%^%C%T%s%0$r9979$7!";v<B>e$N2>A[%Z!<%8$NM-8z2=$"$k$$$OL58z2=$r9T$&!#

- %N!<%I4VDL?.NI,MWr8!CN$7!"server $K<B:]$N%N!<%I4VDL?.$r0MMj$9$k!#

server MQ%(%_%e%l!<%?

- user $+$i$N%a%C%;!<%8$r<u?.$7!"BP1~$9$k%7%9%F%`%3!<%k=hM}%k!<%A%s$KJ,4t$9$k!#

- %?%$%^3d$j9~$_$KhC$F%9%1%8%e!<%i$r8F$S=P$7!"$=$N;X<($r<u$1$F%G%#%9%Q%C%A$r9T$&!#

- 2>A[%a%b%j4IM}%k!<%A%s$N;X<($Khj!"%Z!<%8%$%s!"%Z!<%8%"%&%H$r9T$&!#

- %N!<%I4VDL?.$K4X$9$k%F!<%V%k$r;2>H$7!"%a%C%;!<%88r49$KhC$F%N!<%I4V$NDL?.$r9T$&!#

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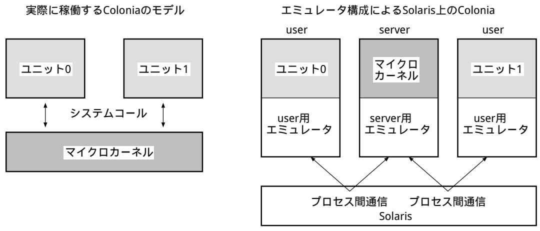
[1] 4X?tmmap $O!"%W%m%;%9$N;}$D2>A[%a%b%j6u4V$N%a%b%jNN0h$K%U%!%$%k$NFCDj$NNN0h$r%^%C%W$9$k!#%^%C%T%s%0$,3NN)9l$P!"%^%C%W$7$?NN0h$KBP9k%a%b%j%"%/%;%9$O!"Solaris KhCF%U%!%$%kXN%"%/%;%9$KCV49$5lk!#%f!<%6$O%U%!%$%k$NB8:_$r0U<1$7$J$$!#



?^ 9: <B:]$N Colonia $H%(%_%e%l!<%?$rMQ$$$? Solaris >e$N Colonia

4.3 3F5 !G=$N%(%_%e%l!<%H

4.3.1 %9%1%8%e!<%j%s%0$H%G%#%9%Q%C%A

<B:]$NColonia K*$$$F! "0 lDN%W%m%;%C%5$O! "F1; ~$K$O0 l$D$N%f%K%C%H$N=hM}7+G-$J$$! #D^$j! "0 l$D$N%f%K%C%H$,F0:n7F$$$k4V$O! "B>$N%f%K%C%H$O;_$^CF$$$k! #$=$N%f%K%C%H$KM?$(il$?;~4V$@$1%W%m%;%C%5$,=hM}$r9T$&$H! "%W%m%;%C%5$OJL$N%f%K%C%H$K%G%#%9%Q%C%A5l$k! #

Solaris >eGbF1MM$K! "0 l$D$N%f%K%C%H$@$1<B9T>uBV$H$7! "B>$N%f%K%C%H$ODd;_>uBV$H9k3HG3lr%(%_%e%l!<%H9k! #D^$j! "server $N%(%_%e%l!<%?$,user $K%7%0%J%k$rH/9T9k3H$G! "%f%K%C%H$N<B9T$"$k$$$ODd;_$N>uBV$r4IM}9k! #<j=gH7FO! "<!Nh$&$JCJ3,$r7P$k! #3N7/$_$r! "?^ 10 $K<($9! #

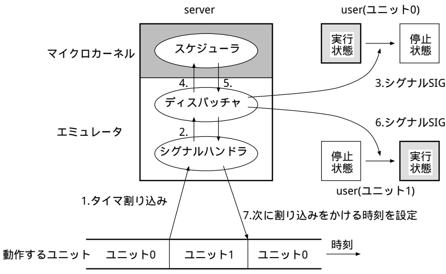
1. %?%$%^3d$j9~$_$,$+$+kH! "%7%0%J%kSIGALRM $,H/9T$5$l! "%7%0%J%k%O%s%I%i$K=hM}$,0\$k! #
2. %7%0%J%k%O%s%I%i$O%(%_%e%l!<%?$NCf$N%G%#%9%Q%C%A%c$K@)8f$r0\$9! #
3. %G%#%9%Q%C%A%c$O8=:_F0:n$7$F$$$kuser KBP7$F%7%0%J%kSIGSTOP $rH/9T$7$FDd;_$5$;$k! #
4. %G%#%9%Q%C%A%c$O%"!<%-%F%/%A%cHs0MB8ItJ,$N%9%1%8%e!<%i$r8F$S=P$9! #
5. %9%1%8%e!<%i$O<B9T2DG=%-%e!<$r;2>H7F%W%m%;%C%5$r%G%#%9%Q%C%A$9kY$-%f%K%C%H$r7hD j$7! "%G%#%9%Q%C%A%c$KDILCN9k! #
6. %G%#%9%Q%C%A%c$O%9%1%8%e!<%i$N;X<($K=>$$! "L\E*$Nuser $K%7%0%J%kSIGCONT $rH/9T$7$FF0:n$r:F3+5;$k! #
7. %7%0%J%k%O%s%I%i$O! "<!$K%G%#%9%Q%C%A$r9T$&;~9o$K3d$j9~$_$,$+$+kh$&$K! "%?%$%^$r@_Dj9k! #

4.3.2 %7%9%F%`%3!<%k

Colonia K*$$$F! "%7%9%F%`$KBP$9$kMW5a;v9`$O%7%9%F%`%3!<%k$H7F%^%$%/%m%+!<%M%k$KAw$k! #%^%$%/%m%+!<%M%kO=lKBP9k=hM}$r9T$$! "7k2LrJVjCMH7$F%f%K%C%H$KJV$9! #

Solaris >eGO! "user MQ%(%_%e%l!<%?$,%f%K%C%H$KBP7F%7%9%F%`%3!<%k$N%$%s%?%U%'!<%9$rDs6!$9$k! #$3lO4X?t8F$S=P$7H7$F0 7$o$l! "%f%K%C%HFb%G!<%?$N<hF@JI! "user MQ%(%_%e%l!<%?$G0 7$($kItJ,$Ouser MQ%(%_%e%l!<%?$,=hM}$r9T$&! #

%f%K%C%H$N@8@.$J$I! "server $K=hM}$r0MMj9kI,MW$,=P$F$-$?>l9gKO! "server $H%W%m%;%94VDL?.$r9T$&! #user MQ%(%_%e%l!<%?$Oserver KBP7$F%a%C%;!<%8$rAw$j! "server $,$=lKBP1~7?=hM}$r9T$&! #user MQ%(%_%e%l!<%?$Oserver $+$iJV;v$r<u$1<h$j! "JV;v$K1~8?=hM}$r9T$CF+$i%f%K%C%H$K=hM}rLa9! #



?^ 10: %(%_%e%l!<%?>eGN%G%#%9%Q%C%A

4.3.3 2>A[%a%b%j4IM}

Colonia K*1k2>A[%a%b%j4IM}$O! "%f!<%6$,;XDj7?2>A[%"%I%l%9$r! "MMU $,%Z!<%8%F!<%V%k$r;2>H9k3HKhCFJ*M}%"%I%l%9$KJQ49$7! "J*M}%a%b%j$K%"%/%;%9$9kH$$$&<j=g$G9T$olk! #user $N%(%_%e%l!<%?$O! "J*M}%a%b%j$r%U%!%$%k$GBeMQ$7! "%U%!%$%k$r2>A[%"%I%l%9$K%^%C%W$9$k4X?tmmap $rMxMQ$7$F<+F0%"%/%;%9$r%(%_%e%l!<%H9k! #

2>A[%Z!<%8$,L$;HMQ$N>uBV$G%"%/%;%9$9$k$H! "$3$3$KO^$@%U%!%$%k$,3d$jEvFilF$$$J$$$N$G5-21J]8n0cH?$HJj! "%W%m%;%9user KO%7%0%J%kSIGSEGV $,H/9T$5lk! #3N%7%0%J%k$r=hM}$9$k%7%0%J%k%O%s%I%i$r@_Dj7F$*$-! "%7%0%J%k%O%s%I%i$+$i2>A[%a%b%j4IM}%k!<%A%s$r8F$S=P$;$P! "%Z!<%8%U%)%k%H$KH<$&2>A[%a%b%j4IM}$,%(%_%e%l!<%H$G$-$k! #

%Z!<%8%F!<%V%kEyO9YFserver $,4IM}$9k?$a! "%7%0%J%k%O%s%I%i$G$Oserver $N2>A[%a%b%j4IM}%k!<%A%s$r8F$S=P$9Y/%a%C%;!<%8DL?.$r9T$&! #server O3lK1~8F%Z!<%8%$%s! "%Z!<%8%"%&%H! "%F!<%V%k$NJQ99Ey$r9T$&! #$3$N<j=g$r?^ 11 $K<($9! #

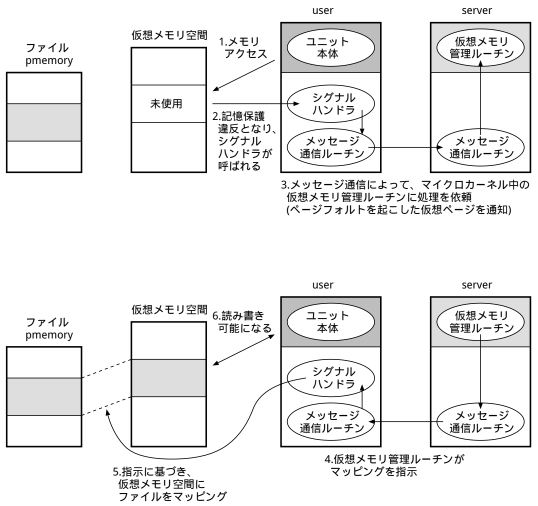
$?$@$7! "user $N2>A[%a%b%j6u4V$H%U%!%$%k$N%^%C%T%s%0$O server $,JQ99$9k3HOG-$J$$$?$a! "server $O%Z!<%8%F!<%V%k$rJQ99$7$?user $=$l$>$lKBP7$F%^%C%T%s%0JQ99$N;X<($r%a%C%;!<%8$GAw?.9k! #

%Z!<%8%F!<%V%k$NL58z2=$O! "%^%C%T%s%0$r2r=|$9$k4X?tmunmap KhCF%(%_%e%l!<%H9k! #3l$r<B9T$7$F%^%C%T%s%0$r2r=|7?2>A[%a%b%jNN0h$K%"%/%;%9$9kH! "L$;HMQ;~$HF1$8$/5-21J]8n0cH?HJ$j! "%Z!<%8%U%)%k%H$N%(%_%e%l!<%H$,$G$-$k! #

4.3.4 %N!<%I4VDL?.

J*M}%Z!<%8$O%(%_%e%l!<%?$G$O%U%!%$%k$,BeMQ$H7F0 7olk,! "$=$lKBP7$F%[!<%`%Z!<%8! "%@%_!<%Z!<%8! "%3%T!<%Z!<%8$,$=l>lINh$&$K0 7olk+$r<!$K<($9! #

- %[!<%`%Z!<%8 %U%!%$%k$,B8:_9kNN0h$KG[CV$5lk! #%^%C%T%s%0$,@.N)$9lP! "2>A[%"%I%l%9$K%"%/%;%9$9k3HGD>@\F I$_=q$-$,2DG=$G$"$k! #
- %@%_!<%Z!<%8 %U%!%$%k$,B8:_7J$$NN0h$KG[CV$5lk! #%^%C%T%s%0$,@.N)$7Fb! "%"%/%;%9;~KO%"%/%;%9$9$kY-%G%#%9%/>e$NNN0h$,B8:_7J$$$?$a%7%0%J%kSIGBUS $,H/9T$5lk! #user $N%(%_%e%l!<%?$O3l$r8!=P$7! "%N!<%I4VDL?.$N%k!<%A%s$KJ,4t9k! #
- %3%T!<%Z!<%8 %3%T!<$,M-8z$G$"$kH-$O%[!<%`%Z!<%8$HF1$8$/%U%!%$%k$,B8:_9kNN0h$K! "L58z$G$"$kH-$O%@%_!<%Z!<%8$HF1$8$/%U%!%$%k$,B8:_7J$$NN0h$KG[CV$5lk! #L58zG"kH$-$K%"%/%;%9$9$k$H! "%N!<%I4VDL?.$KhC



?^11: 2>A[%a%b%j4IM}

$F%[!<%`%Z!<%8$NFbMF$r<hF@$7$F%3%T!<%Z!<%8$rM-8z2=9k!#

%@%_!<%Z!<%8!"%3%T!<%Z!<%8K*1k%N!<%I4VDL?.$NI,MW@-$O!"user $N%(%_%e%l!<%?$,%7%0%J%k SIGBUS $r<u?.$9k3HKhC$F8!CN$9k,!"%N!<%I4VDL?.KI,MWJAw?.%F!<%V%k$O server $,07$&$?$a!"user $+$i server $K%a%C%;!<%8DL?.$r9TCF!"server $,<B:]$N%N!<%I4VDL?.$r9T$&!#$3$1$O!"%N!<%IFb$N%a%C%;!<%8DL?.$HF1$8$/!"%=%1%C%H$Khk%a%C%;!<%8DL?.$rMxMQ$7$F%(%_%e%l!<%H$9$k!#

Colonia K*$$$F%N!<%I4V$G%Z!<%8$r6&M-9k>l9gKO!"%3%R!<%l%s%9@)8f$,I,MW$G$"$k!#%[!<%`%Z!<%8$NFbMF$d!"$=$l$r5-21$7$F$$$k%-%&%C%7%e$,JQ99$5l?>l9g$O!"%Z!<%8$NL58z2=$,I,MW$G$"$k!#

%(%_%e%l!<%?GO!"6&M-%Z!<%8$NJQ99$N;~N_%3%R!<%l%s%9@)8f$r9T$&$?$a!"%U%!%$%k$r2>A[%a%b%jNN0h$K%^%C%T%s%0$9kH$-$K!"$=$N2>A[%a%b%jNN0h$NB0@-$rFI$_9~$_@lMQK7F*$/!#$3Nh$&$K9l$P!"6&M-%Z!<%8$NFI$_9~$_;~KO2?$b5/$3i:KFI_9~$_$,G-k,!"=q$-9~$_;~KO5-21J]8n0cH?$,5/$3$k!#$3lKBP9k%7%0%J%k%O%s%I%i$G!"%3%R!<%l%s%9@)8f$N%k!<%A%s$KJ,4t$7!"I,MW$J=hM}$r9T$&!#

5 $*$ojK

K\9FGO!"JBNs%"%W%j%1!<%7%g%s$N<B9T$r;X8~7?%7%9%F%`$G$"$k%3%s%T%e!<%?!&%3%m%K!<$rDs0F$7!"$=$N4D6-$GF0:n$9$k%*%Z%l!<%F%#%s%0%7%9%F%`Colonia $N@_7W$K$D$$$F=RY?!#

%o!<%/%9%F!<%7%g%sJINJ,LnK$*$1$k@-G=$N8~>e$*$h$SDc2A3J2=$OCx$7$$$bN,$"$j!"Hs>o$KB??t$N7W;;5!$,MxMQ2DG=$J>uBVKJCF$$$k!#Am9g9l$PG|Bg$J=hM}G=NOHJk3li$N7W;;5!;q8;$r:GBg8B$K3hMQ$7!"9bB.$+$D=@Fp$K;E;v$r=hM}G-kh$&$J4D6-$rDs6!$9kH$$$&0UL#$G!"K\8&5f$OHs>o$K0U5A?<$$$bNH9M$($k!#

JBNs%"%W%j%1!<%7%g%s$N<B9T$H$$$&L\I8$rC#@.$9k?aKIT2D7gG"$kDL?.$N9bB.2=N?aK!"2f!9$O6&M-%a%b%j%Y!<%9$N%M%C%H%o!<%/H=lr<BAu9k$?$a$NDL?.%\!<%I$rDs0F7F$$$k!#2f!9$O!"%*%Z%l!<%F%#%s%0%7%9%F%`Colonia K*$$$F!"6&M-%a%b%j$r<B8=$9k?aN%G!<%?9=B$$d=hM}<j=g$r@_7W$7!"$=$l$r4{B8$N3+H/4D6-$N>e$GF0:n5;kY$/!"Dc%l%Y%kItJ,$r%(%_%e%l!<%?KhCFBe9T5;$F3+H/$r?JaF$$$k!#

Colonia $N6&M-%a%b%j4IM}$K$*$$$F:#8e$N2]Bj$H7F;D5l$F$$$kbN$NO1$D$O!"%M%C%H%o!<%/$rDL7?DL?.K*1k!"6&M-%a%b%jNN0h$N%3%R!<%l%s%9@)8f$G$"$k!#%W%m%;%C%5$=$l$>$l$,;}$D%-%c%C%7%e%a%b%j!"$*$h$S%N!<%IFb$NJ*M}%a%b%j$K%-%c%C%7%s%0$5lF$$$k6&M-%a%b%jNN0h$NFbMF$NO14S@-$rJ]$DKO!"%O!<%I%&%'%"$H%=%U%H%&%'%"$NN>J}$+$i$N;Y1g$,I,MWG"$k!#$3N?$aDL?.%\!<%I$N@_7W$b:#8e$NBg$-$J2]BjG"$k!#

$^$?!"8zN($h$$Ii2YJ,;6$r9T$&$?$a$N%9%1%8%e!<%i$N@_7W$b!"%3%s%T%e!<%?!&%3%m%K!<$N=hM}B.EY$*hS=@Fp@-KBg-$/4X$oCF$/$k!#%9%1%8%e!<%i$O!"%N!<%I$N%W%m%;%C%5?t$d=hM}@-G=!"Ii2Y$N>u67!"%f!<%6$,MW5a$9$k QoS!"%N!<%I4V$N5wN%JI$+$i!"Am9gE*$K%f%K%C%H$NG[CV$rH=CG$9$k!#$^$?!"%N!<%I4V$NIi2YKJPj$,@8$8kH!"%f%K%C%H$N0\Aw$r;X<(9k!#3N%9%1%8%e!<%i$N@_7W$K4X7F$O!"MM!9$J3QEY$+$i9M;!!"@-G=I>2A$r9T$oJ/FOJi$J$$!#

K\8&5f$O!"%*%Z%l!<%F%#%s%0%7%9%F%`$N@_7W!"3+H/$K4X$7$F$O$^$@;O$^$C$?$P$+$j$G$"$k!#$3$l$^$G=R$Y$?;v9`0J30Kb!"MM!9$J2]Bj$,;D5l$F$$$k!#8=:_$"$^$j;HMQ$5lF$$$J$$7W;;5!$rM-8z3hMQ$7!":GBg8B$N=hM}G=NO$rH/4x5;k?aK!"3liN2]BjKBP7$F:G1l$NEz$r=P$5J1lPJi$J$$!#

<UK-

K\8&5f$N5!2q$rM?$($F2<5C$?!"K\8&5f<<$NIYEDbC<#65<x$K?<?S$J$k<U0U$rI=7^$9!#

K\8&5fK*$$$F?t!9N4;XF3$rD:$$$?!"CfEg9@=u65<x!"?9bC0lO:=u65<x!"8^Eg@5M5=u<j7W;;5!9=@.J,Ln$N=t;a$K?<$/46<U$NOU$rI=$7$^$9!#

:G8e$K!"MM!9$J3QEY$+$i$4=uNOD:$$$?!"K\8&5f$N6&F18&5f<T$G$"$k@DLZ=(5.;arO8a!"7W;;5!9)3X9V:B7W;;5!9=@.J,Ln$N=t;a$K46<UCW7^$9!#

;29MJ88%

[1] SPARC International, INC. (Aj1[9n5W, EDCfD98wLu/B?ED9%9n4FLu): SPARC %"!<%-%F%/%A%c!&%^%K%e%"%k %P!<%8%g%s8, %H%C%Q%s (1992).

[2] A. S. %?%M%s%P%&%`(0zCO?.9T, 0zCOH~7C;RLu): OS $N4pAC$H1~MQ— @_7W$+$i<BAu, DOS $+$iJ,;6OS Amoeba $^$G, %H%C%Q%s (1995).

[3] J. %Y!<%3%s (F#ED><J?, <DEDM[0l, :#@t5.;KLu): JB9TJ,;6%7%9%F%`— %*%Z%l!<%F%#%s%0%7%9%F%`, %G!<%?%Y!<%9, J,;6%^%k%A%a%G%#%"%7%9%F%`XNE}9gE*%"%W%m!<%A, %H%C%Q%s (1996).

[4] A0@n<i, =j??M}M:, @6?e8,B@O/: J,;6%*%Z%l!<%F%#%s%0%7%9%F%`— UNIX $N<!$K$/$kbN, 6&N)=PHG (1991).

[5] Gk869(, DEED9'IW, Bg5WJ]1Q;L: 8=Be%*%Z%l!<%F%#%s%0%7%9%F%`$N4pAC, %*!<%`<R (1988).

[6] @DLZ=(5., ;3E:Gn;K, 8^Eg@5M5, ?9bC0lO:, CfEg9@, IYEDbC<#: 6&M-%a%b%j%Y!<%9$N%7!<%`%l%9$JJBNs7W;;5!4D6-$r<B8=$9$k%*%Z%l!<%F%#%s%0%7%9%F%`$N9=A[, >p=h8&Js, 97-OS-34 (1997).