

在5G IMS和数据UPF节点中执行硬件维护

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简介

本文档介绍在IP多媒体子系统(IMS)和数据用户平面功能(UPF)节点中执行维护活动的过程。

先决条件

要求

Cisco 建议您了解以下主题：

- 5G-UPF
- 冗余配置管理器(RCM)
- 虚拟数据包核心(VPC) — 单实例(SI)
- 基于内核的虚拟机(KVM)虚拟机监控程序

使用的组件

本文档中的信息基于以下软件和硬件版本：

- 用户微服务基础设施(SMI)2020.02.2.35
- Star OS 21.22

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

背景信息

什么是UPF?

用户平面接口(UPF)是5G核心网络(5GC)的网络功能(NF)之一。它在5G架构中负责数据包路由和转发、数据包检测、处理QoS和外部PDU会话以互连数据网络(DN)。

什么是VPC-SI?

VPC-SI将运行StarOS的物理Cisco ASR 5500机箱的操作整合到能够在商用现成(COTS)服务器上运行的单个虚拟机(VM)中。每个VPC-SI VM都作为独立的StarOS实例运行，并融入了物理机箱的管理和会话处理功能。

什么是KVM虚拟机监控程序?

基于内核的虚拟机(KVM)是一种内置于Linux的开源虚拟化技术。具体来说，KVM可将Linux转换为虚拟机监控程序，允许主机运行多个隔离的虚拟环境，称为访客或虚拟机(VM)。

什么是ICSR?

机箱间会话恢复(ICSR)是需要单独许可证的思科许可功能，此功能为连续呼叫过程提供最高可用性，而不会中断用户服务。ICSR允许运营商配置网关以实现冗余。在网关发生故障时，ICSR允许围绕故障透明地路由会话，从而保持用户体验。ICSR还会保留会话信息和状态。

问题

硬件维护（如硬件故障或软件/固件升级等）需要服务器停机。要在UPF裸机服务器中执行维护，并且要了解如何正常切换服务，以避免UPF应用中出现不必要的停机时间，必须遵循此步骤。

维护程序

UPF节点是托管在KVM虚拟机监控程序中的StarOS虚拟机。一个KVM虚拟机监控程序托管2个虚拟机实例。IMS UPF有1:1冗余，每个活动实例都有一个备用实例。它使用ICSR和会话冗余协议(SRP)来处理冗余。SRP用于在ICSR机箱之间交换hello消息。它还交换主用/备用机箱（检查点数据）之间的会话状态信息。完整的用户会话信息以呼叫恢复记录(CRR)的形式，通过SRP链路从主用机箱发送到备用机箱。

登录KVM节点并使用KVM virsh命令列出VM实例。

```
cloud-user@podname-upf-ims-kvmnode-1:~$ sudo virsh list --all
Id Name State
-----
1 imsupf01 running
4 imsupf10 running
```

```
cloud-user@podname-upf-ims-kvmnode-1:~$
```

登录到UPF实例并检查机箱状态。

```
[local]imsupf10# show srp info
Friday July 22 15:50:24 UTC 2022
Service Redundancy Protocol:
-----
```

```
Context: srp
Local Address: 10.x.x.74
Chassis State: Standby
Chassis Mode: Backup
Chassis Priority: 2
Local Tiebreaker: 02-7E-35-53-F9-F1
Route-Modifier: 9
```

```
Peer Remote Address: 10.x.x.73
Peer State: Active
Peer Mode: Primary
Peer Priority: 1
Peer Tiebreaker: 02-11-59-73-87-35
Peer Route-Modifier: 8
Last Hello Message received: Fri Jul 22 15:50:21 2022 (3 seconds ago)
Peer Configuration Validation: Complete
Last Peer Configuration Error: None
Last Peer Configuration Event: Fri Jul 22 15:50:22 2022 (2 seconds ago)
Last Validate Switchover Status: None
Connection State: Connected
```

```
[local]imsupf01# show srp info
Friday July 22 15:31:20 UTC 2022
Service Redundancy Protocol:
```

```
-----
Context: srp
Local Address: 10.x.x.66
Chassis State: Active
Chassis Mode: Backup
Chassis Priority: 2
Local Tiebreaker: 02-7C-1A-62-FA-3C
Route-Modifier: 5
```

```
Peer Remote Address: 10.x.x.65
Peer State: Standby
Peer Mode: Primary
Peer Priority: 1
Peer Tiebreaker: 02-87-33-98-6D-08
Peer Route-Modifier: 6
Last Hello Message received: Fri Jul 22 15:31:20 2022 (1 seconds ago)
Peer Configuration Validation: Complete
Last Peer Configuration Error: None
Last Peer Configuration Event: Fri Jul 22 15:20:13 2022 (668 seconds ago)
Last Validate Switchover Status: None
Connection State: Connected
```

检查IMS UPF的主用 — 备用ICSR对上的线路数量是否相同。

```
Active node
# show configuration | grep -n -E "^end$"
Thursday July 21 07:30:17 UTC 2022
14960:end
```

```
Standby Node
# show configuration | grep -n -E "^end$"
Thursday July 21 07:31:02 UTC 2022
14959:end
```

在活动UPF上的SRP切换之前，检查SRP会话管理器是否处于活动 — 连接状态，并确保不存在挂起 — 活动状态。

```
[local]imsupf01# show srp checkpoint statistics active
```

Thursday July 21 07:38:04 UTC 2022

Number of Sessmgrs: 20

Sessmgrs in Active-Connected state: 20

Sessmgrs in Standby-Connected state: 0

Sessmgrs in Pending-Active state: 0

在备用UPF上的SRP切换之前，检查SRP sessmgr是否处于主用 — 连接状态，并确保不存在挂起 — 主用状态

```
[local]imsupf02# show srp checkpoint statistics active
```

Thursday July 21 07:40:03 UTC 2022

Number of Sessmgrs: 20

Sessmgrs in Active-Connected state: 0

Sessmgrs in Standby-Connected state: 20

Sessmgrs in Pending-Active state: 0

如果其中任何一项处于“活动”状态，您需要在切换之前先执行这些任务：

```
[upf-ims]# save config /flash/xxx_production.cfg. --> Replace xxx with the desired name of the config
```

```
[upf-ims]# srp validate-configuration
```

```
[upf-ims]# srp validate-switchover
```

在VM关闭之前，您需要确保活动实例切换到备用状态，以使用户能够正常切换。如果实例已处于备用状态，则无需执行任何操作。如果实例处于活动状态，请检查突出显示的值，并确保备用实例已准备好接管。

检查活动UPF实例中的当前用户。

```
[local]imsupf01# show subscribers data-rate summary
```

Friday July 22 16:01:37 UTC 2022

Total Subscribers : **175024**

Active : 175024 Dormant : 0

将活动实例切换为备用。

```
[context-name]<hostname># srp initiate-switchover
```

检查备用的状态，此时该状态会变为活动状态，并且订户会话也会移至新的活动实例。现在，由于两个VM实例都处于备用状态，因此可以关闭它们进行服务器维护。使用给定virsh命令关闭VM实例并验证状态。

```
cloud-user@podname-upf-ims-kvmnode-1:~$ sudo virsh shutdown imsupf01
```

Domain imsupf01 is being shutdown

```
cloud-user@podname-upf-ims-kvmnode-1:~$ sudo virsh shutdown imsupf10
```

Domain imsupf10 is being shutdown

```
cloud-user@podname-upf-ims-kvmnode-1:~$ sudo virsh list --all
```

```
Id Name State
```

```
-----  
1 imsupf01 shut off
```

```
4 imsupf10 shut off
```

```
cloud-user@podname-upf-ims-kvmnode-1:~$
```

在维护后恢复服务器后，VM将自动启动。UPF实例保持备用状态。使用给定命令进行验证。

```

[local]imsupf10# show srp info
Friday July 22 15:50:24 UTC 2022
Service Redundancy Protocol:
-----
Context: srp
Local Address: 10.x.x.74
Chassis State: Standby
Chassis Mode: Backup
Chassis Priority: 2
Local Tiebreaker: 02-7E-35-53-F9-F1
Route-Modifier: 9

Peer Remote Address: 10.x.x.73
Peer State: Active
Peer Mode: Primary
Peer Priority: 1
Peer Tiebreaker: 02-11-59-73-87-35
Peer Route-Modifier: 8
Last Hello Message received: Fri Jul 22 15:50:21 2022 (3 seconds ago)
Peer Configuration Validation: Complete
Last Peer Configuration Error: None
Last Peer Configuration Event: Fri Jul 22 15:50:22 2022 (2 seconds ago)
Last Validate Switchover Status: None
Connection State: Connected

```

数据UPF使用具有N:M冗余的RCM，其中N是活动UPF的数量且小于10,M是冗余组中的备用UP的数量。RCM是思科专有节点或网络功能(NF)，为基于StarOS的用户平面功能(UPF)提供冗余。它存储或镜像来自所有活动UPF的所有所需会话信息。在切换触发器上，选择一个备用UPF以从公共位置接收适当的会话数据。RCM在虚拟机上的K3集群上运行。运营中心配置RCM节点。

数据UPF节点也与IMS UPF节点相同。唯一的区别是RCM冗余管理。

检查KVM节点中的VM状态。

```

cloud-user@podname-upf-data-kvmnode-1:~$ sudo virsh list --all
Id Name State
-----
1 dataupf20 running
2 dataupf11 running

```

```

cloud-user@podname-upf-data-kvmnode-1:~$

```

登录到UPF实例后，检查RCM冗余状态。如果实例已处于备用状态，则无需执行任何操作。如果它处于活动状态，则需要将其平稳地切换到备用状态。

```

[local]dataupf11# show rcm info
Friday July 22 17:23:17 UTC 2022
Redundancy Configuration Module:
-----
Context: rcm
Bind Address: 10.x.x.75
Chassis State: Active
Session State: SockActive
Route-Modifier: 26
RCM Controller Address: 10.x.x.163
RCM Controller Port: 9200
RCM Controller Connection State: Connected
Ready To Connect: Yes
Management IP Address: 10.x.x.149
Host ID: DATAUPF15
SSH IP Address: 10.x.x.158 (Activated)

```

SSH IP Installation: Enabled

[local]dataupf11#

检查所有sessmgr是否都处于Active-connected状态。

```
local]dataupf11# show rcm checkpoint statistics active
```

```
Thursday July 21 07:47:03 UTC 2022
```

```
Number of Sessmgrs: 22
```

```
Sessmgrs in Active-Connected state: 22
```

```
Sessmgrs in Standby-Connected state: 0
```

```
Sessmgrs in Pending-Active state: 0
```

从客户信息调查问卷(CIQ)中确定相应的RCM节点，并检查RCM状态。请注意，RCM切换只能从主节点完成。确保登录到主RCM。

```
[podname-aio-1/dcrm01] rcm# rcm show-status
```

```
message :
```

```
{"status": "MASTER"}
```

```
[podname-aio-1/dcrm01] rcm#
```

使用给定命令查找活动和备用UPF节点（输出被截断）：

```
[podname-aio-1/dcrm01] rcm# rcm show-statistics controller
```

```
message :
```

```
{
  "keepalive_version": "e7386cb81b1fefc3396dfd1d528e0d2a27de80d5de6a78364caf938a0d2149b6",
  "keepalive_timeout": "20s",
  "num_groups": 2,
  "groups": [
    {
      "groupid": 1,
      "endpoints_configured": 7,
      "standby_configured": 1,
      "pause_switchover": false,
      "active": 6,
      "standby": 1,
      "endpoints": [
        {
          "endpoint": "10.x.x.75",
          "bfd_status": "STATE_UP",
          "upf_registered": true,
          "upf_connected": true,
          "upf_state_received": "UpfMsgState_Active",
          "bfd_state": "BFDDState_UP",
          "upf_state": "UPFState_Active",
          "route_modifier": 26,
          "pool_received": true,
          "echo_received": 142354,
          "management_ip": "10.x.x.149",
          "host_id": "DATAUPF15",
          "ssh_ip": "10.x.x.158",
          "force_nso_registration": false
        }
      ]
    }
  ]
}
```

```
....
```

```
....
```

```
{
  "endpoint": "10.x.x.77",
  "bfd_status": "STATE_UP",
}
```

```
"upf_registered": true,
"upf_connected": true,
"upf_state_received": "UpfMsgState_Standby",
"bfd_state": "BFDState_UP",
"upf_state": "UPFState_Standby",
"route_modifier": 50,
"pool_received": false,
"echo_received": 3673,
"management_ip": "10.x.x.153",
"host_id": "",
"ssh_ip": "10.x.x.186",
"force_nso_registration": false
},
```

使用管理IP登录到备用UPF实例并验证状态

```
[local]dataupf13# show rcm info
Friday July 22 17:36:04 UTC 2022
Redundancy Configuration Module:
```

```
-----
Context: rcm
Bind Address: 10.x.x.77
Chassis State: Standby
Session State: SockStandby
Route-Modifier: 50
RCM Controller Address: 10.x.x.163
RCM Controller Port: 9200
RCM Controller Connection State: Connected
Ready To Connect: Yes
Management IP Address: 10.x.x.153
Host ID:
SSH IP Address: 10.x.x.186 (Activated)
SSH IP Installation: Enabled
```

```
[local]dataupf13#
```

验证后，将活动状态正常切换到备用状态。确保使用管理IP。

```
[podname-aio-1/dcrm01] rcm# rcm switchover-mgmt-ip source 10.x.x.149 destination 10.x.x.153
```

注意：如果新的活动UP会话管理器停滞在**SERVER**状态，则可在切换后使用。联系思科技术支持。如果有问题的实例，**sessmgr**必须终止，因此它使用正确的客户端套接字状态重新连接到RCM并恢复。所有**sessmgr**都需要处于**CLIENT**状态。使用给定命令（在隐藏模式下）进行验证。

```
# show session subsystem facility sessmgr all debug-info | grep -E "SessMgr|Mode:"
```

```
Thursday July 21 07:56:26 UTC 2022
SessMgr: Instance 5000
Mode: UNKNOWN State: SRP_SESS_STATE_SOCK_ACTIVE
SessMgr Activity Detected: FALSE
SessMgr: Instance 22
Mode: CLIENT State: SRP_SESS_STATE_SOCK_ACTIVE
SessMgr Activity Detected: TRUE
SessMgr: Instance 21
Mode: CLIENT State: SRP_SESS_STATE_SOCK_ACTIVE
SessMgr Activity Detected: TRUE
```

检查所有**sessmgr**是否处于活动和就绪状态。

```
# show rcm checkpoint statistics verbose
Thursday July 21 07:52:29 UTC 2022
```

```
smgr state peer recovery pre-alloc chk-point rcvd chk-point sent
inst conn records calls full micro full micro
```

```
-----
1 Actv Ready 0 0 1731 68120 3107912 409200665
2 Actv Ready 0 0 1794 70019 3060062 408647685
3 Actv Ready 0 0 1753 68793 3078531 406227415
4 Actv Ready 0 0 1744 67585 3080952 410218643
5 Actv Ready 0 0 1749 69155 3096067 404944553
6 Actv Ready 0 0 1741 68805 3067392 407133464
7 Actv Ready 0 0 1744 67963 3084023 406772101
8 Actv Ready 0 0 1748 68702 3009558 408073589
9 Actv Ready 0 0 1736 68169 3030624 405679108
10 Actv Ready 0 0 1707 67386 3071592 406000628
11 Actv Ready 0 0 1738 68086 3052899 407991476
12 Actv Ready 0 0 1720 68500 3102045 408803079
13 Actv Ready 0 0 1772 69683 3082235 406426650
14 Actv Ready 0 0 1727 66900 2873736 392352402
15 Actv Ready 0 0 1739 68465 3032395 409603844
16 Actv Ready 0 0 1756 69221 3063447 411445527
17 Actv Ready 0 0 1755 68708 3051573 406333047
18 Actv Ready 0 0 1698 66328 3066983 407320405
19 Actv Ready 0 0 1736 68030 3037073 408215965
20 Actv Ready 0 0 1733 67873 3069116 405634816
21 Actv Ready 0 0 1763 69259 3074942 409802455
22 Actv Ready 0 0 1748 68228 3051222 406470380
```

验证订户是否移至新的备用设备：

```
[local]dataupf11# show subscribers data-rate summary
Friday July 22 17:40:18 UTC 2022
```

```
Total Subscribers : 62259
Active : 62259 Dormant : 0
```

当两个实例都处于备用状态时，可以使用virsh命令从KVM关闭VM。

```
cloud-user@podname-upf-data-kvmnode-1:~$ sudo virsh shutdown dataupf20
Domain dataupf20 is being shutdown
cloud-user@podname-upf-data-kvmnode-1:~$ sudo virsh shutdown dataupf11
Domain dataupf11 is being shutdown
cloud-user@podname-upf-data-kvmnode-1:~$ sudo virsh list --all
Id Name State
-----
1 dataupf20 shut off
4 dataupf11 shut off
```

```
cloud-user@podname-upf-data-kvmnode-1:~$
```

当VM关闭时，可以关闭KVM节点（物理服务器）进行维护。完成后，启动服务器。VM自动启动。UPF实例自行变为备用。使用给定命令检验是否相同。

```
cloud-user@podname-upf-data-kvmnode-1:~$ sudo virsh list --all
Id Name State
-----
1 dataupf20 running
2 dataupf11 running
```

```
cloud-user@podname-upf-data-kvmnode-1:~$
```

```
[local]dataupf11# show rcm info
Friday July 22 17:36:04 UTC 2022
```


Redundancy Configuration Module:

```
-----  
Context: rcm  
Bind Address: 10.x.x.77  
Chassis State: Standby  
Session State: SockStandby  
Route-Modifier: 50  
RCM Controller Address: 10.x.x.163  
RCM Controller Port: 9200  
RCM Controller Connection State: Connected  
Ready To Connect: Yes  
Management IP Address: 10.x.x.153  
Host ID:  
SSH IP Address: 10.x.x.186 (Activated)  
SSH IP Installation: Enabled
```

[local]dataupf13#

在RCM节点中，rcm控制器仍然可以将备用UPF显示为“待定备用”。转换到备用状态最多可能需要15到20分钟。使用给定命令检验相同情况（输出被截断）：

```
[podname-aio-1/dcrm01] rcm# rcm show-statistics controller  
message :  
{  
  "keepalive_version": "e7386cb81b1fefc3396dfd1d528e0d2a27de80d5de6a78364caf938a0d2149b6",  
  "keepalive_timeout": "20s",  
  "num_groups": 2,  
  "groups": [  
    {  
      "groupid": 1,  
      "endpoints_configured": 7,  
      "standby_configured": 1,  
      "pause_switchover": false,  
      "active": 6,  
      "standby": 1,  
      "endpoints": [  
        ....  
        ....  
      ],  
      "endpoint": "10.x.x.77",  
      "bfd_status": "STATE_UP",  
      "upf_registered": true,  
      "upf_connected": true,  
      "upf_state_received": "UpfMsgState_Standby",  
      "bfd_state": "BFDState_UP",  
      "upf_state": "UPFState_Standby",  
      "route_modifier": 50,  
      "pool_received": false,  
      "echo_received": 3673,  
      "management_ip": "10.x.x.153",  
      "host_id": "",  
      "ssh_ip": "10.x.x.186",  
      "force_nso_registration": false  
    },  
  ],  
}
```