Rockchip Rockit Runtime Library Developer Guide

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Preface

Overview

This document presents a brief introduction to Rockit Runtime Library.

Product Version

Chipset	Kernel Version
RV1106/RV1103	Linux5.10

Intended Audience

This document (this guide) is mainly intended for:

Technical support engineers

Software development engineers

1. Revision History

Date	Version	Author	Change Description
2022-04-06	V1.4.11	SCH	Initial version
2022-05-26	V1.4.15	SCH	Add VENC and some description
2022-11-30	V1.4.30	SCH	Add log level setting

2. Contents

3. Framework

In order to facilitate Rockit porting, a new runtime libraries has been developed in the kernel. Currently, they are released in the form of kernel objects (ko). The diagram is as follows:
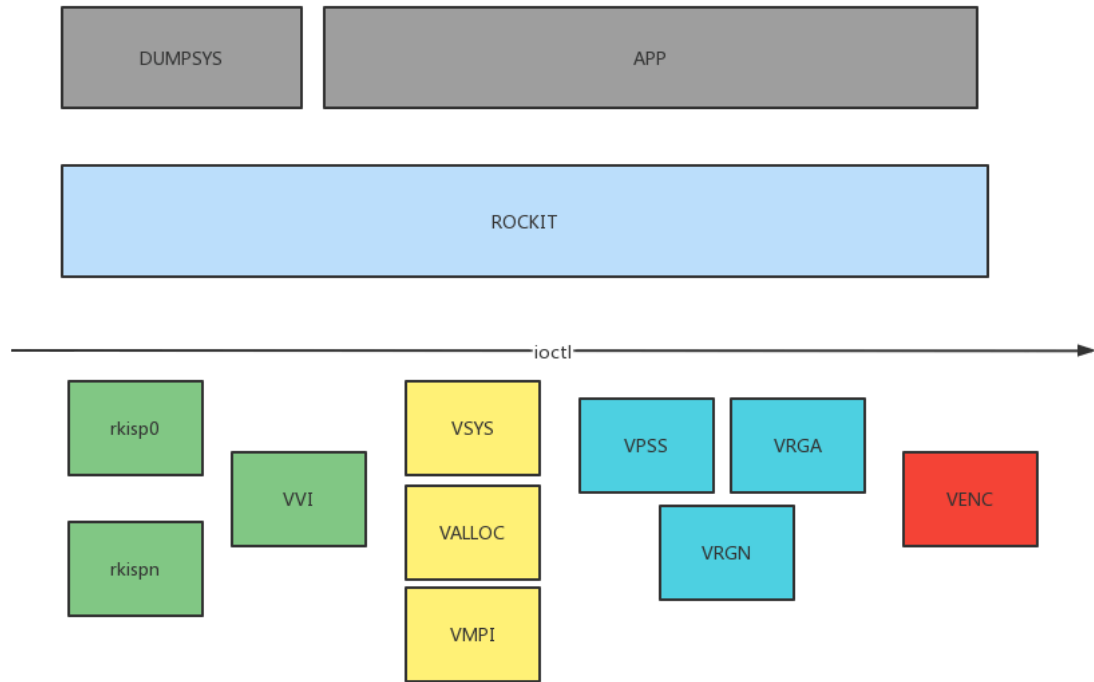

```
.
├── isp.ko     ---- isp module, corresponding to the /dev/mpi/rkisp-vir0 node
├── valloc.ko  --- buffer manager, corresponding to the /dev/mpi/valloc node
├── venc.ko    --- Encoder module, corresponding to the /dev/mpi/venc
├── vmpi.ko    --- media framework, corresponding to the /dev/mpi/vmpi
├── vpss.ko    --- vpss module, corresponding to the /dev/mpi/vpss
├── vrga.ko    --- rga module, corresponding to the /dev/mpi/vrga
├── vrgn.ko    --- rgn module, corresponding to the /dev/mpi/vrgn
├── vsys.ko    --- system module, corresponding to the /dev/mpi/vsys
└── vvi.ko     --- vi module, corresponding to the /dev/mpi/vvi
```

Before using rockit interface, the above ko need to be loaded, and the loading way is as follows (**note: all the above ko have been merged into one ko**):

```
insmod rockit.ko
```

Use the following command to check whether the loading is successful

```
# lsmod
Module                  Size   Used by     Tainted: G
rknpu                  21535  1
rockit                 90530 14
mpp_vcodec            350020  4 rockit
rga3                   76968  3 rockit
sc4336                  8940  2
phy_rockchip_csi2_dphy    7657  0
phy_rockchip_csi2_dphy_hw    7644  0
video_rkisp           138585  3 rockit,[permanent]
video_rkcif           107889  4
rk_dvbm                 5813  2 mpp_vcodec,video_rkisp
```

After loading successfully, you can run related programs that depend on rockit.so.

4. VALLOC

The memory allocator of the media framework, which is responsible for allocating and managing the memory required by the media framework. You can use the following command to check the current memory status:

```
cat /dev/mpi/valloc
```

Detailed Information:

Item	Description	Remarks
module	Module information	Module name
version	Version information	Repository name: commit: version number
build	Build information	Compiler and Compilation date
mpi buf list	Buffer list separator	The following information is related to BUF
buf_id	Global unique ID	Used to identify MPI BUF, similar to HANDLE
pool_id	Buffer pool ID	The buf pool to which the mpi buf belongs, -1 means no pool
refcnt	MPI buf usage count	+1 before use, -1 after use, 0 means no pool, mpi buf will be released
dmacnt	DMA buf usage count	+1 before use, -1 after use, 0 means dma_buf will be released
size	Buffer size	Unit: BYTE, 0 means it is in wrapping mode
handle	Buffer handle	For RV1106, it is the physical address
create	Buffer creator	Records the distribution of BUFFER, error code represents that the BUFFER creator has been deleted
user	Buffer user	For all rotating BUFFERs, the current user will be recorded. and there will be POOLs in the rotating BUFFERs
total	Total memory	Unit: BYTE
mpi pool list	Buffer pool list separator	The following information is related to POOL
poid	Global unique ID	pool_id = poid means that this BUFFER belongs to this POOL
total	Total number of BUFFERS	
free	Remaining number of BUFFERS	Currently available BUFFERs
min	Minimum remaining	-1 indicates frame loss
size	BUFFER SIZE in the pool	All BUFFER sizes must be larger than this value
create	Pool creator	
user	Pool user	

5. VLOG

LOG manager of media framework

5.1 Check the kernel LOG

```
cat /dev/mpi/vlog
```

5.2 How to Set the LOG Output Level of the Module

The command `echo module=level > /tmp/rt_log_level` is used to change the LOG output level of the module, and this command affects rockit so and ko at the same time.

module = all cmpi mb sys vdec venc rgn vpss vgs tde avs wbc vo vi ai ao aenc adec

level=0,1,2,3,4,5,6; 2 is ERR (red), 3 WRN (yellow), 4 INF (green)

5.3 Set the Output Path and Size of SO LOG

```
echo rt_log_path=/tmp/rockit.log > /tmp/rt_log_level

echo rt_log_size=1024000 > /tmp/rt_log_level
```

6. VSYS

The manager for media relationship binding, you can check the current binding relationship and frame rate information through the following command:
```
cat /dev/mpi/vsys
```

Detailed Information:

Item	Description	Remarks
module	Module information	Module name
version	Version information	Repository name: commit: version number
build	Build information	Compiler - Compilation date
mpi node list	Node list separator	The following information is related to nodes
id	Global unique ID	Used to identify MPI nodes, similar to HANDLE
name	Device name of the created node	Multiple nodes may be with the same name
nid	Rockit custom ID	Custom ID for easier management of nodes in Rockit
ref	Usage count	+1 before use, -1 after use, 0 means release
infa_cnt	Received frame count	Total number of frames received by the node
lcnt	Lost frame count	Frames lost due to inability to process or processing failure, frame rate control is not included
frate	Received frame rate	Calculated in seconds (S), does not support setting
fbase	Received frame loss ratio	Receives fbase frames, keeps the first frame, and discards the rest
onfa_cnt	Sent frame count	Total number of frames sent by the node
lcnt	Sent frame loss count	Frames lost due to inability to process or processing failure, frame rate control is not included
frate	Sent frame rate	Calculated in seconds (S), does not support setting
fbase	Sent frame loss ratio	Sends fbase frames, sends the first frame, and discards the rest
itime	Time to receive 1 frame	Unit: microseconds
otime	Time to send 1 frame	Unit: microseconds
next node	Next-level node ID	Supports binding multiple nodes to one node
mpi node frame control	Node frame rate control table	The following information is related to node frame rate control
id	Global unique ID	Used to identify MPI nodes, similar to HANDLE
name	Device name of the created node	Multiple nodes may be with the same name
table	Frame loss table	The size is the frame rate, 0 means keep, 1 means discard

7. VENC

Encoding parameters, can be obtained by the following command:

`cat /proc/vcodec/enc/venc_info`

- VENC thread status

Parameter	Description
last_running	The time when the thread most recent wake-up
run_cnt	Number of times the thread has run
que_cnt	Number of times the thread has been triggered

- VENC channel running status

Parameter	Description
ID	Encoding channel ID
running	Whether the channel is active
combo_run	Whether JPEG combined encoding in a channel is active
cfg_gap	Time consumption of registers of a channel configuration(in ms)
strm_cnt	Number of cached streams in a channel
strm_out	Number of streams sent to the application in a channel
gap_time	Interval between the last two encoding start times of a channel (in ms)
cb_gap_time	Time interval between two JPEG combined encoding operations
last_cb_start	The most recent start time of the JPEG combined encoding.
last_cb_end	The most recent end time of the JPEG combined encoding.

- venc chn attr 1

Parameters	Description
ID	Encoding channel ID
Width	The width of encoding channel
Height	The height of encoding channel
Type	The type of encoding channel type
ByFrame	Get stream ID by frame 0: get by package 1: get by frame
Sequence	Sequence ID It is the frame sequence ID when it is acquired by frame, and it is the package sequence ID when it is acquired by package
GOPMode	GOP mode
Prio	The value of the channel priority

- venc chn attr 2

Parameters	Description
ID	Encoding channel ID
Vestr	Whether to enable encoding
SrcFr	The source frame rate of VENC frame rate control, that is, the input frame rate
TarFr	Target frame rate of VENC frame rate control
Timeref	VENC start time
PixFmt	The format of encoding the current frame
RealFps	VENC real frame rate
Rotation	Whether VENC enables rotation
Mirror	Whether VENC enables mirroring

- h264e chn attr

Parameters	Description
ID	Encoding channel ID
Width	Width in pixels
Height	Height in pixels
Profile	The profile of encoding channel Base: baseline Mp:main profile Hp:high profile

- Syntax INFO1

Parameters	Description
ID	Channel ID
Slcsplten	Whether to use slice split
SplitMode	slice split mode 1: split by byte 2: split by macroblock
Slcsize	The size of the slice, when the split_mode is different, the meanings of slice_size is different
IntraRefresh	Whether to enable P frame to refresh I macroblocks
RefreshMode	The mode of refreshing I macroblocks row: Refresh by row column: Refresh by column
RefreshNum	Refresh the number of rows or columns of I macroblocks in each frame

- Syntax INFO2

Parameters	Description
ID	Channel ID
Profile	The profile type of encoding channel Base: Baseline MP: Main profile HP: High profile
Cabac	Entropy encoding mode, cavlc or cabac
Trans8	Transformation mode used Only trans4x4 mode is enabled by default Y: enable trans8x8 mode
QMatrix	Whether to use a custom quantization table
Poc	The value of the syntax element pic_order_cnt_type
Alpha	The value of the syntax element slice_alpha_c0_offset_div2
Beta	The value of the syntax element slice_beta_offset_div2

- h265e chn attr

Parameters	Description
ID	Encoding channel ID
Width	Width in pixels
Height	Height in pixels
Profile	The profile of encoding channel main: main profile

- Syntax INFO1

Parameters	Description
ID	Channel ID
Slcsplten	Whether to use slice split
SplitMode	slice split mode 1: split by byte 2: split by macroblock
Slcsize	The size of the slice, when the split_mode is different, the meanings of slice_size is different
IntraRefresh	Whether to enable P frame to refresh I macroblocks
RefreshMode	The mode of refreshing I macroblocks row: refresh by row column: refresh by column
RefreshNum	Refresh the number of rows or columns of I macroblocks in each frame

- Syntax INFO2

Parameters	Description
ID	Channel ID
Dblken	Negated value of syntax element slice_deblocking_filter_disabled_flag
Tc	The value of syntax element slice_tc_offset_div2
Beta	The value of the syntax element slice_beta_offset_div2
Saoluma	The value of the syntax element slice_sao_luma_flag
Saochroma	The value of the syntax element slice_sao_chroma_flag
IntraSmoothing	The value of the syntax element strong_intra_smoothing_enabled_flag

- Trans Info

Parameters	Description
ID	Channel ID
CbQpoffset	The value of syntax element pps_cb_qp_offset
CrQpoffset	The value of syntax element pps_cr_qp_offset

- jpege chn attr

Parameters	Description
ID	Channel ID
width	Image width in Pixel
height	Image height in Pixel
quant	Channel quantization qp
qfactor	The qfactor used by channel
qfmax	The maximum value of qfactor used by channel
qfmin	The minimum value of qfactor used by channel

- hw status

Parameters	Description
ID	Channel ID
hw_run	The current channel is running
enc_status	enc status: 0: ENC_STATUS_CFG_IN, 1: ENC_STATUS_CFG_DONE, 2: ENC_STATUS_START_IN, 3: ENC_STATUS_START_DONE, 4: ENC_STATUS_INT_IN, />5: ENC_STATUS_INT_DONE
pkt_fail_cnt	Times of enc request packet pool failures
ring_fail_cnt	Times of stream buf allocation failures
cfg_fail_cnt	Times of generating hardware configuration information failures
start_fail_cnt	Times of enabling hardware encoding failures

- ring buf status

Parameters	Description
ID	Channel ID
w_pos	Write position of code stream buf
r_pos	Read position of code stream buf
used_len	Space used by stream buf
total_len	The total space size of code stream buf
min_size	Latest free space required for single frame allocation
l_w_pos	Last updated write position
l_r_pos	Last updated read position

- packet_pool

Parameter	Description
unused_cnt	Number of unused packets
used_cnt	Number of packets in use
total_cnt	Total number of packets, with a maximum limit of 128 for all channels

- RC base param1

Parameter	Description
ChnId	Encoding channel ID
Gop	Encoding Group of Pictures (GOP)
StatTm	Rate control statistical time in seconds
ViFr	VI (Video Input) frame rate
TrgFr	Encoding target frame rate
RcMode	Rate control mode (cbr/fixqp/vbr/avbr)
Br(kbps)	Bitrate in kbps
IQp	QP of I-frames, valid in FixQp mode
PQp	QP of P-frames, valid in FixQp mode

- RC base param2

Parameter	Description
ChnId	Encoding channel ID
MinQp	Minimum QP for P-frames
MaxQp	Maximum QP for P-frames
MinIQp	Minimum QP for I-frames
MaxIQp	Maximum QP for I-frames
EnableIdr	IDR enable switch Y: Enabled N: Disabled

- RC run comm param1

Parameter	Description
ChnId	Encoding channel ID
bLost	Whether to drop frames when the instantaneous bitrate exceeds the set threshold
LostThr	The threshold of frame dropping
LostFrmstr	Statistics of the number of frame dropping
EncGap	Gap between encoding frames

- RC run comm param2

Parameter	Description
ChnId	Encoding channel ID
SprFrmMod	Super-sized frame processing mode
SprIFrm	Threshold of super-sized I-frames
SprPFrm	Threshold of super-sized P-frames
RCPriority	Rate control priority bitrate: Target bitrate priority framebits: Super-sized frame threshold priority

- RC gop mode attr

Parameter	Description
ChnId	Encoding channel ID
GopMode	Type of gop_mode
IpQpDelta	The Qp Delta value of IP frame. For SmartP mode, it displays the Qp Delta value of Bg frames and P-frames. Range: [-10, 30]
BgInterval	Interval of special P-frames Range: Less than or equal to Gop
ViQpDelta	The Qp Delta value of virtual I-frames and P-frames Range: [-10, 30]

- RC run vbr common param

Parameter	Description
ChnId	Encoded channel ID
ChgPs	The ratio of the bitrate at the start of VBR QP adjustment to the maximum bitrate. This value is calculated by bitrate/max_bitrate * 100
MinIprop	The minimum ratio of IP frame bitrate. Range: [1,100]. Default value: 1
MaxIprop	The maximum ratio of IP frame bitrate. Range: [MinIprop, 100]. Default value: 100
MaxQp	The maximum QP value of P frames. Range: [0, 51]. Default value: 51
MinQp	The minimum QP value of P frames. Range: [0, MaxQp]. Default value: 24
MaxIQp	The maximum QP value of I frames. Range: [0, 51]. Default value: 51
MinIQp	The minimum QP value of I frames. Range: [0, MaxIQp]. Default value: 24
MaxReEncTimes	Number of re-encoding times per frame. 0 means no re-encoding. Range: [0, 3] Default value: 1

- RC run cbr param

Parameter	Description
MinIprop	The minimum ratio of IP frames. Range: [1, 100]
MaxIprop	The maximum ratio of IP frames. Range: [MinIprop, 100]
MaxQp	The maximum QP of P-frames, used to clamp quality. Range: [0, 51]
MinQp	The minimum QP of P-frames, used to clamp the fluctuation of bitrate. Range: [0, MaxQp]
MaxIQp	The maximum QP of I-frames, used to control the minimum number of bits for I-frames. Range: [0, 51]
MinIQp	The minimum QP of I-frames, used to control the maximum number of bits for I-frames. Range: [0, MaxIQp]
MaxReEncTimes	Number of re-encoding times per frame. 0 means no re-encoding. Range: [0, 3]

- RC HierarchicalQp INFO

Parameter	Description
ChnId	Encoding channel ID
bEnable	Whether layered QP is enabled
FrameNum[0]	Number of frames of QP in layer 1
FrameNum[1]	Number of frames of QP in layer 2
FrameNum[2]	Number of frames of QP in layer 3
FrameNum[3]	Number of frames of QP in layer 4
QpDelta[0]	QpDelta of frames in layer 1
QpDelta[1]	QpDelta of frames in layer 2
QpDelta[2]	QpDelta of frames in layer 3
QpDelta[3]	QpDelta of frames in layer 4

- RC debreath_effect info

Parameter	Description
ChnId	Encoding channel ID
bEnable	Whether to enable breath removal
Strength0	Breath removal strength 0
DeBrthEfctCnt	Times of breath removal which is applied to the image

- RC run info1

Parameter	Description
ChnId	Encoding channel ID
InsBr(kbps)	Instantaneous bitrate in kbps
InsFr	Instantaneous frame rate
WatL	Bitrate threshold
CfgBt(kb)	Target size of the previous frame in kb
RealBt(kb)	Actual size of the previous frame in kb
IPRatio	The ratio between Average size of I-frames and P-frames
StartQp	Starting QP
MinQp	Minimum QP
MaxQp	Maximum QP

8. VRGN

The RGN manager of the media framework. Use the following command to see the current RGN information:

```
cat /dev/mpi/vrgn
```

Detailed Information:

Item	Description	Remarks
module	Module information	Module name
version	Version information	Repository name: commit: version number
build	Build information	Compiler - compilation date
rgn list	RGN list separator	The following is the RGN-related information
handle	RGN handle	Used to identify RGN
type	RGN type	Used to identify RGN type: OVERLAY, COVER, MOSAIC
width	RGN area width	
height	RGN area height	
format	RGN area format	OVERLAY and COVER types are valid, "-1" indicates that the input type is not supported
buf_id	Currently used buffer ID for RGN	Valid for OVERLAY type, "-1" for other types
refcnt	MPI buffer usage count	
channel_num	Number of RGN attaches	Number of RGN ATTACH channels (modules)
node_rgn list	node_rgn list delimiter	The following is the NODE_RGN-related information
id	Unique ID for the node	Used to identify MPI node
name	Device name for creating the node	Multiple nodes may be with the same name
h	RGN handle	Used to identify the RGN, similar to HANDLE
x	RGN area x coordinate	X offset of the starting position of RGN
y	RGN area y coordinate	Y offset of the starting position of RGN
h x y	RGN area position information	Group of h, x, and y values that identify the RGN position. It is 8 groups in total.