GS Memory Map

• GS VRAM

210 (x32)

0

640
Frame-0
448
140

140

640
Frame-0
448
140

280

640
ZBUF
448
140

420

640

510 (x32)

512 (x32)

CLUT

5 1 2 +1
5 1 2 +1

40

DMA Packet Sample

• Static＆Dynamic Link Tag Area

Static Link Tag Area

gsinitp
gsframep
vumpgp
teximagep
texclutp
vumtxp
vuobjdtp

Dynamic Link Tag Area

VIFNOP	VIFNOP	gsframep	CALL 0
VIFNOP	VIFNOP	vumpg	CALL 0
VIFNOP	VIFNOP	teximagep	CALL 0
VIFNOP	VIFNOP	texclutp	CALL 0
VIFNOP	VIFNOP	vumtxp	CALL 0
VIFNOP	VIFNOP	vuobjdtp	CALL 0
VIFNOP	VIFNOP	0	END0
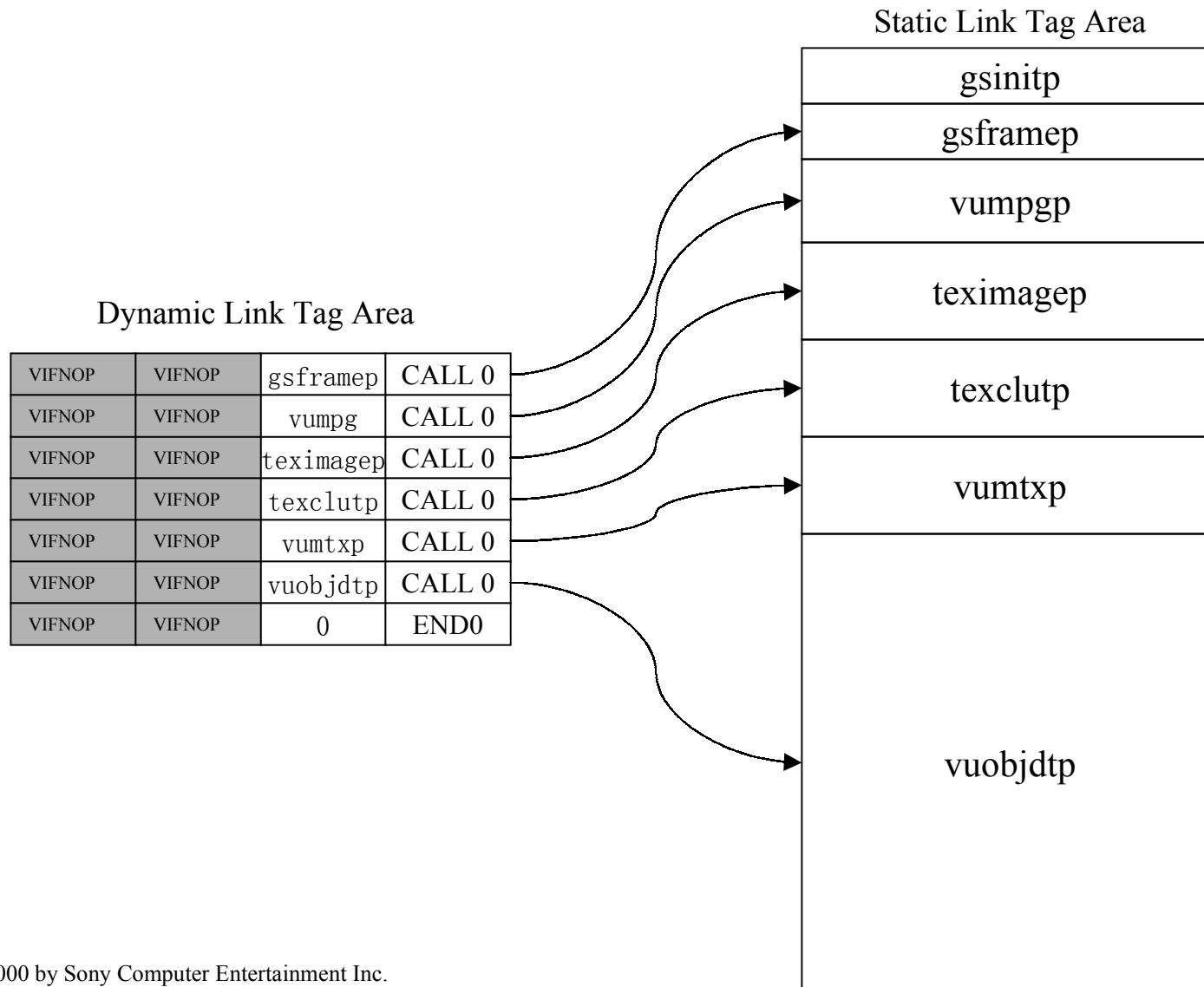
DMA Packet Sample

• GS Initialize Packet (GS Init)

gsinitp

DIRECT n+1	0	initcode	REF m+1

VIFNOP	VIFNOP	0	RET 0

A_D:0x0e	GIFtag: PACKED m
GS_COLCLAMP	set:CLAMP=1
GS_PABE	set:PABE=1
GS_ALPHA_1	set:A,B,C,D,FIX
GS_FOGCOL	set:R,G,B
GS_PRMODECONT	set:AC=1
GS_TEXA	set: TAO,AEM,TA1
GS_TEST_1	set:ATE,ATST,AREF
GS_CLAMP_1	set:WMS,WMT,MINU,MAXU,etc.

m

make_direct_packet(gsinitp , (u_int *)initcode, m);

```
/* GS PRESET Packet */
#define ISN    8
unsigned long initcode[ISN+1][2] __attribute__((aligned(16))) = {
// nloop=ISN, eop=1, pre=0, prim=0, flg=0:PACKET, nreg=1: NREG(0x0e:A_D)
// COLCLAMP CLAMP=1
// PABE PABE=0
// ALPHA_1 A=0 B=1 C=0 D=1 FIX=0
// FOGCOL FCR=100 FCG=100 FCB=100
// PRMODECONT AC=1
// TEXA TAO=128 AEM=0 TA1=0
// TEST_1 ATE=0 ATST=0 AREF=0 AFAIL=0 DATE=0 DATM=0 ZTE=1 ZTST=2
// CLAMP_1 WMS=0 WMT=0 MINU=0 MAXU=0 MINV=0 MAXV=0
    {SCE_GIF_SET_TAG(ISN,   1, 0, 0, SCE_GIF_PACKED, 1),    0x0000000e},
    {SCE_GS_SET_COLCLAMP(1),                    SCE_GS_COLCLAMP},      // 1
    {SCE_GS_SET_PABE(0),                        SCE_GS_PABE},          // 2
    {SCE_GS_SET_ALPHA(0, 1, 0, 1, 0),           SCE_GS_ALPHA_1},       // 3
    {SCE_GS_SET_FOGCOL(100,100,100),            SCE_GS_FOGCOL},        // 4
    {SCE_GS_SET_PRMODECONT(1),                  SCE_GS_PRMODECONT},    // 5
    {SCE_GS_SET_TEXA(128, 0, 0),                SCE_GS_TEXA},          // 6
    {SCE_GS_SET_TEST(0,0,0,0,0,0,1,2),          SCE_GS_TEST_1},        // 7
    {SCE_GS_SET_CLAMP(0,0,0,0,0,0),             SCE_GS_CLAMP_1},       // 8
};
```
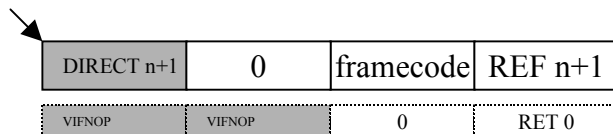
DMA Packet Sample

• GS Initialize Packet (Frame Initialize)

framecode

A_D:0x0e	GIFtag: PACKED n
GSFRAME_1	set:FBP,FBW,PSM,FBMSK
GS_XYOFFSET_1	set:OFX,OFY
GS_TEX1-1	set: LCM,MXL,MMAG etc.
GS_TEX0_1	set: TBP0,TBW,PSM,etc.
GS_ZBUF_1	set:ZBP,PSM,ZMSK
GS_SCISSOR_1	set: SCAX0,SCAX1..etc.
GS_TEST_1	set:ATE,ATST,AREF
GS_PRIM	set: PRIM=6 IIP=0 TME=0 etc.
GS_RGBAQ	set: RGBA
GS_XYZF	set: XYZF(Upper Left)
GS_XYGF	set: XYZF(Bottom Right)
GS_TEST_1	set:ATE,ATST,AREF

n

gsframep

DIRECT n+1	0	framecode	REF n+1
VIFNOP	VIFNOP	0	RET 0

make_direct_packet(gsframep , (u_int *)framecode, n);

```
/* GS Frame Packet */
#define FSN    12
unsigned long framecode[FSN+1][2] __attribute__((aligned(16))) = {
// nloop=FSN, eop=1, pre=0, prim=0, flg=0:PACKET, nreg=1: NREG(0x0e:A_D)   GIFtag
// TEX1_1 LCM=1 MXL=0 MMAG=1 MMIN=1 MTBA=0 L=0 K=0
// TEX0_1 TBP0=9600 TBW=1 PSM=1 TW=6 TH=6 TCC=1 TFX=0 CBP=0 CPSM=0 CSM=0 CSA=0 CLD=0
// FRAME_1 FBP=0 FBW=10 PSM=2 FBMSK=0
// XYOFFSET_1 OFX=27648:(2048-320)*16  OFY=30976(2048-112)*16
// ZBUF_1 ZBP=150 PSM=1 ZMSK=0
// SCISSOR_1 SCAX0=0 SCAX1=639 SCAY0=0 SCAY1=223
// TEST_1 ATE=0 ATST=0 AREF=0 AFAIL=0 DATE=0 DATM=0 ZTE=1 ZTST=1
// PRIM PRIM=6 IIP=0 TME=0 FGE=0 ABE=0 AA1=0 FST=0 CTXT=0 FIX=0
// RGBAQ 200 200 200 0 0.000000
// XYZF2 1728.000000 1936.000000 0 0
// XYZF2 2368.000000 2160.000000 0 0
// TEST_1 ATE=0 ATST=0 AREF=0 AFAIL=0 DATE=0  DATM=0 ZTE=1 ZTST=2
  {SCE_GIF_SET_TAG(FSN, 1, 0, 0, SCE_GIF_PACKED, 1),    0x0000000e    },  // GIFtag A_D
  {SCE_GS_SET_FRAME(0, 640/64, 0, 0),                   SCE_GS_FRAME_1},
  {SCE_GS_SET_XYOFFSET((2048-320)*16, (2048-112)*16),   SCE_GS_XYOFFSET_1},
  {SCE_GS_SET_TEX1(1, 0, 1, 1, 0, 0, 0),                SCE_GS_TEX1_1 },
  {SCE_GS_SET_TEX0(TXDP, TXWW/64, 19, M, M, 1, 0, CLTDP, 0, 0, 0, 1),SCE_GS_TEX0_1 },// 8bit CLUT
  {SCE_GS_SET_ZBUF(140, 1, 0),                          SCE_GS_ZBUF_1},
  {SCE_GS_SET_SCISSOR_1(0 , 639 ,0 , 223),              SCE_GS_SCISSOR_1},
  {SCE_GS_SET_TEST(0, 0, 0, 0, 0, 0, 1, 1),             SCE_GS_TEST_1},
  {SCE_GS_SET_PRIM(6, 0, 0, 0, 0, 0, 0, 0),             SCE_GS_PRIM }, // SPRITE( Frame Clear)
  {SCE_GS_SET_RGBAQ(0, 0, 20, 0, 0),                    SCE_GS_RGBAQ }, // RGBA (BG color)
  {SCE_GS_SET_XYZF((2048-320)*16, (2048-112)*16, 0, 0), SCE_GS_XYZF2 }, // UL point(2048-320, 2048-112)
  {SCE_GS_SET_XYZF((2048+320)*16, (2048+112)*16, 0, 0), SCE_GS_XYZF2 }, // DR point(2048+320, 2048+112)
  {SCE_GS_SET_TEST(0, 0, 0, 0, 0, 0, 1, 2),             SCE_GS_TEST_1},
};
```

DMA Packet Sample

• Image Packet (Path2)

teximagep (clutimagep)

DIRECT7	0	0	CNT 7
A_D:0x0e	GIFtag: PACKED 5		
GS_TEXFLUSH	set: 0		
GS_BITBLTBUF	set: DBP,DBW,DPSM		
GS_TRXPOS	set: DSAX, DSAY		
GS_TRXREG	set: RRW, RRH		
GS_TRXDIR	set 0 (Host →Local)		
0	GIFtag: IMAGE nw		
DIRECT nw	0	image	REF nw
VIFNOP	VIFNOP	0	RET 0
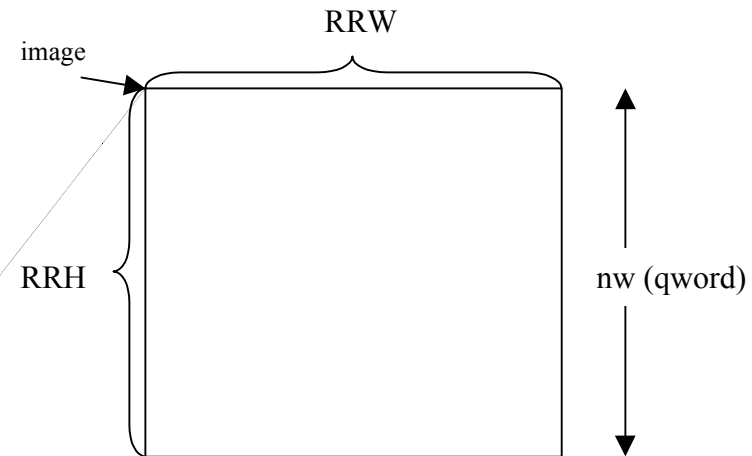
make_image_packet(teximagep, (u_int *)image, DBP, DPW, DPSM, DSAX, DSAX, RRW,RRH);

RRW

image

RRH

nw (qword)
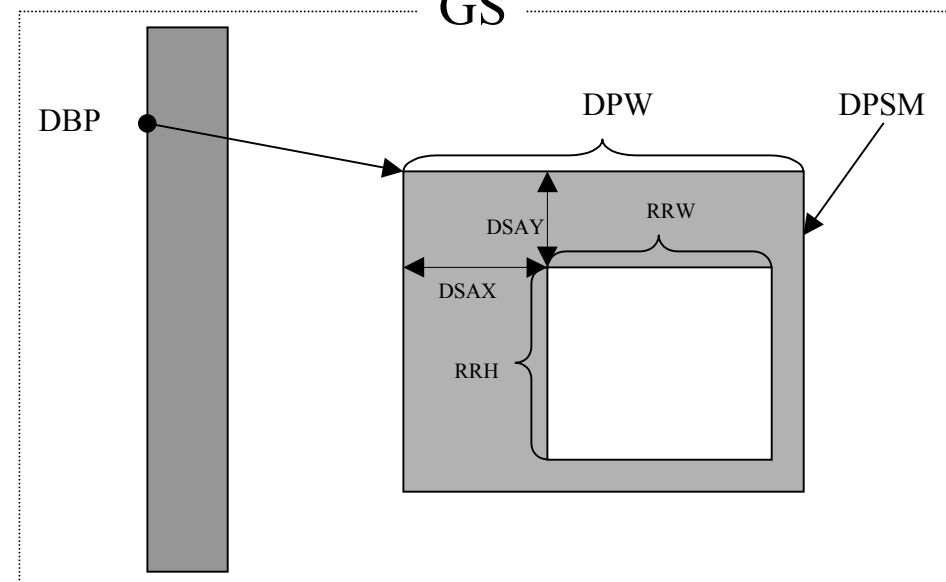
```
/* Set DMA Packet Link for teximage                  (GS:Path2) */
make_image_packet(teximagep, (u_int *)geocol, TX8DP, TXWW/64, 19, 0, 0, TW,TH);
/* Set DMA Packet Link for clut                      (GS:Path2) */
make_image_packet(texclutp,  (u_int *)cltbf, CLTDP, 1, 0, 0, 0, CLTWDTH,CLTWDTH);
```
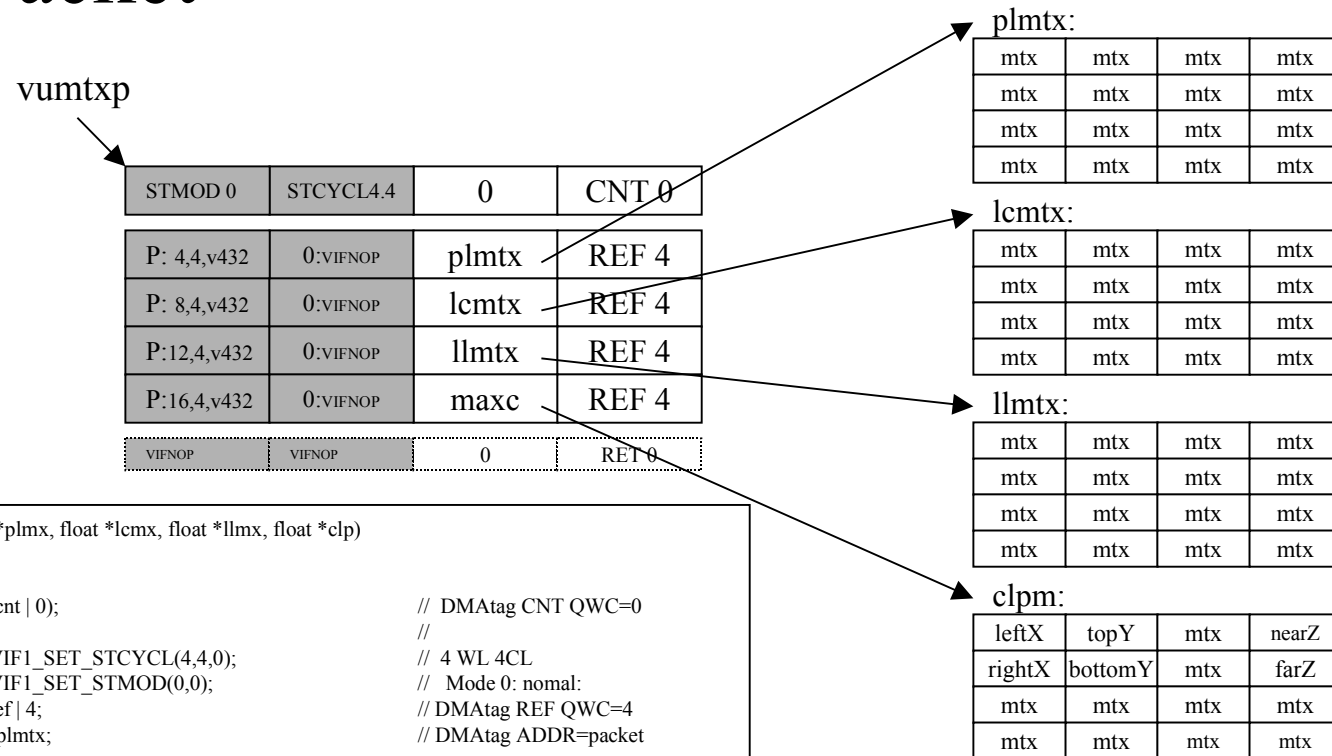
GS

DBP

DPW

DPSM

DSAY

RRW

DSAX

RRH

DMA Packet Sample

• Matrix Packet

vumtxp

STMOD 0	STCYCL4.4	0	CNT 0

P: 4,4,v432	0:VIFNOP	plmtx	REF 4
P: 8,4,v432	0:VIFNOP	lcmtx	REF 4
P:12,4,v432	0:VIFNOP	llmtx	REF 4
P:16,4,v432	0:VIFNOP	maxc	REF 4

VIFNOP	VIFNOP	0	RET 0

plmtx:

mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx

lcmtx:

mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx

llmtx:

mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx

clpm:

leftX	topY	mtx	nearZ
rightX	bottomY	mtx	farZ
mtx	mtx	mtx	mtx
mtx	mtx	mtx	mtx

```
void make_matrix_pack (u_int *p, float *plmx, float *lcmx, float *llmx, float *clp)
{
int p=0;
        (pp)[p++]=(DMAcnt | 0);                          //  DMAtag CNT QWC=0
        (pp)[p++]=0;                                     //
        (pp)[p++]=SCE_VIF1_SET_STCYCL(4,4,0);            //  4 WL 4CL
        (pp)[p++]=SCE_VIF1_SET_STMOD(0,0);               //   Mode 0: nomal:
        (pp)[p++]=DMAref | 4;                            // DMAtag REF QWC=4
        (pp)[p++]=(u_int)plmtx;                          // DMAtag ADDR=packet
        (pp)[p++]=0;
        (pp)[p++]=SCE_VIF1_SET_UNPACK(4, 4, V4_32, 0);   // PRIM/LOCAL
        (pp)[p++]=DMAref | 4;                            // DMAtag REF QWC=4
        (pp)[p++]=(u_int)lcmtx;                          // DMAtag ADDR=packet
        (pp)[p++]=0;
        (pp)[p++]=SCE_VIF1_SET_UNPACK(8, 4, V4_32, 0);   // Light/Color
        (pp)[p++]=DMAref | 4;                            // DMAtag REF QWC=4
        (pp)[p++]=(u_int)llmtx;                           // DMAtag ADDR=packet
        (pp)[p++]=0;
        (pp)[p++]=SCE_VIF1_SET_UNPACK(12, 4, V4_32, 0);   // Light/Local
        (pp)[p++]=DMAref | 4;                             // DMAtag REF QWC=4
        (pp)[p++]=(u_int)clp;                            // DMAtag ADDR=packet
        (pp)[p++]=0;
        (pp)[p++]=SCE_VIF1_SET_UNPACK(16, 4, V4_32, 0);  // Maxcolor & Buffer Pointers

}
```
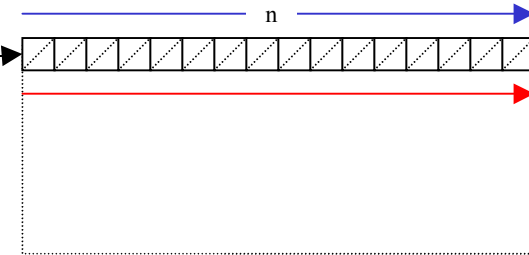
DMA Packet Sample (Ref)

• Mesh Packet: Strip

Triangle Strip(All:XYZ,NXYZ,UV,RGBA,)

vuobjdtp

Pr: 0,1,v432	STCYCL4,4	0	CNT 1
	4:1:2	GIFtag(n*2,1,1,prim,pk,3)	
Pr: 1,n*4,v432	STCYCL 4 , 8	AllM:upper	REF n*4
Pr: 5,n*4,v432	STCYCL 4 , 8	AllM:bottom	REF n*4
MSCAL 0	STCYCL4,4	0	CNT 0

VIFNOP	VIFNOP	0	RET 0

VUmem

0

GIFtag

BASE(BASE+OFFSET)

XYZ0
NXYZ0
UV0
RGBA0

XYZ （WD+0）
NXYZ （WD+0）
UV （WD+0）
RGBA （WD+0）

XYZ1
NXYZ1
UV1
RGBA1

XYZ （WD+ 1 ）
NXYZ （WD+ 1 ）
UV （WD+ 1 ）
RGBA （WD+ 1 ）

DMA Packet Sample

• VU buffer preset

OFFSET240	BASE120	0	CNT 1
outbuf1,outbuf0	0x8000,0000	Pr: u20,1,v416	STCYCL4,4

VUmem — 0

Matrix

— 20

| outbuf1 | outbuf0 | 0x8000 | 0 |

BASE: inbuf-0

BASE+OFFSET: inbuf-1

outbuf-0

outbuf-1
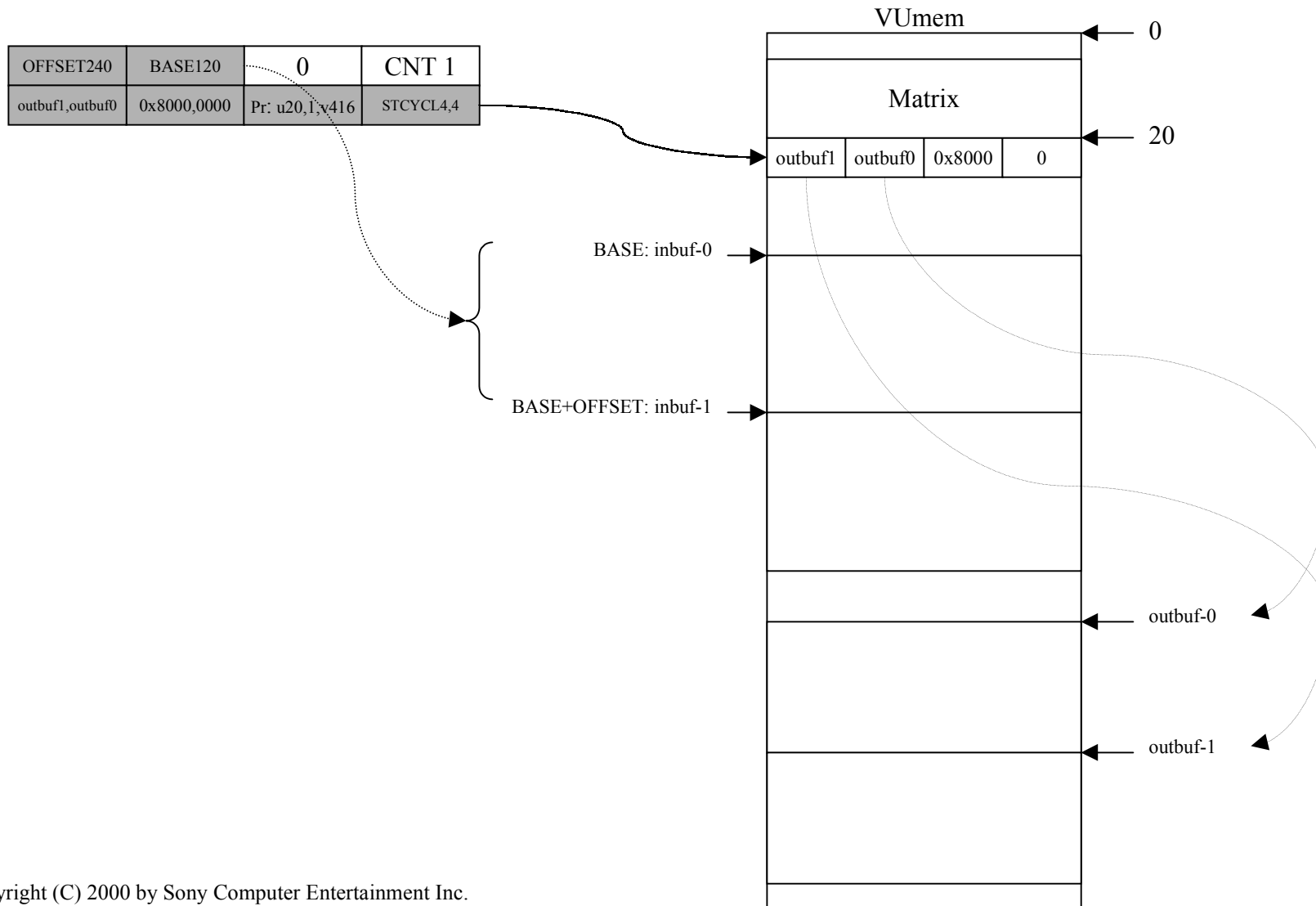
DMA Packet Sample

- ## VU MPG Packet with VU buffer preset packet

vumpgp

mpg

VIFNOP	VIFNOP	mpg	CALL 0
OFFSET240	BASE120	0	CNT 1
outbuf1,outbuf0	0x8000,0000	Pr: u20,1,v416	STCYCL4,4
VIFNOP	VIFNOP	0	RET 0

VU buffer preset

MPG 0,n	0	0	CNT n/2
VUMPG 1		VUMPG 0	
VUMPG 3		VUMPG 2	
:		:	
:		:	
VUMPG n		VUMPG n-1	
VIFNOP	0	0	RET 0
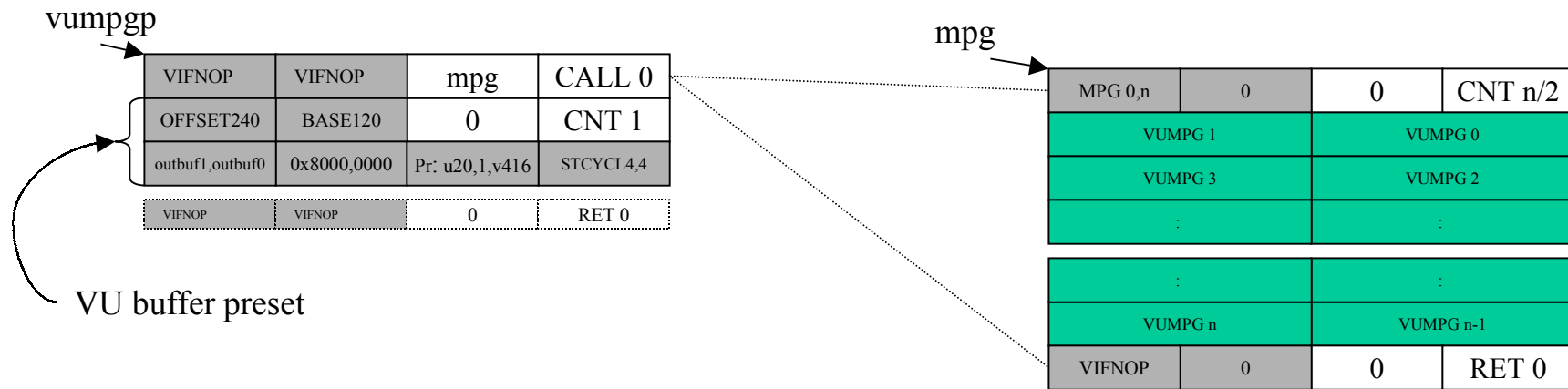
VU Memory Map Sample

- ## VU Memory Map :Strip

```
GIFtag:

Matrix        plmtx
              llmtx,
              lcmtx,
              clip


                          ◄────  BASE

Inbuf-0:
RGB
PXYZ              OFFSET
NXYZ
UV
*34

Inbuf-1:
RGB
PXYZ
NXYZ
UV
*34

Outbuf0 :
GIFtagxx
RGB
STQ
XYZ
* 34

Outbuf1 :
GIFtagxx
RGB
STQ
XYZ
* 34
```
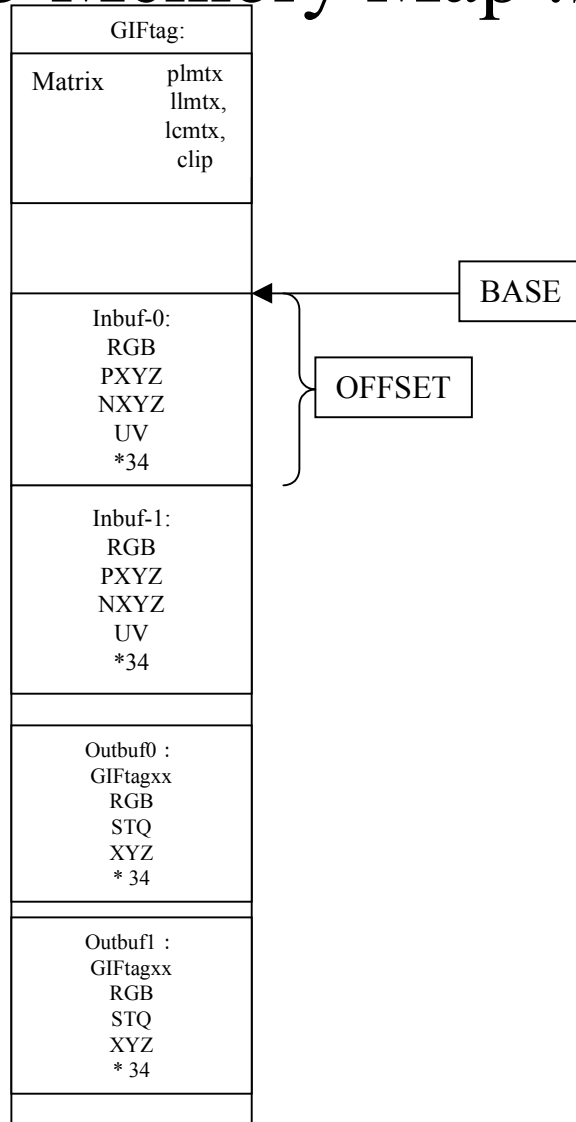
```
VUMPG :
                 no enroll
                 RGBA,XYZ,NXYZ,UV integral data  (34 vertex : 32TriMesh)
                 with CLIP

integral data:
base.h
                 typedef struct {
                 float vx;
                 float vy;
                 float vz;
                 float vw;
                 float nx;
                 float ny;
                 float nz;
                 float nw;
                 float u;
                 float v;
                 float n0;
                 float n1;
                 float r;
                 float g;
                 float b;
                 float a;
                 } PVECTOR __attribute__((aligned(16)));
```
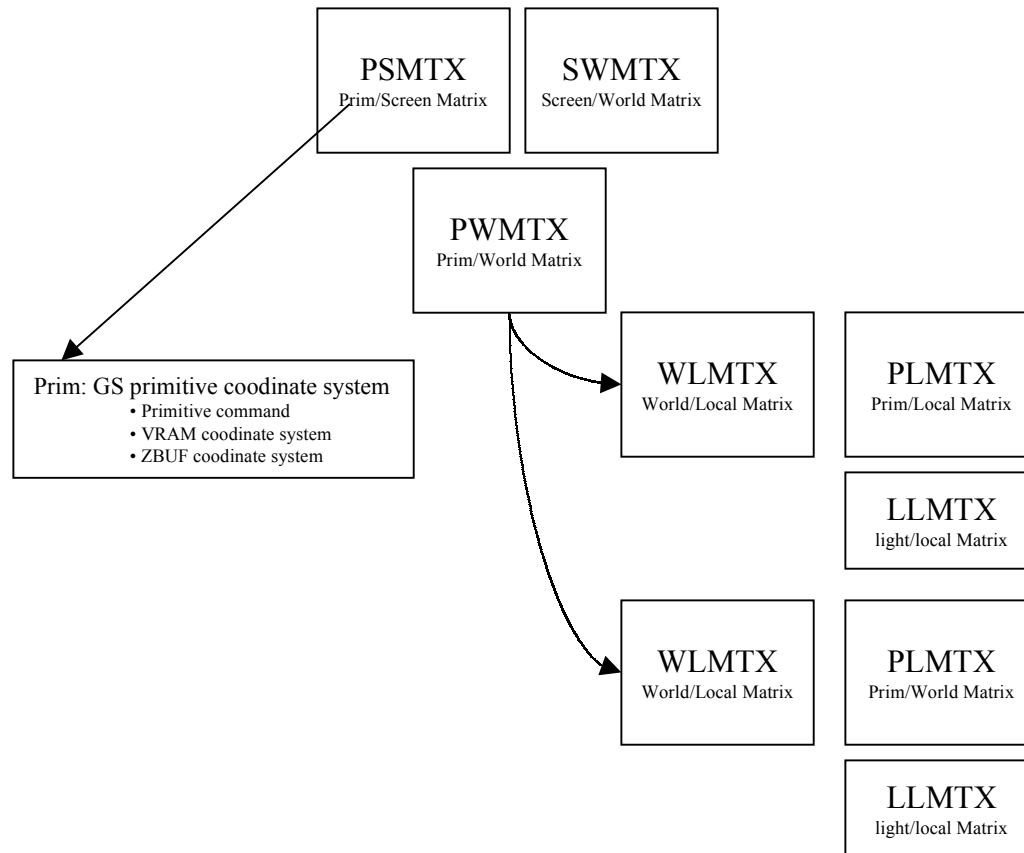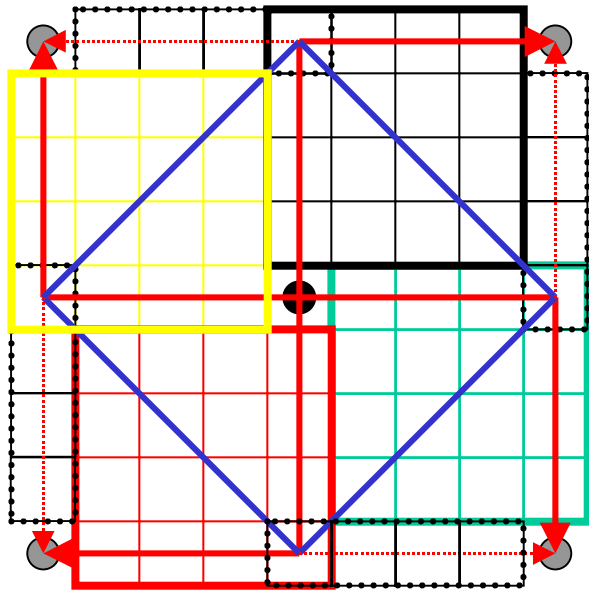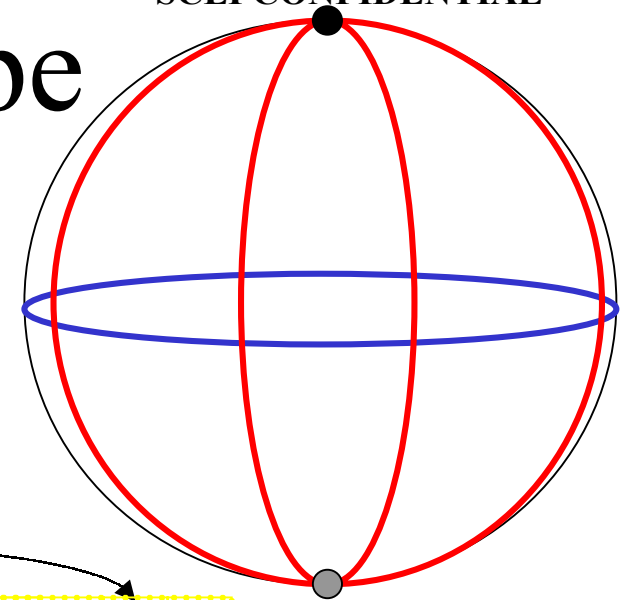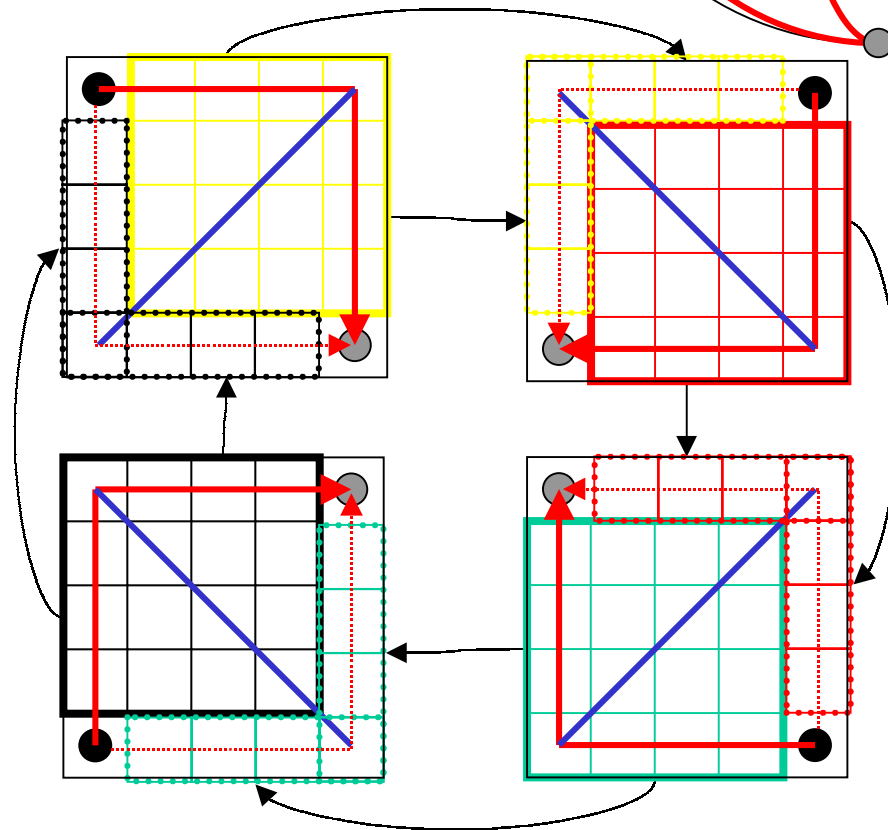
Matrix

- ## Matrix : Coordinate Systems

```
┌─────────────────┐  ┌─────────────────┐
│ PSMTX           │  │ SWMTX           │
│ Prim/Screen Matrix │  │ Screen/World Matrix │
└─────────────────┘  └─────────────────┘
```

PSMTX — Prim/Screen Matrix

SWMTX — Screen/World Matrix

PWMTX — Prim/World Matrix

Prim: GS primitive coodinate system
- Primitive command
- VRAM coodinate system
- ZBUF coodinate system

WLMTX — World/Local Matrix

PLMTX — Prim/Local Matrix

LLMTX — light/local Matrix

WLMTX — World/Local Matrix

PLMTX — Prim/World Matrix

LLMTX — light/local Matrix

8-faced Shape

Whole Model

Divided Model

6-faced Shape

top

0   1   2   3

bottom