

## Um pouco de história

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1

## SketchPad - 1963

- Tese de Doutorado de Ivan Sutherland (MIT)
- Conceito de comunicação com o computador



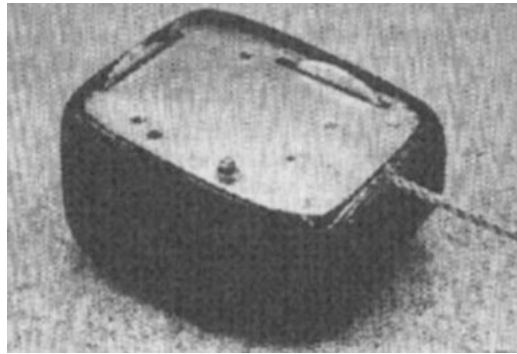
<http://www.youtube.com/watch?v=BKM3CmRqK2o>

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2

## Tecnologia de input

- 1963 Mouse substitui o light pen (vector systems)

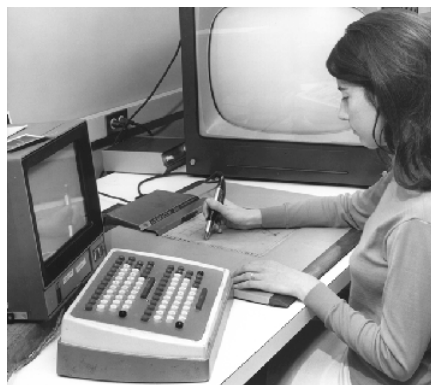


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3

## 1964

- Dispositivo de Entrada  
*Grafacon*



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4

## 1972

- Computador ALTO da XEROX
- Processador de “Textos” (tela longa em comparação às atuais)

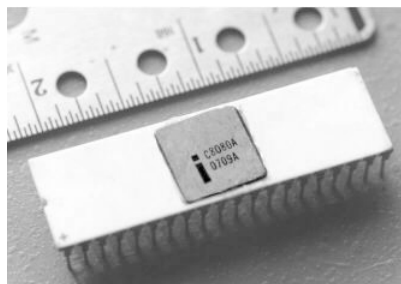


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5

## 1974

- Intel lança o 8080



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6

# 1981



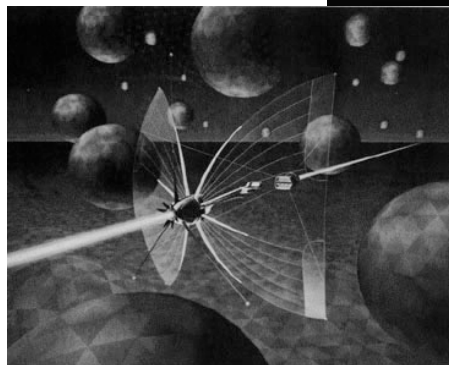
- IBM lança o primeiro PC
- Hoje aproximadamente US\$4000
- 4.77 MHz Intel 8088
- 16 kilobytes RAM, expansível até 256k
- SEM disco rígido! Apenas 2 anos depois... 10MB com o modelo XT

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7

# 1982

- Filme TRON da Disney



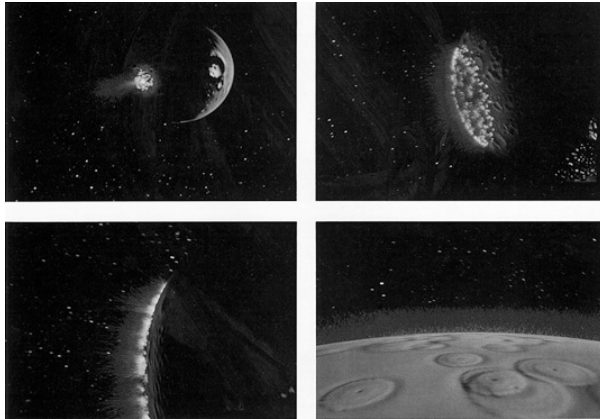
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<http://www.youtube.com/watch?v=-30De9mqoDE>

8

# 1983

Jornada nas Estrelas  
Ira de Khan



Reeves 1983 -Sistemas de Partículas

[http://www.youtube.com/watch?v=n6YvhhY\\_N5A](http://www.youtube.com/watch?v=n6YvhhY_N5A)

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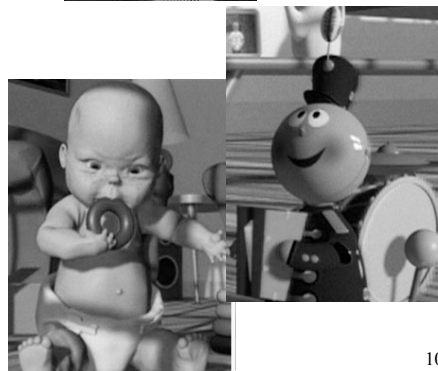
9

# Anos 80

- 1983 – SGI lança o IRIS 1000 e 1400
- 1983 – Alias fundada
- 1984 - Wavefront
- 1988 – Tin Toy da Pixar ganha um Oscar



US\$ 50.000  
1.5MB RAM  
72MB Disco  
Compare com  
o Primeiro PC....

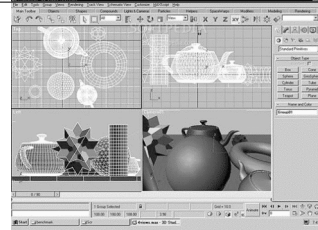


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10

## Anos 90

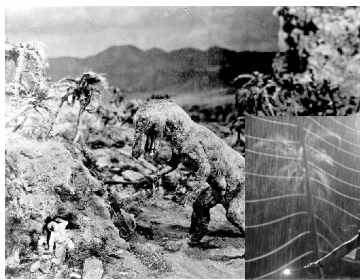
- 1990 – AutoDesk lança 3D Studio
- 1992 - OpenGL especificação
- 1993 - Jurassic Park



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11

## Sofisticação Visual da Audiência...



Lost World - 1922

Jurassic Park - 1997



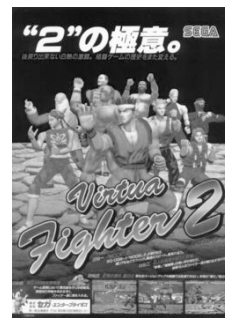
Transformers - 2007



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## Anos 90

- 1994 – Sega Saturn
- 1995 – Toy Story

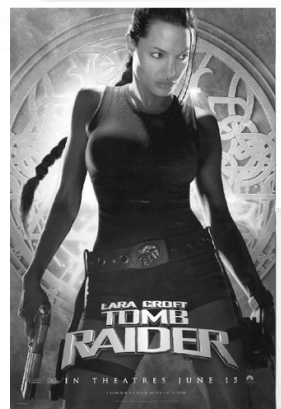
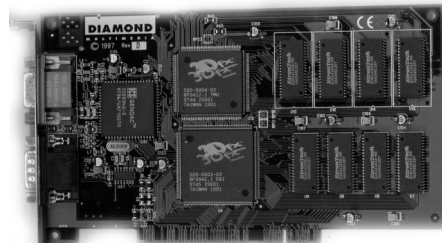


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13

## 1996/1997

- Voodoo board



2001

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14

## Um exemplo



Em 11 anos os polígonos aumentaram aproximadamente **15 vezes!**

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## Lara Croft 2011? 2013? 2020?

Quantos polígonos?



Qual modelo de iluminação?

Qual técnica de animação?

Como representar os materiais?

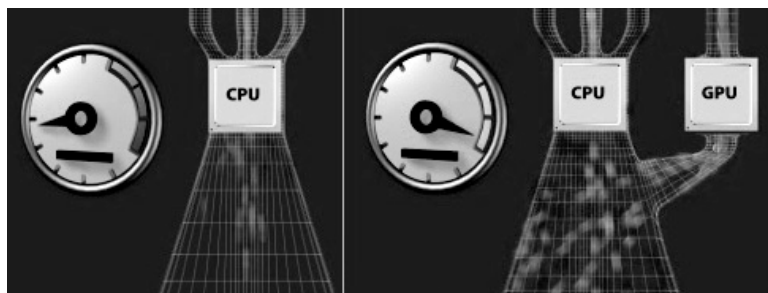
ETC, ETC, ETC...

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16



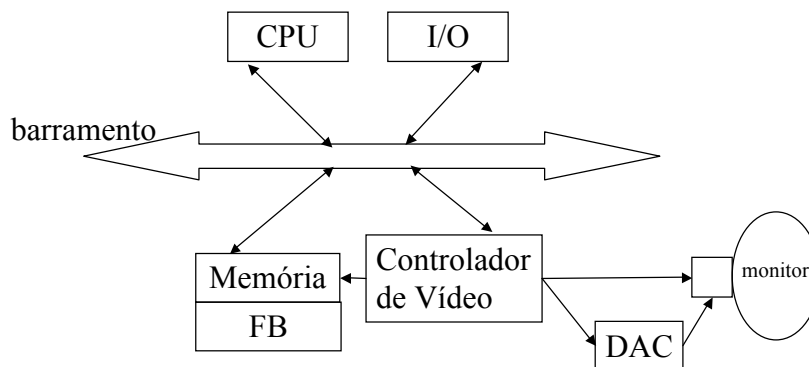
# O que são GPUs?



Graphics Processing Units

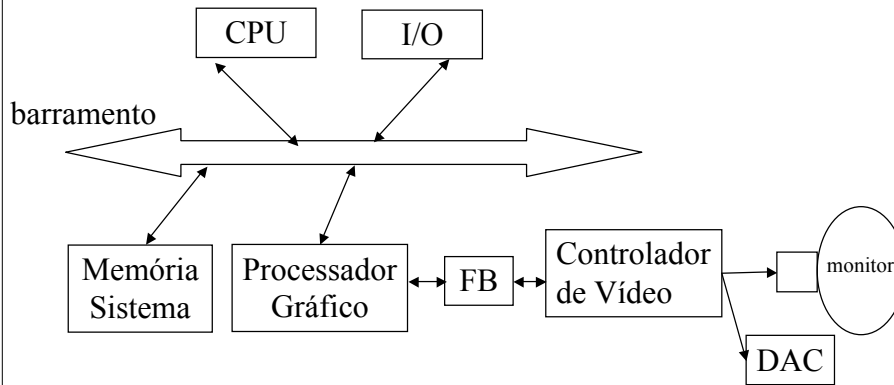
# Arquiteturas Típicas

## 1) SIMPLES



# Arquiteturas Típicas

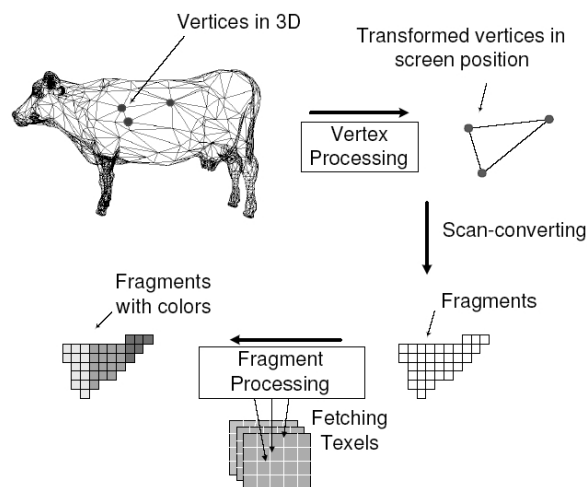
## 2) Com Processador Gráfico



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19

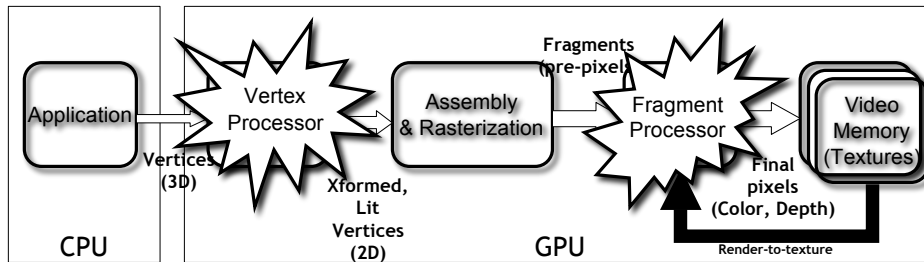
# Graphics Pipeline



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20

# Graphics Pipeline: The Big Picture



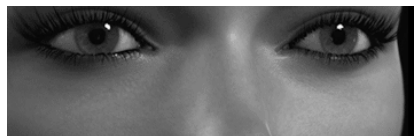
**GPU is a stream processor**

- *Multiple programmable processing units*
- *Connected by data flows*

# Breve Histórico GPUs Nvidia

Ano	Modelo	Processo	#Trans	Mpixels/s	pipes	
1998	RivaZX	0.25	5M	250		
1999	TNT2	0.22	9M	480		
2000	GeForce2 GTS	0.18	25M	800		
2001	GeForce3	0.15	57M	800		**
2002	GeForce4 Ti	0.15	63M	1000	4	
2003	GeForce 5900	0.13	125M	1600	4/8	
2005	GeForce 6800	0.13	222M	3900	16	
2006	GeForce 7800	0.09	302M	6400	24	\$599

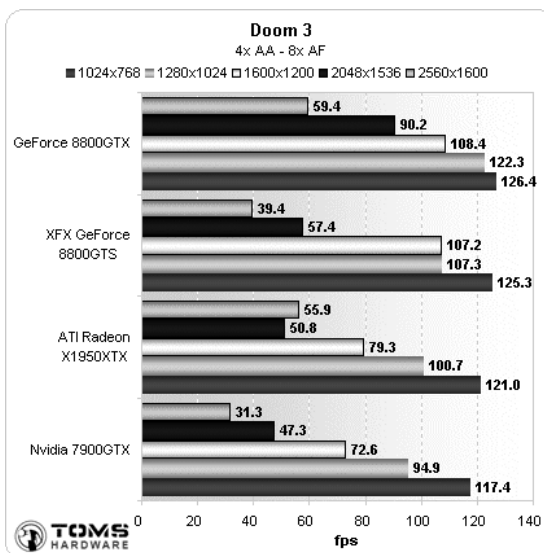
# Placas Gráficas



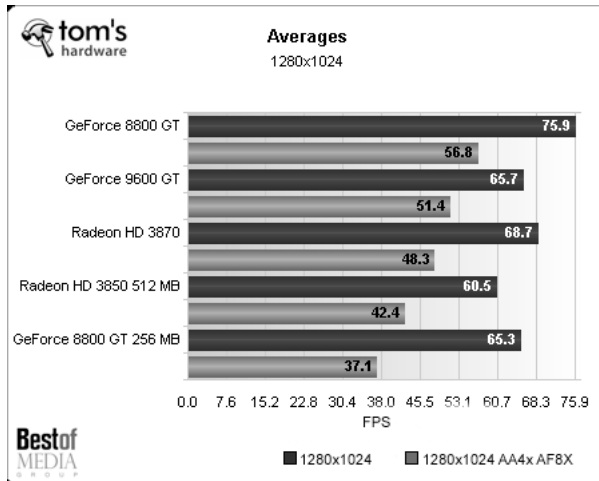
- GeForce 8800GTX
  - Nov. 2006 - US\$599
  - 128 processadores
  - 768MB memória
  - 681 milhões de transistores
  - 10.800 milhões vértices por segundo



# Benchmark



## Series 9000 9600 GT



The raw processing power of this G94 is still a full 38% lower than that of the 8800 GT.

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25

## Series 9000 9600 GT

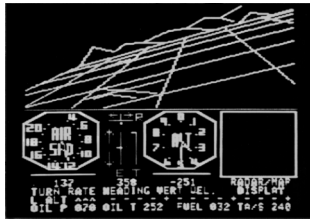
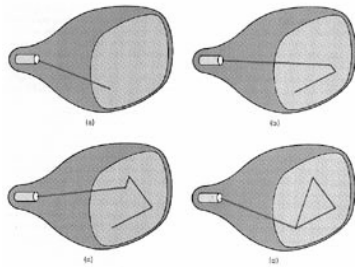
Stream Processors	64
Core Clock (MHz)	650 MHz
Shader Clock (MHz)	1625 MHz
Memory Clock (MHz)	900 MHz
Memory Amount	512MB
Memory Interface	256-bit
Memory Bandwidth (GB/sec)	57.6
Texture Fill Rate (billion/sec)	20.8



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26

## Tecnologia de output



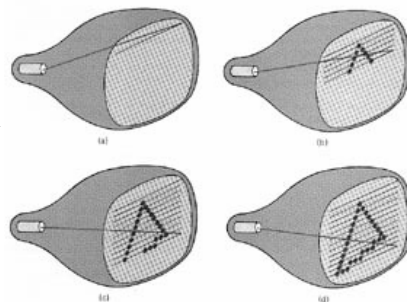
- (Anos 60) Vector systems
  - Processador de display (I/O) conectado na CPU
  - Especificação em alto-nível (início linha, final linha)

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27

## Tecnologia de output

- (Anos 70) Raster systems
  - Tecnologia baseada em TV (tecnologia raster onde linhas são traçadas horizontalmente)



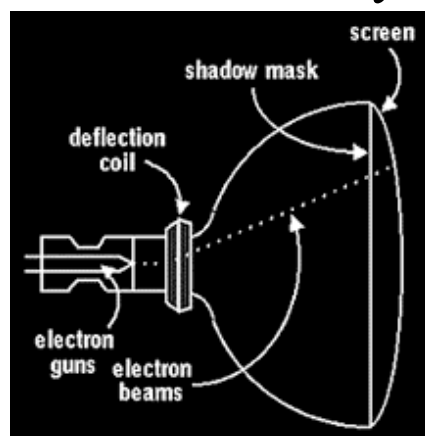
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28

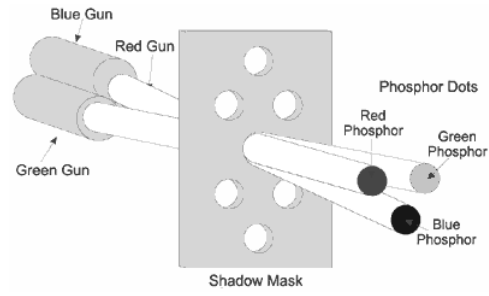
## Componentes

- Frame-Buffer
- Conversor DAC
- Monitor de Vídeo
  - CRT
  - Controlador de Vídeo

## Tubo de Raios Catódicos (CRT - Cathode Ray Tube)



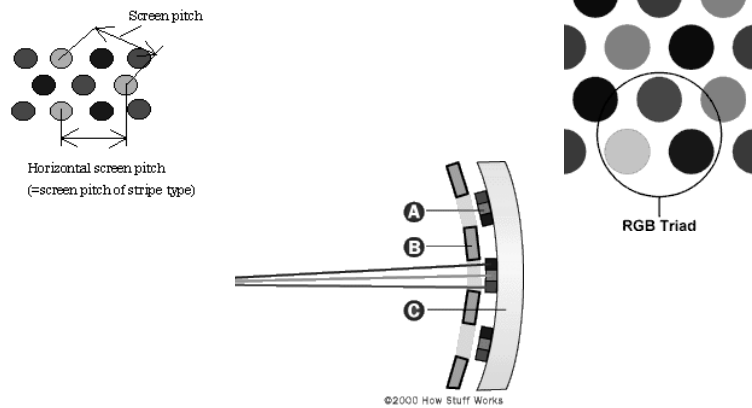
# Shadow Mask



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31

# Pitch/Triad

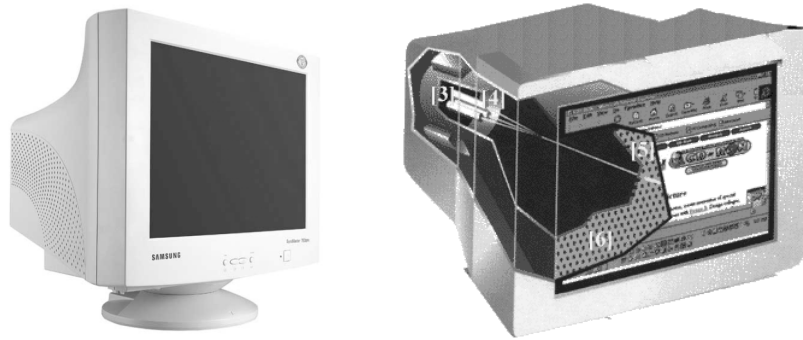


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32



## Monitores



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33

## Conversão FB/Monitor

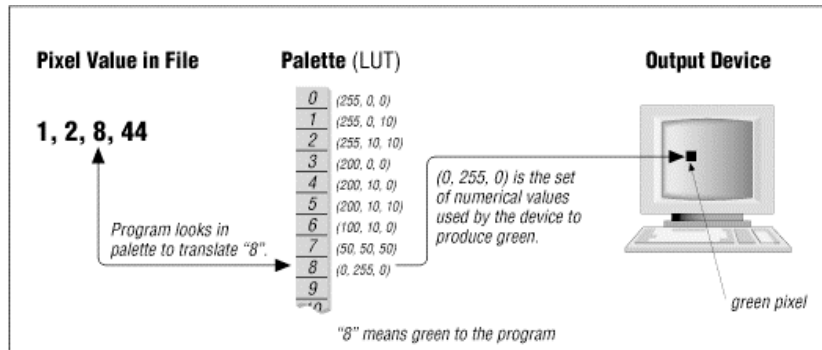
- Diretamente
  - Cada informação de cor do pixel é utilizada diretamente para ativar os fósforos no monitor
  - Por exemplo:  $r=0.5$ ,  $g=0.9$ ,  $b=0.05$
  - Canhão Red com 50% da capacidade, Green com 90% e Blue com 5%

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34

# Conversão FB/Monitor

- Indiretamente



Exemplo de LUT:  
216 Entradas  
24 bits por entrada

FFFFF	FF0FF	CCFFF	CC6FF	90FFF	906FF	66FFF	665FF	33FFF	336FF	00FFF	006FF
FFFCF	FF0CC	CCFFC	CC0CC	90FFC	906CC	66FFC	665CC	33FFC	336CC	00FFC	006CC
FFFF9	FF099	CCFF9	CC699	90FF9	90699	66FF9	66599	33FF9	33699	00FF9	00699
FFFF6	FF066	CCFF6	CC666	90FF6	90666	66FF6	66566	33FF6	33666	00FF6	00666
FFFF3	FF033	CCFF3	CC633	90FF3	90633	66FF3	66533	33FF3	33633	00FF3	00633
FFFF0	FF000	CCFF0	CC600	90FF0	90600	66FF0	66500	33FF0	33600	00FF0	00600
FFFCF	FF3FF	CCCFF	CC3FF	90CFF	903FF	66CFF	663FF	33CFF	333FF	00CFF	003FF
FFCFC	FF3CC	CCCFC	CC3CC	90CFC	903CC	66CFC	663CC	33CFC	333CC	00CFC	003CC
FFC96	FF396	CCC96	CC396	90C96	90396	66C96	66396	33C96	33396	00C96	00396
FFC66	FF366	CCC66	CC366	90C66	90366	66C66	66366	33C66	33366	00C66	00366
FFC33	FF333	CCC33	CC333	90C33	90333	66C33	66333	33C33	33333	00C33	00333
FFC00	FF300	CCC00	CC300	90C00	90300	66C00	66300	33C00	33300	00C00	00300
FF9FF	FF0FF	CC9FF	CC0FF	909FF	900FF	669FF	660FF	339FF	330FF	009FF	000FF
FF9CC	FF0CC	CC9CC	CC0CC	909CC	900CC	669CC	660CC	339CC	330CC	009CC	000CC
FF999	FF099	CC999	CC099	90999	90099	66999	66099	33999	33099	00999	00099
FF966	FF066	CC966	CC066	90966	90066	66966	66066	33966	33066	00966	00066
FF933	FF033	CC933	CC033	90933	90033	66933	66033	33933	33033	00933	00033
FF900	FF000	CC900	CC000	90900	90000	66900	66000	33900	33000	00900	00000