Recap: Ch 1 BTB

- Digital explosion
- Claude Shannon
- Exponential growth
- Moore's law
- 7 Koans of Bits

It’s All Just Bits

- text – bits
- pictures – bits
- Voice over IP phone calls – bits
- streaming audio and video – bits
- Computer programs take those bits and render them so we can see/hear/feel/(smell?) them

Perfection is Normal

- Perfect copies of pictures
- Completely indistinguishable from the original
- If a bit gets corrupted we (generally) know it and can fix it.
- Cheap perfect copies are important in the music and movie industry

There is Want in the Midst of Plenty

- Media changes making old information difficult or impossible to access
- The volume of data can be overwhelming – the needle in a haystack

Processing is Power

- Moore's Law
- Exponential growth (doubling every few years)
- Hard to imagine what another 10 years of this growth will make possible…

More of the Same Can Be a Whole New Thing

- Exponential growth (doubling every few years)
- 1,2,4,8,16,32,64,128,256,512,1024,2048,…
- Cell phones (death of land lines)
- Digital photography (death of film)
  - 1983 (first digital cameras for sale)
  - 1997 Kodak still going strong
  - 2007 Kodak 1/5 its size of the 80s

Nothing Goes Away

- impact on privacy
- convenience at a price
- mis-information persists
- European “right to be forgotten”

Bits Move Faster Than Thought

- Bits move nearly instantaneously around the world at very low cost
- Impacting the global economy
- Blurring the boundaries of national laws

Technology is Neither Good nor Bad

- Nuclear power
- Cryptography
- Sharing of information on the web
- Monitoring can be invasive (tracking your cell phone) or freeing (Alzheimer patient)
- Snowden, Wikileaks
- New applications bring new opportunities for criminals

Recap: Ch 2 BTB - CS Concepts

- meta data
- RFID
- cookies
- IP address
- re-identification
- bio-metric data

What are you supposed to learn?

- What is a digital footprint?
- What technology advances in the last ten years have made ‘Big Brother’ possible
- Which **organizations** try to protect your privacy.
- Why you should read the **“Terms and Conditions”** for every app you download
  - You never know what they might say. Example: Pulse App asks you to give permission for them to track every number you call
- Why you should **consider what you put onto public sites** like Facebook.
  - Are you sure your privacy settings are as you want?

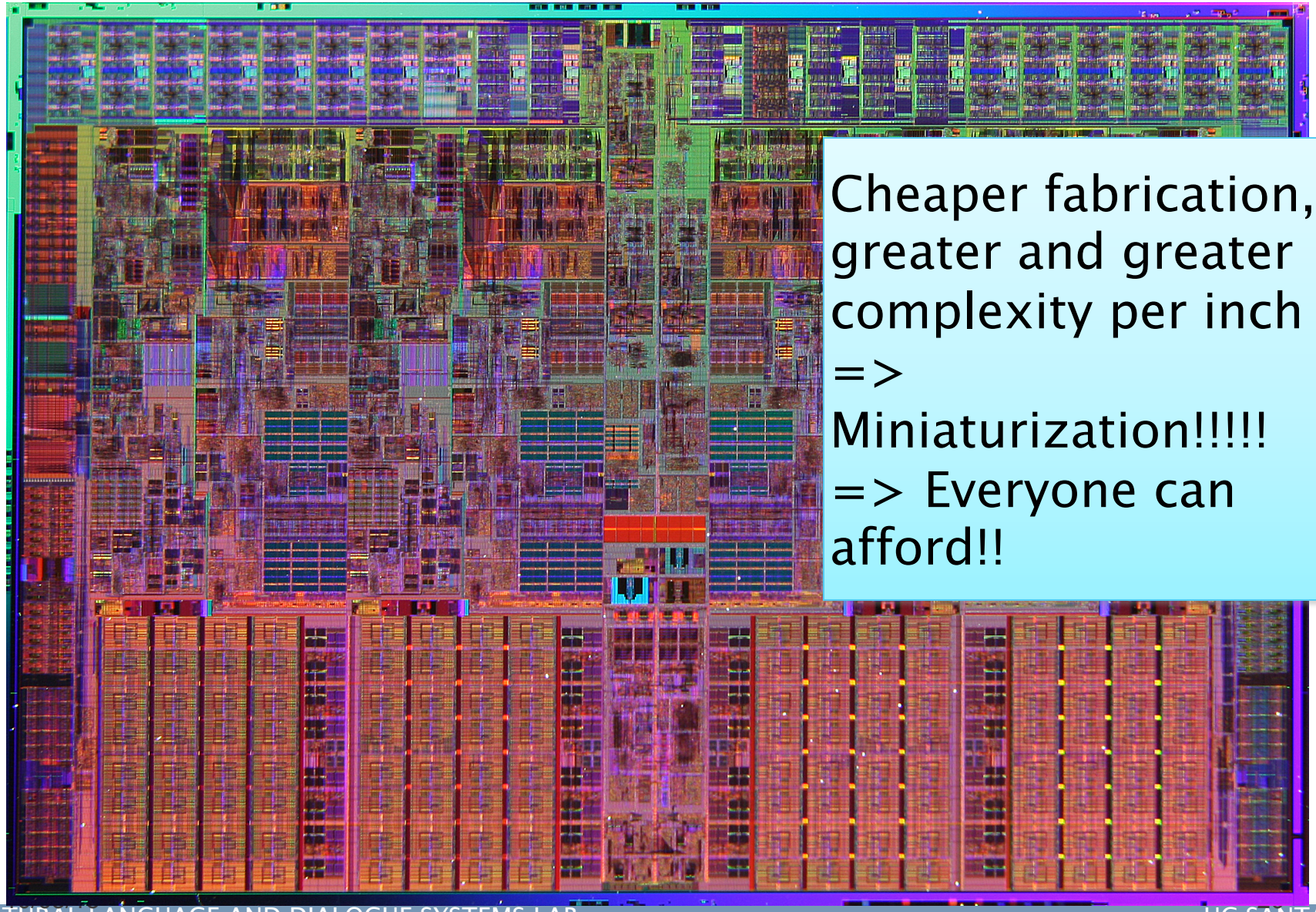
What is YOUR digital footprint?

- Where are you revealing stuff you'd rather not have open to the world?
- Facebook
- Credit card information
- Cookies tracking transaction data
- Amazon purchases
- Embarrassing stuff. Facebook youtube
- Downloads tracking

If you complete a survey that does not ask for your name, address, phone number, or other obvious forms of identification, can you safely assume that your answers are truly anonymous?

A. True
B. False

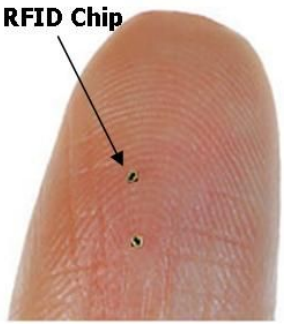
Integrated Circuits: Millions of logical gates

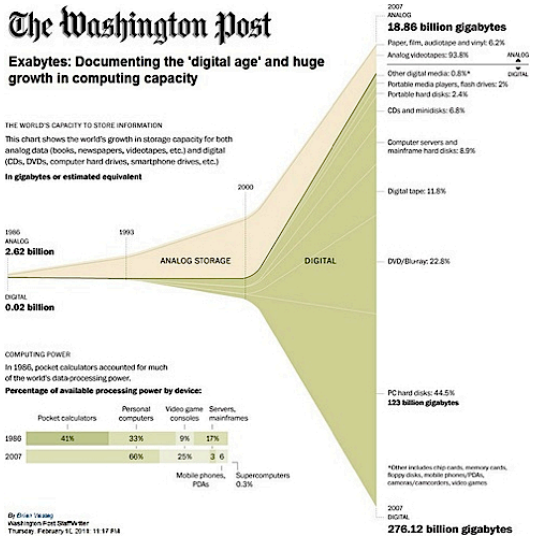


Cheaper fabrication, greater and greater complexity per inch
=>
Miniaturization!!!!!
=> Everyone can afford!!

So how did we get here?

- ICs =>
  - Personal
  - Miniaturization
- Internet
- WWW
- Digitization of Content
- Mobile
- The same technology that is **incredibly useful and often fun! (so we like it)**, also affords ‘Big Brother’

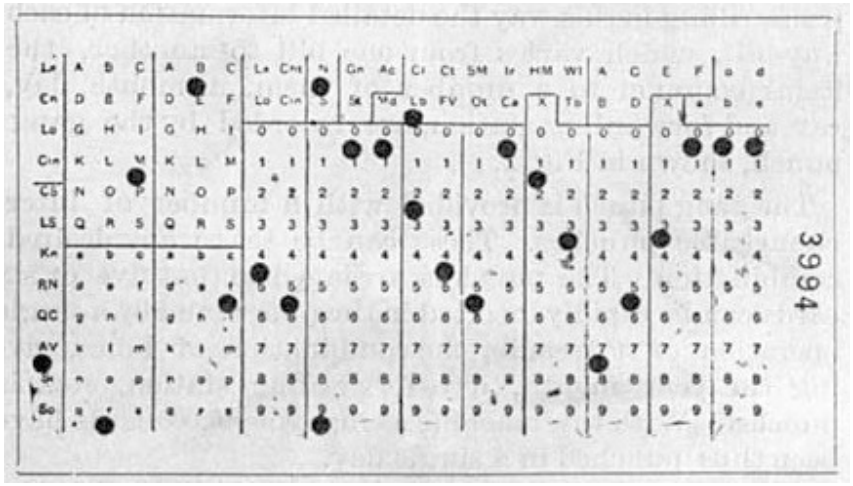




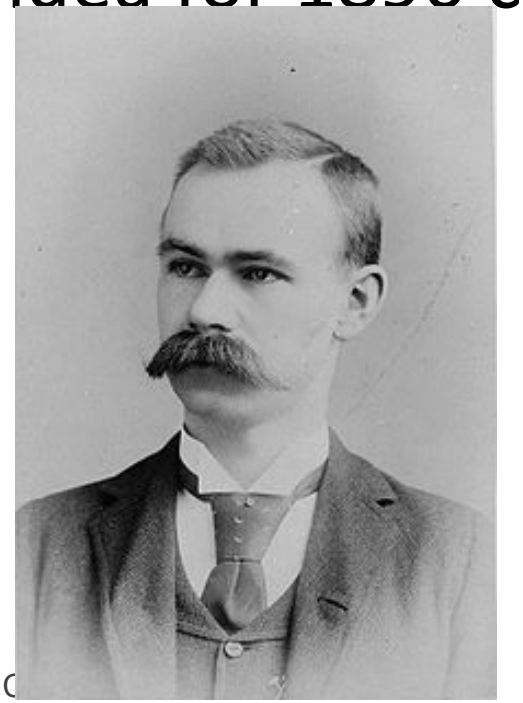
Recap: The Digital Age

The Problem with Writing …

- Only **people** can read it … [Though recently, *some* progress in handwriting analysis has occurred; limited use.]
- First serious advance in digitization: punch cards
- Herman Hollerith develops idea for 1890 census



Hollerith Card, Courtesy IBM

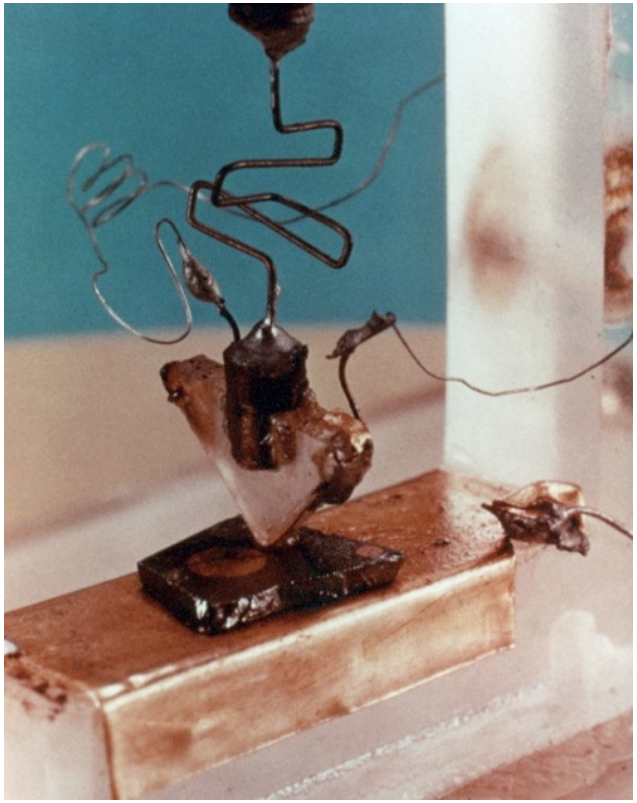


Next Big Things … Very Big!

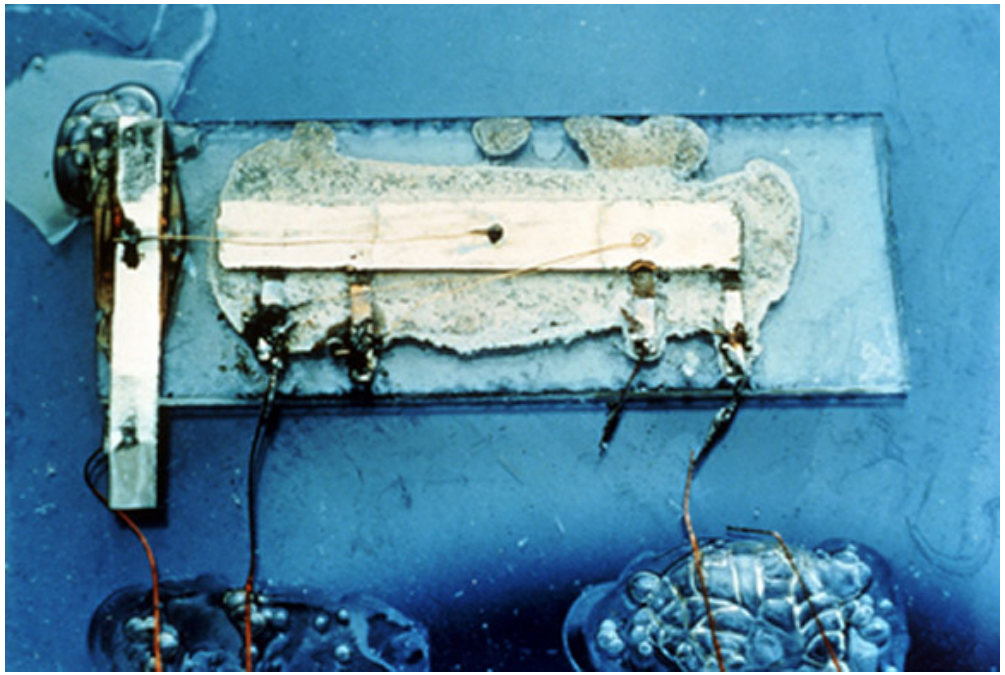
- Electronic computers came after WWII

Next Big Things: Integrated Circuits

- Transistors – solid state switching
- Integrated Circuit – all circuit parts fabbed at once from similar materials



1st transistor



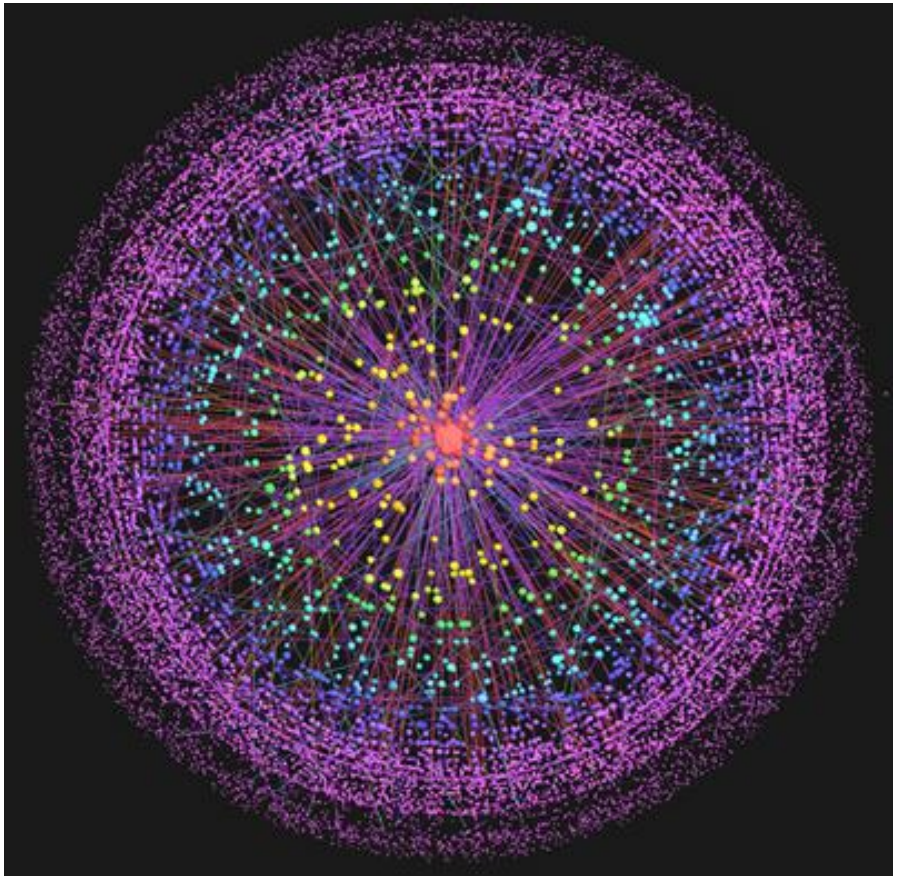
1st integrated circuit

Next Big Thing: Personal Computers

- Ken Olsen, Founder of Digital Equipment, "There is no reason for any individual to have a computer in their home [1977]"

Next Big Thing: Internet

- Invented in 1969, it took almost 20 years to get out of the lab and into public consciousness



"On the Internet, nobody knows you're a dog."

Next Big Thing: WWW + http

- Today, all computers "speak" a common language: hyper-text transfer protocol

Recap: How do computers compute?
Bits and Gates

Positional Notation

- Binary numbers, like decimal numbers, use *place notation*

$$1101 = 1\times1000 + 1\times100 + 0\times10 + 1\times1$$

$$= 1\times10^3 + 1\times10^2 + 0\times10^1 + 1\times10^0$$

except that the base is 2 not 10

$$1101 = 1\times8 + 1\times4 + 0\times2 + 1\times1$$

$$= 1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0$$

Base or radix

1101 in binary is 13 in decimal

Decimal to Binary

- What is the binary representation of the decimal value 21?
- A. 10010
- B. 10100
- C. 10101
- D. 10110
- E. 10111

Binary Addition

```
  011101
+ 010011
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A. 101010
B. 110101
C. 110000
D. 111000
E. 101101

What is the first letter of the message at the bottom?

A. G

B. t

ASCII	0000 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110	0000 0111	0000 1000	0000 1001	0000 1010	0000 1011	0000 1100	0000 1101	0000 1110	0000 1111
0000	NU	SH	SX	EX	ET	EQ	AK	BL	BS	HT	LF	YT	FF	CR	S0	SI
0001	DL	D1	D2	D3	D4	NK	SY	EΣ	CN	EM	SB	EC	FS	GS	RS	US
0010		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
0011	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
0100	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
0101	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
0110	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
0111	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DT
1000	80	81	82	83	IN	NL	SS	ES	HS	HJ	YS	PD	PV	RI	S2	S3
1001	DC	P1	PZ	SE	CC	MM	SP	EP	Q8	QQ	QA	CS	ST	OS	PM	AP
1010	A0	¡	¢	£	♀	¥	¦	§	¨	©	♂	«	¬	-	®	¯
1011	°	±	²	³	´	µ	¶	·	¸	¹	º	»	¼	½	¾	¿
1100	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
1101	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	β
1111	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ

0100 0111|0110 1111|0010 0000|0101 0011|0110 1100|0111 0101|0110 0111|0111 0011

Truth Table for *And (using 0 and 1)*

P	Q	P and Q
1	1	
1	0	
0	1	
0	0	

Truth Table for *Or (using 0 and 1)*

P	Q	P or Q
1	1	
1	0	
0	1	
0	0	

P and Q or R

- What is P and Q or R if P is true, Q is false, and R is true?
- A. True
- B. False

Recap: Ch 3 BTB-CS Concepts

- document formats
- interpreting bits
- ascii, jpg, mp3, …
- meta data
- representing digital images
- modeling vs rendering
- ocr
- sampling rate
- cloud computing
- data compression
- spatial coherence
- temporal coherence
- TCP/IP
- role of processing power in audio/video
- steganography
- disk format (deleting data)
- persistence of data (good and bad)

WYSI(not)WYG

- pdf blackout
- MS Office track changes
  - UN report on assassination
  - SCO lawsuit
- scanned vs pdf/doc
  - not searchable/searchable
  - not easily “read” by readers for the blind
- use security “features” to prevent unauthorized modification

Need for Compression

- HD TV 1080p is 1920x1080 pixels
- or 2,073,600 pixels
- or 49,766,400 bits using uncompressed 24 bit color (8 bits for each of Red, Green, and Blue). That's ~50Mbits per image/frame.
- 20 pictures would be 1Gbit
- 1 minute of video at 16 frames/sec would be 47,775,744,000 (~50Gbits)

Compression

- sampling rate (not exactly compression)
- lossy or lossless
- run length encoding
- spatial coherence (lots of blue sky)
- temporal coherence (video of static scene)
- compression trades computing time (power) for storage space or bandwidth

Data That Just Won't Go Away

- Disk Format
  - files = magazine article (continues on page x)
  - index/TOC
  - deleting just removes entry from index/TOC
- Deleting data in the Cloud?
- Data on your cell phone?
- Once a file is copied, it is hard to totally eradicate

Recap – Ch 3 Ghosts in the Machine

- Meta data – what you see is less than what you get
- Steganography – hiding info in plain sight
- Erased/deleted data may still be around
  - On your disk drive
  - In the cloud
  - On your phone