Carnegie Mellon University

Utils Lecture

17-313, Foundations of Software Engineering, Spring 2023

S3D Software and Societal Systems Department

Administrivia

- Final group presentations
  - Monday, May 8, 2023 05:30pm - 08:30pm In Person GHC 4401
  - Snack Survey on Slack
  - Final Class: AMA with the professors. We will post a survey for questions.

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Software Patents:
The Good, The Bad, and The Ugly

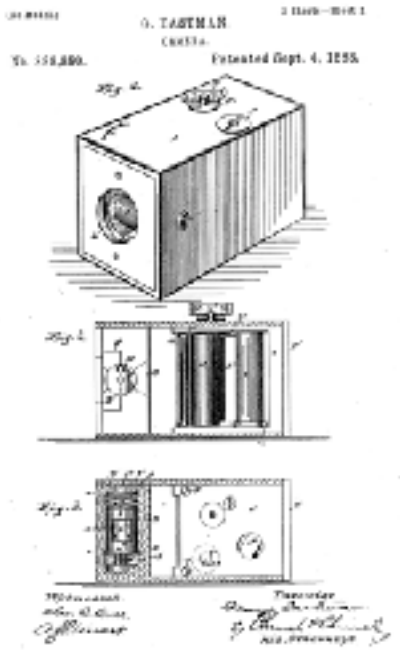
S3D
Software and Societal Systems Department

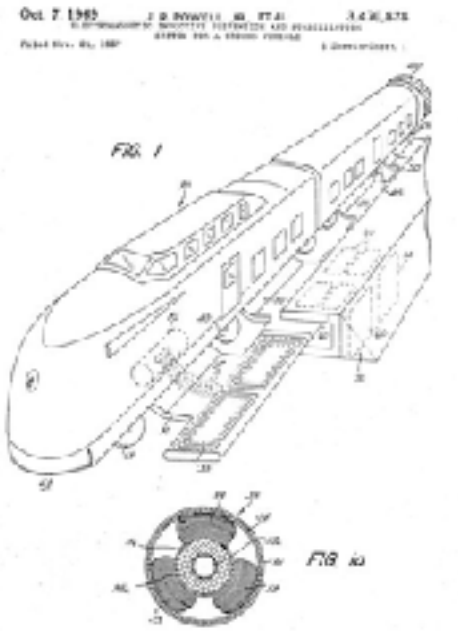
Disclaimer: I’m not a lawyer!

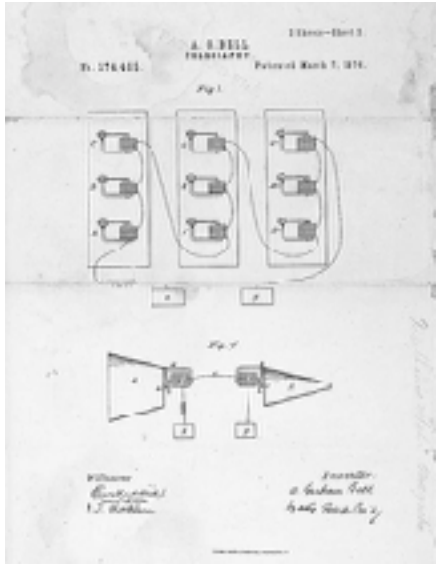
Venice, 1474

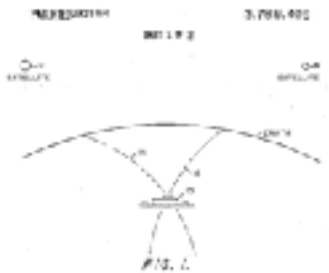
England, 1566

Today: USA









https://www.popularmechanics.com/technology/design/g20051677/patents-changed-the-world

What is a patent? New. Useful. Non-obvious.

“A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, **a new way of doing something**, or offers a **new technical solution to a problem**. To get a patent, technical information about the invention must be disclosed to the public in a patent application.”

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

https://www.wipo.int/patents/en

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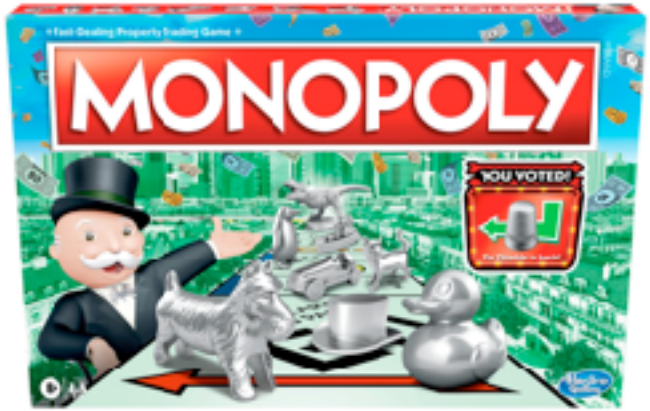
What rights do patents grant?

- Patents **don't** give you the right to make, use, or sell an invention.
- Patents **do** give you the right to **exclude others** from making, using, and selling an invention for the term of a patent (20 years)
    - stop or sue others
    - licensing and royalties



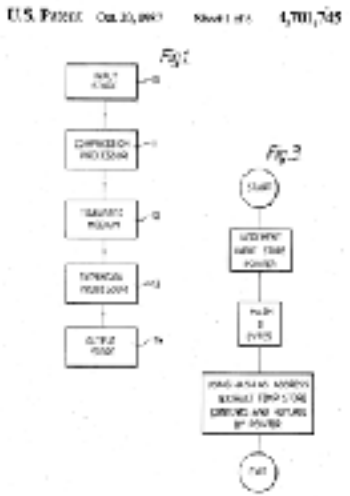
What’s the difference? Patents vs. Copyright

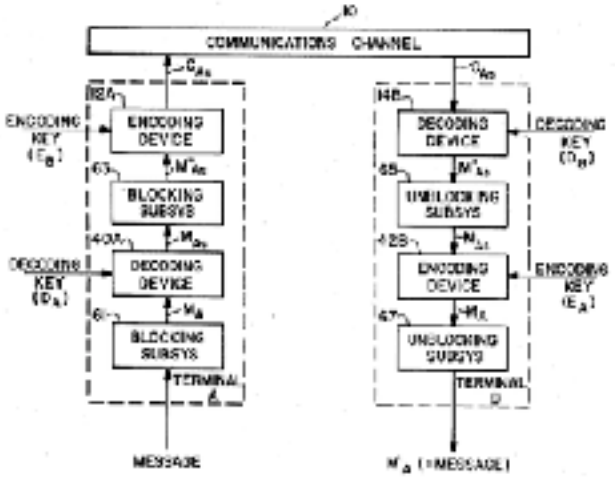
- Copyrights cover the details of expression of a work
- Copyrights don't cover any ideas
  Patents only cover ideas and the use of ideas
- Copyrights happen automatically.
  Patents are issued by a patent office in response to an application.

Why do patents exist?

- Encourage disclosure of inventions
- Reward invention and creativity
- Protect investment of capital into R&D
- Encourage the market to “design around”
- Protect small companies from large ones

Software Patents





Patent or not?

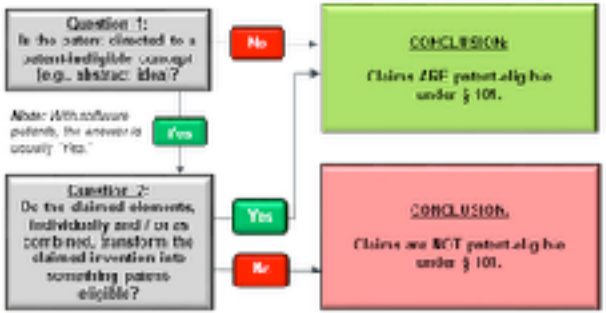
Patent or not?

1. Running bingo on a computer
2. Using a computer to help users plan meals while achieving diet goals
3. Using a computer to order a pizza with customized toppings
4. Prompting a user before establishing a new network connection
5. Automatically notifying users when an item is picked up or delivered
6. Using a computer network to ask people to complete tasks and then wait for them to do them
7. Using SMS to perform tasks (e.g., checking bank balance)
8. Selecting ALL images in a CAPTCHA that match a given text

The software patent system is broken!

Alice vs. CLS Bank (2014)

Case	Claimed Invention	Result	
Alice Corp. v. CLS Bank (June 19, 2014)	Method of computerized risk mitigation in financial settlements	✘ Step 1 ✘ Step 2	**NOT Patent Eligible** *Why?* Risk mitigation is a long-standing "fundamental economic practice" (step 1) and the claims merely required generic computer implementation (step 2)
DigiTech (July 11, 2014)	Method of digital image processing; used "device profiles" to organize devices' spatial and color properties	✘ Step 1 ✘ Step 2	**NOT Patent Eligible** *Why? Claimed "device profile" was intangible; method claims covered organization of information untethered to specific structure.*
buySAFE v. Google (Sep. 3, 2014)	Online transaction performance guarantee	✘ Step 1 ✘ Step 2	**NOT Patent Eligible** *Why? The claims are about creating a contractual relationship that is performed by any general purpose computer.*
Ultramercial v. Hulu (Nov. 14, 2014)	Internet-distribution of copyright material	✘ Step 1 ✘ Step 2	**NOT Patent Eligible** *Why? Offering media in exchange for viewing an advertisement is an abstract idea. Implementing it on the Internet does not transform it into patent eligible.*



https://www.orrick.com/Articles/The-Effect-of-the-Alice-Decision-on-Software-and-3D-Printing-Patents

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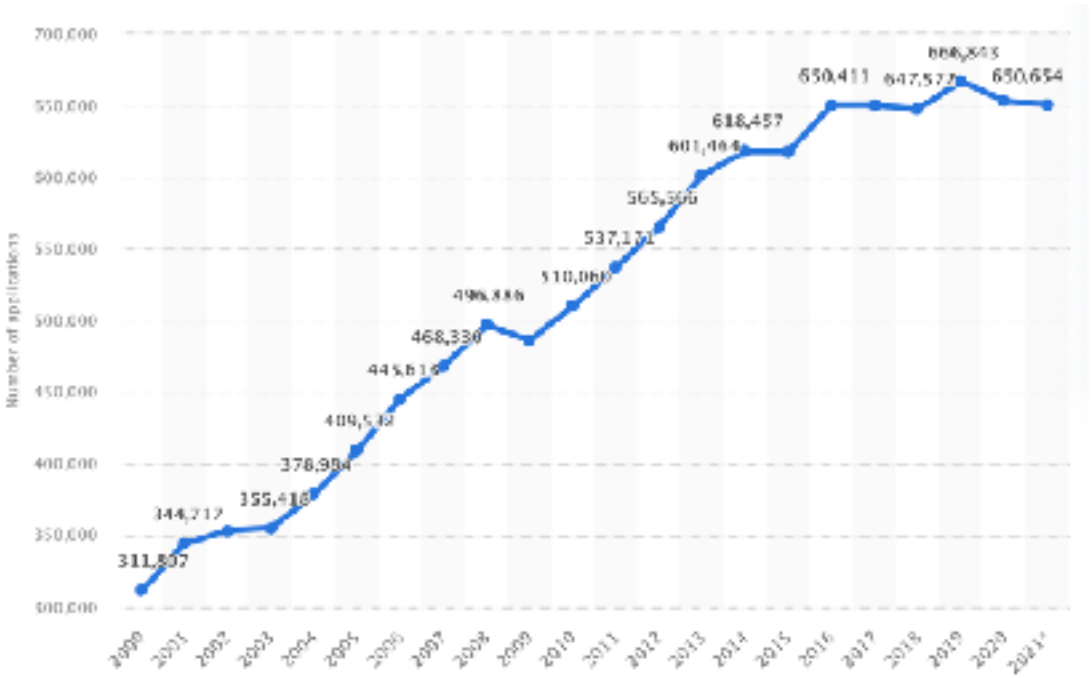
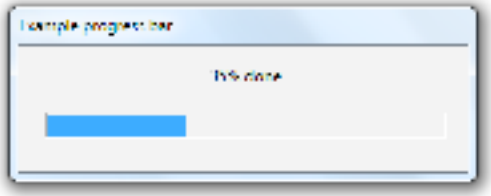
Problem: Inventive step and non-obviousness



https://www.statista.com/statistics/256554/number-of-patent-application-filings-in-the-us

US5960411A



US5301348A

Problem: Long patent pendencies and terms

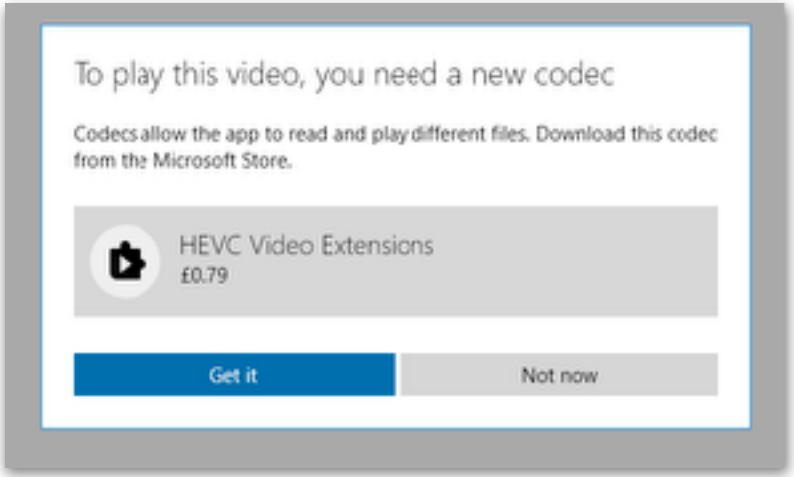
TABLE 4: **PATENT PENDENCY STATISTICS (FY 2021)**

Utility, Plant, Reissue Pendency Statistics by Technology Center (in months)	Average First Action Pendency	Total Average Pendency
Total Utility, Plant, and Reissue Pendency	**16.9**	**23.3**
Tech Center 1600—Biotechnology and Organic Chemistry	17.0	24.0
Tech Center 1700—Chemical and Materials Engineering	18.8	26.7
Tech Center 2100—Computer Architecture, Software, and Information Security	17.5	25.6
Tech Center 2400—Networks, Multiplexing, Cable, and Security	15.7	22.9
Tech Center 2600—Communications	13.5	19.9
Tech Center 2800—Semiconductor, Electrical, Optical Systems, and Components	15.7	22.3
Tech Center 3600—Transportation, Construction, Agriculture, and Electronic Commerce	18.1	25.9
Tech Center 3700—Mechanical Engineering, Manufacturing, and Products	18.6	26.7

https://www.uspto.gov/sites/default/files/documents/USPTOFY21PAR.pdf

Problem: Incompatibility

- PNG was invented to avoid GIF patent issues
- Opus is a patent-free MP3 alternative
- AV1 vs H265



Problem: Independent discovery doesn’t matter!

“The idea that I can be presented with a problem, set out to logically solve it with the tools at hand, and wind up with a program that could not be legally used because someone else followed the same logical steps some years ago and filed for a patent on it is horrifying.”

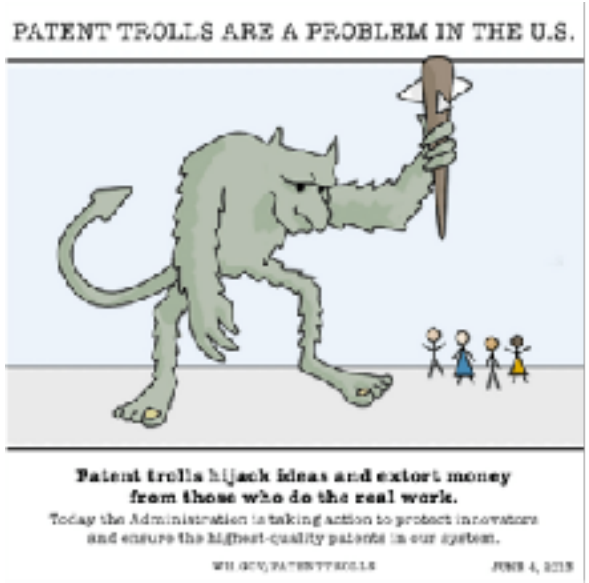
John Carmack

Problem: Only large organizations benefit

- **The patent system relies on people to challenge bad patents**
  - requires considerable time, money, and legal expertise
  - the US legal system requires both parties to pay legal fees (c.f., losers pay costs in Europe) *****
- US software patents cost between **$15,000 to $45,000!**
  - that's before you even apply for international patents!

https://www.patenttrademarkblog.com/how-much-patent-costs
https://www.eff.org/issues/patent-busting-project

Problem: Non-Practicing Entities (Patent Trolls)



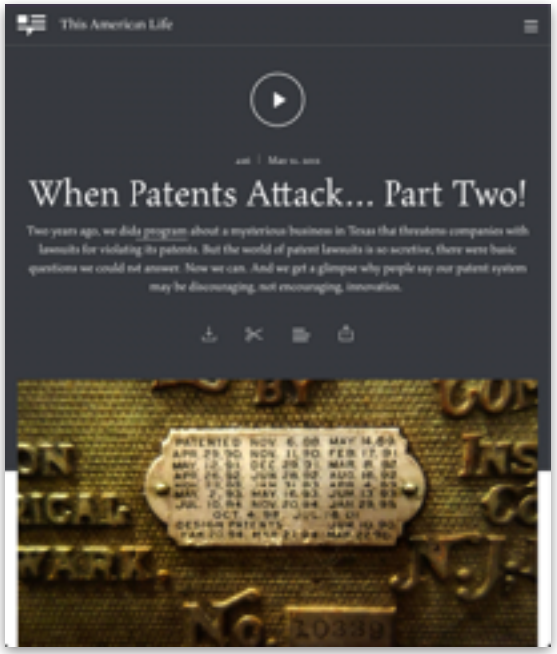
Problem: Innovation is Stifled

“As a developer for a small startup, absurd software patents are a constant worry. Stories abound of people like us getting pressured out of existence over the use of incredibly vague, basic interface elements and system components.”

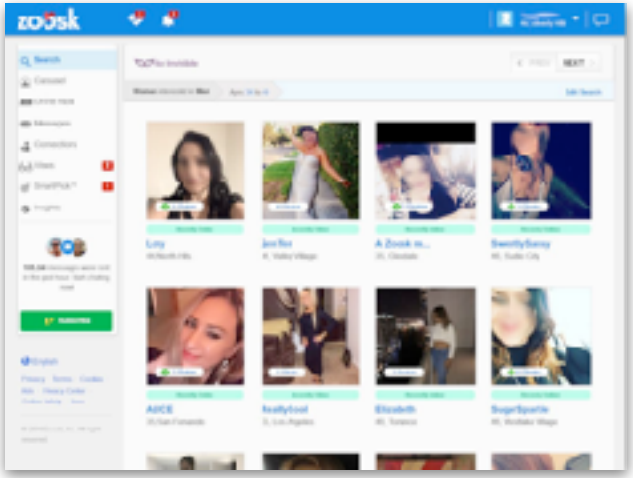
“Software patents are generally written in vague and nontechnical legal language, which obfuscates the patent in question . . . and also makes it easy to dramatically extend the patent to elements not considered at all when the patent was originally filed.”

This American Life: When Patents Attack!

- Innovatio sued libraries and coffee shops for providing WiFi in a public space
- Boadin has sued various media outlets, claiming that its patents are infringed whenever a word or phrase on your computer autocompletes
- NPHJ claims they hold a patent on “scanning and emailing documents”. They tried to sued non-profits for $1000 per employee in damages.



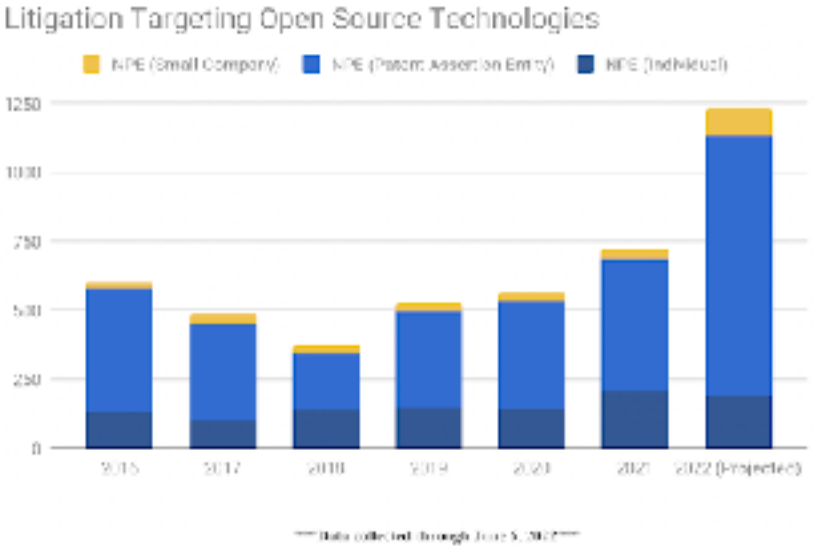
https://www.thisamericanlife.org/496/when-patents-attack-part-two

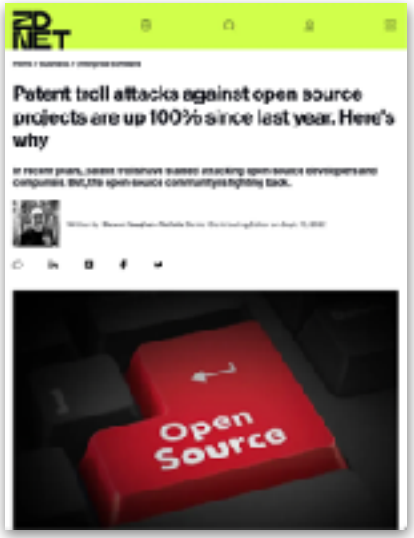


- Zoosk has a website that mobile devices can connect to
- Zoosk's server collects information from the mobile devices, including location and unique device identifiers
- Zoosk users can send and accept invitations to connect with and send messages to each other.
- Zoosk shares profile information of connected users, who are "members of a same social network" (i.e., they're on Zoosk)
- Zoosk can connect users who are in the immediate vicinity of each other, or a particular distance away

https://www.eff.org/deeplinks/2022/05/patent-troll-uses-ridiculous-people-finder-patent-sue-small-dating-companies

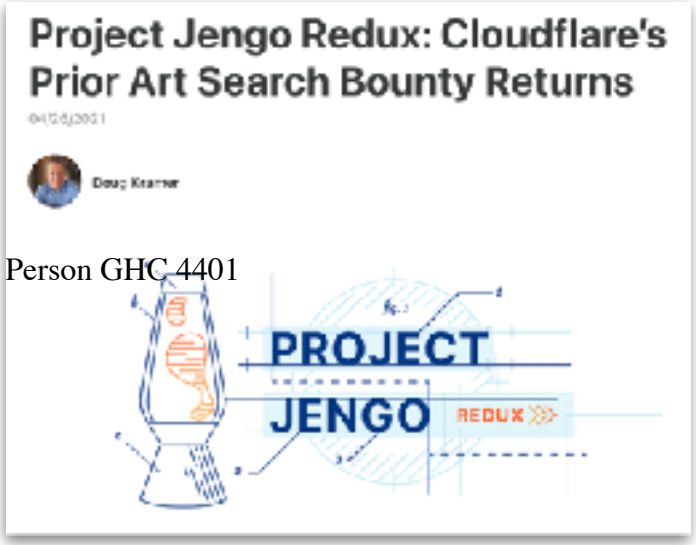
Problem: Open Source is under attack, too!





What next?

- Alternative licensing models
  - The Defensive Patent License (DPL)
  - The Open Invention Network (OIN)
  - License on Transfer (LOT)
- Bogus patent bounties
- Unified Patents
- Commonsense reform
- **Abolish software patents?**



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Considering Tradeoffs

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Life is all about tradeoffs

In this course, we have talked a lot about tradeoffs.

Some tradeoffs we have discussed:

- Writing Tests vs writing more features
- Choosing a familiar tech stack vs a “trendy one”
- Other tradeoffs…?

Think about structured ways to make decisions

Do what is ethical, legal, moral, obvious

Sometimes, there are multiple (legitimate) options, that all seem to have positives and negatives.

What to do?

People have studied this before...

Economics

Biology + Microbiology

Sociology

Engineering

Computer Science

Strategy Games

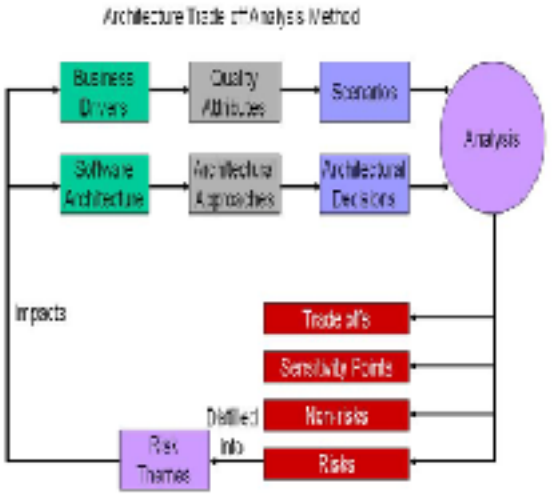
Ethics

Medicine

Politics

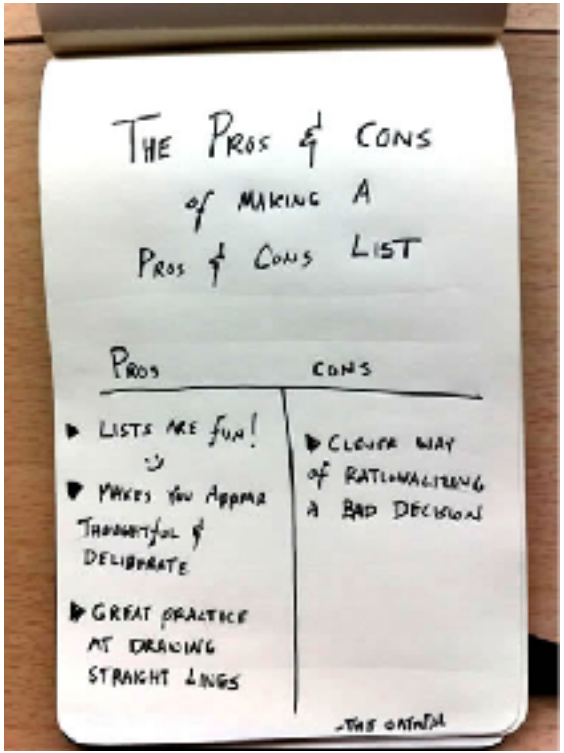
Architecture Tradeoff Analysis Method

1. Present the ATAM.
2. Present business drivers.
3. Present architecture.
4. Identify architectural approaches.
5. Generate quality attribute utility tree.
6. Analyze architectural approaches.
7. Brainstorm and prioritize scenarios.
8. Analyze architectural approaches.
9. Present results.



https://concisesoftware.com/architecture-tradeoff-analysis-method-atam/

Pros and cons



https://theoatmeal.com/blog/pros_cons_list

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Moral or Prudential Algebra

1. Make a list of Pros and Cons
2. Take a few days to think, forcing your brain to come up with all of the positive and negative aspects of taking the measure you're considering.
3. Assign weights to each item on your list depending on its importance.
4. When the weight of a item on your "pro" list is equal to the weight of an item on your "con" list, strike both of them out.
5. What is left in the balance is the choice you need to make. Wait a few more days and, if nothing new occurs to you, act on the decision you've made.

Even Swaps

Premise:

It is easy to make decisions when there is only one objective.

But having only one objective, as any decision maker knows, is a rare luxury.

Even swaps provides a practical way of making trade-offs among any set of objectives across a range of alternatives.

Overview - 3 step process

1. Create a Consequences Table

2. Eliminate “Dominated” Alternatives

3. Make Even Swaps

Running Example from research paper

Example: Alan Miller is a computer scientist who started a technical consulting practice three years ago.

For the first year, he worked out of his home, but as his business grew he decided to sign a two-year lease on some space in the Pierpoint office park.

Now that lease is about to expire. He needs to decide whether to renew it or move to a new location.

Define the objectives

Alan defines five overriding objectives that he needs his office to fulfill:

1. a short commute from home
2. good access to his clients
3. good office services (clerical assistance, copiers and fax machines, and mail service)
4. sufficient space
5. low costs

He finds five viable alternatives: Parkway, Lombard, Baranov, Montana, and his current building, the Pierpoint.

Create Consequences Table

Objectives	Parkway	Lombard	Baranov	Montana	Pierpoint
Commute in Minutes	45	25	20	25	30
Customer Access (%)	50	80	70	85	75
Office Services	A	B	C	A	C
Office Size (Square Feet)	800	700	500	950	700
Monthly Cost ($)	1850	1700	1500	1900	1750

https://hbr.org/1998/03/even-swaps-a-rational-method-for-making-trade-offs

Create Ranking Table

Objectives	Parkway	Lombard	Baranov	Montana	Pierpoint
Commute in Minutes	45 (5th)	25 (2nd tie)	20 (1st)	25 (2nd tie)	30 (4th)
Customer Access (%)	50 (5th)	80 (2nd)	70 (4th)	85 (1st)	75 (3rd)
Office Services	A (1st tie)	B (3rd)	C (4th tie)	A (1st tie)	C (4th tie)
Office Size (Square Feet)	800 (2nd)	700 (3rd tie)	500 (5th)	950 (1st)	700 (3rd tie)
Monthly Cost ($)	1850 (4th)	1700 (2nd)	1500 (1st)	1900 (5th)	1750 (3rd)

https://hbr.org/1998/03/even-swaps-a-rational-method-for-making-trade-offs

Eliminate “Dominated” Alternatives

Objectives	Parkway	Lombard	Baranov	Montana	Pierpoint
Commute in Minutes	45 (5th)	25 (2nd tie)	20 (1st)	25 (2nd tie)	30 (4th)
Customer Access (%)	50 (5th)	80 (2nd)	70 (4th)	85 (1st)	75 (3rd)
Office Services	A (1st tie)	B (3rd)	C (4th tie)	A (1st tie)	C (4th tie)
Office Size (Square Feet)	800 (2nd)	700 (3rd tie)	500 (5th)	950 (1st)	700 (3rd tie)
Monthly Cost ($)	1850	1700	1500	1900	1750

https://hbr.org/1998/03/even-swaps-a-rational-method-for-making-trade-offs

Make Even Swaps

1. Determine the change necessary to cancel out an objective.
2. Assess what change in another objective would compensate for the needed change.
3. Make the even swap.
4. Cancel out the now-irrelevant objective.
5. Select the dominant alternative.

First Even Swaps

- For Baranov, swap 5 commute minutes, for 8% customer access.

Objectives	Lombard	Baranov	Montana
Commute in Minutes	~~25 (1st tie)~~	~~20~~ ~~25 (1st tie)~~	~~25 (1st tie)~~
Customer Access (%)	80	~~70~~ 78	85
Office Services	B	C	A
Office Size (Square Feet)	700	500	950
Monthly Cost ($)	1700	1500	1900

Second Even Swaps

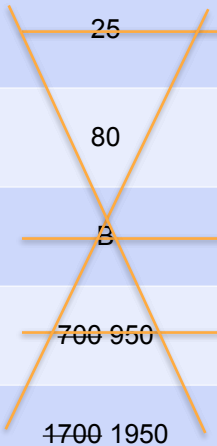
- For Baranov, swap C->B, add $200, for Montana, swap A->B, reduce $100

Objectives	Lombard	Baranov	Montana
Commute in Minutes	~~25~~	~~25~~	~~25~~
Customer Access (%)	80	78	85
Office Services	~~B~~	~~C~~ B	~~A~~ B
Office Size (Square Feet)	700	500	950
Monthly Cost ($)	1700	~~1500~~ 1700	~~1900~~ 1800

Second Even Swaps

- For Lombard, swap 250 sq ft for $250

Objectives	Lombard	Montana
Commute in Minutes	~~25~~	~~25~~
Customer Access (%)	80	85
Office Services	~~B~~	~~B~~
Office Size (Square Feet)	~~700~~ ~~950~~	~~950~~
Monthly Cost ($)	~~1700~~ 1950	1800



Advice for swaps

- Make the easier swaps first
- Concentrate on the amount of the swap, not on the apparent importance of the overall objective.
- Remember that the value of an incremental change depends on what you start with.
- Make consistent swaps.
- Seek out solid information.