An Introduction to the Patent Field

David Cinciruk and Mengke Hu

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Our Motivation

- Want to find a good problem to approach with machine learning
- Decided to choose a topic related to the Patent field
  - Timely Field - New Legislation altered how patents are accepted
  - Many Possible Clients - Large Corporations, Governments, Law Firms, and even Individuals are all part of this field
  - Well Structured Data - Patent Claims are generally wrote in a very particular way
  - Large Free Labeled Database - USPTO has original patent applications, accepted patents, and all office actions available in databases on their website
  - Low Amount of Scholarly Work Compared to Other Fields

What are Patents?

- A patent is a set of exclusive rights granted by a sovereign state to an inventor or assignee for a limited period of time in exchange for detailed public disclosure of an invention
- Need to satisfy a novelty requirement and a non-obviousness requirement
- Three Types of Patents
  - Utility
  - Design
  - Plant

Utility Patents

- The "typical patent"
- Contains both legal and technical descriptions of the invention
  - **Claims (Legal Description)** - description of the invention in the broadest possible way to avoid infringing on currently developed inventions
  - **Specifications (Technical Description)** - description of the invention the way the inventor sees it, may include some more details about how it will be constructed and what it will be used for as well as sketches of the invention. Descriptions in this section help to define terms in claims

Utility Patents - Claims of Patent #8,669,676

1. A system, comprising: a source resonator coupled to an energy source generating a field having magnetic material; and a second resonator located a variable distance from the source resonator having magnetic material and not connected by any wire or shared magnetic material to the source resonator, wherein the source resonator and the second resonator are coupled to provide near-field wireless energy transfer among the source resonator and the second resonator; wherein the field of at least one of the source resonator and the second resonator is shaped using magnetic materials to increase the coupling factor among the resonators.
2. The system of claim 1, wherein the distance between the resonators is greater than 5 cm.
3. The system of claim 1, wherein the distance between the resonators is greater than 10 cm.

Design Patents

- Patents granted for a novel product design
- Only information about item are pictures and their captions

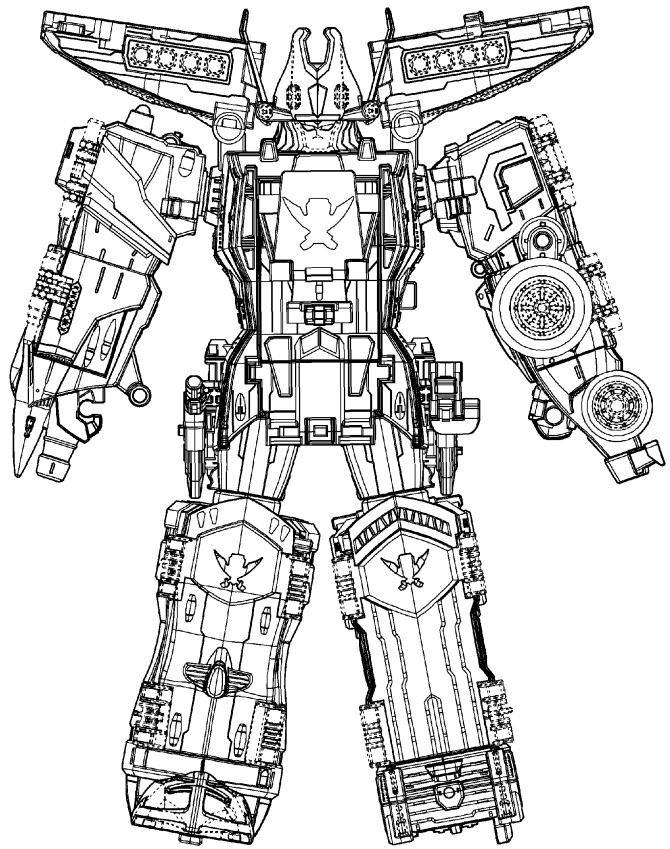


FIG. 1

Plant Patents

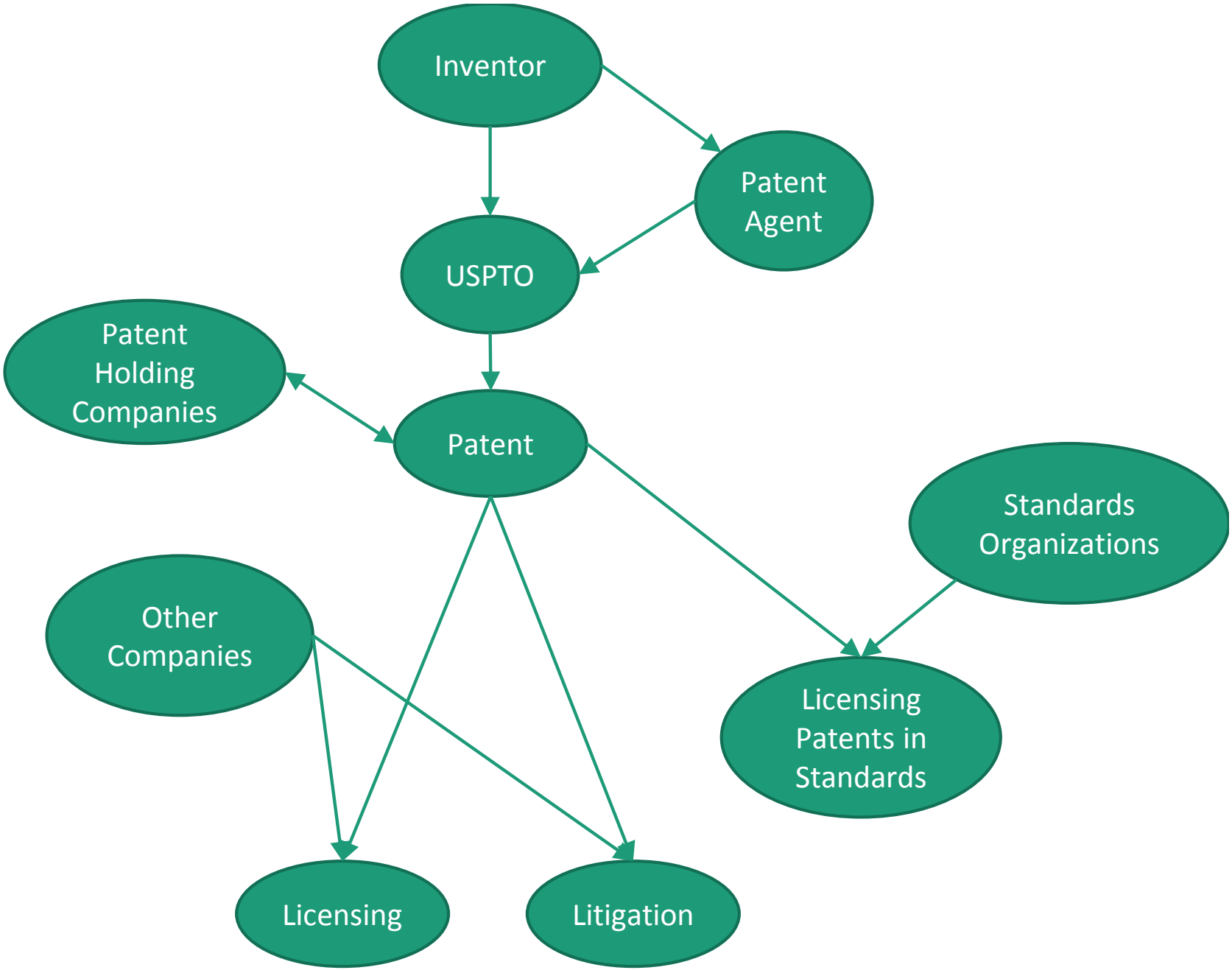
- Patents can be granted for hybridizing different types of plants
- Usually contains who the two parents were, properties of the new hybrid, and photos of the new hybrid

Plant Patents - PP24,209

- Open Pollinated seed of CVAC 45 (PI 296412)
- 0.82 meters tall
- Bush is 0.6 meters wide
- Bush produces average of 1.83 kg of berries on 3-year-old plants

FIG. 2

Lifecycle of a Patent



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The Types of Inventors

- Freelance Inventor
- Employee for a Company
- University Researcher

Freelancer vs. Companies

Freelancer

1. Owns the Patents
2. Usually Seeks a Patent
3. Higher Chance of Messing Up the Patent Application
4. Not Enough Resources for Suing for Infringement

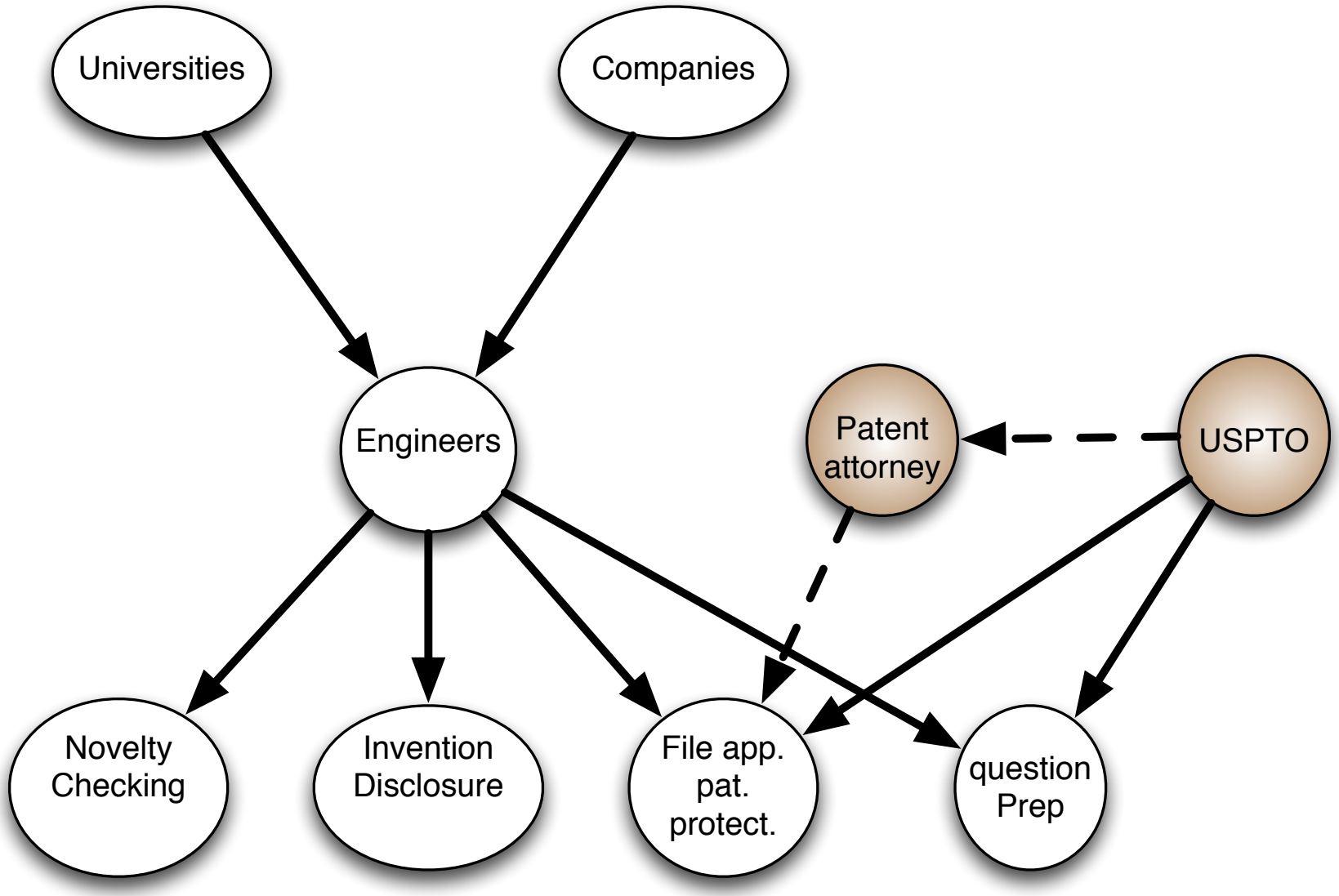
Company Engineers

1. Gives Up Ownership to the Company
2. May Not Necessarily Seek a Patent
3. Has Legal Department and may contract the Application to Outside Law Offices
4. Generally Has Enough Capital and Resources to Sue

University Researcher

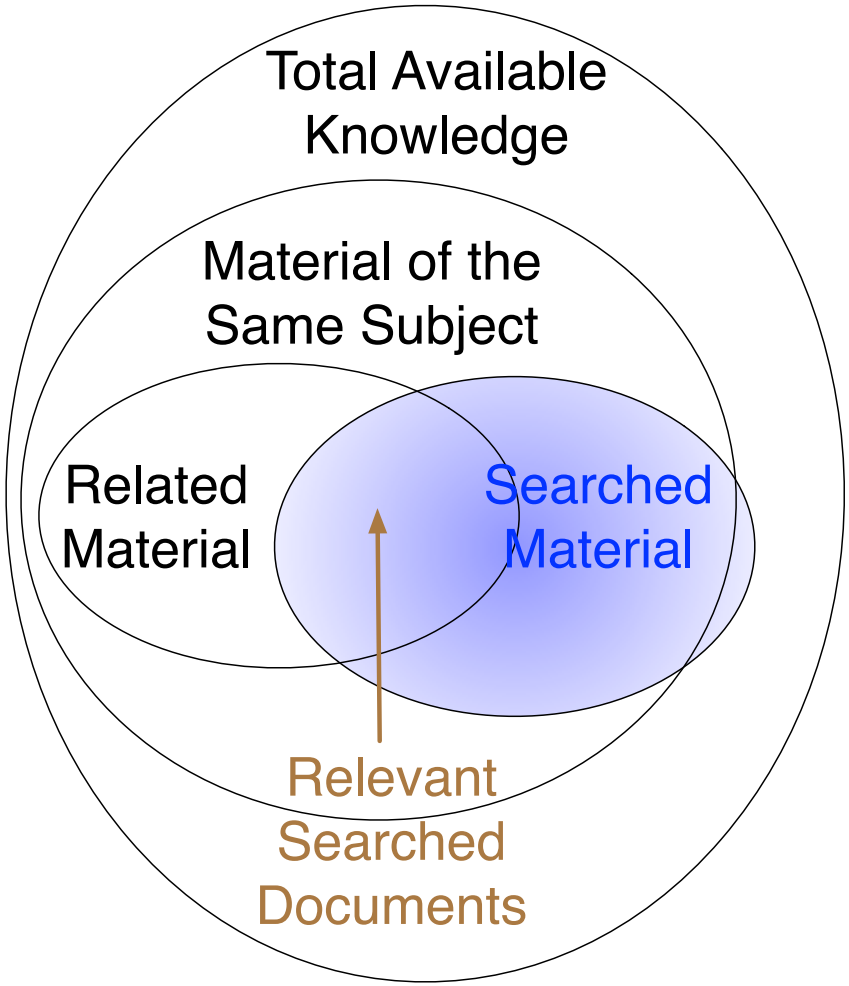
- Universities have their own policy for dealing with patents and research achievements
- Researchers do not invent for the purpose of creating a patent or even to try to sell the product but instead to further the knowledge of the field
- Inventions are patented once they're realized they're novel enough and non-obvious enough to obtain a patent

How to Invent and Get a Patent

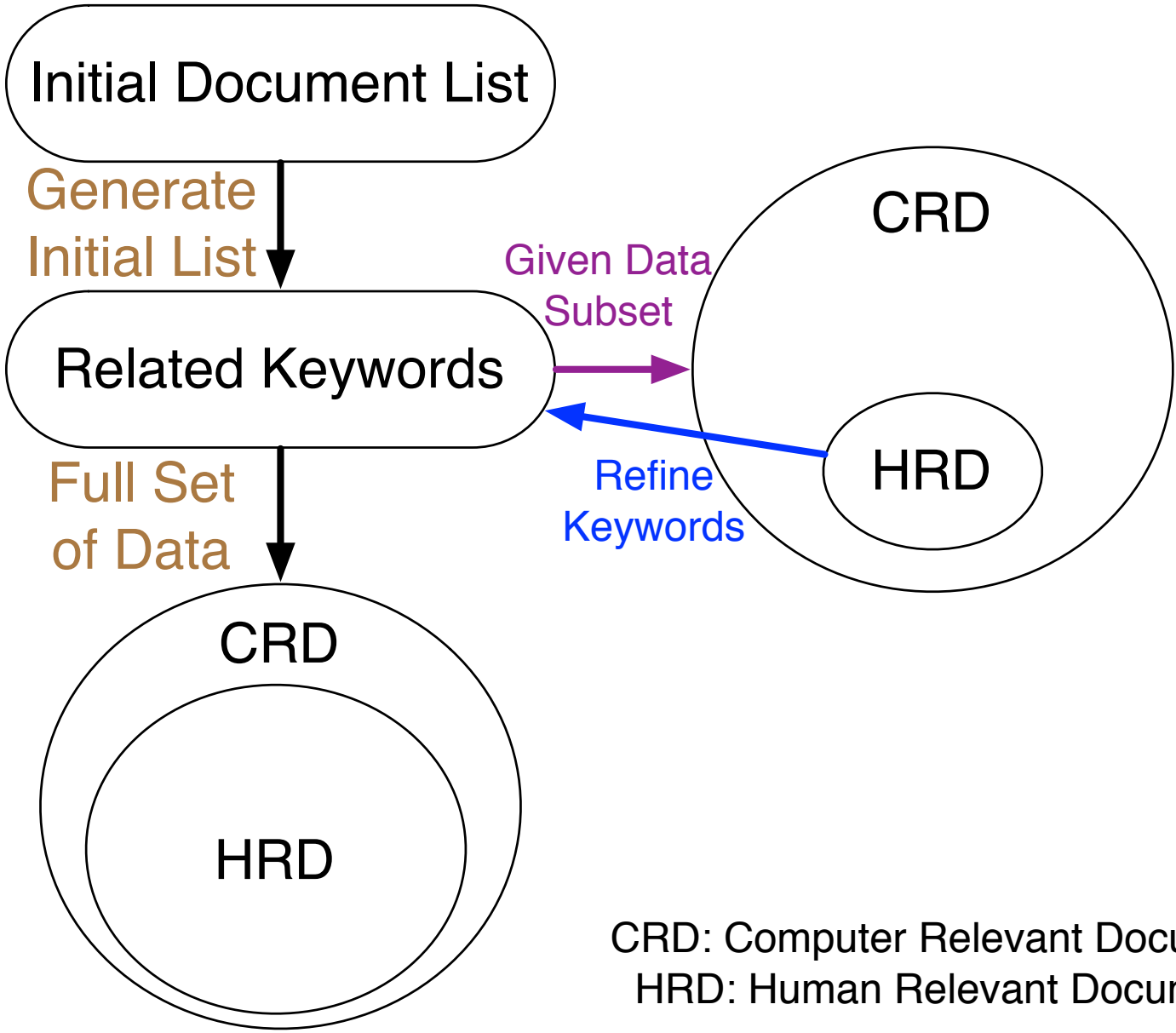


Novelty Check

- Search for prior art to ensure that invention hasn't already been invented
- Typically use patent databases and databases of scholarly journals to ensure invention has not already been invented
- Requires finding and reading all related material on the invention in question



Automated Novelty Check



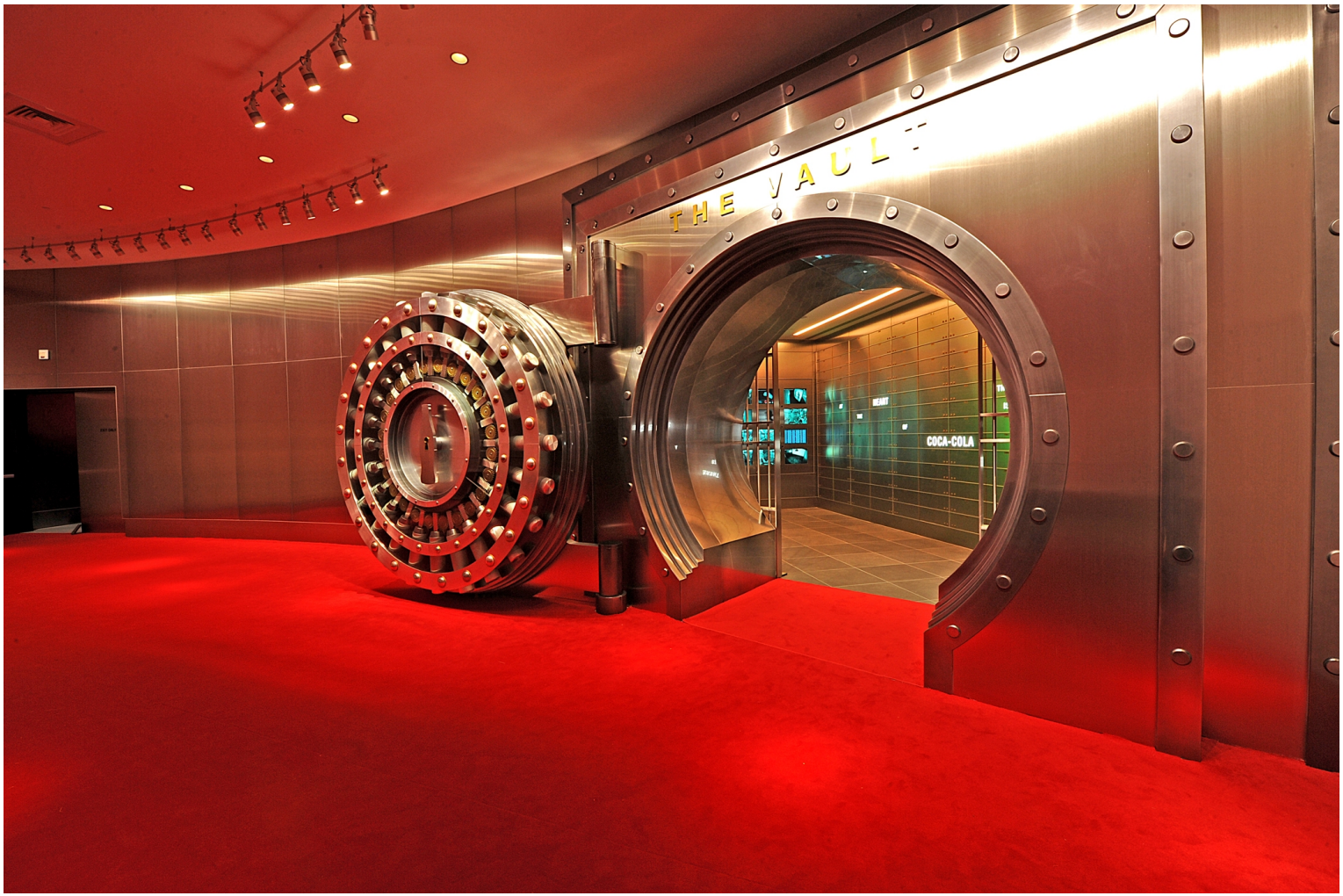
CRD: Computer Relevant Document
HRD: Human Relevant Document

Invention Disclosure Statement

- Submission of your prior art search to the USPTO
- Failure to do so may result in the patent being declared unenforcable
- Information classified into three categories: US Patents, International Patents, and Non-Patent Literature

Trade Secrets

- Can keep invention a secret instead of patenting it to try to make more money from it



Coca Cola's trade secret is so famous that now it has its own vault for the public to visit

Benefits of Trade Secrets vs. Patents

Trade Secrets

- People must reverse engineer to learn how to make rather than just reading the patent
- Can potentially keep benefiting forever if competitors can't discover how to develop it
- There are no attempts to "invent-around" invention since its procedure isn't freely available

Patents

- Guaranteed protection for 20 years (some inventions may not be viable 20 years from now)
- Invention can be reverse engineered and even patented by competitors legally if it is not already patented
- Trade Secrets require a great deal of trust to ensure they are not revealed

Cost-Benefit Analysis

- Can form a minimization problem to either determine whether to patent or keep a secret or the expected loss of patenting or keeping a trade secret
- Requires an educated estimate of the probabilities that a potential trade secret or patent could be circumvented
- Sample Cost-Benefit Analysis Curve

$$(P_{TS} - C_{TS}) \times \max\left(\mathbb{E}[Rel|Geo(Rel)], \mathbb{E}[TS|Geo(TS)]\right) =$$

$$P_{Pat} \times \max\left(\mathbb{E}[Rel|Geo(Rel)], \mathbb{E}[IA|Geo(IA)], 20\right)$$

Expected Loss from Keeping Trade Secrets

- Landis and Posner in their book *The Economic Structure of Intellectual Property Law* suggest a formula for calculating the expected loss

$$L^* = [p(x)(1-q(y))+q(y)(1-p(x))+q(y)p(x)]L+x+y \quad (1)$$

- p and q represent the probability of losing a trade secret either by common law wrong or accidental disclosure/reverse engineering, x and y are the firm's expenditures in preventing those wrongs, and L is the loss in either case
- By minimizing L^* we chose an x and y such that

$$p_x(1-q)L+1=0 \text{ and } q_y(1-p)L+1=0 \quad (2)$$

- Thus the greater the value of the trade secret, the more the firm would have to spend to protect it

Determining the parameters

- Many undefined parameters in the model
- To complicate it, for example, your profits after the expiration of your exclusivity may be higher because of brand recognition
- Computers may be used to estimate some of these parameters, but there are many parameters that may not have been modeled

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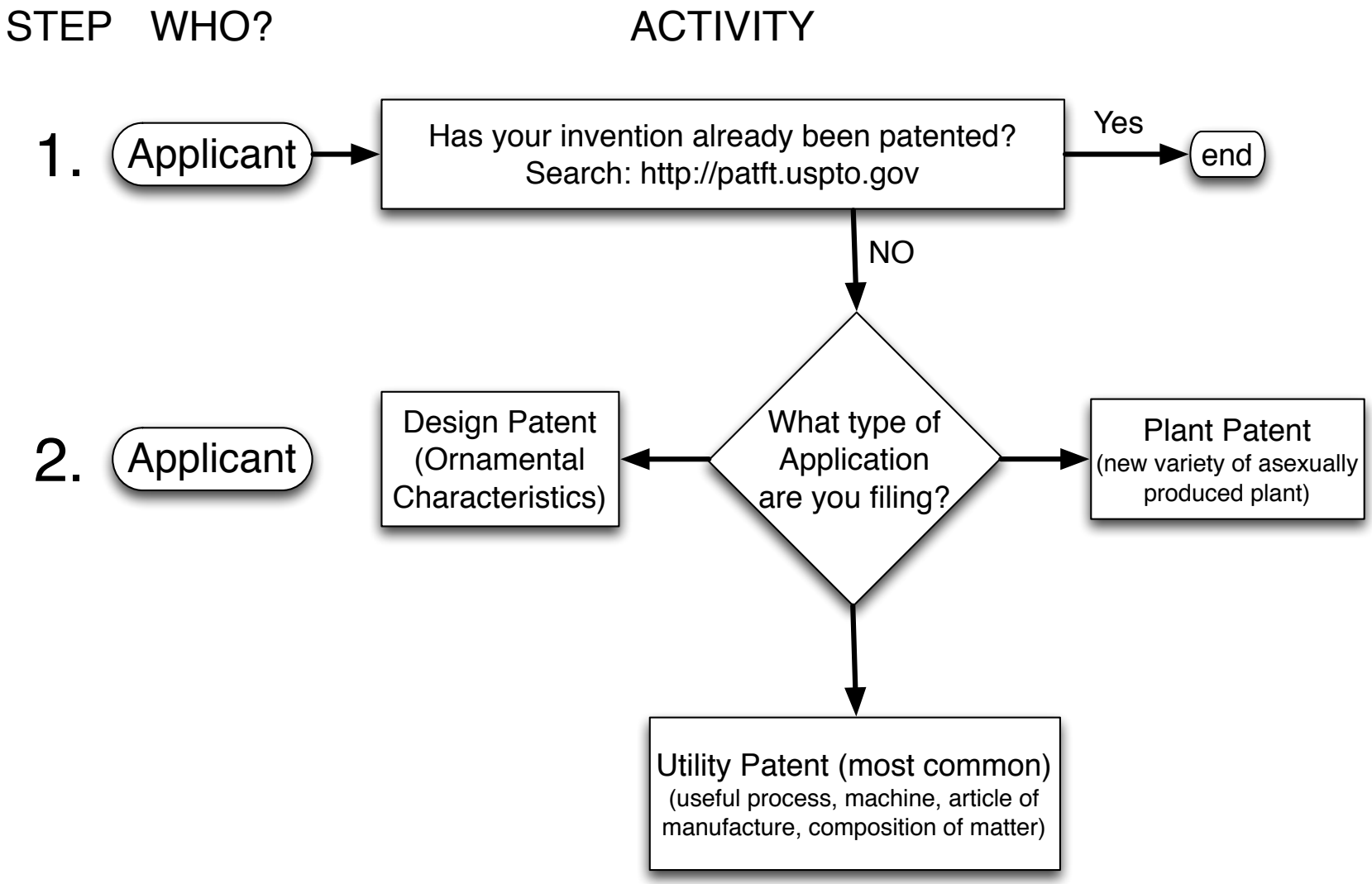
What are Patent Agents

- People that have a license to practice and represent clients before the United States Patent and Trademark Office
- Can prepare, file, and prosecute patent applications for clients
- CANNOT advice a client on matters relating to licensing of an invention, whether to appeal a decision by the Patent Office to court, or represent clients during litigation suits (must also have a law degree to do that)

Steps to Get a Utility Patent According to the USPTO



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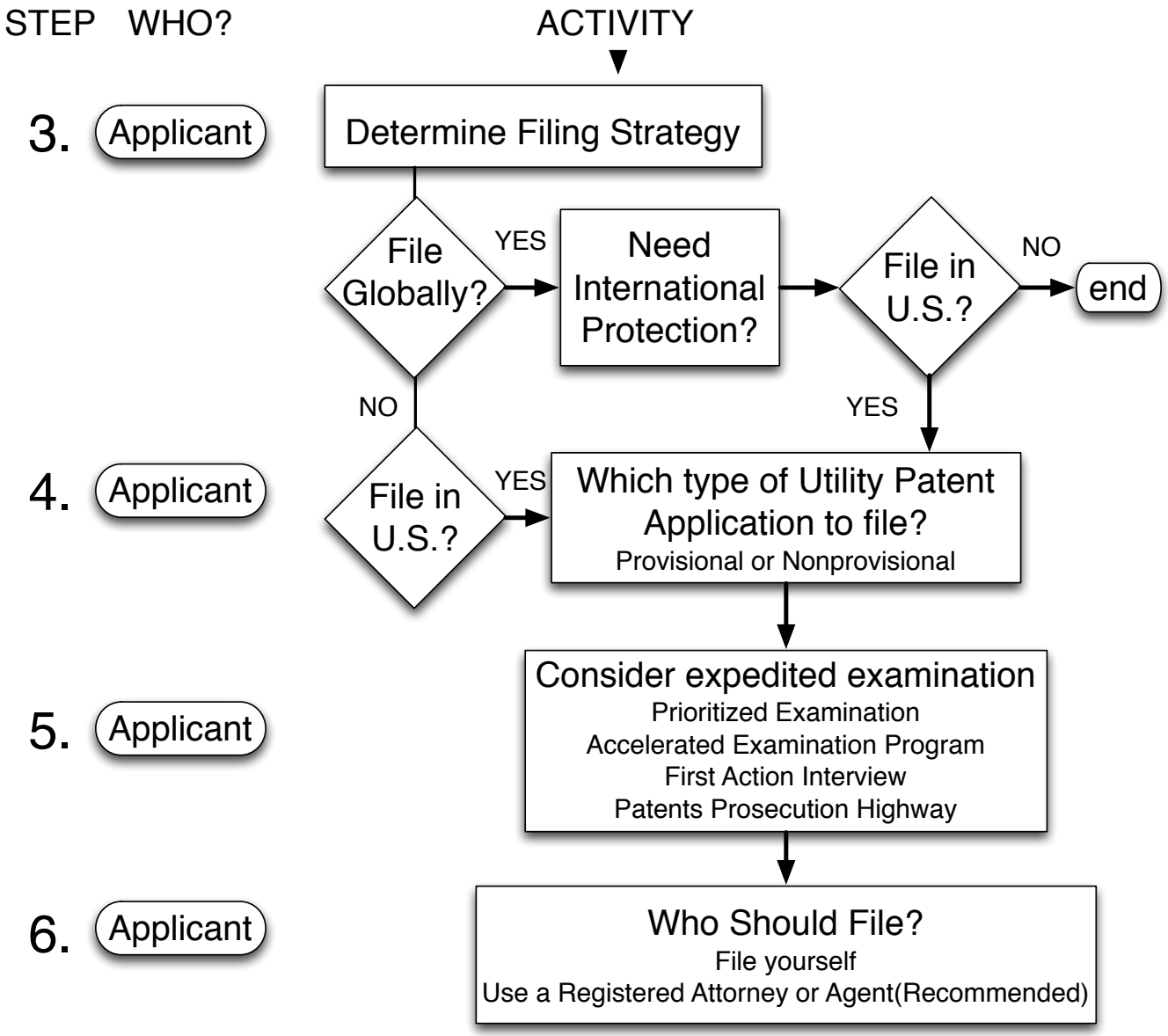

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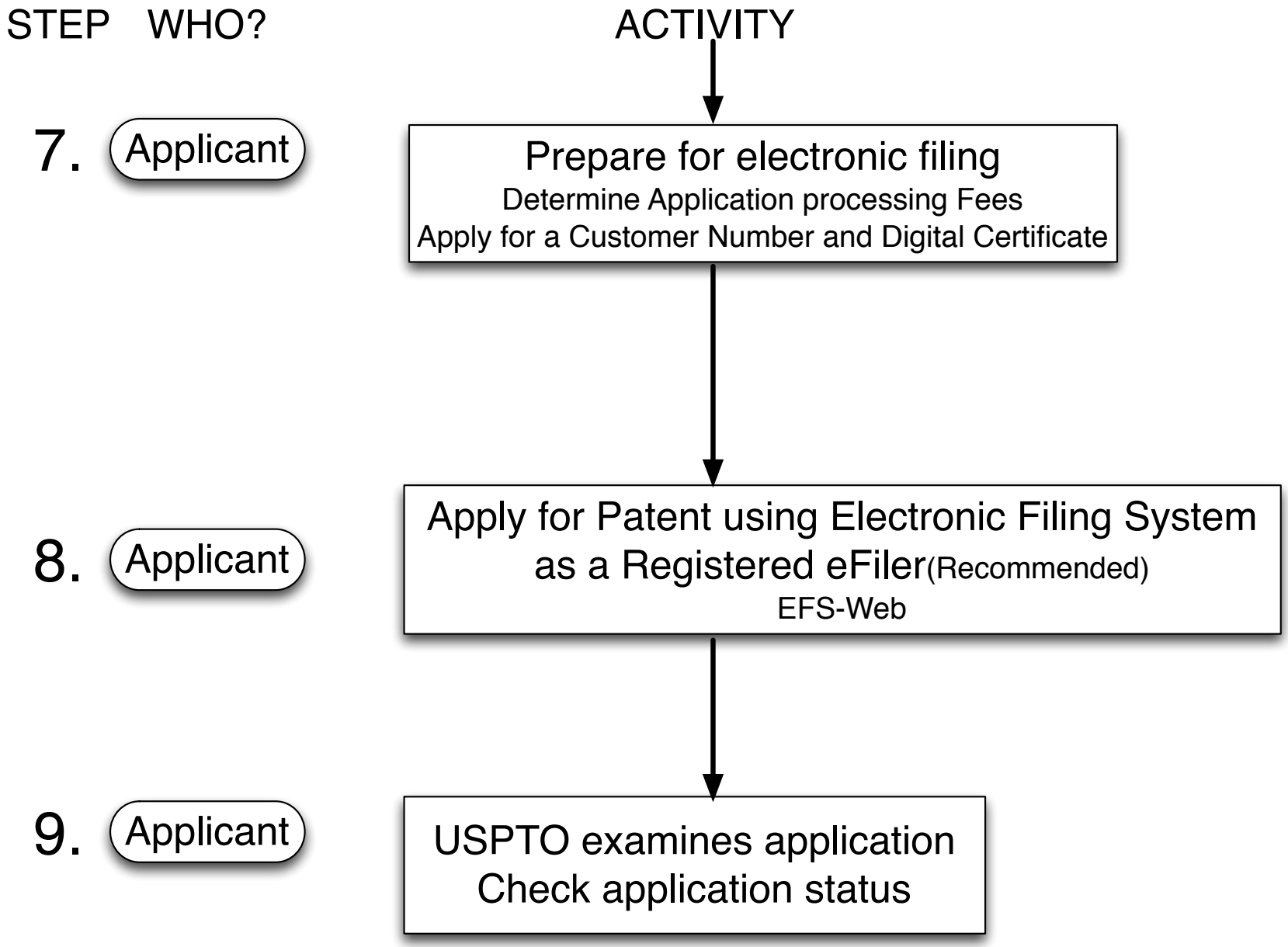

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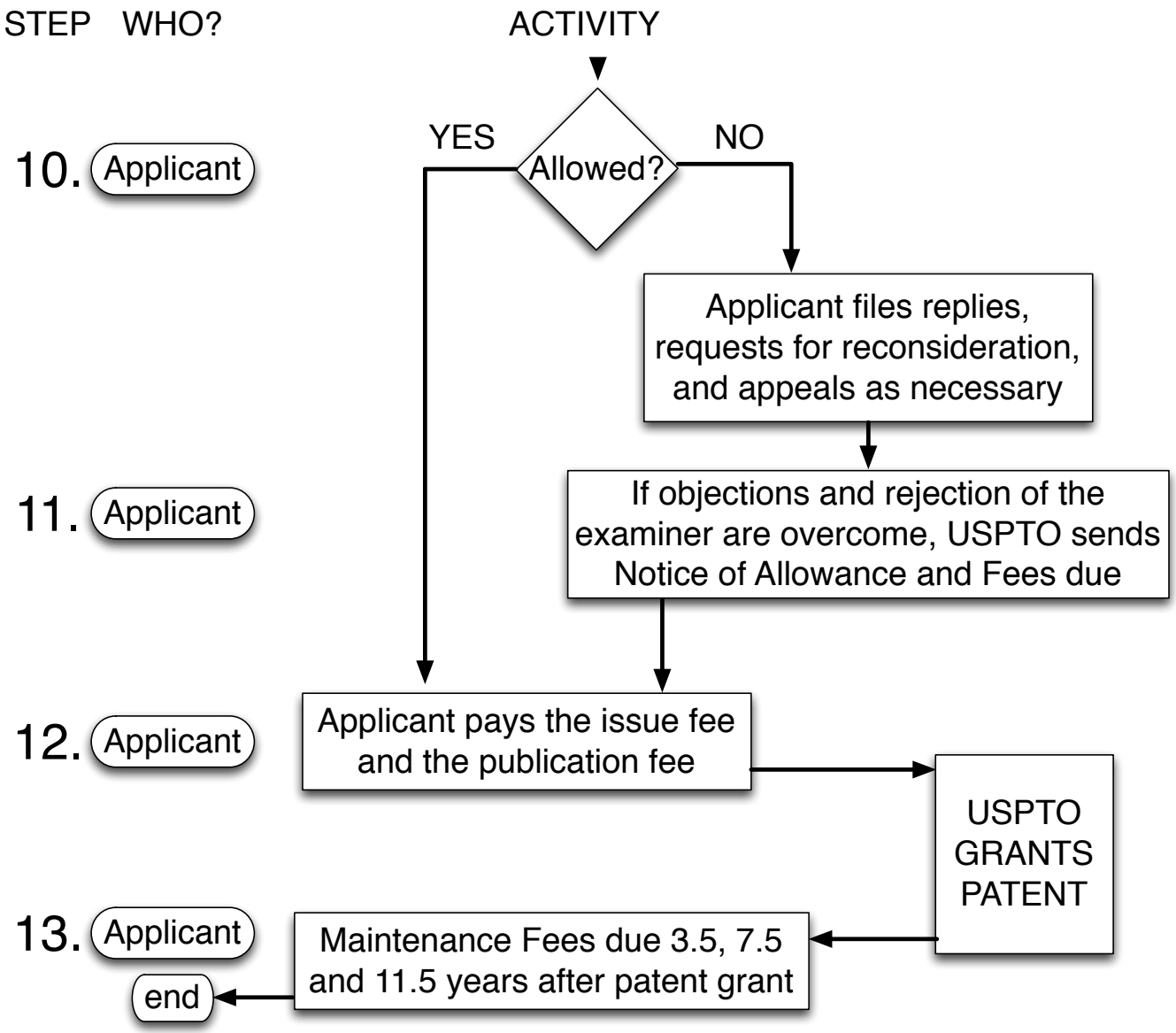


Preparing the Application

- Patent Agent plays a crucial role in preparing and helping to edit the application
- Specification is generally developed by working closely with the inventor
- Most important part of developing the application is in developing the claims

Patent Claims

- They define in technical terms the extent of protection given by a patent
- Portion of the patent document that is used to determine validity of the patent as well as provide the wording to check if an item is infringing on the patent
- Because of that it has a very particular wording and are typically as broad as possible to include all potential "invent arounds" for the commercial product

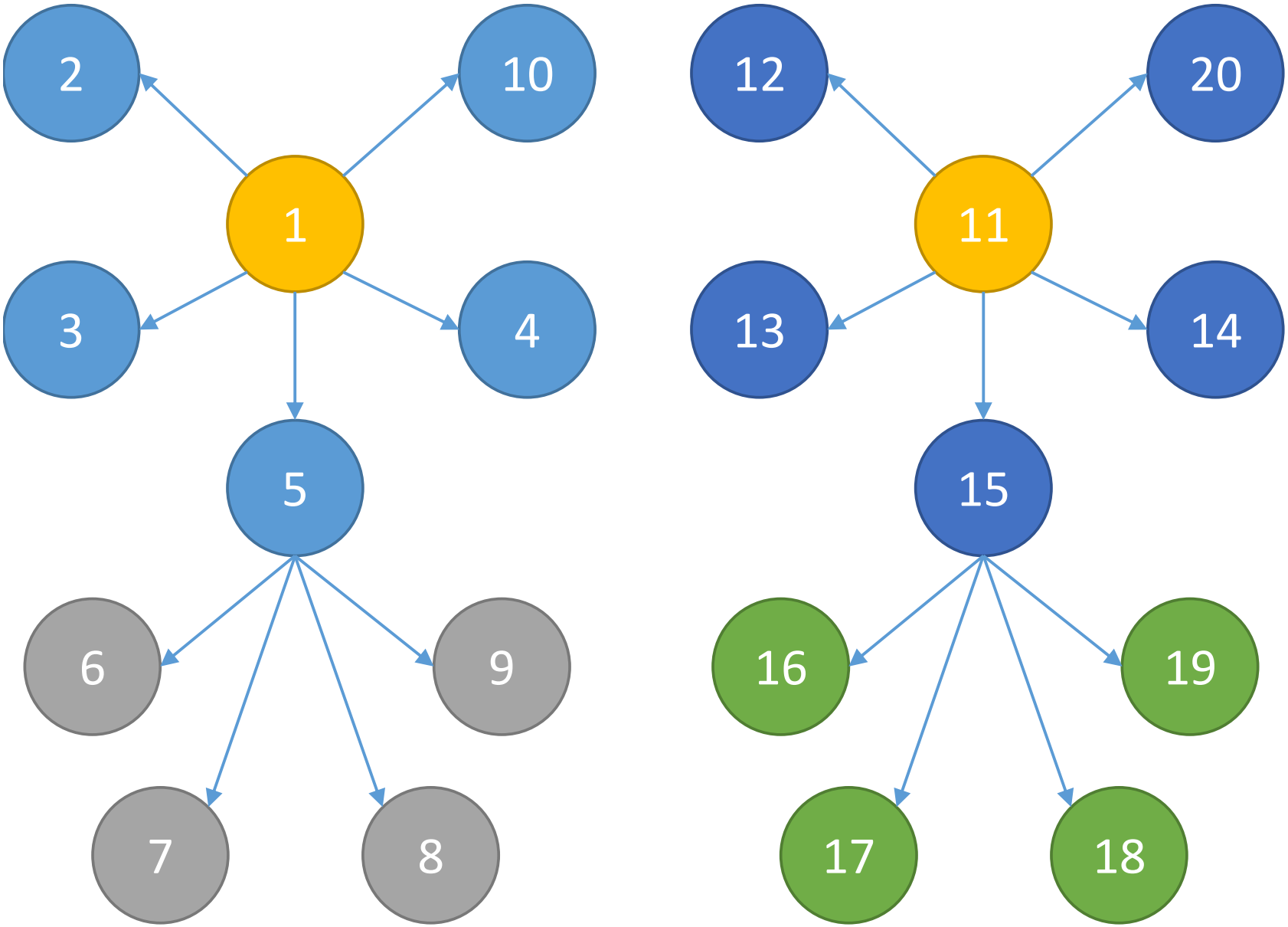
Reiteration of Claims from Patent #8,669,676

1. A system, comprising: a source resonator coupled to an energy source generating a field having magnetic material; and a second resonator located a variable distance from the source resonator having magnetic material and not connected by any wire or shared magnetic material to the source resonator, wherein the source resonator and the second resonator are coupled to provide near-field wireless energy transfer among the source resonator and the second resonator; wherein the field of at least one of the source resonator and the second resonator is shaped using magnetic materials to increase the coupling factor among the resonators.
2. The system of claim 1, wherein the distance between the resonators is greater than 5 cm.
3. The system of claim 1, wherein the distance between the resonators is greater than 10 cm.

Independent or Dependent Claims

- Claims can be either Independent or Dependent
  - Independent Claims are the broadest of the claims that cover everything in the invention along with any variations that would essentially produce the same invention
  - Dependent Claims narrow down the claim it's dependent on to a version of the invention that was produced. Always refer to the parent claim in the claim

Claim Map of Patent #8,669,676



Structure of a Claim

1. A system, comprising: a source resonator coupled to an energy source generating a field having magnetic material; and a second resonator...

- Preamble: tells the type of invention, its purpose or goals, or its relationship to prior art
- Comprising/Consisting Of
  - Comprising: Has the following but may contain other unnamed components
  - Consisting of: Has the following and ONLY the following
- Claim Body: lists the elements that are included. Each element must be described uniquely in the claim

Patent ClaimMaster

- Software Package that helps Patent Agents proofread patent application
- Also streamlines patent prosection and litigation tasks
- Available as a Microsoft Word Add-On

Patent ClaimMaster Features

- Detects logical errors in claims and specification
- Identifies missing and ambiguous anticedent references
- Automatically completes references and detects inconsistencies in references
- Generates Patent Family Trees
- Automates various tasks with interacting with the PTO
- Renumbers claims

Text2PTO

- Software from USPTO providing ease of use tools for Applicants and Examiners
- Allows Applicants to Upload Application to a Validator to Ensure Proper Formatting
- Tells you if you left on “Track Changes” or private information
- Allows for edits to easily be made
- Generates Patent Family Trees

Patent Family Tree

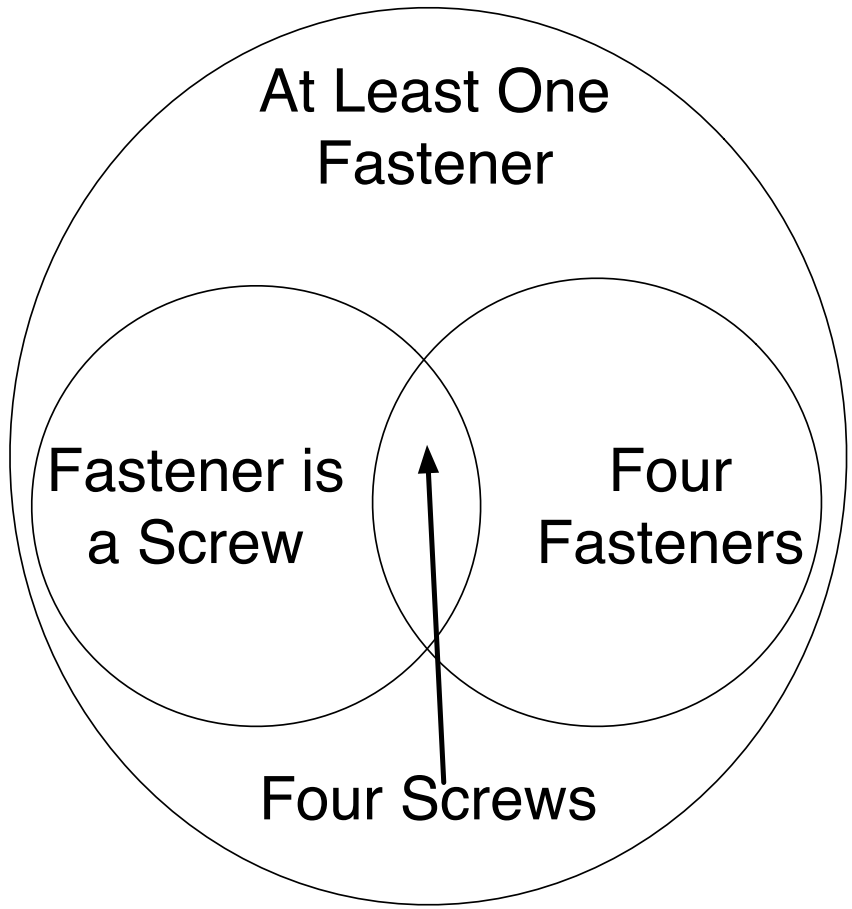
- Map that shows how one patent is related to others - maps of the patent's references and who references the patent
- Example Shown on Board

Potential Outlets for Automation

- These tools only help ensure that the claims are using the correct grammar, structure, and numbering scheme
- Automated tools may help with identifying ways to broaden the claims by learning the common broader terms and phrases and what terms they contain and suggesting them when someone tries to write a less broad term.
- Problem arises from trying to learn the database of phrases and potential broadening

Example of Broadening

- Original:
  - "...four screws holding the case to the body..."
- Revised:
  - "...at least one fastener holding the case to the body..."
  - "The fastner of claim X, wherein the fastner is a screw"



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What is the USPTO

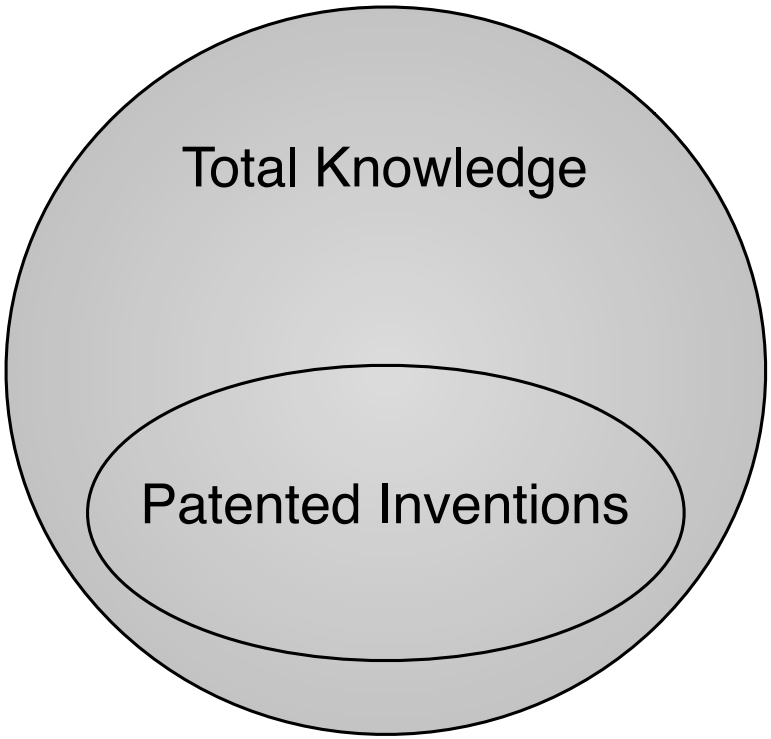
- Office involved with processing and issuing patents and trademarks in the United States
- Needs to ensure invention or idea is actually theirs

USPTO Patent Validation

- Ensure patent application has no errors
- Ensure the invention has not already been invented
- Ensure the Invention is Non-Obvious
- Discover any prior art that is not yet recognized in the patent

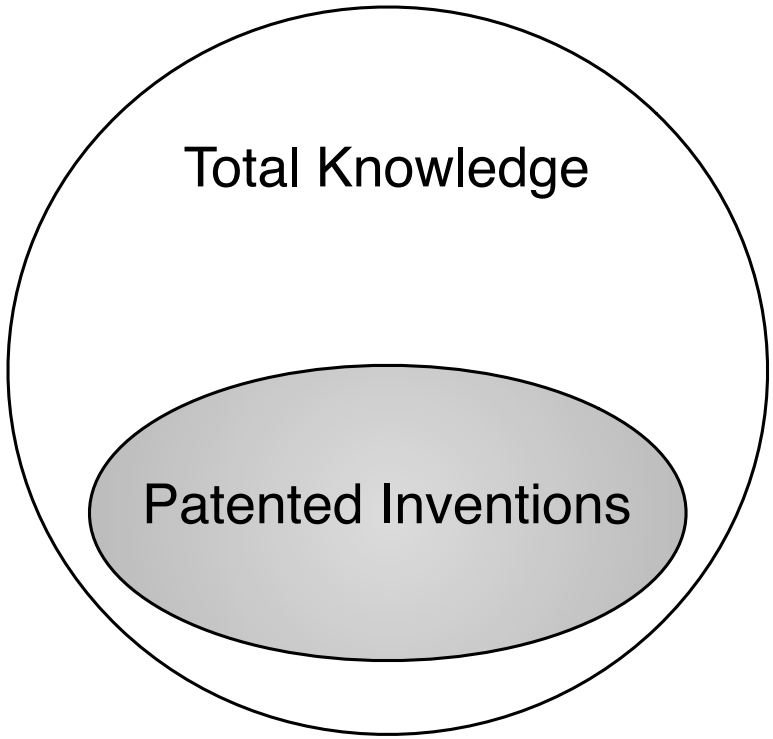
America Invents Act

Before March 16, 2013



First-to-Invent

After March 16, 2013



First-Inventor-to-File

Prior Art Search in the USPTO

- Need to discover if invention has already been patented
- Examiners typically spend less than a day on each patent
- EAST and WEST: Keyword search programs for searching over patents
- ABSS: Biosequence Search tool that returns results if functionally equivalent sequences

USPTO Strategic Plan

USPTO Released Strategic Plans for Improving themselves. These plans include:

- Provide timely examination of patent applications
- Improve quality of patent examination
- Improve/enhance patent appeal and post-grant processes
- Items involving trademarks and the overarching politics of the office

Optimizing Patent Quality and Timeliness

- Re-Engineer Patent Process to Increase Efficiencies and Strengthen Effectiveness
- Increase Patent Application Examination Capacity
- Improve Patent Pendency and Quality by Increasing International Cooperation and Work Sharing
- Measure and Improve Patent Quality
- Improve Appeal and Post-Grant Processes
- Develop and Implement the Patent End-to-End Processing System

Patent Quality Index

- Goal is to identify, measure, and track meaningful indicia of patent examination quality
- Desire to improve quality of performance since the first measurments to a stretch goal

Patent Quality Index

Tests the following for each patent

- quality of the action setting forth the final disposition of the application
- quality of the actions taken during the course of the examination
- perceived quality of the patent process as measured through external quality surveys of applicants and practitioners
- quality of the examiner's initial search
- degree to which the first action on the merits follows best examination practices
- degree to which global USPTO data on patent examination activities is indicative of compact, robust prosecution
- degree to which patent prosection quality is reflected in the perceptions of the examinations corps as measured by internal quality surveys

Patent Quality Index

Component		Weight
Final Disposition Compliance Rate	• Measures propriety of final dispositions of patent applications • Based on review of randomly-sampled Allowances and Final Rejections. • N=3,000 reviews per Fiscal Year; 95% confidence interval +/- 0.75%	20%
In-Process Compliance Rate	• Measures propriety of Office actions on the merits during the prosecution • Based on review of randomly-sampled Non-Final Rejections. • N=3,000 reviews per Fiscal Year; 95% confidence interval +/- 0.75%	15%
Quality Index Reporting: QIR	• Statistical representation of quality-related events in the prosecution of the patent application • Items tracked for Quality Composite include: Actions per Disposal; % Disposals not RCE; % Finals Reopened; 2nd+ Action Non-Finals; Restrictions Made on 2nd or Subsequent Action • Objective metrics; no sampling error	20%
FAOM Search	• Measures degree to which the search and the first action on the merits conforms with the best practices of the USPTO • Based on randomly-selected review of FAOMs and First Action Allowances • Actions receive an exam-type score based upon their compliance with best practices • N=800 reviews per Fiscal Year for each component	10%
Complete FAOM Review		10%
External Quality Survey	• Measures satisfaction of applicants and practitioners with patent examination quality 1. *"In the past 3 months, how would you rate overall examination quality? Very Poor; Poor; Fair; Good; Excellent"* • Metric expressed as ratio of Good/Excellent responses vs. Poor/Very Poor responses • Semi-annual survey of approximately 3,000 frequent-filing applicants and practitioners • 95% confidence interval +/- 3.0%	15%
Internal Quality Survey	• Measures employee satisfaction with various factors and inputs that lead to the ability to perform high quality examination 1. *"During the past quarter, overall how would you rate the internal USPTO factors (training , tools, coaching, etc.) that impact your ability to provide high-quality patent examination? Very Poor; Poor; Fair; Good; Excellent"* 2. *"During the past quarter, overall how would you rate the various external factors (patent applicants/agents/attorneys and their interactions) that impact your ability to provide high-quality patent examination? Very Poor; Poor; Fair; Good; Excellent"* • Metric expressed as ratio of Good/Excellent responses vs. Poor/Very Poor responses • Semi-annual survey of approximately 750 patent examiners • 95% confidence interval +/- 5.0%	10%

Patent End-to-End

- Movement from Images to XML
- Automatic Classification of Patents
- Develop a Database of Prior Art by Classification
- Improve their "Automated Prior Art Searches"
- Automatically Generate Comprehensive Patent Family Maps

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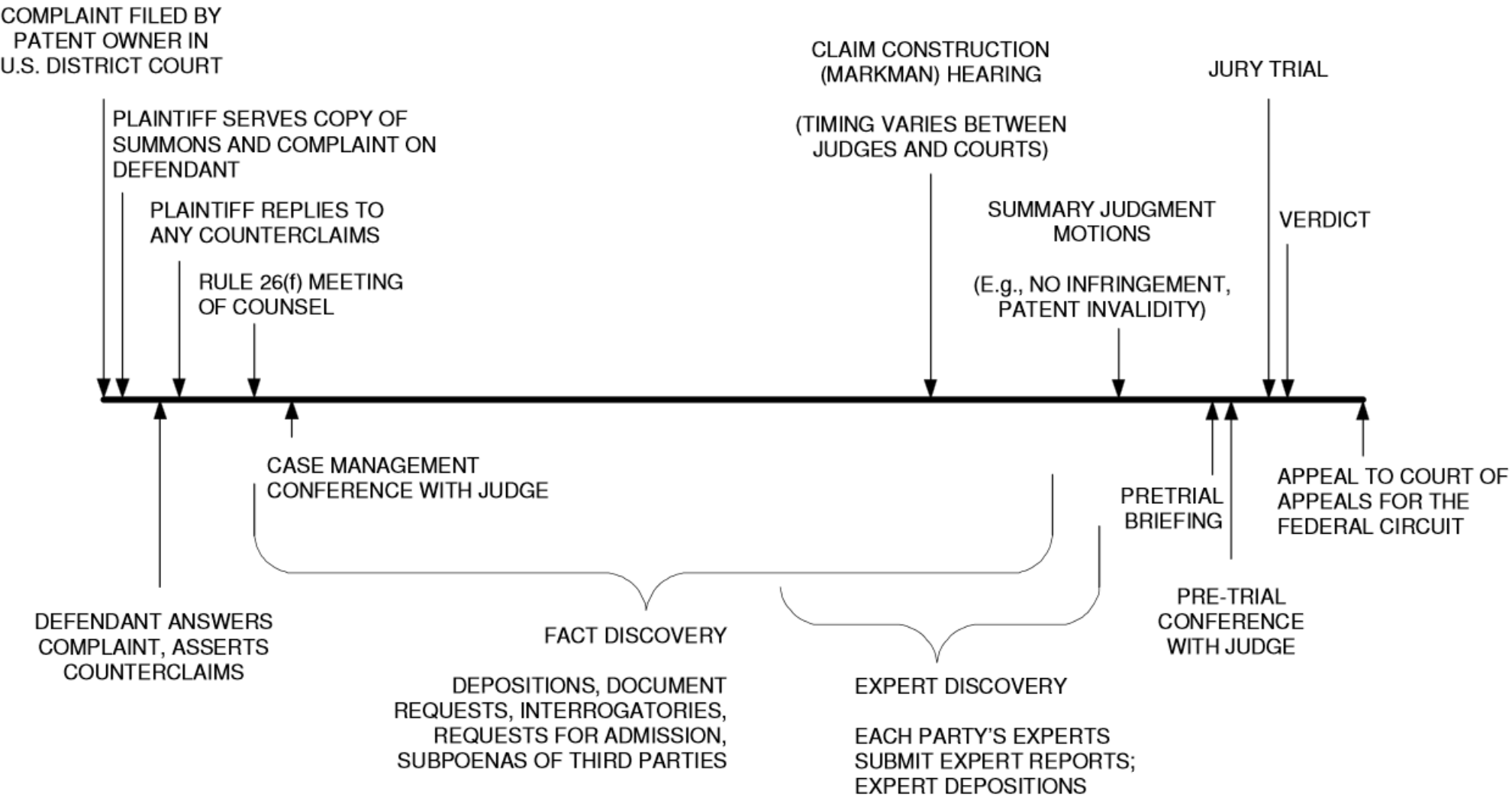
What is Litigation

- Trials where the plantiff sues the defendent over patent infringement
- Patent attornies have to argue that their side is in the right:
  - Plantiff: Has to prove that the defendant infringed on the patent in question (may also try to prove that they did it willingly)
  - Defendant: May prove that they didn't infringe or that the plantiff did not properly get patent

Trends in Litigation

- Usually not clear which side will win case
- Whole Patent can be considered invalid when only one or two claims are considered invalid
- Since odds of winning are close to 50%, most patent attornies aren't paid on contingency, but a growing number are considering it

Relative Timeline of Patent Litigation Suits



Plantiff's Complaint

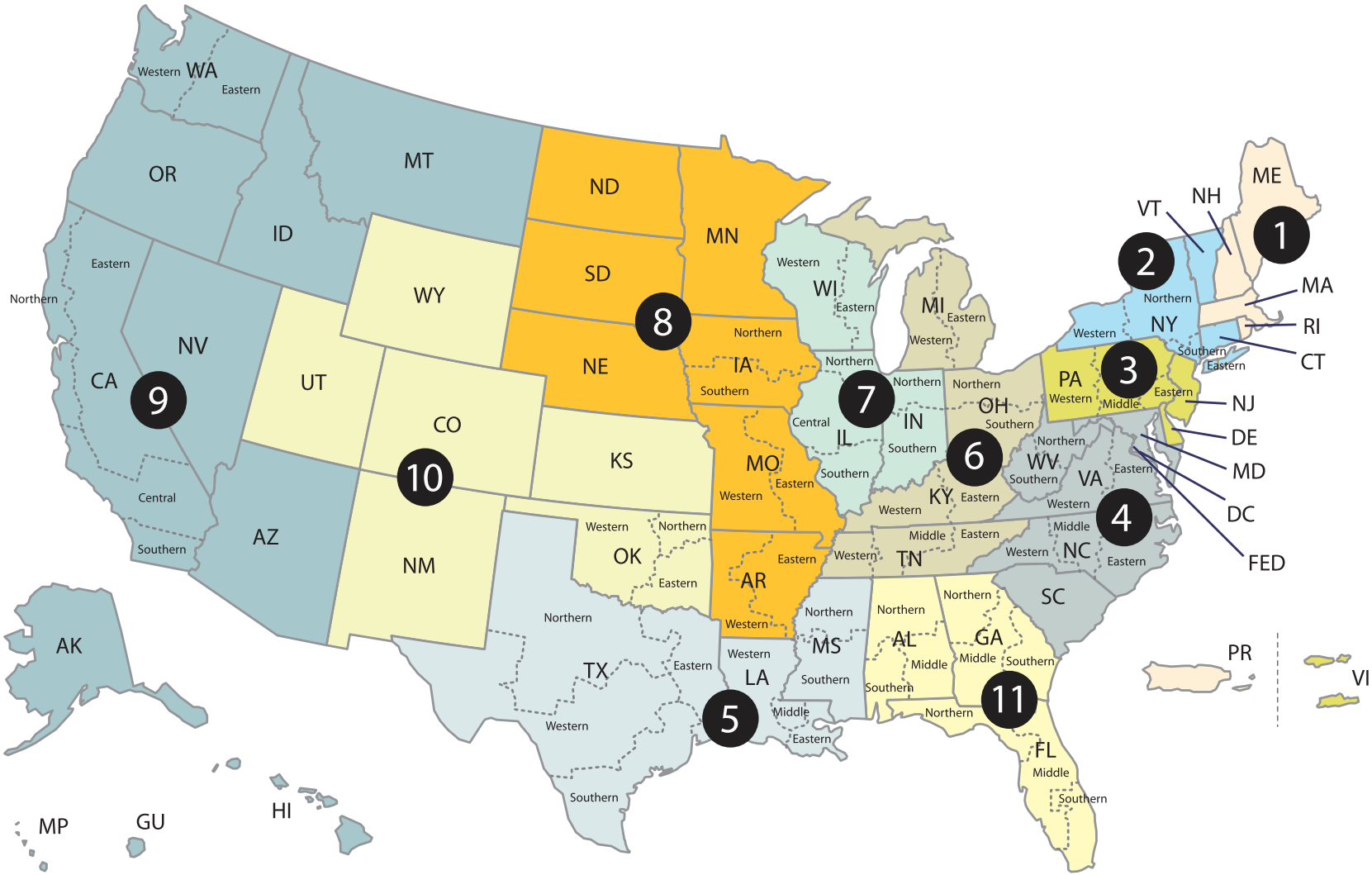
- Identifies alleged infringers and patents involved and includes a brief statement of the alleged infringing acts
- Willful Infringement: Claiming Defendent willfully infringed on the patent in question

Plantiff's Complaint: Choice of District Court

- Can choose to file in any US judicial district where the defendent knowingly profited from the sale of the allegedly infringing products
- Choice usually involve factors like speed that the case will reach trial, experience of the judges, procedural rules adopted by the judges, and the sophistication of the jury pool

Geographic Boundaries

of United States Courts of Appeals and United States District Courts



Defendant's Answer

- Includes defenses such as non-infringement and patent invalidity
- May claim that the plantiff might have, for example, failed to disclose important pieces of prior art to the patent office
- May claim that the plantiff delayed filing suit for an unreasonable and inexcusable length of time causing prejudice to the defedent

Case Management Conference

- Court will conduct to set the schedule of the case
- Attornies from both sides must discuss proposed schedules and submit a joint report to the judge about each sides positions on the required topics of discussion

Discovery

- Scope is very broad - any nonpriviledged matter that is relevant to a claim or defense
- No limit to the number of document requests. Tens and even hundreds of thousands of pages are common
- Default Limit of 25 interrogations per side
- May also spend time to request for admissions

Discovery - Sample Document Requests

Plantiff

- Documents referring to the patent-in-suit
- Documents that support or rebut defendant's claims
- All prior art to the patent-in-suit
- All sales and marketing related to the infringing products

Defendant

- Documents concerning the filing, preparation, and prosecution of the patent-in-suit
- License Agreements related to the patent-in-suit
- Documents relating to how the plantiff came to be aware of the alleged infringement
- All prior art to the patent-in-suit
- All documents referring or relating to the accused products

Discovery - Sample Interrogations

Plantiff

- Describe in Detail why the defendant didn't infringe
- Describe in Detail why the patent-in-suit is invalid
- Set forth the date the defendant became aware of the patents-in-suit
- State the defendant's sales volumes of the accused products

Defendant

- Describe in Detail why the defendant has infringed
- Describe in detail that Defendant's infringement has been willful
- Identify each claim of the patent in suit the plantiff contends to be infringed
- Identify the products that the defendants used, sold, offered for sale, or imported that infringes on the patent

Discovery - Sample Admissions

Plantiff

- Admit that the defendant was aware of the patent-in-suit before the complaint was filed
- Admit that the product contains one of the claim limitations
- Admit that a particular document is an authentic document
- Admit that a particular reference is not prior-art

Defendant

- Admit that a piece of prior art was not disclosed to the Patent Office
- Admit that the plantiff did not communicate with the defendant regarding the patent before the date of the complaint
- Admit that a particular reference is prior art

Claim Construction/Markman Hearing

- Determine the meaning and scope of the patent claims
- Both sides submit and argue their own opinions in front of a judge (no jury)
- Evidence includes claim language, patent specification, and prosecution history

Pretrial Motions

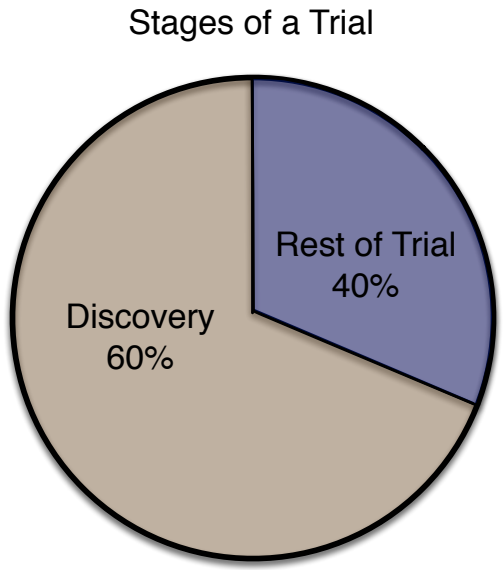
- Asking the court to rule in favor of one party without trial for some cases
- Motions to exclude certain pieces of evidence
- Dividing certain issues into multiple trials

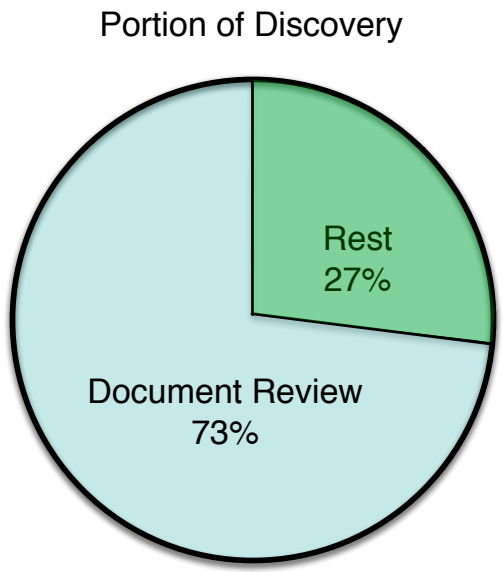
Trial and Appeals

- Only 5% of all cases make it to trial (usually jury trial)
- Most courts impose a time limit per side
- After a judgement is made, most cases are appealed to the US Federal Court of Appeals for the Federal Circuit

Discovery Stage Costs

- Most costly and time consuming stage of the patent litigation suit
- Chief Judge Randall Rader said once that ".0074% of the documents produced actually made their way onto the trial exhibit list"
- $0.73 of every dollar spent on the discovery stage is spent on document review





Predictive Coding

- Term coined by Recommind for Automated Document Review
- Works similar to how Prior Art Search can work
- Picks the Most Relevant Documents or sorts them in terms of relevance

Preprocessing for Predictive Coding

- Extracts Saved Email Chains
- Recursively Look through zip files
- Convert images of scanned documents into text
- Parse XML files
- Break Password Protections

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Introduction to Standard Setting Bodies

- SSBs establish their own policy to regulate the patent and standard conflict problem.
- SSB require patentee to agree on specific licensing conditions when relevant patent exists
- SSB are not involved in arrangement related to patents or in settling disputes on validity

Patents and Standards

Standards:

- Most set by industry
- Perceive by public to be for the public good
- In a technically interlinked world, their nature is potentially global
- Accessibility and ownership issues increasingly debated

Patents:

- Temporary exclusive rights
- Can be used to exclude others from use of the technology, or license
- Embedded in standard, they offer their owners a 'double competitive advantage'
- Territorial nature

- Exclusively owned technologies embodied in standards: rules of inclusion and use must be clear
- Solution: FRAND agreement

Examples of Patent Policy in Standards

- IEEE and 3GPP: Pools the necessary patents, gets them to either give up rights to the Essential Patent Claims for those that follow the standard or makes them agree to use a FRAND license
- USB: Free use of the bare minimum patents needed to implement a complient device

Patent Pool

- Different Patentees (who own a number of patents relevant to the standard) pool their relevant patents into a single license.
- Pools provide a standard license agreement for licensees who are not members of the pool
- It also allocates to each member of the pool a portion of the licensing fees according to the agreement.

Essential Patent Claims

- Claims that would have been infringed on if following the standards
- Need to determine all potential Essential Patent Claims before releasing the standards
- Call for Essential Patent Claims via Letters of Assurance

Letters of Assurance

- Letter of Assurance is necessary in standard application.
- It contains the references of the patents that could possibly become essential patent claims
- The accepted LOA are public resources: each standard linked with a list of essential patent claims.

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Licensing

- Patent doesn't need to be exclusive made and sold by the owner - can be licensed out
- Licensing fees should scale with the expected value of the patent

Patent Valuation

- Process of Determining Value of a Patent
- Many different processes to do it

Cost-Based Method

- Based on the fact that there is a direct relationship between the development of IP and its value
- Reproduction Cost Method: Gather all costs associated with the purchase or development of a replica of the patent
- Replacement Cost Method: Basis of the costs that would be spent to obtain an equivalent patent asset

Market-Based Method

- Estimation of value based on similar license agreements of comporable patent rights
- Comparison is performed in terms of utility, technological specificity and property,

Income-Based Method

- Value of an asset is intrinsic to the expected income flows it generate
- Discounted Cash Flow Method: Estimate future cash flows. Main source of information is generally the business plan of the company that exploits or intends to exploit the asset.
- Relief-From-Royalty Method: Value of the royalty payments from which the company is relieved due to its ownership of the asset

FRAND agreement

- FRAND:fair, reasonable, and non-discriminatory terms
- It is a licensing obligation required by standard organization for members that participate in the standard-setting process.

Why FRAND:

- Each standard may implicate more than 1000 patents. Only some are SEP (Standard Essential Patent), used to practice standard.
- If standard is in widespread use, SEP becomes major obstacle

FRAND Definition

1. Fair: relates to the licensing terms. Licensing terms which are not anti-competitive and that would not be considered unlawful if imposed by a dominant firm in their relative market.
2. Reasonable: refers to the licensing rates. A reasonable licensing rate is a rate charged on licenses which would not result in an unreasonable aggregate rate if all licensees were charged a similar rate.
3. Non-discriminatory relates to both the terms and the rates included in licensing agreements. As the name suggests this commitment requires that licensors treat each individual licensee in a similar manner.

FRAND solution

- Require SEP owners to agree in advance to license SEP
- License must be FRAND
- Facilitates widespread use of standard
- Ensure SEP owners obtain a benefit from use of patent

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Potential Problems for Experiments

- Patent Prior Art Search: Given Invention/Patent/Standard, find patents it potentially could be infringing
- Claim Broadener: automatically detects whether a certain phrase in the claim can be broadened based on previous patents
- Economic Analysis for Trade Secrets: Determine whether to patent or keep a trade secret
- Analysis for Determining Contingency Representation: Determine the amount of fees the lawyer should charge if he does the case on contingency
- Predictive Coding: Determine which documents are related to the litigation suit
- Patent Valuation: Determine the value of a patent for licensing

Most Well Defined Problem

- Patent Prior Art Search is the most well defined problem with the most well defined datasets
- Claim Broadener would be useful, but broadening is a very vague idea
- Trade Secret Analysis has too many variables to make a good problem
- Contingency Analysis is currently too niche of a problem to be taken seriously
- Predictive Coding would relate to more general Information Retrieval topics than we would want to work with
- We do not currently understand enough on Patent Valuation to make an educated decision on it