Fundamentals and Applications of Modern Single-Photon Detector Circuits and Processing Systems

Part 3: Intellectual Property (Offline)

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Carnegie Mellon University

Electrical & Computer ENGINEERING

WOOD IP

For tutorial materials:

Introduction to Intellectual Property: The US Perspective

Theodore Wood: Bio

- **Education**
  - JD, University of Dayton School of Law, CALI Excellence (Highest Grade in Patent Pros.), 1998
  - MSEE, Northrop University, 1984
  - BSEE, North Carolina A&T State University, 1981
- **Professional: Legal**
  - Wood Intellectual Property Law LLC, Owner, Jan 2016 – Present
  - Parks-Wood LLC, Partner, Sep 2012 – Jan 2016
  - Sterne Kessler Goldstein & Fox, Partner, Apr 2001 – Sep 2012
  - Pillsbury Winthrop, Associate, Aug 1998 – Apr 2001
  - NCR Corp, Legal Intern, May 1996 – May 1998
  - Adjunct Professor, Intellectual Property, Northern VA Community College, 2004 - 2015
- **Professional: Military**
  - Lieutenant Colonel, U.S. Air Force (Ret), 1981 - 2004

WOOD IP

What is Intellectual Property?

"Intellectual property" refers to creations of the human mind that are protected by U.S. state and federal law, as well as by other countries' laws in a fashion similar to real property (e.g. a piece of land). U.S. federal and state laws create intellectual property rights that include:

- Patents
- Copyrights
- Trademarks
- Trade Secrets

What is the purpose of a Patent?

- "Congress shall have power . . . to promote the progress of science and useful arts, by securing for limited times to . . . inventors the exclusive right to their respective . . . discoveries."
- U.S. Constitution, Art. I, sect. 8, clause 8 (The Patent Clause)

What is a Patent (what rights does a patent confer)?

- A patent is a grant by the United States federal government that entitles the owner (e.g., an individual inventor or company) to **exclude** others from:
  - ✓ Making, using, selling or offering to sell the invention in the U.S. or importing into the U.S. a patented invention.
- A domestic patent only provides these exclusive rights in the United States.
- A patent does **NOT** necessarily give the owner the right to practice the patent, because of others' potential prior patent rights.

Why Invest in Patents?

- Commercial advantage over competitors
- Exercised by the owner
  - ✓ Directly by making or selling the invention, or
  - ✓ Indirectly by licensing others to make or sell the invention
- Financial reward for bringing innovative and useful products into the marketplace
  - ✓ Credentials the technology
  - ✓ Creates shareholder value
- Recoup dollars spent on R&D
- Stop unfair competition by those who compete by imitation
- Provide valuable trading assets to help assure freedom to operate

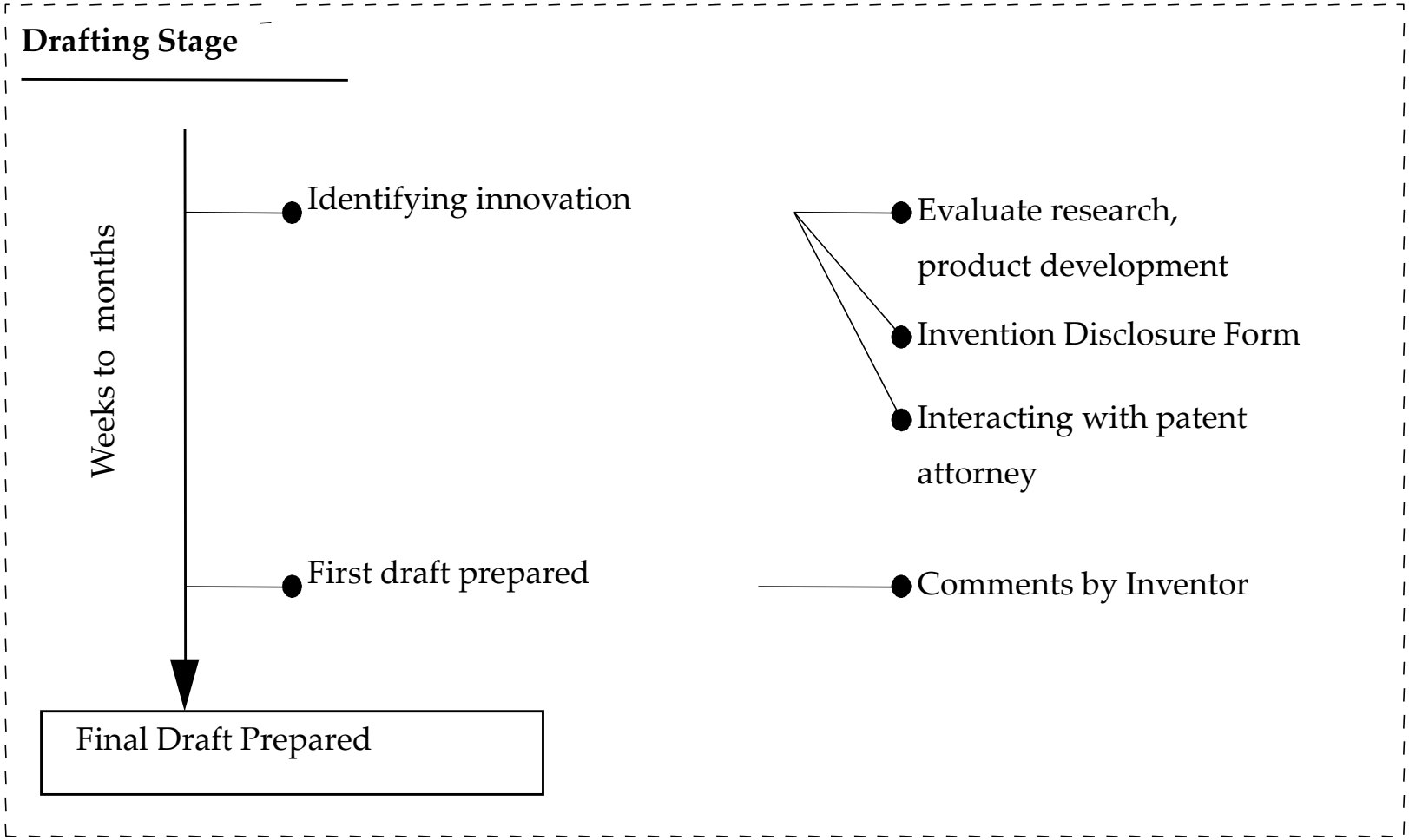
What is Patentable?

- Any person who "invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent"
  - ✓ Compositions of matter (chemical compositions, mixtures of ingredients)
  - ✓ Methods or processes (includes industrial or technical processes)
  - ✓ Articles of manufacture
  - ✓ Machines
  - ✓ New uses of any of the above, e.g. use of Rogaine

Patent Harvesting – The Disclosure Process

- IP audit (what's new)
- What is important?
- What is valuable to protect?
- What Problems are being solved?
- How are competitors solving the problem?

Patent Harvesting (cont.)



Establishing Invention Ownership

- Establish corporate structure
- Prepare employer/employee agreements
- Execute Employer/employee agreements
- Establish IP policy
- Execute invention assignments

Possible Patent Application Filing Strategy

- Provisional Application
- Non-Provisional Application
- Published Application
- Patent Cooperation Treaty

What is a Provisional Application?

- Establishes a filing date (earliest priority date)
- Examination process does not begin
- Clock does not start running on lifetime of patent
- Simpler filing requirements
- Lower filing fees
- Claims are not required

Three Basic Parts of the Patent

- Specification – the description must provide sufficient information to allow one skilled in this area to reproduce the invention
- Drawings – illustrate major inventive features
- **Claims** – defines "legal boundaries" of invention being protected

Three Basic Parts of the Patent

Identify this invention:

Claim:

1. A method to be performed by a computer for operating a matching service, comprising:

generating, from empirical data, a number of factors corresponding to a like number of functions of one or more variables relevant to relationship satisfaction;

approximating the satisfaction that a user of the matching service has in the relationships that the user forms with others;

identifying, with the computer, candidates for a relationship with the user by determining an association between the approximated satisfaction and one or more of the factors; and

approximating the satisfaction that the user will have in a relationship with a particular candidate.

Patent Examination Process

- Examination of Application by Patent Examiner
  - ✓ Novelty (prior art) search
  - ✓ Tests application for legal sufficiency
- Negotiation towards allowable subject matter
  - ✓ Examiner interview
- Appeal/Notice of Allowance
- Issued Patent

What are the Requirements?

- New or Novel (Not already known)
- Non-Obvious
- Utility (Useful) (e.g. not a perpetual motion machine)
- Written Description (Details of the invention)
- Enabled (Must describe how to make and use the invention)
- Best Mode (The preferred way of practicing the invention)

Major Pitfalls

- **By Others:**
- Public use in U.S. before date of filing
- Patent or publication before date of filing
- Filing of another's application before we file our application

- **By Inventor:**
- Publication more than one year before filing
- Public use more than one year before filing
- Sale or offer for sale more than one year before filing
- Publication before filing (for some International patent application filings)

Major Pitfalls (cont.)

- Getting caught-up in successful early funding rounds
- Delay in Establishing an IP Strategy
- Failure to consider IP as revenue stream
- Failure to use IP to attract inventors
- Inadvertent invention disclosures
- Lapse of filing timelines

Summary

- What is Intellectual Property
- Why invest in patents
- Patent harvesting
- The patent examination process
- Major pitfalls

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- **Professional Academic:**
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  - Wood Intellectual Property Law, LLC, 2014-present
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  - Sterne Kessler Goldstein and Fox, LLP, 2013-2014
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  - Kiskeya Microsystems LLC (CEO and Founder) 2014-2019
  - CoolCAD LLC, (Engineer), 2010-2012

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Disclaimer: MD serves as an ad hoc consultant for Wood IP Law, LLC.
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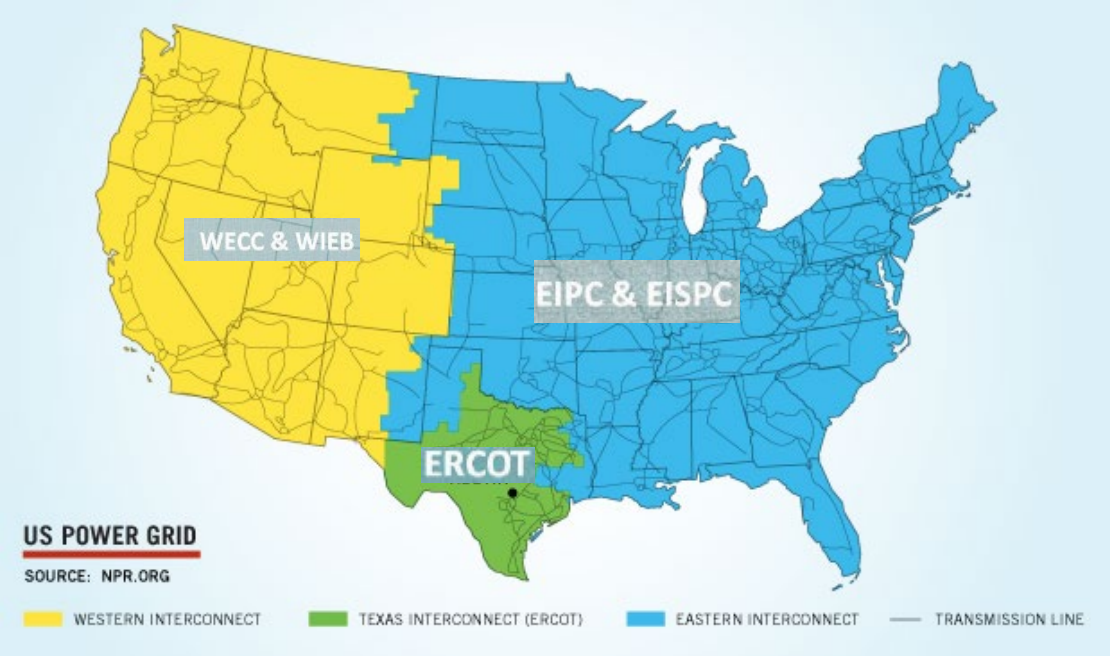
Case Study : Patents and the Electricity Grid

The Electric Grid (geographic view)



- three distinct interconnects
- connectable interconnects
- ERCOT is particular!
  - Texas Utilities "band together" to support WW2 effort!
  - ERCOT becomes the 1st independent US operator in 1996

The Electric Grid (generation by source)

	Coal	Petroleum Liquids	Petroleum Coke	Natural Gas	Other Gases	Nuclear	Renewables	Other	Total Generation (GWh)
2000	51.6%	2.7%	0.2%	15.8%	0.4%	19.8%	9.4%	0.1%	3,807,955
2001	50.8%	3.1%	0.3%	17.1%	0.2%	20.5%	7.7%	0.3%	3,745,745
2002	50.0%	2.0%	0.4%	17.9%	0.3%	20.2%	8.9%	0.3%	3,867,498
2003	50.7%	2.6%	0.4%	16.7%	0.4%	19.6%	9.1%	0.4%	3,892,115
2004	49.7%	2.5%	0.5%	17.8%	0.4%	19.8%	8.8%	0.4%	3,979,023
2005	49.5%	2.5%	0.6%	18.7%	0.3%	19.2%	8.8%	0.3%	4,062,458
2006	48.9%	1.1%	0.5%	20.1%	0.3%	19.3%	9.5%	0.3%	4,071,962
2007	48.4%	1.2%	0.4%	21.5%	0.3%	19.4%	8.5%	0.3%	4,164,748
2008	48.1%	0.8%	0.3%	21.4%	0.3%	19.5%	9.3%	0.3%	4,127,019
2009	44.4%	0.7%	0.3%	23.3%	0.3%	20.2%	10.6%	0.3%	3,956,990
2010	44.7%	0.6%	0.3%	23.9%	0.3%	19.5%	10.4%	0.3%	4,133,854
2011	42.2%	0.4%	0.3%	24.7%	0.3%	19.2%	12.6%	0.3%	4,112,181
2012	37.3%	0.3%	0.2%	30.3%	0.3%	18.9%	12.4%	0.3%	4,067,551
2013	38.9%	0.3%	0.3%	27.3%	0.3%	19.4%	13.1%	0.3%	4,074,457

U.S. Department of Energy, *2013 Renewable Energy Data Book*, December, 2014.

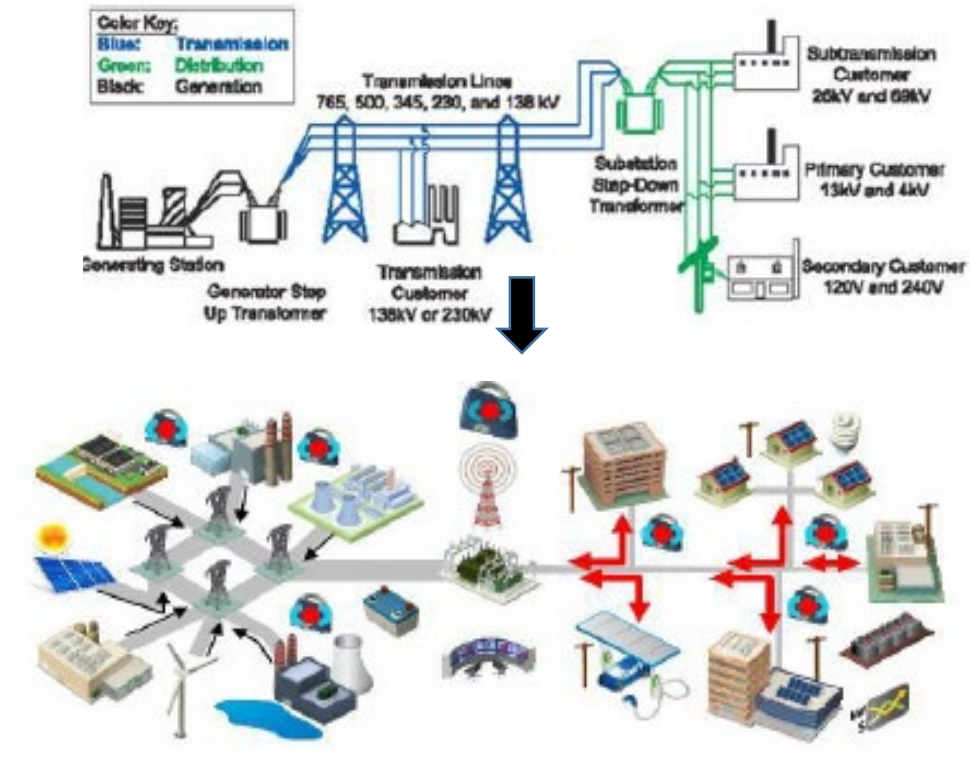
Trends

- coal ↓
- renewables ↑
- fossil fuels ↓
- nuclear —

Driving Growth Factors

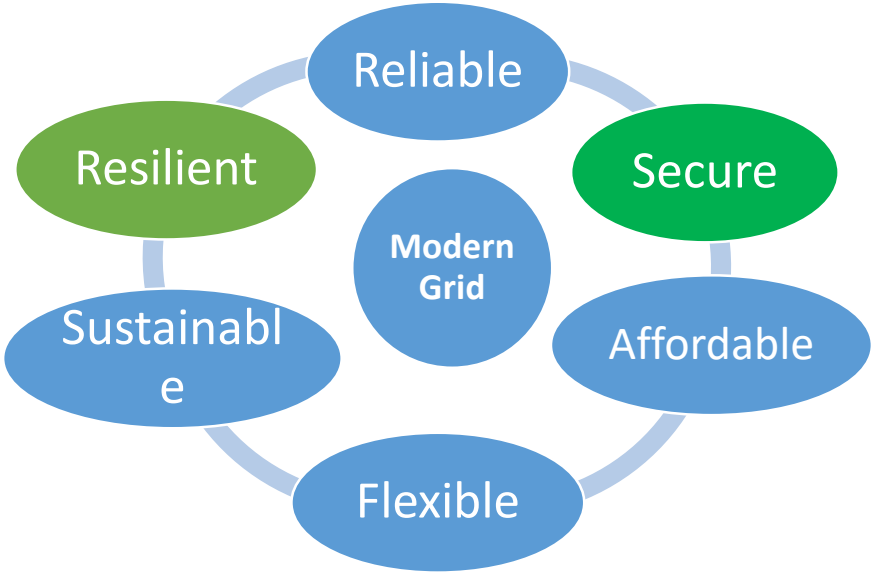
- upstream pressure for "clean" energy!
- **reliability** and efficiency
- **resiliency**

The Modernized Grid



Current Weaknesses

- Interconnects still fairly centralized
- Expensive and environmentally costly



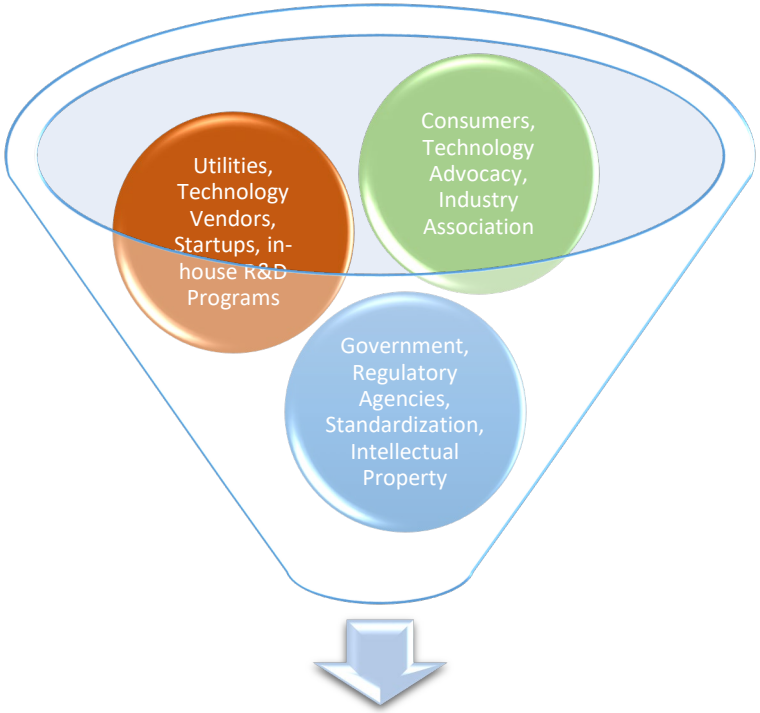
Threats to the Grid

- Cyberelectronic Warfare is the new normal!
  - Cyberelectronic activity can be used to disrupt the nation's infrastructure and institutions
  - **e.g., 1,131 cyberattacks** against U.S. DOE computer systems in 2012-2014
    - **159 successful!**

- Cybersecurity is crucial for the modern grid as systems can be linked via non-dedicated communication networks

- Cybersecurity for the modern grid is **difficult** because of the disparate nature of grid technologies and the lack of standardization

The Modern Grid's Development Ecosystem



<u>How intellectual property can tie all of this together?</u>

- Patents ***foster*** innovation!
- Patents can incentivized companies to engage in standardization!
- Patent rich start-ups have a greater likelihood of market success!
- Patents *can* encourage collaboration!

Challenges for Grid Cybersecurity Patents

- Software-based inventions *may* be ineligible!
- United States Patent Office delays can cripple the pace of innovation!
- Shortage of patent practitioners in this emerging field!
- Development of Standards Essential Patents (SEPs) may be difficult!

Eligibility

- 35 U.S.C. § 101:

"Whoever invents or discovers any new and useful **process**, **machine**, **manufacture**, or **composition of matter**, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

- ***Alice Corp. v. CLS Bank International***, 573 U.S. __, 134 S. Ct. 2347 (2014):
  - **mere** implementation of a **conventional** method on a **computer** is not patent eligible
- Cybersecurity patents may therefore be ineligible unless…

The Alice-proof Patent Application

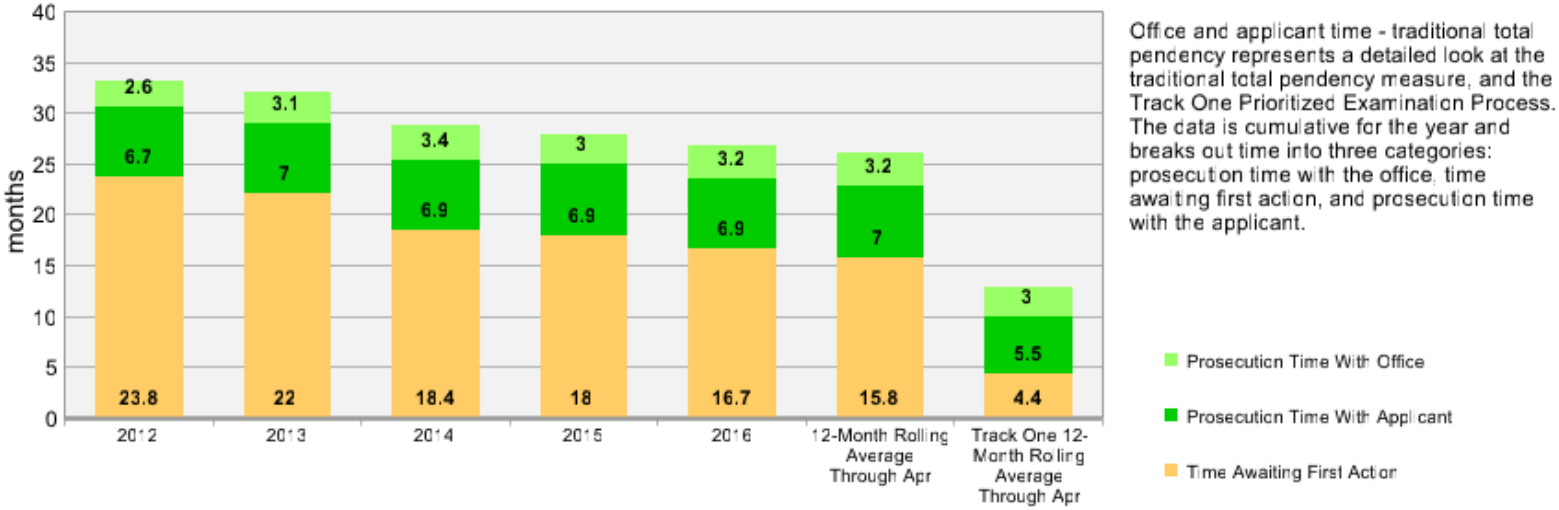
- The invention entails a special purpose computer or machine *created* by the novel software.

- The invention is an application-specific system that goes beyond the ‘mere implementation’ of a conventional idea on a computer.

- At least one part of the invention *cannot* be performed without a computer.

- The invention adds up to significantly more of one or more judicially recognized exceptions of 35 U.S.C. § 101.

U.S. Patent and Trademark Office Pendency



- Recommendation: The USPTO should incentivize Grid Cybersecurity innovation by lowering the cost of Track One Petitions for Grid-related technologies.

IP Training for Cybersecurity Professionals

- Universities should incorporate introductory Intellectual Property courses as an elective in newly-established cybersecurity programs

- Companies should implement basic IP training programs for inventors, especially in areas that pertain to cybersecurity patents

- Patent practitioners and companies should actively take part in providing the Examining Corps with Technology Exposure Training Seminars in order to improve the quality of Cybersecurity patent examination

Encourage the Creation of SEPs

- Companies should embrace a collaborative R&D research model!
- Companies should compete on products but *collaborate* on standards!
- Companies should engage standard developing organizations early into the development cycle (corollary to shortening patent examination)

Conclusions

- Patents protect innovation, and they have constitutional basis
- Patent *policy* can help *foster* innovation
- Patents are an essential part of the start-up economy
- As an engineer, you should invest some time in learning about Patents