Technology Transfer To Practice

SATC TTP

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DISCLAIMER

- This is the first run
- Unpolished
- Work in progress
- Feedback is appreciated

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- National Science Foundation, ACI, Cyber Security Transition to Practice Workshop #2: Creating a TTP Roadmap", NSF 1550544, Jul 2015-Jun 2016
- "A Principal Investigator's Guide to Transferring Cybersecurity Technology to Practice (TTP)", Rebecca Bace and Alec Yasinsac, Ph.D., University of South Alabama, www.southalabama.edu/colleges/soc/research/resources/guidetotransferringtechnologytopractice.pdf
- National Science Foundation, ACI, "EAGER: Creating a TTP Ecosystem Discovery and Support Resource for Cybersecurity Technology Transfer to Practice", NSF 1636470, Aug 2016-Jul 2017, $199,902

Presentation Outline

1. SATC TTP Designation
2. TTP Overview
3. The TTP Decision
4. Principal Investigator
5. The TTP Team
6. Business Processes
7. University Tech Transfer
8. Funding
9. Dancing the TTP Bear
10. Advice from TTP Veterans

NSF-SATC TTP Designation

- Component of the regular SATC solicitation
- Transition existing research results to practice

SATC TTP Designation

- TTP Designation objective:
  - Support the development, implementation, and deployment of later-stage and applied security research into an operational environment.
- The operational environment can be:
  - Commercial, Government, Academia

TTP Designation Evaluation Criteria

- Description of the problem being solved or need being met
- Identification of a target user group or organization that will serve as an early adopter of the technology or specific milestones as to when an early adopter will be named;
- Deployment plan for implementing the capability or prototype system into an operational environment;
- Novelty of the intended system, software, or architecture;
- Composition of the proposal team;
- Appropriateness of the budget for the effort; and
- Extent of university Technology Transfer Office collaboration
- Post-grant sustainability;

SATC TTP Designation

- A TTP-designated proposal must:
  - Specifically describe how the successful research results will be further developed and deployed in organizations or industries, including in networks and end systems
  - Include a project plan that addresses system development milestones and an evaluation plan for the working system

SATC TTP Designation

- A Successful TTP-designated proposal should:
  - Have a well-defined user group
  - Include an industry partner
  - Have a solid, well-rounded project team
  - Show a good relationship with University TTO
  - Have a sound software development strategy
  - Present a convincing sustainability plan

NSF-SATC Submission Deadlines

- **MEDIUM** Projects
  - October 12, 2016 - **October 19, 2016**
- **SMALL** Projects
  - November 06, 2016 - **November 16, 2016**

NSF-SATC Funding & Duration

- **MEDIUM** Projects
  - 4 years
  - **$501,000 - $1,200,000**
- **SMALL** Projects
  - 3 years
  - **Up to $500,000**

TTP Defined

For our purposes, Technology Transfer to Practice (TTP) is:

The process of implementing an academic research result into operation in industry, government, or academia

TTP Further Defined

TTP involves the following three activities:

1. Producing a discernable outcome from federally funded, transformative research;
2. Establishing intellectual property protection for the outcome;
3. Delivering the outcome to productive use by society.

Which form of TTP?

- Start up
- Licensure
- Spin off
- Free distribution
- Informal TTP

Why engage TTP?

- Expand the impact of your research
- Codify the value of your research
- Expand/extend NSF funding
- Profit
- Form long-term industry connections
- Opportunities for students
- Etc.

What are the risks?

1. Career impact
2. Financial liability
    a. Company
    b. Personal
3. Reputation
4. Loss of family time
5. Stress

Key TTP Impediments

- Understanding the process
- Finding a client
- Team building
- The “business” stuff
- Building production code

The TTP Decision

1. The outcome must be well-defined; that is, it must be possible to uniquely distinguish the outcome in the form of its Intellectual Property (IP) and there must be a way to protect that IP.

2. There must be a clearly defined or envisioned use and customer for the outcome

The TTP Decision

1. What is the product or service?
2. What is the value proposition?
3. What is the price-performance advantage?
4. What is the market/who is the customer?
5. Is the market open/crowded/saturated?
6. What resources are required?
7. What is the potential ROI?
8. What are the risks?

What is the product or service?

- The research result is rarely a product
  - E.g. Diffie-Hellman, RSA, etc.
- Many possible applications
  - How do you pick the right one or set?
- Well, you define and evaluate the value proposition

What is the value proposition?

- How does your research result deliver value to the prospective customer?
  - New capability
  - New product
  - Simplicity
  - Efficiency
  - Improved performance
  - Security
  - Integrity
  - Privacy
  - Etc.

What is the market/who is the customer?

1. For either commercial, agency, or academic projects, having a broad customer base is important to success
2. The product defines the customer(s)
3. It is essential to have a proof of concept customer partner
4. Finding a customer is a major TTP pitfall

Is the market open/ crowded/saturated?

- How do you know?
  - Ask a pro
  - Do some research
  - Pay a pro to do some research

The TTP Team

- Essential
  - The Project Lead/CEO
  - The Chief Scientist
  - The Entrepreneurial Lead
- Miscellaneous
  - Lead Developer
  - Counsel
  - Admin Staff
  - IT Staff

The Principal Investigator

- Provides the project vision
  - Leadership plan
  - Research plan
  - Development plan
  - Evaluation plan
  - Business plan
  - Administrative plan
- Provides operational oversight

Business Processes

- Protecting intellectual property
- Licensure
- Starting a business
- NDAs
- Subcontracting
- Market analysis
- Marketing
- Accounting
- Etc.

University Tech Transfer

- Usually under the VP for Research
- Their first priority is: Protect the university
- That means
  - #1: protecting against liability
  - #2, protecting IP
- They also probably provide some "incubator" services, e.g.
  - IP assistance
  - Office space
  - Pooled administrative staff
  - Mailing address
  - Etc.

Funding

- SATC TTP Designation
- SBIR/STTR
- Venture Capital
- Angel Networks

SBIR/STTR

- An approximately $190 million program that catalyzes the commercialization of high-risk technological innovations.
- The NSF SBIR/STTR program funds roughly 400 companies each year.
- Nurture high-impact technology innovations
- Seed funding for start-up and early stage tech ventures
- Qualcomm, Symantec – SBIR awards recipients
- Grants, not contracts – equity-free investment
- NSF funding de-risks for other investors
- Strong focus on commercialization

Who/What SBIR/STTR Funds

- High technical risk innovations with potential for high commercial / societal impact
- R&D only – you will need to raise money for other activities
- Focus on start-ups and early stage companies
- Typical program profile (2014 stats):
  - 72% of funded companies <5 years old
  - 90% of funded companies <10 employees
  - 80% of funded companies had not received a prior Phase II award

Private Funding: Venture Capital and Angel Networks

- Angel: Local consortia that pool resources to fund startups for an ownership share
  - The funding decision is per investor, based on the a project pitch to the Angel Network
- Venture: Private companies or consortia that "buy in" to the startup at the beginning
  - Bigger money

Access to Private Funding

- Venture
  - Personal contacts
  - Networking
  - Consultant
  - Trade shows
  - Etc.
- Angel
  - Publically advertised
  - Chamber of Commerce
  - Etc.

Venture Capital

- IS - Money for businesses that can't access classic capital markets
- IS – both individual and institutional
- IS – usually actively involved in management of firms
- IS – **an acquirer of part of the business**

- IS NOT – receivables financing
- IS NOT – line of credit
- IS NOT – investment banking
- IS NOT – grant or gift
- IS NOT – lottery
- SHOULD NOT BE – silent
- SHOULD NOT BE - clueless

What Represents Venture Success?

Short Term

- Healthy, Growing Firm
- Scalable, Useful Solution(s)
- Explosive Market Growth
- Solid Team
  - R&D
  - Sales and Marketing
  - Operations
- Strong stable of strategic partners

Longer Range

- Subsequent funding rounds, driven by growth
- Good publicity
- Demonstrated market dominance
- Explosive growth as measured by EBITDA
- Strong Exit

Angel Networks

- Annual Sources of Start-up Funding
  - –Venture Capital ~$.3 billion
  - –State Funds ~$.5 billion
  - –Angel Investors ~$20 billion
- Angels: 90% of outside equity for start-ups

http://www.angelcapitalassociation.org/data/Documents/Press%20Center/What%20Ents%20Should%20Know%20About%20Angels%202009.pdf

A Peak at the Lean Startup Approach

- Think “Agile Process”
- Good for products/customers:
  - Commercial
  - Agency
  - Academic

A Peak at the Lean Startup Approach

- Before establishing a firm business model that identifies the market, finances, operations, etc., the startup must first validate it business model hypothesis that is repeatable and scalable.

1. Business Model Canvas
2. Customer Development
3. Agile Development

Lean Startup Business Model Canvas

- Key Partners
- Key Activities
- Key Resources
- Cost Structure
- Revenue Streams
- Value Proposition
- Customer
  - Segments
  - Relationships
  - Channels

Lean Startup Customer Development

1. **Customer Discovery**
   - Devise a business plan hypothesis
   - Tests customer reactions
2. **Business Model Validation** for the customer. Is the model:
   - Repeatable
   - Scalable

Lean Startup
Agile Development

You know

TTP Case Studies

TTP Case Studies

- Qeygo
- Investigators: Mike Neumann, Diana Neumann, and Rebecca Bace
- **Academic Organization**: NA. The original research was funded by a US military grant. Licensure for commercial use was granted to those researchers if they would take the results to market.
- **Topic**: Zero-knowledge based authentication mechanism. The product allowed a user to access a security sensitive system in lieu of, or in addition to, using a userid/password. The user could input an ID, then look for a key sequence on a mobile device (be it another system, a smart phone, or other messaging device. There were a number of compatible authentication mechanisms, e.g. fingerprint scanner, a retina scanner, an optical scan of a bar or QR code, a smart card scanner. The user could specify an arbitrary number of mechanisms to protect especially high value transactions.
- **TTP Process**: Start-up, acquired by larger company.
- **Outcomes**: The team demonstrated the prototype to the prospective buyer's board of directors. A week later they were approached by the firm, who wished to commence formal negotiations for acquisition of our startup and its product. The acquisition was completed within a quarter and the technical team joined the acquiring firm to oversee the commercial development and integration of the product with the other offerings of the firm. Subsequently, within the year, the acquiring firm was itself was acquired at a significant increase in value (i.e. the acquisition was a good one) and Mike and Diana received a significant return from the successful tech transfer of their research results.

MATH Snacks

"Smart and yummy educational animations, mini–games, and interactive tools that help mid-school learners better understand math concepts."

New Mexico State University

"One of the most exciting outcomes of the Math Snacks I-Corp efforts is the new focus of the PI's as we continue to seek funding. There is an increased interest in the distribution and commercialization of the products throughout the writing process. This has resulted in the team seeking out these partners and getting letters of support prior to submitting grants. For example, the NMSU Learning Games Lab, which produced Math Snacks was selected by Glass Labs at USC to be one of the game developers involved in a pilot study where teachers can go for a clearinghouse of gaming resources for the classroom. The I-Corp experience has made the education team and the development team realize how important this is to future development and funding."

CORPS
NSF Innovation Corps

Mobile Robots: CISE-Funded City-Climbers with Artificial Intelligence

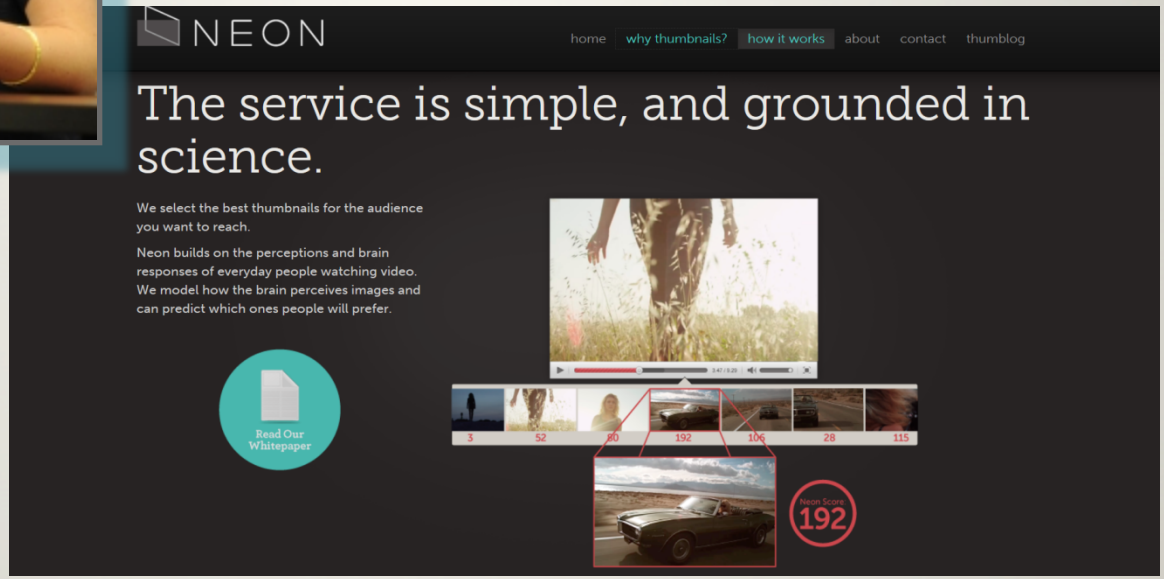
A wall-climbing robot system based on the teams **"City-Climber"** technology for building façade inspection and glass wall cleaning applications. The current practice of manual inspection of building façade is time-consuming, expensive, and poses risk to human workers.

The City-Climber technology provides a solution to meet a strong demand for automated inspection of building façades. In addition, the City-Climber robots can be modified to carry out tasks such as to clean glass walls and solar panels. Under prior funding, this team developed several wall-climbing robot prototypes, named City-Climber.

Sophie Lebrecht, Carnegie Mellon University, Entrepreneurial Lead; Mike Tarr, PI; Babs Carryer, Mentor

Sophie Lebrecht identified that the brain computes a very rough, very rapid and automatic snapshot of perception in order to estimate the likability of an object. They had essentially discovered a way to predict the images people would be most attracted to, and that image discovery had huge market potential—anytime there is an image, and you want a human to relate to that image, the research is applicable.

NEON



Forbes **"[...Neon] is now integrating her research into an algorithm that helps determine which online images produce the greatest number of clicks."**

CORPS
NSF Innovation Corps

CISE-funded AppScale is the open source implementation of Google App Engine cloud platform.

Cloud computing platform that automatically deploys and scales unmodified Google App Engine applications over public and private cloud systems.

AppScale

PI: Chandra Krintz
University of California-Santa Barbara
"AppScale -- Spurring Innovation Through Cloud Application Portability"

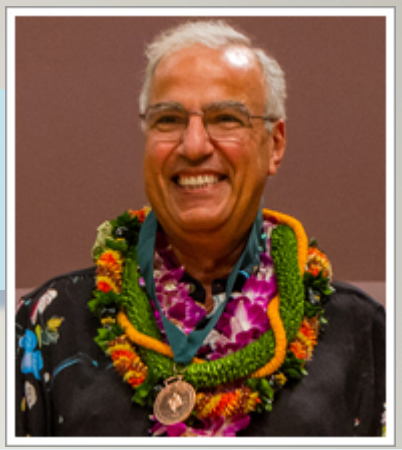
"They've already received $1.5M in Angel financing and are going out for their series A round now."

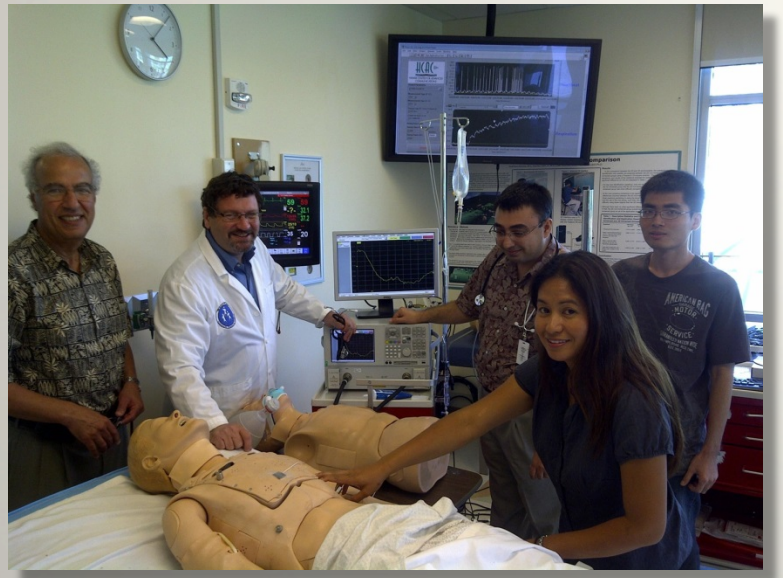
"Selected as a GigaOm "Best of the Best" finalist for new start-up"

"AppScale Launches As An Open-Source Backup Equivalent To Google App Engine"

Magdy Iskander, University of Hawaii
NSF Industry/University Collaborative Research Center (I/U CRC)

Microwave Stethoscope





MiWa Technologies has developed the Cardiopulmonary Stethoscope, a low-cost, non-invasive integrated radio frequency-based system for lung water and vital sign measurements.
Being able to closely **monitor the changes in lung water, respiratory rate, and heart rate**, are the foundation for proactively preventing worsening of patients' heart failure.

Traversing the TTP Stages

- Define the product
- Protect the Intellectual Property
- Capture the customer's "rigor expectations"
- Examine the regulatory demands
- Understand the integration testing complexities
  - Product testing
  - Integration testing
  - New threat management

Advice From TTP Veterans

- The project leader's total commitment is critical to TTP success
- Treat University TTP with kit gloves
- Recognize the challenges of the academic calendar/schedule/pace
- Not all academics are good entrepreneurs
- Research your market via trade shows

Advice From TTP Veterans (Cont)

- Refer to and use tips/advice from industry analysts (Garner, Forrester, etc.)
- Be cautious of open source
- Consider an academic or agency transfer
- Demand in the security field can change very quickly
- Investigate/seek state funding/resources for TTP

NSF SATC TTP Ecosystem

Providing Centralized TTP Resources*

1. "Mentoring" services
2. Best Practice repository
3. Software maintenance center
4. Matchmaking assistance
5. Contracting advice

*In development

TTP Ecosystem Services

- TTP Familiarization for Investigators
- Match-making
- Activities to identify prospective TTP-interested investigators;
- TTP training services for NSF PIs;
- Establishment of a TTP mentoring service for NSF/SATC PIs and prospective PIs;
- Development and implementation of a "Best TTP Practices" repository;

Mentorship Service

- Bull pen of experts with TTP experience
- Low/no cost to NSF Awardees
- Topics
  - Lean startup
  - Market analysis
  - IP
  - Staffing
  - Finance
  - Etc.

Best Practice Repository

- Identifying and attracting clients
- Negotiating IP issues
- Budgeting and accounting
- Marketing
- Staffing
- Software Development
- Case studies

Special Interest Groups

- Virtual Peer Group
  - Sign up today
- Listserv
- Tips & Tricks
- FAQ
- Success stories
- Upcoming events

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