InfoWare 2016 International Expert Panel:

Academia-Industry Partnership: How to Successfully Transfer the Knowledge

November 17, 2016, Barcelona, Spain

InfoWare / Eleventh International Multi-Conference on Computing in the Global Information Technology (ICCGI 2016)

InfoWare
November 13–17, 2016 - Barcelona, Spain

InfoWare Expert Panel: . . . How to Successfully Transfer the Knowledge

Panelists

- *Claus-Peter Rückemann* (Moderator),
  Westfälische Wilhelms-Universität Münster (WWU) /
  Leibniz Universität Hannover /
  North-German Supercomputing Alliance (HLRN), Germany
- *Vincent Poulain d'Andecy*,
  Yooz, France
- *Kendall Nygard*,
  North Dakota State University, USA
- *Eugen Borcoci*,
  Polytechnic University of Bucharest, Romania
- *Roger Bostelman*,
  National Institute of Standards and Technology, USA
- *Claus-Peter Rückemann*,
  WWU Münster / Leibniz Universität Hannover / HLRN, Germany

InfoWare / ICCGI 2016: `http://www.iaria.org/conferences2016/ICCGI16.html`
Program: `http://www.iaria.org/conferences2016/ProgramICCGI16.html`

InfoWare Expert Panel: . . . How to Successfully Transfer the Knowledge

Panel Statements and Preview:

- **Knowledge, data, transfer, workflows, and procedures:** Should be understood and defined.
- **Implementations:** Should consider knowledge-appropriate means and measures.
- **Reducing** . . . to economic value / costs is too simplified.
- **Value of data:** A currency should be implemented.
- **Long-term:** Data and knowledge should be preserved for long-term, longer than project intervals.
- **Measurability:** Transfer, quality, and sustainability should be measured.
- **Best practice** . . . for knowledge and transfer should become mandatory (e.g., for participation and funding).
- **Howto:** Examples needed for knowledge transfer to academia and industry:
- **Products and knowledge transfer:** Know-hows are in the labs but companies wishes can boost product maturity and knowledge transfer beyond lab skills/wish.
- **Practice:** Mission, staff, and partnering (National Institute of Standards and Technology).
- **ICT:** Academy- Industry - partnership experience - in ICT European Research Projects, FP6 FP7, H2020, etc.
- **University-Industry:** University- Industry & Telecom operators - direct cooperation experience.

InfoWare Expert Panel: . . . How to Successfully Transfer the Knowledge

Pre-Discussion-Wrapup:

- **Focus:** Experiences with knowledge transfer?
- **Special conditions:** . . . with academia-industry partnerships?
- **How-to define:** Data, Big Data, knowledge, . . .?
- **How:** . . . does knowledge manifest?
- **Means:** Priorities on what data to keep and which means to employ?
- **Context:** Who is involved?
- **How-to:** How can sustainable solutions be created?
- **Recommendations:** Which general and special recommendations?
- **Sustainability:** Scenarios beyond multi-disciplinary and long-term?
- **Networking:** Discussion! Open Questions?

  Suggestions for next Expert Panel?

InfoWare Expert Panel: Conclusions / Post-Panel-Discussion Summary

Post-Panel-Discussion Summary (2016-11-18):

- **Means of transfering knowledge (by panelists/audience):**
  - **Formal knowledge documentation, following experiences and best practice.**
  - **Prototype (e.g., for software product).**
  - **Open Source, code (e.g., procedural knowledge).**
  - **Patent (e.g., technical implementation, product).**
  - **(Transfer staff / hire – someone with appropriate knowledge).**
  - **. . .**
- **Base for partnership and knowledge transfer:**
  - **Definitions/common understanding of knowledge and how it shall be transferred, contracts (goals, milestones, schedules, pre- and post-project phases, . . .), formal description, standards, long-term strategy, understanding of value of data and appropriate currency, . . .**
- **Support for transfering knowledge (by panelists/audience):**
  - **There is no unique set of core requirements.**
  - **Goal is to improve the knowledge transfer:**
  - **Dedicated scientists, experts, and decisions groups.**
  - **Coordinating knowledge transfer group f. applied cases (supporting experts).**

InfoWare Expert Panel: Table of Presentations, Attached

Panelist Presentations: (presentation order, following pages)

- **Best Practice for Knowledge and Transfer** (*Rückemann*)
- **Yooz - Technologies Transfer Experiences** (*Poulain d'Andecy*)
- **Technology Transfer Issues** (*Nygard*)
- **Experience gained at UPB/ETTI in Academy-Industry Cooperation** (*Borcoci*)
- **Academia & Industry/NIST Partnership: How to Successfully Transfer Knowledge** (*Bostelman*)

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Academia-Industry Partnership: How to Successfully Transfer the Knowledge

Best Practice for Knowledge and Transfer

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November 17, 2016, Barcelona, Spain

Dr. rer. nat. Claus-Peter Rückemann[1,2,3]

[1] Westfälische Wilhelms-Universität Münster (WWU), Münster, Germany
[2] Leibniz Universität Hannover, Hannover, Germany
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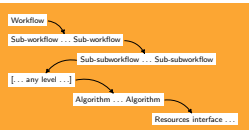


Knowledge and knowledge transfer

- **Scenarios / aspects / combinations:**
  Academia, industry, adademia-industry,
  ..., projects, long-term knowledge,
  ..., scientific research, economic purpose,
  ..., partnership, collaboration, cooperation,
  ..., publically funded, industry fundes,
  ...
- **Content and applications:** Most important, highest value (natural sciences, fundamental research, applied sciences, practical applications, ...) real value not seen by many.
- **Knowledge and documentation:** ... mostly neglected (e.g., by partners, funding agencies, researchers). What is data, what is knowledge, what is Big Data ...?
- **Solid concepts and means:** Available but rarely used.
- **Who cares?:** Someone (else) or Big Data or G**gle.

Vision ... regarding knowledge, transfer, content, and scenarios

- **Understanding:** Transfer, knowledge, value of data, Big Data, ... in context.
- **Defining:** Data, knowledge, ...
- **Implementing:** Solutions based on appropriate means and measures.
- **Keeping:** Data and knowledge, e.g., for long-term.
- **Measuring:** Success.

Understanding:

- **Facets of transfer:**
  – Long-term knowledge transfer ("generations") ...
  – Pre-, In-, Post-Project knowledge transfer ("projects").
  $\Rightarrow$ Any long-term and project activities will face combinations of various facets.

Knowledge and how it manifests:

- **Factual knowledge**,
- **Conceptual knowledge**,
- **Procedural knowledge**,
- **Metacognitive knowledge**, ...

Defining knowledge (Summit delegates and contributors)

- **"Knowledge is created from a subjective combination of different attainments as there are intuition, experience, information, education, decision, power of persuasion and so on, which are selected, compared and balanced against each other, which are transformed, interpreted, and used in reasoning, also to infer further knowledge. Therefore, not all the knowledge can be explicitly formalised. Knowledge and content are multi- and inter-disciplinary long-term targets and values. In practice, powerful and secure information technology can support knowledge-based works and values."**

Citation: *Rückemann, C.-P., Gersbeck-Schierholz, B., and Hülsmann, F., Przemysław Skurowski, Michał Staniszewski (2015): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Knowledge and Computing; September 23, 2015, The Fifth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 13th International Conference of Numerical Analysis and Applied Mathematics (ICNAAM), September 23–29, 2015, Rhodes, Greece.*

Delegates and contributors: *Claus-Peter Rückemann, Friedrich Hülsmann, Birgit Gersbeck-Schierholz, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany*;*Przemysław Skurowski, Michał Staniszewski, Silesian University of Technology, Gliwice, Poland*; *International EULISP post-graduate participants, ISSC, European Legal Informatics Study Programme, Leibniz Universität Hannover, Germany*

Defining data-centric and Big Data (Summit delegates and contributors)

- **"The term data-centric refers to a focus, in which data is most relevant in context with a purpose. Data structuring, data shaping, and long-term aspects are important concerns. Data-centricity concentrates on data-based content and is beneficial for information and knowledge and for emphasizing their value. Technical implementations need to consider distributed data, non-distributed data, and data locality and enable advanced data handling and analysis. Implementations should support separating data from technical implementations as far as possible."**
- **"The term Big Data refers to data of size and/or complexity at the upper limit of what is currently feasible to be handled with storage and computing installations. Big Data can be structured and unstructured. Data use with associated application scenarios can be categorised by volume, velocity, variability, vitality, veracity, value, etc. Driving forces in context with Big Data are advanced data analysis and insight. Disciplines have to define their 'currency' when advancing from Big Data to Value Data."**

Citation: *Rückemann, C.-P., Kovacheva, Z., Schubert, L., Lishchuk, I., Gersbeck-Schierholz, B., and Hülsmann, F. (2016): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data-centric and Big Data – Science, Society, Law, Industry, and Engineering; Sep. 19, 2016, The Sixth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 14th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sep. 19–25, 2016, Rhodes, Greece.*

Delegates and contributors: *Claus-Peter Rückemann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany;Zlatinka Kovacheva, Middle East College, Department of Mathematics and Applied Sciences, Muscat, Oman; Lutz Schubert, University of Ulm, Germany; Iryna Lishchuk, Leibniz Universität Hannover, Institut für Rechtsinformatik, Germany; Birgit Gersbeck-Schierholz, Friedrich Hülsmann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany*

Implementing and keeping: Which data to keep, by which means?

- Publication and dissemination (Golden Open Access, ...), Knowledge resources (knowledge, collections, containers, references, classification, ...) including media sources, program sources, publications, realia, ..., via long-term means, Universal Decimal Classification (UDC), Unified Modeling Language (UML), Knowledge discovery, High End Computing, ...

Who?

- project funding organisations, organisations affiliated with partnership/research/collaboration, organisations specialised on knowledge preservation, researchers, creators, ...

Measuring Success:

- Measuring success, with partnership, collaboration, and transfer (common items: schedule, scope, budget, satisfaction customer, satisfaction team, quality of data, work, procedures, ...)
  - **Knowledge transfer should be part of the partnership / collaboration.**
  - **Defining knowledge (factual, procedural etc.) for the partnership (e.g., with the contract).**
  - **Specifying intervals (as part of collaborations, fully funded) even before and after collaborations for knowledge transfer.**
  - **Defining (and agreeing on) workflows and procedures.**
  - **Evaluating transfer, quality, and sustainability (long-term aspects, satisfaction of participants).**

Conclusions:

- Knowledge, data, transfer, workflows, and procedures should be understood and defined.
- Implementations should consider knowledge-appropriate means and measures.
- Decision making on knowledge should be done by experience and practice.
- Reducing to economic value / costs is too simplified.
- A currency should be implemented for the value of data.
- Data and knowledge should be preserved for long-term, longer than project intervals.
- Transfer, quality, and sustainability should be measured.
- Best practice for knowledge and transfer should become mandatory (e.g., for participation and funding).

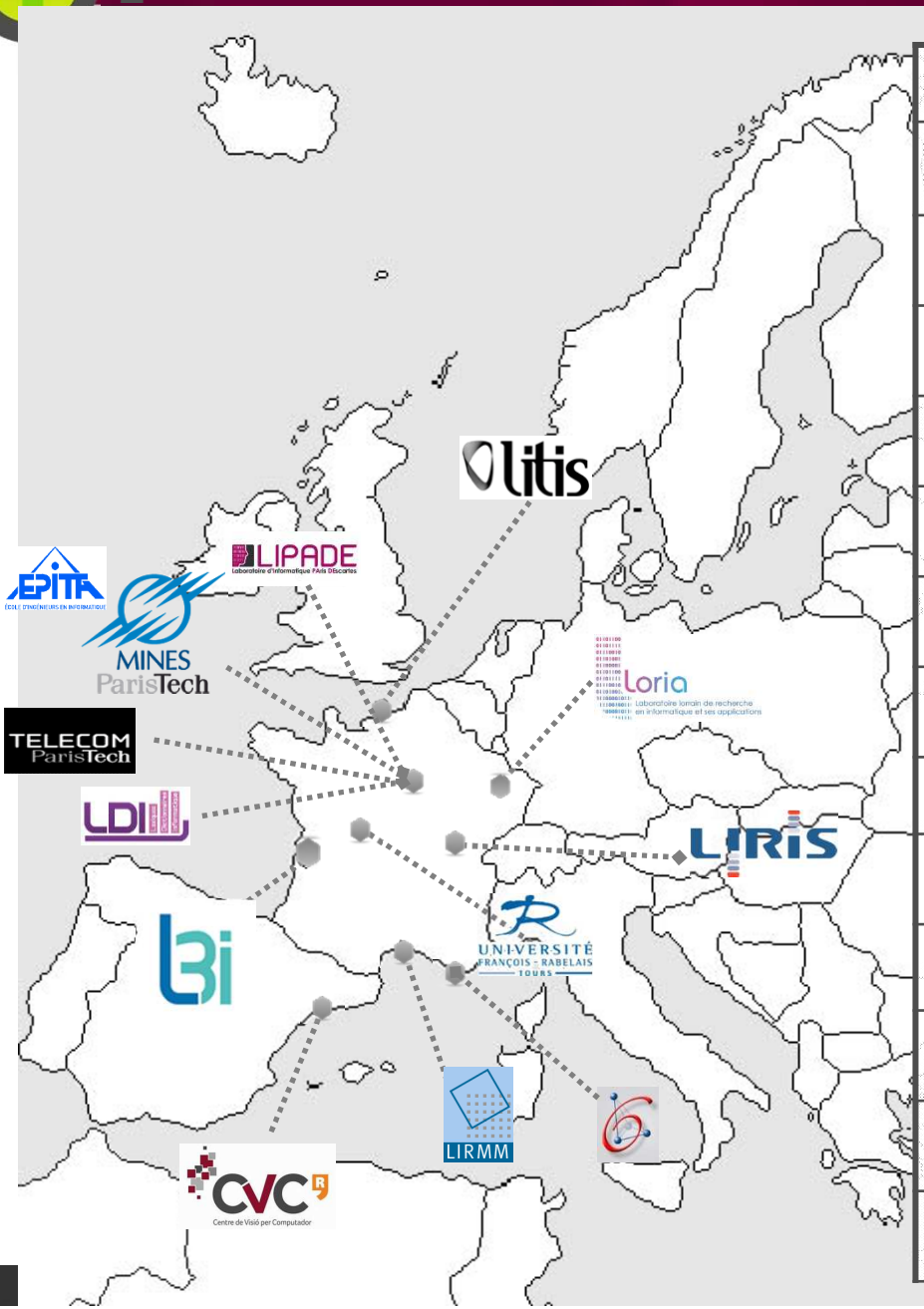
Thank you for your attention!

Wish you had an inspiring conference and a pleasant stay in Barcelona!

Technologies Transfer Experiences

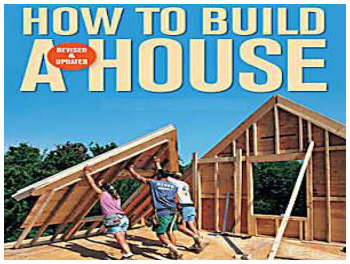
Vincent Poulain d'Andecy

More than 30 projects in 7 years

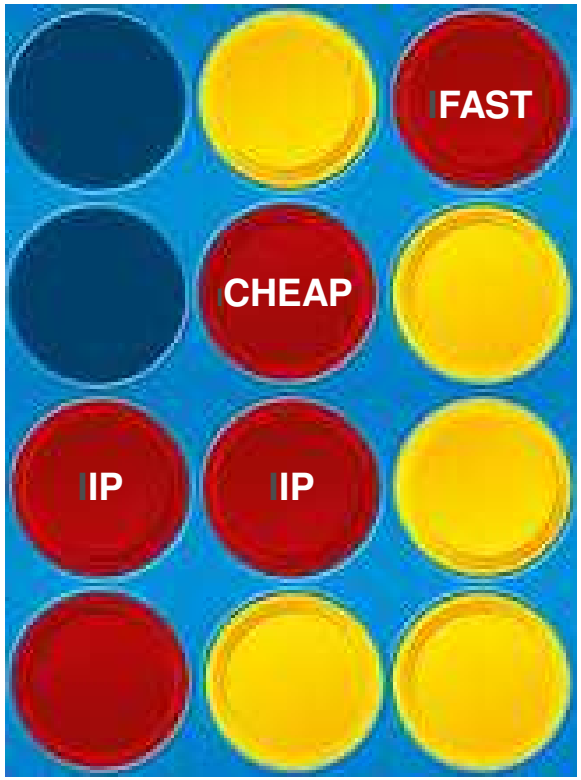


Lab	Partnership Framework & Skill	
Loria	DOD	Document analysis, handwriting recognition
	DOD PIXL	Forensic analysis, color image processing
litis	DOD	Document analysis, handwriting recognition
CVC	DOD	Handwriting recognition, multimodal man-machine interface
TELECOM ParisTech	DOD	Handwriting recognition
UNIVERSITÉ FRANÇOIS - RABELAIS TOURS	DOD	Document Classification, color image processing
LIRIS	DOD PIXL	Data Extraction , Color Image Processing
LIRMM	DOD	Natural Langage Processing
LIPADE	DOD PIXL	Image processing, document analysis, handwriting recognition
	DOD	Security, OCR, document classification
LDI	DOD	Natural Langage Processing
MINES ParisTech	LINX	Color Image processing
EPITA	LINX	Natural scene processing

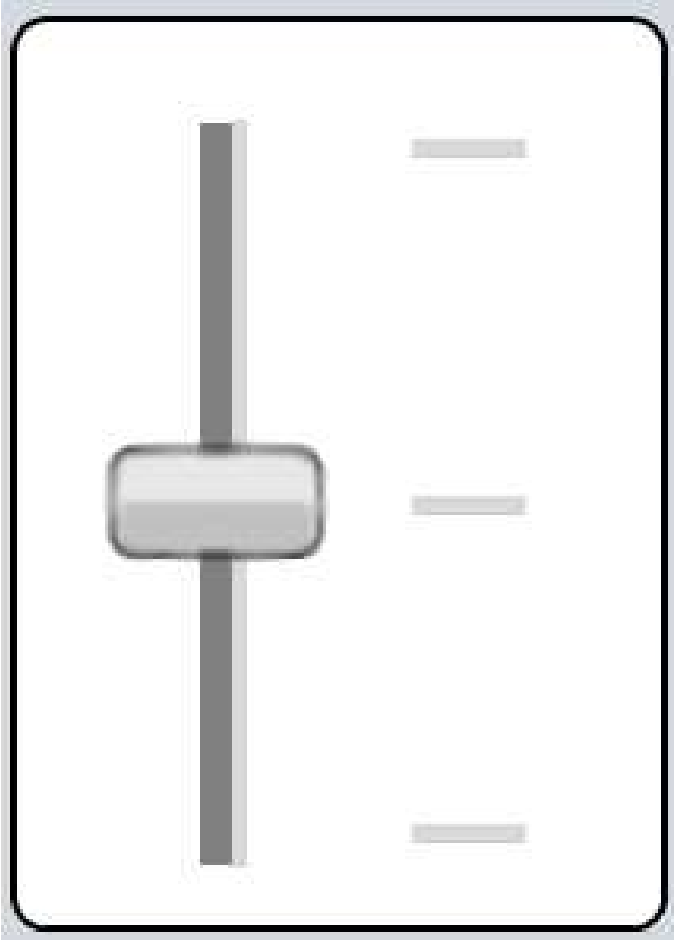
Get a « product »



	MAKE	BUY	RENT
Time to market			
Cost			
Strategic vision			
Innovation			



Know-hows are in the lab but,



Proof of Concept

LAB skills

Prototype

Product

Company wish

Win-win Partnership Evaluation

	Lab	Industrial
Benefits	• Research Axes • Materials • Humans ressources • **Dissemination**	• Get a « product » • IP • **Time boxed** • Acceptable budget
Charges	• Give expertise • **Implement a reliable feature respecting industrial concerns** • IP Transfer	• Give a challenge • **Provide materials** • **Confidentiality** • $$$ Fund $$$ • Integration effort
Balance	• Compatible with lab roadmap => Go	• Compatible with business roadmap => Go

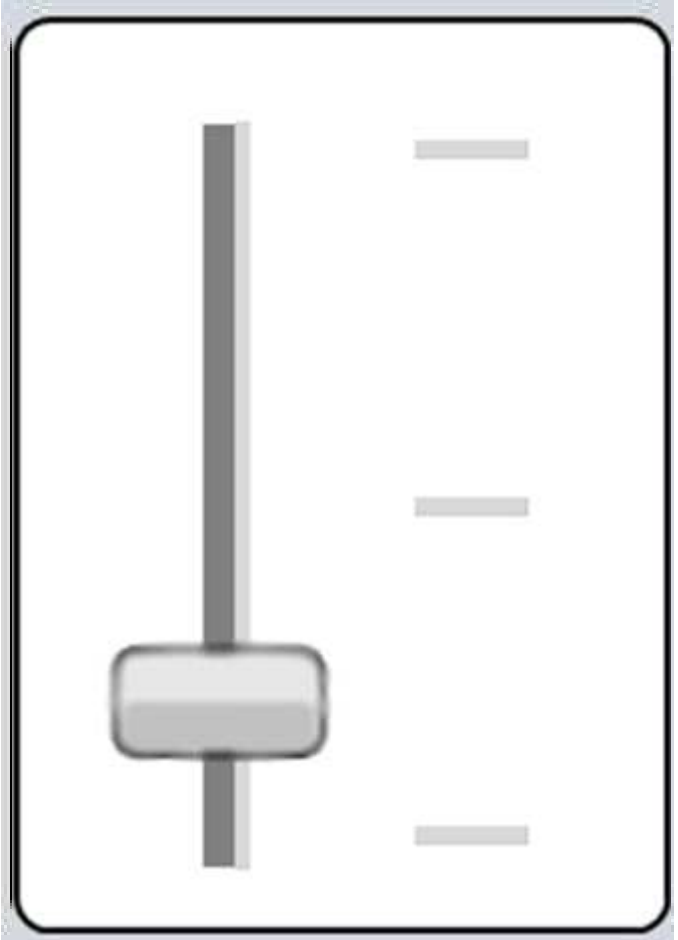
Issues to set-up a project

- State of the art
  - Evaluation of the current know-how to a given problem
  - Risk : delay and scope definition of the knowledge transfert
- Scientific and functional objectives
  - Expectation in the result
  - Risk : under-estimate the need of the partner
- Cost
  - Fund the project with a research program
  - Risk : write a proposal is expensive, low success rate
- IP
  - Shared property is impossible to manage
  - Risk : result explotation at the end of project

Issues when implementing a project

- Recruitment
  - Skills and motivation of involved fellows
  - Risk : lost of motivation of the student during long project
- Scientific and functional objectives
  - Project management + tight collaboration
  - Risk : lost of the real objective
- Quality
  - Robustness and generic implementation
  - Risk : delay and pain for the industrial partner
- Integration into the product
  - Synchronization between Academia and Industry teams
  - Risk : Late delivery… lost of support !

How to enhance the knowledge transfert ?



Proof of Concept

LAB wish

Prototype

Product

Company wish

Technology Transfer Issues

Kendall E. Nygard
North Dakota State University

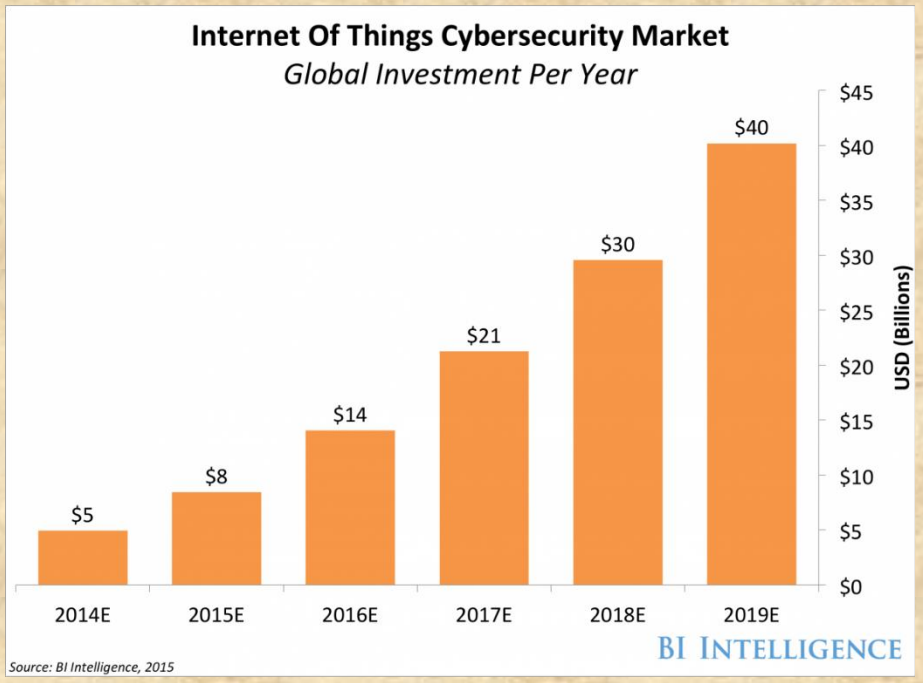
Four Points

1. Software security issues are often an afterthought
2. Intellectual Property Issues
3. There can be clashes between orientations of industry and academic consultants
4. Time scales often differ

Point 1: Software Security in the Internet of Things is lacking

- Figure Source: Business Insider
- 66% of major companies rate them selves as underprepared for security in the context of Internet of things

Sources: Wordstream, Raytheon



The Focus Tends to be on Operations, not Software Builders

- Operations people tend to build firewalls, intrusion detection systems, anti-virus engines, etc.
- But software designers and builders often focus on functional requirements, and non-functional requirements (e.g., security) are an afterthought or ignored altogether

Need for Software Security

- Recognize that hackers easily skirt standard security and exploit vulnerabilities in the software itself
- Secure software resists attack by avoiding
  - Access points where hackers can enter and install malicious software (e.g., Target breach)
  - Testing shortcuts
  - Buffer overflows, careless use of pointers
  - Invalid inputs (e.g., SQL injection)
  - Inconsistent error handling

U. S. State of North Dakota Takes Action in Cyber Security

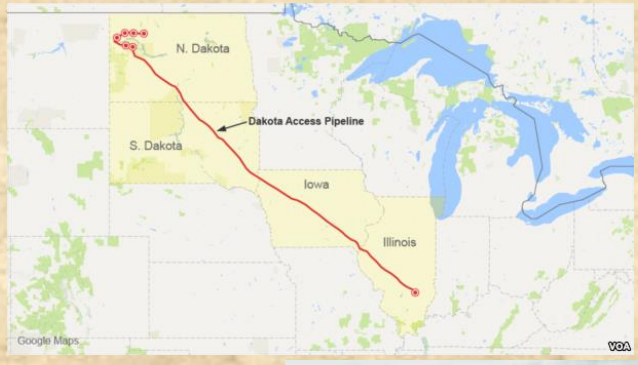
- Upwards of 40 million attacks monthly on state government alone
- Huge need for Cyber Security professionals
- Governor Task Force established
- Chancellor of Higher Education System establishes 11 campus consortium in Cyber Security education

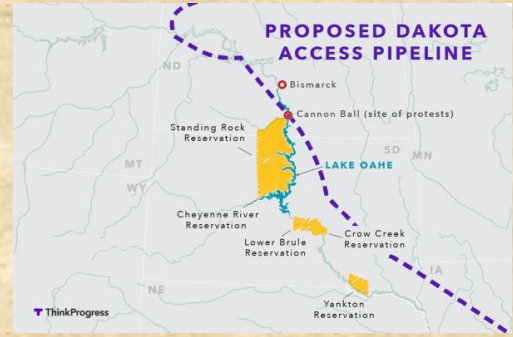
Point 2: Intellectual Property Clash

- Two examples in my personal experience where issues of intellectual property rights resulted in the project not being funded at all

Point 3: Disconnect Between the Orientation of Industry People and Consultants/Academics

- Industry focus on profits and shareholder value
  - Can limit consideration of sustainability practices and environmental effects (carbon emissions, damage to water supplies)





Point 4: Differing Time Scales

- Academics get grants for an extended period of time
- Academics have a host of responsibilities, not just the project
- Industry has tight deadlines, employees who only work the project

Panel on Academia- Industry Partnership

Topic: Academia-Industry Partnership: How to Successfully Transfer the Knowledge

Experience gained at UPB/ETTI in Academy-Industry Cooperation

Eugen Borcoci
University Politehnica Bucharest (UPB)
Electronics, Telecommunications and Information Technology Faculty (ETTI)
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InfoWare 2016 Conference, November 13-17, Barcelona

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **University POLITEHNICA of Bucharest (UPB) -** the oldest (190 years) and largest technical university Romania.
- **UPB**
  - 15 faculties, more than 20 000 students and about 3000 people in the academic and research staff (including Ph.D students)
  - **Programs of study:**
    - **Bachelor of Science** programs in 17 major fields and more than 70 distinct specializations, 4 years
    - **Master of Science** programs in more than 170 specializations, 2 years
    - **Ph.D.** degrees in 14 fields of Engineering Sciences, 3 years
  - **Electronics, Telecommunications and Information Technology Faculty (ETTI)** : ~2500 students and 200 Ph.D. students
  - **Telecommunications Department**: ~50 teaching staff, 30 engineers and technicians, and 50 associated specialists

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- Research centre: **CCSRST - "Research Centre for Systems, Networks and Software in Telecommunications"** affiliated to the Telecommunication Department

- **CCSRST expertise**:
  - networks architectures
  - convergent networks (telecom and computer networks)
  - fixed and mobile communication technologies
  - network and services management and security
  - protocol specification, validation and implementation
  - adaptive algorithms
  - networked multimedia systems, QoS assurance
  - traffic management and performance evaluation
  - routing and switching
  - embedded systems

  - **Recent domains of interest:**
    - Cloud computing, SDN, NFV, 5G, IoT

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **Cooperation with industry/operators**

- **1. Int'l Research projects in the area of networking and services**
  - **Examples of CCSRST participation to IST/ICT Int'l European research projects:**
  - **Integrated projects (IP)**
    - IST FP5 MOICANE (2001-2002), (10 partners)
    - FP5 IP ENTHRONE I "E2E QoS through Integrated Management of Content, Networks and Terminals" (2003-2005), (18 partners)
    - FP6 IP ENTHRONE II, „E2E QoS through Integrated Management of Content, Networks and Terminals" (2006 - 2008) (20 partners)
    - FP6 IP, WEIRD-IST-034622 „WiMAX Extension to Isolated Research Data Networks" (2006-2008), (15 partners)
    - FP7 ALICANTE , "Media Ecosystem Deployment Through Ubiquitous Content-Aware Network Environments" (2010-2013), (20 partners)

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **Examples of CCSRST participation to IST/ICT Int'l European research projects (cont'd):**

- **Specific Target Research Projects**

  - FP7, STREP SMART-Net, "SMART-antenna multimode wireless mesh Network", (2008-2011), (6 partners)

  - CHIST-ERA, DISEDAN, „Service and User-based Distributed Selection of Content Streaming Source and Dual Adaptation", (2014-2015), (3 partners)

- **Networks of Excellence**
  - Euro Next Generation Internet (2003-2006), (50 partners)

  - Euro Future Generation Internet (2006-2008), (20 partners)

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **Experience gained from joint research int'l projects**

- **Integrated – large projects (IP)**
  - most profitable (scientific, technical) for both parts: academy and industry
  - ***two way transfer of knowledge***
  - opportunity for strong cooperation between groups
  - in many cases the cooperation continued for new projects
  - experience gained during theoretical studies but also from pilot platforms developments

  - Academia took benefit from transfer of knowledge from industrial partners:
    - Real life system design know-how, implementation skills (integration, testing, validation)
    - project and teams management, risk analysis

  - Industrial partners took benefit from transfer of knowledge from Academia:
    - Developing new advanced architectures
    - Algorithms and procedures development
    - Performance evaluation by simulation studies

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **Experience gained from joint research int'l projects (cont'd)**

- **Integrated – large projects (IP)**
  - **Issues to be considered in project proposal construction**
    - high competition in FP7, H2020, ..
    - much care to clearly define the objectives - as to correspond to the Call
    - (at least) 1/2 year, before submission deadline (to start construction)
      - Core of partners team needed to guide the proposal
    - Clear splitting of tasks among partners (aiming to efficiency)
      - Academia: mainly to be involved in requirements identification, architecture specs, algorithms, simulation studies, performance evaluation, implementation
      - Industry: mainly to be involved in requirements identification, architecture specs, coordination of: implementation, integration, testing, validation
    - Carefully define the project management aspects
    - Identify the impact, follow up opportunities, risks

    - Realization issues: PoC or Pilot?
      - Pilot: Specification, design, implementation, integration, validation (correcteness , performance) – who, when/milestones, responsabilities ?

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **Experience gained from joint research int'l projects (cont'd)**

- **Specific target research projects**
  - more scientific orientation
  - usually - Proof of Concept-focused
  - more simulation studies are needed to validate solutions
  - less – complete implementation is required but not excluding it
  - scalability studies /evaluation frequently is asked
  - Ph.D theses – additional results of such projects

  - **Issues**
    - is industry really interested in results? (ask feedback from industry)
    - can be attracted industry partners in such projects?
    - are the results applicable in real use cases?
    - future studies?

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- **2.Faculty &Telecom Dept. Cooperation with national entities – industry/ operators**
  - Lectures (inside a course) – to offer a better industry perspective
  - Lectures sets given by industry experts on specific novel topics in their area of interest
  - Diploma work (both bachelor and master) supervised in shared mode (UPB+ Entity x)
  - Feedback from industry - on the academic curricula - to adjust/update the material for novel technologies
  - Student work (summer stages) in enterprises
  - Scolarships offered by Companies (competition based)
  - Ph.D studies - oriented for topics of shared interest

Experience gained at UPB/ETTI in Academy-Industry Cooperation

- Thanks !

VEHICULAR 2016 - The Fifth International Conference on Advances in Vehicular Systems, Technologies and Applications

Panel on KNOWLEDGE TRANSFER

Academia & Industry / NIST Partnership: How to Successfully Transfer Knowledge

Roger Bostelman
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Thu, Nov 17, 17:00- 18:30

Working with NIST

- To help accomplish its mission:
  - … to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
  - NIST seeks out high-quality partnerships, collaborations, and other interactions with U.S. companies, universities, and agencies at the federal, state, and local levels.
- Each year NIST hosts about 2,700 associates and facility users who work with about 3,400 NIST staff members at two main campuses in Gaithersburg, MD and Boulder, CO.

  https://www.nist.gov/pba/working-national-institute-standards-and-technology

Academia, etc. - NIST Partnering

Academia

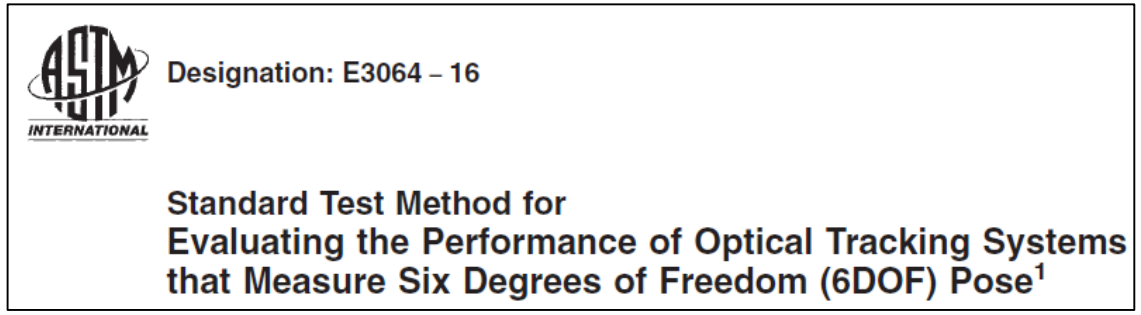
- Summer Students
- Summer Undergraduate Research Fellowships (SURF)
- Pathways Students
- Grants
- Cooperative Research and Development Agreements (CRADAs)
- Guest Researchers
- National Research Council Post-Doctoral Research Associates

Industry

- Contracts
- Memoranda of Understanding and Letters of Agreement
- Small Business Innovative Research (SBIR) Program
- Technology Partnerships Office
- Informal Collaborations (e.g., standards development)
- others

Knowledge Transfer Examples

- Summer Undergraduate Research Fellowships (SURF)
  - All science disciplines
  - Over 100 students per year for 10 weeks
  - Requires presentation/final report showing what the student learned (i.e., knowledge that was transferred)
- Standards Development
  - Subcommittees include academia, industry, government that "partner" to develop consensus standards. For example:
    - ASTM Committee E57.02 recently developed and published a new standard:



    - Included several international partners from industry, academia, and NIST labs
    - Various organizations measured OTSs to work toward a common goal – *i.e., industry standard*