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The Necessary Link Between Business Goals and Technology Choices

Linda Northrop
Director, Product Line Systems Program
Software Engineering Institute

Carnegie Mellon University
Pittsburgh, PA 15213

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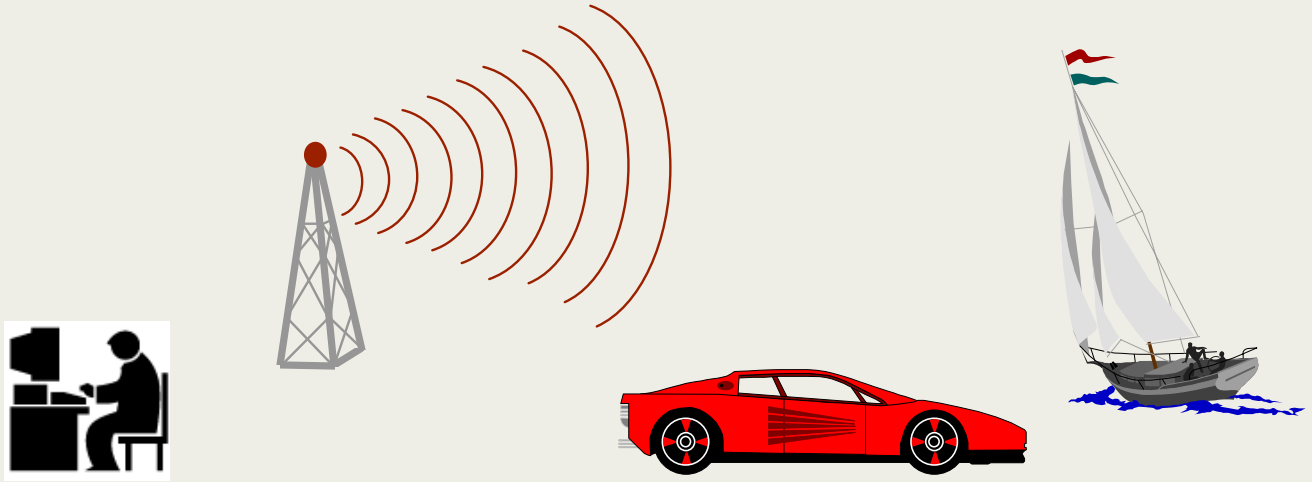
Beginning of the 21st Century



Software has become the bottom line for many organizations who never envisioned themselves in the software business.

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Typical Business Goals

- High quality
- Quick time (or first) to market
- Increased market share
- Effective use of limited resources
- Product alignment
- Low cost production
- Low cost maintenance
- Mass customization
- Mind share

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The Ultimate Universal Goal

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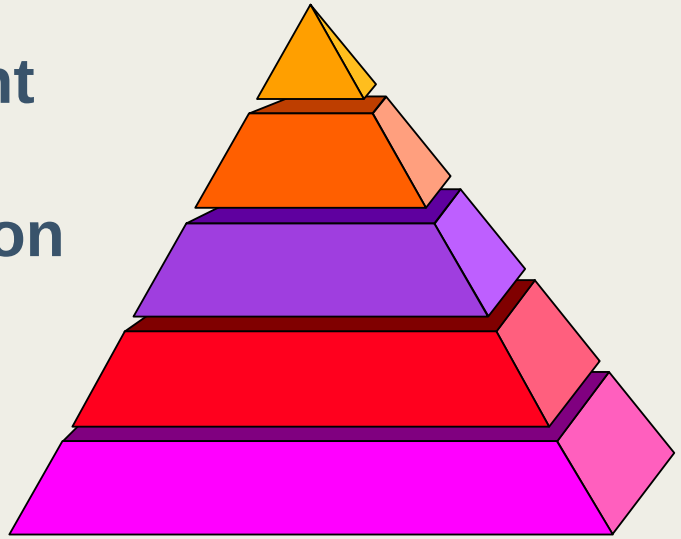
Software (System) Strategies

Process Improvement

Technology Innovation

Reuse



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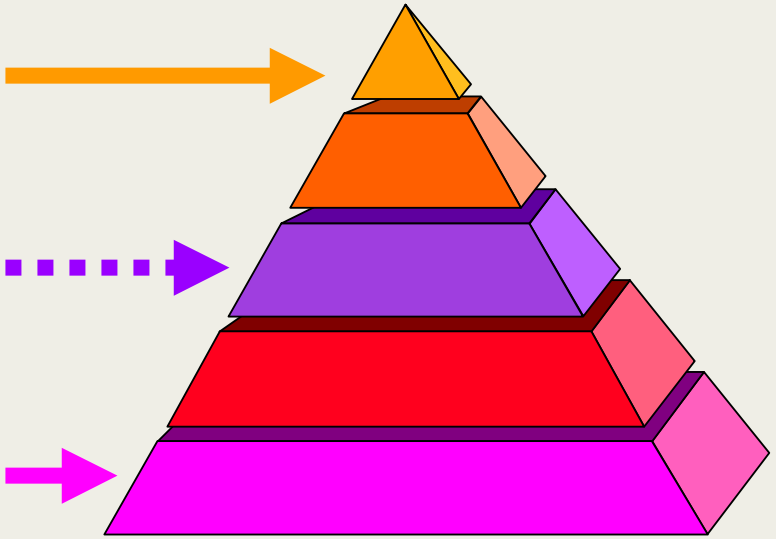
Technology Innovation Flavors

New Products

New Approaches



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Technology Innovation Types

Continuous innovation (*sustaining technologies*)

- improve performance of established products
- fit in current contexts

Discontinuous innovation (*disruptive technologies)*

- new and effective products
- force a new context and approach
- are difficult to incorporate into legacy systems

Some innovations are a little of both and some differ based upon the consumer.

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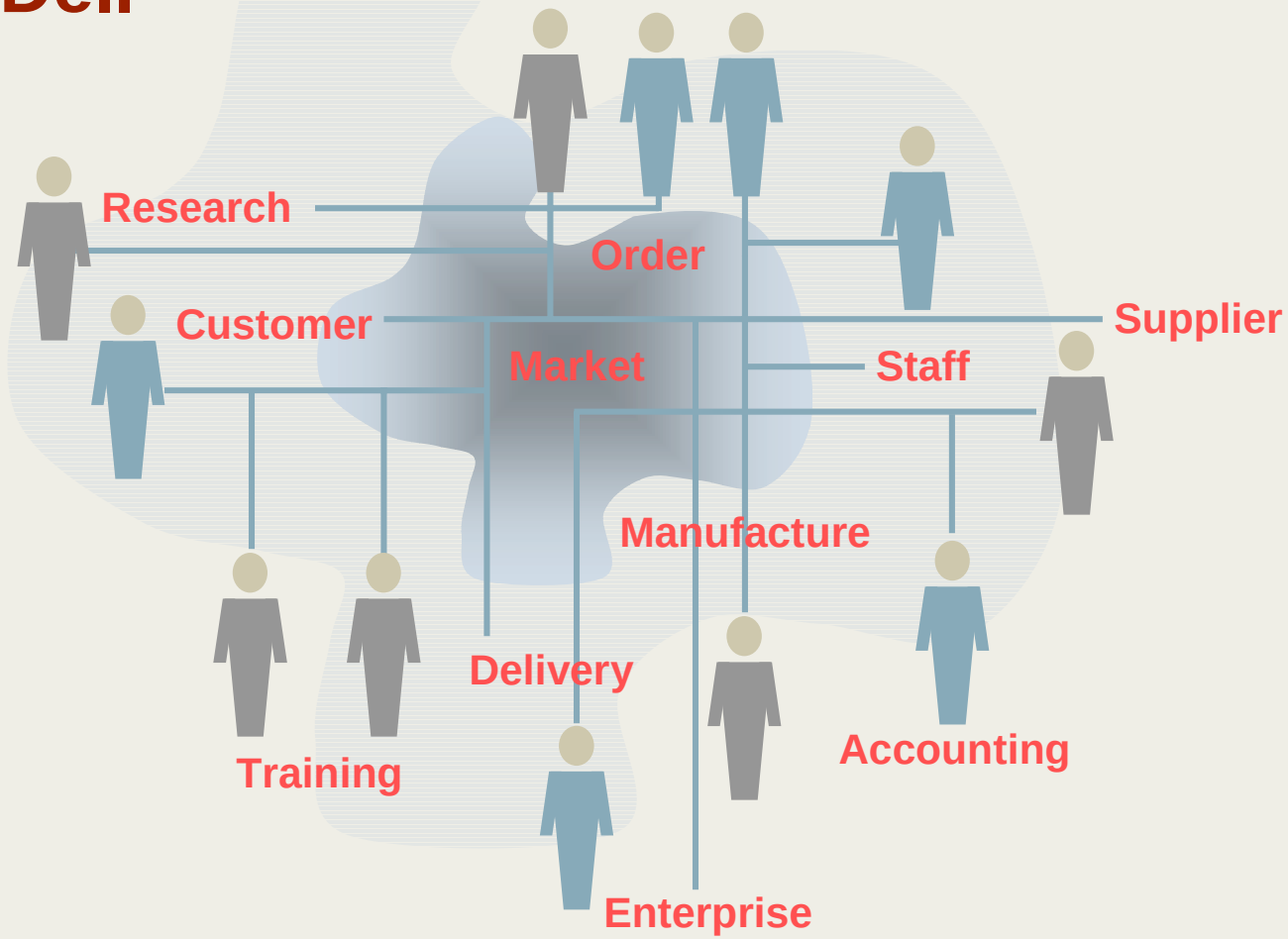
The Internet: A Sustaining Technology to Dell



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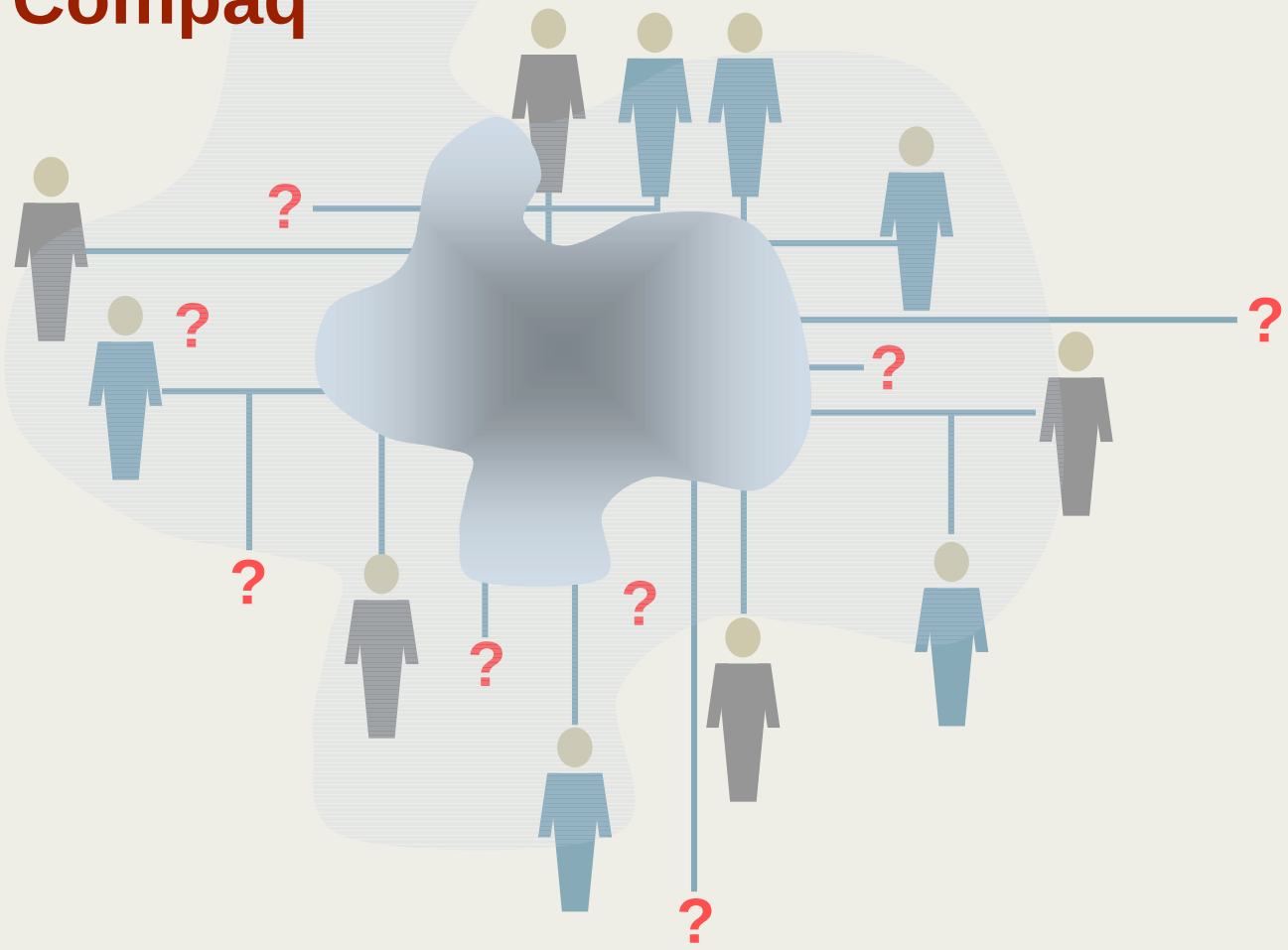
The Internet: A Disruptive Technology to Compaq



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Technology Innovation Roots

Sometimes from commercial practice

Most often from software research

- **pure**
- **applied**
- **reapplied**

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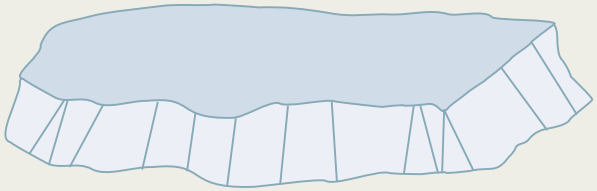
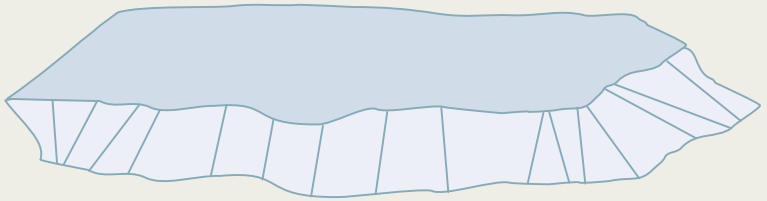
The Landscape



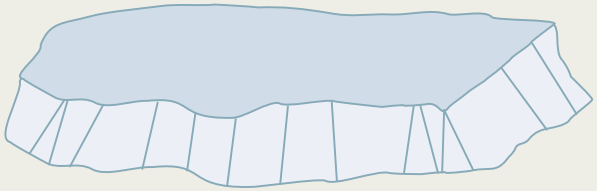
Software Research



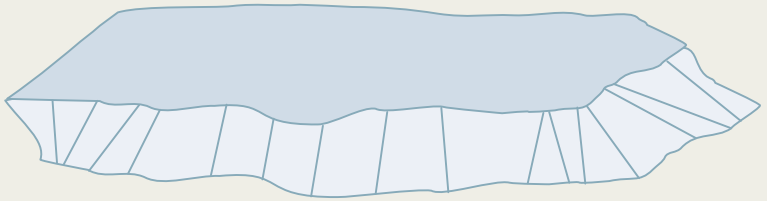
Commercial Practice

The Landscape

technology
innovations



Software
Research



Commercial
Practice

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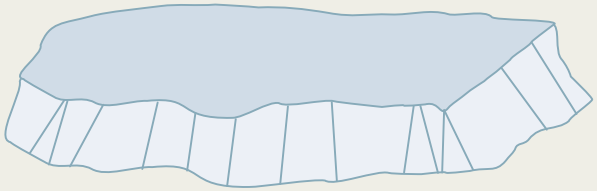
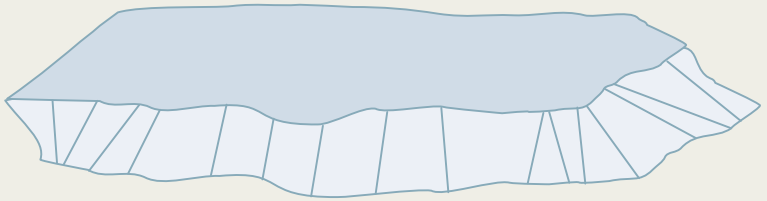
The Landscape

transition

technology
innovations





Software
Research

Commercial
Practice

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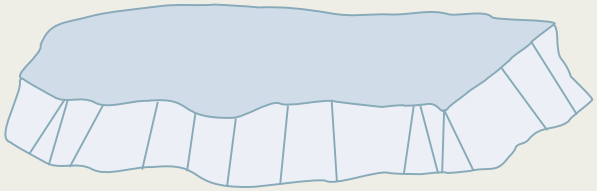
The Landscape

transition

technology innovations

adopt



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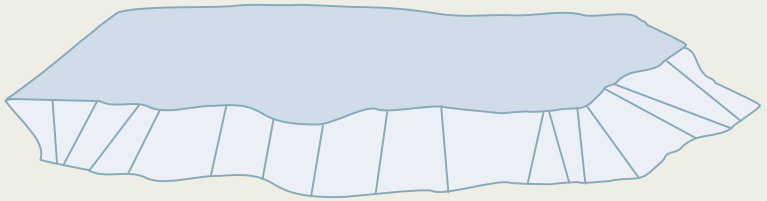

Commercial Practice

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Why Do Organizations Choose to Adopt a Technology Innovation?

It depends….

- **for no good reason**
- **because it is new and neat (rare)**
- **because they can align its potential value with business goals**
- **because it has a proven track record to achieve business goals**
- **because they are forced into it**

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FoxMeyer Drug Co.

In the early 1990s, bet its future on a massive enterprise software and warehouse automation system

Expected to:

- save $40 million annually
- serve a rapidly expanding customer base
- get information about customer buying patterns

Result:

- Missed product schedules
- Lost more than $34 million
- Filed for protection under Chapt 11 of federal bankruptcy code

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Adoption Failure

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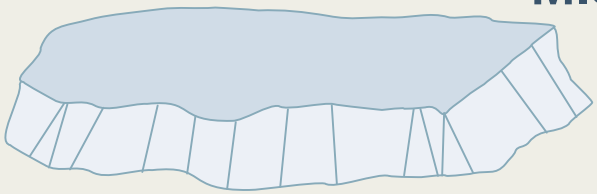
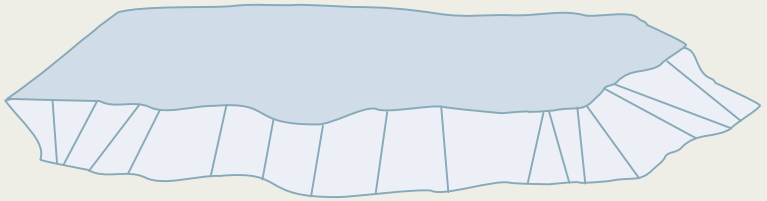
Adoption Failures

slow maturation process

need for quick results

MISMATCH





Software Research

Commercial Practice

Cummins Inc.: Diesel Engine Control Systems

Chose to adopt a software product line approach to

- **Improve time-to-market**
- **maintain high quality**
- **broaden market portfolio**

The result:

- **built over 20 product groups with over 1000 separate engine applications**
- **slashed product cycle time from 250 person-months to a few person-months**
- **reduced build and integration from one year to one week**
- **exceeded quality goals**
- **met product schedules**
- **Enjoyed high customer satisfaction**

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Adoption Success

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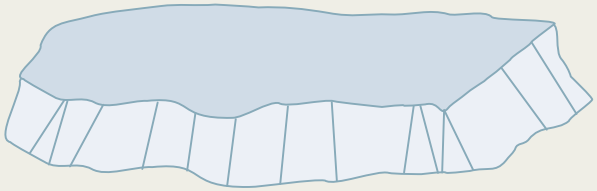
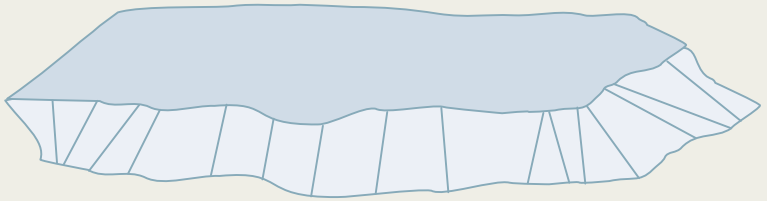
Transition Failures

technology
innovations that do
not become
mainstream practice

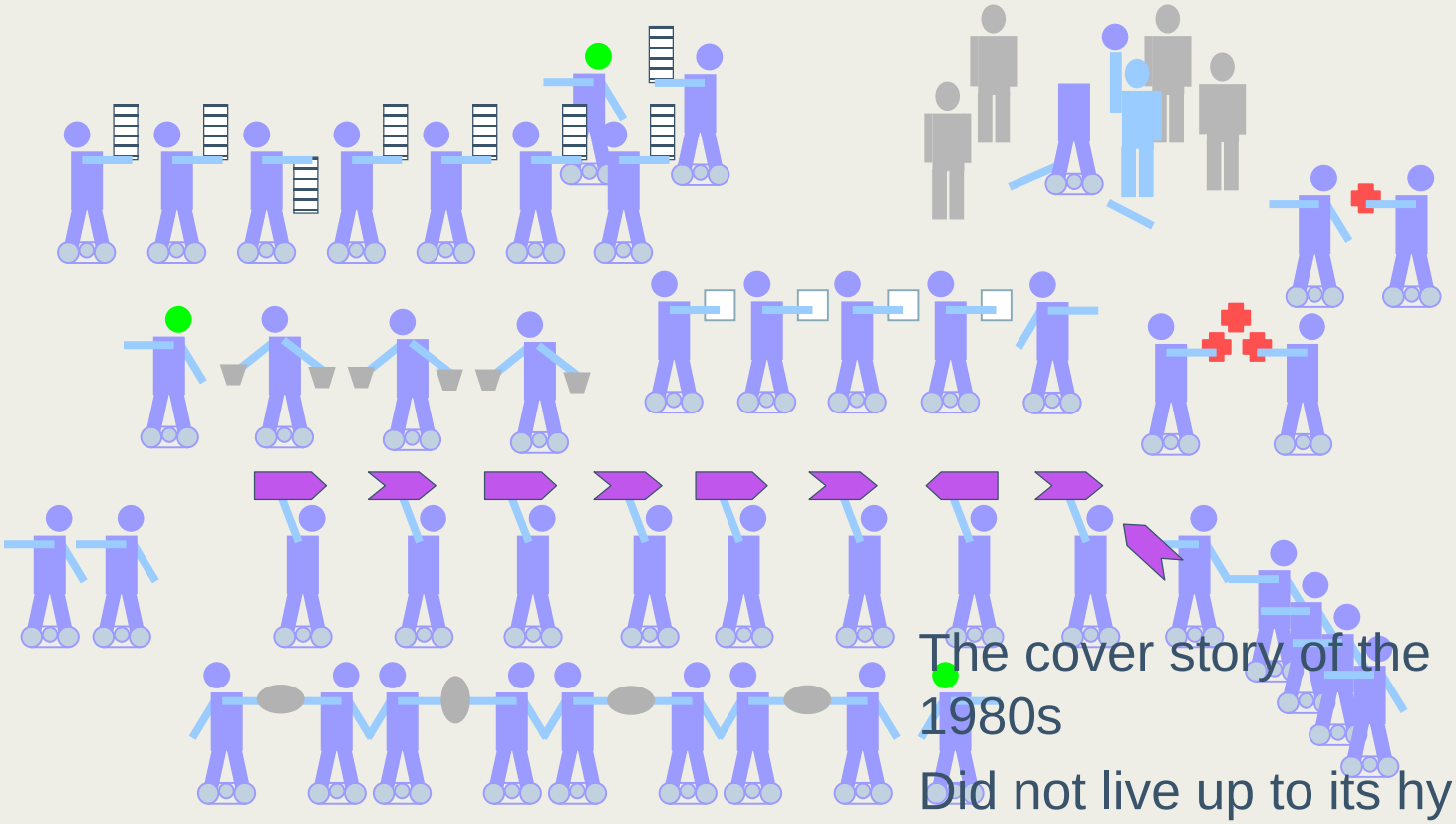


Software Research



Commercial Practice

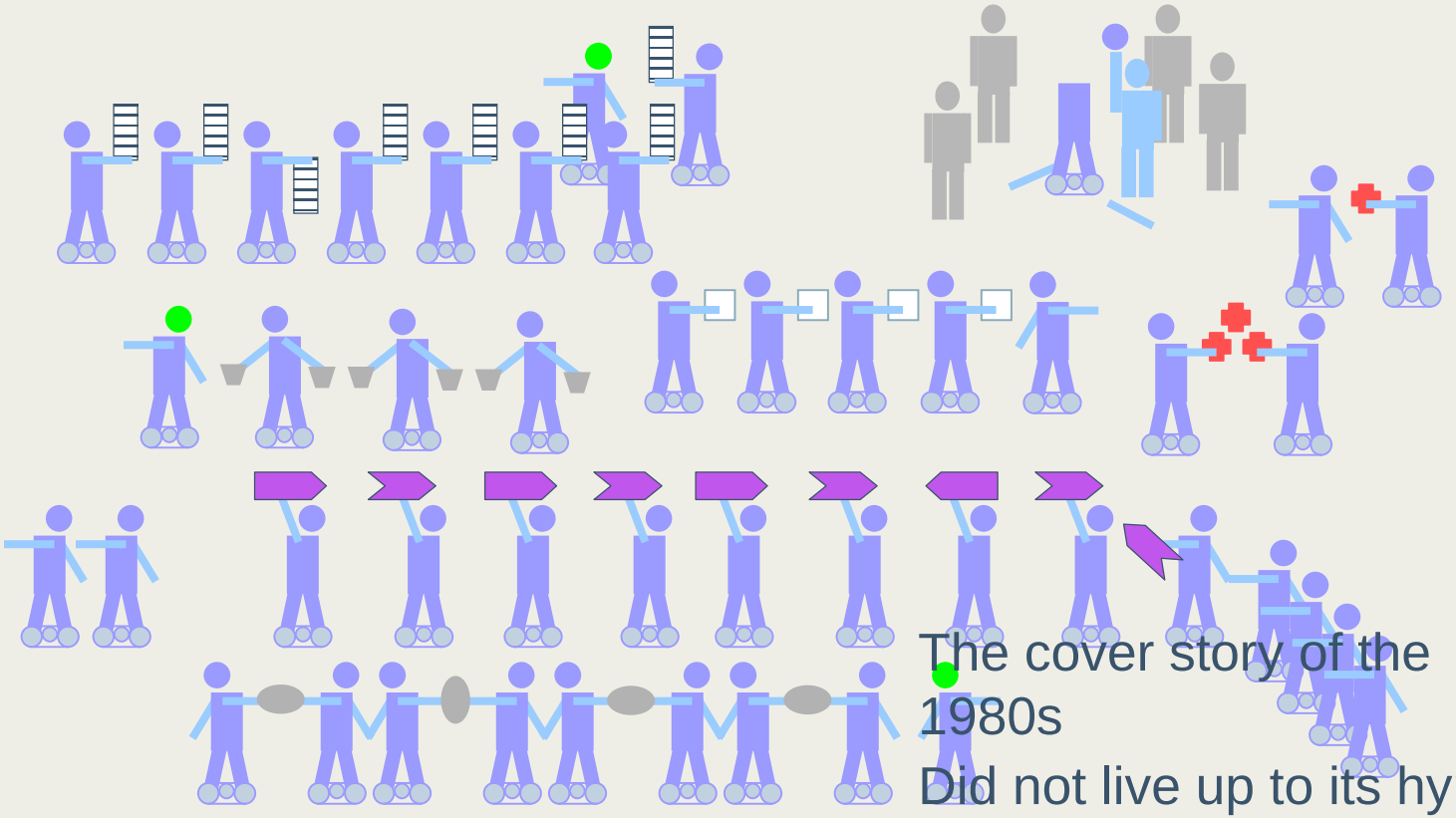
Artificial Intelligence



The cover story of the 1980s

Did not live up to its hype

Artificial Intelligence



The cover story of the 1980s

Did not live up to its hype

transition failure

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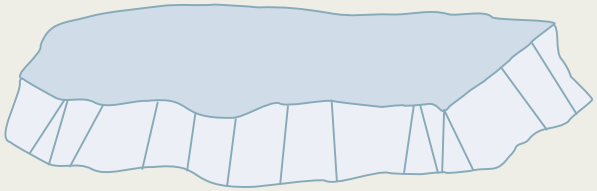
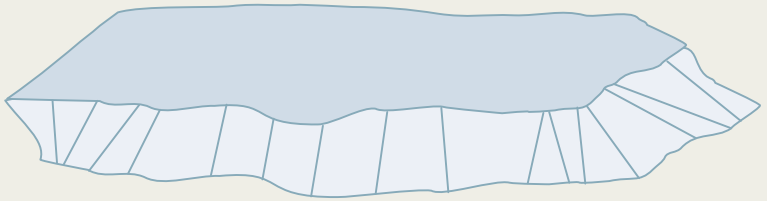
Transition Success

technology
innovations that do
become mainstream
practice



Software Research



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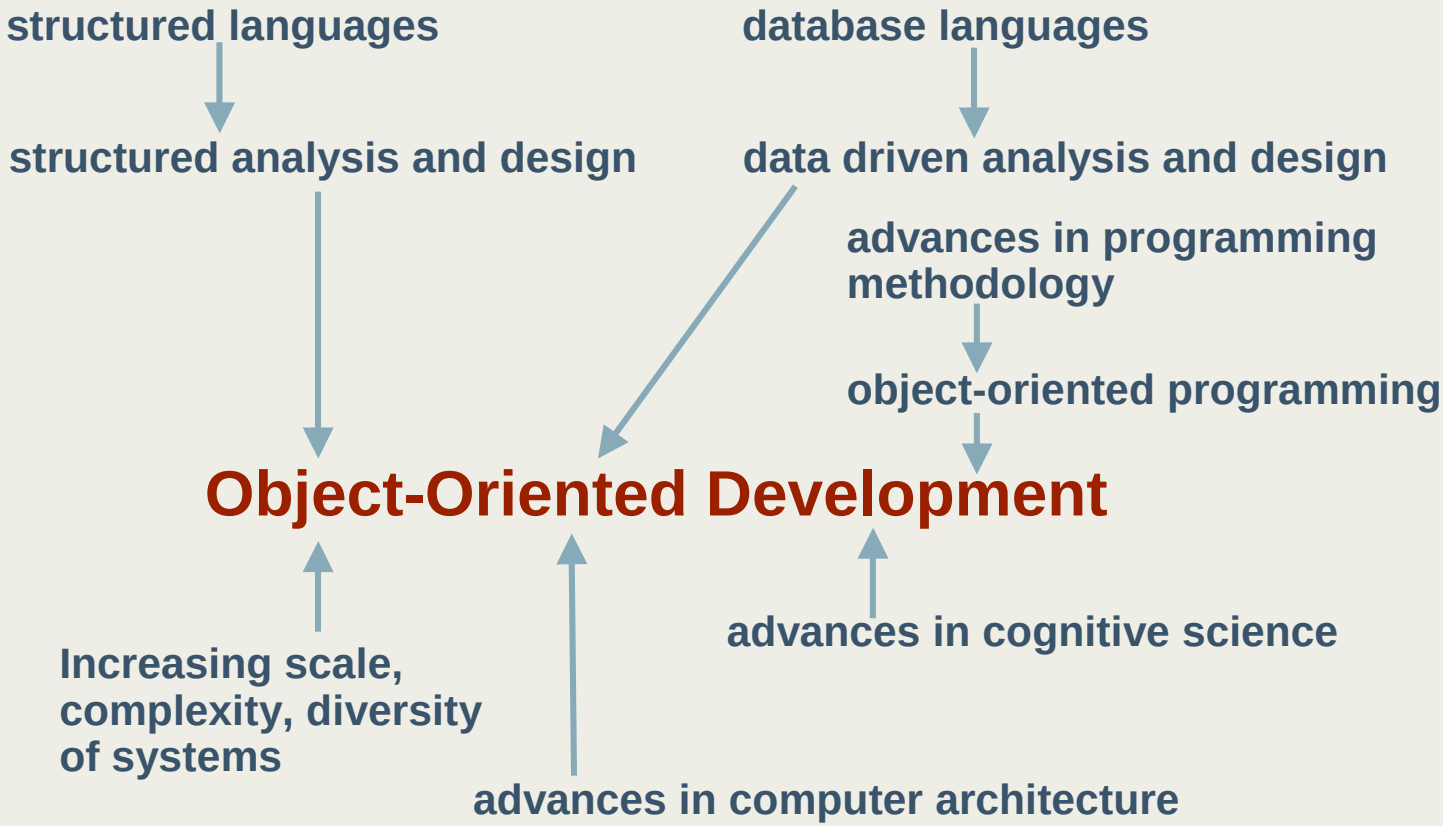
Influences (Adoption Factors) on Object-Oriented Development



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Object-Oriented Transition Strengths

Rapidly growing research and practitioner communities that provided

- **Languages**
- **Design methods**
- **Analysis methods**
- **Conferences**
- **Training**
- **Consultants**
- **Books**
- **Tools**
- **Supporting approaches and products**
- **Measures of impact (after while)**

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transition success

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And Yet…

"*Even though objects were invented several decades ago, they are entering the commercial IS market place slowly. Certain things are still missing; typical examples are money and transaction classes and version management of the modeling and programming tools.*"

Alistair Cockburn, 1997
Surviving Object-Oriented Projects

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Alistair Cockburn, 1997
Surviving Object-Oriented Projects

Technology transition takes a long time.

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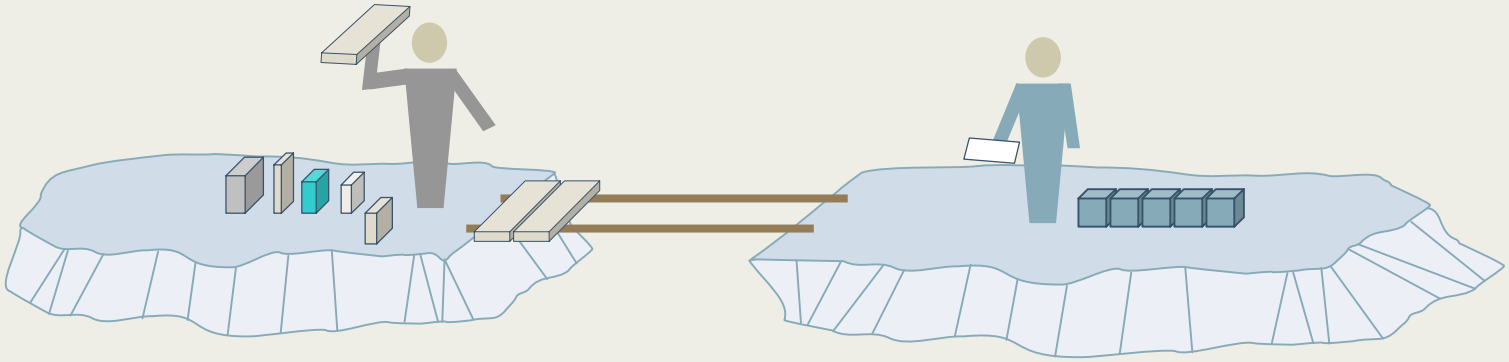
Making the Link: Transition Path



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Commercial Practice

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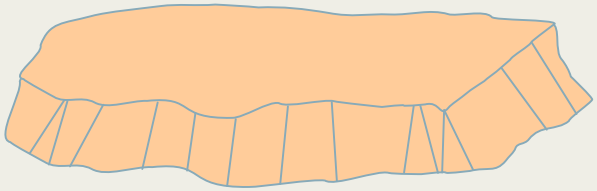
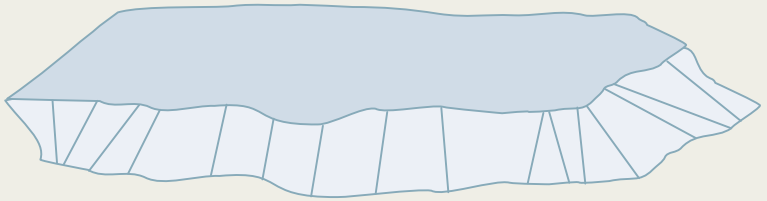
Transition: the Job of the Technologist

transition technology innovations *adopt*



Software Research



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Transition 101

If the goal is mainstream, commercial practice, technologists need to *market* in order to effect transition

What is marketing?

Taking actions to create, grow, maintain, or defend markets

What are markets?

- a set of actual or potential customers
- for a given set of products or services
- who have a common set of needs or wants and
- who reference each other when making a buying decision

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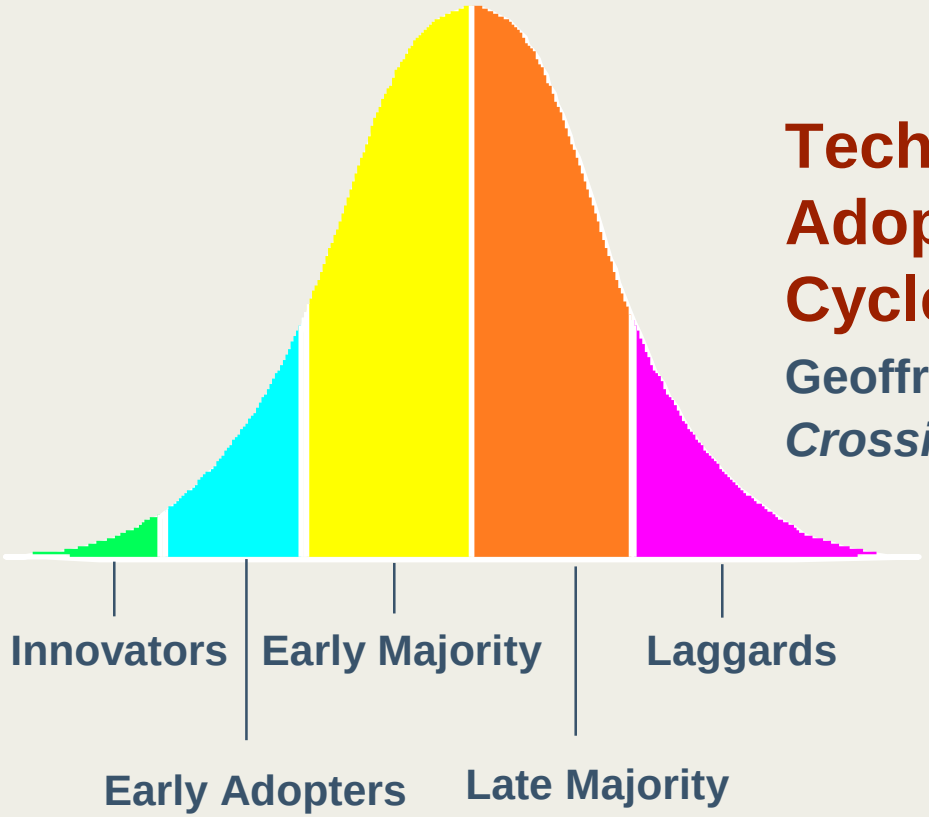
A Helpful Model



Technology Adoption Life Cycle

Geoffrey A. Moore
Crossing the Chasm

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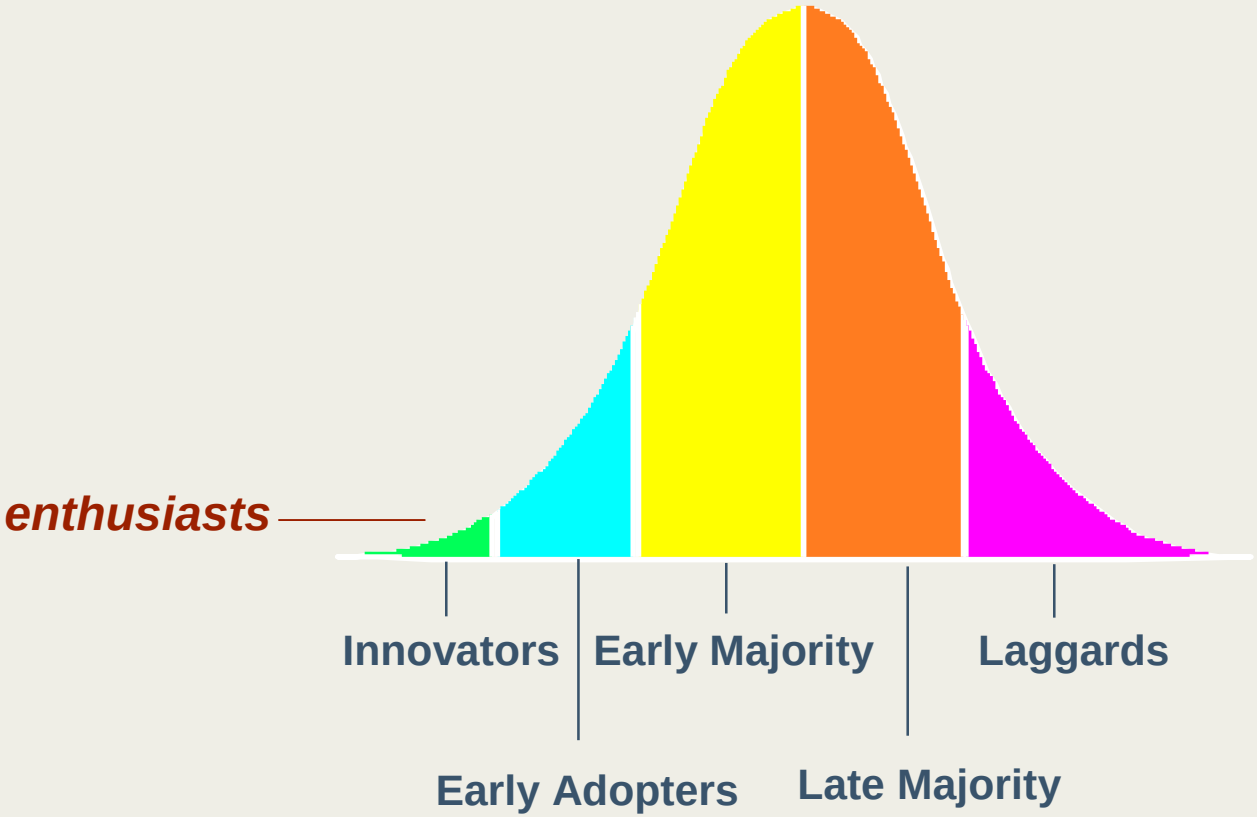
A Helpful Model



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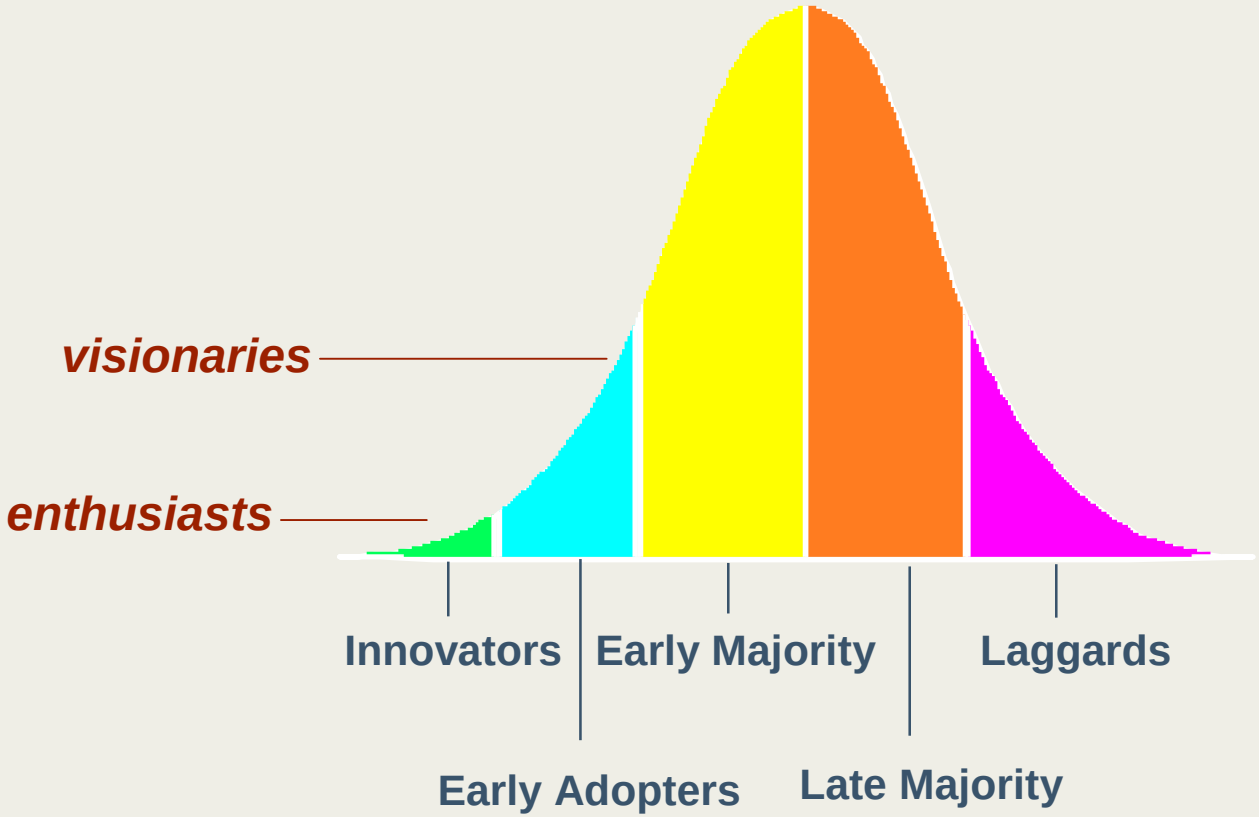
A Helpful Model



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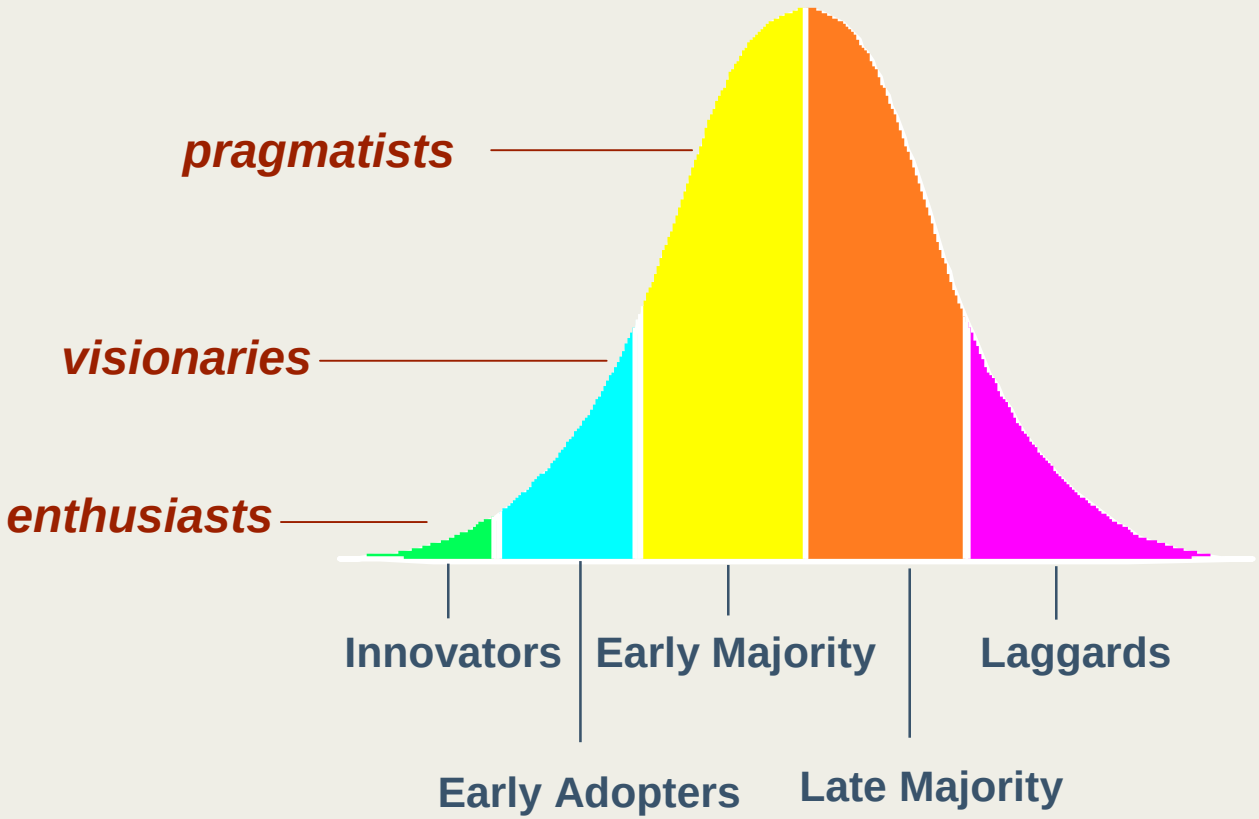

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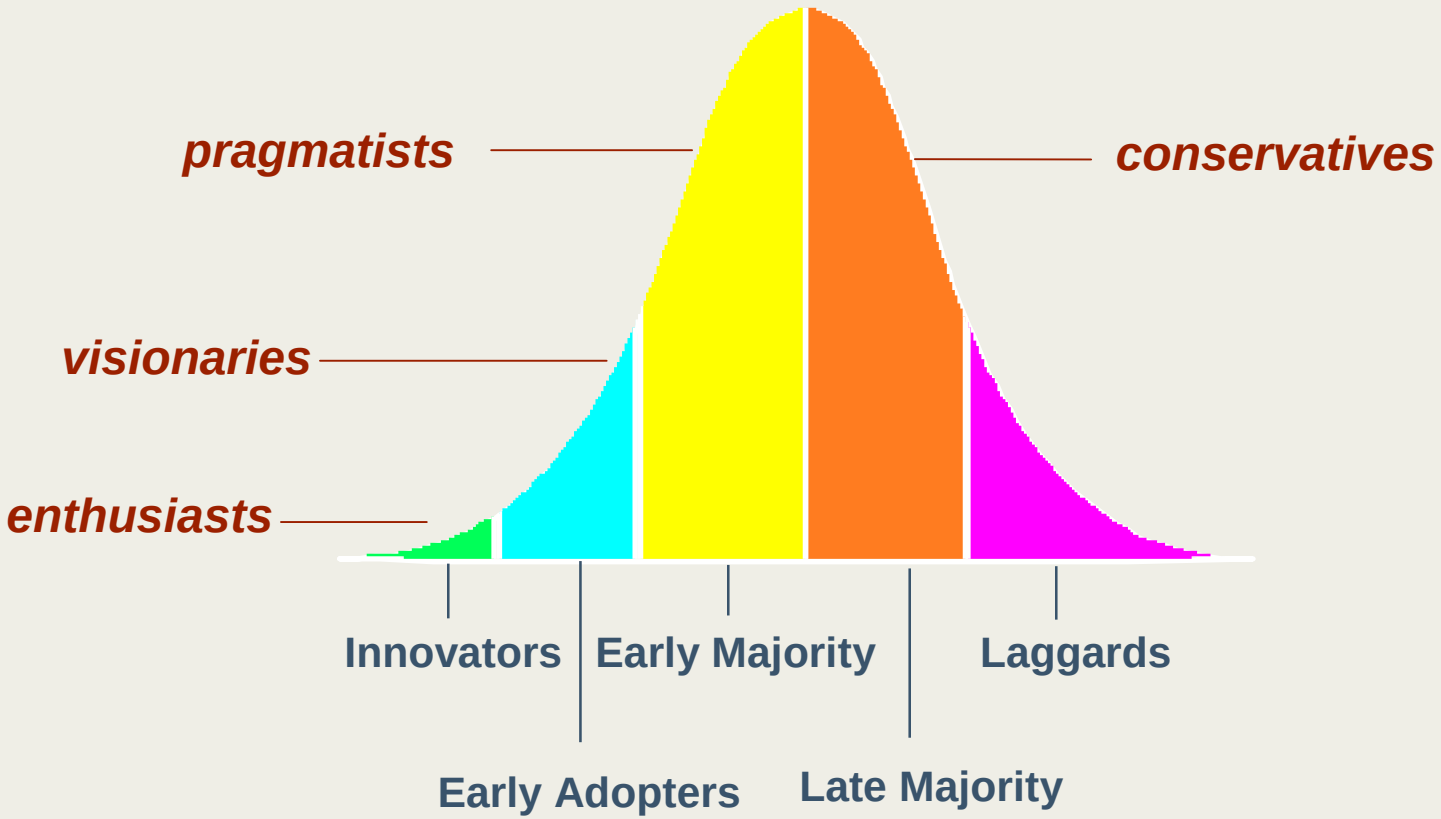
A Helpful Model



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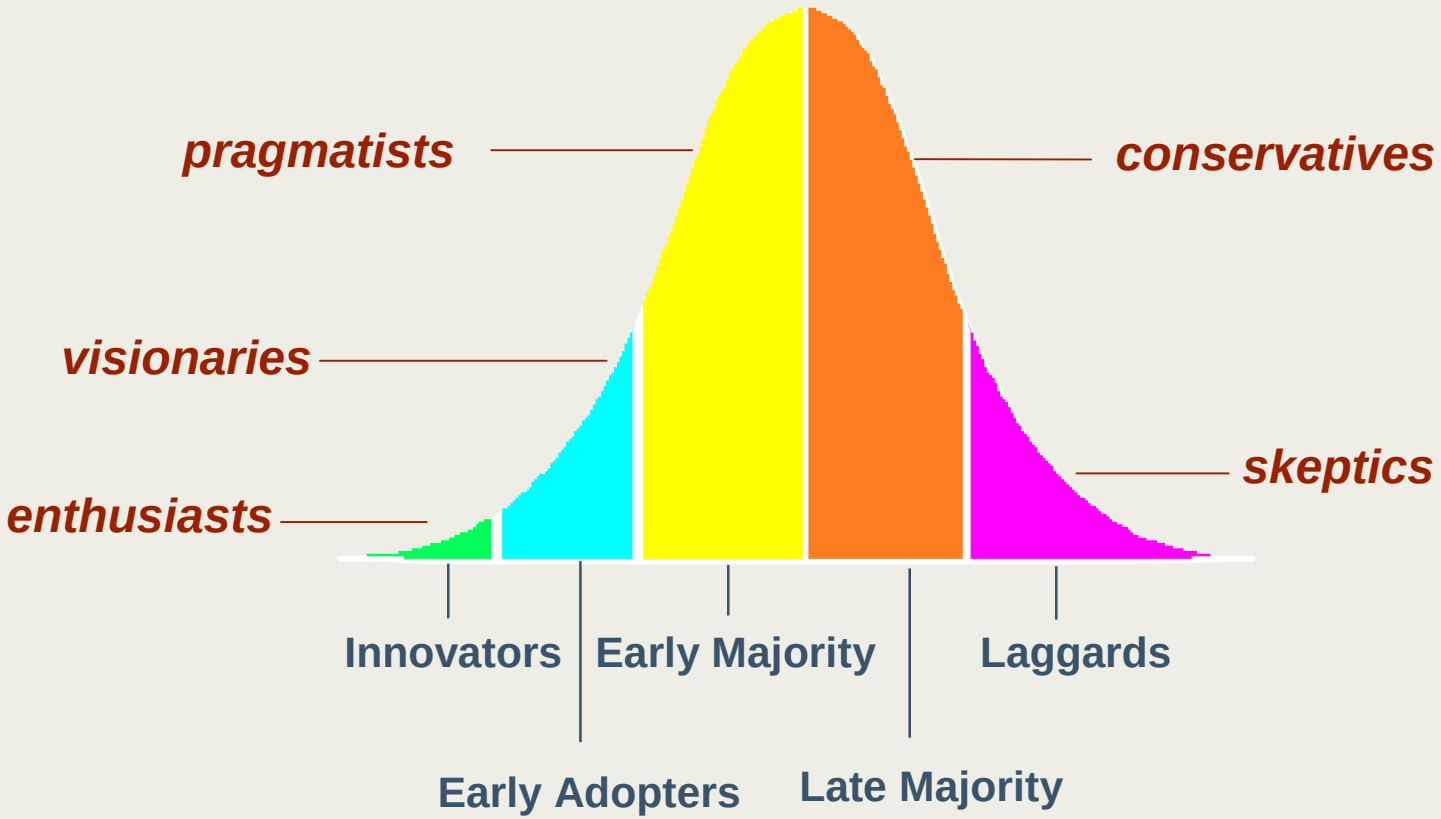

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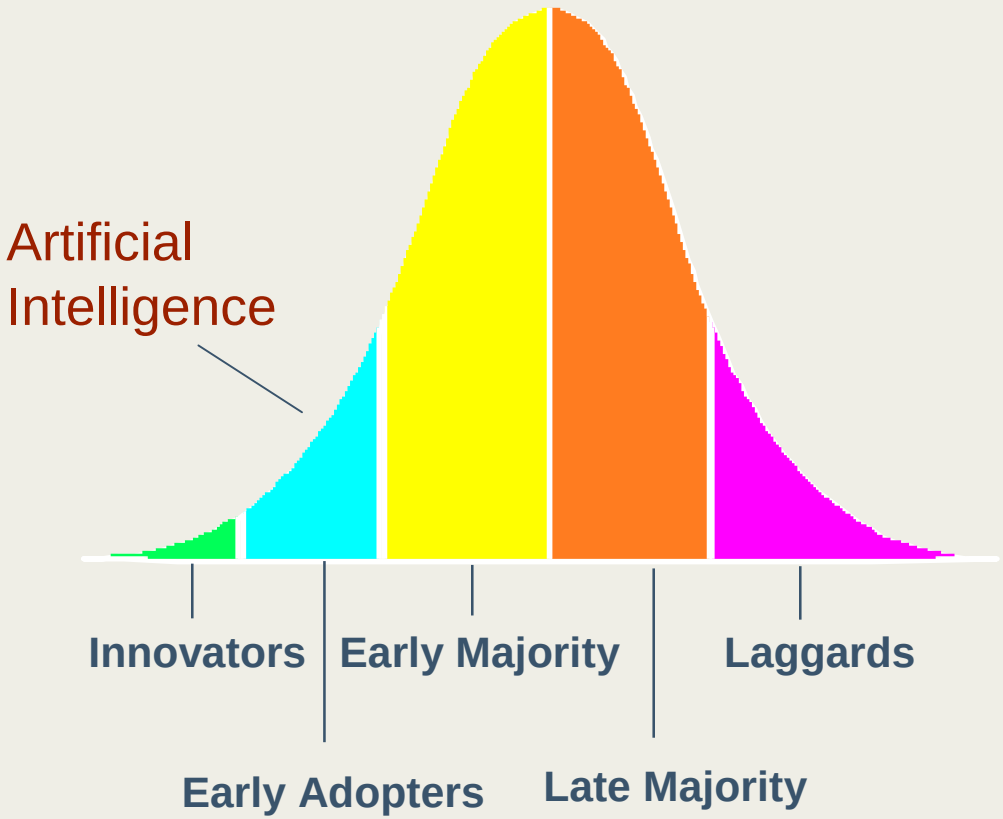
Transition Examples



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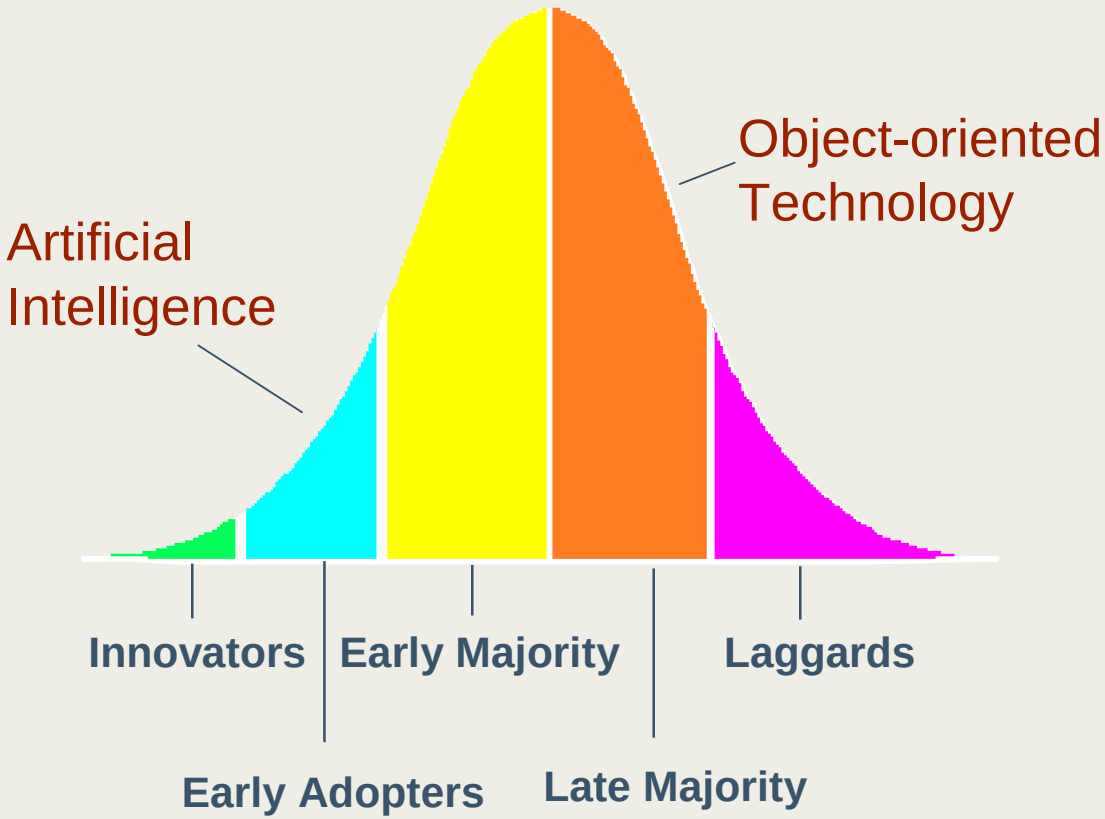
Transition Examples



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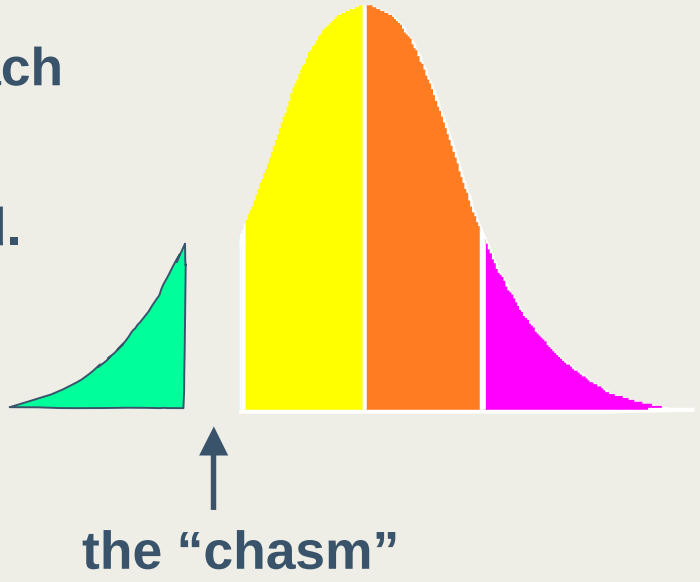
Transition Challenge: the Chasm

There is a gap between each group.

Each gap must be bridged.

The most significant gap is the one that separates the early adopters from the early majority.

The real challenge is "crossing the chasm."



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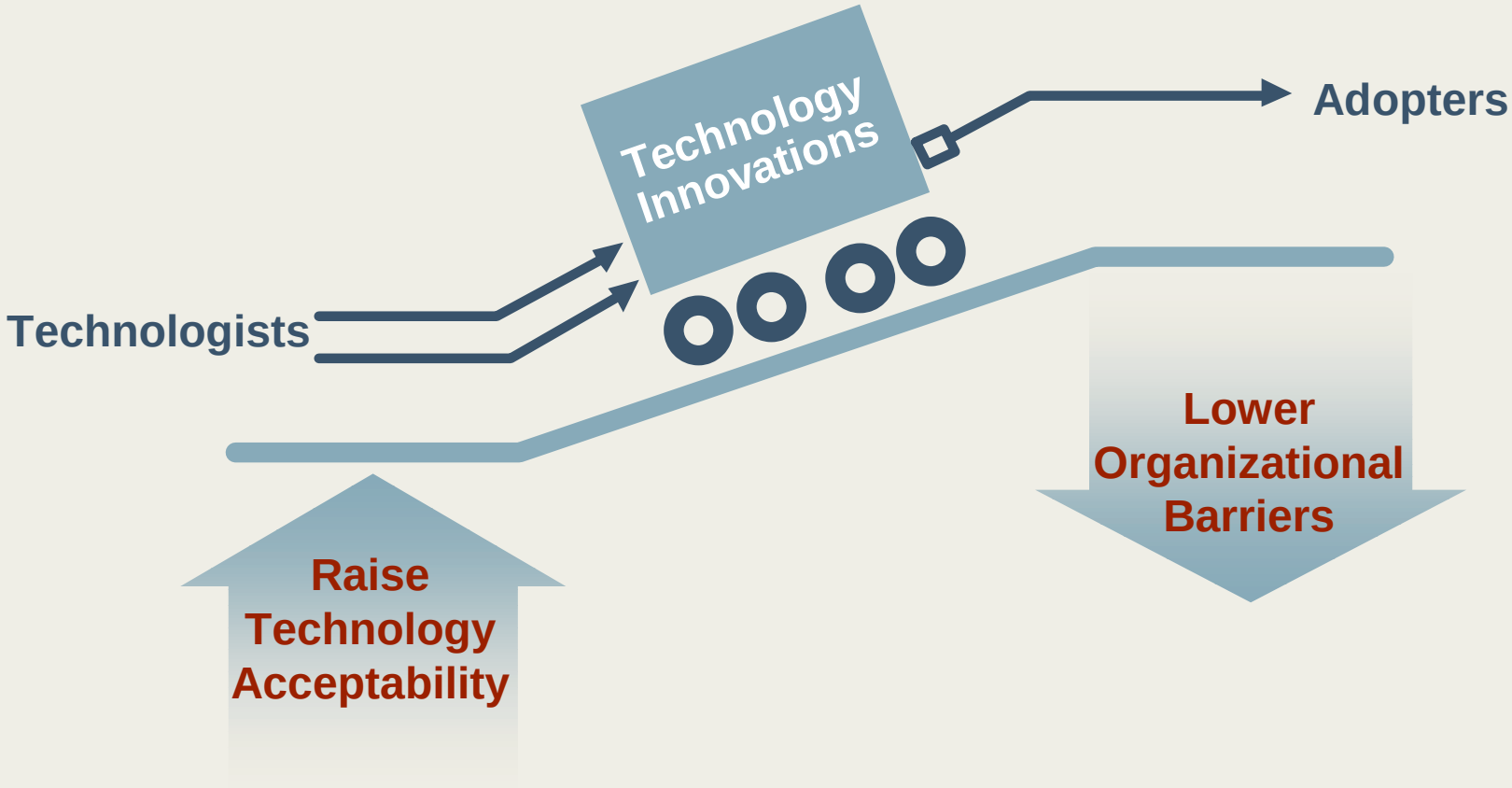
Crossing the Chasm



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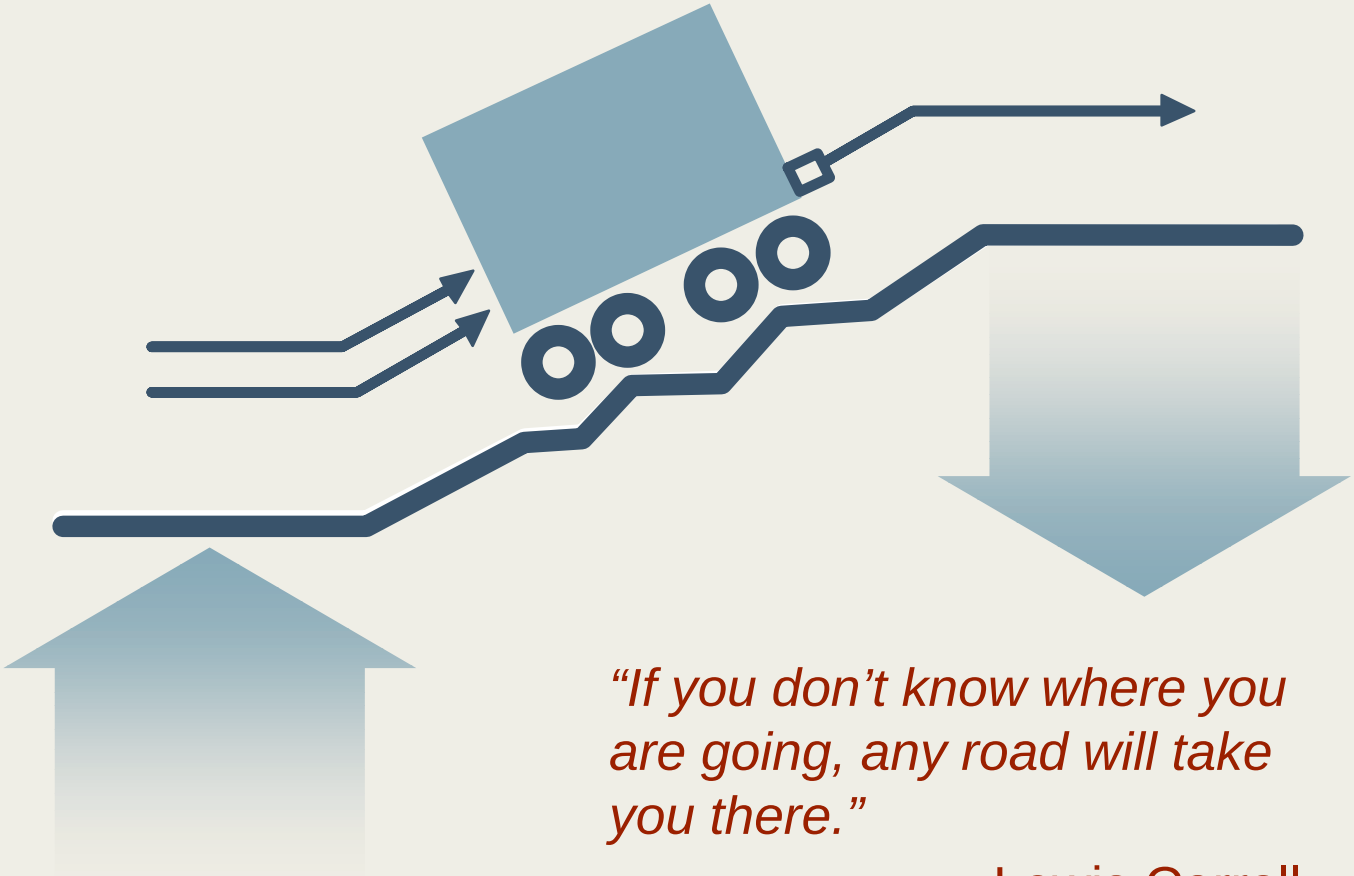
Often a Bumpy Road



"If you don't know where you are going, any road will take you there."

Lewis Carroll

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Transition Musts

Plan your attack
Establish the need
Use open experimentation
Develop the whole product
Ensure tool support
Address management fit
Collect data and amass ROI figures
Develop and implement a communication (advocacy/marketing) plan
Form tactical alliances
Find leaders and potential champions at all levels
Focus on constraints of transition environment
Plan to support the whole life cycle

Timing is everything

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The Ultimate Transition Pledge

"Our new product radically improves productivity on an already well-understood critical success factor specific to your business, and there is no existing means by which you can achieve a comparable results." ***Geoffrey A. Moore***

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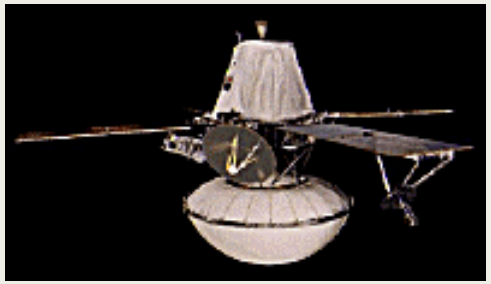
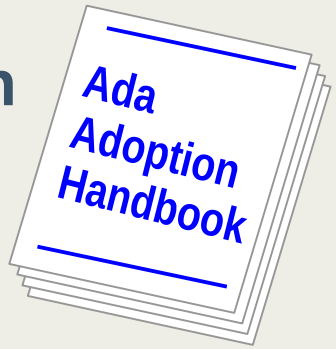
SEI Transition Examples

Capability Maturity Model

Rate Monotonic Analysis



Ada Adoption



SEI Transition Examples

Capability Maturity Model

Succeeded

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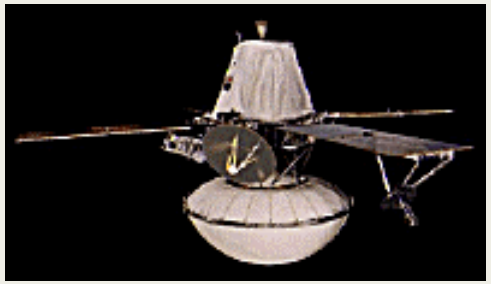

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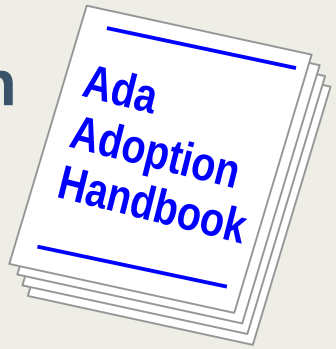

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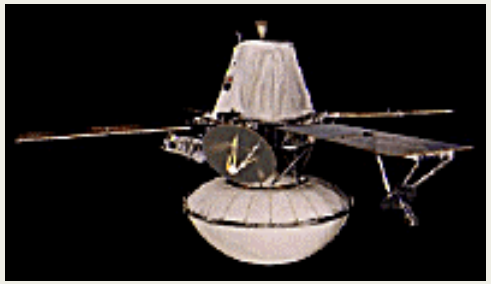
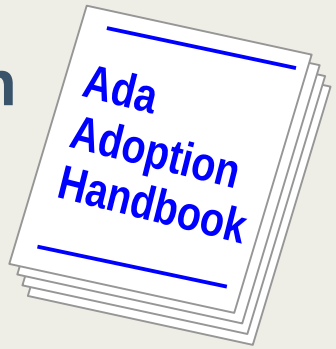


Rate Monotonic Analysis

Partially succeeded

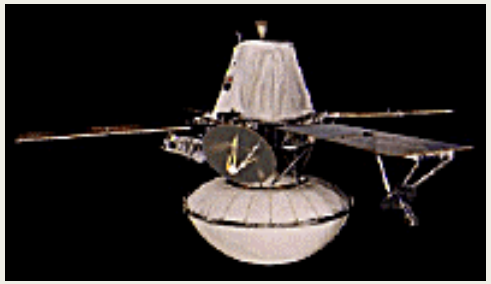
Ada Adoption



SEI Transition Examples

Capability Maturity Model

Succeeded



Rate Monotonic Analysis

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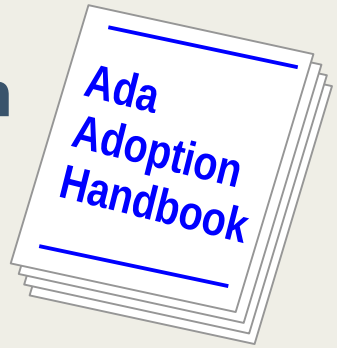

Failed

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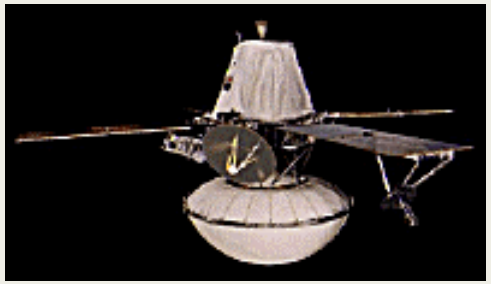
SEI Transition Examples

Capability Maturity Model

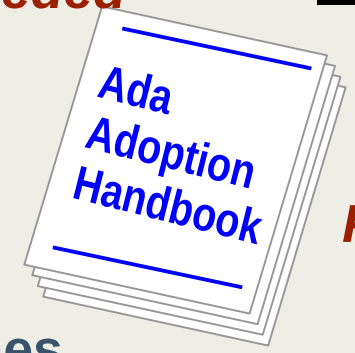
Succeeded



Rate Monotonic Analysis

Partially succeeded

Ada Adoption



Failed

Software Product Lines and Software Architecture

Still in process

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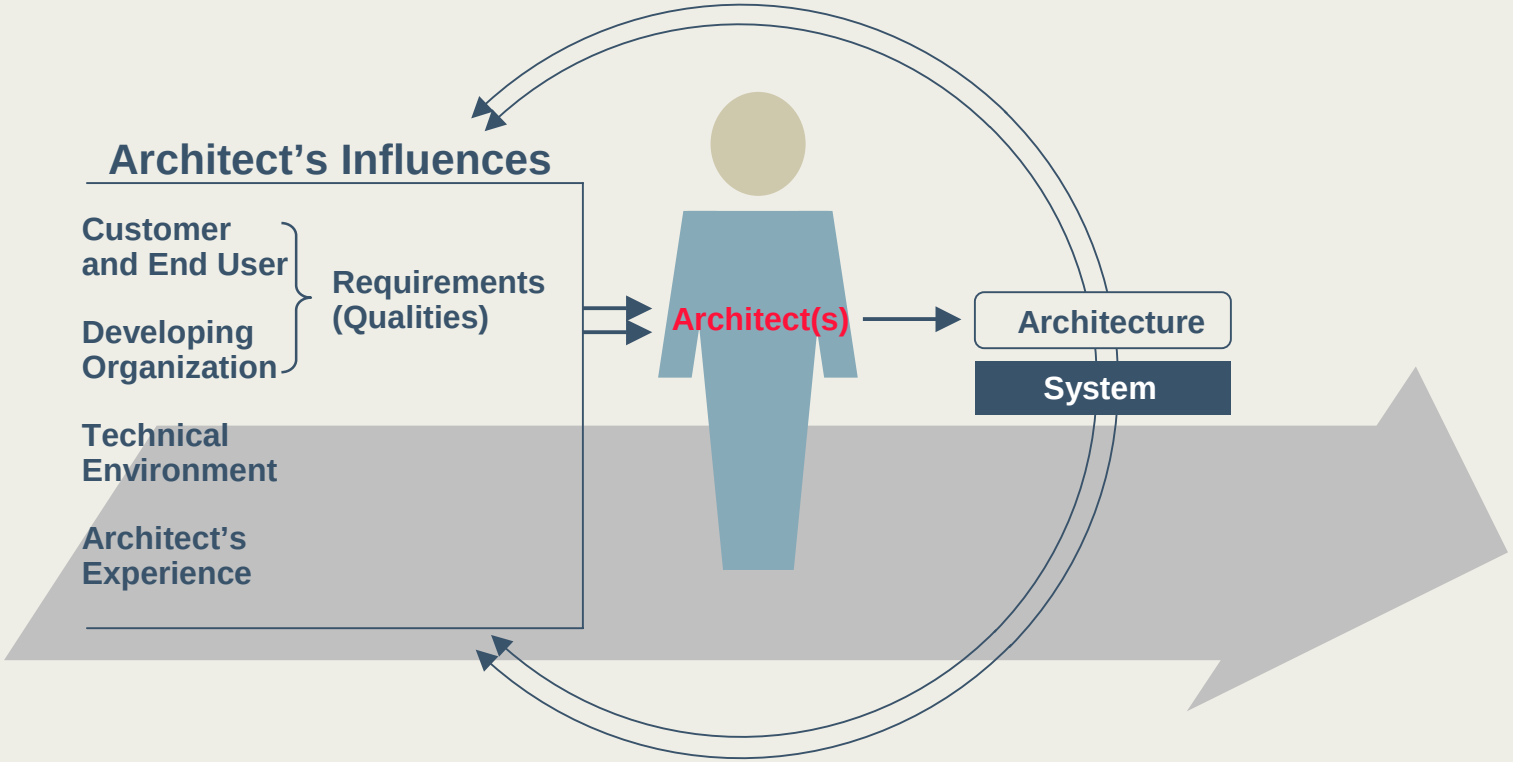
The Architecture Business Cycle



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Making Architecture Tradeoff Analysis a Practice

Starting Points

Quality attribute/ performance engineering

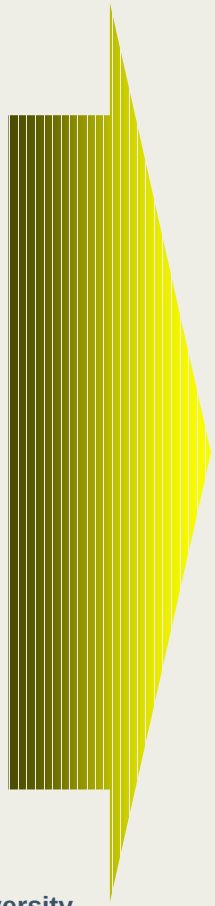
Software Architecture Analysis Method (SAAM)

Security analysis

Reliability analysis

Software Architecture Evaluation Best Practices Report

Software architecture evaluations



Mature

Architecture tradeoff analysis

- attribute-specific patterns
- attribute tradeoff analysis techniques

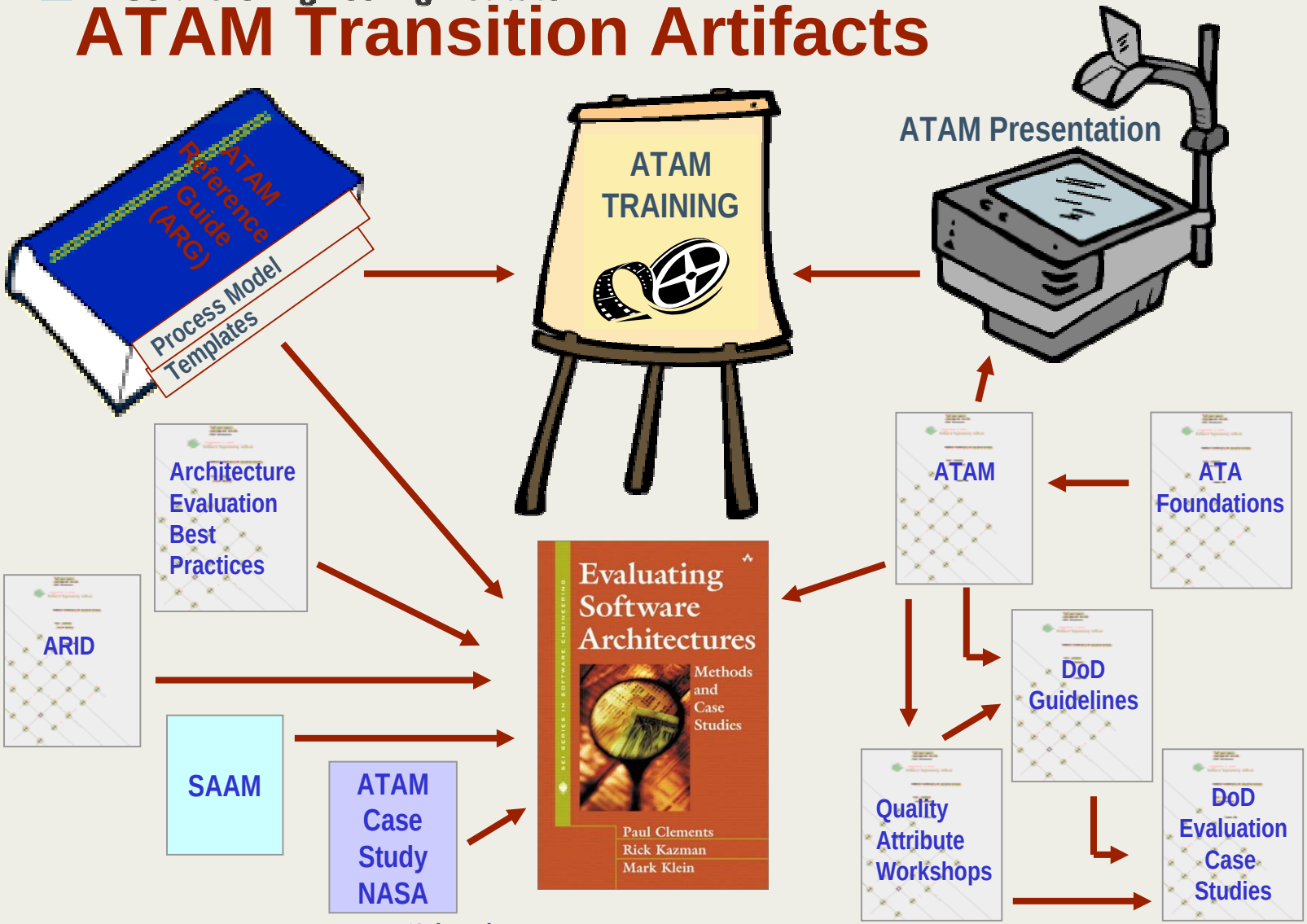
Architecture reconstruction

Architecture documentation

Transition

- Architecture Evaluations
- Sample Architecture Descriptions
- Architecture Reconstructions
- Coaching
- Workshops
- Technical reports
- Presentations
- Web site
- Books
- Courses
- Tutorials

ATAM Transition Artifacts



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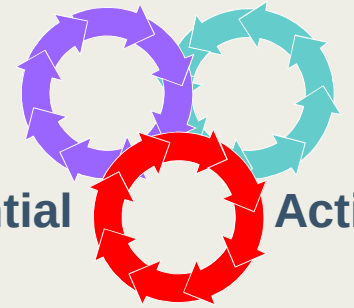
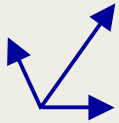
Making Software Product Lines Happen



Essential Activities

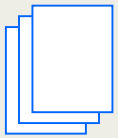
Practice Areas

Software Engineering	Technical Management	Organizational Management



Probe

Patterns



Case Studies

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29 Software Product Line Practice Areas

Software Engineering	Technical Management	Organizational Management
Architecture Definition	Configuration Management	Building a Business Case
Architecture Evaluation	Data Collection, Metrics, and Tracking	Customer Interface Management
Component Development	Make/Buy/Mine/ Commission Analysis	Developing an Acquisition Strategy
COTS Utilization	Process Definition	Funding
Mining Existing Assets	Scoping	Launching and Institutionalizing
Requirements Engineering	Technical Planning	Market Analysis
Software System Integration	Technical Risk Management	Operations
Testing	Tool Support	Organizational Planning
Understanding Relevant Domains		Organizational Risk Management
		Structuring the Organization
		Technology Forecasting
		Training

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Our Assumption So Far

Software research (the technologists) are separate from the commercial organizations whose practice they wish to influence.

What if the research is internal to a company?

Is all this transition activity still necessary?

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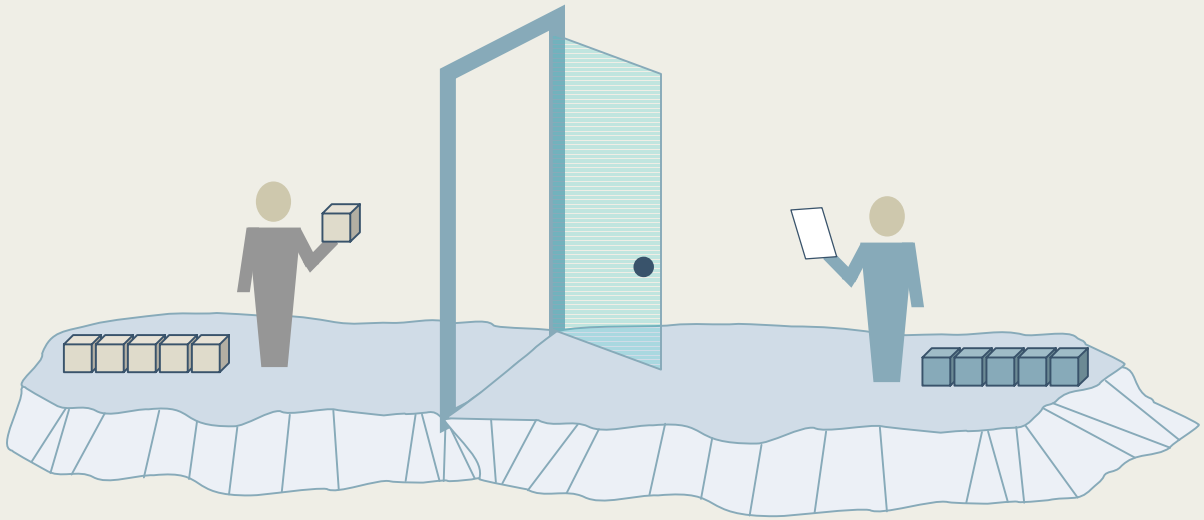
The Myth



Corporate Research

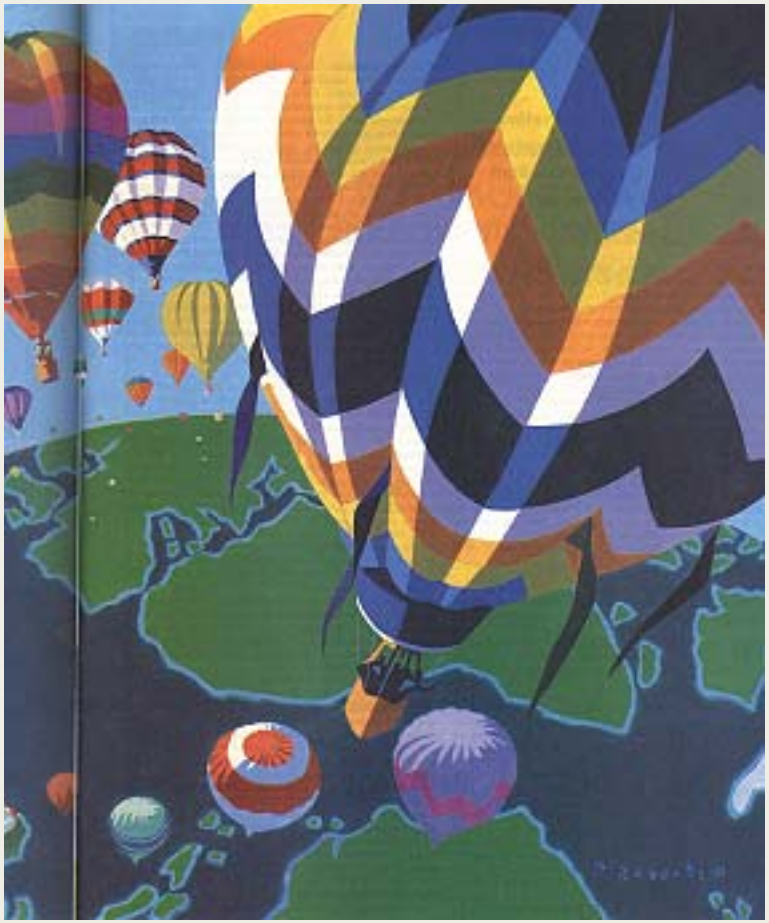
Corporate Practice

Xerox PARC

PARC had the “goods,” and they had them early.

Xerox couldn’t transcend the copier business.

Xerox never fully understood the potential of PARC’s technology.



BYTE
August 1981

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Xerox PARC

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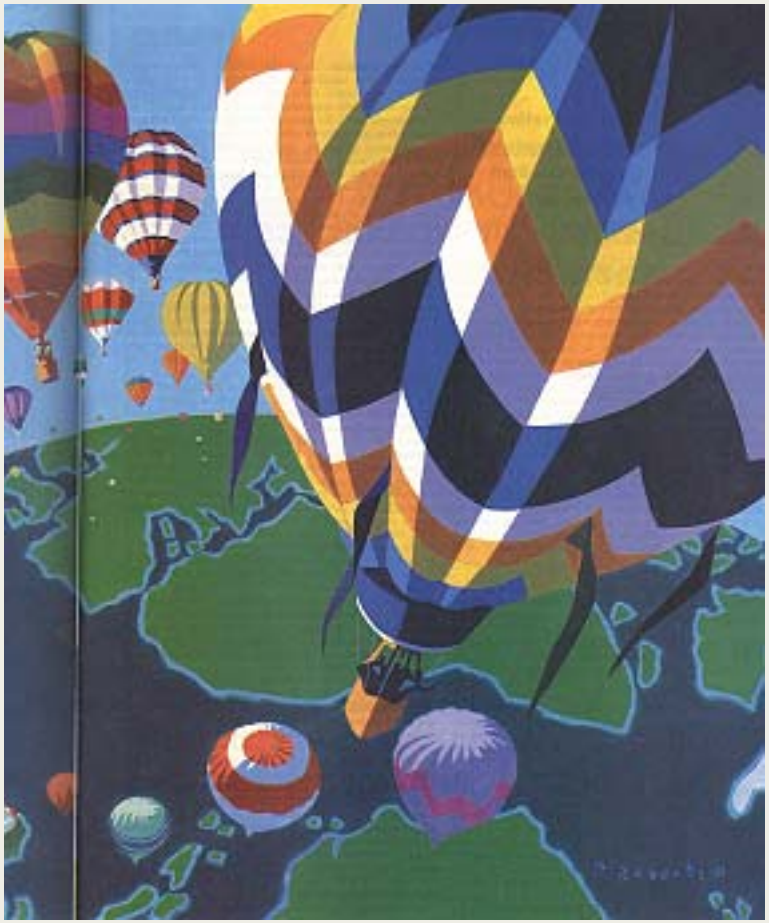
both a transition and an adoption failure



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Of Course, There is a “Silver Lining”

Others made the maturation and transition efforts and the innovations from PARC have found their way into mainstream products and approaches.

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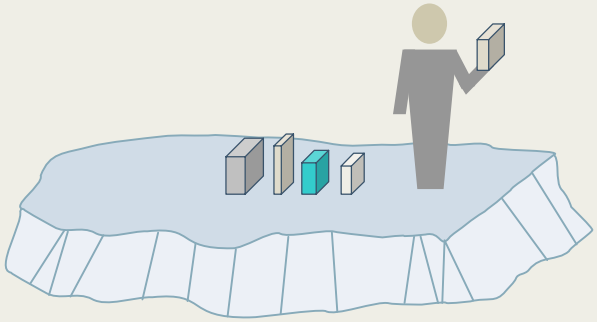
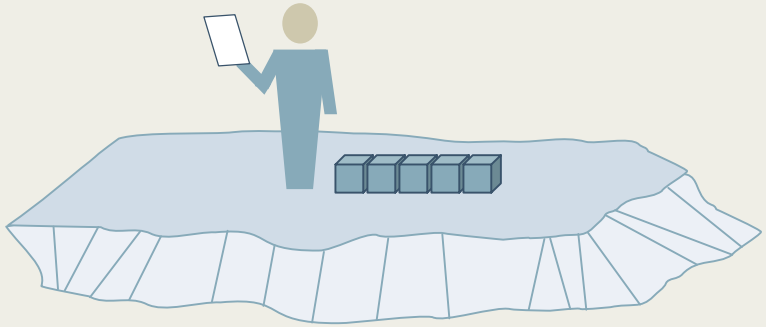
The Reality



Corporate Research



Corporate Practice

A transition effort is needed no matter where the innovation comes from.

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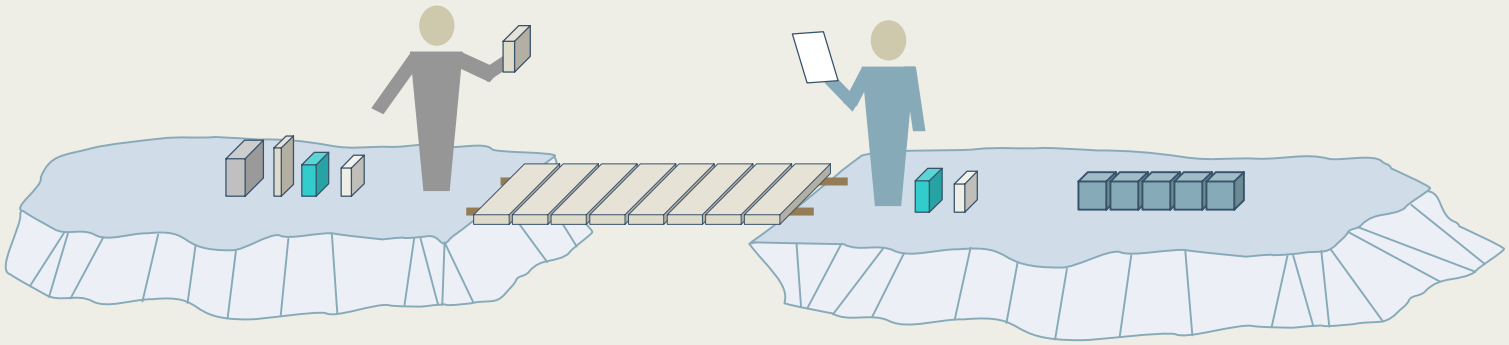
Making the Link: the Adoption Path

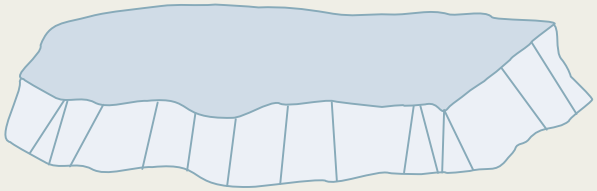


Software Research

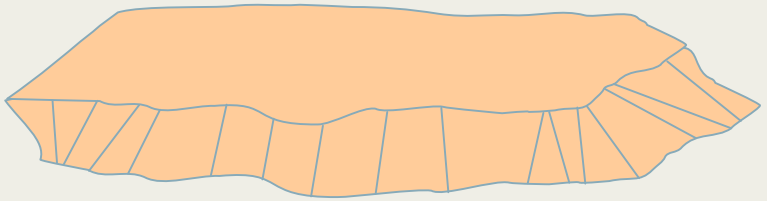
Commercial Practice

Adoption: the Job of Business Units

transition technology innovations *adopt*



Software Research



Commercial Practice

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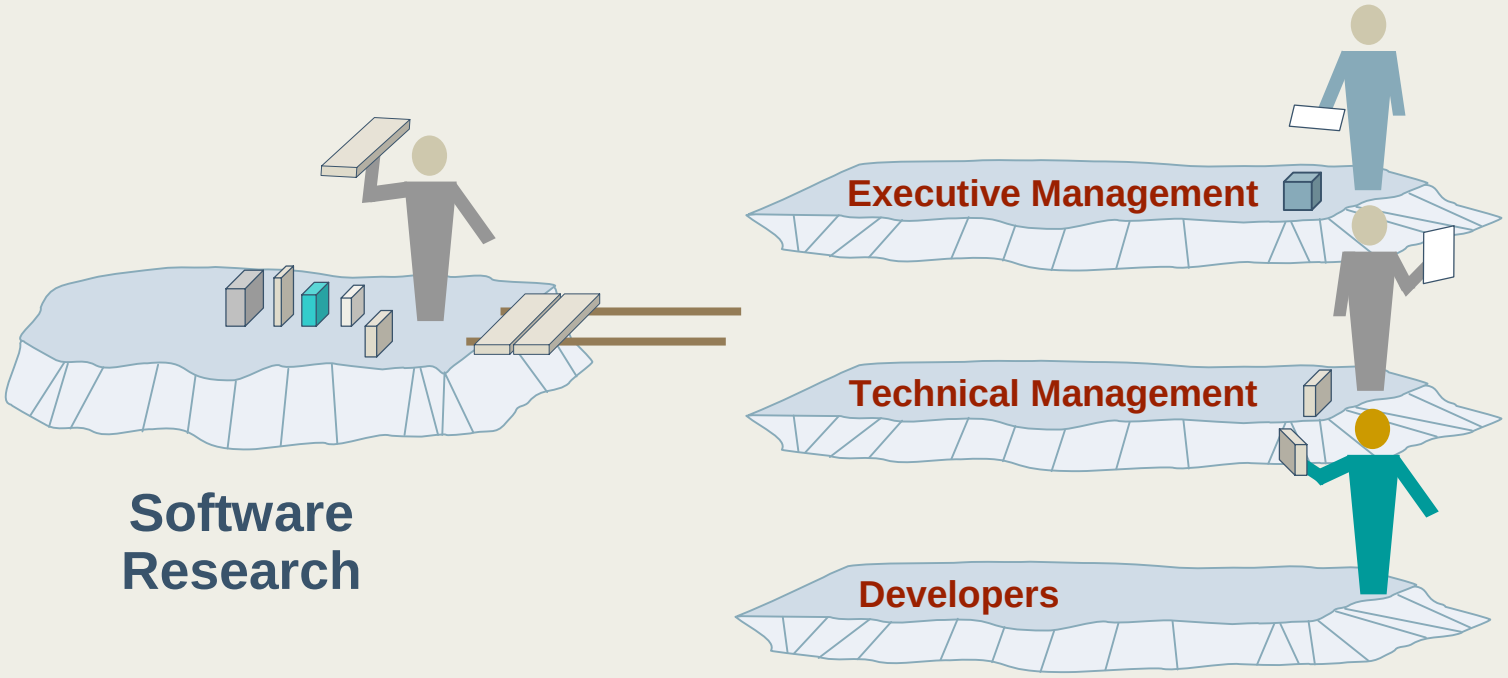
On the Receiving End



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Adoption Musts

Developers

- Need to be informed, current, and well-connected
- Training, training, training, and communication

Technical Management

- Management processes
- Data and metrics to be able to estimate, schedule, and budget
- Tool support
- Methodology

Executive Management

- $Investment
- Business Case
- Adoption Plan
- Champion(s)

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What's in a Business Case?

Business goals and the rationale

Strategy indicating a match with technology choice

The cost of adoption

- the direct full cost
- indirect costs

The forecasted ROI

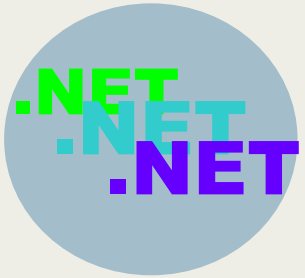
The feasibility of an adoption plan

Risks

Measures to collect and track

A business case requires data that can be trusted.

The Truth about Marketing and Hype



Make sure that the data you use in your business case is proven and relevant.

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Can't Make a Business Case?

If there is no business case to be made, the temptation is to resist the innovation.

However, beware of disruptive technologies!

To deal with disruptive technologies, there are more executive management musts

- Technology forecasting
- Organizational risk management
- Barrier analysis (usually culture)
- Market analysis (Beware of creating a vacuum at the low market end.)

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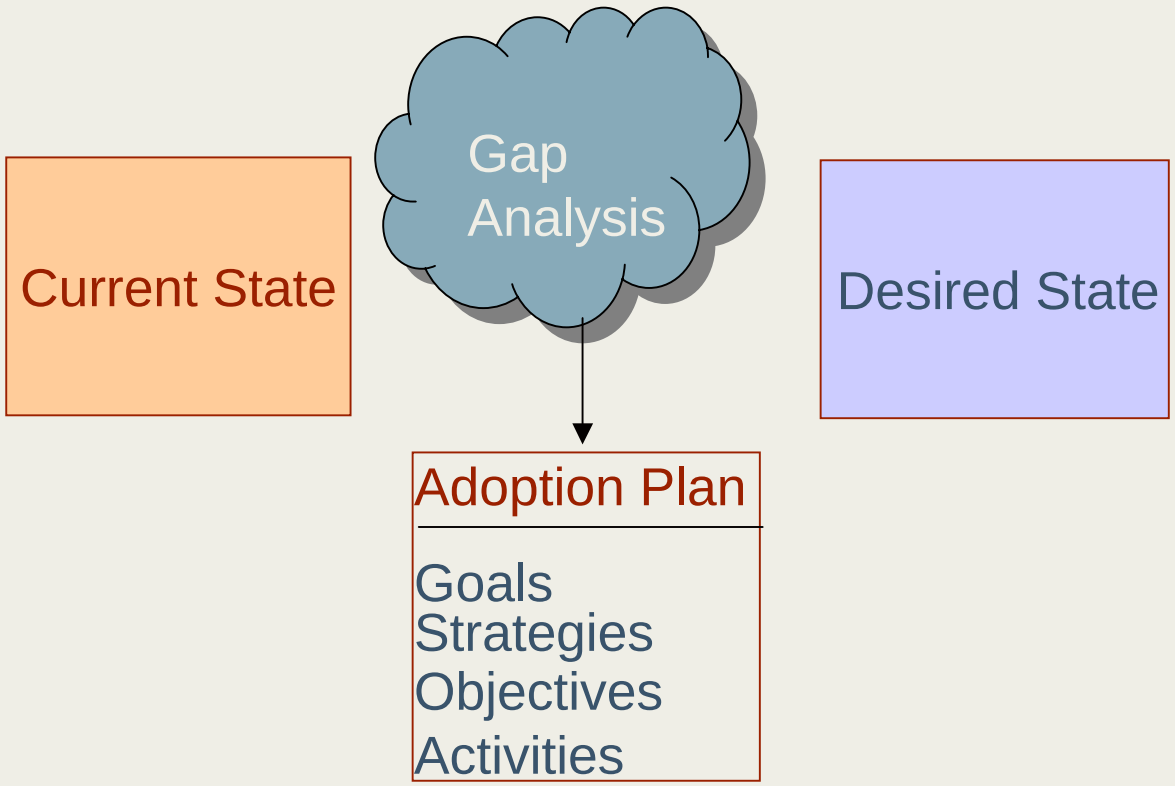
Adoption Planning



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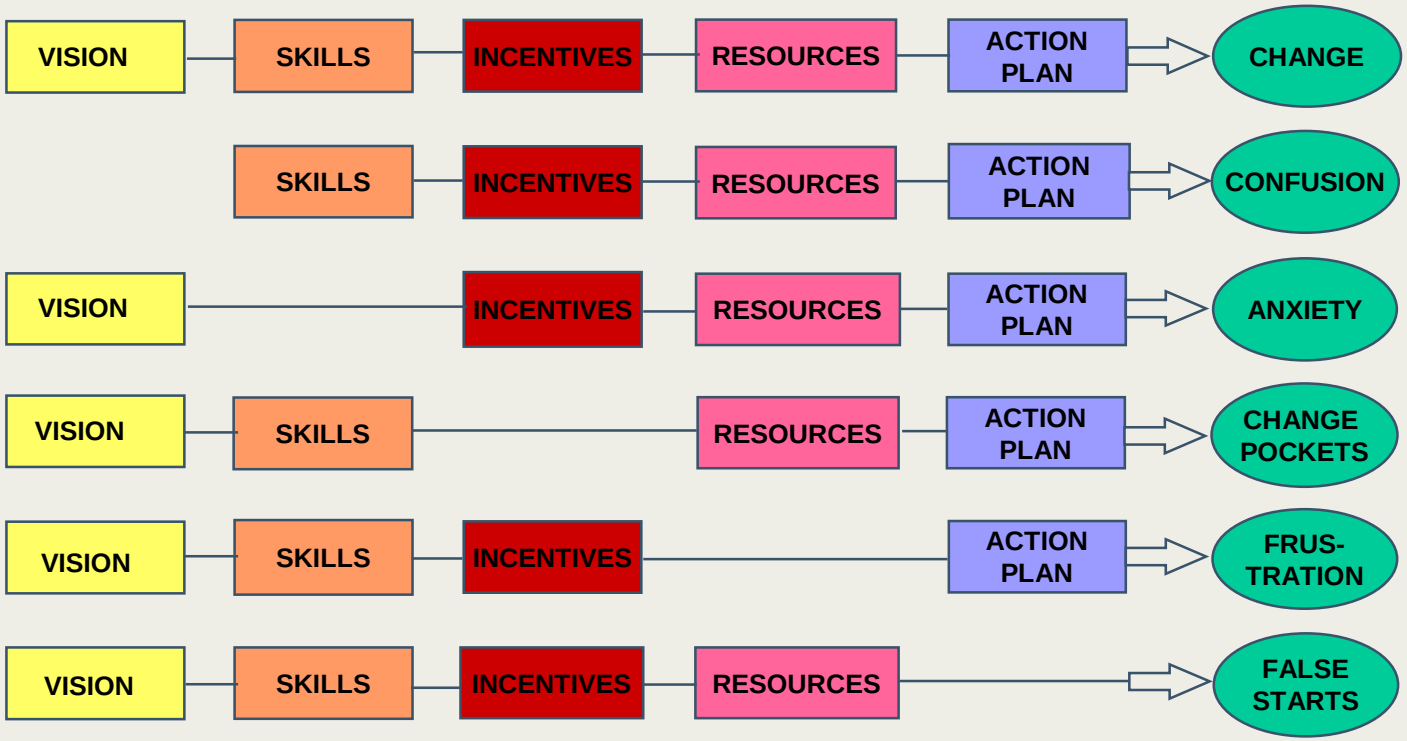
Managing Technology Change



"Managing Technological Change"
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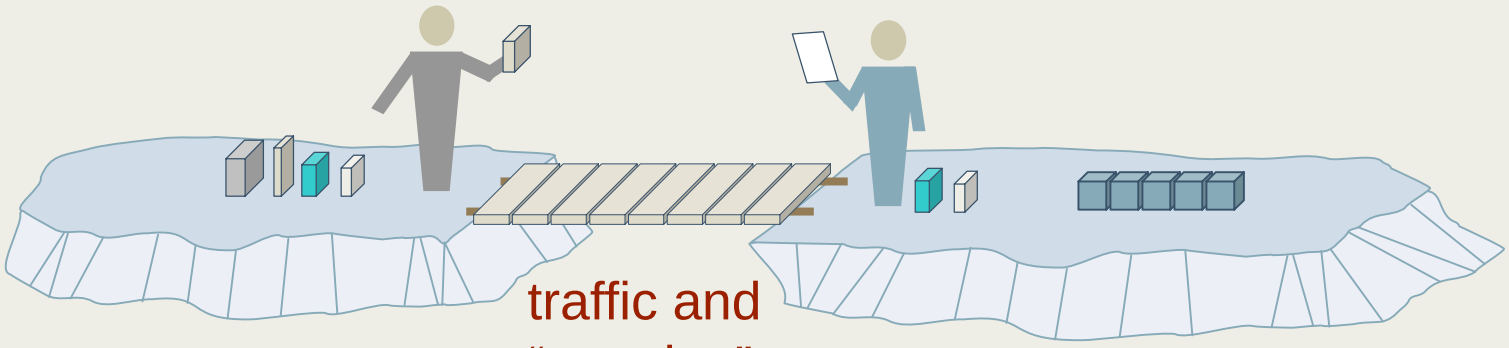
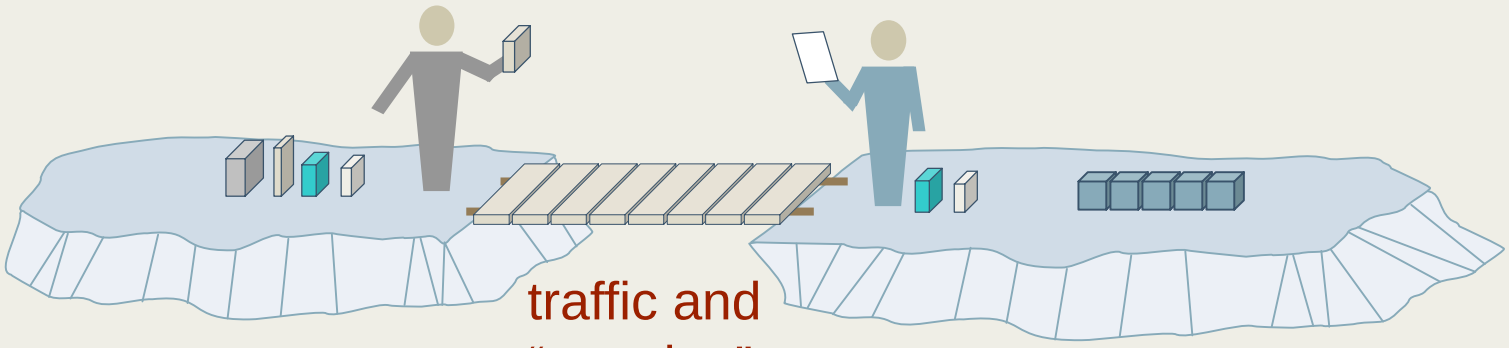
Making the Link aka “the Contest”



Making the Link aka "the Contest"



traffic and "sporting"

Software Research

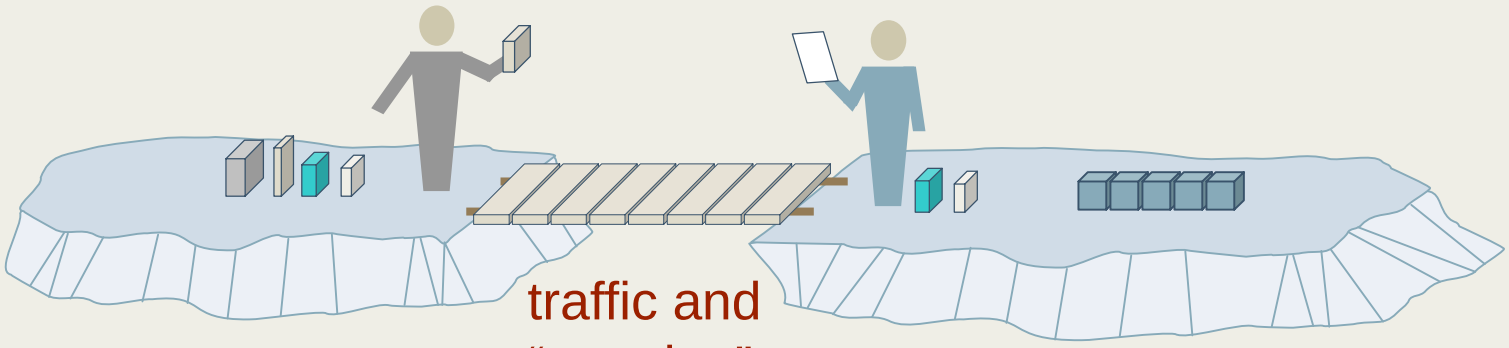
Commercial Practice

Business goals are often ephemeral.

Businesses are impatient.

There are fits and starts.

Making the Link aka “the Contest”



Software Research

Be aggressive AND supportive.

Create scenarios for business case support.

Be flexible.

Commercial Practice

Business goals are often ephemeral.

Businesses are impatient.

There are fits and starts.

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Some think…..

Technology transition is a contact sport

- **requires discipline**
- **requires training**
- **requires interaction**
- **follows a plan**
- **is orderly**

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The Truth:
Technology Transition is a Collision Sport

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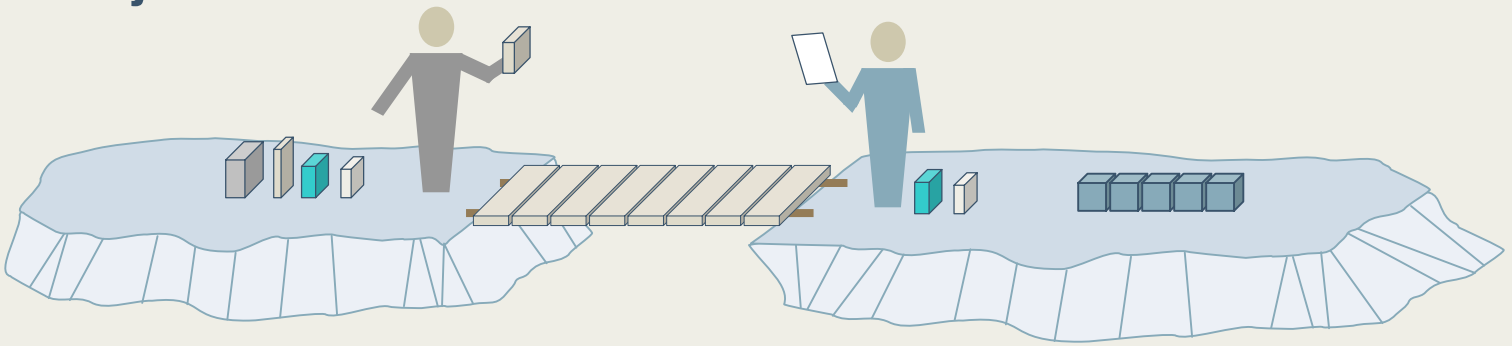
Conclusion

To bridge technology innovation into mainstream commercial practice requires

- innovation of intrinsic **value**
- aggressive, proactive **transition**
- proactive **adoption**
- **timing**
- just a bit o'**luck**



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Attribution

Crossing the Chasm, **Geoffrey A. Moore**
The Innovator's Dilemma - When New Technologies Cause Great Firms to Fail**, Clayton M. Christensen**
Software Runaways - Lessons Learned from Massive Software Project Failures**, Robert L. Glass**
Fumbling the Future - How Xerox Invented, Then Ignored, the First Personal Computer**, Douglas K. Smith and Robert C. Alexander**
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Jim Mitchell, Sun Research
John Maher, formerly SEI
Priscilla Fowler, formerly SEI

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Questions – Now or Later

Linda Northrop
Director
Product Line Systems Program
Telephone: 412-268-7638
Email: lmn@sei.cmu.edu

U.S. mail:
Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213-3890

World Wide Web:
http://www.sei.cmu.edu/ata
http://www.sei.cmu.edu/plp
http://www.sei.cmu.edu/pacc

SEI Fax: 412-268-5758