

Proudly sponsored by the DoD and IUP and WCCC

# CYBERSECURITY WORKSHOP

## October 19 & 26, 2019

### Planned Activities

- ◆ Introduction to the CySP Program
- ◆ Hands-on activities using the Raspberry Pi
- ◆ Guest speaker presentations by security experts
- ◆ Hands-on session on Scrum Team and security of various physical systems (airport, hospitals, etc)
- ◆ Hands-on activities on threat modelling, attack trees, and misuse cases.

### Workshop Details

9:00 a.m. to 3:00 p.m.  
each Saturday

WCCC Campus  
Student Achievement Center  
Rooms 833 & 838  
145 Pavilion Lane  
Youngwood PA 15697

- ◆ Space is limited, please act now
- ◆ Open to all interested Community College students and faculty.
- ◆ Lunch will be sponsored.

### REGISTRATION INFORMATION

Email [CyberReg@westmoreland.edu](mailto:CyberReg@westmoreland.edu)

An auto-reply will have further information about the event, as well as a Google Form to register.

### PARTICIPATION ADVANTAGES

- ◆ Student participants receive a Raspberry Pi 4 Starter Kit with Fan Cooled Case
- ◆ Faculty participants receive a \$500 stipend

## PARTICIPATION ADVANTAGES

Offered at no cost!

Student participants receive a Raspberry Pi 4 Starter Kit!

Faculty participants receive a \$500 stipend

Skills and knowledge for a growing career field!

Free lunch provided!

## REGISTRATION INFORMATION

Send an e-mail to [CyberReg@westmoreland.edu](mailto:CyberReg@westmoreland.edu)

An auto-reply will provide more information.

## WORKSHOP DETAILS

October 19 & 26, 2019

The workshop is held over two consecutive Saturdays.

Westmoreland County Community College  
Student Achievement Center  
Rooms 833 & 838  
145 Pavilion Lane  
Youngwood PA 15697

## PROJECT PI'S

**Dr. Waleed Farag**  
Director, Institute for Cybersecurity  
Professor, Computer Science

**Dr. Imran Ghani**  
Associate Professor, Computer Science

## SPONSORED BY:



Department of Defense



Indiana University of Pennsylvania



# CYBER SECURITY WORKSHOP



Proudly Presented By:  
DoD, IUP & WCCC

## DoD CySP & CAPACITY BUILDING PROJECT INFO

### DoD Cyber Scholarship Program

The DoD CySP is a federally supported program to encourage the recruitment of cyber talent to support national infrastructure.

Under the leadership of the Project PI, Waleed Farag, IUP, along with a selected group of national universities, has been awarded funding in the 2019–20 academic year from the Department of Defense (DoD) in support of the Cyber Scholarship Program (CySP).

### DoD CySP Capacity Building Project

In addition to the scholarship recruitment award, IUP received a Capacity Building award for a project titled "An Innovative Pedagogical Approach Based on Agile Methodology for Faculty Development in Cybersecurity".

The goal of this capacity building project is to find additional ways to recruit more students to enter the cybersecurity workforce. This goal will be achieved through a unique blend of faculty development, hands-on workshops, and the continued cultivation of relationships with local community colleges. As a result, this project will hold a number of workshops at surrounding Community Colleges.

**Visit the DoD CySP page for more information**  
**[www.iup.edu/dodscholarship](http://www.iup.edu/dodscholarship)**

## WORKSHOP ACTIVITIES

Introduction to the  
CySP Program

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Hands-on activities  
using the Raspberry Pi

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Guest speaker  
presentations by  
security experts

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Hands-on session on  
Scrum Team and  
security of various  
physical systems  
(airport, hospitals, etc)

---

Hands-on activities on  
threat modelling, attack  
trees, and misuse cases

## WORKSHOP SCHEDULE - DAY 1

10/19/19

9:00 a.m. to 9:20 a.m.

**The DoD CySP, CAE program at IUP, and Cybersecurity Activities at IUP**  
Dr. Waleed Farag, Director, IUP Institute for Cybersecurity

9:20 a.m. to 9:30 a.m.

**BREAK**

9:30 a.m. to 11:30 a.m.

**Introduction to Agile Mindset and Scrum Methodology**  
Mr. Jeff Pulcini, Agile Coach and Project Manager

11:30 a.m. to 12:30 p.m.

**LUNCH**

12:30 p.m. to 1:40 p.m.

**Hands-on Session: Raspberry Pi and Security Applications**  
Dr. Waleed Farag, Director, IUP Institute for Cybersecurity

1:40 p.m. to 1:50 p.m.

**BREAK**

1:50 p.m. to 3:00 p.m.

**Hands-On Session: Importance of 5 C's in Agile Teams**  
Dr. Imran Ghani, Associate Professor of Computer Science, IUP

## WORKSHOP SCHEDULE - DAY 2

10/26/19

9:00 a.m. to 10:50 a.m.

**Methods to Decompose & Address System Cyber Security Threat Risk**  
Mr. Nigel Wright, Technical Program Manager, Uber

10:50 a.m. to 11:00 a.m.

**BREAK**

11:00 a.m. to 12:00 p.m.

**Hands-on Session: Scrum Team + Airport and other  
Physical Entities Security - Iteration 1**  
Dr. Imran Ghani, Associate Professor of Computer Science, IUP

12:00 p.m. to 12:50 p.m.

**LUNCH**

12:50 p.m. to 1:50 p.m.

**Hands-on Session: Scrum Team + Airport and other  
Physical Entities Security - Iteration 2**  
Dr. Imran Ghani, Associate Professor of Computer Science, IUP

1:50 p.m. to 2:00 p.m.

**BREAK**

2:00 p.m. to 3:00 p.m.

**Hands-on Session: Threat Model, Attack Tree + Misuse case on white board  
& on SeaMonster or PPT**  
Dr. Imran Ghani, Associate Professor of Computer Science, IUP

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# Cybersecurity Workshop

<http://www.pollevo.com/nwright999>

Nigel Wright

October 19 & 26, 2019  
WCCC Campus  
Student Achievement Center

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# Hello!

## About Nigel!

- **Pittsburgher**  
Grew up south of Pittsburgh in California, PA. Parents are fans of British Rock!
- **Breaking Computers Since 1989**  
The best way to fix something is to break it first!
- **Working on Robot Cars!**  
Previous roles involved creating product lines for Automated Rail Signaling



# Agenda

## Hour 1

- Cyber Security in Industrial Systems
- System Analysis 101
- Examples of System Exploits
- Identifying & dealing with Risks & Vulnerabilities
- Speed Reading with Program Management Techniques

<10 Minute BREAK>

## Hour 2

- Exercise & Group Work
  - Overview of an example of Theoretical Airport Security System Design by generating set of Risks
  - Group Exercise
  - Group Review of Exercise

—  
Agenda;

**Cyber Security in Industrial Systems**

**System Analysis 101**

**Examples of System Exploits**

**Identifying & dealing with Risks & Vulnerabilities**

**Speed Reading with Program Management Techniques**

—  
What is an **industrial**  
system?

# Knowledge of Industrial Systems?

Extremely knowledgeable

Not knowledgeable at all



Neutral

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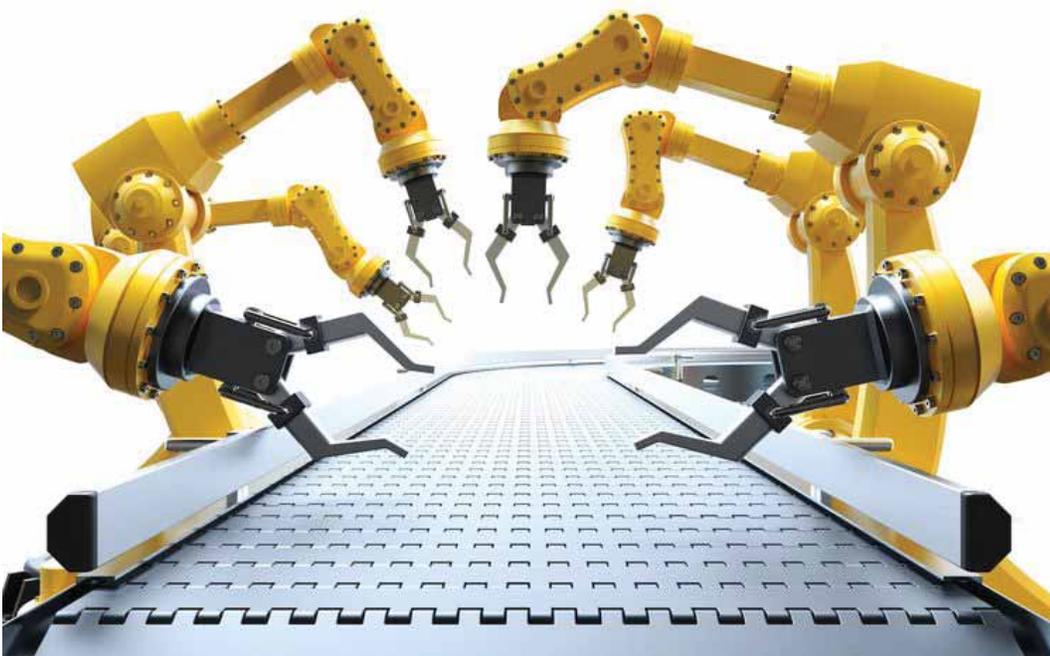
## Industrial Control System (def)

Industrial control system (ICS) is a collective term used to describe different types of control systems and associated instrumentation, which include the **devices, systems, networks**, and controls used to operate and/or automate industrial processes.

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# Industrial Control System (def)

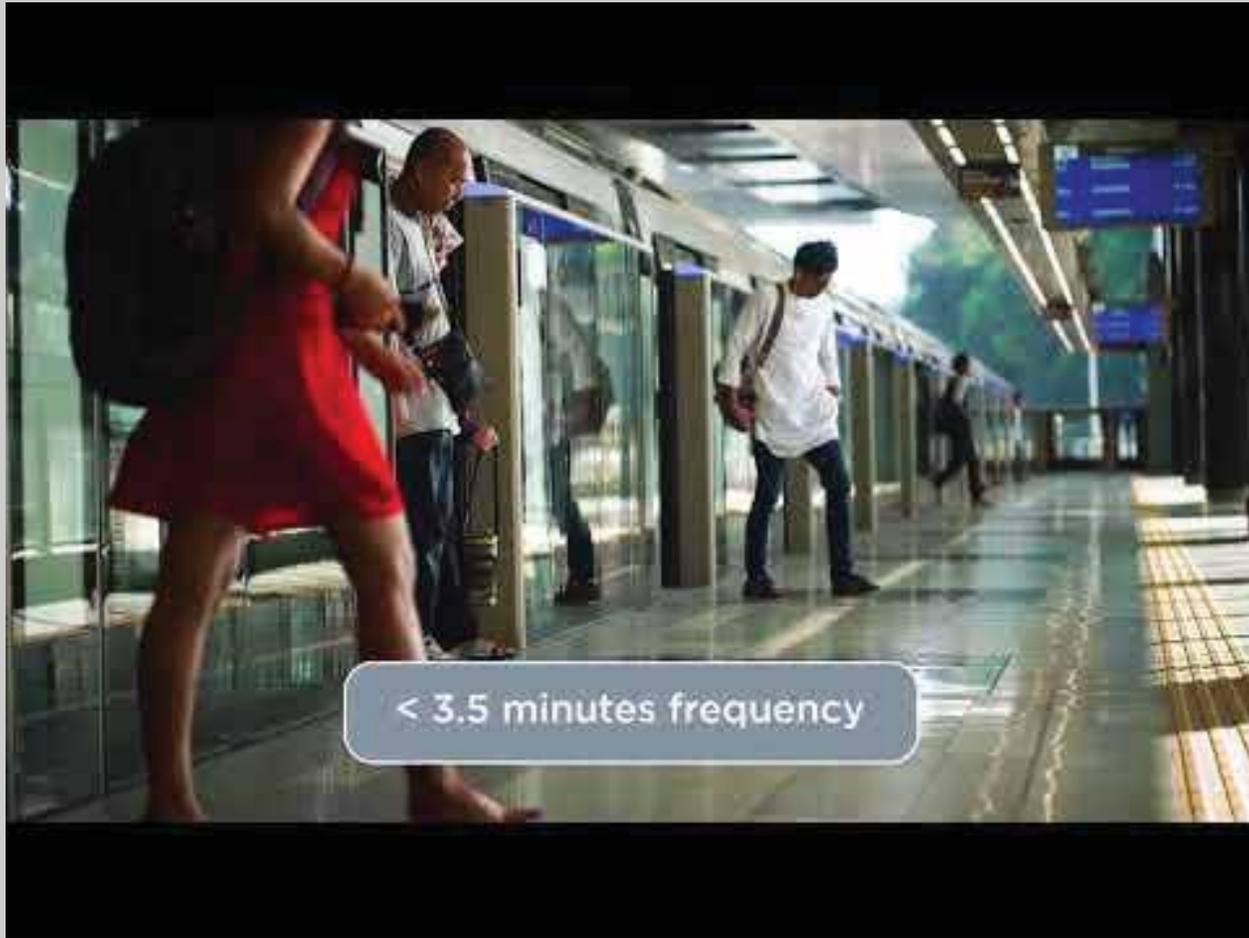


Made up of *many* items, each with its own design life, update cycle, and iterations.

Used by highly skilled and non skilled technicians.

Low -> No Tolerance for Failures

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# What type of cyber security risks would be present in this system?

Networking

Misuse

Unintended design

Malware

Zero-day exploit

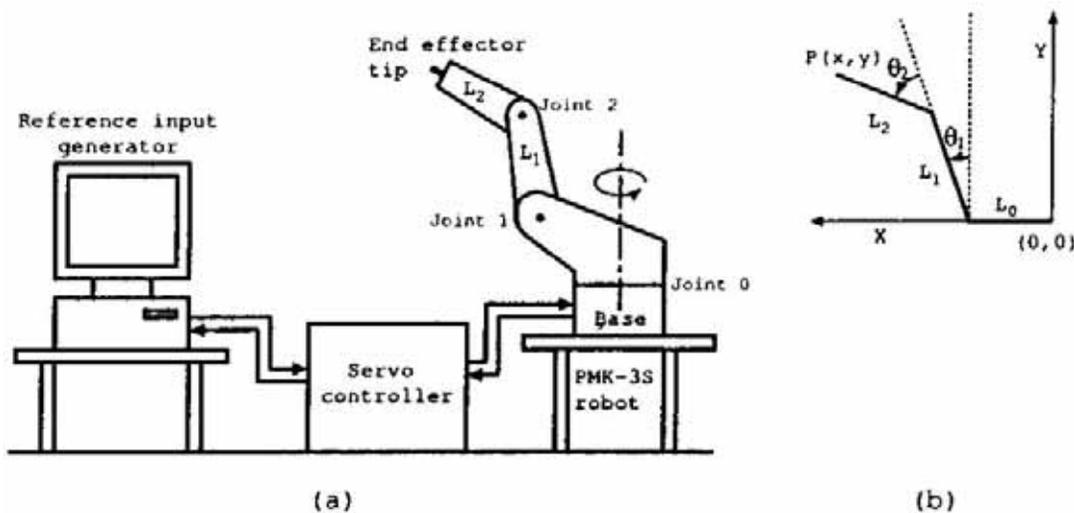
Man in the middle

—

**It depends**

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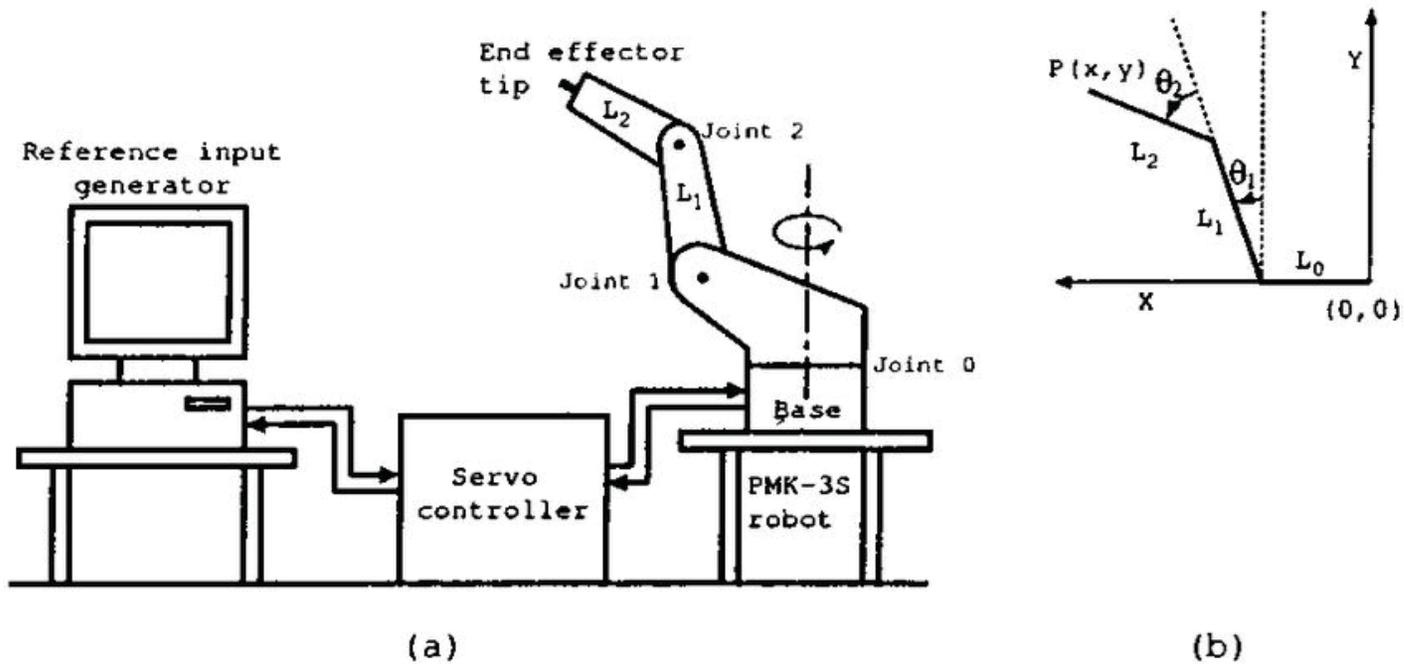
# Systems Engineering



Systems engineering is an interdisciplinary field of engineering and engineering management that focuses on how to design and manage complex systems over their life cycles.

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# Systems Engineering & Cybersecurity



What is vulnerable in this diagram?

—

## Agenda;

Cyber Security in Industrial Systems

**System Analysis 101**

Examples of System Exploits

Identifying & dealing with Risks & Vulnerabilities

Speed Reading with Program Management Techniques

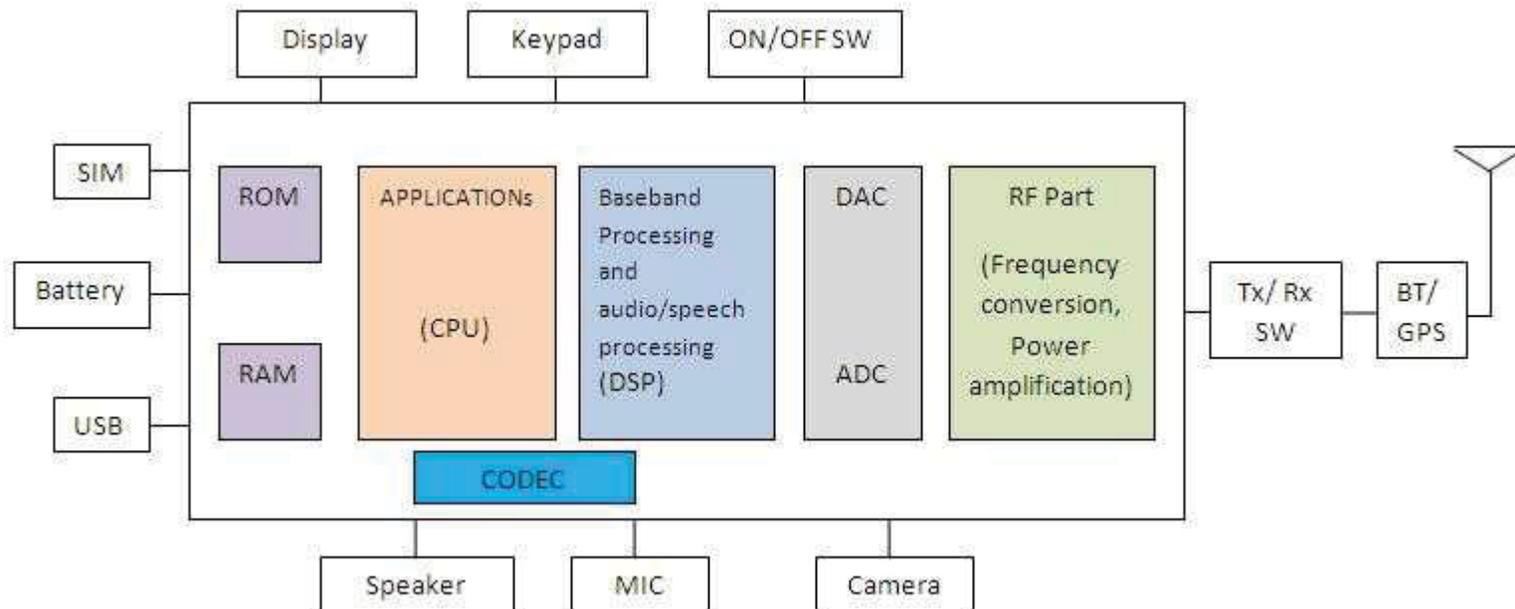
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# Decomposing a System



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# Decomposing System





# What is this System?



Start the presentation to see live content. Still no live content? Install the app or get help at [PollEv.com/app](https://PollEv.com/app)

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## Agenda;

Cyber Security in Industrial Systems

System Analysis 101

**Examples of System Exploits**

Identifying & dealing with Risks & Vulnerabilities

Speed Reading with Program Management Techniques

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## Malicious actors vs. Bad Design

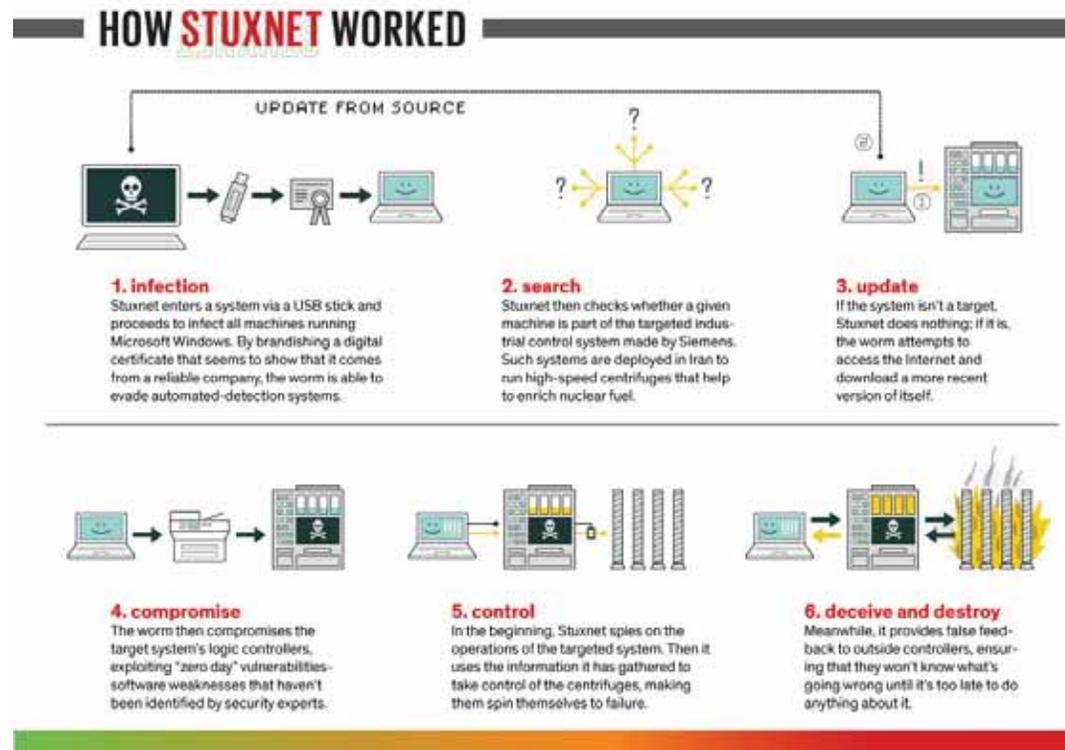


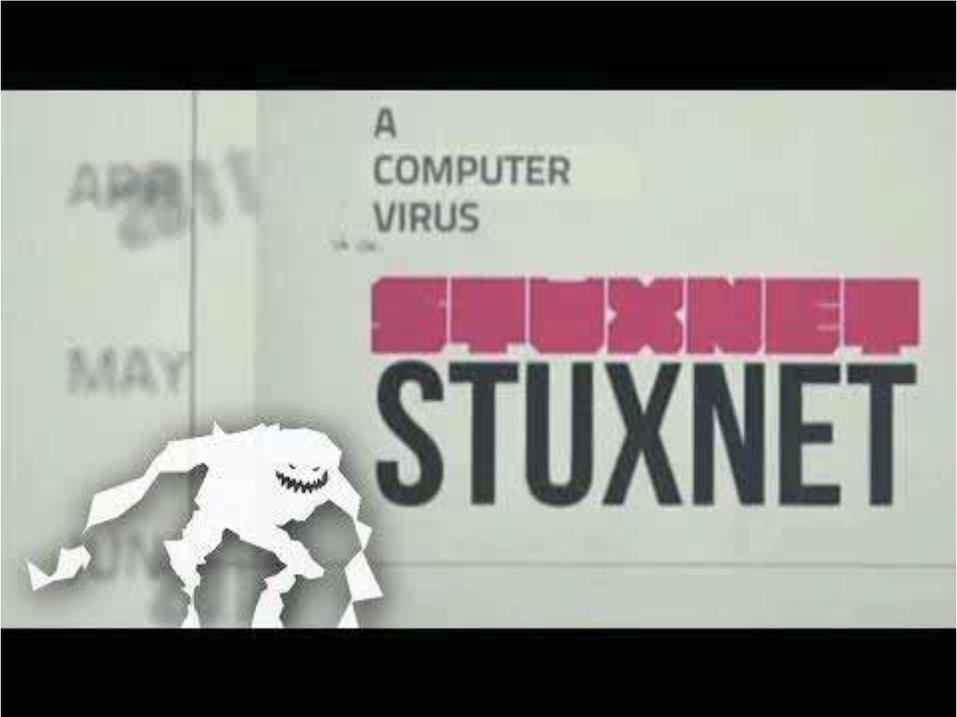


## Stuxnet

- Stuxnet is a malicious computer worm, first uncovered in 2010
- Targets SCADA systems and is believed to be responsible for causing substantial damage to Iran's nuclear program.
- Although neither country has openly admitted responsibility, the worm is widely understood to be a jointly built American/Israeli cyberweapon

# How did STUXNET get in?







## 2003 Cascading Blackout

- The Northeast blackout of 2003 power outage through United States, and the Canadian
- August 14–28, 2003, beginning just after 4:10 p.m. EDT. Some power was restored by 11 p.m.
- Most did not get their power back until two days later. In other areas, it took nearly a week or two for power to be restored.
- At the time, it was the world's second most widespread blackout in history,

# 2003 Blackout



**What would be your first response?**





## Tesla Lane Monitoring

- **Tesla Model S comes with Advanced Lane Assistance Systems with their 2014 release.**
- **Uses the front facing cameras and computer vision system to recognize the lanes.**
- **The system beeps and the steering wheel vibrate, alerting the driver of an unintended lane change.**



# How do we design against adversarial use?



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## Agenda;

Cyber Security in Industrial Systems

System Analysis 101

Examples of System Exploits

**Identifying & dealing with Risks & Vulnerabilities**

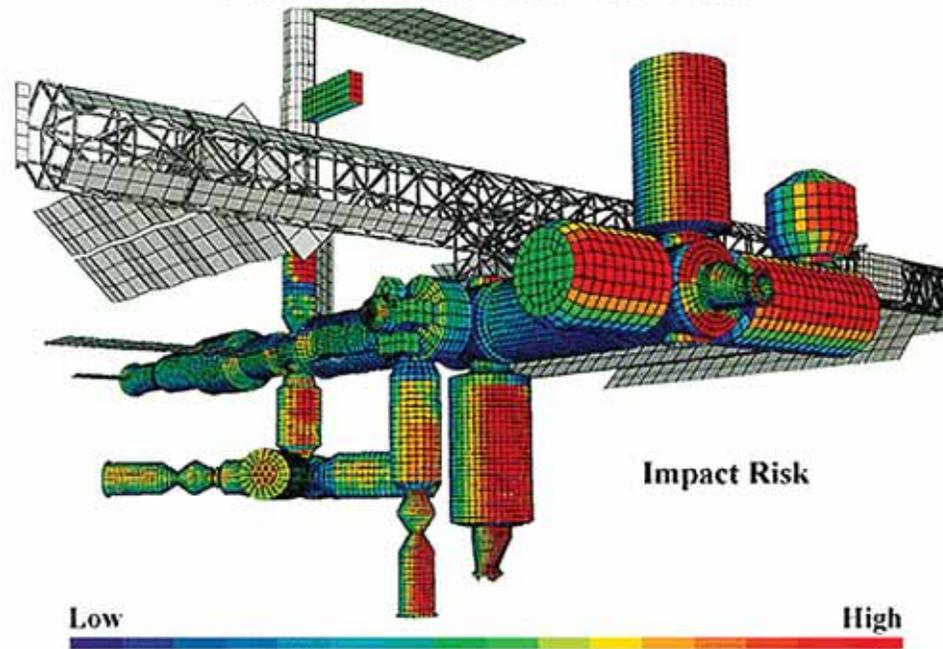
Speed Reading with Program Management Techniques

—  
As an engineer you need to embrace **risk** based thinking!

Focus your efforts on those that are most needed!

# International Space Station

Probability of No Impacts From a  $> 1$  cm  $\phi$  Debris



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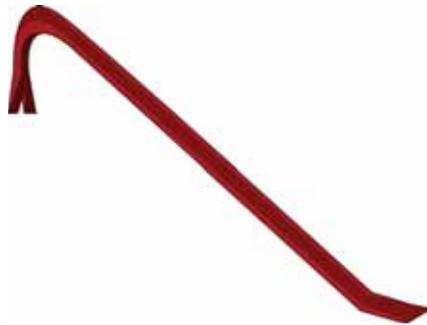
**Everyday elements can be  
misused, have exploits and  
present vulnerabilities!**

---

**What is this?**



# Risk: Design Misuse!





**What types of screwdriver misuse can you think of?**

# Marketplace Misuse!



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## Agenda;

Cyber Security in Industrial Systems

System Analysis 101

Examples of System Exploits

Identifying & dealing with Risks & Vulnerabilities

**Speed Reading with Program Management Techniques**



## Examples of Project's you've worked on?



# Program Management 101

What is a project?

# What is a project?

Large body of work with specific deliverables

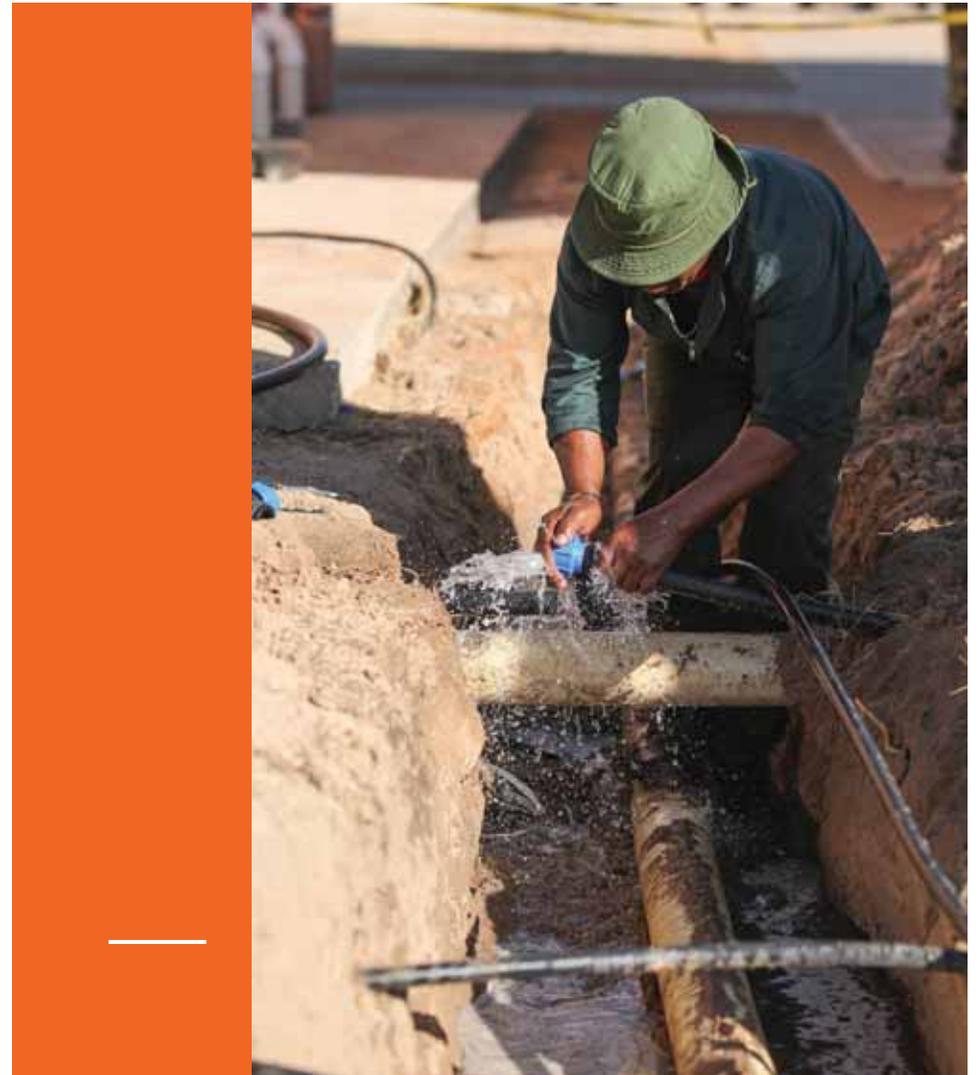
Constraints driven

Basic; Time, Quality, Cost

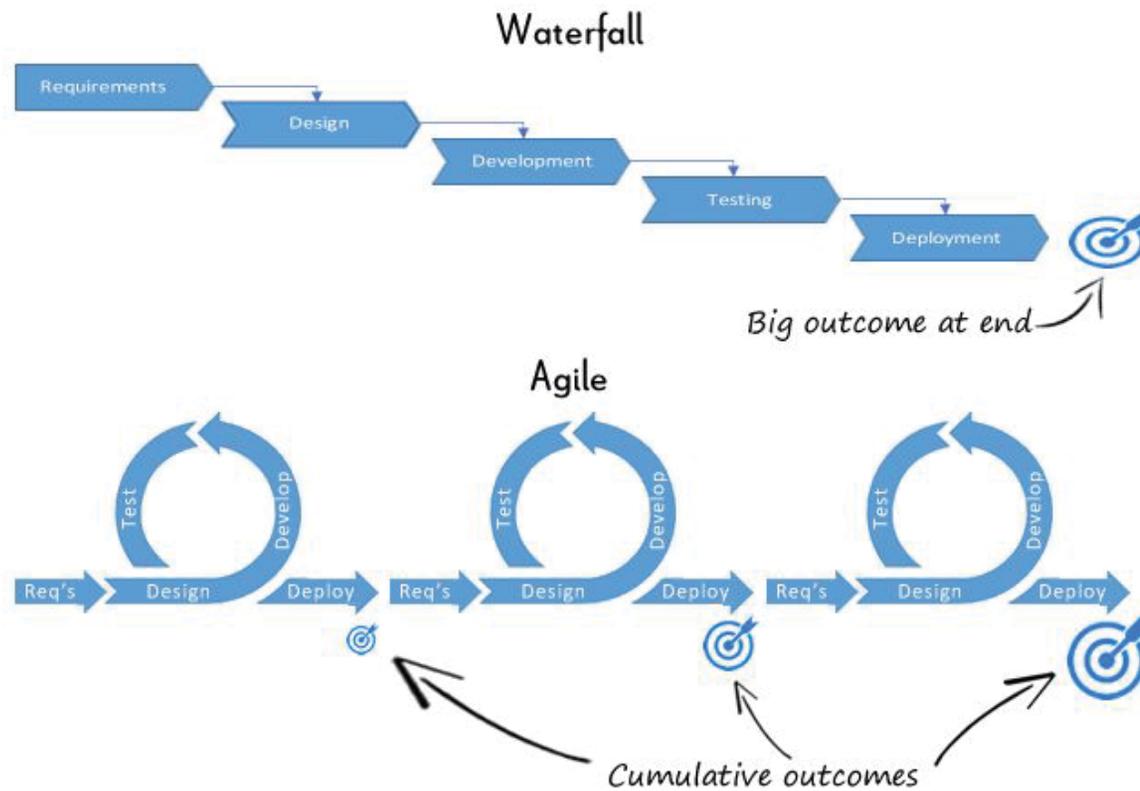
6(+ Risk, Opportunity, Scope )

Collection of stakeholders

Like it or not, you have all worked on a project in your life?



# Waterfall vs. Agile Project Methods



# — Not all projects are equal!

*Some are sprints, some are marathons. The **constraints** will inform your management approach*

# What methodology would you use?

## Project:

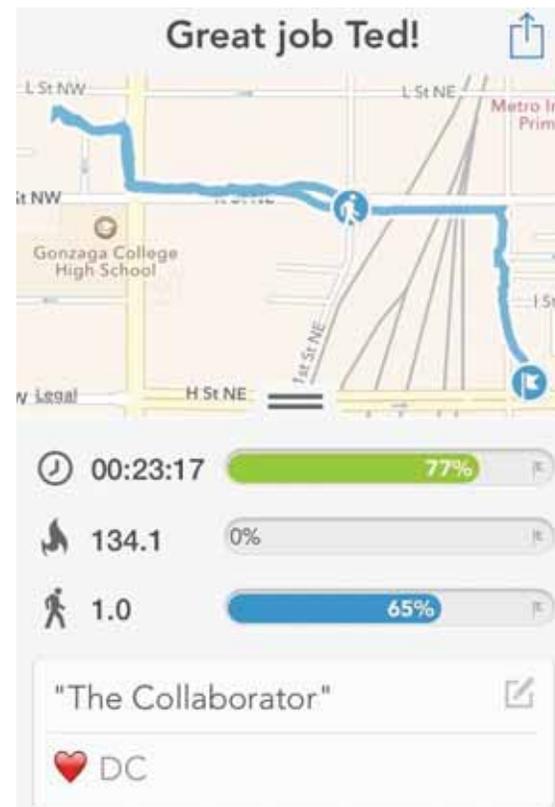
Create a calorie tracking app for seniors

## Constraints;

*Duration: 9 Weeks*

*Budget; \$1,000*

*Quality; 1 Demo with Investors*



# Which Methodology

Waterfall

Agile

# What methodology would you use?

## **Project:**

Upgrade existing steel chemistry reporting system

## **Constraints;**

*Duration: 15 Weeks*

*Budget; \$100,000*

*Quality; 0 Missed Reports for initial production run (100 coils of steel)*



## Which Methodology PT 2

Agile

Waterfall

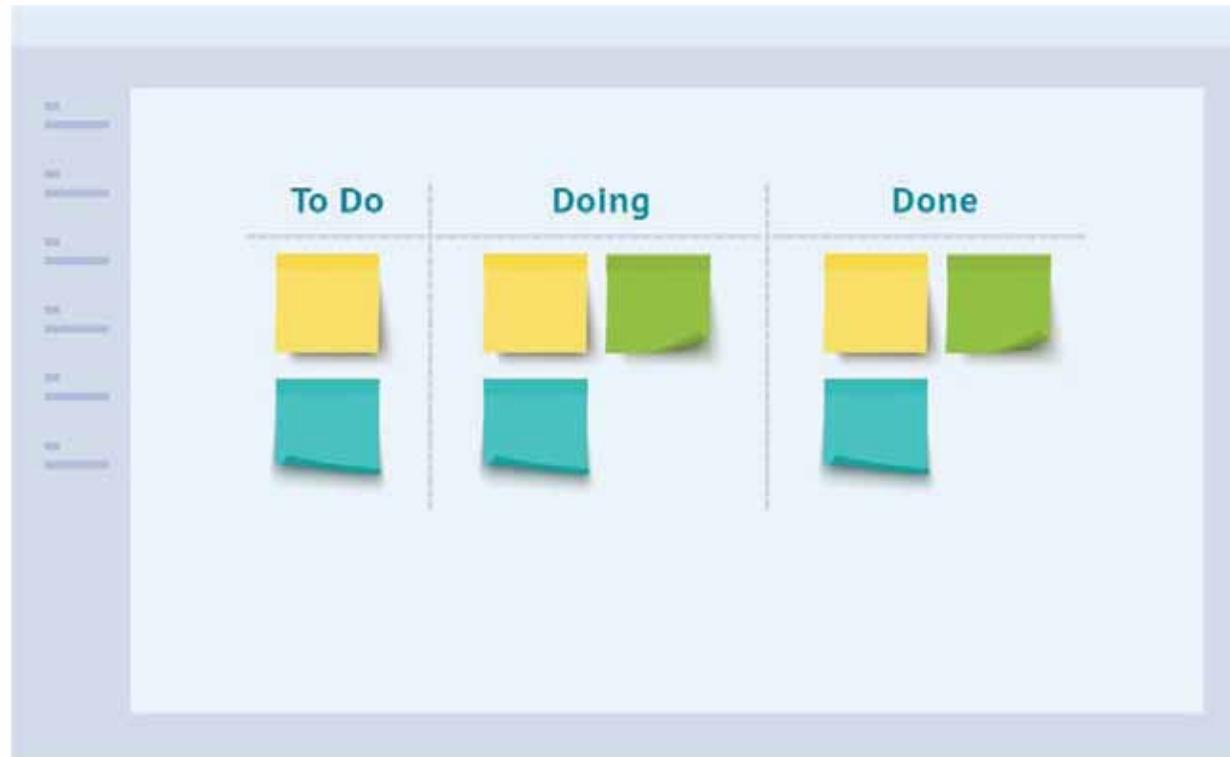
# Kanban

**Kanban** (看板) (signboard or billboard in Japanese) is a scheduling system for lean manufacturing and just-in-time manufacturing (JIT). Taiichi Ohno, an industrial engineer at Toyota, developed kanban to improve manufacturing efficiency. Kanban is one method to achieve JIT. The system takes its name from the cards that track production within a factory.

Kanban became an effective tool to support running a production system as a whole, and an excellent way to promote improvement. Problem areas are highlighted by measuring lead time and cycle time of the full process and process steps. One of the main benefits of kanban is to establish an upper limit to work in process inventory to avoid overcapacity.



# Simplified Kanban Board



# Kanban & you



# Agenda

## Hour 1

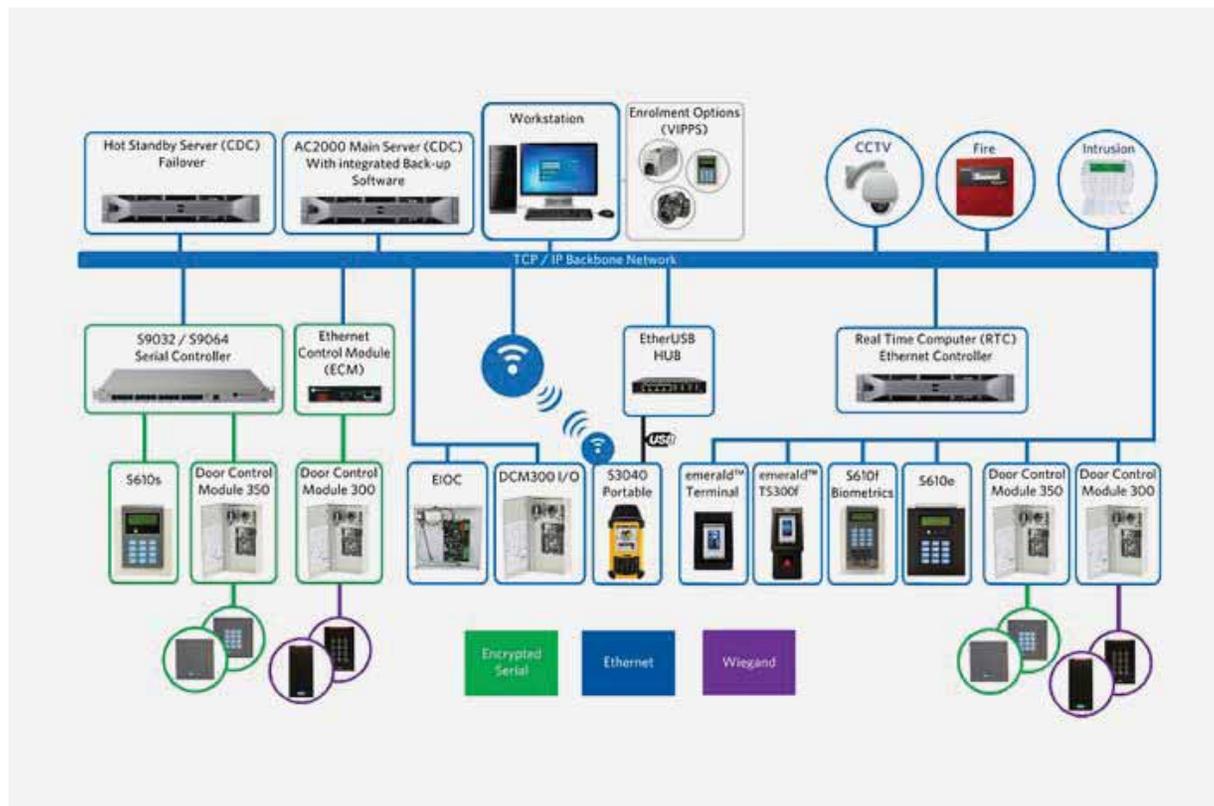
- ~~Cyber Security in Industrial Systems~~
- ~~System Analysis 101~~
- ~~Examples of System Exploits~~
- ~~Identifying & dealing with Risks & Vulnerabilities~~
- ~~Speed Reading with Program Management Techniques~~

~~<10 Minute BREAK>~~

## Hour 2

- Exercise & Group Work
  - Overview of an example of Theoretical Airport Security System Design by generating set of Risks
  - Group Exercise
  - Group Review of Exercise

# Airport Control System - System Decomp



# Airport Control System - Risk Generation



# Airport Control System - Kanban Risk Priority



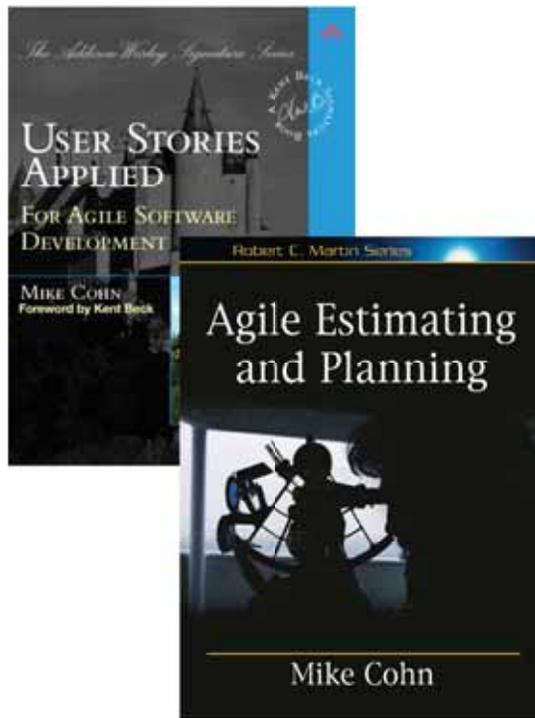
# **Airport Control System - Kanban Risk Mitigations**

# An Introduction to Agile/Scrum

Jeff Pulcini  
Cyber Security Workshop  
October 19, 2019

Co sponsored by The Department of Defense,  
Indiana University of Pennsylvania and Westmoreland Community College

# CREDITS



Base presentation was done by:  
Mike Cohn (circa 2007)  
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[www.mountaingoatsoftware.com](http://www.mountaingoatsoftware.com)  
(720) 890-6110 (office)

Other portions are credited as appropriate.

Additional material by Jeff Pulcini



Mountain Goat Software,  
LLC



# Goals and Ground Rules

- Introduce the concepts of Agile/Scrum
- Contrast with another methodology, i.e waterfall
- Why we should care?

Get the big picture, concepts, and keywords

I'm not going to be rigorous in history or definitions

I'm likely to make extreme statements to make the point.

*We will talk software development, but Agile can be used for anything.*

# Problem Statement

**What we have been doing is not working.**

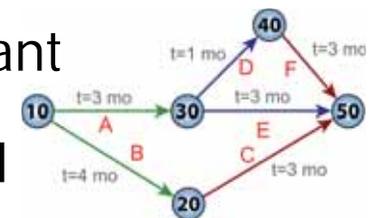
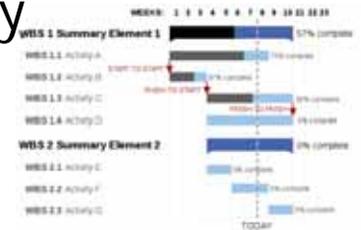
We are faced with...

- Producing more and better output with shrinking budgets
- Maximize the actual and perceived value we deliver
- Keep up with the pace of change in the market

## How did we get here?

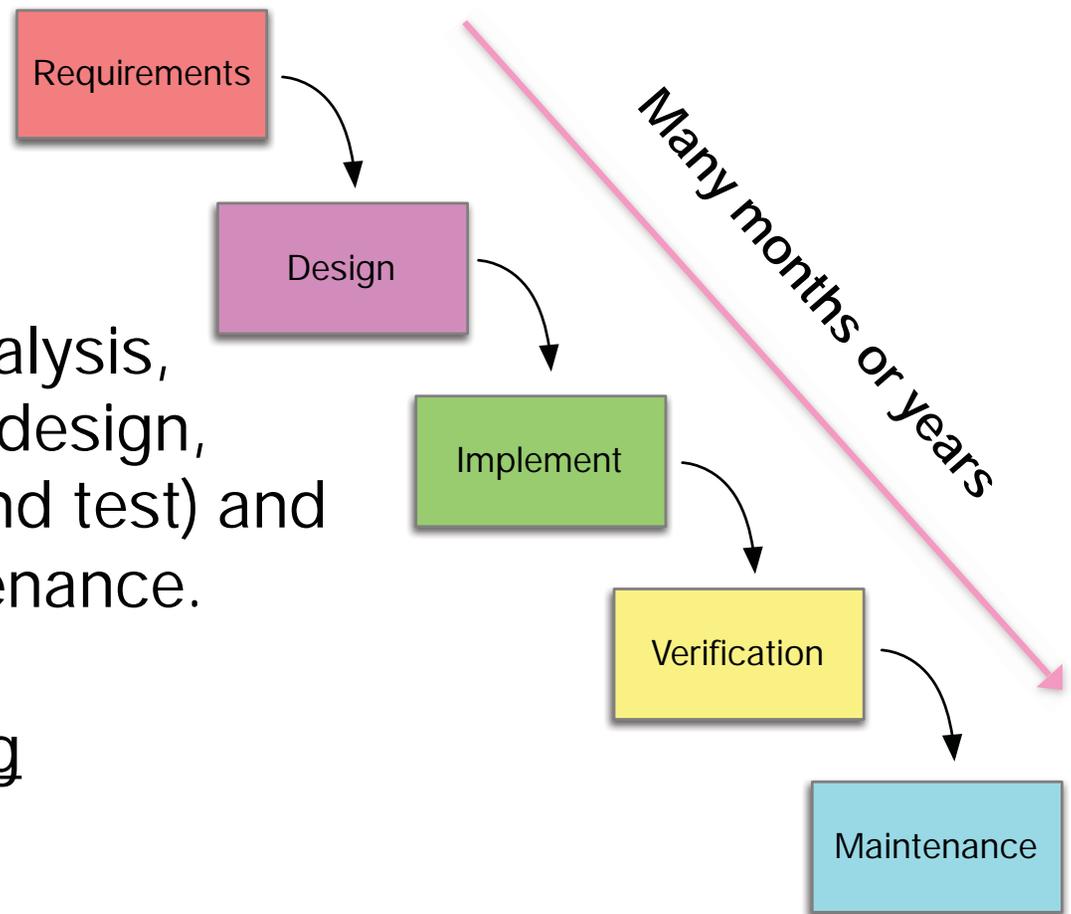
# Project Management - (a VERY brief overview)

- People have ALWAYS organized work
- Management of process and projects became more codified as we developed “Scientific Management” principles in the early 1900’s
- Henry Gantt developed the Gantt chart in 1903
- In the 1950’s the PERT chart (1958) (program evaluation and review technique) and critical path management were dominant
- In the 60’s more formalized “waterfall” techniques were used
- In 1969, the Project Management Institute was incorporated
- in 1985 the DOD issued DOD-STD-2167A that was their standards for working with software development contractors



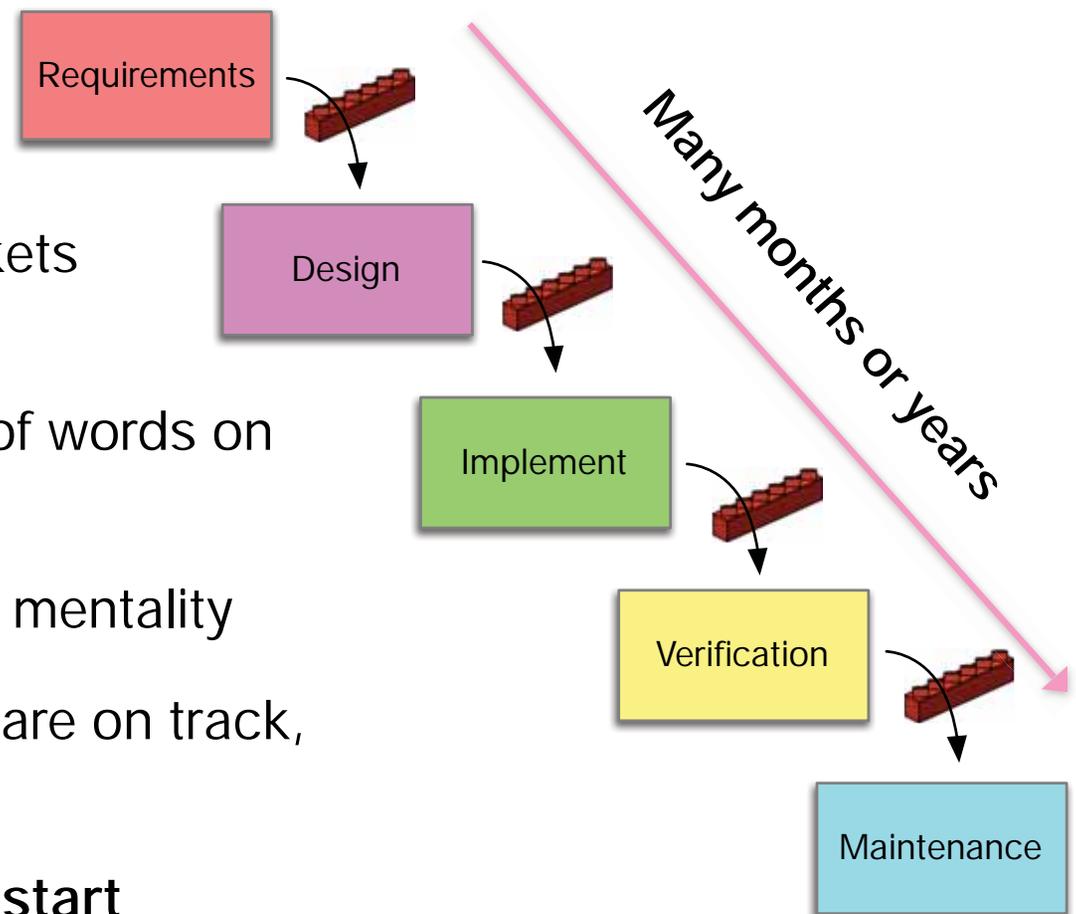
# Waterfall Project Management Methodology

- A step-wise approach to product delivery
- It is a relay race of analysis, requirements definition, design, Implementation (code and test) and then delivery and maintenance.
- Product delivery is a "big bang" / "all or nothing"

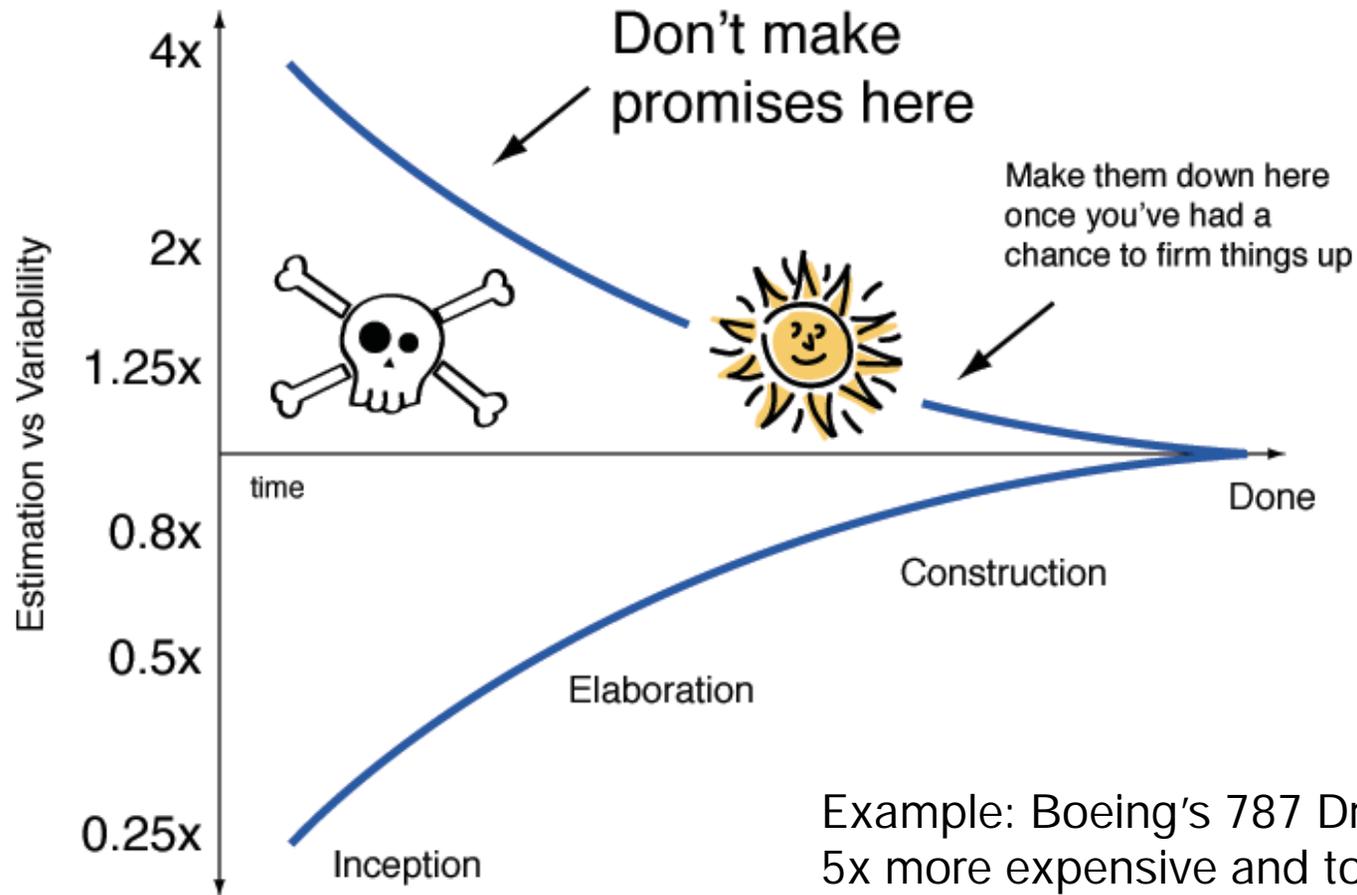


# Downside of This Approach

- Focus is primarily on process, not people
- Long development cycles
- Unresponsive to changing markets (and thus users needs)
- Formal communications, Lots of words on paper
- Each step fosters a them vs. us mentality
- Plan based - We measure if we are on track, not what we have done
- **You know the least when you start**



# Cone of Uncertainty



Example: Boeing's 787 Dreamliner was 5x more expensive and took twice as long to deliver than original estimates.

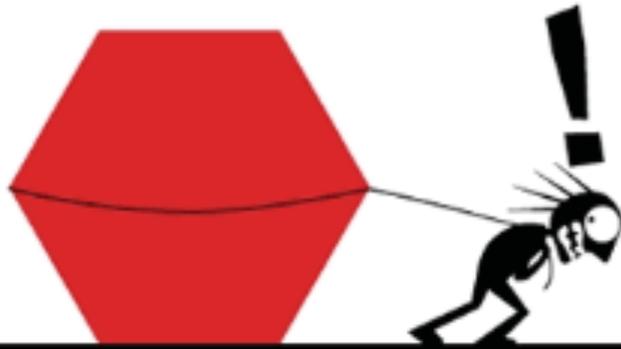
# We're losing the relay race

**“The... ‘relay race’ approach to product development...may conflict with the goals of maximum speed and flexibility. Instead a holistic or ‘rugby’ approach—where a team tries to go the distance as a unit, passing the ball back and forth—may better serve today’s competitive requirements.”**

Hiroataka Takeuchi and Ikujiro Nonaka, “The New New Product Development Game”, *Harvard Business Review*, January 1986.

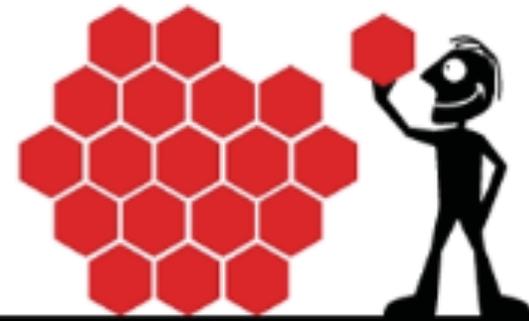
# Waterfall vs. Agile

## THE WATERFALL PROCESS

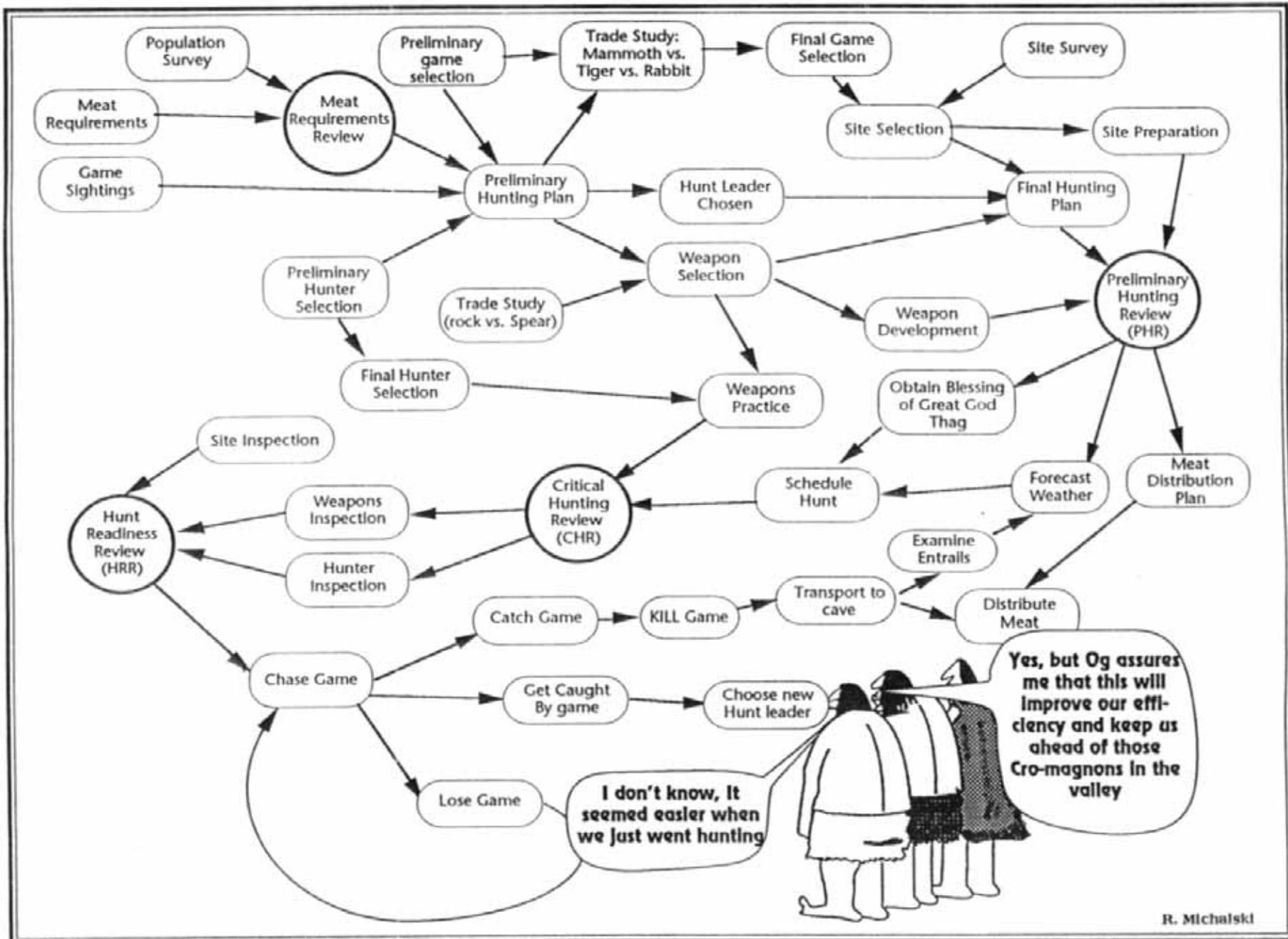


*'This project has got so big,  
I'm not sure I'll be able to deliver it!'*

## THE AGILE PROCESS



*'It's so much better delivering this  
project in bite-sized sections'*

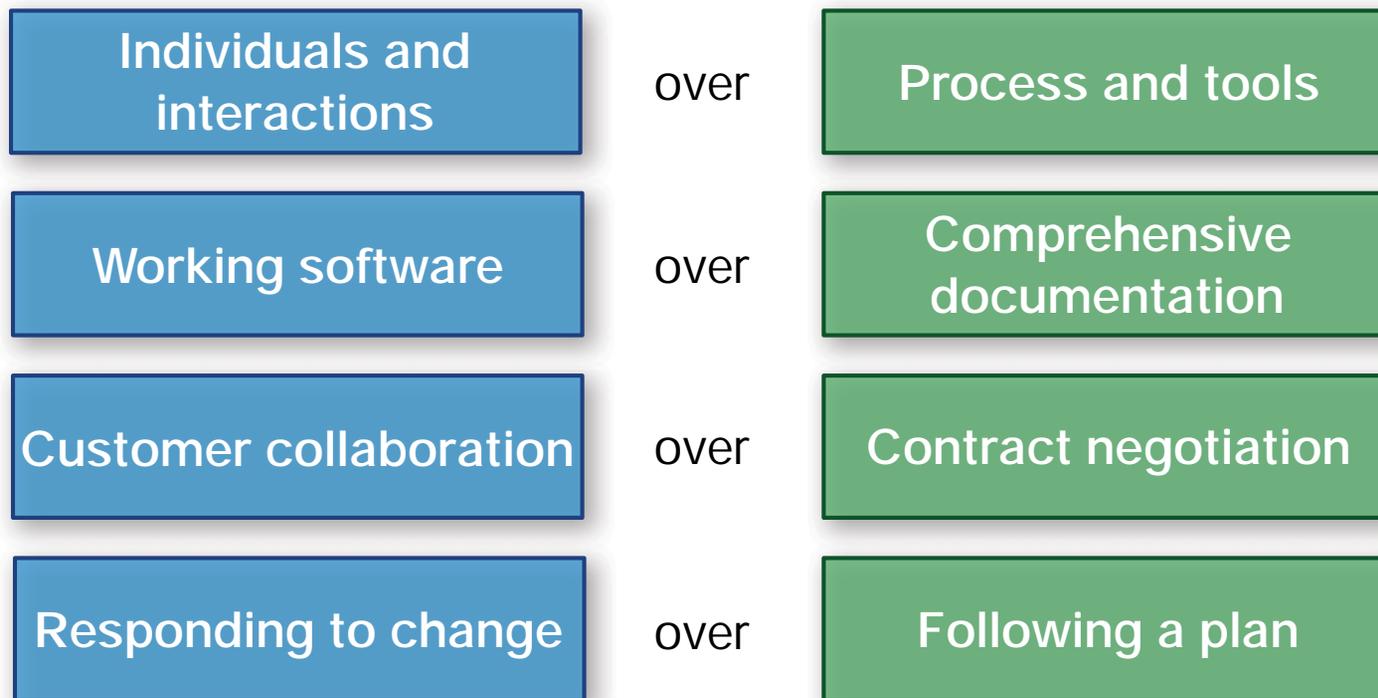


• Why the Neanderthals became extinct •

**Agile – some definitions,  
changing our mindset**

# The Agile Manifesto

“We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value

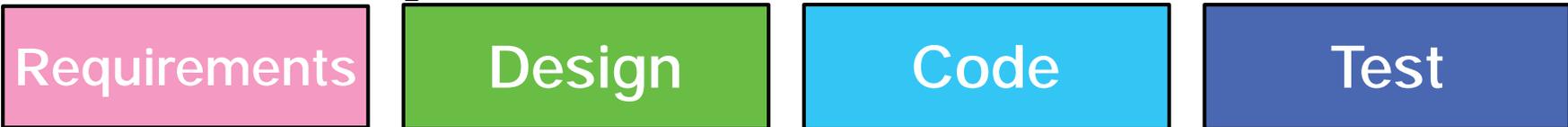


That is, while there is value on the items on the right, we value the items on the left more.”

# 12 Agile Principles

1. **Our highest priority is to satisfy the customer** through early and continuous delivery of valuable software.
2. **Welcome changing requirements**, even late in development. Agile processes harness change for the customer's competitive advantage.
3. **Deliver working software frequently**, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. **Business people and developers must work together daily throughout the project.**
5. **Build projects around motivated individuals.** Give them the environment and support they need, and trust them to get the job done.
6. The most **efficient and effective method of conveying information** to and within a development team **is face-to-face conversation.**
7. **Working software is the primary measure of progress.**
8. **Agile processes promote sustainable development.** The sponsors, developers, and users should be able to maintain a **constant pace indefinitely.**
9. Continuous **attention to technical excellence** and good design enhances agility.
10. **Simplicity--the art of maximizing the amount of work not done--is essential.**
11. The best architectures, requirements, and designs emerge from **self-organizing teams.**
12. At regular intervals, **the team** reflects on how to become more effective, then **tunes and adjusts its behavior** accordingly.

# Sequential vs. overlapping development



Rather than doing all of one thing at a time...

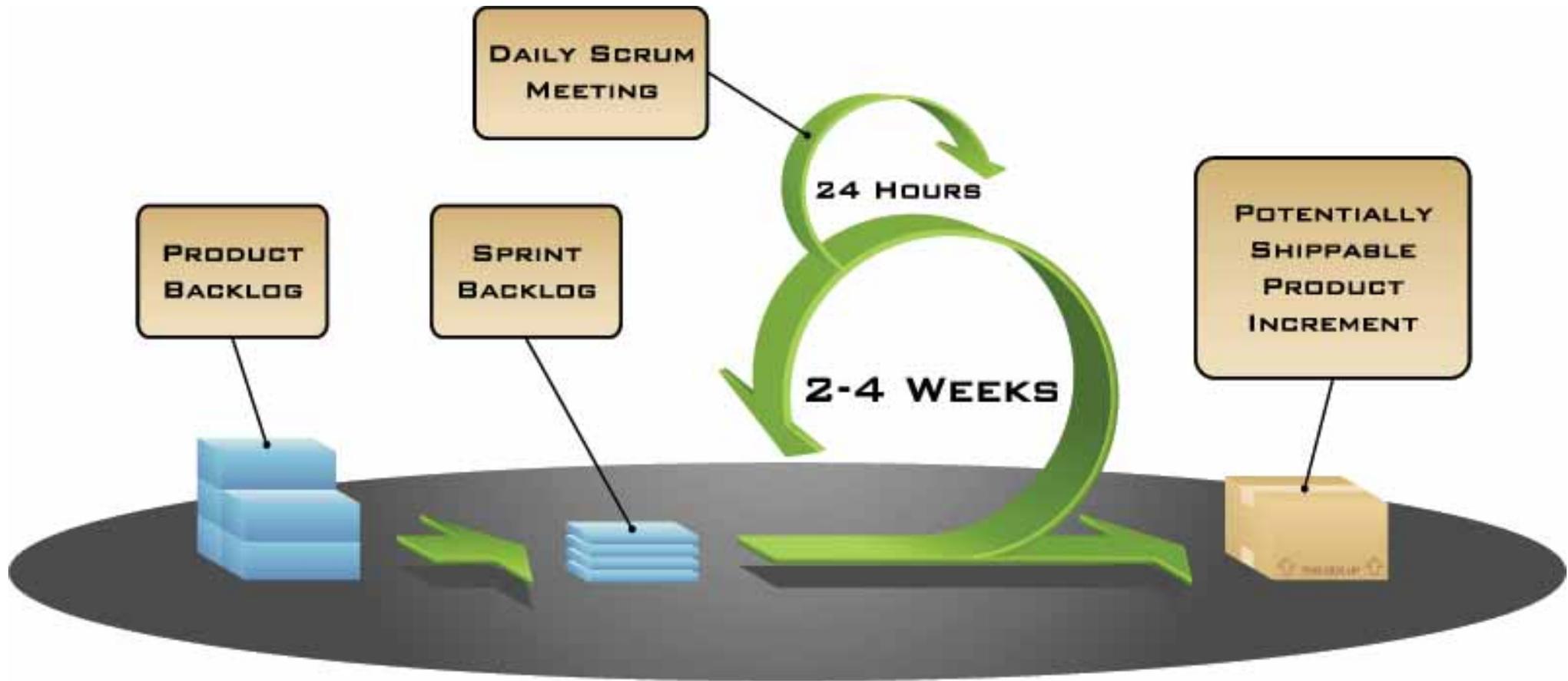
...Scrum teams do a little of everything all the time



Source: "The New New Product Development Game" by Takeuchi and Nonaka. *Harvard Business Review*, January 1986.

# Scrum – The Big Picture

# The Big Picture



COPYRIGHT © 2005, MOUNTAIN GOAT SOFTWARE

# Characteristics



- Requirements are captured as items in a list of “product backlog”
- Product progresses in a series of short “sprints”
- Self-organizing teams
- No specific engineering practices prescribed
- Uses generative rules to create an agile environment for delivering projects

# Scrum Details

# Scrum Framework

## Team Roles

- Product owner
- ScrumMaster
- Team

Now they are called  
EVENTS!



## ~~Ceremonies~~

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily scrum meeting

## Artifacts

- Product backlog
- Sprint backlog
- Burndown charts

# Scrum Framework

## Team Roles

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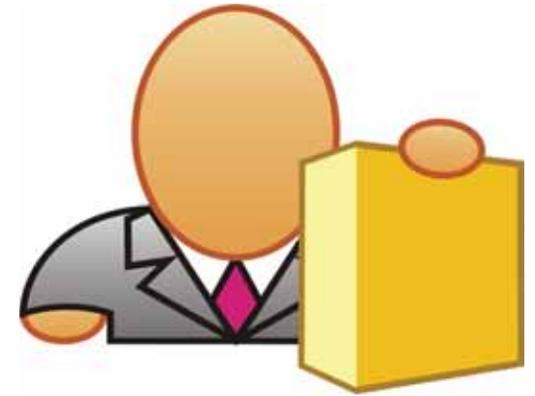
## Events

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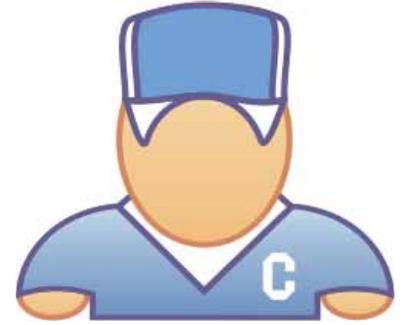
- Product backlog
- Sprint backlog
- Burndown charts

# Product Owner



- Define the features of the product
- Decide on release date and content
- Be responsible for the profitability of the product (ROI)
- Prioritize features according to market value
- Adjust features and priority every iteration, as needed
- Accept or reject work results

# The Scrum Master



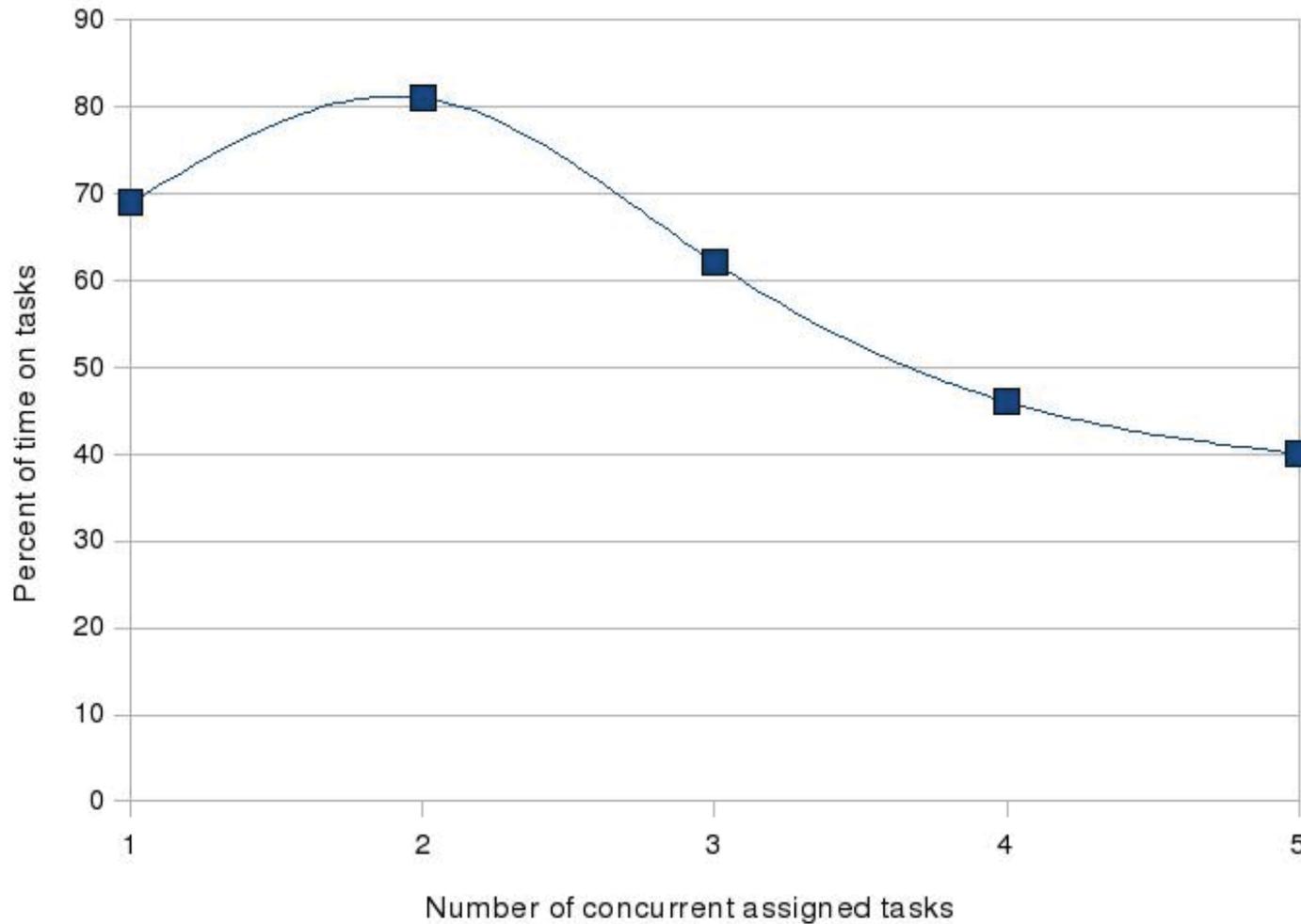
- Represents management to the project
- Responsible for enacting Scrum values and practices
- Removes impediments
- Ensure that the team is fully functional and productive
- Enable close cooperation across all roles and functions
- Shield the team from external interferences
- The ScrumMaster differs from a Project Manager in that he does not exercise command and control

# The Team



- Typically 5-9 people
- Cross-functional:
  - Programmers, testers, user experience designers, etc.
- Members should be full-time (no multi-tasking!)
  - May be exceptions (e.g., database administrator)
- Teams are self-organizing
  - Ideally, no titles but rarely a possibility
- Membership should change only between sprints

# The Myth of Multitasking



from a 1990's [Harvard Study](#) by Steven C.Wheelwright and Kim B.Clark

# Scrum framework

## Team Roles

- Product owner
- ScrumMaster
- Team

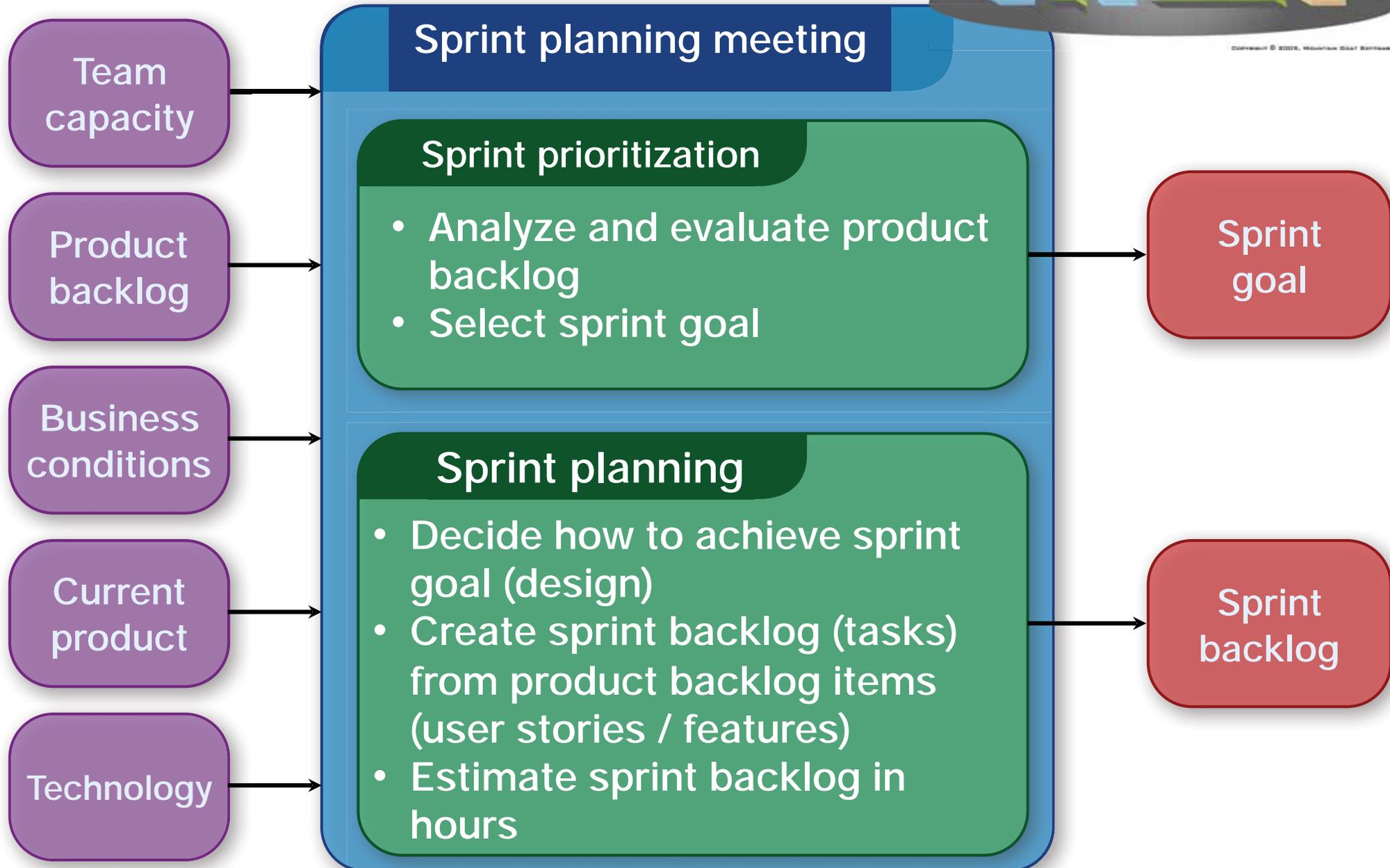
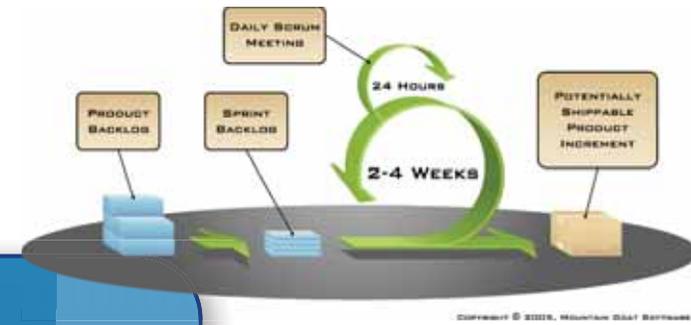
## Events

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily scrum meeting

## Artifacts

- Product backlog
- Sprint backlog
- Burndown charts

# Sprint Planning



# The sprint goal

- A short statement of what the work will be focused on during the sprint

## Database Application

Make the application run on SQL Server in addition to Oracle.

## Life Sciences

Support features necessary for population genetics studies.

## Financial services

Support more technical indicators than company ABC with real-time, streaming data.

# Sprint Planning

- Team selects User Stories from the product backlog they can commit to completing
- Sprint backlog is created
  - Tasks are identified and each is estimated (1-16 hours)
  - Done Collaboratively, not alone by the Scrum Master/Product Owner
- High-level design is considered

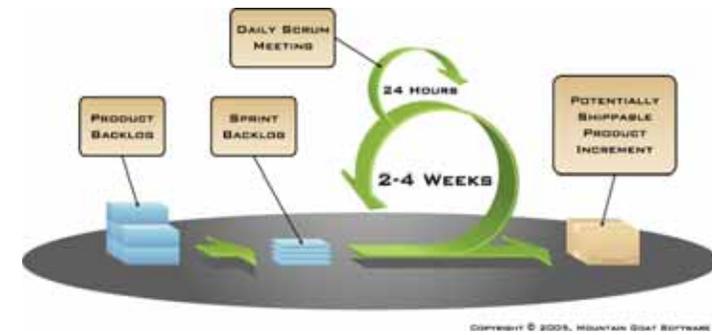
## User Story

As a vacation planner, I  
want to see photos of the  
hotels.

(The who, what and why of  
what is to be done)

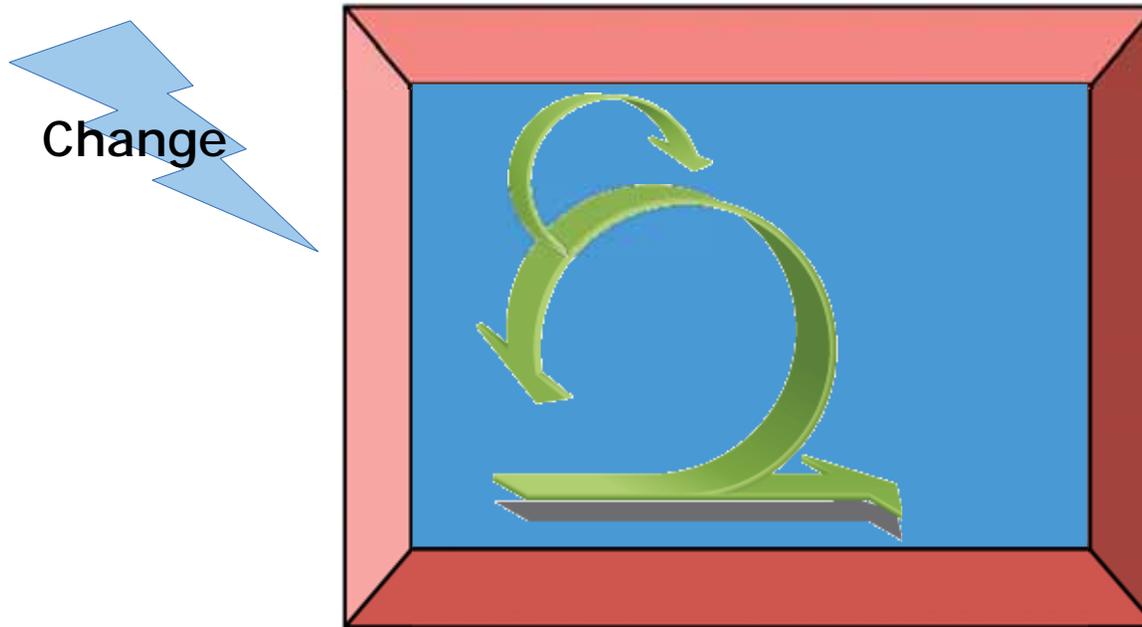
Code the middle tier (8 hours)  
Code the user interface (4)  
Write test fixtures (4)  
Code the foo class (6)  
Update performance tests (4)

# Sprints



- Scrum projects make progress in a series of “sprints”
- Typical duration is 2–4 weeks or a calendar month at most
- A constant duration leads to a better rhythm
- Product is designed, coded, and tested during the sprint

# No changes during a sprint



- Plan sprint durations around how long you can commit to keeping change out of the sprint

# The Daily Scrum



- Parameters
  - Daily
  - 15-minutes
  - Stand-up
- Not for problem solving
  - Whole world is invited
  - Only team members, ScrumMaster, product owner, can talk
- Helps avoid other unnecessary meetings



# Everyone Answers Three Questions

1

What did you do yesterday?

2

What will you do today?

3

Is anything in your way?

- These are *not* status for the ScrumMaster
- They are commitments in front of peers

# The Sprint Review



- Invite the world
- Whole team participates
- Informal
  - 2-hour prep time rule
  - No slides
- Team presents what it accomplished during the sprint
- Typically takes the form of a demo of new features or underlying architecture



# Sprint Retrospective

- Periodically take a look at what is and is not working
- Typically 15–30 minutes
- Done after every sprint
- Whole team participates
  - ScrumMaster
  - Product owner
  - Team
  - Possibly customers and others

# Start / Stop / Continue

- Whole team gathers and discusses what they'd like to:

Start doing

Stop doing

Continue doing

This is just one  
of many ways  
to do a sprint  
retrospective.

# Scrum Framework

## Team Roles

- Product owner
- ScrumMaster
- Team

## Events

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily scrum meeting

## Artifacts

- Product backlog
- Sprint backlog
- Burndown charts

# Product Backlog

This is the  
product backlog



- The requirements
- A list of all desired work on the project
- Ideally expressed such that each item has value to the users or customers of the product
- Prioritized by the product owner
- Reprioritized at the start of each sprint

# A Sample Product Backlog

Backlog item	Estimate
Allow a guest to make a reservation	3
As a guest, I want to cancel a reservation.	5
As a guest, I want to change the dates of a reservation.	3
As a hotel employee, I can run RevPAR reports (revenue-per-available-room)	8
Improve exception handling	8
...	30
...	50

# Sprint backlog

This is the  
sprint backlog



- One or more backlog items make up the backlog.
- The work is decomposed into tasks and hours.
- If work is unclear, define a sprint backlog item with a larger amount of time and break it down later.
- Individuals sign up for work of their own choosing - work is never assigned.
- Estimated work remaining is updated daily as more becomes known.
- Any team member can add, delete or change the sprint backlog.

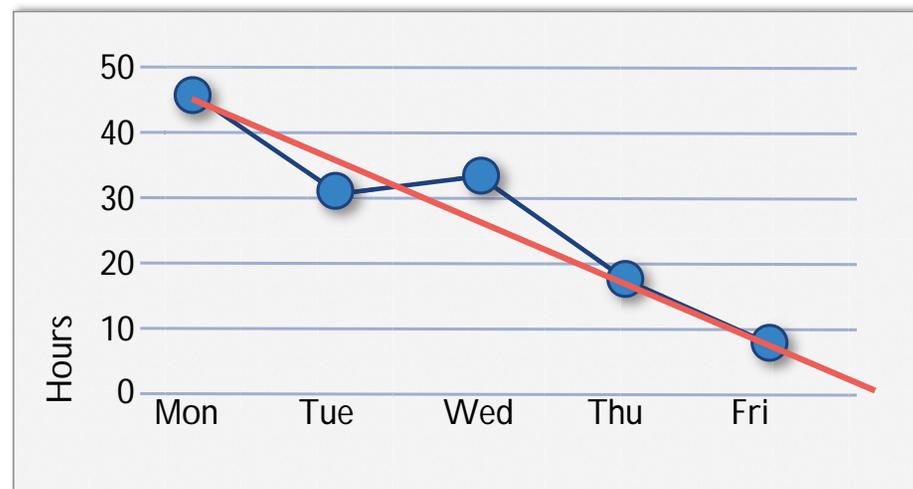
# A Sprint Backlog

Tasks	Mon	Tues	Wed	Thur	Fri
Code the user interface	8	4	8		
Code the middle tier	16	12	10	4	
Test the middle tier	8	16	16	11	8
Write online help	12				
Write the foo class	8	8	8	8	8
Add error logging			8	4	

# Burndown Example

Tasks	Mon	Tues	Wed	Thur	Fri
Code the user interface	8	4	8		
Code the middle tier	16	12	10	7	
Test the middle tier	8	16	16	11	8
Write online help	12				
	44	32	34	18	8

Ideal 



**Why do this?**

# Reasons for Adopting Agile Success Rates

April 1, 2018

## PROJECT SUCCESS RATES AGILE VS WATERFALL

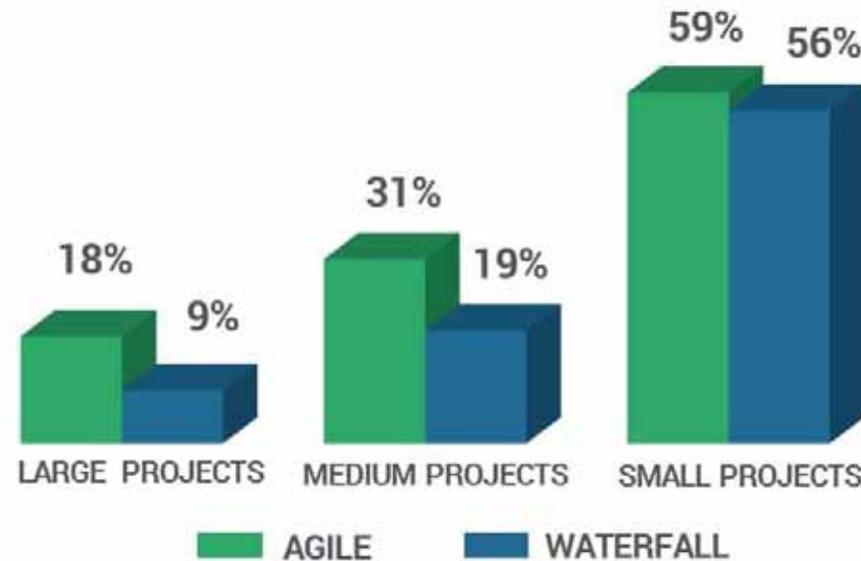


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SOURCE: STANDISH GROUP CHAOS STUDIES 2013-2017

# Reasons for Adopting Agile Success Rates

## PROJECT SUCCESS RATES BY PROJECT SIZE **AGILE VS WATERFALL** *FOR LARGE PROJECTS, AGILE APPROACHES ARE 2X MORE LIKELY TO SUCCEED*



*Source: Standish Group, Chaos Studies 2013-2017*

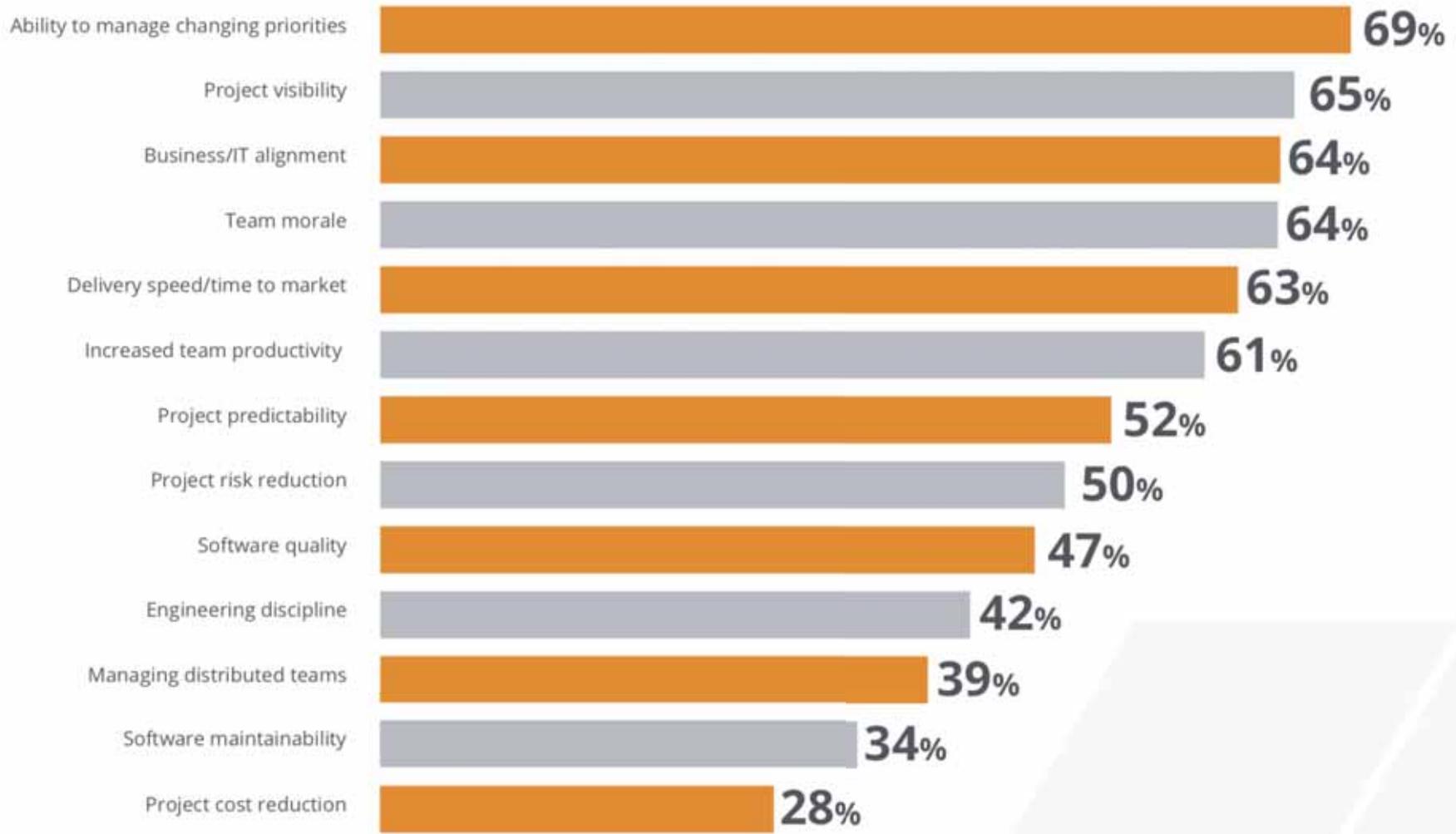
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# Reasons for Adopting Agile Shifts in Industry Attitudes

## Changes from 2018 to 2019

- Less about increasing productivity (51% compared to 55%)
- More about improving team morale (34% compared to 28%)
- Less about reducing project risk (28% compared to 37%)
- More about reducing project costs (41% compared to 24%)

# Benefits of Adopting Agile



# Bottom Line

- Agile projects are 2X more likely to succeed
- Agile projects are 1/3 less likely to fail than waterfall projects

The Standish Group has conducted surveys of IT project success and failure rates every 2 years since 1994.

# Scrum has been used for:

- Commercial software
- In-house development
- Contract development
- Fixed-price projects
- Financial applications
- ISO 9001-certified applications
- Embedded systems
- 24x7 systems with  
    99.999% uptime requirements
- The Joint Strike Fighter
- Video game development
- FDA-approved, life-critical systems
- Satellite-control software
- Websites
- Handheld software
- Mobile phones
- Network switching applications
- ISV applications
- Some of the largest applications in use