
Cybersecurity Workshop

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

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WCCC Campus

Student Achievement Center





Hello!

About Nigel!

→ **Pittsburgher**

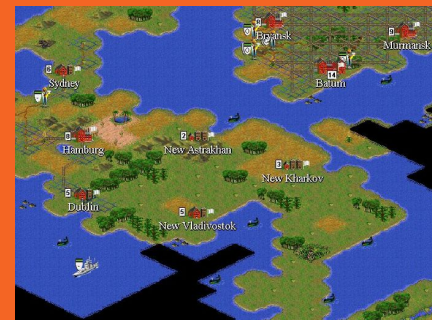
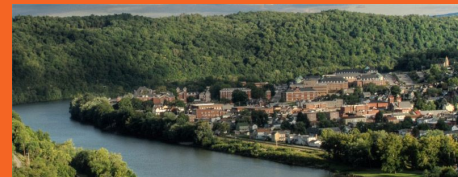
Grew up south of Pittsburgh in California, PA. Parents are fans of British Rock!

→ **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

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Agenda;

Cyber Security in Industrial Systems

System Analysis 101

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What is an **industrial**
system?

Knowledge of Industrial Systems?

Extremely knowledgeable

Not knowledgeable at all

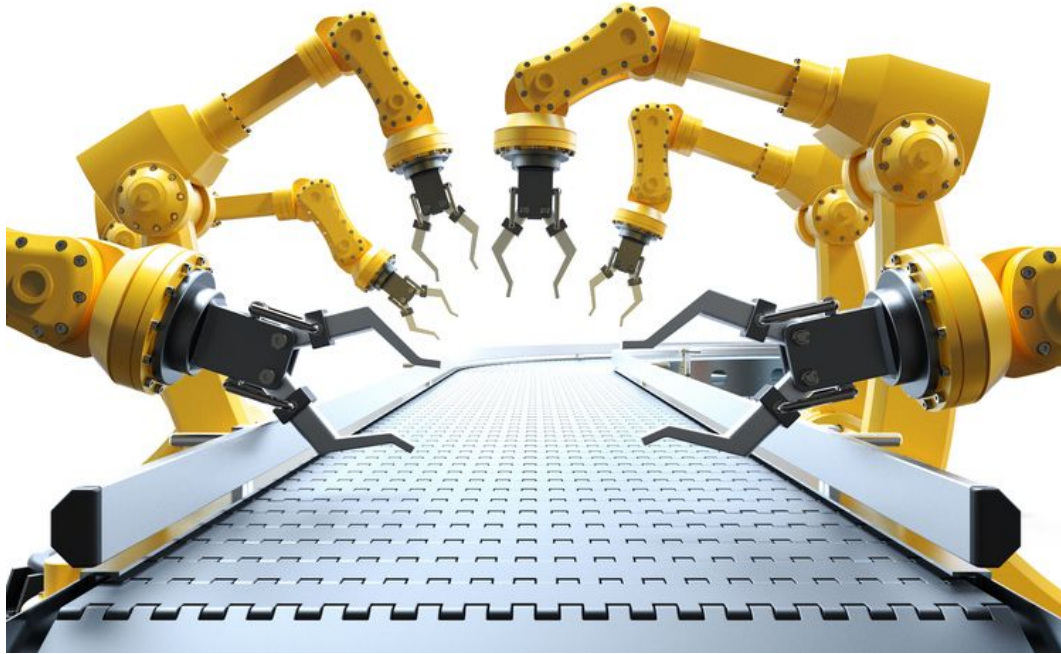


Neutral

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.

Industrial Control System (def)



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

Used by highly skilled and non skilled technicians.

Low -> No Tolerance for Failures



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

Networking

Misuse

Unintended design

Malware

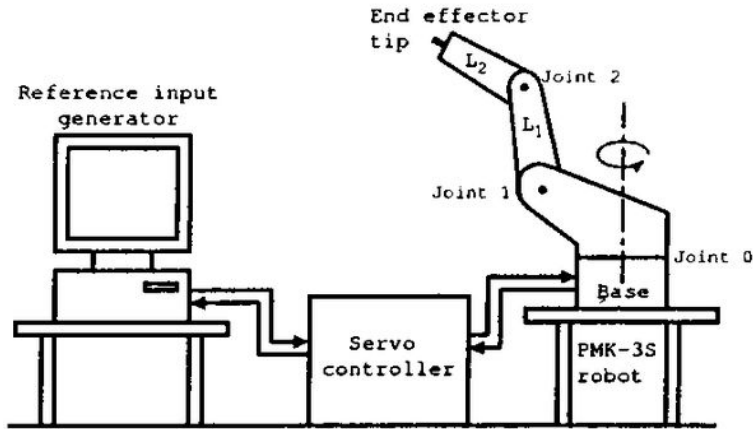
Zero-day exploit

Man in the middle

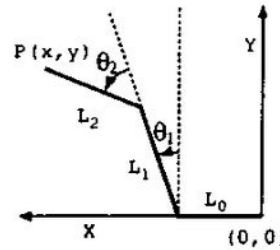
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It depends

Systems Engineering



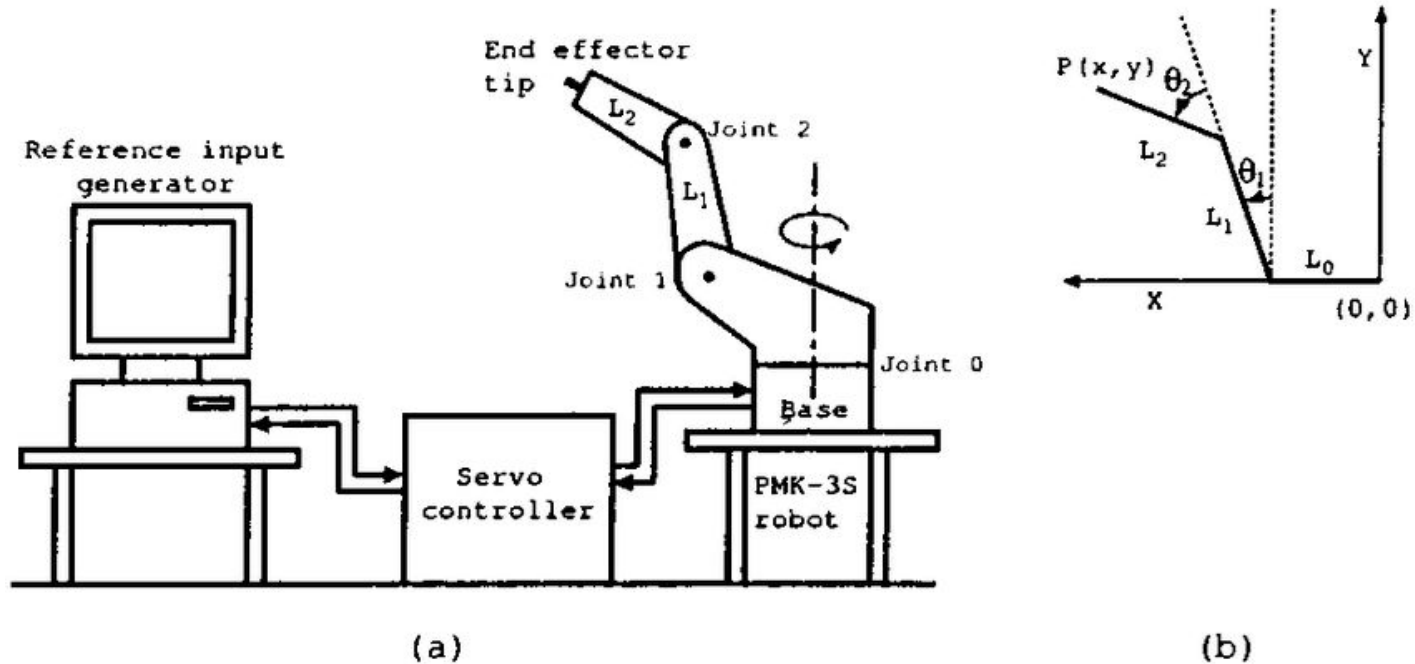
(a)



(b)

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.

Systems Engineering & Cybersecurity



What is vulnerable in this diagram?

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Cyber Security in Industrial Systems

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Examples of System Exploits

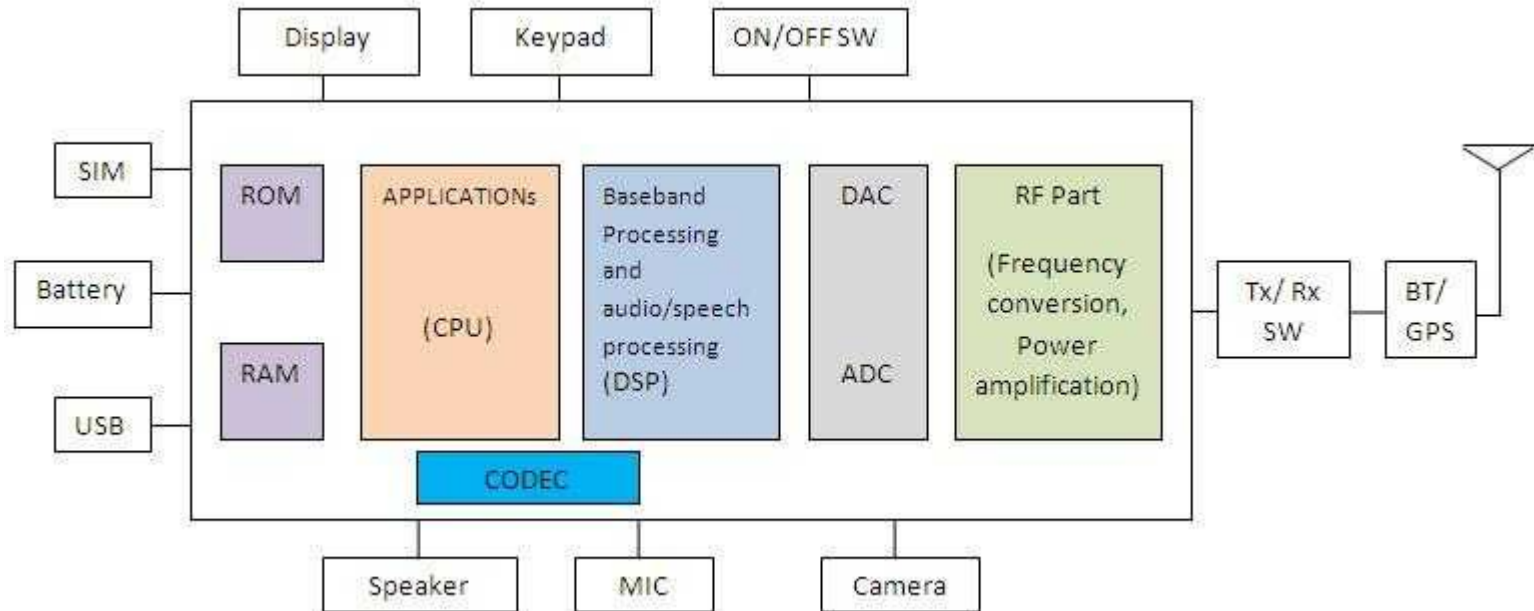
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Decomposing a System



Decomposing System



What is this System?

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Malicious actors vs. Bad Design



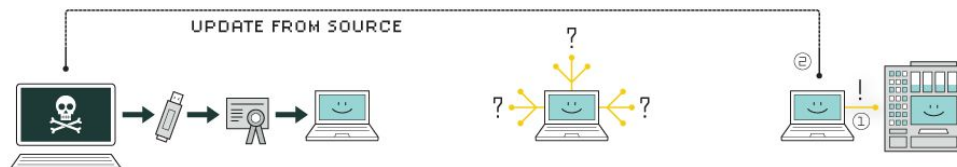


Stuxnet

- 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?

HOW STUXNET WORKED



1. infection

Stuxnet enters a system via a USB stick and proceeds to infect all machines running Microsoft Windows. By brandishing a digital certificate that seems to show that it comes from a reliable company, the worm is able to evade automated-detection systems.

2. search

Stuxnet then checks whether a given machine is part of the targeted industrial control system made by Siemens. Such systems are deployed in Iran to run high-speed centrifuges that help to enrich nuclear fuel.

3. update

If the system isn't a target, Stuxnet does nothing; if it is, the worm attempts to access the Internet and download a more recent version of itself.



4. compromise

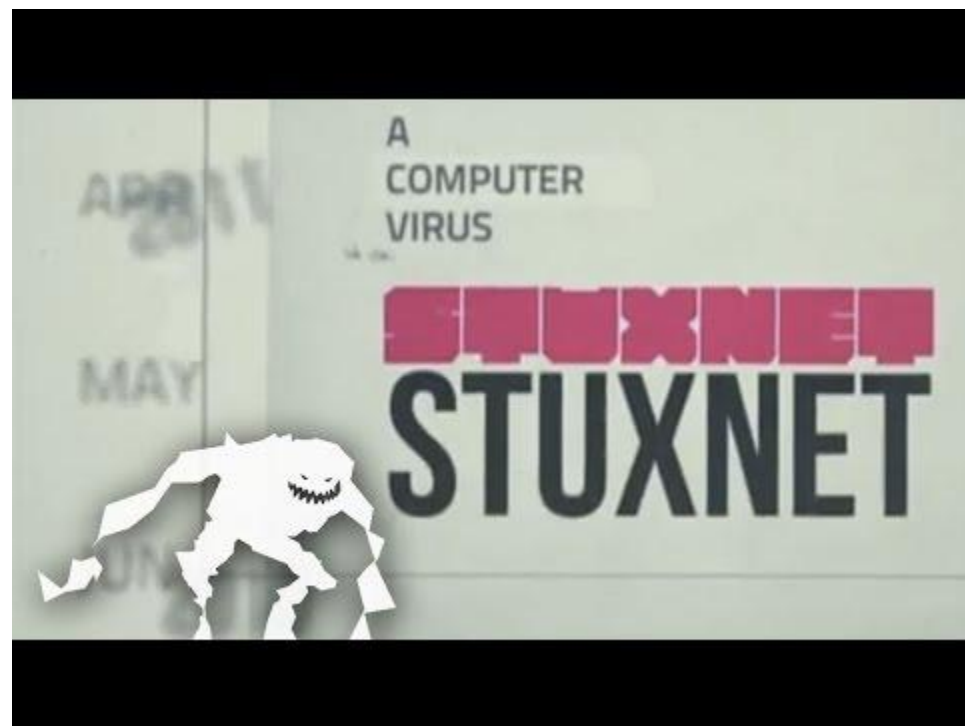
The worm then compromises the target system's logic controllers, exploiting "zero day" vulnerabilities—software weaknesses that haven't been identified by security experts.

5. control

In the beginning, Stuxnet spies on the operations of the targeted system. Then it uses the information it has gathered to take control of the centrifuges, making them spin themselves to failure.

6. deceive and destroy

Meanwhile, it provides false feedback to outside controllers, ensuring that they won't know what's going wrong until it's too late to do anything about it.





2003 Cascading Blackout

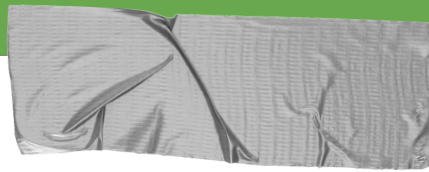
- The Northeast blackout of 2003 power outage through United States, and the Canadian
- August 14–28, 2003, beginning just after 4:10 p.m. EDT. Some power was restored by 11 p.m.
- Most did not get their power back until two days later. In other areas, it took nearly a week or two for power to be restored.
- 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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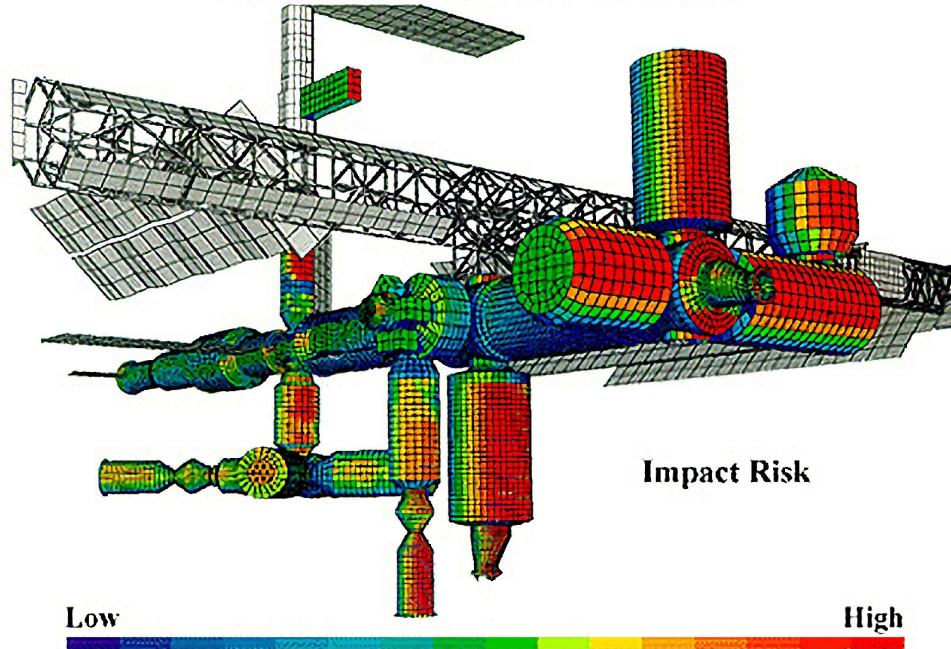
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As an engineer you need to embrace **risk** based thinking!

Focus your efforts on those that are most needed!

International Space Station

Probability of No Impacts From a > 1 cm \varnothing Debris

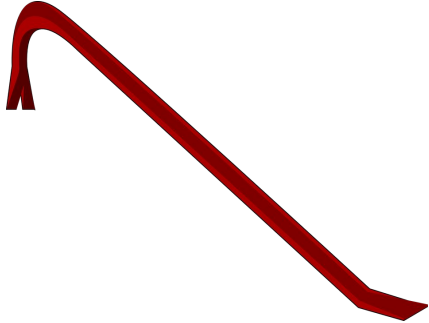


**Everyday elements can be
misused, have exploits and
present vulnerabilities!**

What is this?



Risk: Design Misuse!



What types of screwdriver misuse can you think of?

Marketplace Misuse!



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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

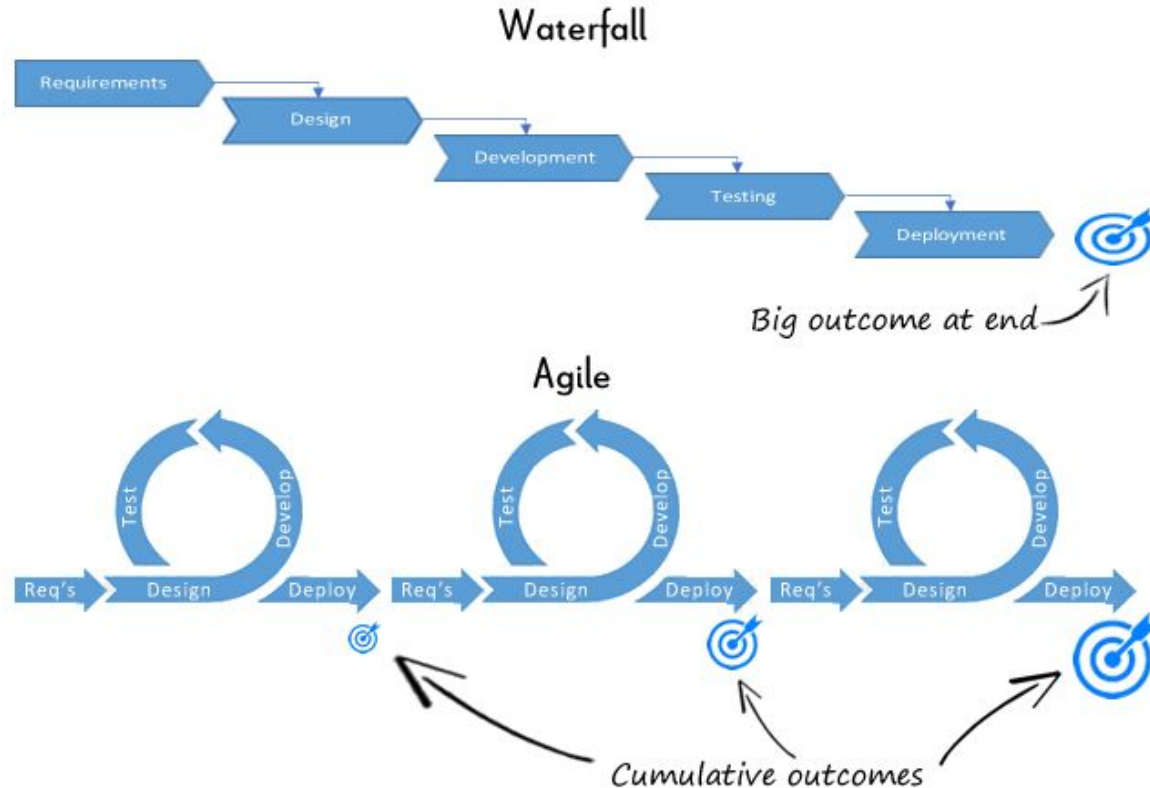
6(+ Risk, Opportunity, Scope)

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:

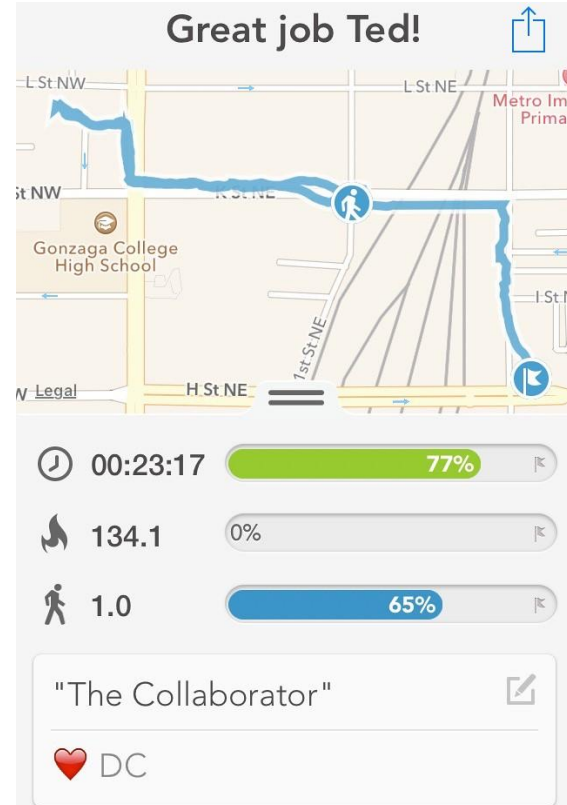
Create a calorie tracking app for seniors

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

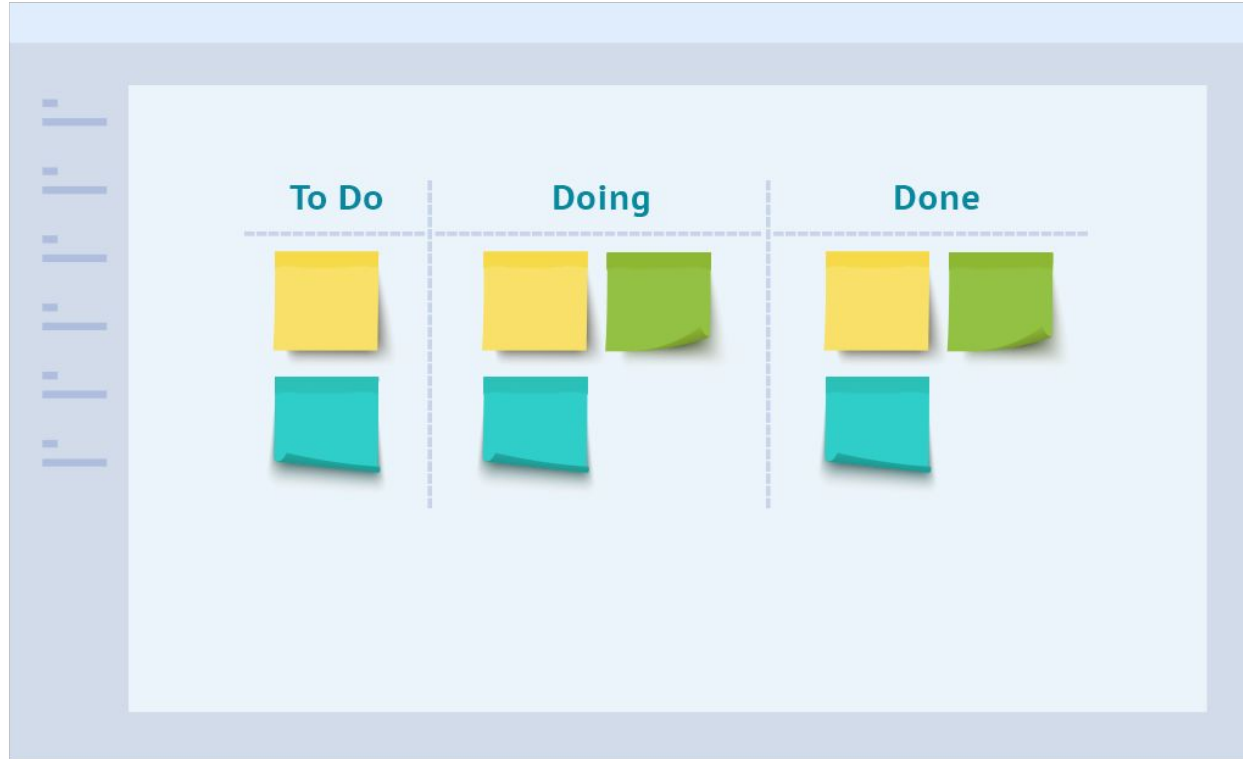
Kanban

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

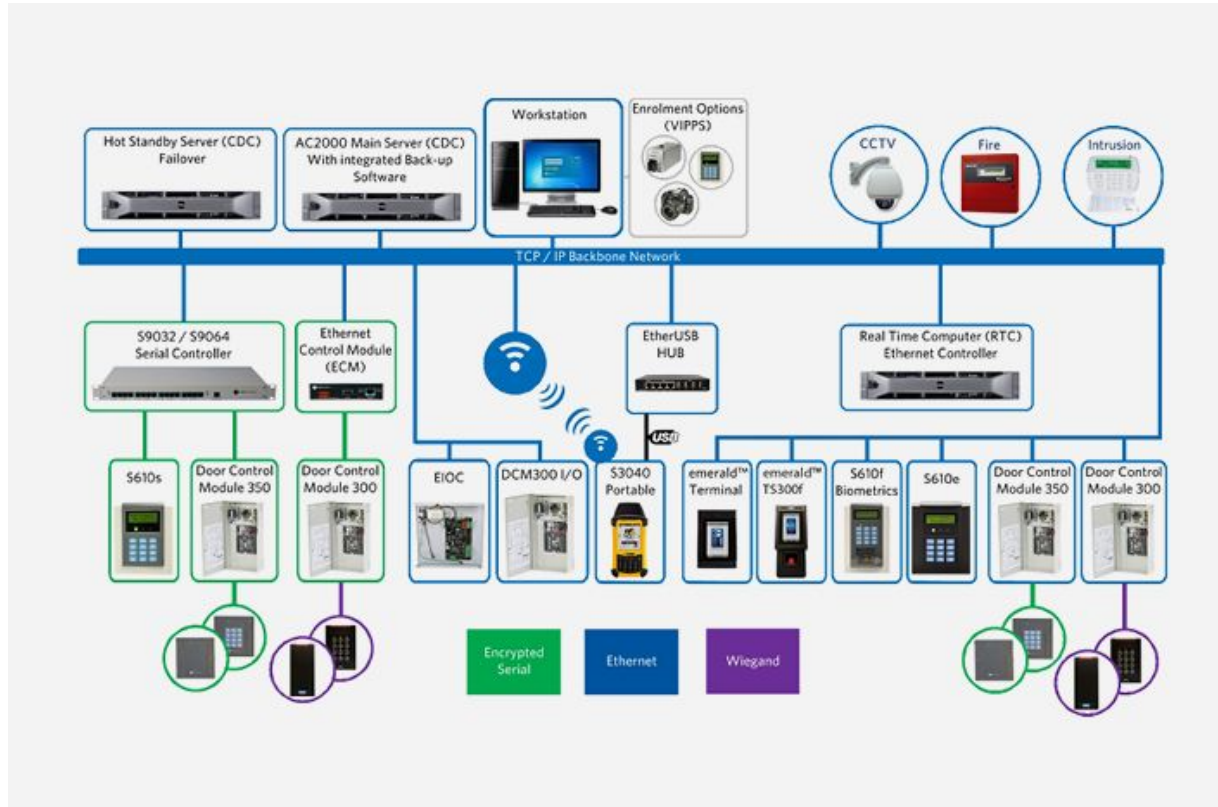
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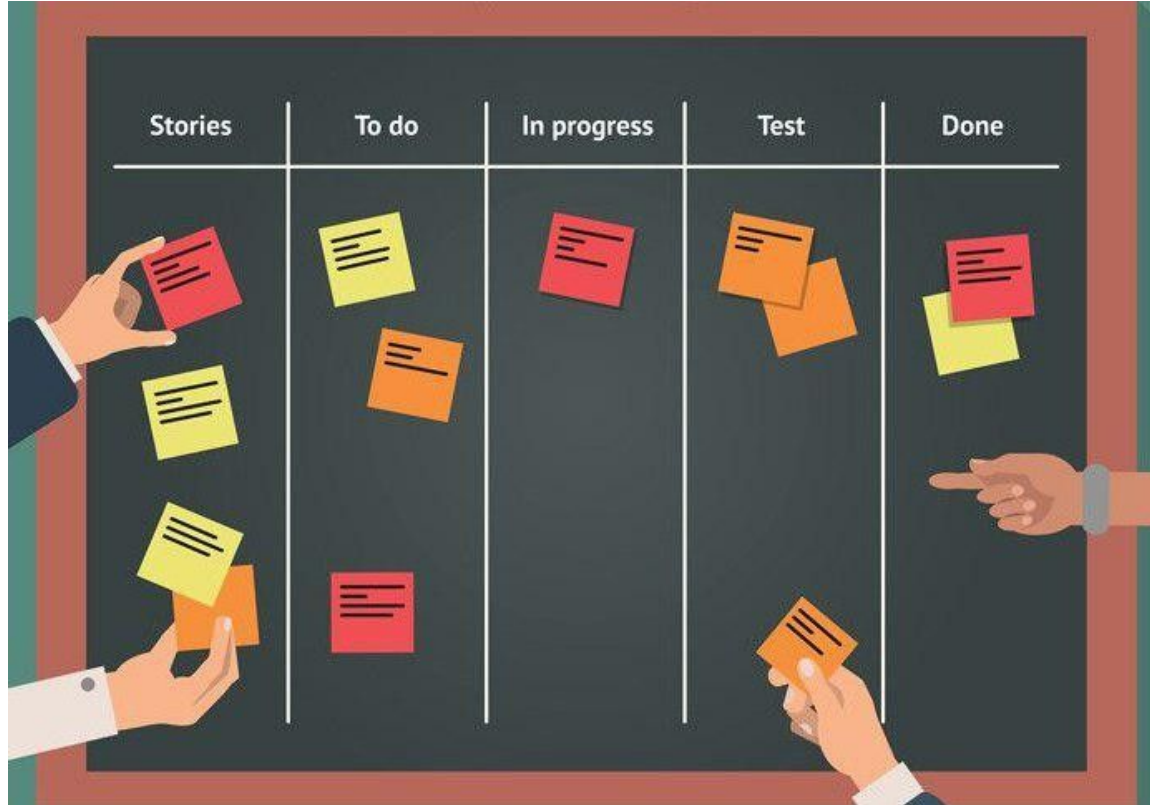
Airport Control System - System Decomp



Airport Control System - Risk Generation



Airport Control System - Kanban Risk Priority



Airport Control System - Kanban Risk Mitigations