FMEA

What could possibly go wrong?
What could possibly go wrong?

- Developers often focus on a new features, not full system in use.
  - Ex: Students write project that has no way to add user to user database.
  
  “Hey, I've got SQL terminal to created *my* user...”

- We need to know..

- Shows us how the system is likely to fail in the field!
- Eye-opening!
FMEA

- FMEA:...
- Brainstorm
  - How can components of a system fail
- Rate
  - What will the effects of these failures be?
  - How likely is the failure?
  - Can we detect the failure?
- Compute
  - What is the risk for this possible failure?
FMEA Process

1) Imagine how some component could fail
2) List effects of failure
   • .. (1-10)
3) Think what could cause this failure
   • .. (1-10)
4) State how this failure is currently detected
   • .. (1-10)
5) Compute Risk Priority Number [RPN]: multiply above three scores (1-1000)
6) List possible actions to reduce this risk
Example: Submarine

- Arctic exploration via autonomous submarine
  - Imagine assignment 3 (beat box) transformed into a sonar system
  - Sonar emits a ping sound and receives an echo off objects in the water.
  - Allows submarine to map obstacles.

- Features (As3 -> sub)
  - Play sound
  - Accelerometer (vibrations)
  - Webpage: User-interface
  - Two boards networked to do left & right sonar
<table>
<thead>
<tr>
<th>Rating</th>
<th>Severity of Effect</th>
<th>Likelihood of Occurrence</th>
<th>Ability to Detect</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Hazardous without Warning</td>
<td>Very high; Failure is almost inevitable</td>
<td>Can not detect</td>
</tr>
<tr>
<td>9</td>
<td>Hazardous with Warning</td>
<td>Very high; Failure is almost inevitable</td>
<td>Very remote chances of detection</td>
</tr>
<tr>
<td>8</td>
<td>Lose of primary function</td>
<td>High; Repeated failures</td>
<td>Remote chances of detection</td>
</tr>
<tr>
<td>7</td>
<td>Reduced primary function</td>
<td>High; Repeated failures</td>
<td>Very low chances of detection</td>
</tr>
<tr>
<td>6</td>
<td>Lose of secondary function</td>
<td>Moderate; Occasional failures</td>
<td>Low chances of detection</td>
</tr>
<tr>
<td>5</td>
<td>Reduced secondary function</td>
<td>Moderate; Occasional failures</td>
<td>Moderate chances of detection</td>
</tr>
<tr>
<td>4</td>
<td>Minor defect noticed by most customers</td>
<td>Moderate; Occasional failures</td>
<td>Moderate high chances of detection</td>
</tr>
<tr>
<td>3</td>
<td>Minor defect noticed by some customers</td>
<td>Low; Relatively low failures</td>
<td>High chances of detection</td>
</tr>
<tr>
<td>2</td>
<td>Minor defect noticed by discriminating customers</td>
<td>Low; Relatively low failures</td>
<td>Very high chances of detection</td>
</tr>
<tr>
<td>1</td>
<td>No effect unlikely</td>
<td>Remote; Failure is unlikely</td>
<td>Almost certain</td>
</tr>
</tbody>
</table>
Failure Mode Example

- Complete this failure mode
  - Component: System status LED
  - Failure mode: burnt out
  - Failure effect: ________________________________
  
    - Severity #: __________________
  
    - Potential cause: ________________________________
  
    - Occurrence #: ______________
  
    - How to detect failure: ________________________________
  
      - Detection #: ______________
  
    - RPN (Risk): ______________
  
    - Actions: ________________________________
Ex: Some failures to consider

- Complete an FMEA for the following failure modes
  - Audio output: unplugged
  - Accelerometer: stops registering movement
  - Accelerometer: fried
  - CPU: system load too high
  - Application: audio buffer underflow
  - Application: ping-queing thread locks-up
  - Application: crash
  - Web server crash
# FMEA Example Sheet

<table>
<thead>
<tr>
<th>Component</th>
<th>Failure Mode</th>
<th>Failure Effect</th>
<th>Sev</th>
<th>Potential Causes</th>
<th>Occ</th>
<th>How to detection failure?</th>
<th>Det</th>
<th>Risk</th>
<th>Actions Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status LED</td>
<td>Burnt out</td>
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<tr>
<td>Audio Output</td>
<td>Unplugged</td>
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<tr>
<td>Accelerometer</td>
<td>Stops registering movement</td>
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<td></td>
<td>Fried</td>
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<tr>
<td>CPU</td>
<td>System load too high</td>
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<tr>
<td>App</td>
<td>Audio buffer underflow</td>
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<td></td>
<td>ping-queueing thread locked</td>
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<td></td>
<td>Crash</td>
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<td>Web server</td>
<td>Crash</td>
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