**CS 487 – SOFTWARE ENGINEERING**

**Week 6 Engagement – Dependability and Reliability**

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1. **System Reliability:**

* **Reliability**: The system’s ability to work without interruptions.
* **Non-functional requirement**: Like performance and scalability, it’s about how well the system works.
* **User expectations**: Users want systems to always work, but 100% reliability is tough.
* **Reliability vs. Availability**: If a system isn't available, you can’t trust it to be reliable.
* **Unreliability**: This can show up as errors, wrong answers, missing information, or crashes.
* **Impact**: When a system is unreliable, it makes it tough to get things done, especially when you need critical information.

2. **Dependability Considerations:**

- **Repairability**: Systems should have diagnostic tools and be easily reparable, with quick, "surgical" repairs.

- **Maintainability**: Systems should be easily and economically adaptable to new functional requirements.

- **Error Tolerance**: The system should be able to automatically detect and fix a small subset of possible errors.

- **Survivability**: The system should be robust and able to survive even when subjected to attack or failure.

3. **Risk Management:**

* **Resilience**: The system should withstand any danger, recognizing, resisting, and recovering from all attacks.
* **Risk Management**: Involves several steps:
  + **Identify failures**: Determine what could go wrong.
  + **Compute likelihood**: Assess how likely each failure is.
  + **Examine threats**: Look at possible threats and vulnerabilities.
  + **Specify remedies**: Decide on actions to prevent or fix issues.
* **Reliability Assessment**: Evaluated through risk assessments that:
  + **Redundantly check**: Repeatedly examine the system.
  + **Cost-benefit analysis**: Weigh the costs of mitigating risks against the benefits of reliability.

4**. Failure Categories:**

* **Hardware failure:** Failure in the design, manufacturing, or operation of the major hardware components.
* **Software failure:** errors in coding, requirement errors, or any combination of the two. **Operational failure:** The user made an advised action.

5. **Safety-Critical Systems:**

We may classify a system as being primary safety-critical, if failure directly causes harm, or secondary safety-critical, if a failure could result in harm or a dangerous situation could arise.

6. **Security in Systems:**

* **Open Systems**: Designed for data sharing, making them attractive targets for attackers seeking unauthorized access or causing denial of service attacks.
* **Security Engineering**: Involves policies, standards, and measures to minimize threats.
* **Security Management**: Includes:
  + **User access control**: Managing who can access the system.
  + **Deployment strategy**: How the system is set up and maintained.
  + **Monitoring and recovery**: Ability to detect attacks and recover from them.

7. **Designing for Security and Deployment:**

- Security practices such as limiting access, minimizing harm/recoverability through redundancy, and allowing for recovery.

- Deployment will include supporting views of the configuration, minimizing default privileges, and making fixes easier.

8. **Dependable Programming Techniques:**

- Practices that depend or don't depend on the system such as visibility management, input checking, exception handling, recovery, and checking array bounds.

- Practices to avoid (i.e., risky programming) such as dynamic memory allocation, unbounded arrays, recursion.