

# Installation and Maintenance of Health IT Systems

## Unit 9a

### Creating Fault Tolerant Systems, Backups, and Decommissioning

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## What We'll Cover...

- What is Fault Tolerance?
- Why is Redundancy and Fault Tolerance Important?
- The Three Levels of Fault Tolerance
- The Six Rules of Fault Tolerance in a System
- Let's Get Technical...Creating Fault Tolerance
- Outlining Backup Strategies
- Tips On Decommissioning Data and Hardware

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## Why is Redundancy and Fault Tolerance Important?

- As EHR system usage continues to expand, our dependence on them increases exponentially.
- EHR systems require failover and fault tolerance abilities to ensure uptime and data integrity.

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## Why is Redundancy and Fault Tolerance Important?

- Forrester Consulting reports three-quarters of their survey respondents experienced downtime related to a server failure during that past two years.
- Only 1 percent of server outages were resolved within five minutes.
- Sixty-eight percent had an impact on clinical activities and greater than half affected administrative processes.

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## Three Levels of Fault Tolerance

- Hardware Fault Tolerance:
  - By managing extra hardware resources, the computer subsystem increases its ability to continue operation.
- Software Fault Tolerance:
  - Structure the computer software to compensate for faults such as changes in program or data structures due to transients or design errors.

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## Three Levels of Fault Tolerance

- System Fault Tolerance:
  - Compensating for failures in other system facilities that are not computer-based.

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## The Six Rules of Fault Tolerance

- **Rule 1:** Know precisely what the system is supposed to do. Part of this process should be determining how long a system can be allowed to deviate from its specification before the deviation is declared a failure.
- **Rule 2:** Look at what can go wrong, and try to group the causes into classes for easier manageability.

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## The Six Rules of Fault Tolerance

- **Rule 3:** Study your application and determine appropriate fault containment regions and the earliest feasible time to deal with potential faults.
- **Rule 4:** Completely understand the requirements of your application and use them to make appropriate time/space trade-offs.

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## The Six Rules of Fault Tolerance

- **Rule 5:** Whenever possible, concentrate on the credible faults and ignore those less likely to occur unless they can be dealt with at little or no additional cost.
- **Rule 6:** Carefully determine application failure margins and use the information to balance the degree of fault tolerance needed with the cost of implementation.

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## Creating Fault Tolerance

- Creating Hardware Fault Tolerance
  - Choose fault tolerant servers over clustering
  - Include Hot add memory
  - Hot Swappable Hard Drives
  - Hot plug PCI-X slots to allow adding or removing PCI expansion cards
  - Redundant power supplies and cooling fans
  - Mirror critical systems and disperse throughout the network.

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## Creating Fault Tolerance

- Creating Fault Tolerant Data Storage:
  - RAID, which is available on systems where basic disks have been changed to dynamic disks. RAID 1 (disk mirroring) is an excellent method for providing fault tolerance for boot/system volumes, while RAID 5 (disk striping with parity) increases both the speed and reliability of high-transaction data volumes such as those hosting databases.

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## Creating Fault Tolerance

- On Windows, consider enabling Volume Shadow Copy Service (VSS), which lets Windows keep point-in-time snapshots of data volumes so users can recover accidental deleted files or revert to earlier versions of documents they are working on.

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## Creating Fault Tolerance

- Have a frank discussion with your vendor about how fault tolerance is designed into the software code.
- Consider virtualization of key data and/or application servers. Combined with duplicate hardware hosting, can an excellent availability strategy.

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## Creating Fault Tolerance

- **Creating System Fault Tolerance:**
  - Use a distributed architecture can help maintain access to the application in the event of a network interruption.
  - Install UPS along with backup power in key areas such as server rooms and wiring closets.
  - Building redundancy and fault tolerance in network infrastructure switches, routers, and WAN links can provide secondary network connections between sites should the primary network link go down.

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## Creating Fault Tolerance

- For Windows networks, consider using Network Load Balancing (NLB) as an option. This feature can be used to provide failover support for applications and services running on IP networks.

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