Managing Clinical Information Systems’ Recovery and Patient Care Impact Following A Hospital Data Center Emergency Power Off Event

(When Tabletop Exercises Become Reality)

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Vanderbilt University Medical Center: Who are we?

• Located in Nashville, Tennessee
• Academic Medical Center: Clinical, Research, Teaching
• Serving Middle Tennessee, Southern Kentucky, Northern Alabama and The World!
• Only Level 1 Trauma Center in Middle Tennessee

Vanderbilt University Medical Center
By the Numbers: Licensed Beds (Sept.2005)

• Adult and Children’s Hospitals, Clinics (832 and 215 licensed beds, respectively)
• Psychiatric Hospital (88)
• Rehab Hospital (80)
• Campus and Satellite Clinics
Vanderbilt University Medical Center
By the Numbers: Discharges and Clinic Visits (FY06)

- Discharges 43,000 (Excludes Psychiatric Hospital)
- Ambulatory Visits 1,020,000
- Outpatient Surgeries 19,100
- Emergency Room Visits 91,000

Vanderbilt University Medical Center: Clinical Information Systems

- Healthcare’s 100 Most Wired (2005, 2006)
- Electronic Medical Record (EMR)
- Computerized Physician Order Entry (CPOE)
- Closed-Loop Dispensing (pilot)
- Film-less Imaging
- Paperless Clinics
- Electronic Whiteboards (ED, ICU, Clinics), Inpatient bedboard
- Bedside Monitoring and Documentation

Vanderbilt University Medical Center: Disaster Recovery Strategy

- Internal recovery strategy for select systems, using a separate backup facility (i.e. 2nd data center) featuring SRDF, HA clustering and Standby O/S recovery solutions over a diverse path DWDM network
- Backup facility (Co-lo arrangement): Class-A data center space, recovery floor space and conference space, with redundant HVAC and power (including on-site backup power generation)
- VUMC provides servers, disk, network (everything but the space, power, and cooling)
Vanderbilt University Medical Center: Recovery Challenges

- RTO <4hrs for critical clinical systems
- RPO = Time of Event
- Multiple platforms (mainframe, mid-range, Linux, Windows, DB2, Oracle, SQL, commercial and in-house developed apps)
- Multiple Dependencies
- Multiple Interfaces
- Semi-centralized support model

The Tabletop Exercise: June 28th, 2006

- Objective: Evaluate Computer Operations, Facilities and Helpdesk Emergency Response Procedures
- Scenario based on event that recently occurred at another hospital
- Primary Data Center fire suppression in by-pass mode while maintenance is performed, i.e. detection system is active but FM200 tanks are temporarily deactivated
- Minor server fire leads to Emergency Power Off (EPO) Event

The EPO Event: Sunday July 16th, 2006. 03:20

Scheduled maintenance to integrate third UPS into the primary data center UPS system requiring upgrade of input power service feeds and bypass feeds (14 hours)

- Planned load transfer from UPS1 and UPS2 to UPS3 failed. UPS3 shutdown (automatics safety feature) (00:06)
- Vendor proposed removing UPS’s from the equation and running in maintenance bypass mode (via the newly installed distribution panel) to avoid taking a load loss. IT Administrator On Call notified and approval given to proceed (00:25)
- Transferred load to bypass – data center operating solely from generators via new distribution panel (03:15)
- New Distribution Panel Maintenance By-Pass Breaker short-circuited; Breaker was opened to prevent further damage, personal injury and risk to data center facility, resulting in EPO (03:20)
Data Center EPO: Event Management

- Immediate Impact
- Emergency Response and Notification
- IT Impact Assessment and Response
- Clinical Impact Assessment and Response
- IT/Hospital Administration Realtime, Communication and Response
- IT Disaster Recovery
- Business Unit Recovery
- Post Event Critique
- Lessons Learned

Data Center EPO: Immediate Impact

- Loss of power to primary data center and network
- Loss of clinical applications (critical and non-critical)
- “House-wide Downtime” (HWDT) for all hospital units, Ancillaries, and Emergency Departments
- Loss of automated notification system
- Loss of email application
- Loss of Service Desk application

Data Center EPO: Emergency Response and Notification

- Overhead announcement to all hospital areas – “Use Down-Time Procedures”
- Computer Operations notify:
  - IT Administrator On Call
  - Service Desk
  - DR On Call
  - IT support groups
- Service Desk notify:
  - Hospital Administration
  - Downtime Notification List Report (end users)
Data Center EPO: IT Impact Assessment and Response

- 03:35 Generator power restored to data center (no UPS battery backup)
- 04:15 Emergency Response Team begin to arrive on site - Facilities provide DR Team and IT Administrator with status update
- Recovery time (i.e. start of HWDT to end of HWDT) estimated at 4 hours (based on previous experience)
- 04:30 IT Command Center established (DR Team, Service Desk Manager)
- Conference Call Bridge initiated

Data Center EPO: Clinical Impact Assessment and Response

- Activate Downtime Procedures for:
  - Registration, Census, Bed Management
  - Order entry
  - Pharmacy
  - Ancillary results reporting (e.g. Lab)
  - Radiological studies (film or studies read at device)
- Staffing level assessment
  - Fetal monitoring (1 nurse per delivery room)
  - CCU (Vitals Monitoring)
  - Patient Transport, etc
- Hospital placed on diversion

IT/Hospital Administration Relationship, Communication and Response

- Partnership
- Information shared via Conference Call Bridge
  - Outage status
    - Impact
    - Estimated recovery time (emphasizing estimated)
    - Orange Alerts
  - Escalation assessment
    - Hospital on diversion
    - Hospital Emergency Operations Center activation
- Maintain communication (regular status updates)
Data Center EPO: IT Disaster Recovery

• DR Team and IT Admin On Call review recovery plan options, agree strategy
  – Decision made to failover mainframe only to 2nd data center (Census, clinical systems’ interface “hub”)
  – Recovery of applications by priority and critical dependencies
• DR Team establishes presence in data center as extension of IT Command Center to liaise with
  – IT Admin On Call
  – Computer Operations
  – IT Recovery staff

Data Center EPO: Business Unit Recovery

(It’s not over ‘til it’s over)

• 08:30 Service Desk application functional
• 08:34 End Of House-wide Downtime (Start to End = 5.25 hours). Census system available.
  Multiple systems still not recovered - State of “Gracious Degradation”
• 10:00 Normal power restored
• 11:00 Mainframe failback (required 15 minutes HWDT)
• 16:00 Lab system caught back up
Data Center EPO: Post-Event Critique

- IT Conducts Post Event Critique
  - Root Cause Analysis
  - IT Recovery and Response
  - Solicit input from Hospital Administration and clinical areas
  - Report created and circulated to senior management, participants

- Dept. Emergency Preparedness conducts critique
  - IT provides background and root cause
  - Focused on care unit issues
  - Downtime Procedures and communication
  - Staffing

Data Center EPO: IT Disaster Recovery

Issues Synopsis – Lessons Learned

- Communication
  - Incident Notification - On Call report not intuitive
  - On Call information incomplete
  - Service Desk recently moved out data center
  - Between recovery teams (IT/IS) and recovery coordinators
  - End User Communication
  - Data Center servers managed by other groups
  - What do support personnel want to know?

- Recovery Priority and “Graceful Degradation”
- Understanding new systems and support structure
- Bullet-proofing the mission critical and critical path systems

Data Center EPO: Did the Tabletop Exercise Help?

- Yes
  - Issues experienced were accurately predicted by tabletop exercise
  - Reinforced the value of tabletop exercises

- No
  - If issues identified aren’t expeditiously addressed, documented and published
  - Different crew on duty morning of July 16th
Data Center EPO: In perspective

- 12/30/02 (Monday) VUH Data Center Power Outage – NES “nuisance trip”
  - HWDT 19:24 - 06:42 (Approx 11.5 hours)
    - All systems impacted

- 3/9/03 (Sunday) VUH Data Center Power Outage (Inverter and UPS failure)
  - HWDT 13:00 - 21:35 (8.5 hours approx)
    - All systems impacted. Residual impact past end of HWDT

- 3/13/05 (Sunday) VUH Data Center EPO
  - HWDT 13:05 - 17:03 (approx 4 hours)
    - All systems on UPS1 impacted. Residual impact past end of HWDT

- 8/7/05 (Sunday) 2nd Data Center Transformer Fire
  - HWDT 13:37 - 17:28 (approx 4 hours)
    - Significant delay gaining access to the 2nd Data center facility

- 7/16/06 (Sunday) VUH Data Center EPO
  - HWDT 07:20 - 09:04 (approx 5.25 hours)
    - All systems. Residual impact past end of HWDT