Modernizing SatOps Data Centers Using Strategic Technologies

R. Rangachar
Satellite Control Systems
Intelsat

Fleet operated by Intelsat

- Current: 66 satellites
  - 55 Intelsat spacecraft & 11 for 3rd party customers
  - 65 Geostationary & one Medium Earth Orbit spacecraft
  - 44 operated prime from East Coast Satellite Operations Center (ESOC)
  - 22 operated prime from Long Beach Satellite Operations Center (LSOC)
- 1 to be launched in 2010:
  - New Dawn (Intelsat)
- 3 to be taken over in 2010:
  - DTV12 (DIRECTV), Spaceway 1 and 2
- Third party customers: DirecTV, ICO, HNS (and others under contract or negotiations)

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Ground Control Systems

- Currently maintaining/deploying multiple ground control systems (GCS) for TT&C of the spacecraft fleet.
  - GNS – Intelsat legacy system
  - EPOCH IPS – ISI system
  - TCR – Legacy Hughes/Boeing and PAS modified provided GCS
  - ISIS – GCS delivered with Boeing 702 spacecraft
  - L5 CGS – Legacy GCS for control of LEASAT 5
  - IAI GCS – Delivered with IS-24 satellite

ACRONYMS

- *GCS = Ground Control System*
- *TT&C = Telemetry, Track & Command*
- *GNS = Ground Network System*
- *EPOCH = {ISI's proprietary software name}*
- *IPS = Integrated Product Suite*
- *ISI = Integral Systems, Inc.*
- *PAS = PanAmSat*
- *TCR = Telemetry, Command, & Range*
- *ISIS = Integrated Satellite Interface System*
- *IAI = Israel Aerospace Industries*

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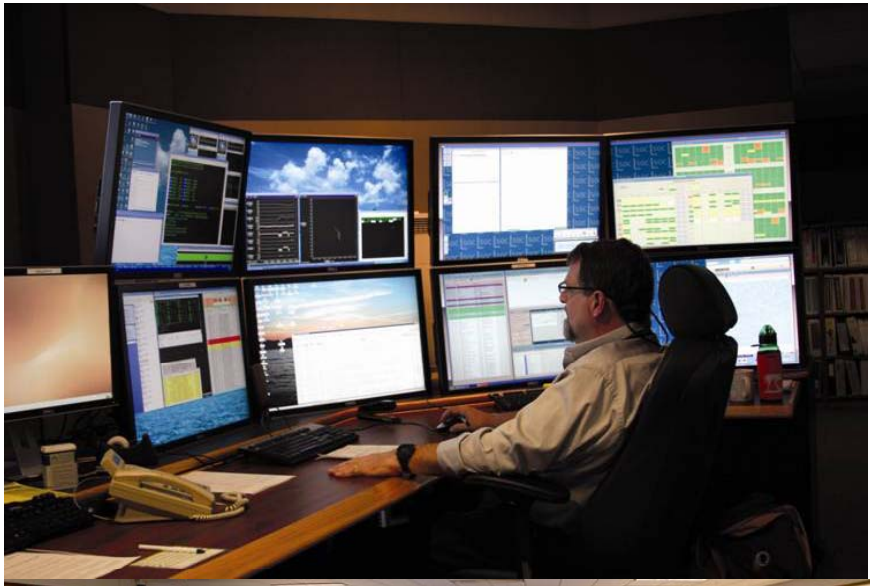
ESOC/LSOC SOC configuration:

- ESOC/SCC:
  - 5 stations; each station has 2 PCs, each with 4x30in LCD
  - One PC for GNS, another for Epoch. Other systems can be accessed from both PCs
- LSOC/OCC
  - 5 Epoch clients & 3 GNS clients each with 4x24" LCD
  - Other systems can be accessed from all PC's
- Polycom Video Conferencing system between the two SatOps center
- XOP telephone/conferencing system to communicate with TTC sites



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ESOC/LCC configuration:

- 31 PC stations; 4 DSS stations
- Each PC station has 3x18in LCD or 2x24in monitors
- All PCs provide access to GNS, EPOCH, TCR
- 3 Projectors to support the mission
- Secure wireless access to Internet and Intranet
- XOP Conferencing system with wireless headsets

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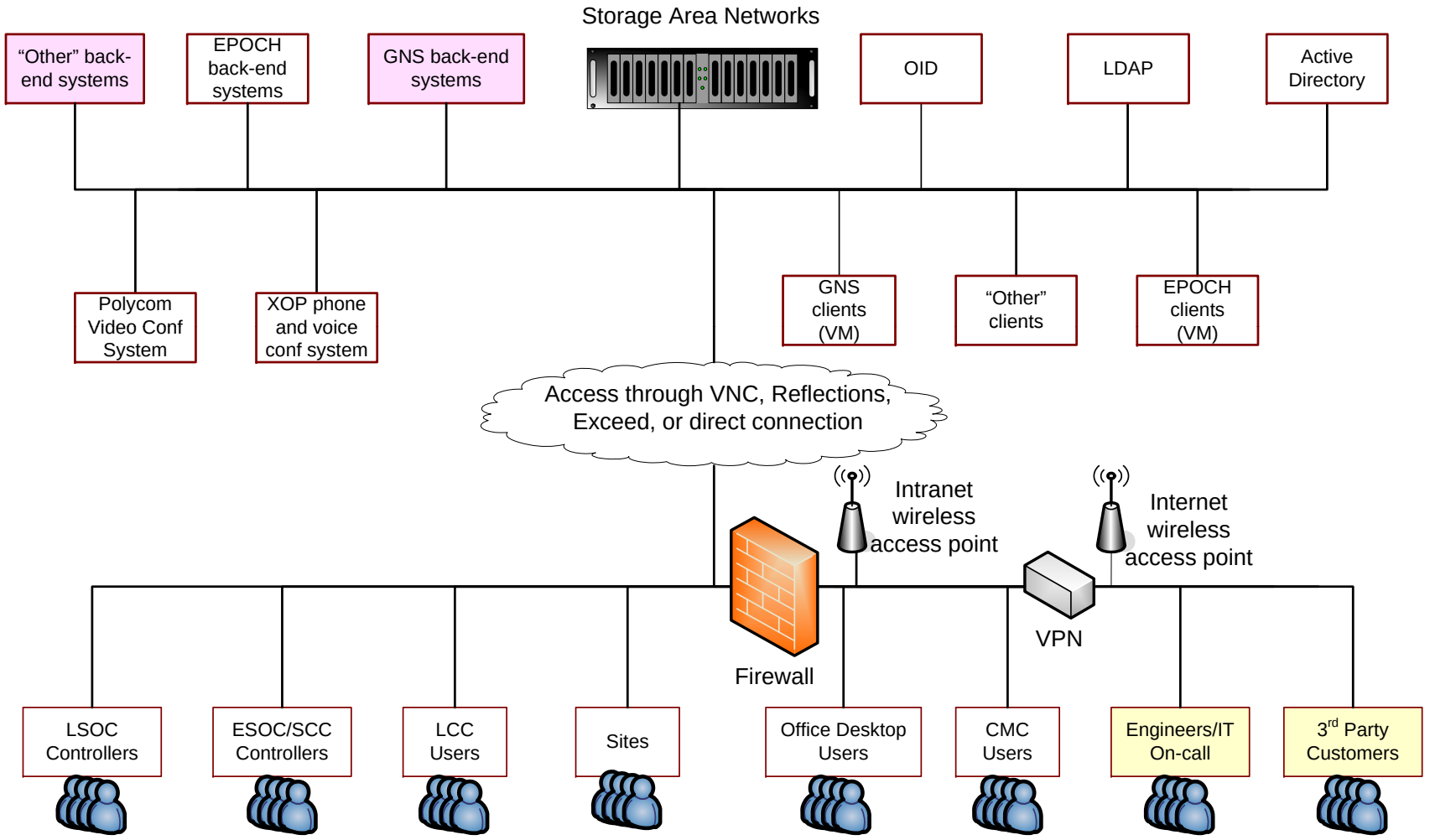
Intelsat SatOps System Overview



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Strategic Technologies and Initiatives

- Strategic technology (Gartner):
  - Existing technology that has matured and/or become suitable for a wider range of uses
  - Emerging technology that offers an opportunity for strategic business advantage for early adopters
  - A technology with potential for significant market disruption in the next five years
- 2009 Strategic Technologies and technology initiatives (Gartner, NASCIO, AICPA and other sources) in use at Intelsat

1. Business Continuity Management and Disaster Recovery
2. Virtualization
3. Mobile and Remote Computing
4. Collaboration technologies
5. Business Intelligence
6. Web-Oriented Architectures
7. Identity and Access Management
8. Conforming to Assurance and Compliance Standards
9. Green IT
10. Cloud Computing

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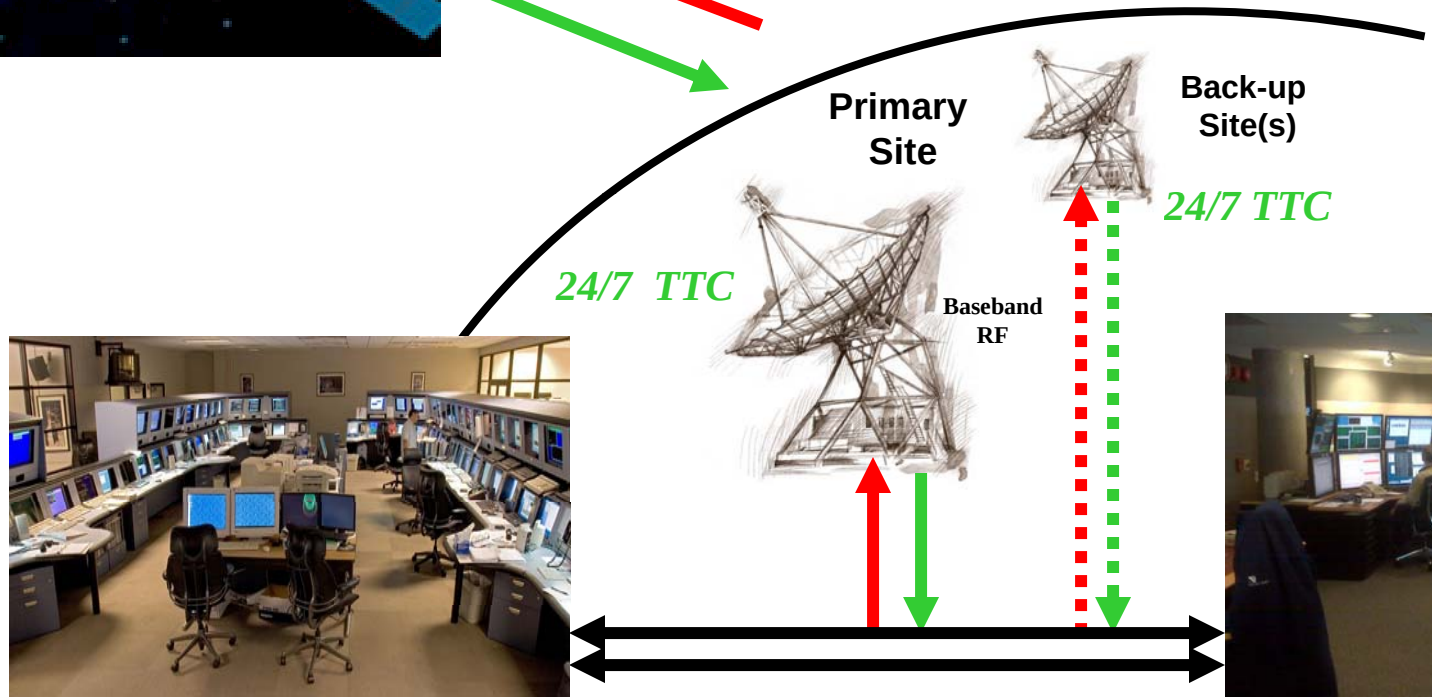
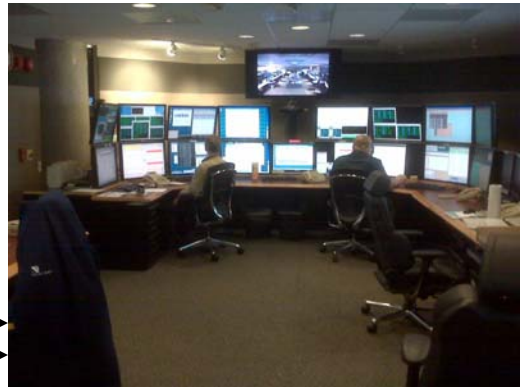
Strategic Technologies and Initiatives

Business continuity and disaster recovery
Fully Redundant Satellite Operations Network
One SOC in control/backup



Long Beach Satellite Operations Center (LSOC)

Full East-West Connectivity: Redundant DS3 lines (with path diversity)



East Coast Satellite Operations Center (ESOC)

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Strategic Technologies and Initiatives

Disaster recovery:

Scenario 1

Primary Data Center down

Primary control team operational

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Primary team uses redundant SOC

Command

Telemetry

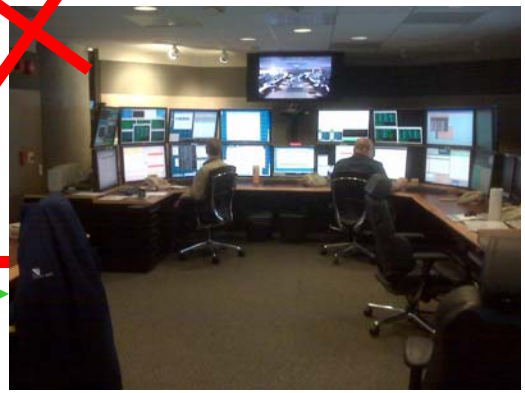
Back-up Antenna

Primary Antenna

TM/Commanding unavailable

Long Beach Satellite Operations Center (LSOC)

ESOC controllers command via LSOC data center



East Coast Satellite Operations Center (ESOC)

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Strategic Technologies and Initiatives

Disaster recovery:
Scenario 2
Primary SOC unavailable
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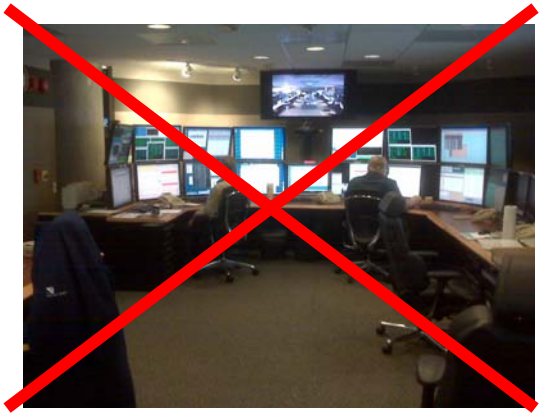
Satellite control switched over to back-up SOC

Command

Telemetry

Back-up Antenna

Primary Antenna



Commanding switch over to the Hot back-up SOC

Long Beach Satellite Operations Center (LSOC)

East Coast Satellite Operations Center (ESOC)

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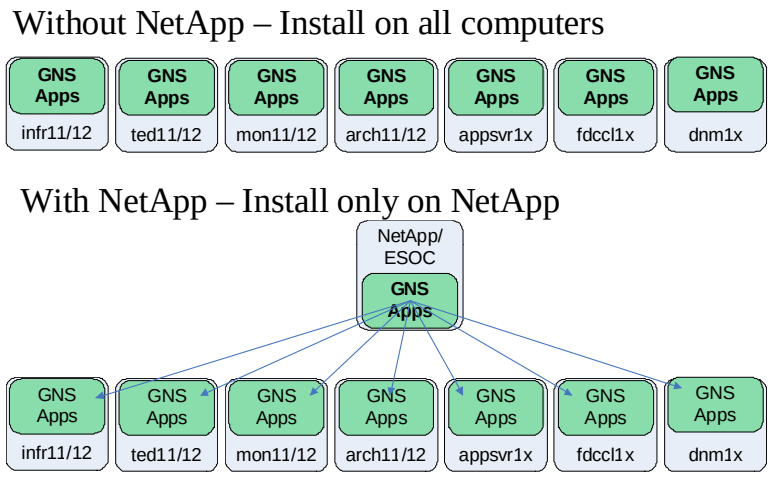
Strategic Technologies and Initiatives

Storage Virtualization

- Storage virtualization using Storage Area Networks (SANs)
  - NetApp and Winchester Systems
- All GNS databases, file servers, application binaries, scripts, etc. installed in one location on NetApp
  - Duration of software installation reduced from days to minutes
  - Improved maintainability; reduced disk space consumption due to deduplication



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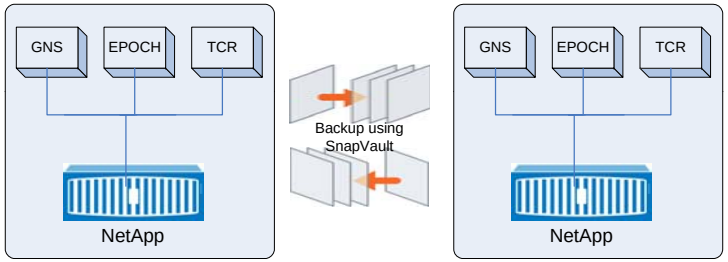
Strategic Technologies and Initiatives

Storage Virtualization

- All Epoch procs located on a Central File Server (CFS) on NetApp. Significant reduction in IT support to capture procs to all clients
- Significant improvements in reliability and performance due to RAID-DP, hot swappable drives, multiple/redundant network and power connections, etc.
- Improved backup and disaster recovery capabilities due to the use of SnapVault for backup to the other SOC (SnapVault not yet implemented)
- All Epoch archive data to be moved to Winchester Systems SAN



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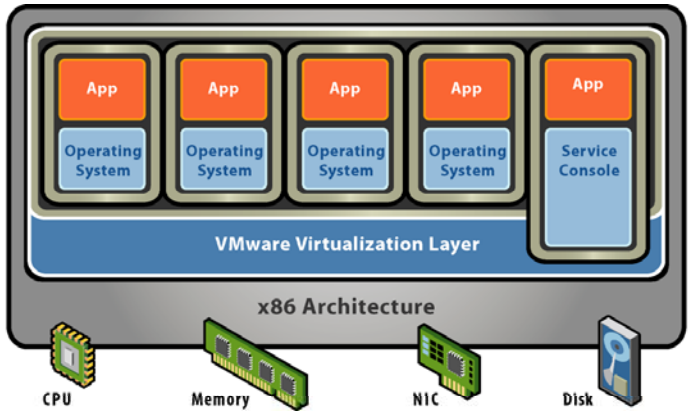
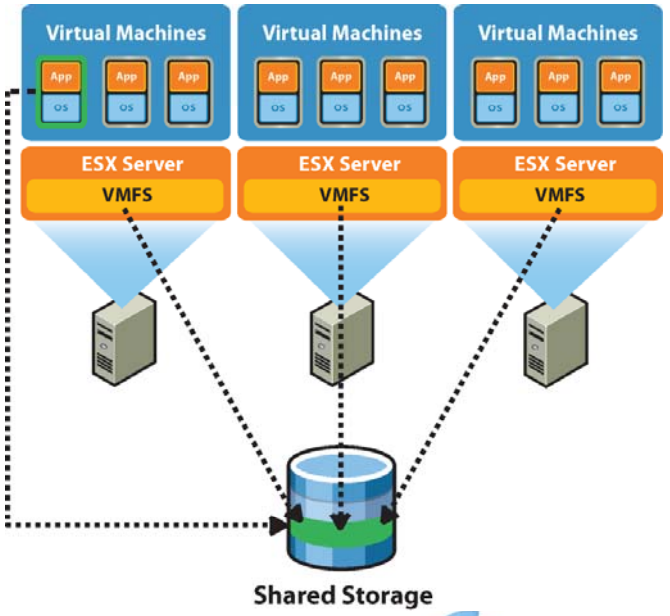
Server virtualization:

- VMWare sessions used for GNS clients and some Epoch clients
- Significant reduction in the time to setup new clients
- Can instantly provision additional resources (CPU, disk space, memory)
- Saving data on NetApp further improves reliability and availability
  - Some of our high-availability VMs have file systems hosted from the NetApp so that those can be recovered in minutes





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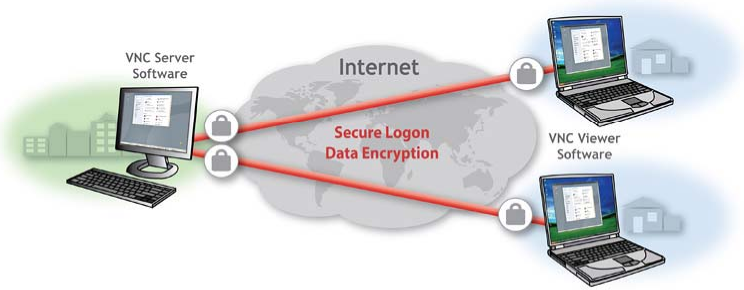
Strategic Technologies and Initiatives

Mobile and Remote Computing:

- Most customers use VNC to access SatOps systems
- Same solution no matter where they are located or which system (client) they use
- Use of dedicated sessions allows customers to save their workspace configuration, thus speeding up access to information
- Citrix, Reflection-X, Exceed are also available
- Mobile computing (using iPod or BlackBerry) is not yet supported, although VNC viewer is available for many mobile devices



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Strategic Technologies and Initiatives

Collaboration technologies

- SourceForge, an integrated suite of web-based software, was customized to support configuration management, issue tracking, project management, and collaboration
- Streamlines the SatOps toolset by integrating several tools into a standardized Web-based environment
- Helps coordinate activities of geographically dispersed teams and overcome the challenges of distributed work environment
- Enables management and staff visibility into project information across all stages of the project life cycle regardless of where they’re working, boosting productivity and reducing rework

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Strategic Technologies and Initiatives

Business intelligence

- Support faster decision making and simplify operational processes
- Several tools were developed to improve situational awareness and simplify and speed-up access to information
- Ranging for many satellites not operated on GNS is performed using GNS
- Even when ranging is done on other systems, ground station hardware configuration (moving/pointing antennas, configuring uplink/downlink hardware) can be performed using GNS
- Events and alarms from TCR, Epoch, and GNS systems are consolidated under the GNS Event/alarm display system
- GNS tools to view/plot real time and historical telemetry data have been enhanced to view/plot data for satellites operated on Epoch and TCR systems

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Strategic Technologies and Initiatives

Web-Oriented Architectures

- Web-based solutions are being used where feasible to migrate legacy systems
- Web based tools such as Service Desk Plus (for tracking service requests) and Applications Manager (for monitoring health of SatOps systems) have been implemented
- Web-based solutions are being evaluated for the next generation GNS applications

Identity and Access Management/Conforming to Assurance and Compliance Standards

- Oracle Identity Management is used to manage user identities across all resources
- Helps deploy applications faster, apply the most granular protection to resources, and eliminate latent access privilege
- OID, Active directory, LDAP, ArcSight are being used to meet DoD MAC1 requirements

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Strategic Technologies and Initiatives

Green IT

- Whenever possible, more energy-efficient products are being used to reduce energy consumption
- Examples: Virtualization of servers and storage, remote access to support telecommuting, recycling of retired components

Cloud computing:

- Research in progress to provide dynamic/dedicated access to GNS clients
- Users not tied to a client; also provide the option to login to the same client
- Improved availability and performance

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Summary

- Intelsat is using a number of strategic technologies and initiatives in its data centers to support satellite operations
- Business continuity Management and Disaster recovery are simplified by the use of strategic technologies such as virtualization and remote computing
- Virtualization of servers and storage provides an order of magnitude improvement in reliability, maintainability, and performance
- Web-centric and collaboration tools improve communication and help overcome the challenges of distributed work environment
- Use of strategic technologies improves operational efficiencies, and most of them support Green IT initiatives

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