GENESIS RTS™
Begin with endless potential.

3rd Party Real-Time Monitoring Providers:

Dr. Eric van Oort

Genesis Real-Time Systems

Houston, Texas
20 April 2015

Introduction

- Eric van Oort
  - B.J. Lancaster Professor at University of Texas - Austin
  - Co-PI, OESI
  - CEO, EVO Energy Consulting
  - Chairman, Board of Directors, & Co-Founder Genesis RTS
  - 20 year veteran of Shell Oil Company, former RTOC lead
- Genesis RTS
  - Collaboration of oil & gas subject-matter experts, ex.-NASA engineers, and KM specialists
  - Founded in April 2012

A REAL-TIME VIGIL

Shore-based engineers for Shell monitor offshore rigs 24/7 from high-tech centers

By BRETT CLANTON
HOUSTON CHRONICLE

IN the months since the Deepwater Horizon accident, Eric van Oort has received inquiries from competitors, investigators and even BP about the network of high-tech centers Shell uses to keep watch over its offshore wells from land.

Shell may gather the same real-time well data other oil companies collect today, but its centers have drawn attention because the company staffs them with engineers who monitor the data around the clock for problems.

MANAGER: Eric van Oort, performance improvement manager, says Shell uses the centers "to interact with the rig in real time to keep it actively out of trouble."

"A lot of oil companies use their real-time operating centers in a passive mode, collecting data, being able to do post-mortem analysis. We use them to interact with the rig in real time to keep it actively out of trouble," said van Oort, performance improvement manager for wells at Shell Upstream Americas, during a tour of the company's real-time operations center in west Houston.

While no one claims such centers could have prevented the deadly April 20 blowout at BP's Macondo well, they are getting a closer look as oil companies face pressure regulators and the publi ensure the safety of offs drilling.

This summer, in fact began building a 24-hou real-time operations cen at its west Houston cam Expected to be complete by year-end, it will continuously monitor all the company's drillin and completions in the Gulf of Me company spokesm Daren Beaudo said. Others coul follow suit.

Major oil companies including Exxon Mobil Corp., Chevron Corp. ar ConocoPhillips say they real-time well data to ke tabs on offshore drilling projects, especially big a costly deep-water wells. The information, collec by sensors on drilling ri and inside wells and bea to land by satellite, allow

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Please see SHELL, P

Houston Chronicle, Sept 19, 2010

Real-Time Operations Center Related Papers

Activities at UT Austin

Real-Time Operations Center, UT Austin

SPE-170323-MS

Improved Regulatory Oversight using Real-Time Data Monitoring Technologies in the Wake of Macondo

Kyle M. Carter and Eric van Oort, SPE, The University of Texas at Austin, and Andrew Barendrecht, Genesis Real-Time Systems

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Abstract

As shown by the Macondo blowout, an uncontrolled deepwater well control event can result in loss of life, damage to the environment, and significant damage to company and industry reputation. Consistent adherence to safety regulations is a recurring issue in deepwater well construction. The two federal entities responsible for offshore U.S. safety regulation are the Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE) and the U.S. Coast Guard (USCG). The regulatory authority of these two bodies spans well planning, drilling, completions, emergency evacuation, environmental response, etc. The wide range of rules these agencies are responsible for cannot be comprehensively verified with the current infrequency of on-site inspections. Offshore regulation and operational safety could be greatly improved through continuous remote real-time data monitoring.

Many government agencies have adopted monitoring regimes dependent on real-time data for improved oversight (e.g. NASA Mission Control, USGS Earthquake Early Warning System, USCG Vessel Traffic Services, etc.). Appropriately, real-time data monitoring was either re-developed or introduced in the wake of catastrophic events within those sectors (e.g. *Challenger*, tsunamis, *Exxon Valdez*, etc.). Over recent decades, oil and gas operators have developed Real-Time Operations Centers (RTOCs) for continuous, pro-active operations oversight and remote interaction with on-site personnel. Commonly seen as collaborative hubs, RTOCs provide a central conduit for shared knowledge, experience, and improved decision-making, thus optimizing performance, reducing operational risk, and improving safety. In particular, RTOC's have been useful in identifying and mitigating potential well construction incidents that could have resulted in significant non-productive time and trouble cost.

In this paper, a comprehensive set of recommendations is made to BSEE and USCG to expand and improve their regulatory oversight activities through remote real-time data monitoring and application of emerging real-time technologies that aid in data acquisition and performance optimization for improved safety. Data sets and tools necessary for regulators to effectively monitor and regulate deepwater operations (Gulf of Mexico, Arctic, etc.) on a continuous basis are identified. Data from actual GOM field cases are used to support the recommendations. In addition, the case is made for the regulator to build a collaborative foundation with deepwater operators, academia and other stakeholders, through the employment of state-of-the-art knowledge management tools and techniques. This will allow the regulator to do "more with less", in order to address the fast pace of activity expansion and technology adoption in deepwater well construction, while maximizing corporate knowledge and retention. Knowledge management provides a connection that can foster a truly collaborative relationship between regulators, industry, and non-governmental organizations with a common goal of safety assurance and without confusing lines of authority or responsibility. This solves several key issues for regulators with respect to having access to experience and technical know-how, by leveraging industry experts who would not normally have been inaccessible. On implementation of the proposed real-time and knowledge management technologies and workflows, a phased approach is advocated to be carried out under the auspices of the Center for Offshore Safety (COS) and/or the Offshore Energy Safety Institute (OESI). Academia can play an important role, particularly in early phases of the program, as a neutral playing ground where tools, techniques and workflows can be tried and tested before wider adoption takes place.

Paper SPE 170323, Kyle M. Carter et al.

- Activities:
  - Undergrad & grad student projects analyzing real-time and historical well data provided by operators using UT - RTOC facility
  - Industry-sponsored graduate R&D on data-quality improvement, data-analytics, pattern recognition, drilling automation, robotics (drilling.utexas.edu)

Questions - 1

1. Describe the role of third-party providers?
   - Provide enabling tools, processes and people (SME's) to help operators achieve operational excellence (safety and performance) in onshore and offshore well construction
2. How do you interface with industry customers, and how do you view this relationship?
   - Primarily through SME's: in-house optimization engineers, 24/7 monitoring specialists
   - Collaborative relationship that allows the operator to take full ownership (of data-integration, decision-making etc.)
3. What services do you provide?
   - Design & build RTOC's
   - GenesisCORE™ – set of tools and applications
   - Genesis360™ – people and processes
   - K(NOW) – Knowledge Management framework

GENESIS/INTELLICESS SENTINEL
GENESISCORE RIGTIME
GENESISCORE STRESSWORKS
GENESISCORE DRILLFAST
GENESISCORE ZONECONTROL
GENESISCORE STOPLOSS
GENESISCORE SUNRISE

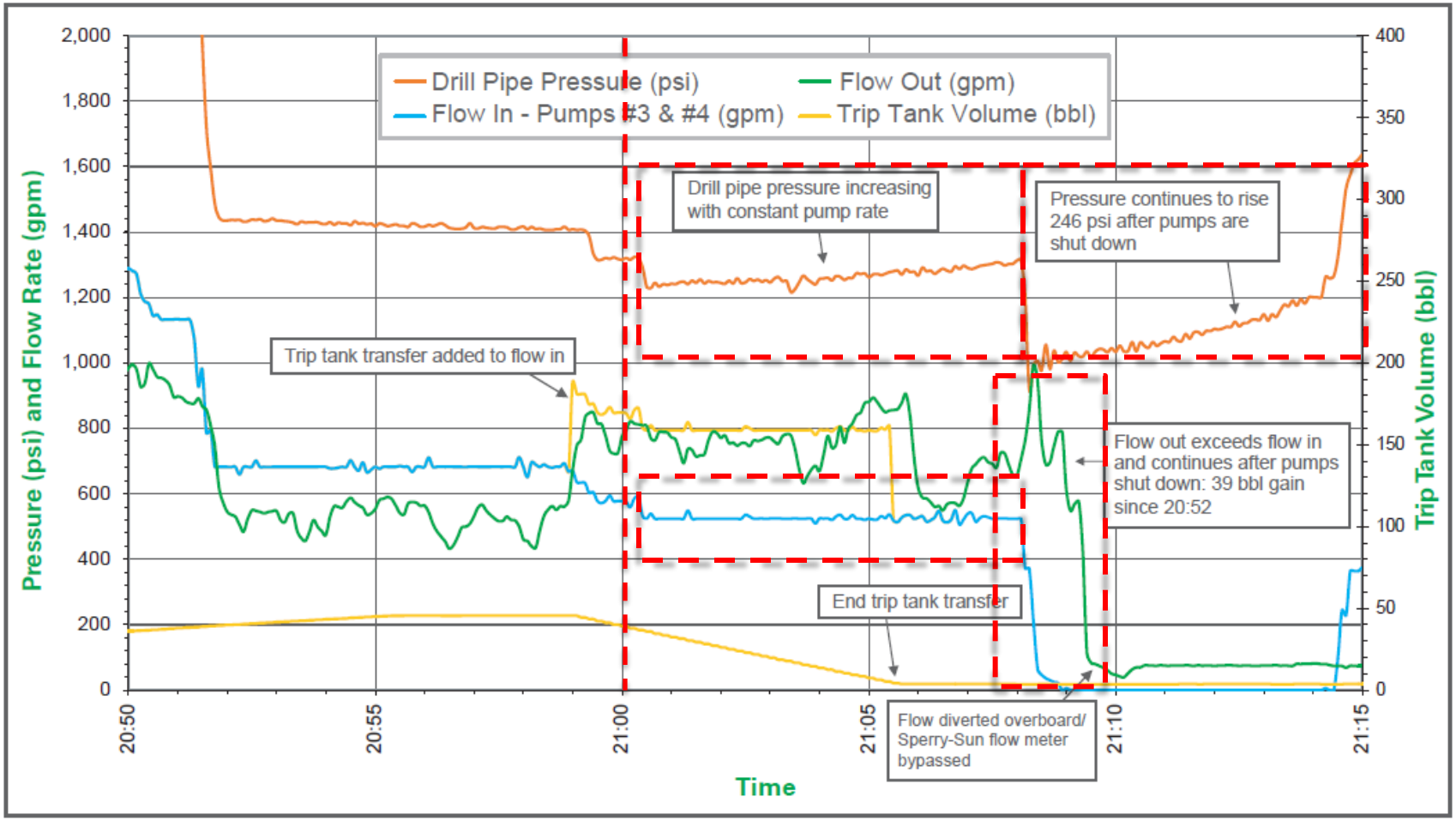
Questions - 2

4. How do the services lend themselves toward operational decision making?
   - Tools provide the ability to rapidly analyze (patterns in) complex data that indicate dysfunctional hole or drilling behavior (e.g. formation influx or stuck pipe trend)
   - SME's are able to quickly transfer industry best practice on real-time monitoring workflows and subsequent decision-making processes to the operator
5. What about accountability between the Operator and your firm?
   - Accountability for operational decision-making should always reside with the operator, but contractors should be accountable for the quality of the data and accuracy of the information they provide.
6. What level of automation and remote control is appropriate to balance accountability, responsibility, and operational efficiency?
   - Up to Level 5 "Decision Support" seems appropriate for now, but R&D progresses towards full automation with (remote) supervisory control using RTOC's

Levels of Automation	Functions			
	Monitoring	Generating	Selecting	Implementing
1. Manual Control	Human	Human	Human	Human
2. Action Support	Human/Computer	Human	Human	Human/Computer
3. Batch Processing	Human/Computer	Human	Human	Computer
4. Shared Control	Human/Computer	Human/Computer	Human	Human/Computer
5. Decision Support	Human/Computer	Human/Computer	Human	Computer
6. Blended Decision Making	Human/Computer	Human/Computer	Human/Computer	Computer
7. Rigid System	Human/Computer	Computer	Human	Computer
8. Automated Decision Making	Human/Computer	Human/Computer	Computer	Computer
9. Supervisory Control	Human/Computer	Computer	Computer	Computer
10. Full Automation	Computer	Computer	Computer	Computer

Levels of Automation, Endsley and Kaber, 1999

Macondo Real-Time Data Pattern Analysis

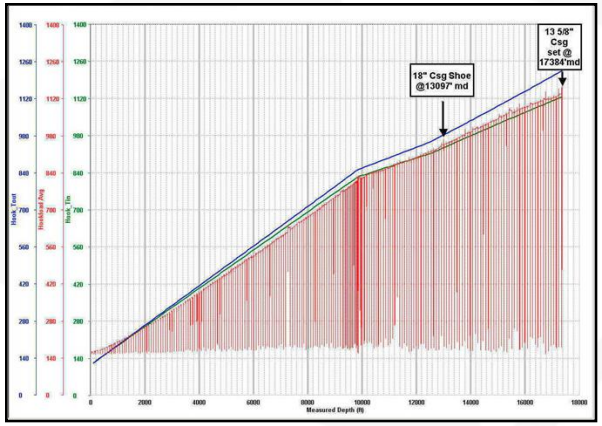


(Adapted from Deepwater Horizon Study Group Report)

Questions - 3

7. What are your suggested protocols for remote oversight and the established chain of command?
   - Typically green / yellow / red flag “interactions” for remote monitoring observations
   - Communication and decision-making protocols may have some standard features, but need to be customized to fit the operator’s chain of command and need for involvement of both internal and external subject-matter experts

8. Are there critical operations and specific parameters that are typically monitored?
   - Operators: safety and performance-critical parameters: pressures, loads/torque, volumes, flow rates, temperatures, operational readiness of equipment, etc.
   - Regulators: parameters associated with regulatory compliance and prevention of catastrophic events (particularly blowouts and associated spills), NOT day-to-day drilling operations and performance management

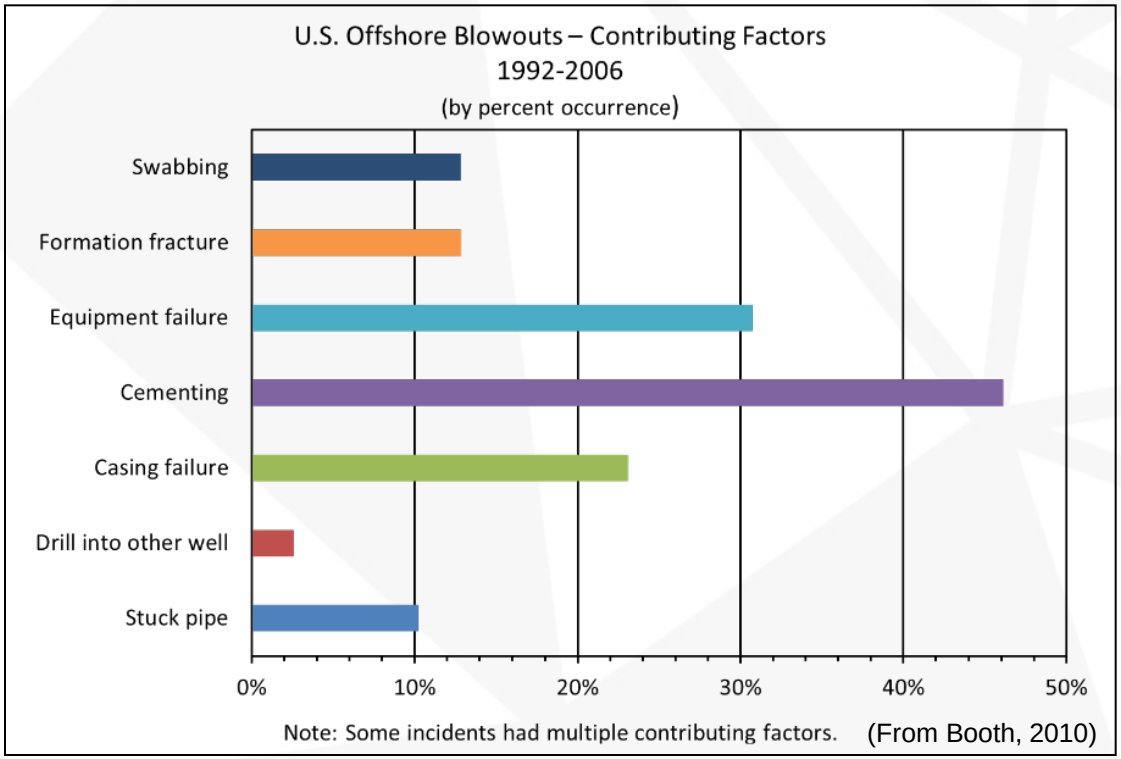


Example of a hookload plot used for prevention of stuck pipe events

US Offshore Blowouts – Contributing Factors

Paper SPE 170323, Kyle M. Carter et al.

Drilling Event
Formation Strength
BOP Reliability
Casing & Cement
Casing & Cement
Drilling Event
Drilling Event

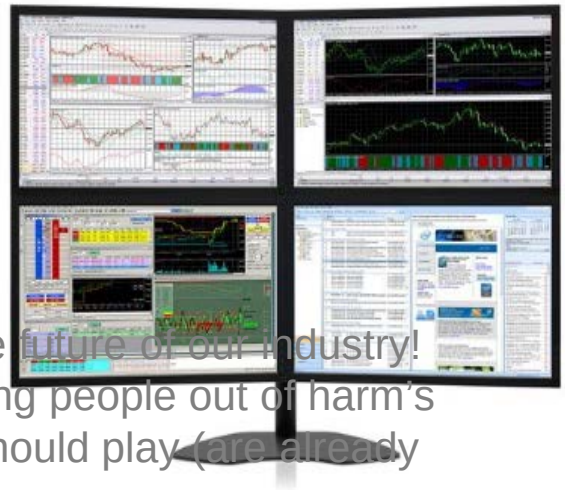


Barrier verification to help prevent major well control incidents:

- BOP Reliability Verification
- Formation Strength Evaluation
- Casing & Cement Evaluation
- Drilling Event Detection

Questions - 5

10. Does your company rely on any automation and predictive software in real-time monitoring?
11. What role could automation and predictive software tools play in real-time monitoring?
12. What role could CBM play in real-time monitoring? Describe how operating equipment using condition-based monitoring could be tailored and/or used for real-time monitoring.



- Automation, predictive data analytics, "big data" and CBM are the future of our industry! They can (and will) have a strong positive effect on safety ("taking people out of harm's way") and performance optimization (NPT/ILT reduction). They should play (are already playing) a prime role in RT monitoring
- CBM of critical equipment (BOP's and their control systems), top drives, mud & cement pumps etc. should augment monitoring of critical well test information (BOP tests, casing & shoe tests, production casing high and low tests, etc.)
- All will require subject-matter expertise, reliable input data, state-of-the-art modeling algorithms, and they ability to minimize false positives (leading to "alarm fatigue")

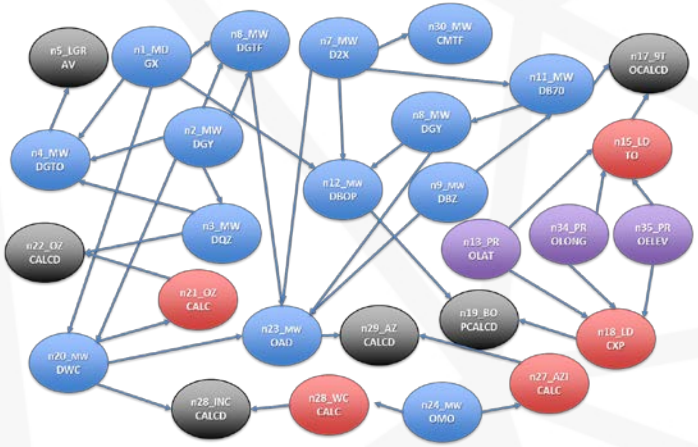
Sentinel™ - Data Quality Tool

Sentinel™ is a "behind the scenes" rig data watchdog – if you have bad data…and you do…you need improved fidelity in your well plan execution decisions - the results: improved well safety and faster well delivery through improved ROP, reduced NPT/ILT

	Rig A	Rig B	Rig C	Rig D	Rig E	Rig F
Rotary Torque	17%	17%	22%	24%	21%	18%
Makeup Torque	23%	11%	12%	17%	60%	13%
Rotary RPM	1%	1%	1%	1%	2%	1%
Pump Rate	1%	32%	1%	1%	40%	1%
Block Position	6"	<0.5"	<0.5"	6ft	<0.5"	<0.5"
Hookload	11%		18%		12%	
Pit Volumes	15%	12%	18%	16%	15%	22%
Pump Pressure	5%	4%	4%	4%	3%	5%

Actual SPE and Chesapeake study of numerous rigs and contractors –with noted sensor errors

GENESIS/INTELLICESS SENTINEL



Simulated relational Bayesian network for rig sensors

- Relational Bayesian networks allow for real-time autonomous sensor fault detection
- Adaptive technology maximizes redundancies – minimizes missed and false alarms and differentiates between sensor and process failures
- Sentinel can actually correct faulty data
- Minimal rig-to-rig re-configuration required

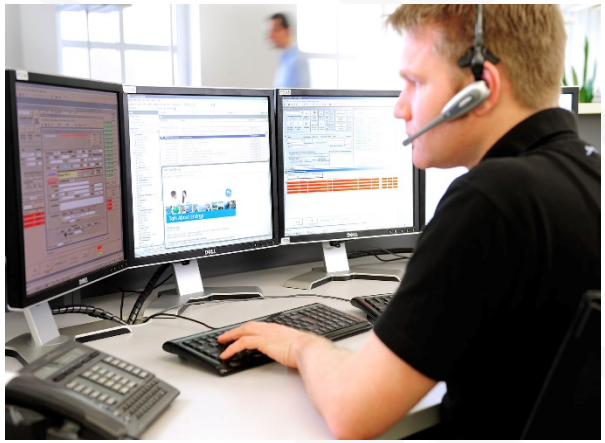
Questions - 6

12. How could BSEE leverage RT technologies? What advice could you give to BSEE?
    - Learn from experienced real-time operators, build collaborative relationships, understand and address their concerns about situational awareness, etc.
    - Adopt commercial-off-the-shelf solutions for maintenance, upgrades & versioning
    - Adopt vendor-neutral IT infrastructure, data-collection / integration / archiving systems; look beyond WITS & WITSML (e.g. OPC-UA) data-protocols
    - Adopt state-of-the-art KM systems for knowledge retention & training
    - Focus RTM activities on those events that historically have caused blow-outs
13. Which activities could real-time monitoring supplement or replace?
    - Reduce frequency of offshore inspections
    - Reduce labor-intensive inspection / test paperwork
    - Leverage limited number of BSEE / Coast Guard staff amidst growing offshore / Arctic activity
    - Attract and recruit talent to BSEE / Coast guard interested in working with advanced technology

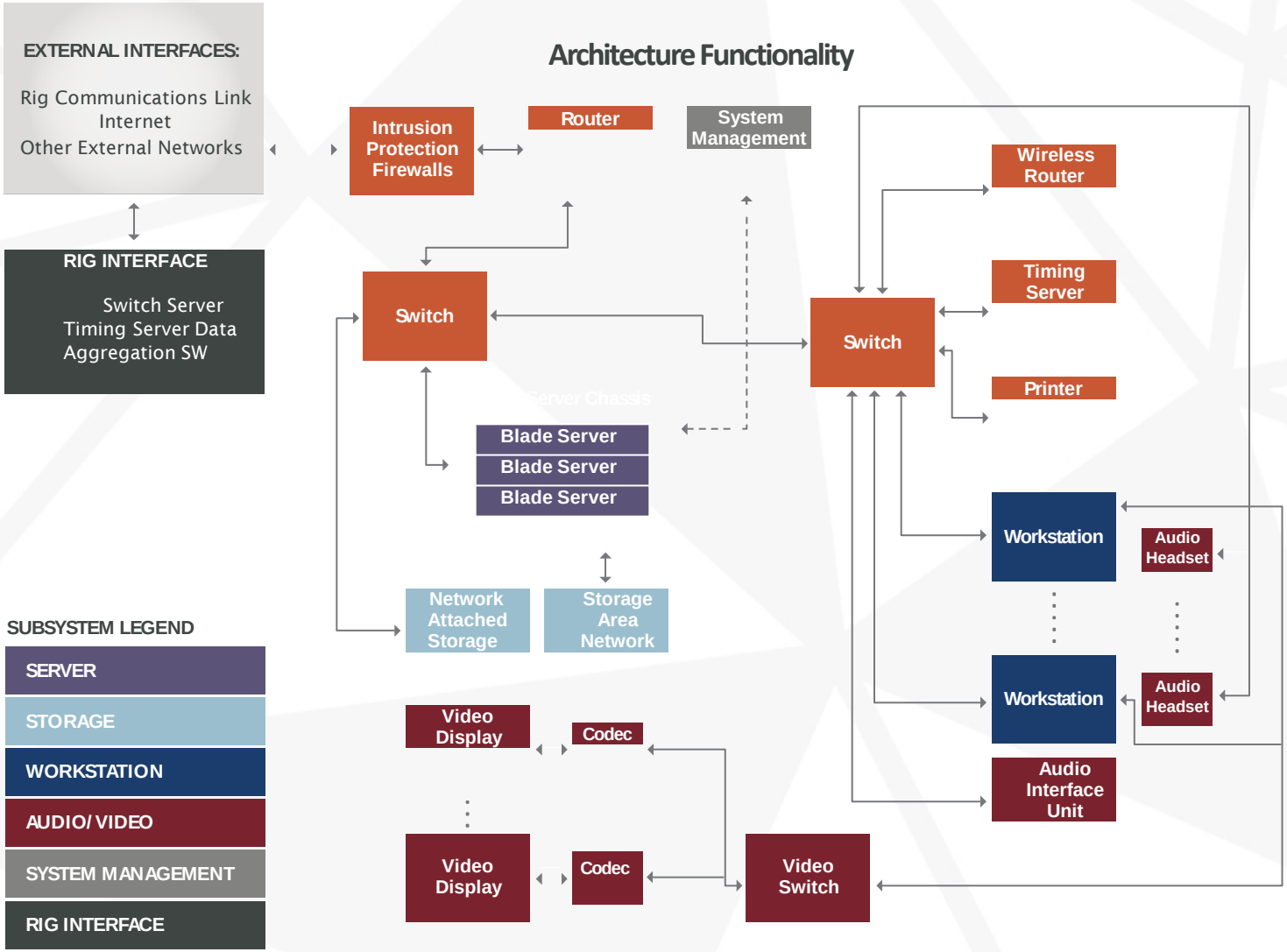
Additional Slides

Information Technology Design Components

- Implemented high reliability, availability, and maintainability factored into the design.
- Open architecture, vendor neutral, and easily configurable/scalable
- Cost effective design, utilizing commercial–off-the-shelf (COTS) components
- Standards based design Support WITS, WITSML, and OPC data-standards.
- Flexible scalable data storage and archival
- Cyber security planning
- Operational health and status monitoring.
- Incorporates data & information virtualization
- A state-of-the-art audio and video capability



RTOC Architecture



Tool Examples