Designing Cyber Exercises

(ISC)^2 Pittsburgh Chapter

CERT | Cyber Workforce Development

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CWD Mission

Provide force-multiplying solutions…

To rapidly grow the nation's cyber workforce…

Addressing the problems of time, scale, and cost

CWD Perspective

CWD Challenges

- Vulnerabilities, threats, and technologies change so rapidly
- Unlike adversaries, rule of law limits full freedom of maneuver
- Traditional "Brick and Mortar" training models
  - Difficult to train regularly due to logistics/budget restrictions
  - Doesn't scale across a globally distributed workforce
  - Difficult to "train as you work" routinely
  - Difficult to assess individual/ team readiness routinely

CWD Research/Solutions Focus

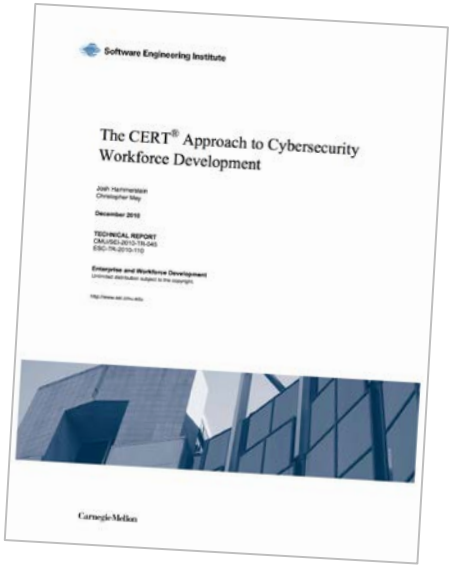
- Focuses on the problems of time, scale, and cost.
- Develop innovative methods to compress the time it takes to build cyber expertise and to amplify that expertise across a globally distributed workforce
- Emphasize individual/team readiness and effectiveness

Overview

- Background
- Why develop an exercise
- Types of exercises
- Planning
- Design
- Development
- Execution
- Supporting documentation
- Lessons Learned

Background

- Knowledge, skills, and experience
  - **Knowledge** building provides a solid foundation of knowledge; fundamentals and concepts
  - **Skill** building focuses on learning how to apply hands-on, technical skills
  - **Experience** building develops the ability to adapt and successfully apply skills in changing and unfamiliar environments; apply knowledge and skills in real world scenarios
- Skill proficiency
- Training scalability
  - Audience
  - Budget



Source: The CERT® Approach to Cybersecurity Workforce Development

Workforce Development Cycle

Figure 1: The CERT Approach to Cybersecurity Workforce Development

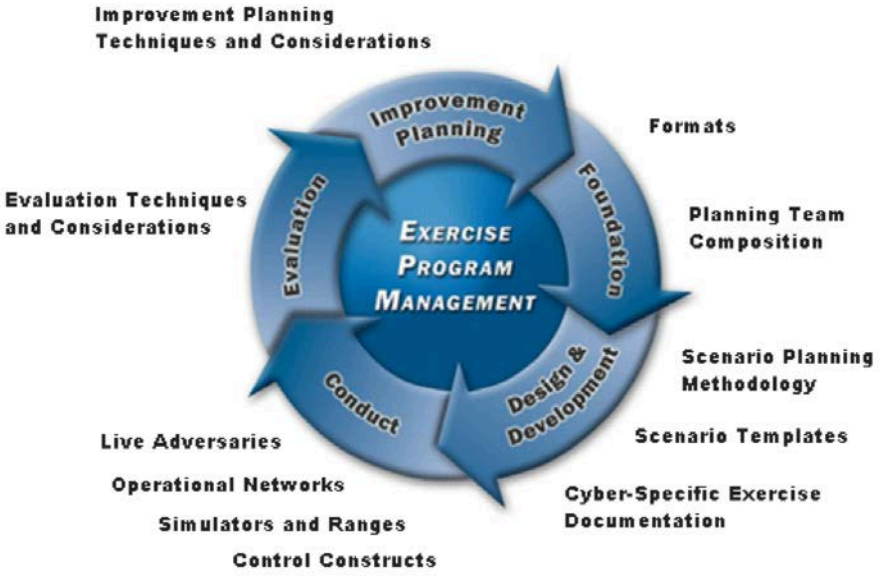
Why Exercises?

- Experience building
  - Safe environment
  - Repeatable
- Demonstrate capabilities
  - Integration of people, processes, and technology
- Experimentation
  - Tactics, techniques, and procedures
- Focus on process improvement
  - Organizational education

Proven Approach

- Exercises have been used to prepare for natural disasters and physical hazards for many years
  - Military "wargaming" → early 1800's
- Homeland Security Exercise and Evaluation Program (2002)
  - Based on DOD training and exercise programs
  - Fundamental principles that frame a common approach to exercises
  - Unique challenges for cyber
- *National Strategy to Secure Cyberspace* (2003)
  - Cyber exercises identified as a critical component to develop public-private partnerships and evaluate cyber security continuity plans

HSEEP



Cyber Exercise Hurdles

- Requires operational realism to enhance value
- Lack of codified best practices leads to ad hoc formats and planning methodologies
- Unique complexities based on the technical nature of cyber exercises
- Rapidly evolving policies, actions, and doctrine

Definitions

- **Exercise** – a military maneuver or simulated wartime operation involving planning, preparation, and execution that is carried out for the purpose of training and evaluation*
- **Exercise Objective** – a specific statement of purpose, guidance, and/or direction for an exercise*
- **Cyber** – people, process, technology, and operations associated with digital information systems, networks, and data**
- **Cyber Exercise** – an exercise whose objectives primarily focus on protecting, defending, and recovering cyber assets and operations from a cyber attack or incident**

* Source: CJCSM 3500.03D, 15 AUG 2012

** Source: Methods for Enhanced Cyber Exercises

Exercises

- Influenced by organizational resources and exercise objectives
- **Discussion-based** focus on familiarization of plans, policies, agreements, and procedures
  - Tabletop Exercise (TTX)
  - Seminar
  - Workshop
  - Game
- **Operations-based** validate plans, policies, agreements, and procedures while clarifying roles and responsibilities
  - Drill
  - Functional Exercise
  - Full Scale Exercise

Exercise Complexity

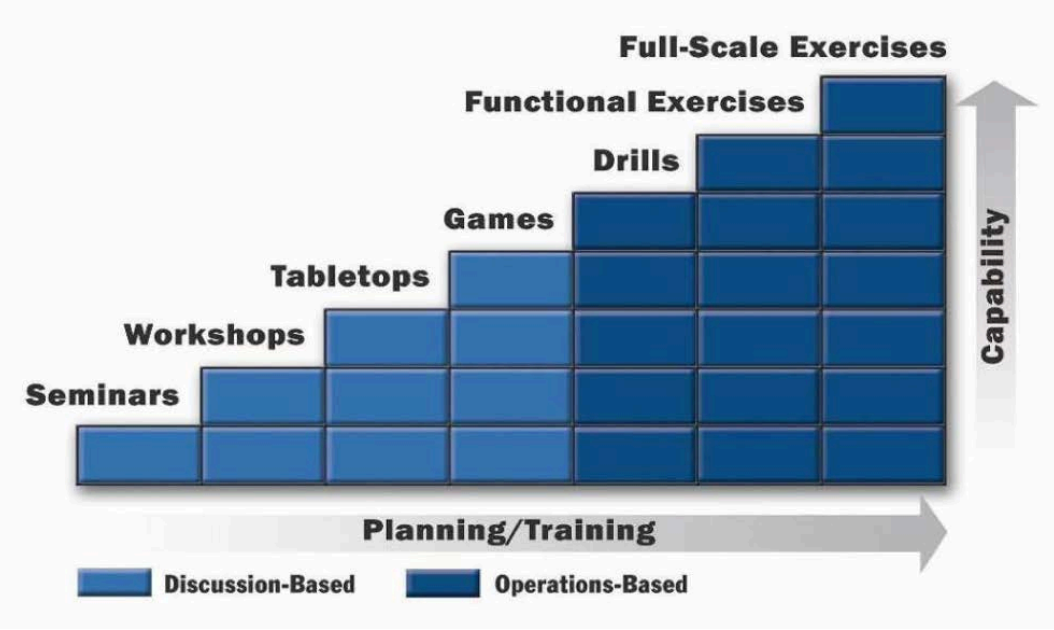


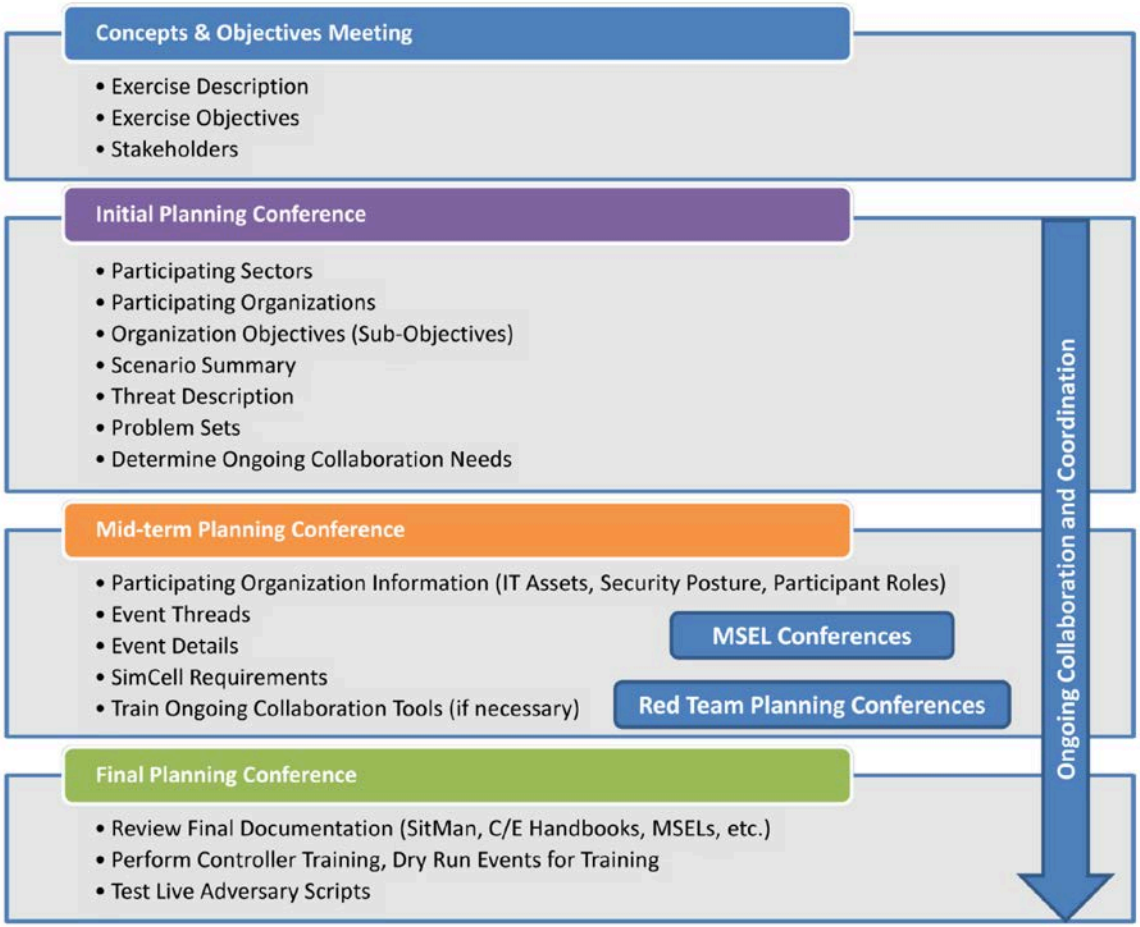
Figure 3: HSEEP Building-Block Approach [14]

Source: Methods for Enhanced Cyber Exercises

Foundation: Exercise Planning

- Executive and leadership support and commitment
  - Objectives
  - Resources
- Establish an exercise planning team
- Develop a project management timeline and clearly identify milestones

Building to the Event



Source: Methods for Enhanced Cyber Exercises

Teams

- Planning teams are usually based on the type of exercise, complexity, scenario, location, and resources available
- Scalable 4-cell planning construct
  - Exercise Control (White Cell)
  - Threat Emulation (Red Cell)
  - Observer/Controllers/Evaluators (Black Cell)
  - Trusted Agents

Design: Objectives

- Well-defined objectives guide scenario development and evaluation criteria
- Exercise objectives (SMART):
  - **S**imple
  - **M**easurable
  - **A**chievable
  - **R**ealistic
  - **T**ask-oriented
- Most importantly, objectives should be specific and relevant

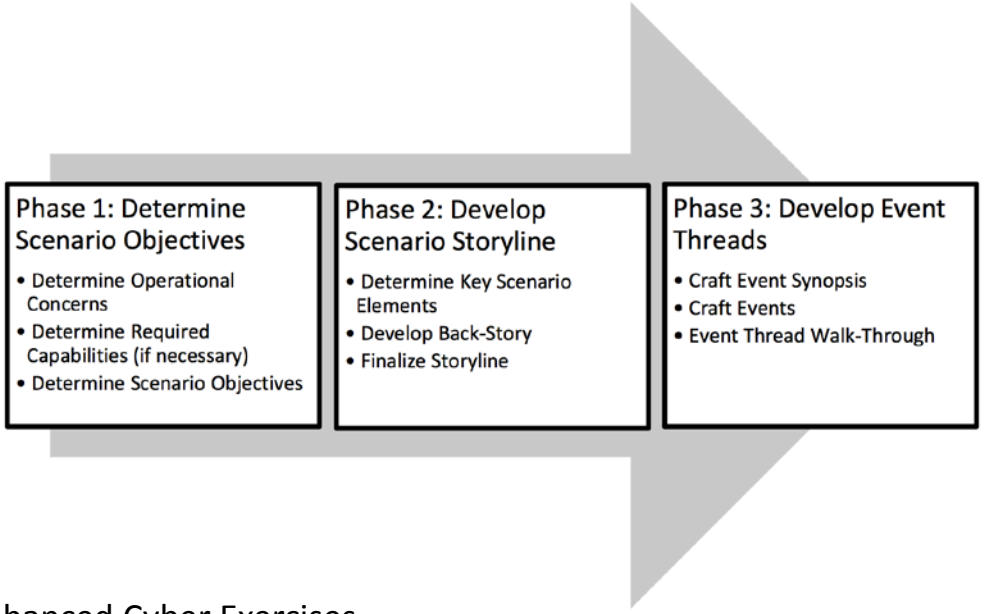
  "Identify potentially compromised systems that are communicating with an adversary C2 node via DNS."
- Recommend limiting the number of objectives to ensure exercise is manageable

Design: Scenario

- The storyline that drives the exercise
  - Integration of realistic threats with a plausible story
  - Every aspect of the scenario should support specific exercise objectives
- Key scenario elements
  - Scenario objective(s)
  - Threat
  - Target
  - Operational effect (not necessarily business impact)
- Collaborative effort → Trusted Agents (SMEs)
  - Threats
  - Cyber defense capabilities
  - Policies and procedures
  - Project and/or organizational considerations

Scenario Planning Methodology

- Phase 1: Develop Scenario Objectives
- Phase 2: Develop Scenario Storyline
- Phase 3: Develop Event Threads



Source: Methods for Enhanced Cyber Exercises

Key Scenario Elements

- Scenario objective(s)
  - Scenario objectives deconstruct exercise objectives into activities that can be developed as event threads
- Road to war – overview of the situation
- Threat
  - Actors and motivations
  - Live OPFOR
  - TTPs
- Target
  - Systems
  - Information/data
  - People
  - Processes
- Operational effect (not necessarily business impact)
  - Target effect
  - Discovery
  - Timeframe

Development: Scenario

- Master Scenario Event List (MSEL)
  - Chronological list of observable events during the exercise period
- Exercise event-level (lowest level)
  - Scenarios can have multiple event threads
  - Event threads typically have multiple events
- Event types
  - Threats
  - Injects
  - Player expected action
  - White-noise

Exercise Environment

- Exercise realism
  - Operational network v. cyber range
  - Scenario validation/plausibility
  - Systems and processes
  - Threat emulation
  - Traffic generation

Exercise Execution

- Exercise Control – maintain positive control of all activities including MSEL execution, ensuring objectives are met, and conducting briefings
  - Staffing from across the planning team
  - STARTEX/PAUSEX/ENDEX
  - Exercise Rules of Engagement (EXROE)
- Communications
  - Primary and backup communication channels

Documentation

- Scenario Mapping
- MSEL
- Playbooks
- Instructor/facilitation guides
- Range infrastructure
- Exercise environment configuration
- Data handling procedures
- … many, many more

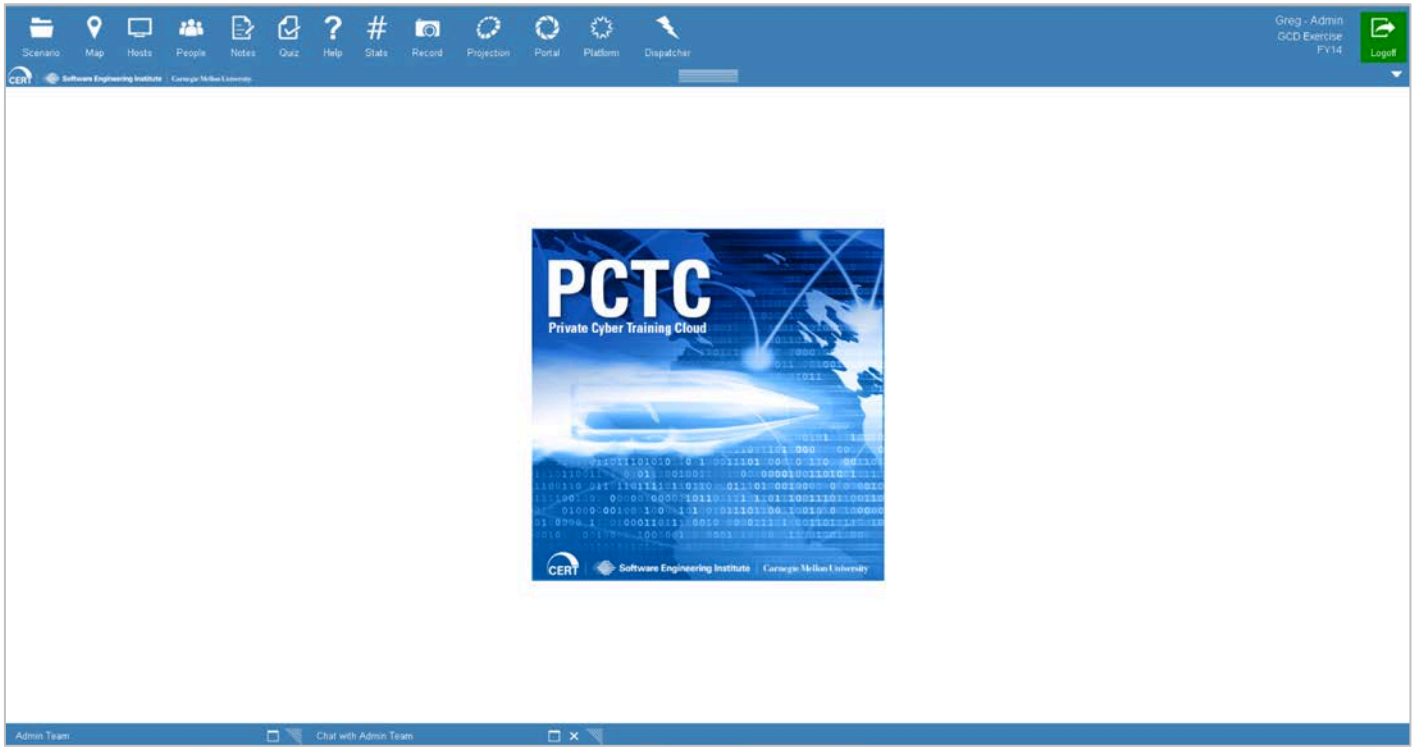
Lessons Learned

- Effective process improvement completes the exercise cycle
- After Action Review
  - Drive organizational change
  - Improve the exercise experience

Misc Cyber Exercises

- Notable cyber exercises
  - Cyber Storm (DHS NCSD)
  - Cyber Flag (USCYBERCOM)
  - Cyber Guard (USCYBERCOM, NGB, DHS, FBI)
  - Cyber Defense Exercise (DOD, Service Academies)
  - CyberPatriot (AFA)
  - Cyber Shield (NGB)
  - Bulwark Defender (USSTRATCOM)
  - …
- Cyber training and exercise service providers
  - Online competitions
  - Challenges

Demo



Summary

- Cyber exercises enable experience building in a controlled environment
- Effective planning is critical to the success of the exercise
- HSEEP provides a framework for designing cyber exercises based on best practices and a proven methodology

References

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Methods for Enhanced Cyber Exercises
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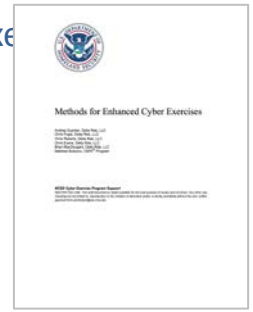

Questions

Greg Longo

Cyber Workforce Development

U.S. Army Exercise Portfolio Manager

ggl@cert.org

412-268-8330