# Interactive Visualization Development For Rapid Response

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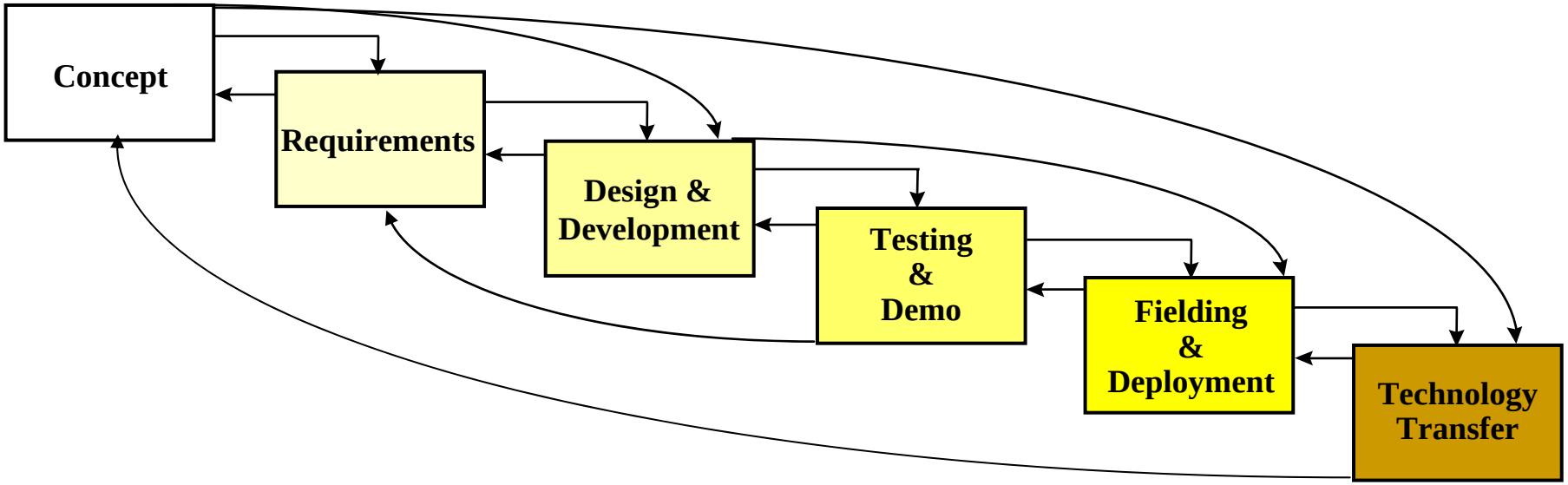
MITRE

# Overview - Modified Systems Development Approach




- Accelerated system engineering process presented through an example development effort

# Concept – Problem/Solution



- **Problem: No global view of Computer Network Defense (CND) status – Results in limited data for decision making and lack of integrated defense tactics**
  - **Limited data presentation integration**
  - **Fragmented situational awareness**
  - **Need for overall understanding**
  - **Lack of global visualization**

**Current data is disparate and presented in a tabular format limits quick assessment**

**Differing products present their unique, but restricted view of the global situation**

- **Capabilities not available in Commercial-Off-The-Shelf (COTS) software**
- **"The [display] requirement has been around since day one of the mission inception**

**Basic Data (Data Points)**
→ **Information (integrated display)**
→ **Knowledge (layered Information)**
→ **Understanding (scenarios)**
→ **Decision Making (response)**

**Solution: Interactive three dimensional (3D) Graphical User Interface (GUI) display presenting a fusion of actual NetD attack status in real-time across the cyber domain, enhancing user perception of dense defensive Information Warfare (IW) data for situational awareness, quick assessment, decision-making, and immediate response to experienced threat activity**

# Requirements - Tracking



- #: Requirement tracking number
- Requirements: A brief description
  - White: Open Requirements
  - Gray: No longer relevant, OBE
  - Blue: Details TBD, Priority 5
  - Green: Implemented & Tested
- Suggestion: description of enhancement provided by a user –
- Modules: Requirement applied to
- Related Modules: Potential module(s) effected
- Priority: Original & New Priority
  - 1: Immediate, next release
  - 2: Following release
  - 3: Will be completed in designated timeframe if enough resources
  - 4: Will investigate possibility
  - 5: Will consider in the future
  - D: Delivered in operational prototype
- Source: Requirement submitter
  - UD: User Derived Requirement
  - DD: Developer Derived Requirement, may be suggestions from the field or the Display team
- Status Type: The status of the suggested enhancement
  - Reviewed: By Display Team, disposition indicated
  - Evaluation: Under evaluation by Display Team
  - Pending: Evaluation by Display Team
- Disposition:
- Release: Version requirement will be included within
- Questions/Comments
- Query: Query tool required
- Wks: Weeks to work

# User Derived Needs

Requirements

- First glance should tell overall health and what's up and what's down (i.e., core services)
- Want as much information presented as possible (i.e., aggregation) on one screen
- Global display that provides a status of alerts and sensor status
- Pull data and consolidate relevant facts into an integrated display (i.e., provides summary information by layer – e.g., TCP/IP model)
- Drill down for additional information
- Accurate and timely, to include IW and general status notifications
- Easy on the eyes (i.e., salience)
- Standardized views
- Easy to use (i.e., intuitive - not much training needed, people are changing all the time)

# Community Requirements

- **Primarily**
  - Situational Awareness/Common Operational Picture (COP)
  - Dynamic Performance Monitoring
  - Ability to centrally monitor and collect configuration information
  - Need visualization tools for analyst, operator, and decision support and effective indications and warnings
- **Secondarily - Related**
  - Computer Network Defense (CND) Concept Exploration
  - Dynamic Mapping of Systems and Connections
  - Need to provide commander with positive control of information resources
  - Need to prioritize and dynamically allocate access
  - Need ability to centrally manage security posture of enterprise applications and equipment
- **Other Efforts**
  - Present different views of managed objects on the display to meet the need of users
  - Provide multiple level drill-down capabilities (additional linkages to be established between modules in the future for
  - Provide the capability of launching element managers and other network/system managers for a physical object
  - Present information associated with the managed objects including object dependency data

# Human Machine Interface (HMI) Factors



- User Interface: Specification of a conversation between the user and the computer
  - GUI
  - Display
  - Zones
  - Messaging
  - Dialogue Tone and Terminology
  - Function Keys
  - Color Selection
- Reporting: Major output functionality, accuracy and clarity are fundamental, focus on formatting and generation
- System Functionality: Applicability of functions, data capture and format, processing capabilities, and system support to retain usefulness
  - Usability
  - Processing
  - System Errors
  - Data
  - Audio Outputs
  - Maintenance
- Support Documentation & Training: Proper and effective use, complete routine and unique tasks, and troubleshoot problems
  - System Documentation
  - Training and Training Material

# HMI Considerations



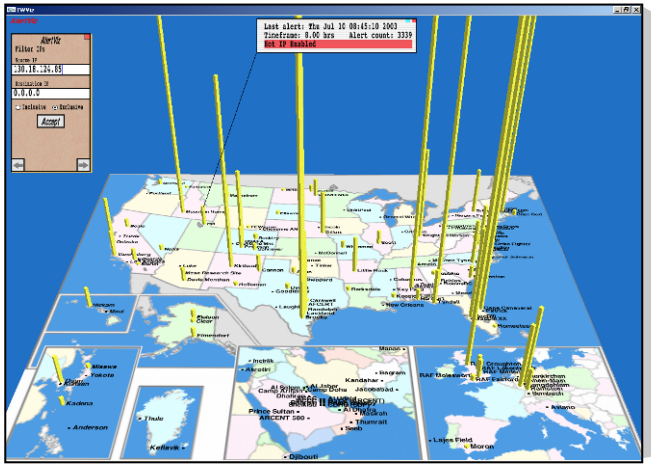
- User should expect:
  - To be aware of what to do next
  - To know system expectation
  - Data checking--has been entered correctly or not
  - Explanation of delays
  - Task completion notification
  - Standardized formatting, information, instructions
  - Messages appear in the same general area and remain long enough to ‘read’ them
  - Dialogue be limited to one idea per frame, whether paging or scrolling through the zone

- Criteria:
  - Ease of use
  - Human Factors Engineering
  - Documentation
  - Training
  - Security
  - Maintainability
  - Reliability
  - Interoperability

# Operational Platform Requirements



- **Best viewed on a large screen display**
  **(Note: plasma screens have burn in issues)**
- **High-end graphics card:**
  - **ATI Radeon**
  - **Visiontek NVIDIA GeForce**
  - **Appian Jeronimo Graphics Card**



- **Personal Computer (PC) based systems**
  - **Desktops**
    **(e.g., Dell Dimension)**
  - **Laptops**
    **(e.g., Dell Inspiron)**
- **Windows Operating Systems (OSs)**
  - **XP (Experience)**
  - **Windows 2000**
  - **NT (New Technology)**

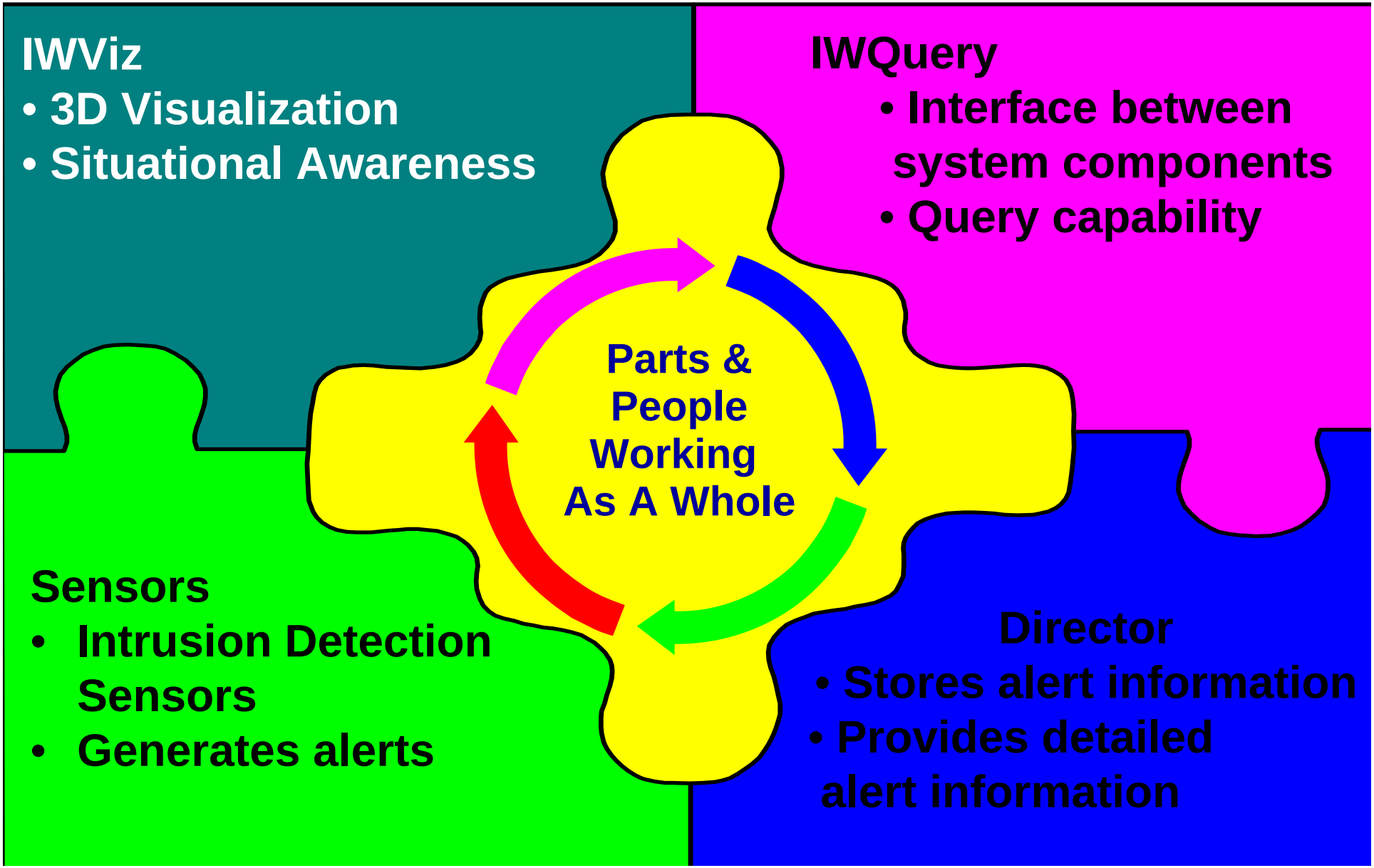
# Systems Design and Development

Design & Development

- Identify related components and needed integration
  - Conflicts
  - Similarities
- Breakdown the problem into workable modules
  - Alert Visualization (AlertViz) provides global alert visualization
  - Exploration Visualization (ExViz) provides the same data with queried data for specific time frames
  - Connection Visualization (ConnViz) provides connection log visualization in a grid sorted by Source (Src) or Destination (Dst) Internet Protocol (IP) on one axis, time on a second axis, and quantity of connections in the third axis
- Prioritize development focus based on requirements
- Design to Concept - Provide a viable 3D-display prototype to meet network operational needs
- Interactive development – Frequent updates – Quick turn around

# Integration

Design & Development



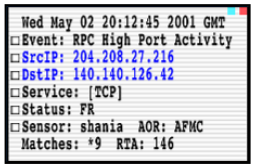
# AlertViz

Design & Development

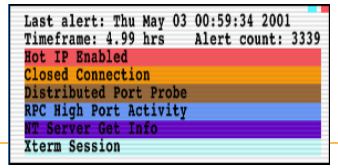
- **Represent Alerts:**
  - Cubes over designated sites
  - Information Window containing relevant alert data
  - Date and time of last alerts received and destination location indicator
- **Usability:**
  - Configurable files for tailoring
    - Filter designators and descriptors
    - Coordinates (e.g., site latitude/longitude)
    - Sensor collectors
    - Hot IP list with blinking option
  - User selectable color coding
  - Point and click/auto data fill
  - User defined profiles
  - Visual sizing

- **Alerts filtered on:**
  - String Match Events (e.g., BAD_PASSWORDS)
  - Events (e.g., Distributed Port Probe)
  - Protocols (e.g., Transmission Control Protocol [TCP])
  - Source or Destination IP
  - Area of Responsibility (AOR)
  - Sensor

General Information Window



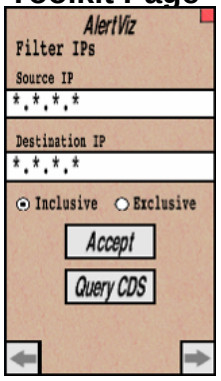

Last Alert Information Window




Area of Responsibility Toolkit Page


Events Toolkit Page

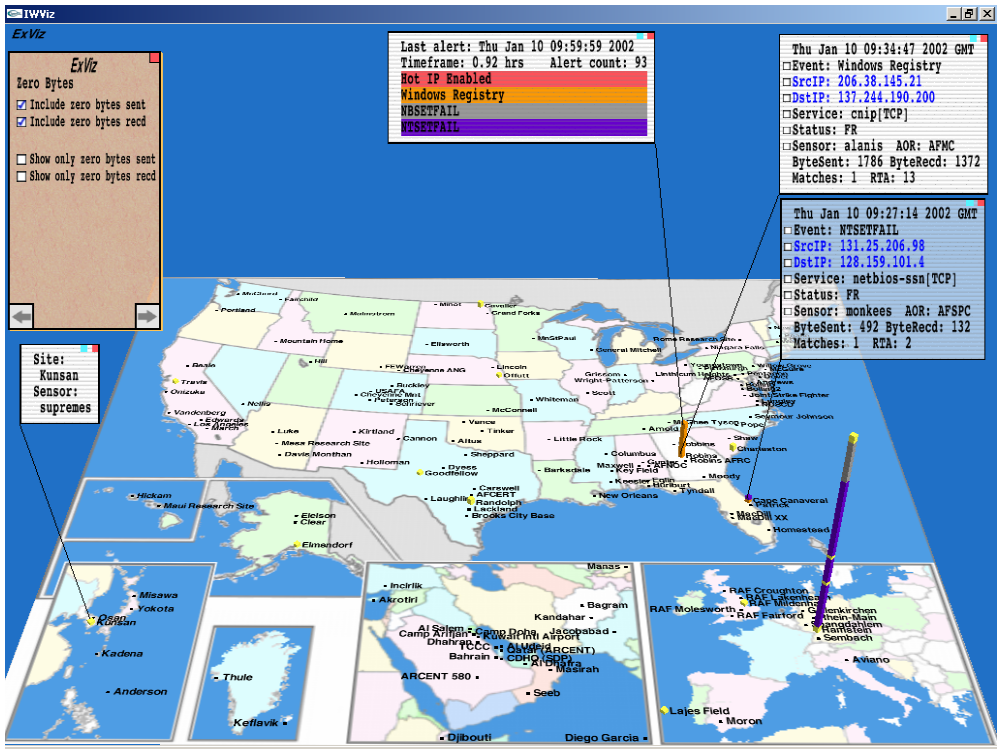

Filter IPs and CDS IP Search Toolkit Page



# ExViz

Design & Development

- Includes all functional capabilities included on the AlertViz module as well as:
  - Information Window containing bytes sent and received
  - Date and time of last alerts received and destination location indicator
- Query capability on:
  - Source IP/Destination IP
  - Date
  - Time range
  - Status
  - Bytes transferred
  - Destination Port #




- Alerts filtered on:
  - Capabilities included on the AlertViz module
  - Zero Bytes Filtering

# Testing & Demonstration

Testing & Demo

- IWViz Functionality
  - Installation
  - Configuration
  - Starting Up
  - Shutdown
  - Modules
  - Popup Menubar Operations
  - File Options
  - Profile Options
  - Tools Options
  - Display Options
  - Filters Options
  - Windows
  - Navigation & User Interface
  - Maintenance
- Test Areas Covered
  - Module
    - AlertViz (A)
    - ExViz (E)
    - ConnViz (C)
  - Unit
    - Date
    - Pass / Fail
    - Tester
  - System
    - Date
    - Pass / Fail
    - Tester
    - Regression Date
    - Pass / Fail
  - Government Acceptance
    - Date
    - Yes / No
    - Approver
  - User Acceptance
    - Date
    - Yes / No
    - Approver

# Fielding and Deployment Activities

Fielding & Deployment

- Pre-Deployment Activities (Preparation)
  - Coordination activities
  - Build contact list and locations
  - Interim Certificate to Operate (ICtO) approval
  - Prepare platform and support documents
  - Survey requesting configuration information
  - Baseline software
  - Coordinate travel with Points of Contact (POCs)
  - Accreditation
- Deployment Activities (Fielding)
  - General briefing
  - Check setup and configuration (e.g., Director connection)
  - Test run setup
  - Train target users
  - Review System Change Request (SCR) process
  - Question and Answer (Q&A)/collect initial comments
  - Out brief
- Post-Deployment Activities (Sustainment)
  - Update deployment process
  - Prepare after action report
  - Follow-up on submitted enhancements
  - Send out software and documentation updates to deployed locations
  - Review CND visualization needs and support options
  - Provide maintenance and help desk support
  - Finalize documentation – worked throughout process

# Deployment Rationale

Fielding & Deployment

- IWViz offers capabilities not available in Commercial-Off-The-Shelf (COTS) software
- No licensing fees
- Satisfies Intrusion Detection System (IDS) related visualization requirements
- Conditions—Provides prototypes to users "as is" with ongoing support from government sponsor until successful sustainment transition occurs, currently:
  - Working assessment of network impact or interoperability—
    None expected or experienced in the laboratory operation
  - User's manual provided—
    Includes setup directions
  - Training provided—
    Initially at deployment, On-The-Job, Call in technical support
  - Initial load and configuration—
    Users to support updates and new version installs

# Technology Transfer

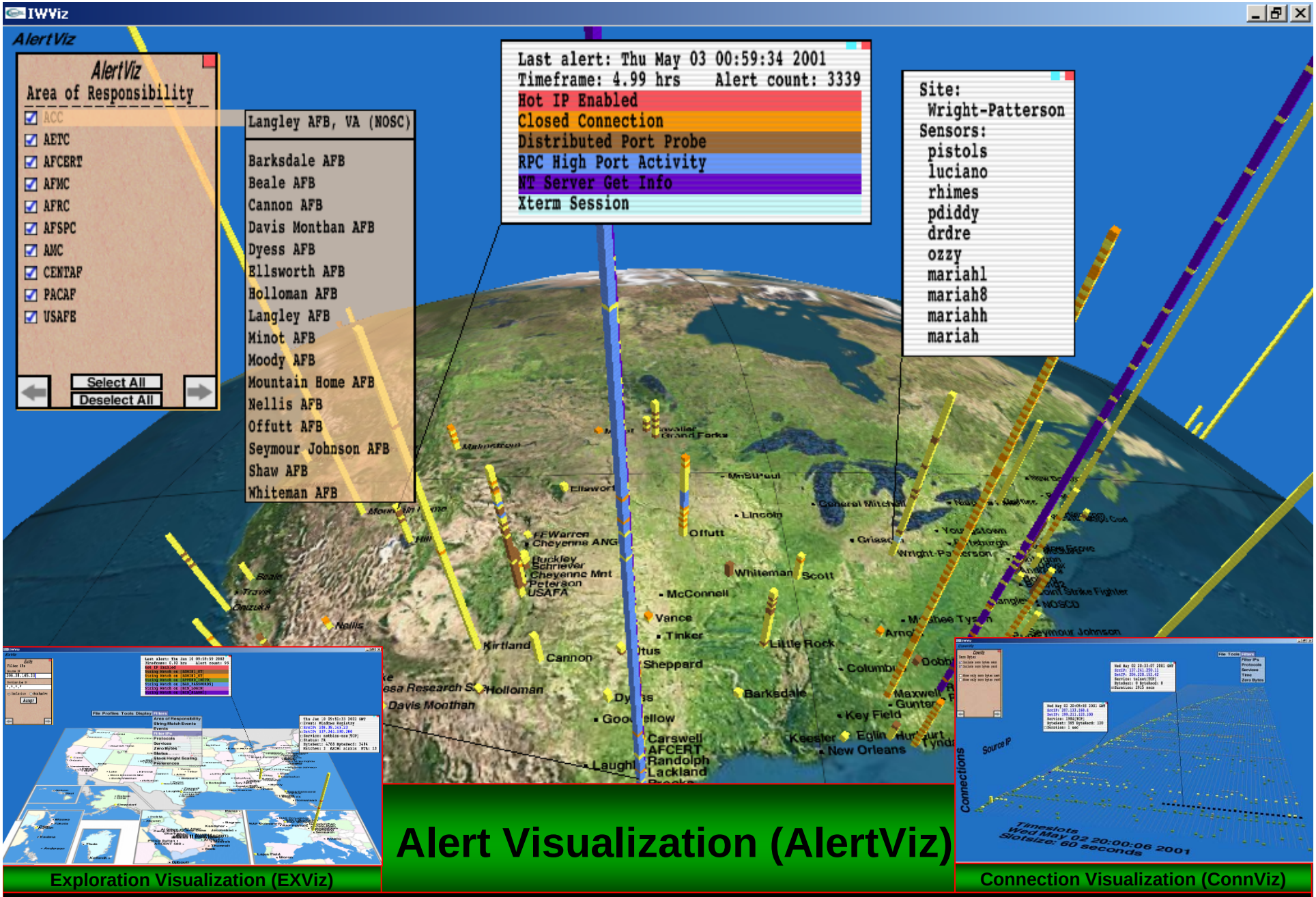


- IWViz moved from the prototype stage and was ready to migrate to an operational technology
  - MITRE not chartered or staffed to provide product sustainment
  - Necessary to implement an IWViz technology transfer plan
- Concerns
  - Intellectual Property
  - Conflict of Interest
  - Legal & Ethical (Contact)
  - Lose of Direction
- Select best way forward
  - Which is the easiest and least confining?
  - Which ones do we want to pursue, could be one or many?
- Options
  - Commercial License – Nonexclusive: Can require them to give back copies
    - We transfer the software directly to selected companies
    - Sponsor transfers the software to contractors and/or companies
  - Open Source
    - Need Public Release
    - Open to all folks national and abroad
    - Hard to track who has it
  - Cooperative Research And Development Agreement (CRADA) – Joint government/industry R&D partnerships which share resources
  - Industry Standards – Influence
  - External Publications – Public domain

# Growing Interest in Technology Transfer

Technology Transfer

- Venture investors looking for solid technology underpinnings in investment opportunities—reaction to dot com era mistakes
- Research institutions increasingly willing to partner with venture community for additional revenue opportunities
- Homeland Security and other government initiatives driving interest in potential applications of advanced technologies being developed in research institutions
- Mid-Atlantic technology commercialization organizations ideally positioned at the crossroads of industry and government technology hubs
- Tech transfer still relatively new (Bayh-Dole Act passed in 1980)




Exploration Visualization (EXViz)

# Alert Visualization (AlertViz)

Connection Visualization (ConnViz)

**Real time situational awareness allowing for quicker response in decision making**

**Allows for initial situational assessment and predictive support**

# Primary Support Team

- Therese Metcalf—Technical Lead-MITRE
- Ken Beyer—Government Project Lead
- Dr. Mike Wingfield—Lead Developer-MITRE
- Tim Farias—Testing & Technical Support-MITRE
- Interface Developer—Varied Government Support
- Users—Government Personnel