Net-Centric Collaboration and Situational Awareness with An Advanced User-Defined Operational Picture (UDOP)

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Presentation Outline

- User-Defined Operational Picture – Introduction
- Architecture & Key Concepts
- UDOP-Based Collaboration
- Enabling Technologies
- Summary and Road Ahead
UDOP Introduction
What is a UDOP?

- UDOP = User-Defined Operational Picture

- *Decision-focused view* of the operational environment that organizes *disparate data sources* to support accurate *situational awareness* (SA) and timely decision-making in a distributed *net-centric environment*

- Users must be able to:
  - **Create** UDOPs (identify content to be included/excluded for the picture)
  - **Visualize** UDOPs (specify how selected content should be presented)
  - **Augment** UDOPs (derive added-value based on domain knowledge)
  - **Tailor** UDOPs (adjust contents to address needs of user/echelon)
  - **Share** UDOPs (conduct rich collaboration in a net-centric enterprise)
UDOP Template (aka Recipe)

- A UDOP Template defines:
  - Base Data
  - Data Sources
  - Spatial Filters
  - Temporal Filters
  - Attribute Filters
  - Symbology

- UDOPs do not contain the data, they just refer to it
  - Contain references (URLs)
  - “Execution” of a UDOP will consume the data from the web services

- Different use cases
  - Standing vs. Ad-hoc
  - Various Time Frames
    - Planning
    - Monitoring
    - After-Action

- UDOPs can:
  - hierarchically feed other UDOPs
  - change during collaboration
  - be used in sequence during execution of a workflow
Architecture & Key Concepts
Architecture

UDOP Application Layer
- UDOP Snapshots
- UDOP Template Viewers
- UDOP Author Tools
- Organic Data
- DoD Portal

UDOP Services Layer
- NCES Services
- UDOP Server

Information Layer
- Geo-Events
- Gazetteer
- Tracks
- Satellites
- MIDB
- Weather
- National Imagery
- GIS Data
- Globes

Visualization
- Web browser
- Media Player
- ArcGIS Explorer
- AGI Viewer
- Google Earth

Collaboration
- UDOP Author Desktop App
- UDOP Author Web Site
- Direct Adapters (e.g., KML Feeds)
- Collaboration Services
- Symbology Services
- UDOP Creation Service
- Analysis Services
- Data Loaders
UDOP Services

• Creation
  – Assist author clients in creating/editing/tailoring UDOPs
  – Offer high-level automatic UDOP generation

• Visualization (Symbology & Rendering)
  – Enable centralized stylization and symbol generation

• Sharing (Storage & Discovery)
  – UDOP Repository stores UDOP Templates available for: browsing, previewing, loading, modifying

• Aggregation
  – Support server-side UDOP Aggregation
  – Provide transformation services for Data Source Aggregation

• Collaboration
  – Asynchronous via UDOP Repository
  – Synchronous via Peer-to-Peer mechanisms
Peer-to-Peer Collaboration

- Geo- and Time- enabled

- Core techniques
  - Whiteboard
  - Chat
  - Social networking
    ▪ Presence
    ▪ Rooms
    ▪ Sessions

- UDOP-specific
  - Shared annotations
  - Shared templates
  - Shared organic data
  - Shared workflow
  - Dynamically linked views
UDOP-Based Collaboration – Use Cases
Personal UDOP for SA

1. Create new empty UDOP Template with Author App

2. Select Data Sources
   a) Base Data (Maps & Imagery)
   b) Data Services (SOAP, RSS, KML)
   c) “Organic” Data (loaded from local files)
   d) Value-Added Analysis Service (e.g. Weather Impacts)

3. Customize UDOP Template
   a) Determine Appropriate Filters
   b) Set Appropriate Symbology Options

4. Data Retrieval (Filtering, Transformation)

5. View Interactive UDOP with Author App 4D Display

6. Save UDOP Template
1. Create new empty UDOP Template with Author App

2a. Select Data Sources (Base Data)

2b. Select Data Sources (Data Services)

2c. Select Data Sources ("Organic Data")

3. Customize UDOP Template

4. Data Retrieval

5. View Interactive UDOP with Author App 4D

6. Save UDOP Template
1. Create new empty UDOP Template
2a. Select Base Data (globeserver)
2c. Select Data Sources ("Organic Data")
3. Customize UDOP Template (Determine Appropriate Filters)
4. Data Retrieval
5. View Interactive UDOP with Author App 4D Display
Sharing UDOP Templates

- User X Creates UDOP Template with Author App
- User X Generates UDOP Snapshots
- User X Publishes UDOP to Repository
  - Snapshots
  - Template
- User Y Browses Repository
  - Through Web Browser
  - From UDOP Author
  - Through Repository RSS Feed
- User Y Opens UDOP Template in Author App
- User Y Views Interactive UDOP with Author App 4D Display
1. User X Creates UDOP Template with Author App

2. User X Generates UDOP Snapshots

3. User X Publishes UDOP to Repository

4. User Y Browses Repository

5. User Y Opens UDOP Template in Author App

6. User Y Views Interactive UDOP with Author App 4D Display
1. User X Creates UDOP Template with Author App

2. User X Generates UDOP Snapshots

3. User X Publishes UDOP to Repository

4a. User Y Browses Repository (Through Web Browser)

4b. User Y Browses Repository (From UDOP Author)

4c. User Y Browses Repository (Through Repository RSS Feed)

5. User Y Opens UDOP Template in Author App
Automatic M2M Generation

1. DoD Portal Has New Geospatial Content
   a) Due to Entry of new Event by User X
   b) Due to Database Update

2. Portal Calls UDOP Creation Service with High-Level Request

3. Creation Service Creates a Detailed UDOP Template

4. Creation Service Generates UDOP Snapshots

5. UDOP Template and Snapshots are Published to Repository

6. Link to UDOP Sent Back to Calling Portal

7. User Y Reviews UDOP by Following Portal Link
   a) Uses Snapshots
   b) Opens Template
1a. DoD Portal Has New Geospatial Content Due to Entry of new Event by User X

2. Portal Calls UDOP Creation Service with High-Level Request

3. Creation Service Creates a Detailed UDOP Template

4. Creation Service Generates UDOP Snapshots

5. UDOP Template and Snapshots are Published to Repository

6. Link to UDOP Sent Back to Calling Portal

7a. User Y Reviews UDOP by Following Portal Link and Using Snapshots

7b. User Y Reviews UDOP by Following Portal Link and Opening Template
GAPS Demonstration

1. DoD Portal Has New Geospatial Content due to Entry of new Event
2. Portal Calls UDOP Creation Service with High-Level Request
3. Creation Service Creates a Detailed UDOP Template
4. Creation Service Generates UDOP Snapshots
5. UDOP Template and Snapshots are Published to Repository
6. Link to UDOP Sent back to Calling Portal
7. User Reviews UDOP by Following Portal Link
   7a. User Reviews UDOP Using Snapshots
   7b. User Reviews UDOP By Opening Template

UDOP Creation Service
Peer-to-Peer Collaboration

1. User X Opens Application
2. User X Initiates a Collaboration Session
3. User X Invites Users Y and Z (via phone, email, external chat)
4. Users Y and Z Open Application and Join Session
5. User X, Y, and Z Collaborate
   a. Text Chat
   b. Share Data
   c. Share Views
   d. Shared Annotations
   e. Shared Whiteboard
6. Optionally, Users Archive the Collaboration Session
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1. User X Opens Application
2. User X Initiates a Collaboration Session
3. User X Invites User Y (via phone, email, external chat)
4. User Y Opens Application and Joins Session
5a. User X and Y Collaborate – Text Chat
   - User X sends a text message
   - User Y receives message and responds
5b. User X and Y Collaborate – Share Data
   - User Y receives message and opens STK scenario
   - User Y clicks on 'Set View' in chat session to refresh screen to User X's view
   - User X zooms to Area of Interest then sends the view to User Y
5c. User X and Y collaborate – Share Views
   - User X texts User Y to open STK scenario, then User X opens STK scenario
5c. User X and Y collaborate – Share Annotations
   - User Y sends User X Annotation
   - User X clicks on 'Display Annotations' in chat session to refresh screen displaying User Y's annotation
6. Optionally, Users Archive the Collaboration Session
1. User X Opens Application
2. User X Initiates a Collaboration Session
3. User X Invites User Y (via Chat)
4. User Y Open Application and Join Session
5a. User X and Y Collaborate – Text Chat
5b. User X and Y collaborate - Share Data
5c. User X and Y Collaborate – Share Views
6. Optionally, Users Archive the Collaboration Session

- User Y view of the directions sent from User X
- Y is online in Chat contacts
- Text Chat: Incoming (red), Outgoing (blue)
- Geo Chat: Incoming, Outgoing, Who, timestamp
- .NMF Explorer doc: References to layers, Viewing parameters, List of tasks
- Textual Directions

ArcGIS Demonstration
1. User X Opens Application
2. User X Initiates a Collaboration Session
3. User X Invites User Y (via phone, email, external chat)
4. User Y Open Application and Join Session
5a. User X and Y Collaborate – Text Chat
5b. User X and Y Collaborate – Shared Data
5c. User X and Y Collaborate – Shared View
5d. User X and Y Collaborate - Shared Annotations
5e. User X and Y Collaborate - Shared Whiteboard
6. Optionally, Users Archive the Collaboration Session
Geospatial Visualization and Analysis

- ArcGIS and CJMTK
  - Powerful Geographic Data Management, Visualization, and Analysis
  - DoD MCG&I Standard for C2I applications
  - Provides ArcGIS Desktop and ArcGIS Server Technologies

- AGI Technologies
  - Geodynamic Analysis and Visualization functionality
  - Includes performance models for Space, Air, Ground, and Water moving objects
  - Supports dynamic intervisibility, coverage, performance analysis

- Google Earth
  - Powerful, easy-to-use Net-Centric earth visualization
  - Based on KML which is now a more widely used standard
  - Supports visualization of imagery, terrain, 3D buildings
  - Supports search of locations based on name or address
Web and SOA Infrastructure, Messaging Technologies

- Web and SOA Infrastructure
  - .NET
    - Supports building, deploying, and running Web Services and applications
    - Standards-based, multi-language environment that is very widely deployed and used
  - J2EE
    - Specification for developing and deploying multi-tiered business applications
    - It differs from .NET in that it is a standard, rather than an implementation

- Messaging Technologies
  - eXtensible Messaging and Presence Protocol (XMPP) supports real-time communication amongst applications
  - XMPP supports instant messaging, session management, whiteboarding, collaboration, etc.
Summary and Road Ahead
Summary

- UDOP Concept is a natural evolution of Shared Situation Awareness paradigms within a highly networked environments

- The proposed UDOP Concept is valid for many operational paradigms including Air, Ground, and Space C2, Homeland Security, Cyber Security, Event Management, etc.

- UDOP System supports operations by providing Net-Centric collaboration amongst systems as well as end-users

- The Authors have conducted R&D partially instantiating the UDOP Concept with software that supports Creation, Visualization, Augmentation, Tailoring, and Sharing of UDOPs

- Global Awareness Presentation Service (GAPS) project has operationally deployed significant portions of this UDOP R&D to USSTRATCOM

- This UDOP R&D can be applied and deployed to other domains including Space and Cyberspace applications.