



EPA's Environmental
Information Symposium
2008

Raytheon

Customer Success Is Our Mission

Air
Land
Sea
Space
Cyberspace

Innovation. In all domains.

*Environmental
Management
Line of Business:*
Vision for the Future

11 December 2008

**Assured National and economic security
through environmental systems integration**

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EPA's Environmental Management Business Reference Model

Business Area	LoB FEA BRM 2.0 as of May 2005	Sub-Function 1 FEA BRM 2.0 as of May 2005	Sub-Function 2 EPA BRM 4.6
<p align="center">Services to Citizens</p>	<p align="center">108 - Environmental Management</p>	<p align="center">- 023 Environmental Monitoring & Forecasting</p>	<p>01 Air Monitoring & Forecasting</p>
		<p>02 Water Monitoring & Forecasting</p>	
		<p>03 Land Monitoring & Forecasting</p>	
		<p align="center">- 024 Environmental Remediation</p>	<p>01 Site & Area Evaluation & Cleanup</p>
		<p>01 Manage Air Quality</p>	
		<p>02 Manage Water Quality</p>	
		<p>03 Ensure Safe Drinking Water</p>	
		<p>04 Manage Hazardous and Non-Hazardous Wastes</p>	
		<p>05 Manage Environmental Risk from Substances</p>	
		<p>06 Prevent Pollution</p>	
<p>07 Compliance & Enforcement</p>			
<p>08 Environmental Stewardship</p>			



What Would It Look Like To Enable Planners To Effectively Access Geo-enabled Decision Tools

Context:

- **Data Volumes Measured In Petabytes**
- **Model Development, Integration, Validation**
- **From Photons to Decision Support**

The opportunity: provide decision makers the geo-enabled "information" they need, not all the "data" that exists

Gap Analysis...at the Enterprise Level

- NASA and NOAA collect extensive remote sensing data that is important
 - But few use it—why? How can remote sensing data be made usable?
- All agencies produce models—yet there is no shared capability or model development environment that includes collaboration tools
 - integration problems (data don't fit together), inconsistent time series, missing data (often missing where you most want them)—spatially and thematically
- Growing need to be able to deploy models, at every level of Government
 - Need for shared/virtualized arrangements around supercomputing resources
- Communities are increasingly asking for scientific advice from the federal government on environmental conditions
 - This new service would also be the major consumer of data and model outputs
- More and more agencies are publishing data in geo web services
 - Should there be shared services to deliver all the federal agencies environmental data in geo formats?

Opportunity for Enterprise level cross-agency collaboration



Potential Goals of an Environmental Management LoB

- Share Business:
Know what business functions are (or should be) conducted across agencies
 - Share methodologies and approaches
- Share Services
 - SOA services
 - Federated business component systems
- Share DATA
 - Converging data standards
 - Ultimately, shared ontologies

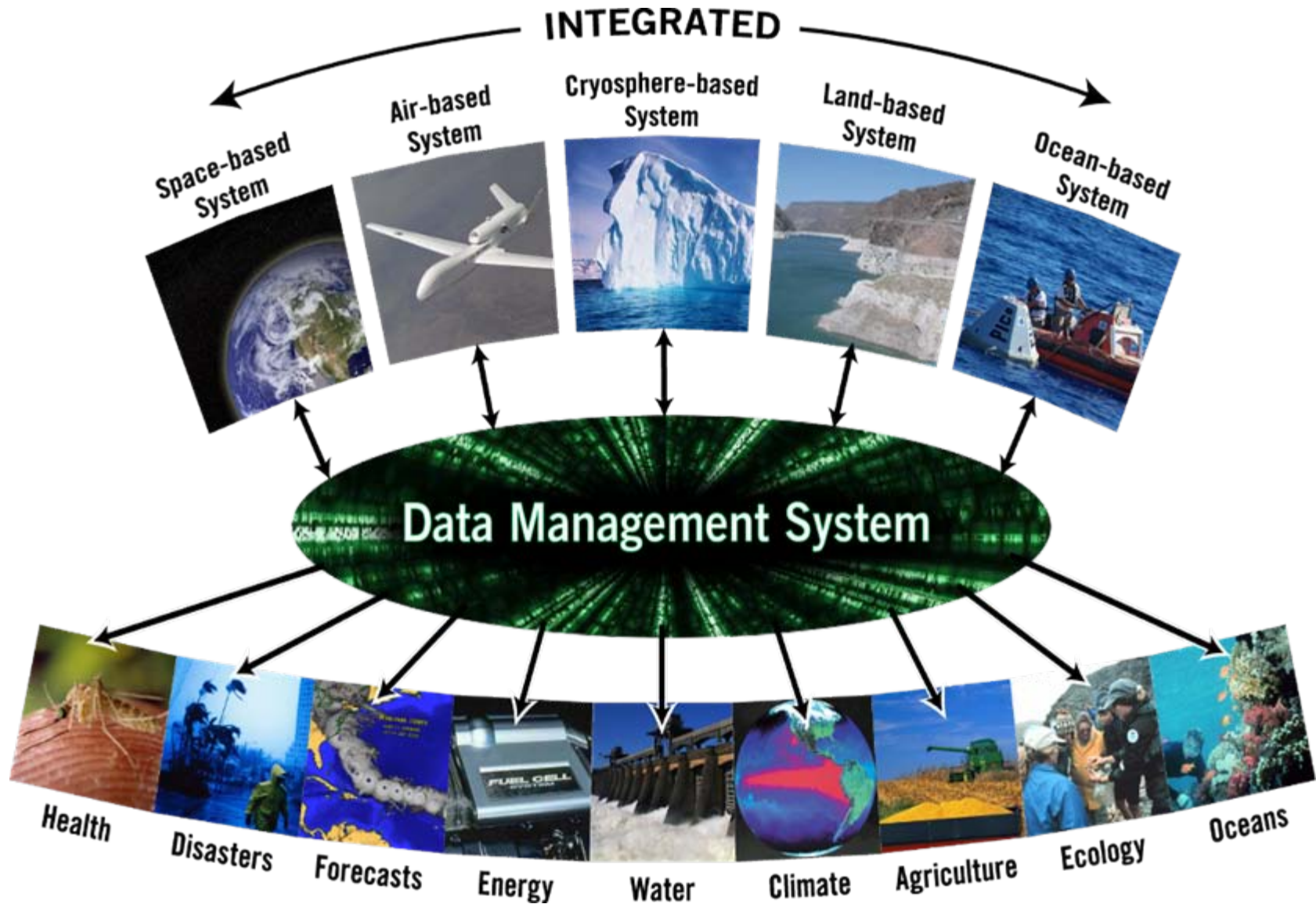
SoS Conceptual Architecture



SoS Conceptual Architecture (EMLoB)

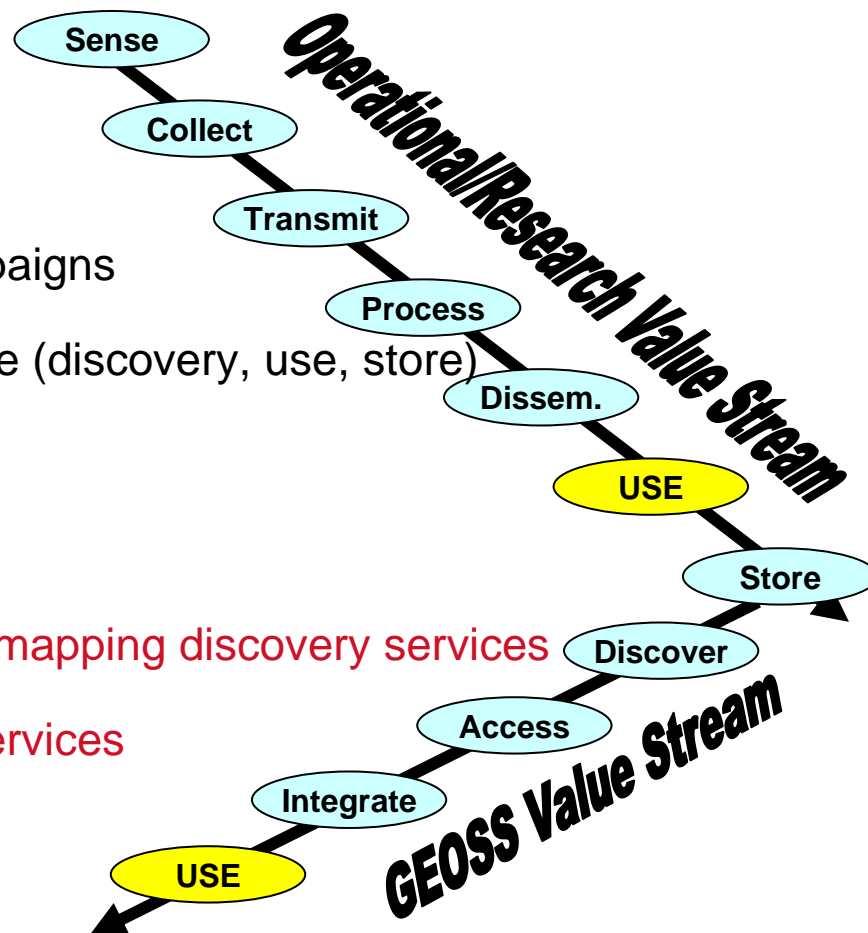


SoS Conceptual Architecture (GEOSS)



The Way Forward for an Environmental LOB

- ✓ SoS reference architectures
- ✓ Effective cross-agency governance
- Shared/leveraged sensors, platforms, campaigns
- Complete, hierarchical metadata architecture (discovery, use, store)
- Shared, flexible, elastic cloud computing
- Outcome-focused Centers of Excellence
- ✓ Semantic-based creation/maintenance and mapping discovery services
- ✓ Syntactic-based parsing/access/transport services
- Model integration frameworks
- Tailored user portlets



Share Methodologies, Share Services, Share Data

Share Methodologies, Share Services, Share Data

Assumed In Place

- ✓ Effective cross-agency governance
- ✓ SoS reference architectures
- ✓ Semantic-based creation/maintenance and mapping discovery services
- ✓ Syntactic-based parsing/access/transport services

Required Services

- Sensing Services and Mission Management
 - Shared/leveraged sensors, platforms, campaigns
- Data Access and Fusion Services
 - Complete, hierarchical metadata architecture (discovery, use, store)
- Product, Modeling, and Analysis Services
 - Model integration frameworks
- Supercomputing Services
 - Shared, flexible, elastic cloud computing
- Application and Decision Support Services
 - Outcome-focused Centers of Excellence
- Geo-Enabled Collaboration and Visualization Services
 - Tailored user portlets

Six Necessary Shared Services

EMLoB "Plug-N-Play" SoS Services

Spanning the Environmental Information Life Cycle

- Sensing Services/MM
- Data Access and Fusion Services
- Product, Modeling, and Analysis Services
- Supercomputing Services
- Application and Decision Support Services
- Geo-Enabled Collaboration and Visualization Services

Tailored Solutions

...into
GEOSS and IEOS



Aviation



Carbon Management



Ecological Forecasting



Energy Management



Public Health



Water Management



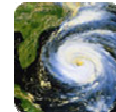
Agricultural Efficiency



Air Quality



Coastal Management



Disaster Management



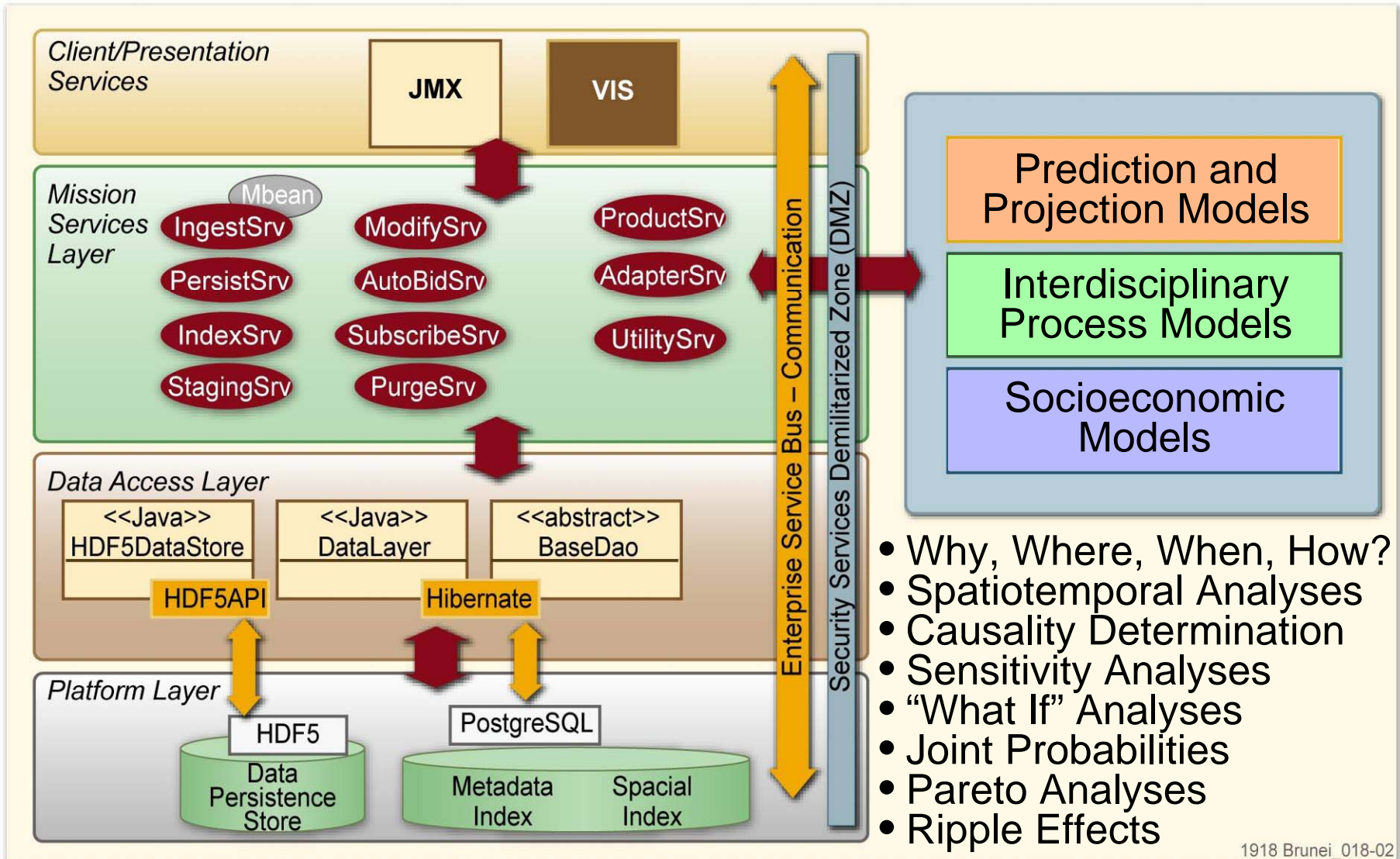
Homeland Security



Invasive Species

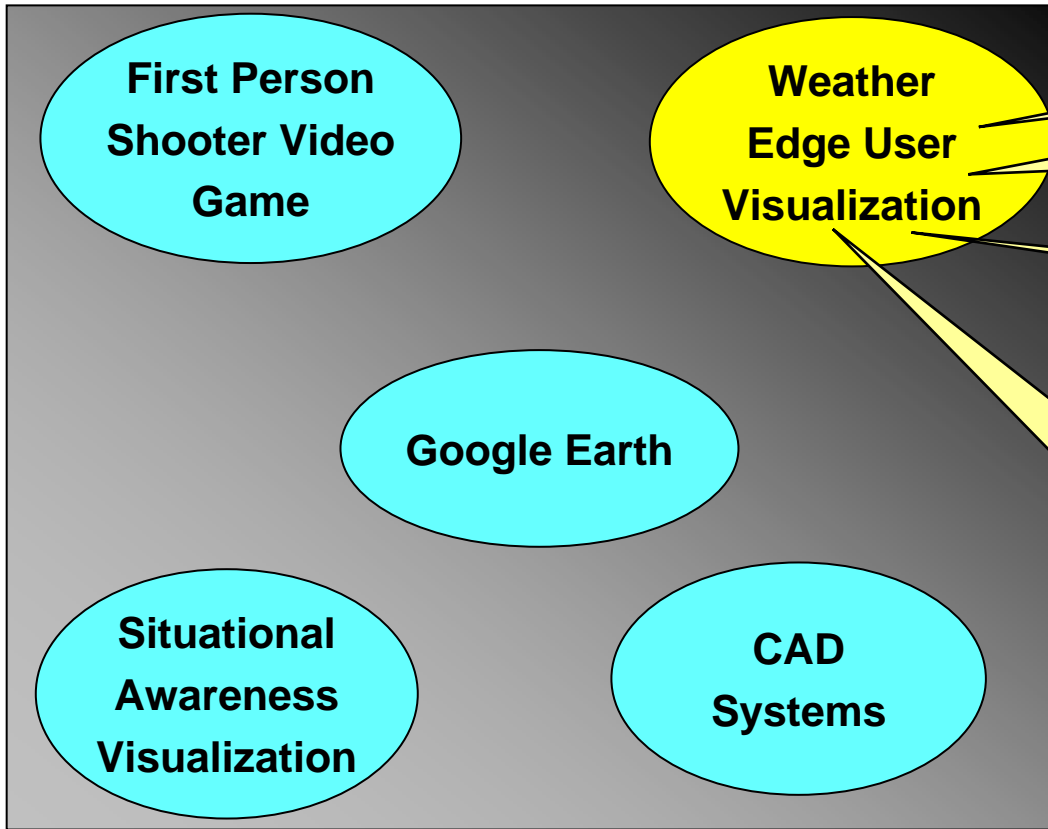
- Effective cross-agency governance
- SoS reference architectures
- Semantic-based creation/maintenance & mapping discovery services
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Generic SOA for Data and Model Fusion and Decision Support



Enabling Planners To Effectively Access Geo-enabled Decision Tools (Example 1, NWS)

Increasing Data Interactions

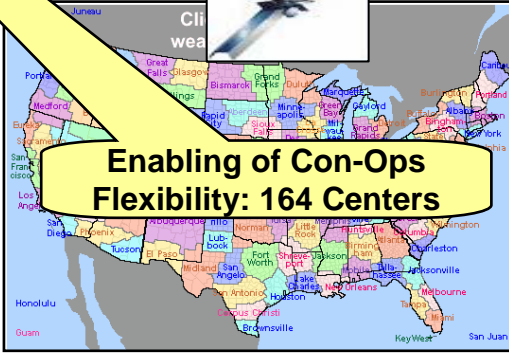


Totally Non-Propriety Solution (Open Source)

Quickly Adaptable to New Science & Data Types

Accelerate Innovation & Speed of Deployment

Sat Com

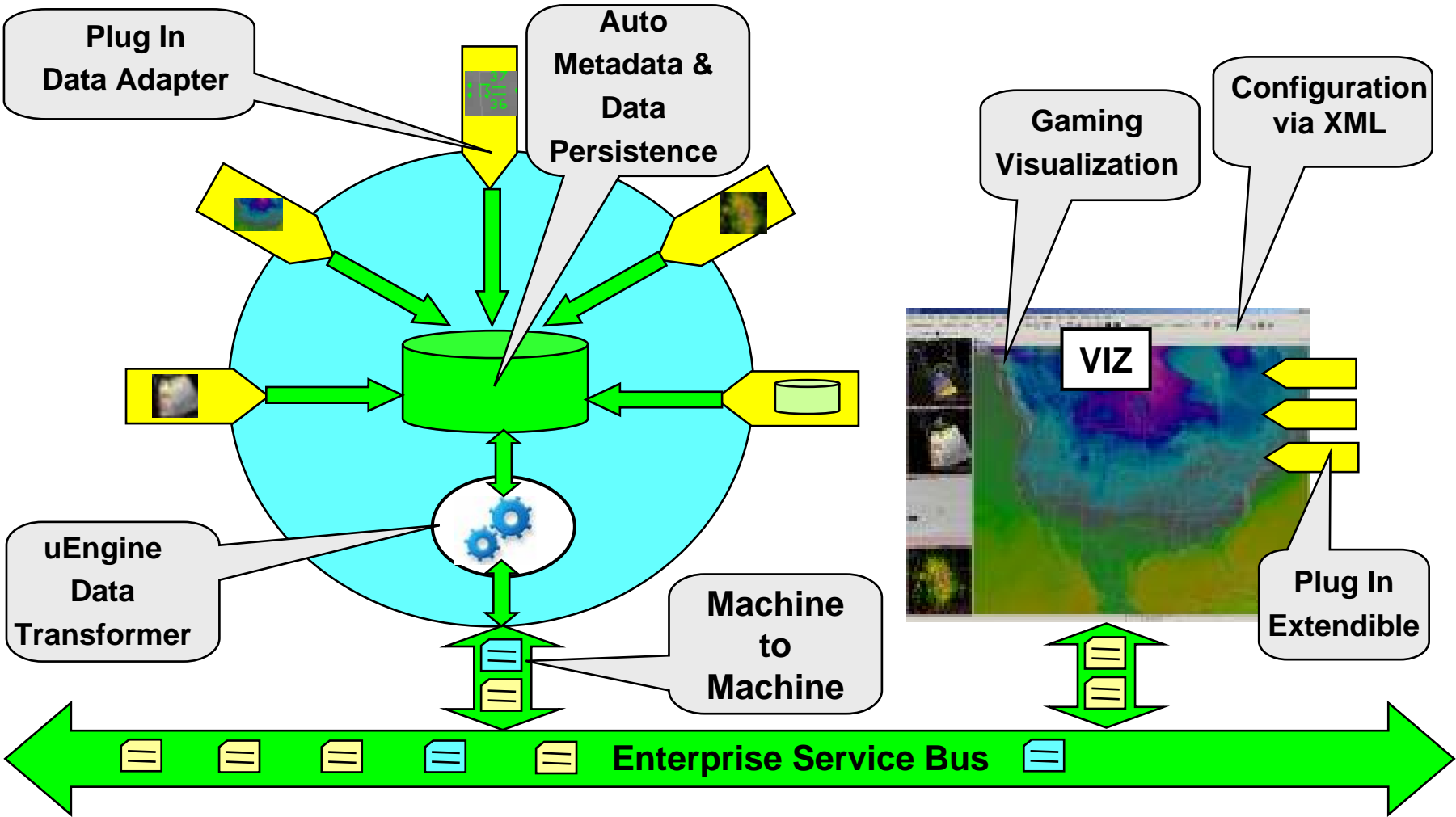


Enabling of Con-Ops Flexibility: 164 Centers

Increasing Data Rates

Designed to minimize customer cost of ownership

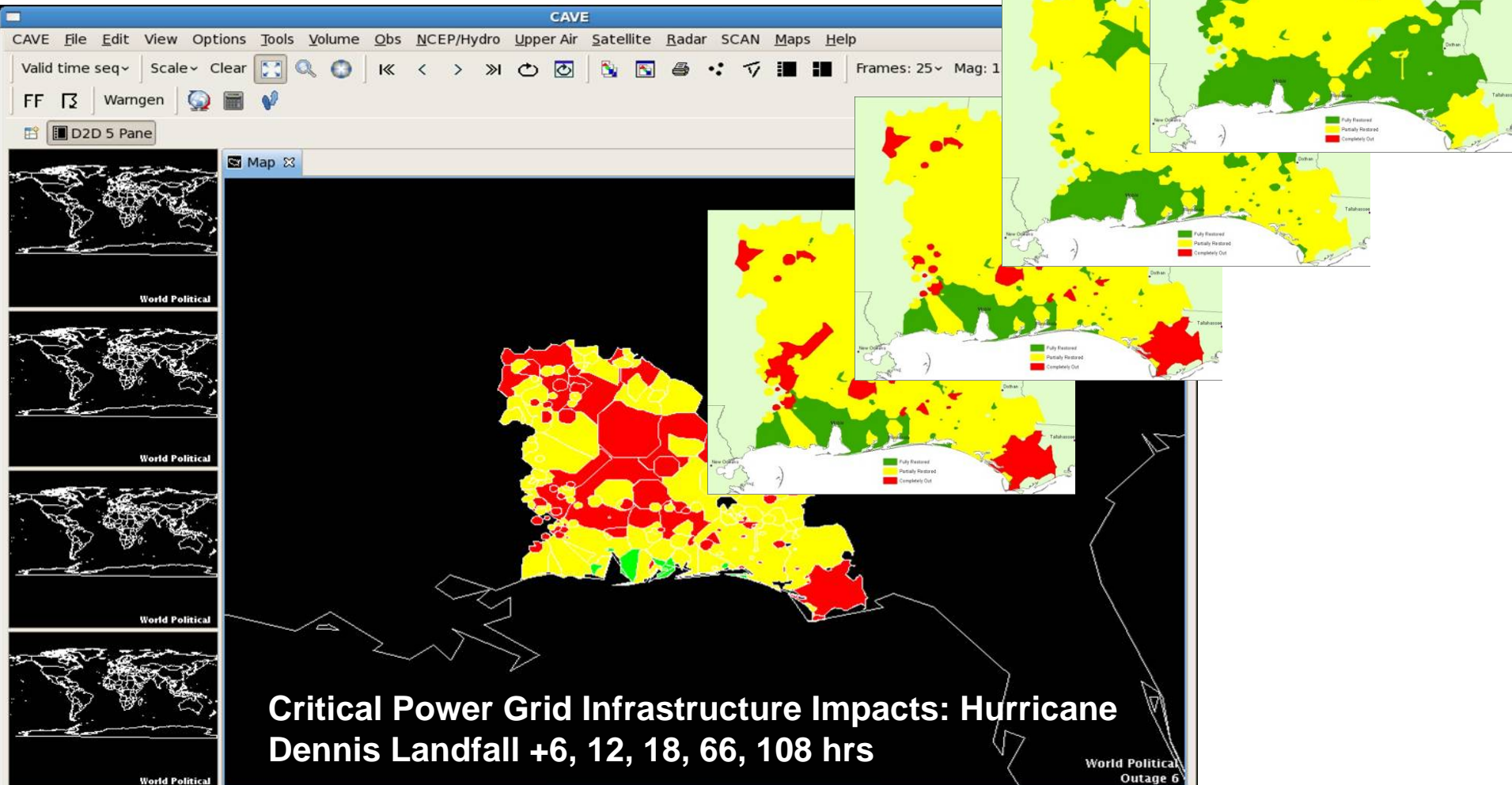
AWIPS II: Plug In Adaptable Data Fusion & Data Transformation Framework With Visualization



High Data Rates With Gaming Style Interaction

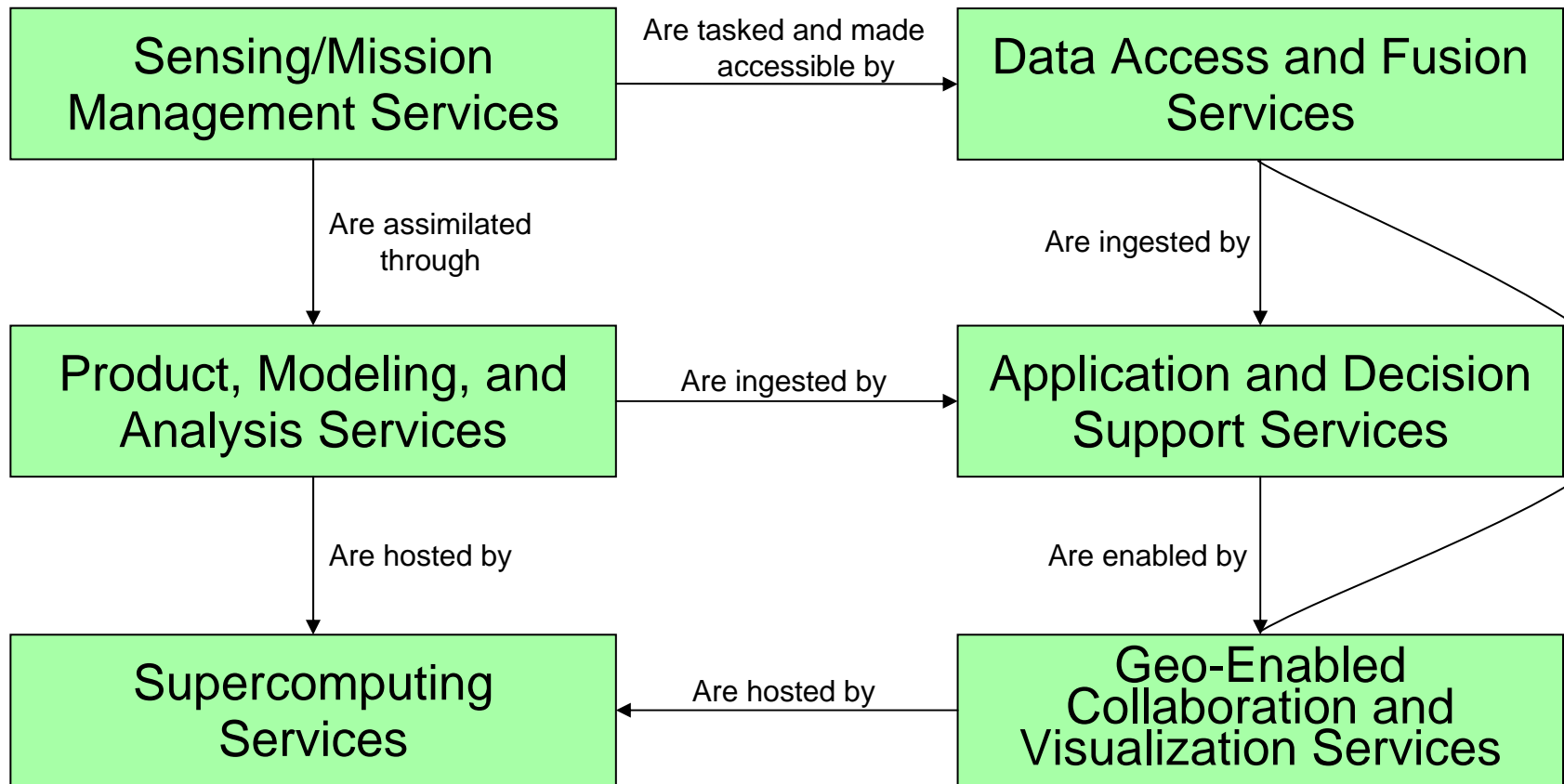
Enabling Planners To Effectively Access Geo-enabled Decision Tools (Example 2, DOE)

Tomorrow's forecasts: projections of most-likely, best-case, and worst-case scenarios of socioeconomic impacts—e.g., probability and duration of power loss by city block.



Critical Power Grid Infrastructure Impacts: Hurricane Dennis Landfall +6, 12, 18, 66, 108 hrs

Mission Multipliers and Cost Savers: Towards Shared Enterprise Capabilities



 Potential Shared Enterprise Capability

Virtualization—The Way Forward...

- **GEOSS Decision Support Challenge**
 - The world is changing at an incredible rate—dramatic change
 - Environmental change on our planet brings tremendous unknowns
 - An increasingly complex, interdisciplinary problem
 - Traditionally isolated disciplines are now connected
- **EMLoB, like GEOSS, is best solved as a shared enterprise**
 - Distributed web services architecture is key
 - SOAs facilitate cost-effective sharing of diverse services
- **Paradigm shift in data access/delivery/analysis services**
 - Suggests the need to enable interactive, distributed data analysis
 - Services should support interactive geo-enabled analysis
 - Architectures can virtualize access to distributed data services
 - Suggests the need to support remote query, access, and computation
 - Decision support and geospatial analysis services are coupled to other services
 - State variables should always be accompanied by understandable uncertainties