



Geospatial Cloud Computing: An Eye Towards the Future

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Promising Features of Cloud Computing for Geospatial Data and Analytics

- Software as a Service (SaaS):
 - Flexible, scale, on-demand & Pay as you go
- Platform as a Service (PaaS)
 - Flexible, scale, on-demand & Pay as you go
- Infrastructure as a Service (IaaS)
 - Flexible, scale, on-demand & Pay as you go
 - Elastic, highly reliable with quick response at peak periods



Promising Features of Cloud Computing for Geospatial Data and Analytics

- Data as a Service (DaaS);
 - Multi-tenancy, system configuration to be a pooled and shared resource by many institutions and governments enhancing the ability to discover and share data
 - Ability to access this storage intensive (raster) data quickly and given the low cost the ability to store more time dependant/historical data
 - Pay as you go for data access may provide promise for a business model that in the long-term could support the financing of the NSDI



The Promise of the NSDI

- Consistent means to share geographic data among all users could produce significant savings for data collection and use and enhance decision making. [Executive Order 12906](#) calls for the establishment of the National Spatial Data Infrastructure defined as the technologies, policies, and people necessary to **promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors, and the academic community.**



The National Geospatial Advisory Committee

- The National Geospatial Advisory Committee (NGAC) is a Federal Advisory Committee sponsored by the Department of the Interior under the Federal Advisory Committee Act. “The Committee will provide **advice and recommendations** related to management of Federal and national geospatial programs, the **development of the National Spatial Data Infrastructure**, and the implementation of Office of Management and Budget Circular A-16 and Executive Order 12906. The Committee will **review and comment upon geospatial policy and management issues** and will provide a **forum to convey views representative of non-federal stakeholders in the geospatial community**.



NGAC GeoCloud Game March 23, 2010

- Geospatial Cloud Computing Workshop **designed to increase awareness and understanding of cloud computing issues.** The workshop will feature a “war-game” designed to allow members of the NGAC, FGDC Executive Committee, and geospatial professionals within government to gain understanding and **common language around the challenges involved in migrating to cloud computing technology and the risks and rewards associated with this migration.** This game has been designed to **simulate the issues** we face as a nation in the development and deployment of the National Spatial Data Infrastructure. The game has defined roles for Federal/Tribal, State and local governments as well as the Private sector. Issues associated with the collection and sharing of spatial data across governments, the impacts of outdated policy and the shortage of skilled personnel have been designed into the game as well as other contemporary dilemmas we face.



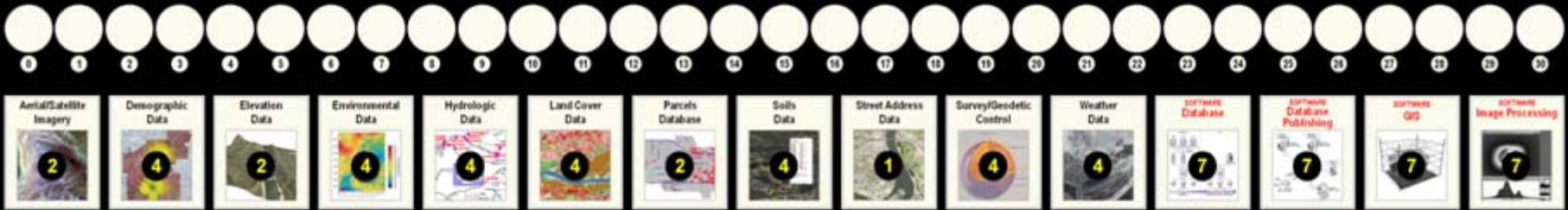
Game Design Criteria

- Designed as a game not a simulation
- Designed to drive collaboration (sharing) and to highlight the interdependencies of multiple layers of government in solving mission driven geographic problems
- Designed to highlight variability in resolution of spatial data between governments
- Designed to highlight the importance of policy, process and risk mitigation and the variability in resources to support these activities between Federal, State and Local governments

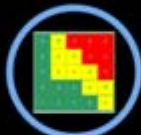
Federal Government Console



Federal Infrastructure



Potential Federal Tasks



Mitigation Investment
To Mitigate Message:
Pay 1 Resource
Die Roll must equal 4, 5, or 6



Transactions from State



Transactions to State

2 Resources to Place each Resource



1 Resource to Place each Resource



0 Resource to Place each Resource



Transactions from Local



Policy Investment
To Pass Policy Check:
Die Roll + Investment must equal 5 or more
Failure = No MVP



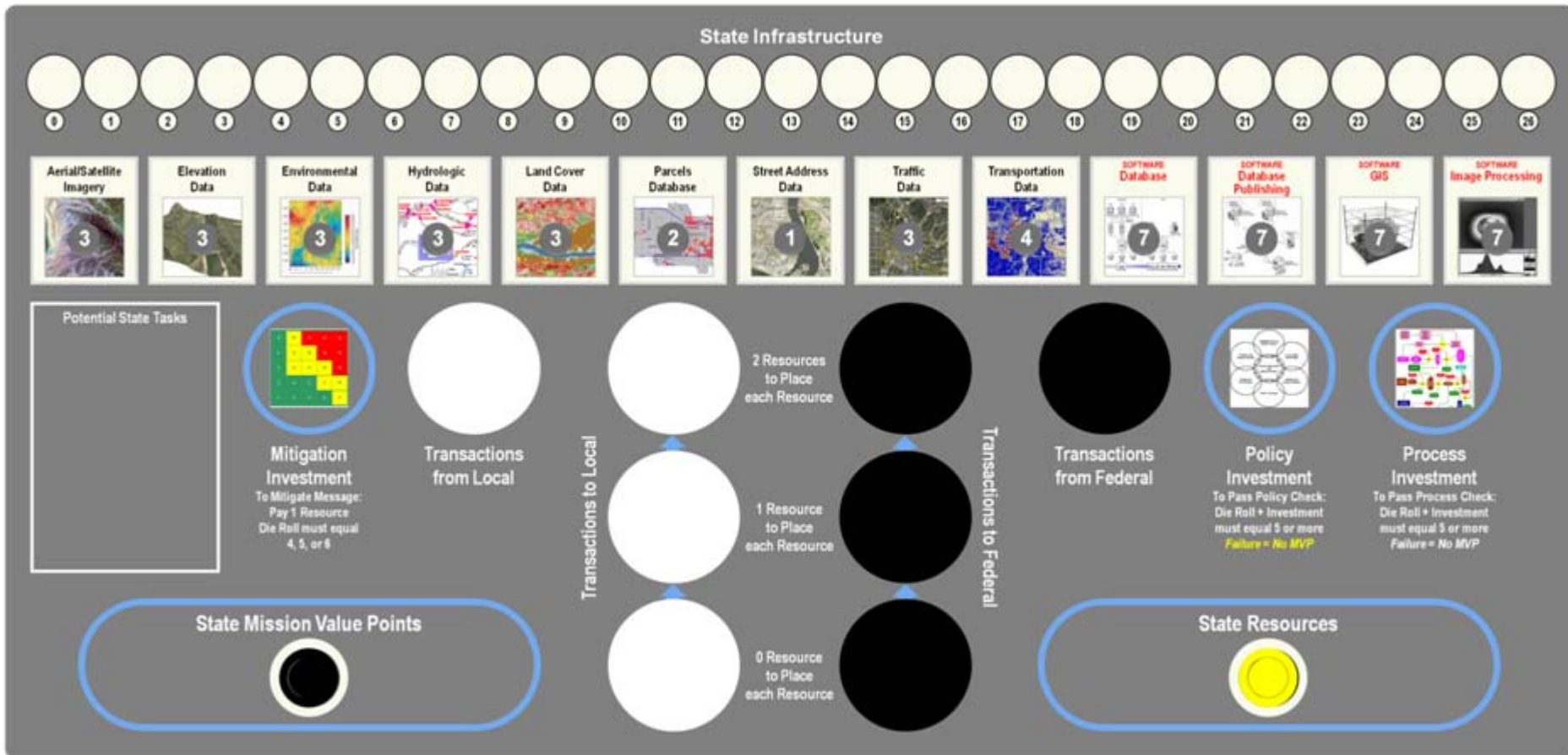
Process Investment
To Pass Process Check:
Die Roll + Investment must equal 5 or more
Failure = No MVP

Federal Mission Value Points

Federal Resources



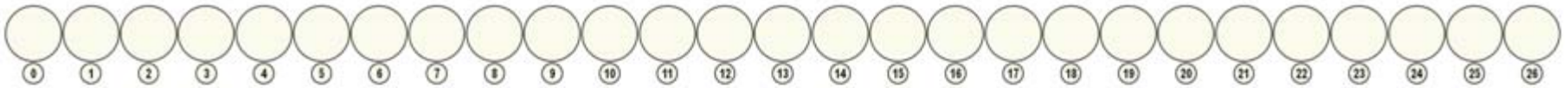
State/Regional Government Console





Local Government Console

Local Infrastructure



Potential Local Tasks



Mitigation Investment

To Mitigate Message:
Pay 1 Resource
Die Roll must equal 4, 5, or 6



Transactions from Federal

Transactions to Federal



2 Resources to Place each Resource



1 Resource to Place each Resource



0 Resource to Place each Resource



Transactions to State



Transactions from State



Policy Investment

To Pass Policy Check:
Die Roll + Investment must equal 5 or more
Failure = No MVP



Process Investment

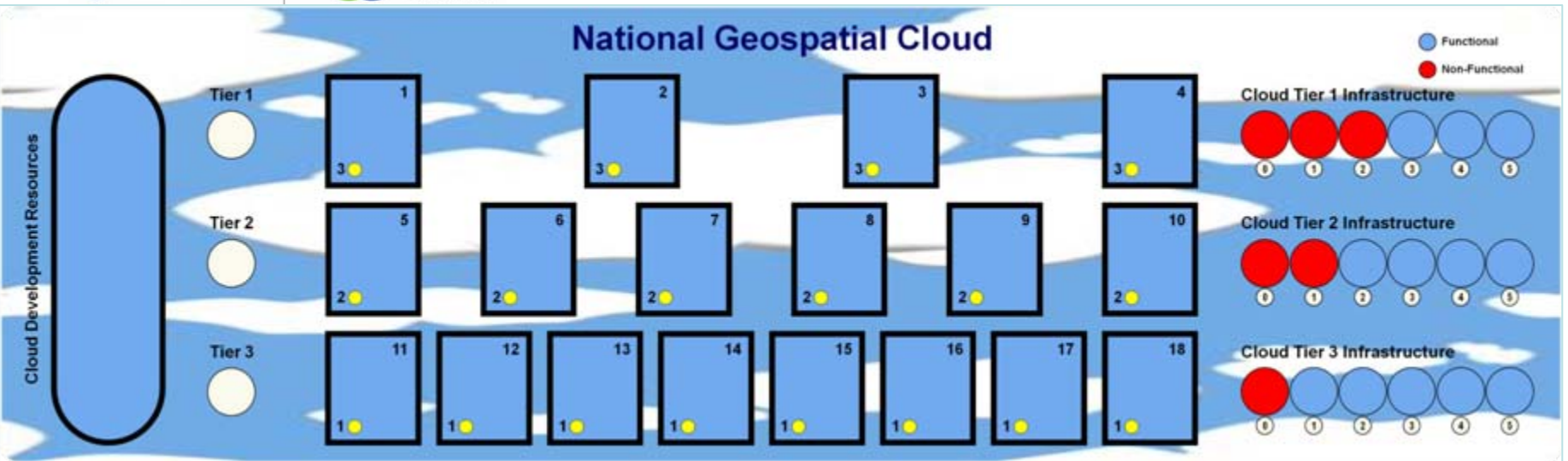
To Pass Process Check:
Die Roll + Investment must equal 5 or more
Failure = No MVP

Local Mission Value Points



Local Resources





- Cloud Tiers
 - Supports 3 tiers
 - Only tier can be tooled during each allocation phase
 - Deployment costs are cheaper in the higher tiers
- Cloud Infrastructure
 - Tier 1 requires 3 resources to active and supports 3 additional redundancy resources
 - Tier 2 requires 2 resources to active and supports 4 additional redundancy resources
- Cloud Data and Software
 - Data and software can be deploy in the cloud by any role during the allocation phase
 - Cloud data and software can be used by any role to accomplish tasks

0 0 ② Task 9: Local 

Improved ease of accessibility to your datasets has enabled potential collaborators to partner with you to improve your data resolution.

If you have at least 3 **available** Organizational Infrastructure points, gain 1 Mission Value Point.

Maintenance Check (maximum of 4 Resources)

1 8 ① Task 8: State

Your Geospatial Segment Submission has been poorly rated by OMB.

Unless you have at least 2 Resources invested in Policy, lose 1 Process Resource.

Process Check

1 4 ① Task 13: Federal

Your deployment of social networking tools for citizens to report service problems has dramatically improved your data maintenance program.

If you have at least 4 **available** Infrastructure points, gain 2 Mission Value Points.

2 0 ① Task 14: Local or State

Limitations in your data storage infrastructure require that you discard older data versions in order to make room for newer data.

Lose 2 **available** Organizational Infrastructure points.

Maintenance Check (maximum of 4 Resources)

2 2 ② Task 7: State

Your cost of data distribution has been reduced due to your use of the inherent data dissemination facilities provided by the cloud.

If you have at least 2 Datasets in the Cloud, gain 2 Resources.

Maintenance Check (maximum of 4 Resources)

0 8 ③ Task 8: Local or Federal 

Your lack of adherence to metadata standards has led to low utilization of your services and loss of (revenues or interest) from your organization.

Lose 1 Resource from a Transaction Track.

0 9 ① Task 4: Local

Vast amounts of your Organizational geospatial data remain underutilized and unavailable for critical decision making due their ill-defined format, quality and accuracy.

Lose 1 Policy Resource.

Process Check

1 9 ① Task 4: Local or Federal

Your lack of cross agency coordination policies has resulted in the development of redundant and conflicting datasets for an environmental monitoring task.

Unless you have at least 2 Resources invested in Policy, lose 2 Organizational Datasets.

2 1 ② Task 8: Federal

Your lack of participation with the FGDC has left you out of an exciting new project with significant funding.

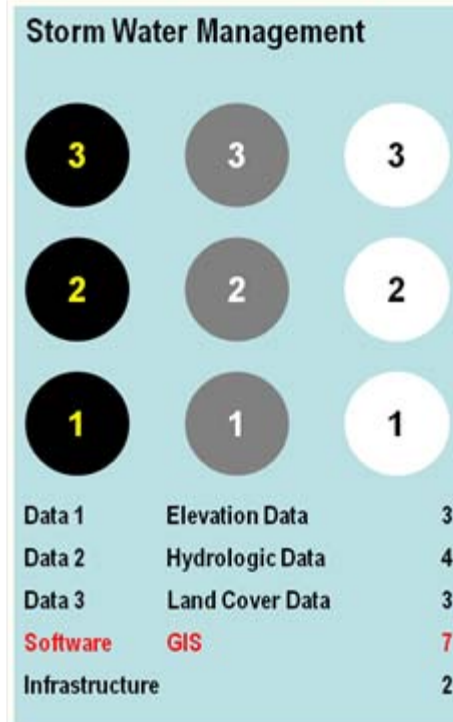
Unless you have at least 2 Resources invested in Policy, lose 1 Organizational Dataset.

3 0 ③ Task 10: Local

As the recognized authoritative data source for Street Address Data, cloud-based data metering tools have provided you with statistics on the data usage patterns and enabled you to make the case for more funding of your data collection programs.

If you have at least 2 Resources invested in Policy, gain 2 Resources.

Tasks



- Each task can be started at levels 1, 2, or 3
- Tasks require data software and infrastructure at specified levels
- Player may not necessarily possess required task resources (data, software, infrastructure) at the specified levels
- Tasks accomplished with software in the cloud do not expend organizational infrastructure



The Results

- It was complicated!
- Our players in general were not accustomed to playing war-games or simulations
- It took several rounds for the players “ to get it” !
- By the end of the allotted play time they were fully engaged and would have liked to continue



What Worked!

- The game successfully pointed out the importance of
 - Collaboration and sharing
 - The varying fidelity of spatial data between federal, state and local agencies
 - The interdependencies of these data sets in solving real-world geospatial opportunities/problems
 - The importance of role-playing to think through and experience complex organizational behavior issues
 - The importance of guiding policies and process to facilitate process between and among government agencies



Take Aways and the Implications for the GeoCloud

- Cloud technology holds great promise for the realization of the NSDI
- Much work needs to be done around data standards process and metadata documentation as data moves more frequently
- Much work needs to be done around the business model of the cloud and particularly the pay-as-you-go revenue stream for DaaS
- Policies need to be implemented to support the movement to the cloud.



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