

Supporting Information Centric Operations with Geographic Information Systems

David Swann
Defence Business Development
ESRI
dswann@esri.com

Agenda

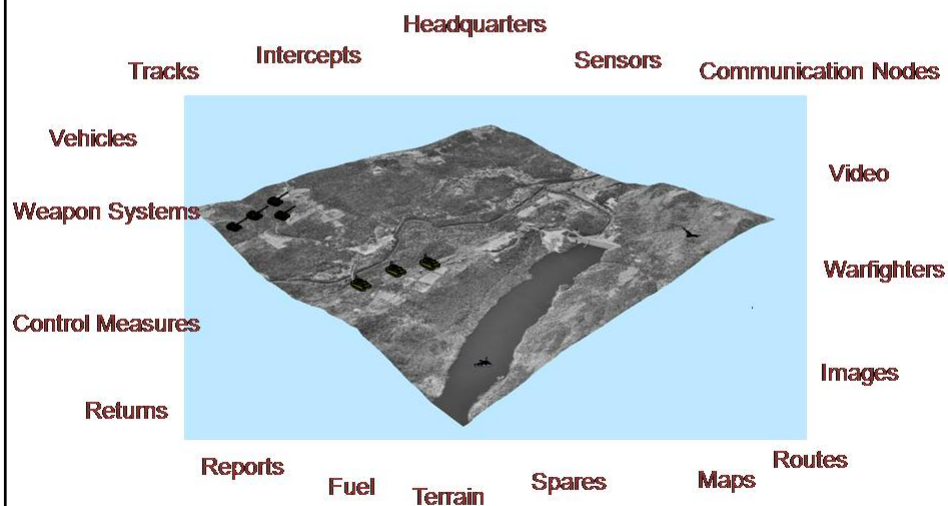
- Why GIS?
- Information Centric Operations
- Prioritizing the Flows of Information
- Types of Information flow
- The role of standards in establishing continua
- Coping with bandwidth – GIS strategies

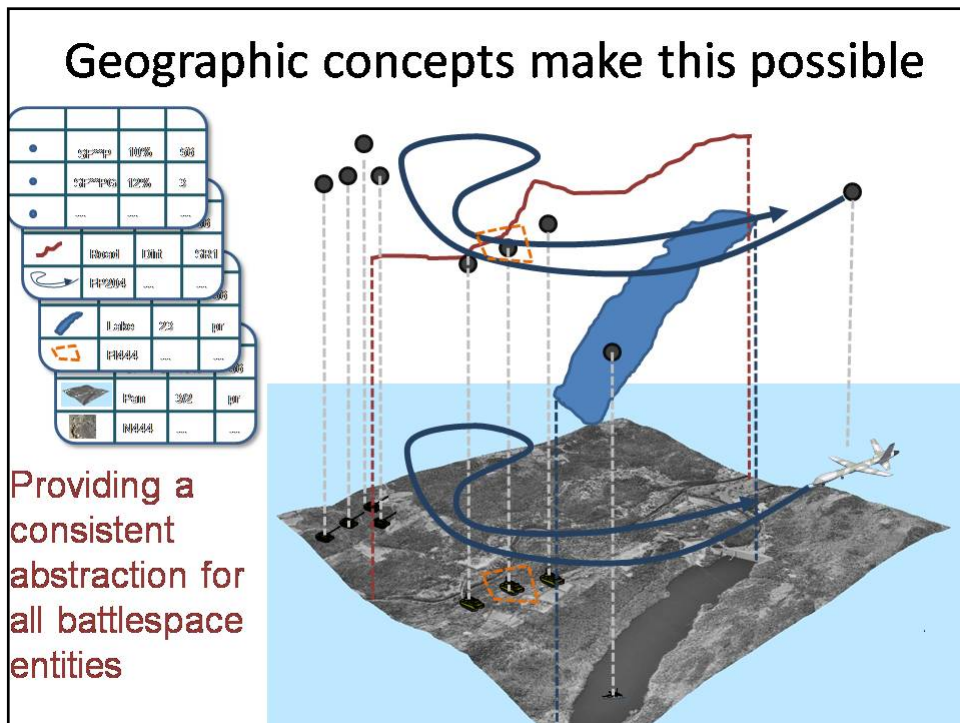
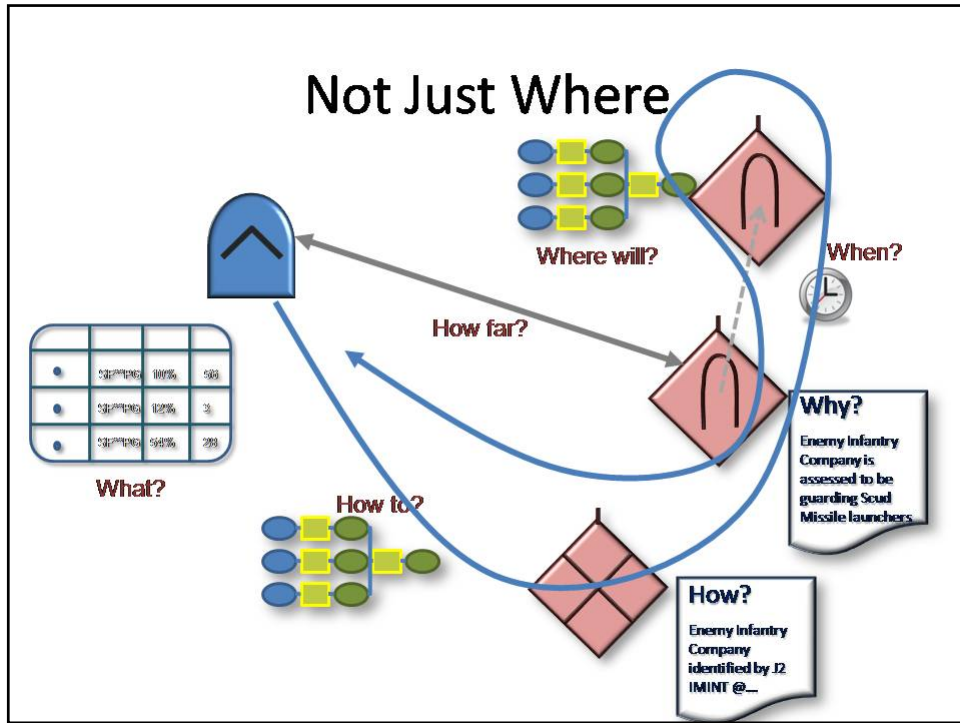
Why Geographic Information Systems?

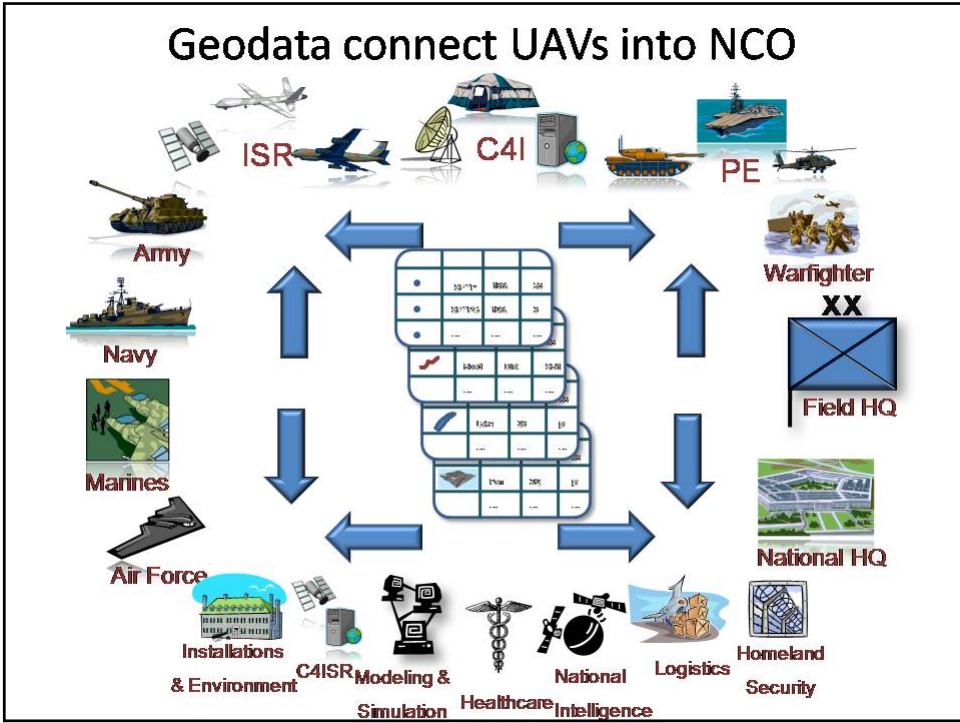
Beyond Dots on the Map

Page 3

Because Everything is Somewhere







Information Centric Operations

A focus on the Purpose, not just the Bearer

Why Geospatial Information Matters

- Geospatial Information is huge – pipes are small
- The world changes, geospatial information changes, the user needs to know (CONSTANTLY)
- Only Video Teleconferencing consumes more bandwidth
- Lots of people understand VTC... few understand GI
- GI needs to form continua:
 - Producer to Warfighter
 - Ministry of Defence to Warfighter
 - Sensor to Decision Maker to Shooter
- GIS concepts and techniques offer many immediate solutions to cope with the bandwidth that's here now

Page 9

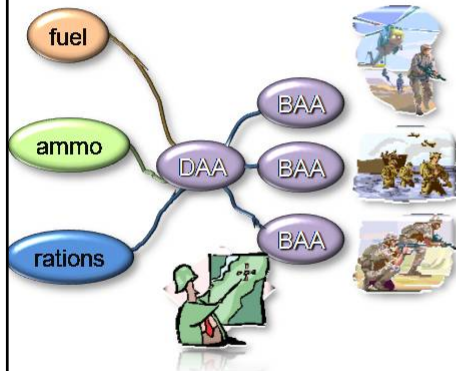
Why Network Centric Operations not Information Centric Operations?

- If the only tool is a hammer (more bandwidth), everything looks like a nail (haven't got enough bandwidth)
- Networks can be readily acquired using existing (vertical) acquisition processes
- Information challenges existing processes because it must be implemented horizontally to be useful.
- Think about Materiel Logistics... then think about Information Logistics

Page 10

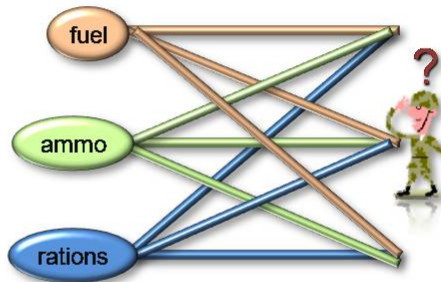
Material Logistics

Material-Centric Logistics



- Logistics Staff plan, command and control the flow of prioritized materiel across existing road networks
- Engineers maintain the road network

Road-Centric Logistics

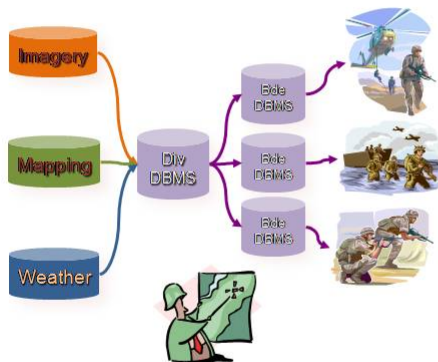


- Road planners determine that brigade needs for materiel can only be met with kilometer-wide roads.
- The plan is delayed until the Engineers build kilometer-wide roads

Page 11

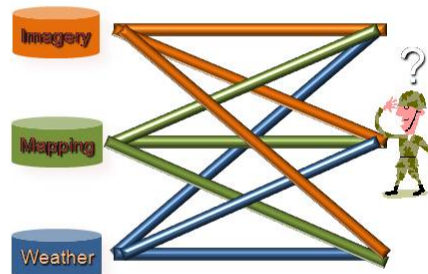
Information Logistics

Information-Centric Operations



- Information Staff plan, command and control the flow of prioritized information across existing bandwidths
- Communication Engineers maintain the communications network

Network-Centric Operations



- Network Engineers determine that brigade needs for information can only be met with Gigabit networks.
- Information flows are delayed until the Gigabit network is acquired

Page 12

Prioritizing the Flows of information

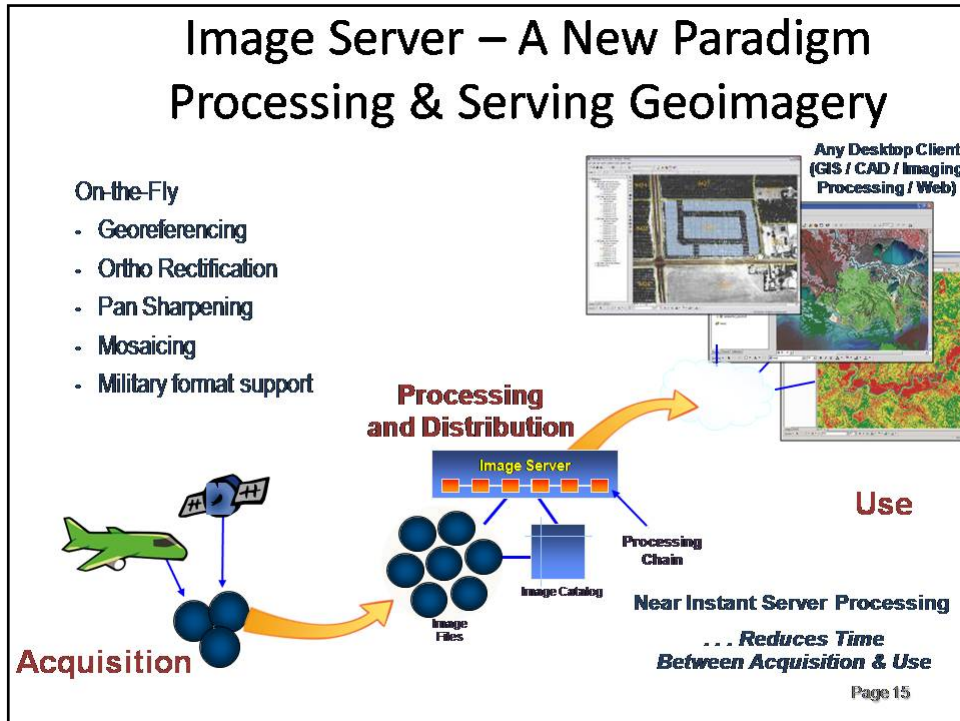
Is your journey necessary?

What pixels are important?

- A theater holding of imagery might be vast
- 99.99% of full resolution pixels will never even be viewed – by anyone! That leaves a smaller amount of potentially useful data
- The warfighter's immediate target might be covered by a small tile of imagery
- But only 1% of those pixels matter – the warfighter's information needs might be satisfied with an amount of actionable information that can be realistically transferred on available bandwidth

• 400TB
• 400GB
• 10MB
• 100Kb

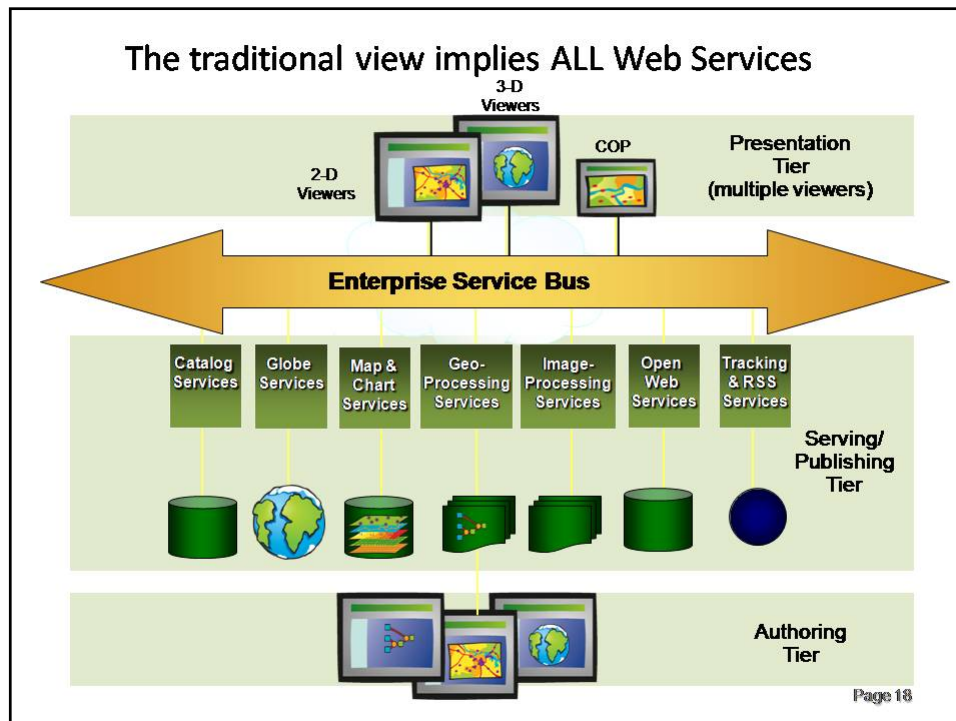
What if there was a technology to selectively and on-demand transfer 100kB from that 400TB archive? Page 14



- ## Mapping & Imagery as services versus Mapping & Imagery as products
- **Products** – all or nothing, when you get it
 - A CD-ROM of CIB is 650MB
 - A CD-ROM of VMAP is 650MB
 - A file of NITF is 4GB
 - **Services** – what you need, when you need it
 - The warfighter caches the 10MB of 5m resolution pixels that will matter for the next 24 hours
 - The warfighter accesses the 40kB service of 1m resolution pixels that matter... now
- Page 16

Types of Information Flow

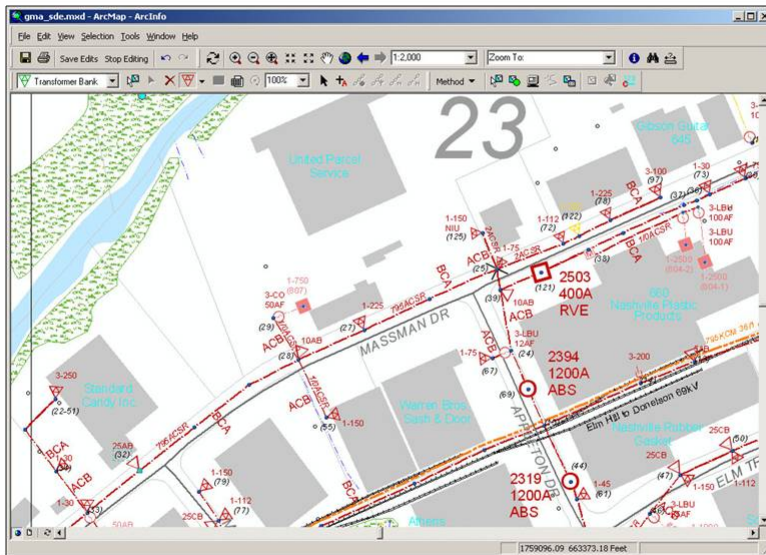
All information flows are not equal



The role of Standards

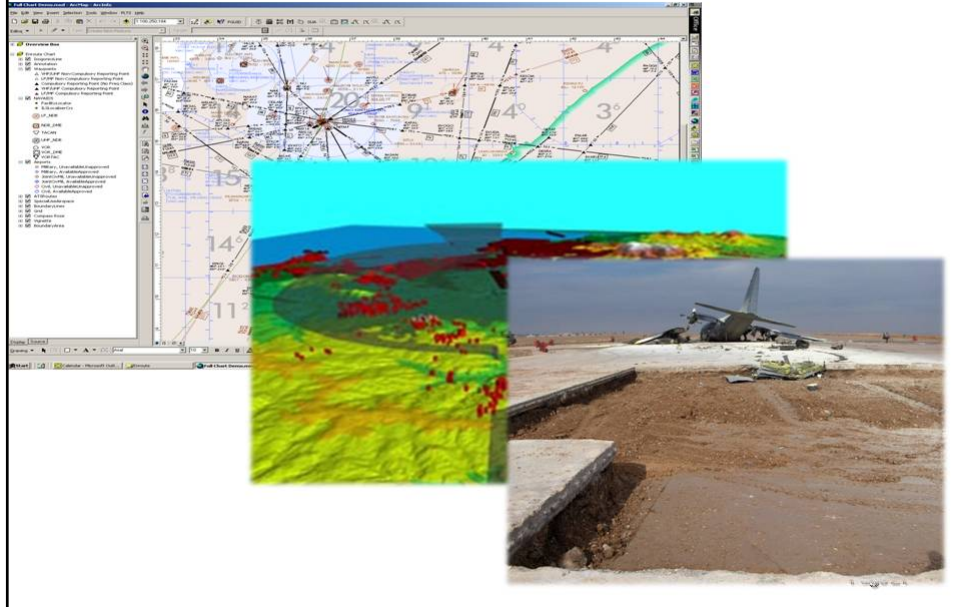
Establishing Continua

Some continua will demand bridging between



From State watching (1:50,000) to People watching (1:500) Page 20

Some continua demand semantic consistency



Coping with Available Bandwidth

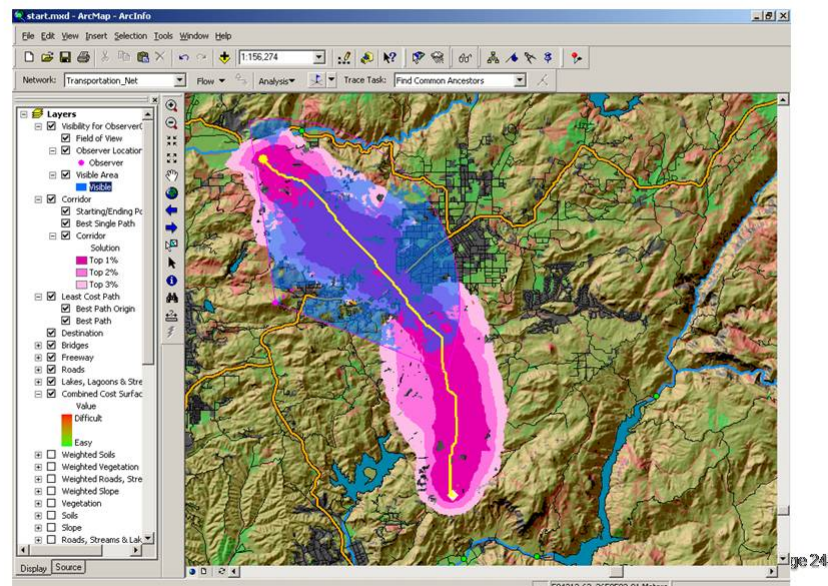
Squeezing more through the pipes

Squeezing more into less – GIS Strategies

- Analysis – compressing TB of data into MB of actionable terrain information
- Web Services – sending only the pixels needed
- Off-network transactions – only using the network for high-priority information
- Layers – a mechanism for prioritization
- Separating Data, Business Logic & Presentation – assembling an information system to fit the bandwidth
- Application independence from data source – applications remain constant as bandwidths increase (and capabilities grow)

Page 23

Advanced Analysis – from Data to Knowledge



Analysis compresses data into actionable information

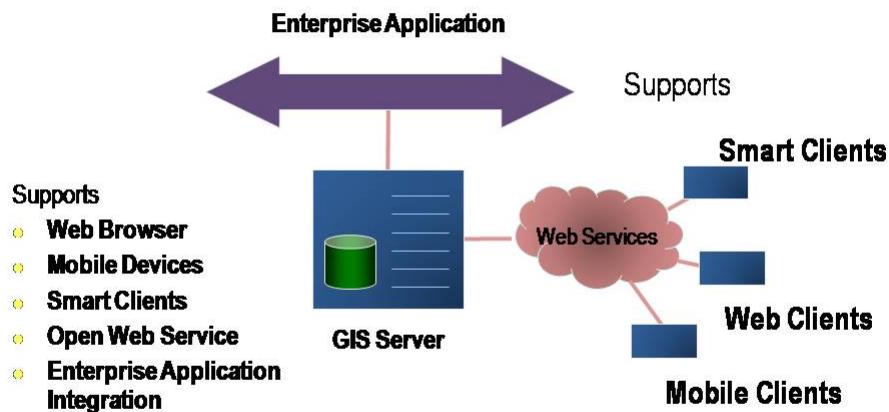
Many GB of raw data

A few MB of actionable information

- Done once, this is interesting.
- Done throughout a SOA – this enables Information Centric Operations on existing networks

GIS Server

Serving Actionable Information throughout a SOA



... Based on modern IT standards while respecting defence and GIS standards

Off-network Transactions

- A 1TB data brick traveling 1000 km at 50km/h has a bandwidth of 50GB/h... 140mb/s... probably better than any WAN available.
- GIS users in many domains need to maintain data integrity off network... strong techniques already exist
 - Replication
 - Check out

Page 27

Layering Data

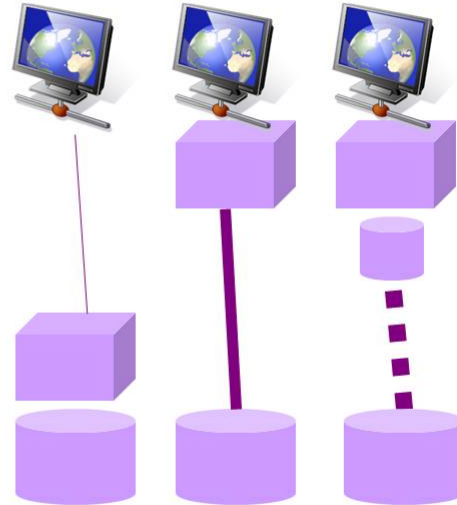
- **How important is that data?**
 - Imagery is useful as a backdrop
 - Road information is critical to develop my logistics plan
 - Elevation data is essential for visibility studies to support RF planning
- **How important is the timeliness of that data?**
 - As a backdrop, monthly update of imagery is adequate
 - I need to understand how today's road closures will impact my logistics plan
 - Elevation data doesn't need to be updated
- **What areas of data are important?**
 - This key ground needs up to date imagery NOW
 - I'm only interested in up-to-date road information covering my logistics plan
 - I need higher resolution elevation data of this key ground
- **How important is it that change is immediately reflected?**
 - This key ground needs imagery showing battle damage
 - A bridge closure must be immediately reflected
 - I don't need to reflect elevation change urgently

Page 28

Separating Data, Business Logic & Presentation



When Data, Business Logic & Presentation are tied together ALL data has to come to the user



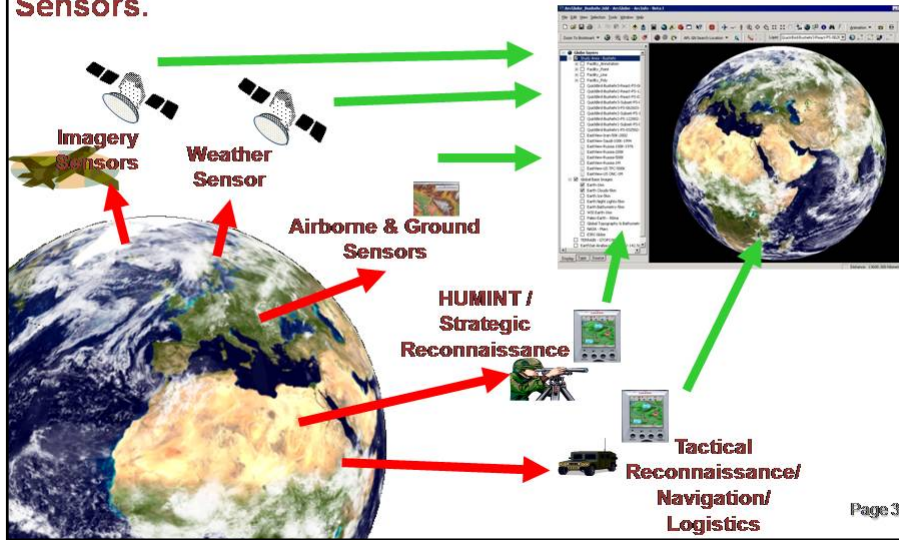
When Data, Business Logic & Presentation are separated, choices can be made based on available bandwidth

Page 29

Bringing Everything Together

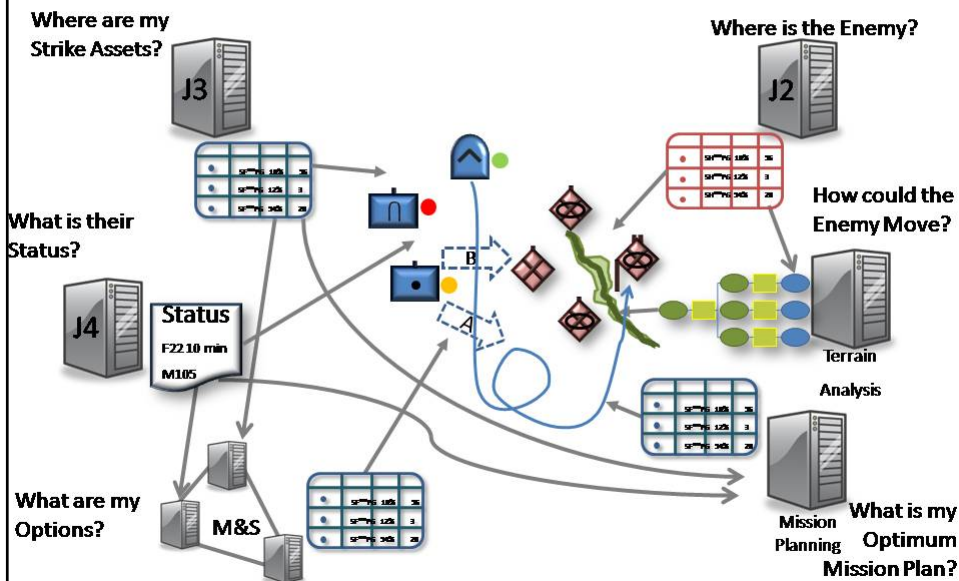
The Vision

Situational Awareness Derives from Direct Connections to Sensors.



Using a GeoSOA to Make Better Decisions

How can I effectively Strike the Enemy?



Conclusions

- A focus on information rather than network encourages new approaches.
- Understanding information priority is important
- Information priority establishes appropriate information bearers
- Standards play a critical role in establishing information continua
- GIS offers many concepts and techniques for coping with existing bandwidth

Page 33

Questions?