Knowledge On-Demand

Future Legal and Policy Requirements

Lesley Arnold
Smart Phone is our ubiquitous connection to the real world

3.6 Billion unique users\(^1\)

50% uptake = global average

Potential to leapfrog fixed-line technology

1. [https://www.statista.com/topics](https://www.statista.com/topics)
Questions and Answers

Questions unpredictable

Leave the data where it is and let the analytics do the work

Is this land likely to be flooded

How much land was cleared illegally in last 5 years

Should we evacuate now
On-Demand Knowledge
Road Block 1 – Hardcoded Analytics

How long before the fire reaches my property
Semantic Web – Making Data Smart

Third stage in the Evolution of the Web

- Web 1.0: One-way interaction
- Web 2.0: Two-way participation
- Web 3.0: Linked Data (Semantic Web)
Unprecedented sources of machine-readable data

50 billion IoT devices by 2020\(^1\)

Capacity to generate and infer new Knowledge

1. https://www.statista.com/topics
AI Landscape for Knowledge On-demand

- Speech Recognition
- Natural Language Processing
- Machine-learning
- Deep-learning
- Predictive Apps
- Image Recognition
- Knowledge Representation
  - Ontologies
  - Vocabularies

New tools for next-generation spatial infrastructures
The Traditional Query Process

Time consuming manual process

Query → Process → Data

DataProcessQuery

Time consuming manual process
Knowledge On-Demand Query Process

Query

Process

Linked Data

Ability to infer knowledge Automatically
Government can support innovative query applications by publishing machine-readable data

The market will establish new business models
Major Differences
Next Generation Infrastructure

Designed for Knowledge-OUT

Open Query Applications

Linked Data accessible via the Web

Global data integration
Semantic Web Future

Linked Data

Government Data Stores → Data on the Web

New Insights ← Rules

Semantic Web → Data Integration
Who owns the new insights.

Will inferencing/auto aggregation reveal national security
Intellectual property rights do not generally apply to facts and “information” per se, but rather the maps, images and datasets
Data Release - Self descriptive
Digital Rights Management

Lead-in with Data Request

Encrypted data

Copy, decrypt, and write
Knowledge On-demand requires a rethink and redesign in the way data and supporting services are structured (Digital handling)
Next Generation Systems

Answers to questions NOT access to data
Queries need to be context dependent.

Will this home be flooded?
Information Privacy?
Open Query Process

APPLICATION

1. Execute the query
2. Interpret the question
3. Retrieve data resources
4. Process the query
5. Portray the answer
6. Rank/Rate answers quality

Deliver Answer

APP TOOLS

- Speech Recognition
- NLP, Profiling
- Semantic Search
- Spatial Filtering
- Domain and Process Ontologies
- WMS Text, graph, voice, video
- Provenance Trust Models
Natural Language Processing
Used to decompose a human query.
Machine learning used to infer meaning

Will my home ever be flooded?
Future Time
Place/area
Submerged by water

Interpret the question
Retrieve data resources
Process the query
Portray the answer
Rank/Rate answer
Semantic Search and Spatial Filtering
Identifies and filters data relevant to a user's query and context
Improves simple metadata searches

Will my home ever be flooded?

Building Footprint/Land parcel

GPS Coordinate or Address

Flood Risk Map
The knowledge to answer a question initially comes from humans.


Machines learn from this knowledge.
Domain Ontologies are used to represent knowledge in a particular domain. They are shareable and reusable.
Need for ontology for data licensing and use
Data Release Ontology

Understand what elements exist and how they relate

Dataset
- Access Category
  - Open Access
  - Restricted
  - Confidential
- Value
  - Not to be Released
  - Public Domain
  - Commercial
  - Non-Commercial (copyrighted)
  - Freemium
- Licence
  - Free
  - Cost Recovery
  - Full-commercial

User
- Action
  - View only
  - Query
- Type
  - Citizen
  - Government
  - Academia
  - Business

Rules:
Can only have one access category
Data Release Ontology

Can Manage Intellectual Property

Global Dataset can be accessed by:

- Sri Lanka
- Vietnam
- Australia

User:
- Action:
  - View only
  - Query
- Type:
  - Citizen
  - Government
  - Academia
  - Business

Rules: Creative Commons
Data Release Ontology

Can be Shared

Map Portal

Access Services
- Catalogue
- Metering
- View/download

Data Release
- Security
- Licensing
- Ecommerce

Ontology

The Web
Process Ontologies are used to compile, coordinate and run a series of processes to answer a query. They are shareable and reusable.
Global Geospatial Community Issue – who owns the ontologies

Policies for sharing Knowledge Representation
Ontology Libraries Exist

Developers need not start from scratch

Linked Open Vocabularies (LOV)
Ontology Libraries Exist

Developers need not start from scratch

There is a need to coordinate these knowledge repositories
Portray Answers
Query dependent
Application dependent
User preference dependent e.g. Google™
Who owns the visualisation of a query response
Portray Answers
Query dependent
Application dependent
User preference dependent e.g. Google™

Interpret the question → Retrieve data resources → Process the query → Portray the answer → Rank/Rate answer
Ranking according to accuracy
Rating according to relevance
No models currently exist for geospatial analytics/queries

Interpret the question
Retrieve data resources
Process the query
Portray the answer
Rank/Rate answer
Provenance
New level for Warrantability
Legal/policy issues
Publishing data
Third party
DRM
Next Generation infrastructure

Designed for Knowledge -OUT

Open Query Applications

Linked Data accessible via the Web

Global data integration

Diagram showing the flow of data from various users (GIS Users, Mobile Users, Business App Users, Web App Users) through different applications (Browse and Retrieve, Open Query Application, Fixed Query Application, Open Query On-demand Applications) to the Web of Data, which connects to Global Data Resources via HTTP. The diagram also shows the integration and analytics processes, with data silos at the bottom.
<table>
<thead>
<tr>
<th>Problems</th>
<th>Solutions</th>
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| Data Custodians do not understand their responsibility | Data Custodianship policy and guidelines  
Mandates  
Data Framework  
Data Sharing and Release Act  
National Geospatial Strategy (datasets recognised as being of national importance) |

<table>
<thead>
<tr>
<th>PEST</th>
<th>IGIF Part 2</th>
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<table>
<thead>
<tr>
<th>Consequences</th>
<th>Measures</th>
</tr>
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</table>
| Information Not shared, not usable  
No obligation about open data  
Uncertainty – what should be open  
Priority – no mandatory obligation  
Accountability – better safe than sorry | Increase in use of standards – thus interoperability  
Increase in accessible data  
Increase in use of data  
Increase in applications developed using data  
Economic growth |
Goals

• Legal and Policy Strategic Pathway (Achieving IGIF Goals)
  • Establish practise examples, implementation approaches,
  • Licensing and pricing frameworks
  • Coherent legal, data and technical infrastructure

• Privacy, Digital Rights Management and Data Security
  • Data protection laws
  • Balance access and privacy
  • Data release classifications

• New Technologies (Risk, new laws, vehicle/phone tracking)
  • Drones
  • Digitalisation first choice (linked data?)
  • Autonomous vehicles
  • The U.S. government works to minimize human sources of GPS interference through spectrum regulations (domestic and international), interference detection and mitigation efforts, and law enforcement.
  • Legislation needs updating re new technologies

• Data Usability (Increase Digital Maturity) (Open data, sharing, standards)
  • SDGs – integrated geostatistical data

• Legal Interoperability, Collaboration, Multidisciplinary Approaches, Global Networks
  • Communication tools for policy development but also recognise L & P documents are a tool for communication
  • Mandates
  • The part L and P places in sustainable digitisation
  • Working in a legal and ethical environment
  • Support innovation
  • Alignment across Ministries
  • Policy for Supply chain alignment (Process as well as alignment to government strategy and initiatives)
Benefits of legislative reforms to ensure geospatial programs progress

- Improves business competitiveness
- Better services for citizens
- Supports preparedness and comprehensive security
- Maintains and develops efficient administrations
- Improve Digital Maturity
- Tools for Stakeholder engagement
Why Policy Fails!
Get the Order right

1. Strategy
   - Delivers
   - GOAL = Reduce number of deaths on roads

2. Policy
   - Enforces Policy
   - Bring in speed limits

3. Legislation
   - Fines for driving over the speed limit
Get the Timing right

Allow for Transition
Get the Timing right
Allow for Transition

Policy

Capability
Communication
Processes
Communicate How

Policy

Guidelines
Procedures
Standards
Tonga

• People. Business, land
• Land = social political and environmental connotations
• No Survey Act
• Climate Change is significant issue
• Sufficiently resourced to achieve strategy for sustainable development
• Strategy – With National Action Plans
• Pacific Geospatial and surveying Council strategy 2017-2020.
• Challenge not to lose momentum
• Partners NZ Surveyors (LINZ) and Australia
• Building blocks are not there – modern geodetic reference framework