



Spatially Enabling
Australia and New Zealand

Next Generation Spatial Information Infrastructure

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Australian Government
Department of Industry and Science

Business
Cooperative Research
Centres Programme

What is the CRC SI?

- A CRC is a 'Cooperative Research Centre' setup through the Business Cooperative Research Centres Programme
- Funded through Government and Industry (investing over \$180 million*) to conduct user-driven research in spatial information that address issues of national importance.
- Our partners include federal and state government agencies, universities and over 50 companies.

Research Programs

- **NATIONAL PRECISE POSITIONING**

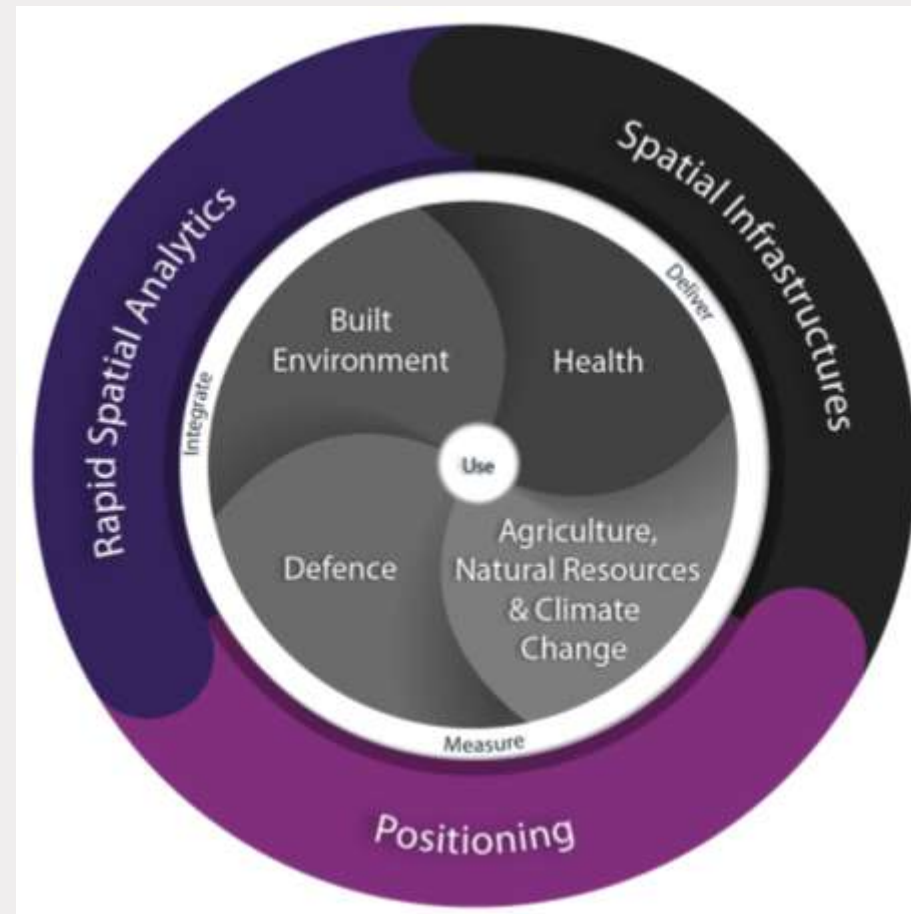
Focused on solving multi satellite (GPS etc.) signal processing and economic impediments to the creation of precise positioning services operating at less than 2 cm (x/y) accuracies.

E.g. supports autonomous operations such as remote mining.

- **RAPID SPATIAL ANALYTICS**

Improve the lag between data capture to valued information generation through automation, from devices and cloud-based infrastructure.

E.g. Provide answers and not just data.
Internet of Things / Sensor Networks

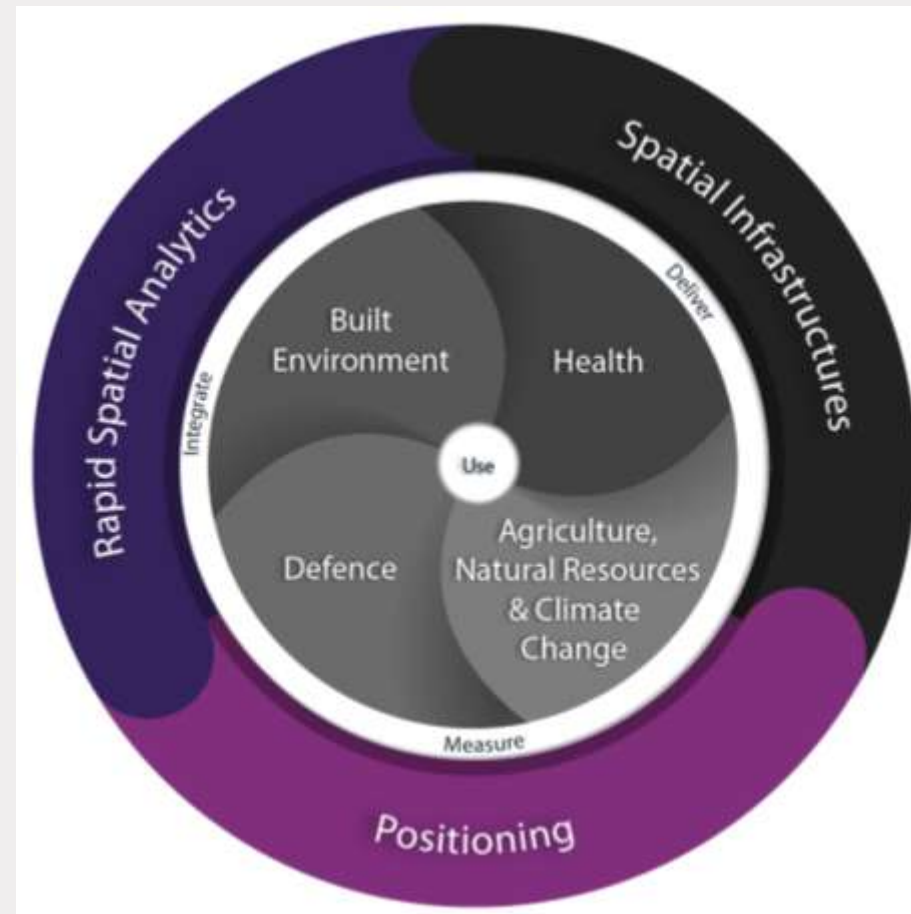


Research Programs

- **NEXT GENERATION SPATIAL INFRASTRUCTURES**

To identify and exploit the emerging capabilities of the semantic web to enable smarter and automatic data linkages along an information supply chain to create value-added applications.

E.g. Information discovery, linkage and output generation through smarter data models and cloud services to link.



Research Programs

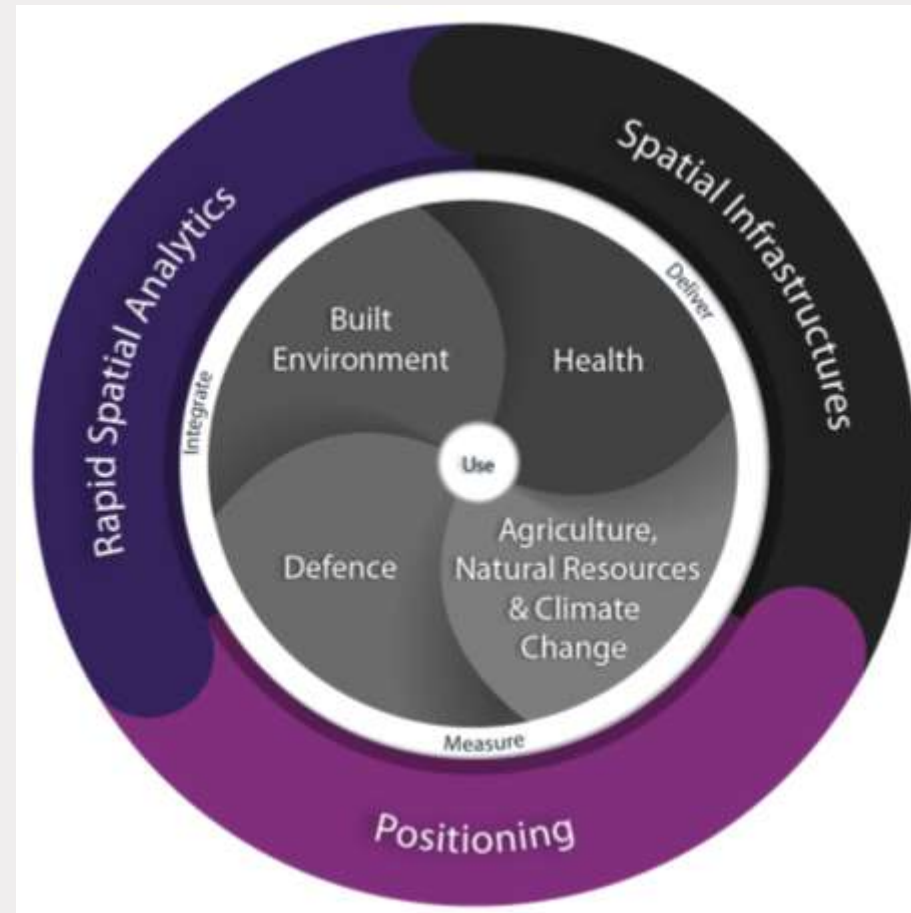
- **APPLIED RESEARCH**

Agriculture, Natural Resources and Climate Change (4.1): applying ways to automate estimation of biomass and improve carbon monitoring systems on farms and through improved environmental monitoring tools;

Defence (4.2): by adapting the capabilities of CRC·SI's research portfolio;

Health (4.4): by helping agencies to spatially enable their clinical databases and improve service delivery;

Built Infrastructure (4.5): Applying economic focus to spatial modelling supporting sustainable built infrastructure development.



Research partners...



Government partners...

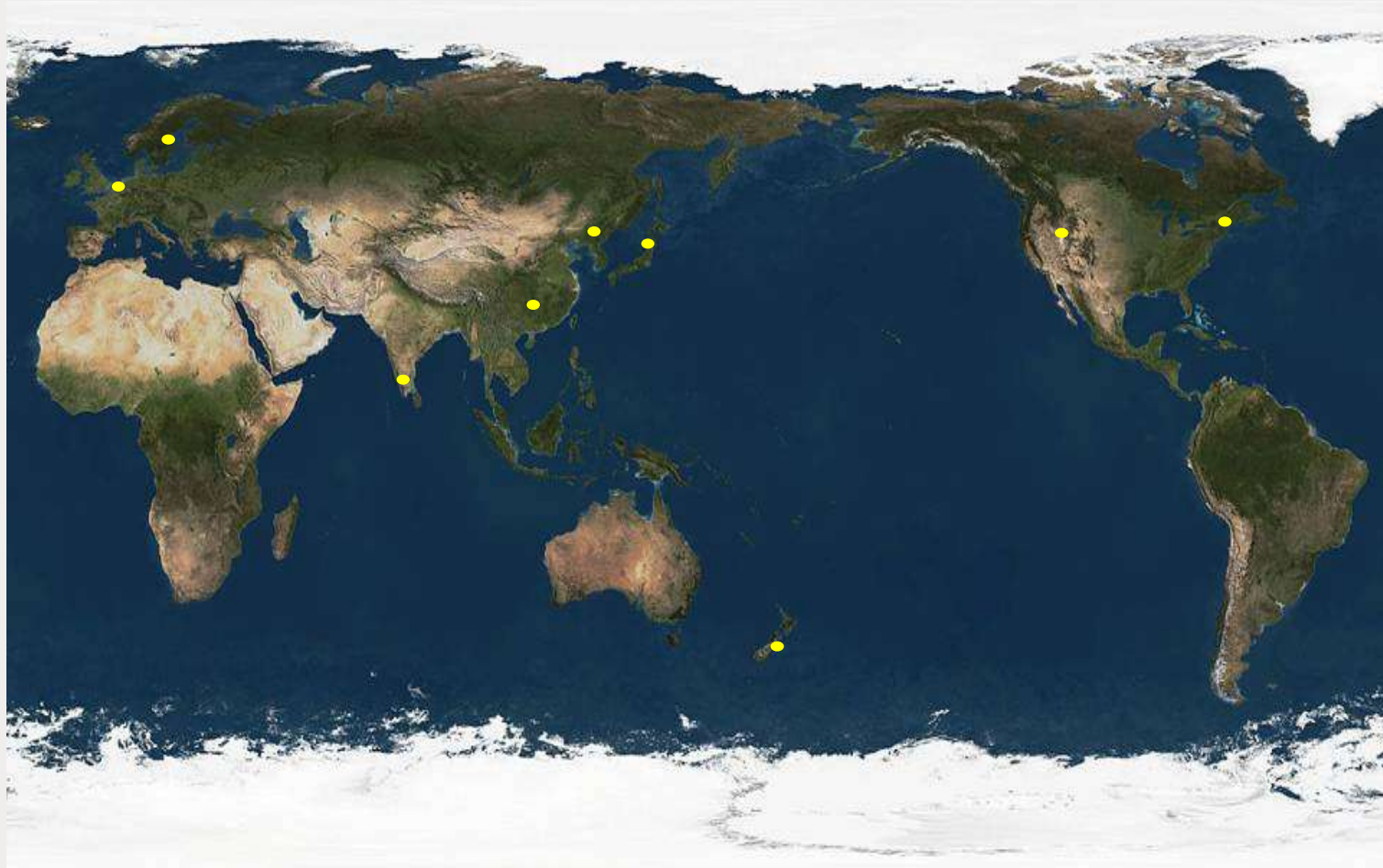




International Collaborations



future position | 52° 17' North
17° 06' East
213 141 90 30



Our PhD Program

Since 2003:

- 32 active
- 46 completions

(Employed equally by industry, government, universities)



The Australian Spatial Landscape

- **GDP** growth of around 2.5% in 2014 (around world average)
- **Debt:** Federal Government debt levels low by international standards (<30% of GDP)
- **Productivity** flat and of real concern to government and industry
- **Strategy:** Both the Business Council of Australia and the Chief Scientist calling for a national strategy, especially for STEM, and to also address education and skilled capacity building
- Increased interest from Government in having Australia retain ‘**indigenous capability**’ especially in GNSS and EO.
- **The ‘Open’ agenda** is driving Australian government to redefine their role in data production and management. They will do less creation, blend much more data with industry and community, focus more on standards, accept volunteered data, and contemplate more targeted regulation
- Increased tension between the ‘open’ agenda versus privacy and cyber security
- Impact of commoditisation
- **BuildingSmart** calling on the Australian Government to mandate use of BIM’s for building and planning
- **Collaboration:** Australian businesses that collaborate are 55% more likely to report increased productivity (Australian Innovation Systems Report, 2012)

Recent Australian Policy Developments

- National Space Utilisation Policy (2013)
- National Positioning Infrastructure (2013)
- Space Community of Interest (commenced February 2014)
- Industry Innovation and Competitiveness Agenda (2014)
- Earth Observation Strategy (under development)

Drivers

Technology Drivers

- Global Navigation Satellite Systems growth*
- Satellite imaging growth*
- Web 3.0 semantic web*
- 3D and 4D fully topological and metric
- Digital Earth (Virtual reality) *
- Geolocation (Location Intelligence) *
- Sensor web and RFIDs (Internet of things)
- UAVs

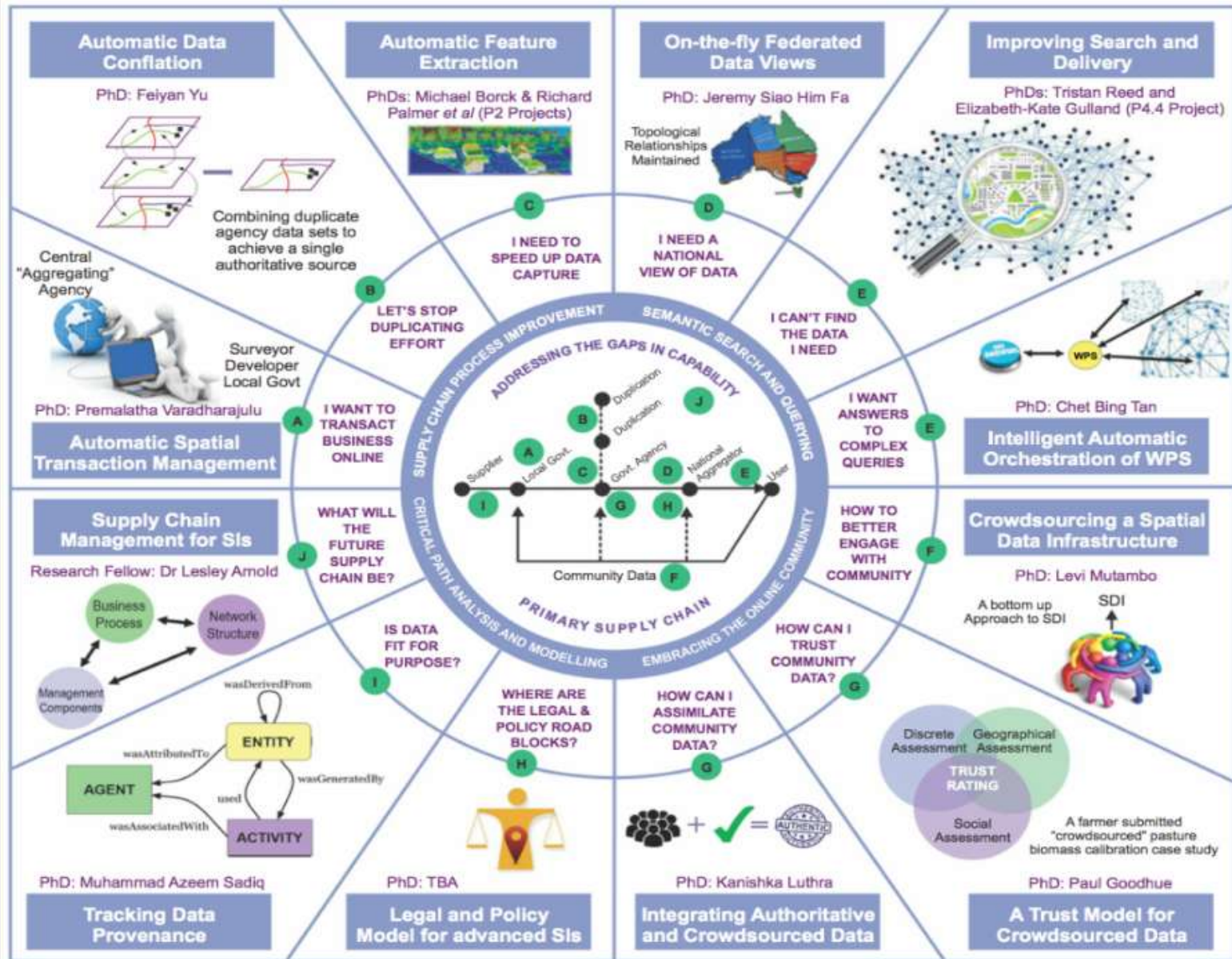
Policy Drivers

- Open source, open access, open standards, open data*
- Government out sourcing *
- Space policy *
- Broadband

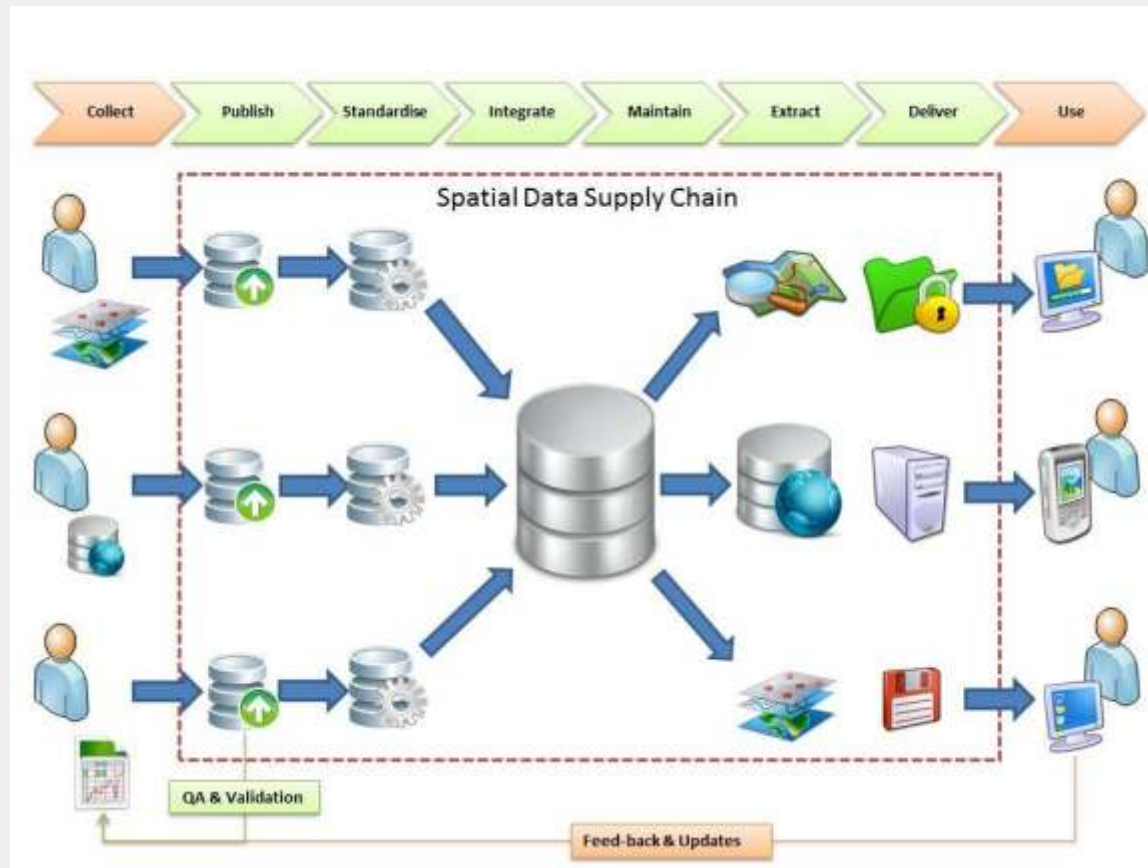
*CRCSI activity

All disruptive
All capable of leading to productivity increases

Program Area – Next Generation Data Infrastructure:

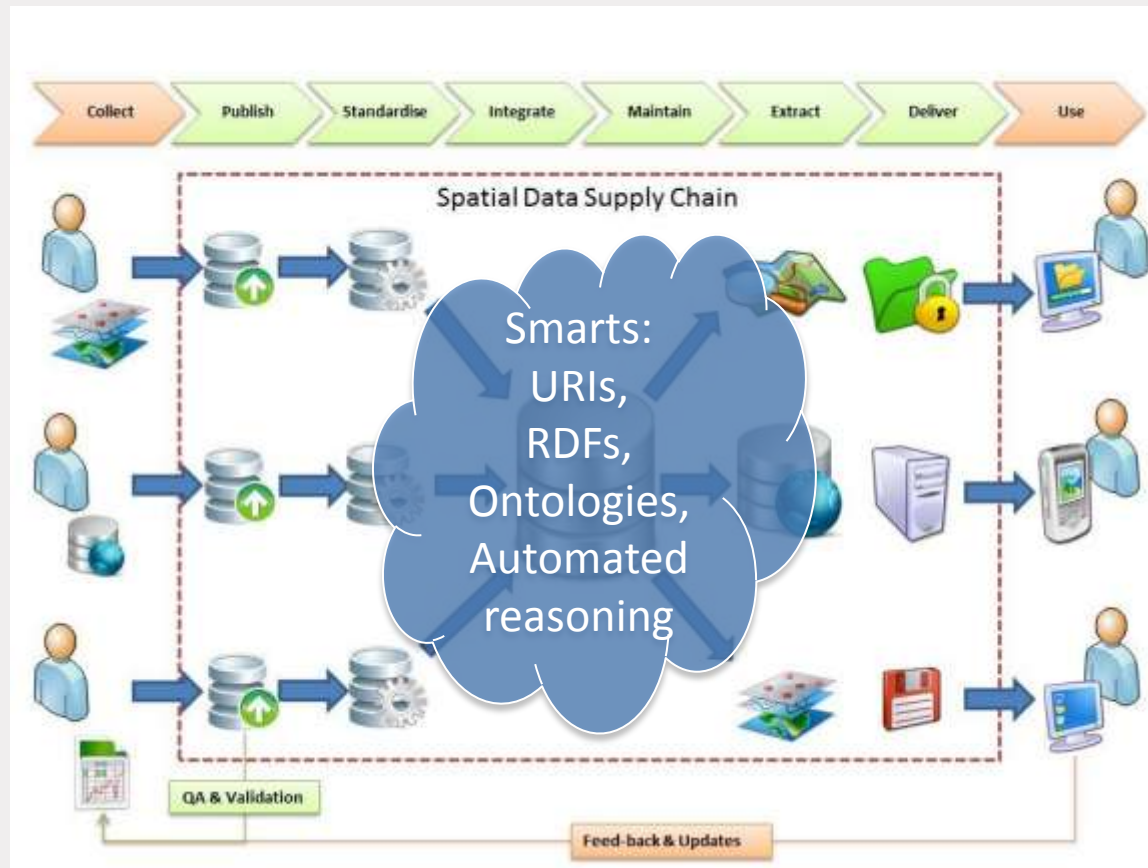


Spatial Data Supply Chain



Maurits van der Vlugt (2012) Alignment Study of Spatial Data Supply Chains, Phase 1: Alignment Study of Spatial Data Supply Chains, CRCSI.

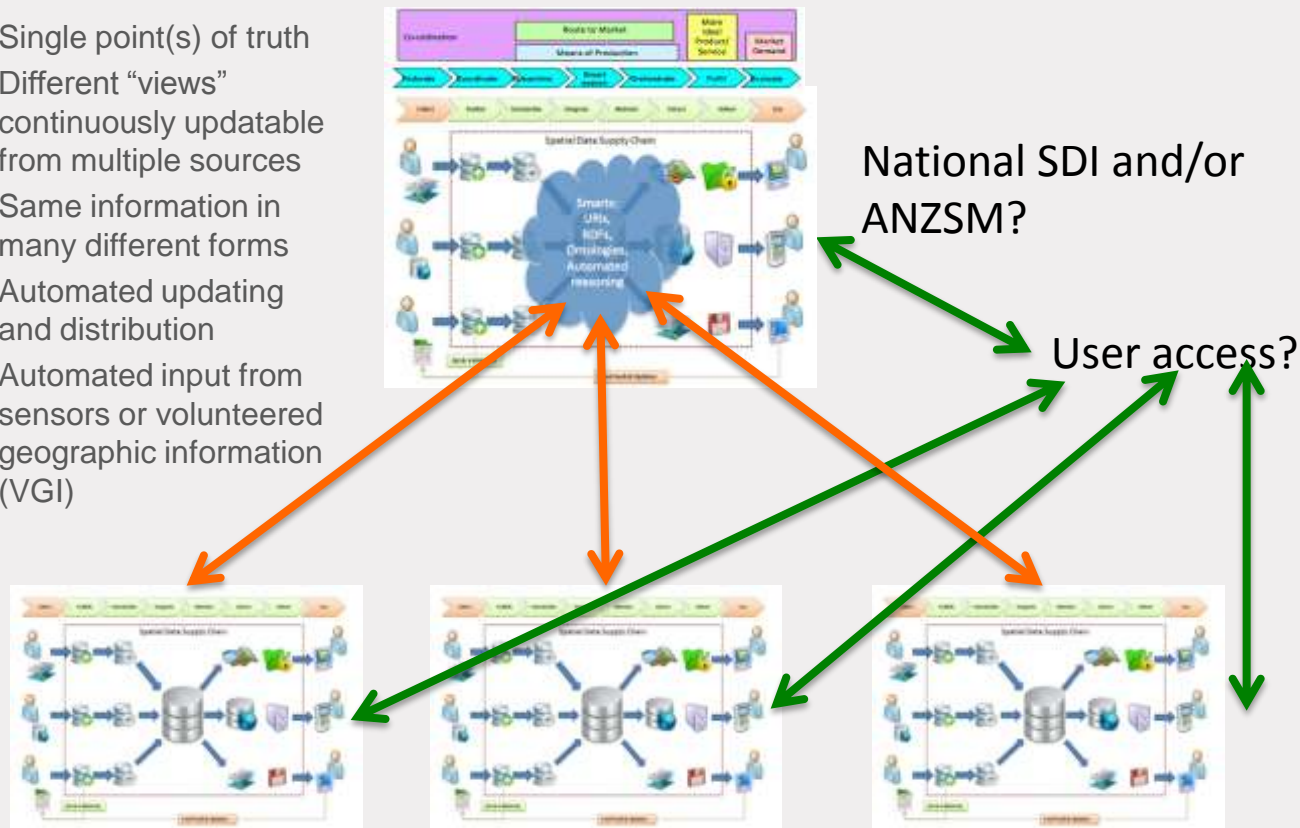
New Spatial Data Supply Chain



After Maurits van der Vlugt (2012) Alignment Study of Spatial Data Supply Chains, Phase 1: Alignment Study of Spatial Data Supply Chains, CRCSI.

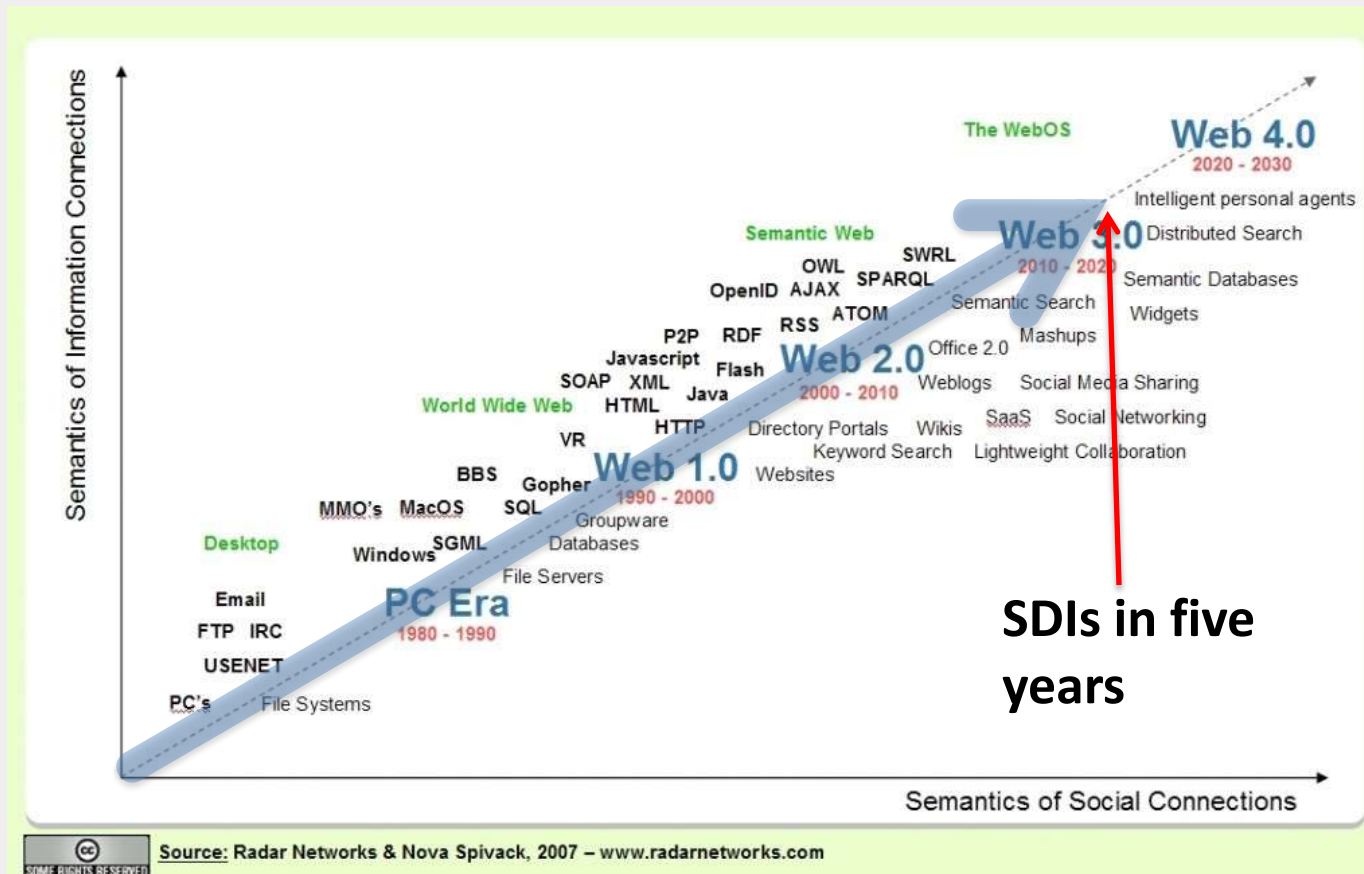
Federated Spatial Data Supply Chain

- Single point(s) of truth
- Different “views” continuously updatable from multiple sources
- Same information in many different forms
- Automated updating and distribution
- Automated input from sensors or volunteered geographic information (VGI)

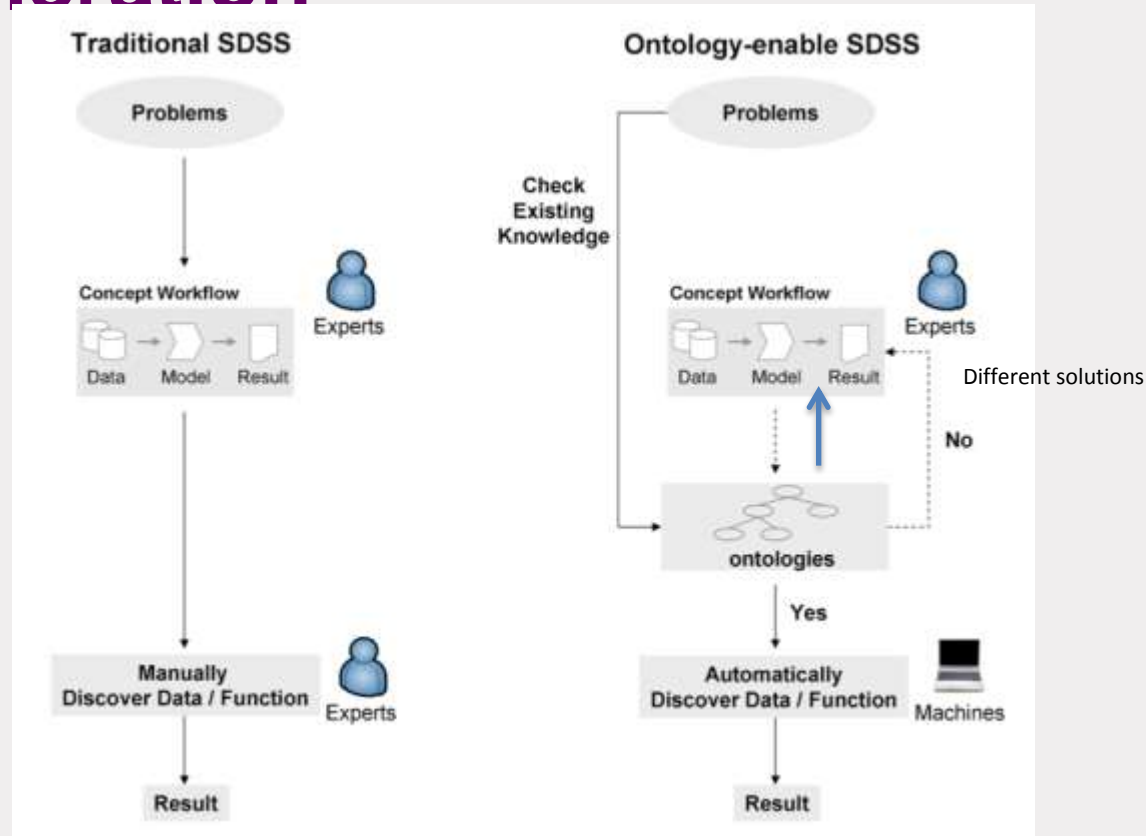


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Evolution of the Web

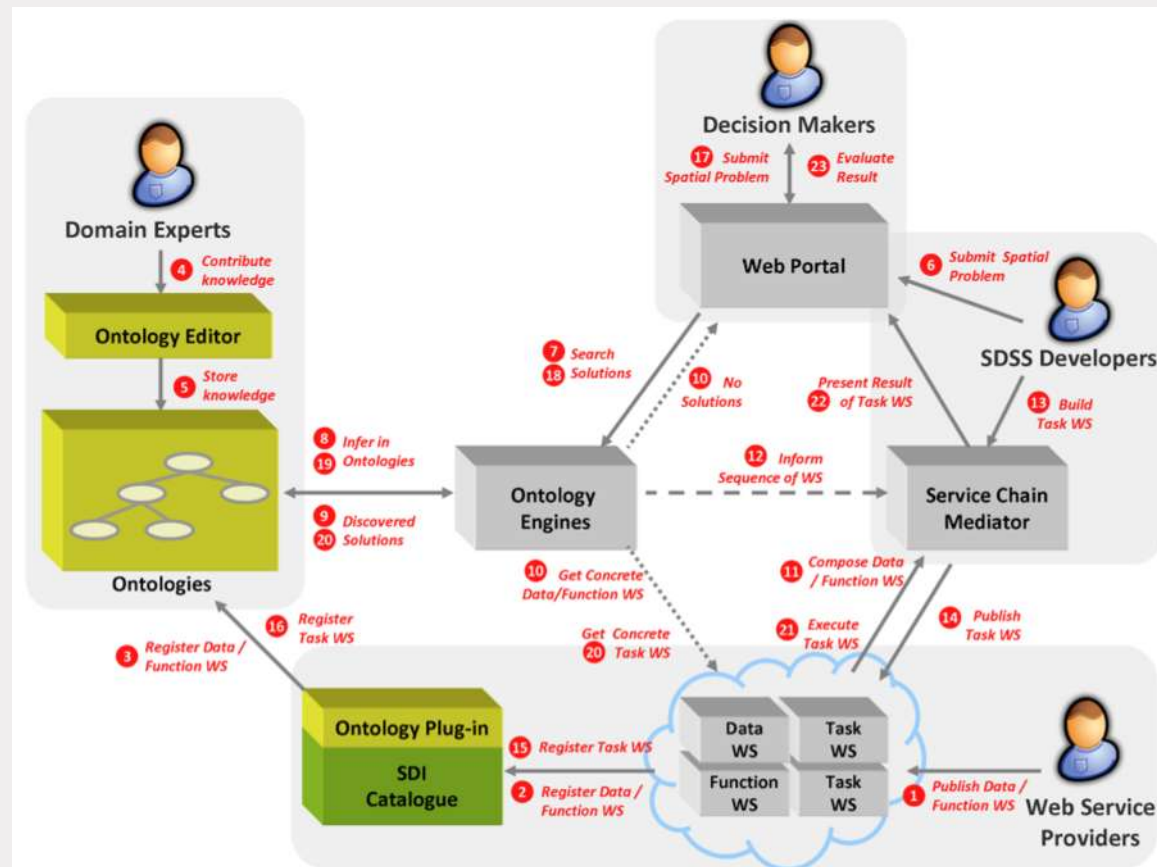


Example: Workflow Generation



Source: Chin-Te Jung, Chih-Hong Sun, (2010), Ontology-driven Problem Solving Framework for Spatial Decision Support Systems, Proc. GSDI 2010, Singapore.

Ontology-based Problem Solving



Source: Chin-Te Jung, Chih-Hong Sun, (2010), Ontology-driven Problem Solving Framework for Spatial Decision Support Systems, Proc. GSDI 2010, Singapore.

Projects

- P3.01: Semantic Web Technologies for the Spatial Marketplace
- P3.02: Semantic Web Technologies for Federated Data Integration
- P3.03: Jurisdictional Level Data Integration
- P3.04: Automated Determination of Licensing Models for Spatial Information

P3.01: Semantic Web Technologies for the Spatial Marketplace

- Overall – ease of access to content (data and services), publishing (data and services)
- Research issues:
 - Search for web-based services
 - Web service orchestration
 - Automatic metadata and ontology generation and evolution
 - User interface issues and usability

P3.02: Semantic Web Technologies for Federated Data Integration

- Overall – seamless generation of national datasets
- 12 national datasets
- Vertical supply chain
- Research issues:
 - Automatic metadata and ontology generation and evolution
 - Semi-automated and automated data integration
 - Automated schema evolution
 - User interfaces issues and usability

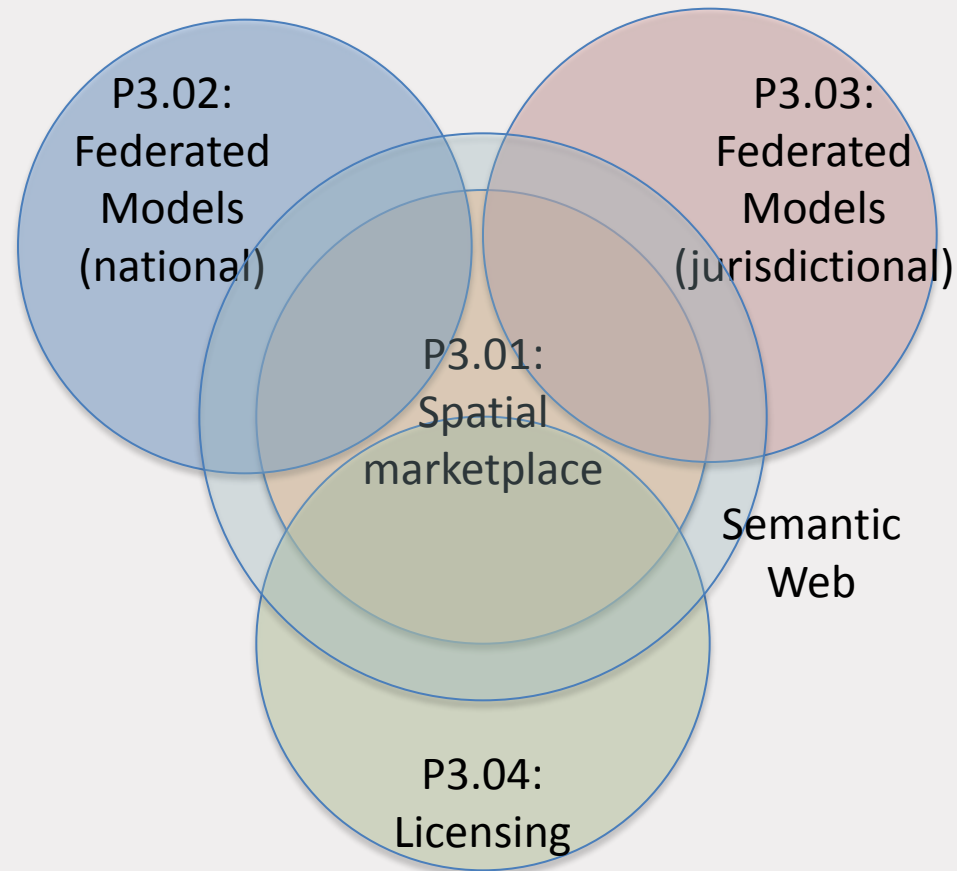
P3.03: Jurisdictional Level Data Integration

- Overall – seamless generation of jurisdictional (state/territory) datasets
- Horizontal and vertical supply chains
- Vertical – LGAs to State/Territory Agencies
- Horizontal – between States/Territories
- Research issues:
 - Use of crowd sourced data and its integration with authoritative data
 - Automatic metadata and ontology generation and evolution
 - Semi-automated and automated data integration
 - User interfaces issues and usability

P3.04: Automated Determination of Licensing Models for Spatial Information

- Overall – making it easier to understand and deal with licensing/terms of use/costing
- Issue when combining data/processes from different sources
- Research issues:
 - User interfaces issues and usability
 - Encapsulation of Licensing, Copyright and Terms of Use knowledge into rules for reasoning

Project Relationships



Example Rule (from policy)

A plot must be in the same suburb as the road it has frontage with

Adopt_plot (x):
 Proposed_Plot (p)
 Existing_Locality (p, l)
 Proposed_Frontage (p, f)
 Frontage_Locality (f, l)



Instance from DB	Request from GUI
Proposed_Plot (A)	
Existing_Road (Bradford St)	Proposed_Frontage (A, Bradford St)
Property_Locality (A, Coolbinia)	
Road_Locality (Bradford St, Coolbinia)	
Proposed_Plot (D)	
Existing_Road (Lonsdale St)	Proposed_Frontage (D, Lonsdale St)
Property_Locality (D, Coolbinia)	
Road_Locality (Lonsdale St, Yokine)	

Results of applying rules:

Adopt_plot (A):

APPROVED

Proposed_plot (A) true
 Existing_Locality (A, Coolbinia) true
 Proposed_Frontage (A, Bradford St) true
 Frontage_Locality (Bradford St, Coolbinia) true

Adopt_plot (D):

NOT APPROVED

Proposed_plot (D) true
 Existing_Locality (D, Coolbinia) true
 Proposed_Frontage (D, Lonsdale St) true
 Frontage_Locality (Lonsdale St, Coolbinia) false

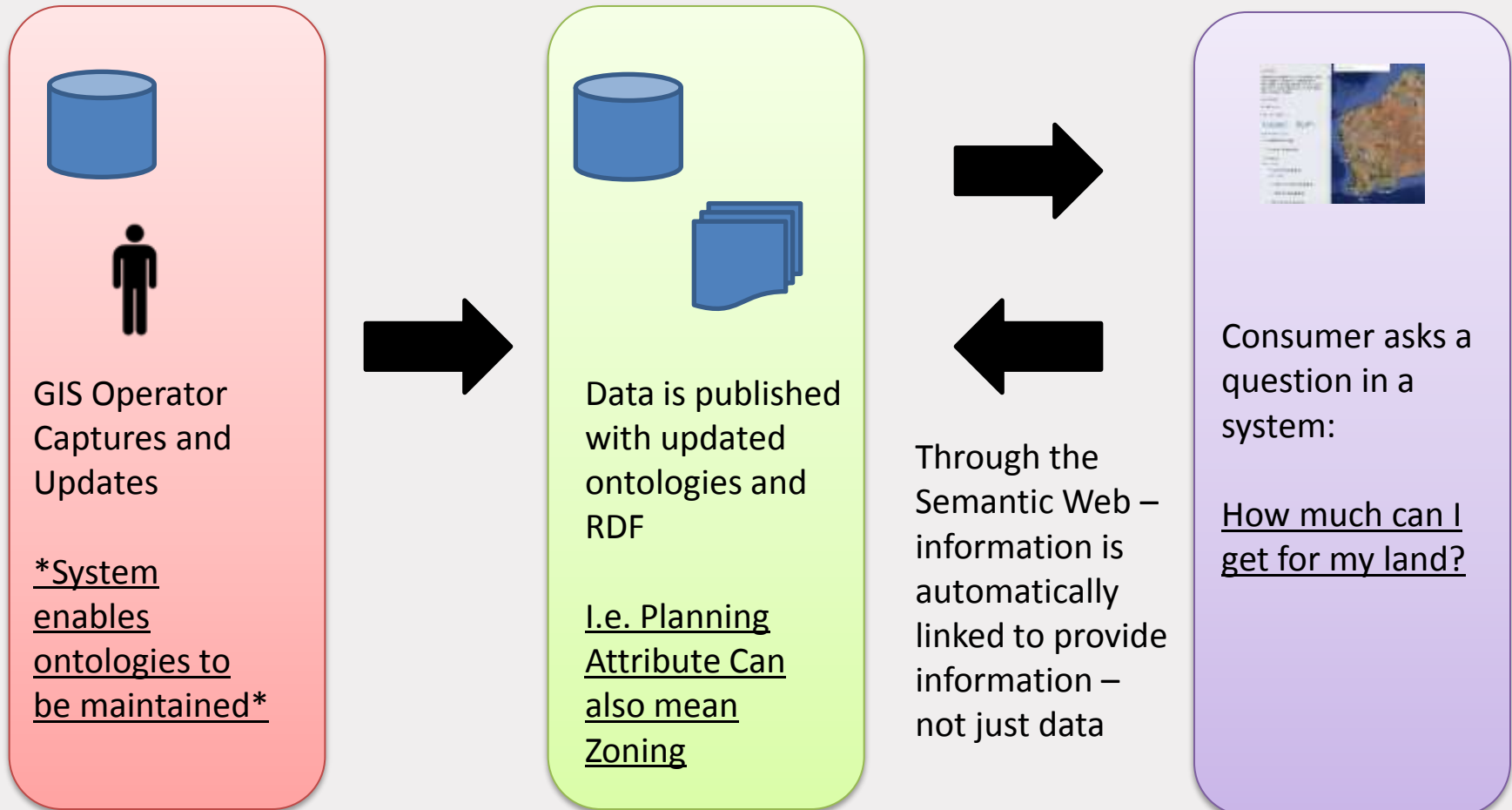
Program 3 - Utilisation

- Enablers – Providers of technology solutions to enable the next generation spatial infrastructure
- Suppliers - Entities who are engaged in capture, supply, delivery and are tasked with the management of spatial information.
- Aggregator - Groups who generate information products or coordinate the 'joining' of information into a single dataset.
- Consumer – Those who need information to answer or inform which may involve accessing multiple data, from any point at any time without knowing what to ask for.

Program 3 - Utilisation

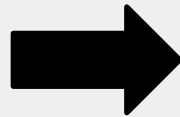
- Program 3 is about enabling data to connect, autonomously through technology to meet the needs of the consumer
- Enabling data to become 'smart' uses Ontologies and Resource Description Files (RDF)
- E.g. If I 'change' my data schema – how does the updating, publishing information downstream users of the data through the supply chain.

Enabling the Future Spatial Infrastructure



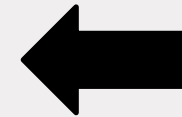
GIS Operator
Captures and
Updates

*System
enables
ontologies to
be maintained*



Data is published
with updated
ontologies and
RDF

I.e. Planning
Attribute Can
also mean
Zoning



Through the
Semantic Web –
information is
automatically
linked to provide
information –
not just data



Consumer asks a
question in a
system:

How much can I
get for my land?

2015 CRCSI Annual Conference

Melbourne

25-27 November 2015



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