Going global: the return of the address wars

Anthony Beck (GeoLytics)

Abstract

Dr. Anthony Beck (GeoLytics Ltd.)
6th March 2019
18:30 - 19:45 Going global: the return of the address wars
or 'What characteristics are required for Global Address applications in the 21st century?'
Speaker: Dr Ant Beck
Venue: Room 4.31, University of Edinburgh Informatics Forum, 10 Crichton Street, Edinburgh, EH8 9AB
BCS link
GIT link
This document has been written in CommonMark: an unambiguous implementation of Markdown for scholarly writing.

Contents

1 Bio

Ant is as an interdisciplinarian working at the interfaces of geo-science, heritage, smart-cities, remote sensing, plant and soil science, computing and knowledge engineering. He has undertaken research in a number of contrasting fields (humanities, social science and science) and is committed to approaches that maximize academic, industry, policy and public impact. Project work include:

- large scale data integration in the utility sector (the award winning UK Water Industry Research projects Mapping the Underworld and VISTA),
- heritage remote sensing (landscape programmes in India and Syria and hyperspectral imaging in the UK) and

- digital transformation programmes (addressing frameworks at United Utilities and land administration domain modelling at Registers of Scotland).

He is a passionate advocate of Open Science and sees this as a way to increase the impact of science in society. Since 2015 Ant has provided GIScience, Knowledge Engineering and Data Analytics consultancy services. He is currently undertaking a conceptual redesign of Scotland's Land Register. Ant is still research active: he was the lead author on an urban energy modelling paper published in 2018 and is a co-author on a recently submitted subsurface utility detection paper. He is a father. He juggles.

2 Abstract

An address is much more than a representation of a property: when included as part of a nation's infrastructure, an address helps to provide social and legal identity. By providing a fundamental knowledge base to inform decision making and action, addresses help to develop, implement and support other critical national policies such as:

- Governance
- Urban development and management
- Migration and social integration
- Security
- Economy and commerce
- Environmental sustainability, risk and disaster management

Addressing the world: an address for everyone co-ordinated by the Universal Postal Union documents in detail the problems that poor address infrastructure and address interoperability pose. As part of the solution this white paper neatly summarises the state of the art in addressing and advocates approaches to improve addressing aimed at nation states. Key to this is the assumption that an address requires a road network, a street name and a house number. This national address infrastructure can be a significant barrier to implementation and can starkly highlight the division between urban and rural communities. However, technology is disrupting this status-quo and the 21st Century will see significant change in address infrastructure.

This presentation examines the assumption that credible addresses require an underlying address infrastructure. By removing the need for address infrastucture (and conflation of national address systems) it is possible to define the characteristics of a global address framework. Inevitably any global address framework will take advantage of Global Navigation Satellite System (GNSS) positioning (such as GPS). However, the characteristics of how this is implemented will have significant implications in their re-use scenarios. We will discuss the key characteristics of a global address framework in terms of impact.

Commission on Legal Empowerment of the Poor and United Nations Development Programme, 2008. Making the law work for everyone: Vol 1 - report of the commission on legal empowerment of the poor, Available at: https://unipsil.unmissions.org/sites/default/files/making_the_law_work_for_everyone.pdf [Accessed February 5, 2019].

UPU, 2012. Addressing the world: an address for everyone, Universal Postal Union. Available at: http://www.upu.int/en/activities/addressing/addressing-the-world-initiative.html [Accessed November 5, 2014].

3 Going global: the return of the address wars

3.1 What characteristics are required for Global Address applications in the 21st century?

Anthony Beck (GeoLytics)

Figure 1: Dystopos (2005)

Figure 2:

```
## PDF output using pandoc

## For a clean export resetart kernel and clear output

import os


### Export this notebook as markdown
commandLineSyntax = 'ipython nbconvert --to markdown 20190306_Global_Address_Wars_Presentation.ipynb'
print (commandLineSyntax)

os.system(commandLineSyntax)

### Export this notebook and the document header as PDF using Pandoc

commandLineSyntax = 'pandoc  -f markdown -t latex -N -V geometry:margin=1in DocumentHeader.md 20190306_

os.system(commandLineSyntax)


ipython nbconvert --to markdown 20190306_Global_Address_Wars_Presentation.ipynb
```

```
0
```

To convert and run this as a static presentation run the following command:

```
# Notes don't show in a python3 environment

!jupyter nbconvert 20190306_Global_Address_Wars_Presentation.ipynb --to slides --post serve
```

To close this instances press *control 'c'* in the *ipython notebook* terminal console

Static presentations allow the presenter to see *speakers notes* (use the 's' key)

If running dynamically run the scripts below

```
#Future proof python 2
from __future__ import print_function #For python3 print syntax
from __future__ import division

# def
import IPython.core.display

# A function to collect user input - ipynb_input(varname='username', prompt='What is your username')

def ipynb_input(varname, prompt=''):
        """Prompt user for input and assign string val to given variable name."""
        js_code = ("""
            var value = prompt("{prompt}","");
            var py_code = "{varname} = '" + value + "'";
            IPython.notebook.kernel.execute(py_code);
        """).format(prompt=prompt, varname=varname)
        return IPython.core.display.Javascript(js_code)
```

```
# inline

%pylab inline
```

3.2 About me

Figure 3: It's all about me - details about Anthony Beck

- Honorary Research Fellow, University of Nottingham: orcid
- Director, Geolytics Limited - A spatial data analytics consultancy

3.3 About this presentation

- Available on GitHub - https://github.com/AntArch/Presentations_Github/
- Fully referenced PDF

4 Addresses

4.1 are part of the fabric of everyday life

Figure 4: Kaye (2012)

4.2 Have economic and commercial impact

Figure 5: Denelson83 (2008)

4.3 Support governance and democracy

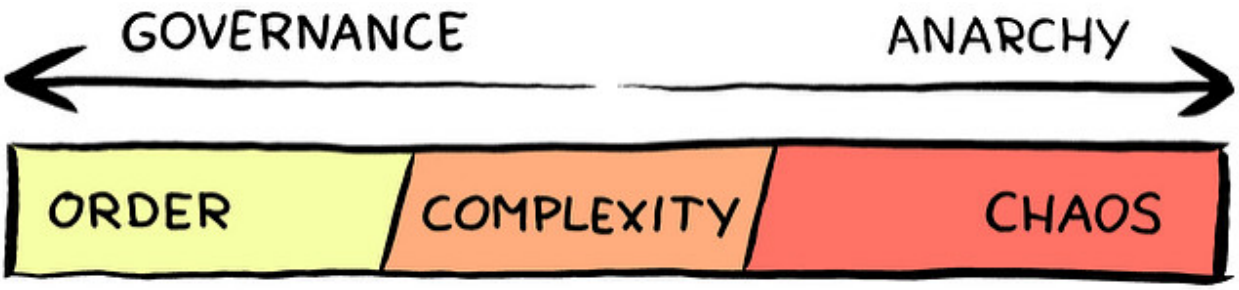


Figure 6: Appelo (2010)

- Addresses are a pre-requisite for citizenship in many countries.
- Without citizenship individuals are excluded from:
  - public services
  - formal institutions.
- This impacts on democracy.

4.4 Support Legal and Social integration

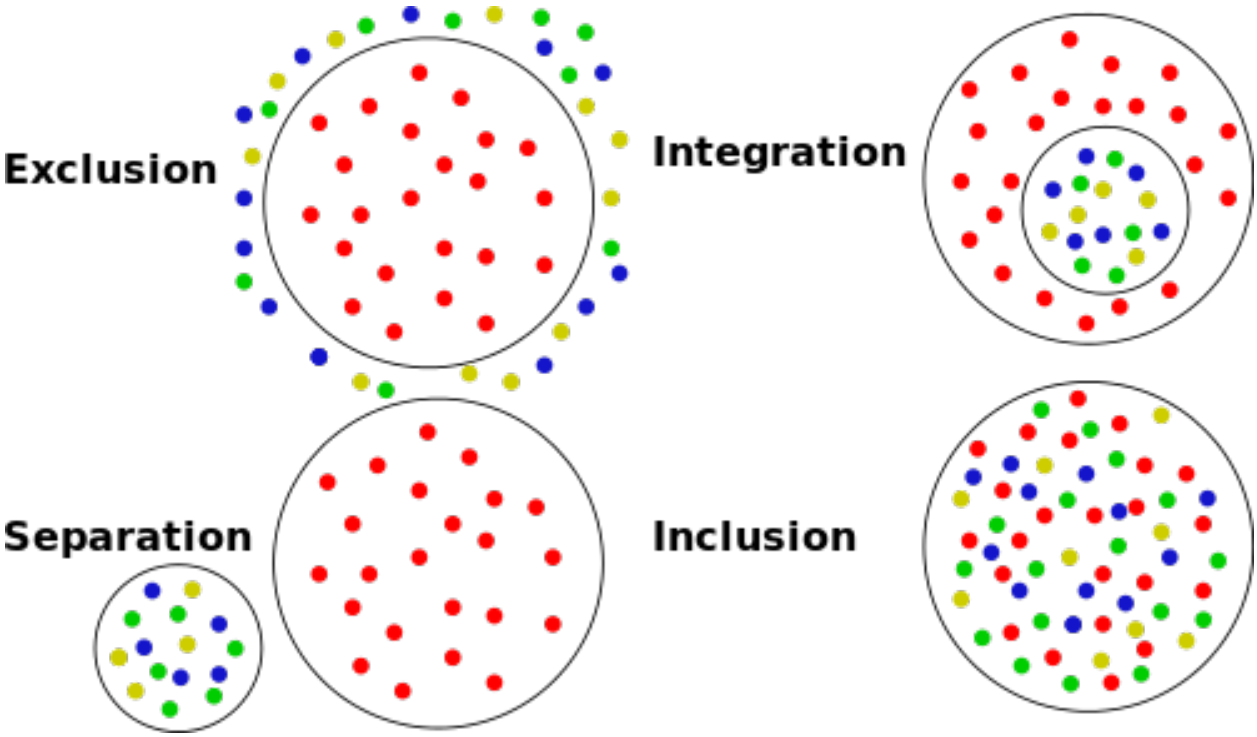


Figure 7: Beck (2015d)

- Formal versus Informal
- Barring individuals and businesses from systems:
  - financial
  - legal
  - government
  - ....

4.5 Provide spatial structure.

Figure 8: Pavliga (1992)

- This helps to identify, locate and access marginalized areas.

4.6 Bridge gaps

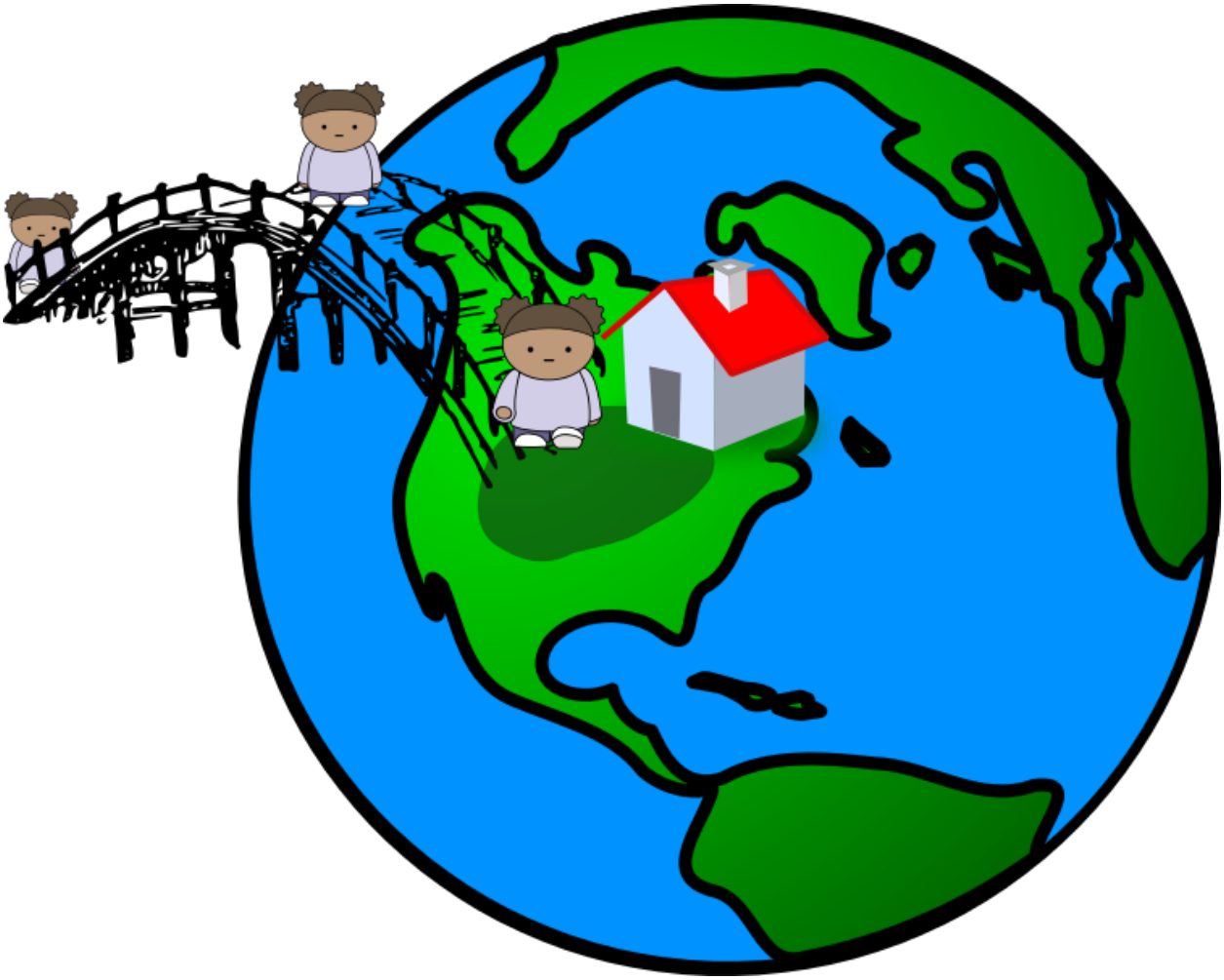


Figure 9:

provide the link between ***people*** and ***place***

5 What is an address?

5.1 Address abstraction

- Address did not spring fully formed into existance.
- They are used globally
  - but developed nationally
  - and for different reasons

5.2 Address abstraction

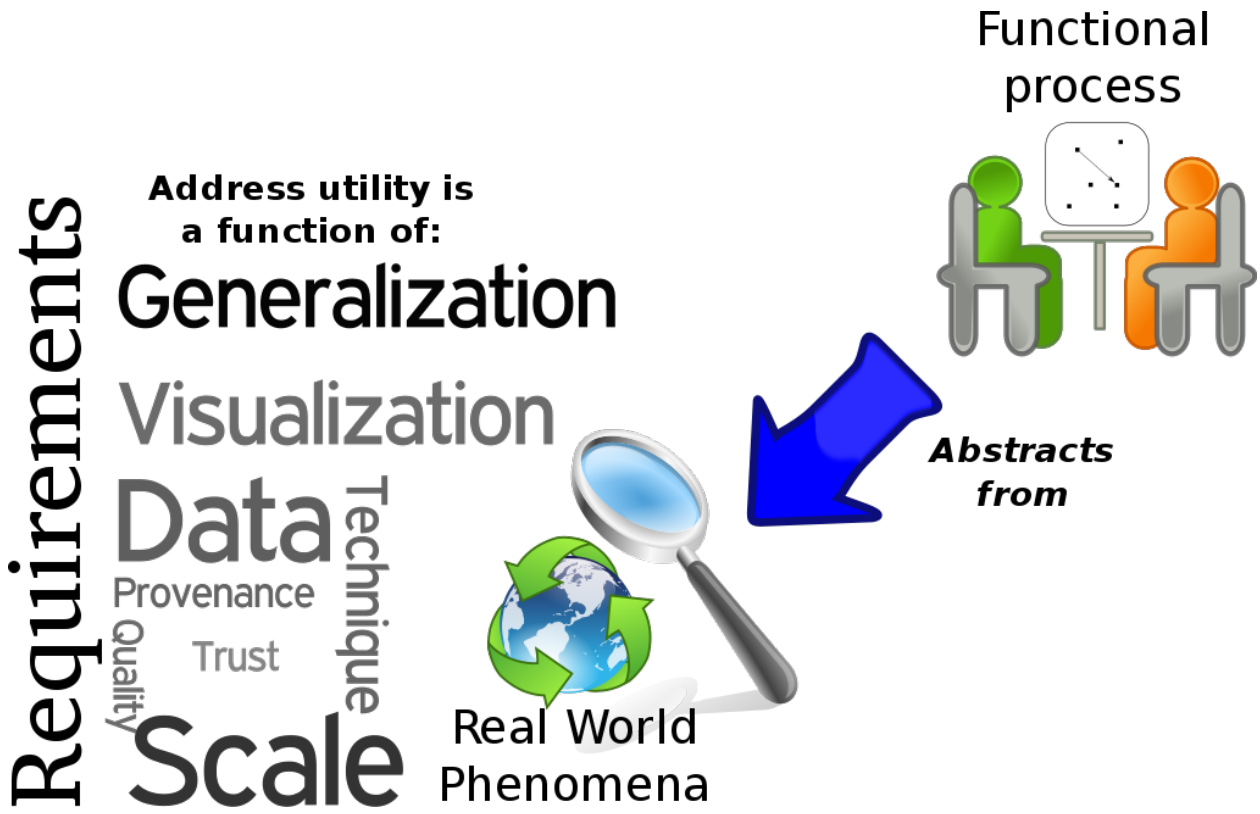


Figure 10: Beck (2016c)

5.3 In the beginning ..... was the ledger, the register, the record

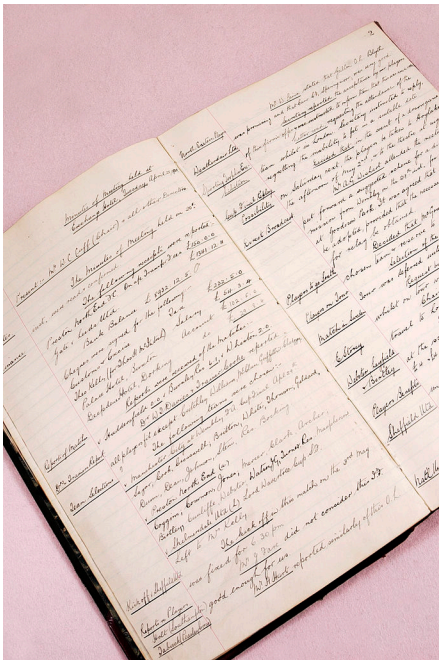


Figure 11: France (2004)

5.4 Then came formalisation

- Local Land and Property Gazetteers and Registers
- Mail
- Address Base
- The World Bank
- Etc……

Let's look at some

5.4.1 Korea: The Jibeon system - taxation

- Until recently, the Republic of Korea (Korea) has used land parcel referening (jibeon)
  - Parcels are assigned chronologically according to date of construction.
  - **No local predictability**.

Figure 12: after (UPU (2012), p.57)

- Until recently, the Republic of Korea (Korea) has used land parcel numbers (jibeon) to identify unique locations.
  - These parcel numbers were assigned chronologically according to date of construction and without reference to the street where they were located.
  - This meant that adjacent buildings did not necessarily follow a sequential numbering system.
- This system was initially used to identify land for census purposes and to levy taxes.
- In addition, until the launch of the new addressing system, the jibeon was also used to identify locations (i.e. a physical address).

5.4.2 UK Addressing Geoplace - Formal

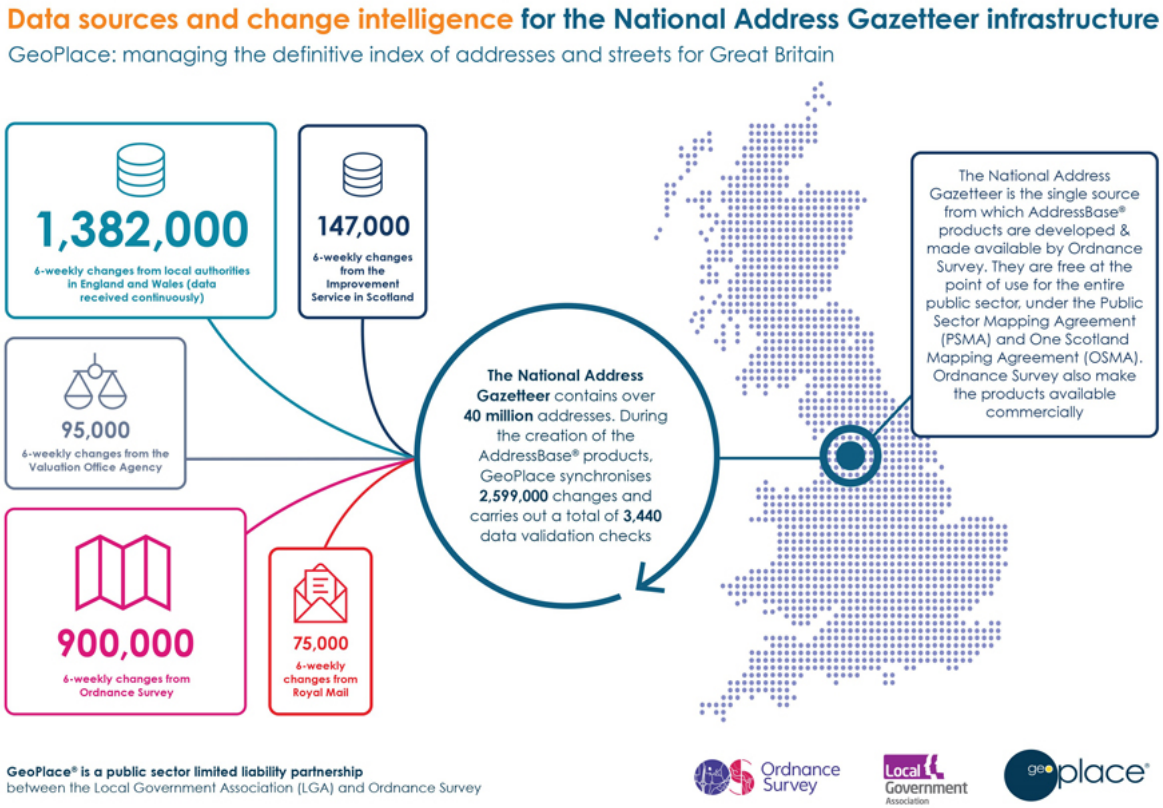


Figure 13: Geoplace graphic

- GeoPlace is a limited liability partnership owned equally by the Local Government Association and Ordnance Survey.
- It has built a synchronised database containing spatial address data from
  - 348 local authorities in England and Wales (the *Local Land and Property Gazetteers* (LLPG) which cumulatively create the *National Land and Property Gazetteer* (NLPG)),
  - Royal Mail,
  - Valuation Office Agency and
  - Ordnance Survey datasets.
- The NAG Hub database is owned by GeoPlace and is the authoritative single source of government-owned national spatial address information, containing over 225 million data records relating to about 34 million address features. GeoPlace is a production organisation with no product sales or supply operations.
- The NAG is made available to public and private sector customers through Ordnance Survey's AddressBase products.

5.4.3 The AddressBase Family

Figure 14: Ordnance Survey graphic

- The National Address Gazetteer Hub database is owned by GeoPlace and is claimed to be *the authoritative single source of government-owned national spatial address information*, containing over 225 million data records relating to about 34 million address features.
- Each address has its own *Unique Property Reference Number* (UPRN). The AddressBase suite have been designed to integrate into the Ordnance Survey MasterMap suite of products.

AddressBase is available at three levels of granularity (lite, plus and premium).

- AB+ merges two address datasets together (PAF and Local Authority) to provide the best available view of addresses currently defined by Local Authorities, giving many advantages over AddressBase.
- AB+ lets you link additional information to a single address, place it on a map, and carry out spatial analysis that enables improved business practices.
- Geoplace argue that further value comes from additional information in the product which includes:
  - A more detailed classification – allowing a better understanding of the type (e.g. Domestic, Commercial or Mixed) and function of a property (e.g. Bank or Restaurant)
  - Local Authority addresses not contained within PAF – giving a more complete picture of the current addresses and properties (assuming they are in scope (see below))
  - Cross reference to OS MasterMap TOIDs – allowing simple matching to OS MasterMap Address Layer 2, Integrated Transport Network or Topography Layer
  - Spatial coordinates
  - Unique Property Reference Number (UPRN) – which provides the ability to cross reference data with other organisations, and maintain data integrity.
- Premium includes the address lifecycle

AddressBase supports the UK Location Strategy concept of a 'core reference geography', including the key principles of the European Union INSPIRE directive, that data should only be collected once and kept where it can be maintained most effectively (see AddressBase products user guide). *It's probably worthwhile mentioning that this is not an open address layer - however, a 2104 feasibility study sponsored by the department of Business, Innovation and Skills included a recommendation that AddressBase lite is made openly available.*

5.4.4 Royal Mail - Access and Delivery points

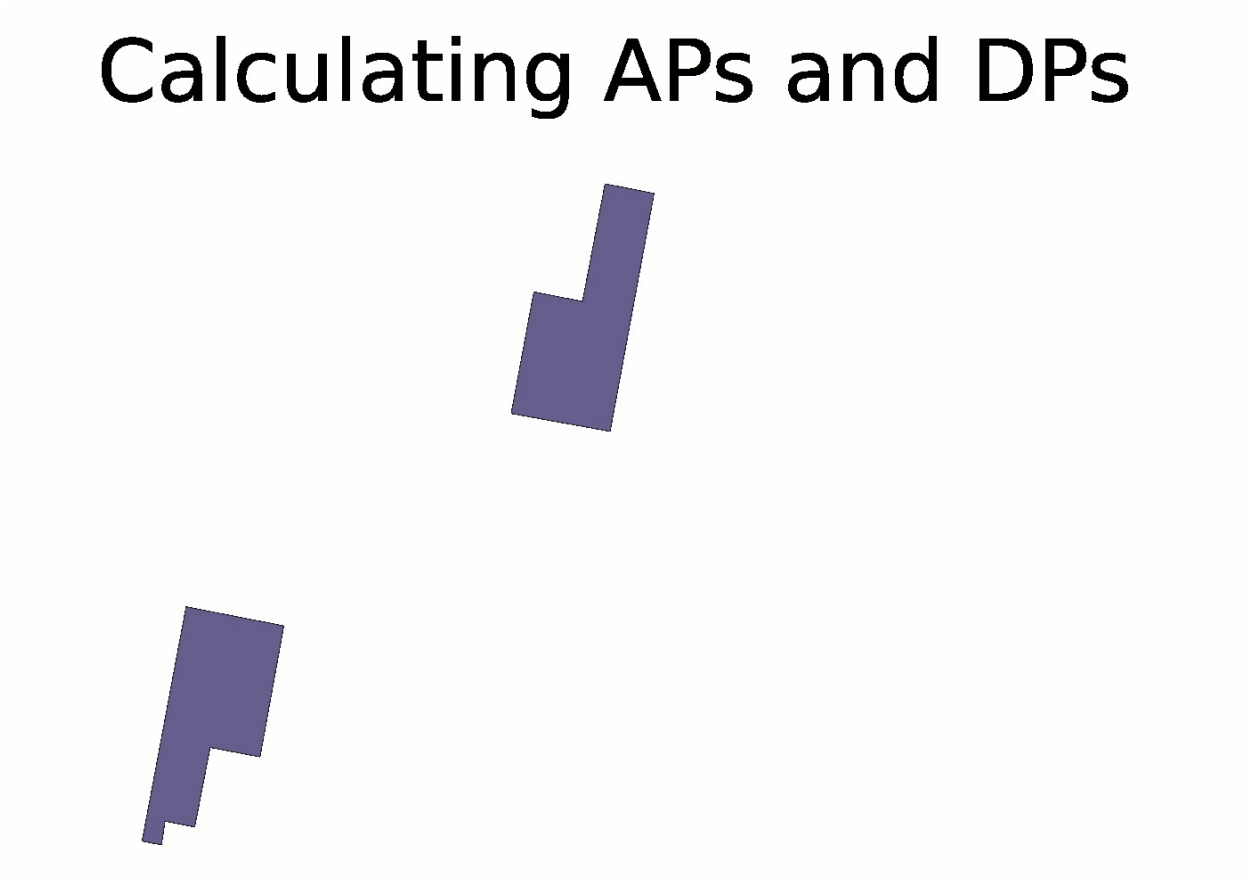


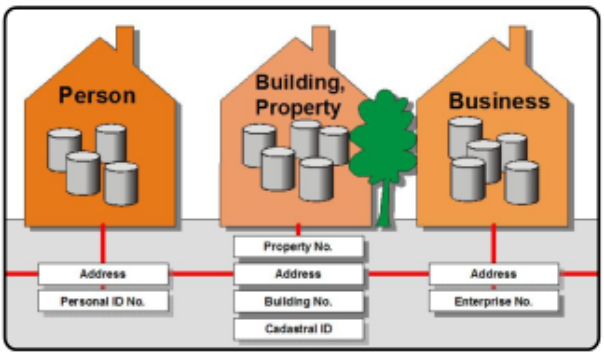
Figure 15: Access Points and Delivery Points

5.4.5 Denmark: An addressing commons

- Geocoded address infrastructure
- Defined the semantics of purpose
  - what is an address
- Open data
  - an address commons with full stakeholder engagement and participation
  - **There is no such thing as an unmatched address**

Revised as a co-ordinating spine across domains

as a zero-cost accessible service



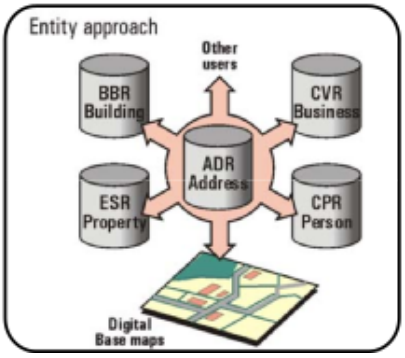


Figure 16: after Lind (2008)

- Geocoded address infrastructure
- Defined the semantics of purpose
  - what is an address
- Open data
  - an address commons
- The re-use statistics are staggering:
  - 70% of deliveries are to the private sector,
  - 20% are to central government
  - 10% are to municipalities.
- Benefits:
  - Efficiencies
  - No duplication
  - Improved confidence
  - Known quality
  - **There is no such thing as an unmatched address**

A credible service providing a mutlitude of efficiencies (UPU (2012), pp.50 - 54)

5.4.6 The World Bank

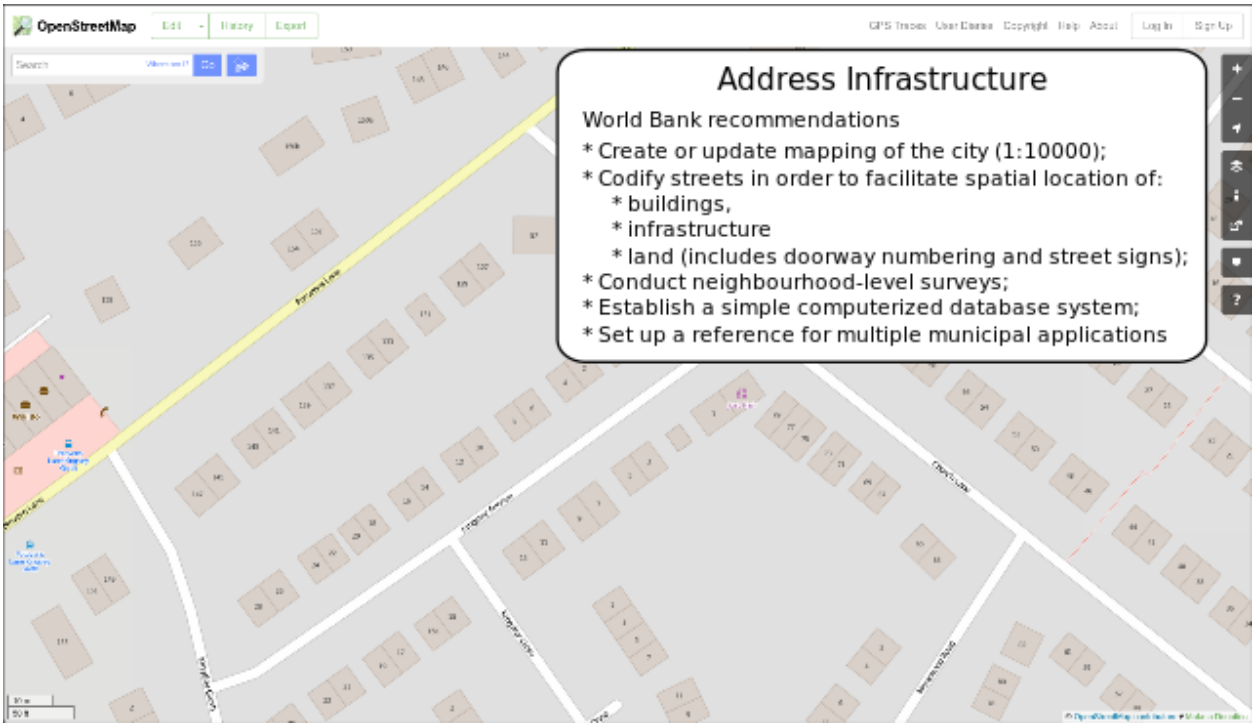


Figure 17: Beck (2015f)

- Urban bias
- Cost of infrastucture development
- Lack of community involvement

The World Bank has taken a *street addressing* view-point (UPU (2012), p.57). This requires up-to-date mapping and bureacracy (to deliver a street gazetteer and to provide the street infrastructure (furniture)). However, (UPU (2012), p.44) demonstrates that this is a cumbersome process with a number of issues, not the least:

- Urban bias
- Cost of infrastucture development
- Lack of community involvement

6 Addressing issues

- Addresses are increasingly over-loaded
  - Assets as addresses
  - Services as addresses
  - People as/at addresses
- Addresses as things

Figure 18: Public domain image

6.1 Issues: addresses = postal address.

- Is *Postal* a constraining legacy?
- Is *address* a useful term?

Figure 19: Public domain image

7 Taking stock

7.1 Addresses are heterogeneous

In terms of:

- What they mean
- What they are used for
- Who uses them
- How they are accessed

Figure 20: Beck (2015a)

7.2 Assets can have addresses

So - anything can have an address (the *Internet of Things*)

Figure 21: Post box

7.3 National data silos

- They have been created to solve national issues.
  - Applying different paradigms
  - Are *relative referencing system* that do not implicitly provide an accurate spatial location.
- No unifying semantics.

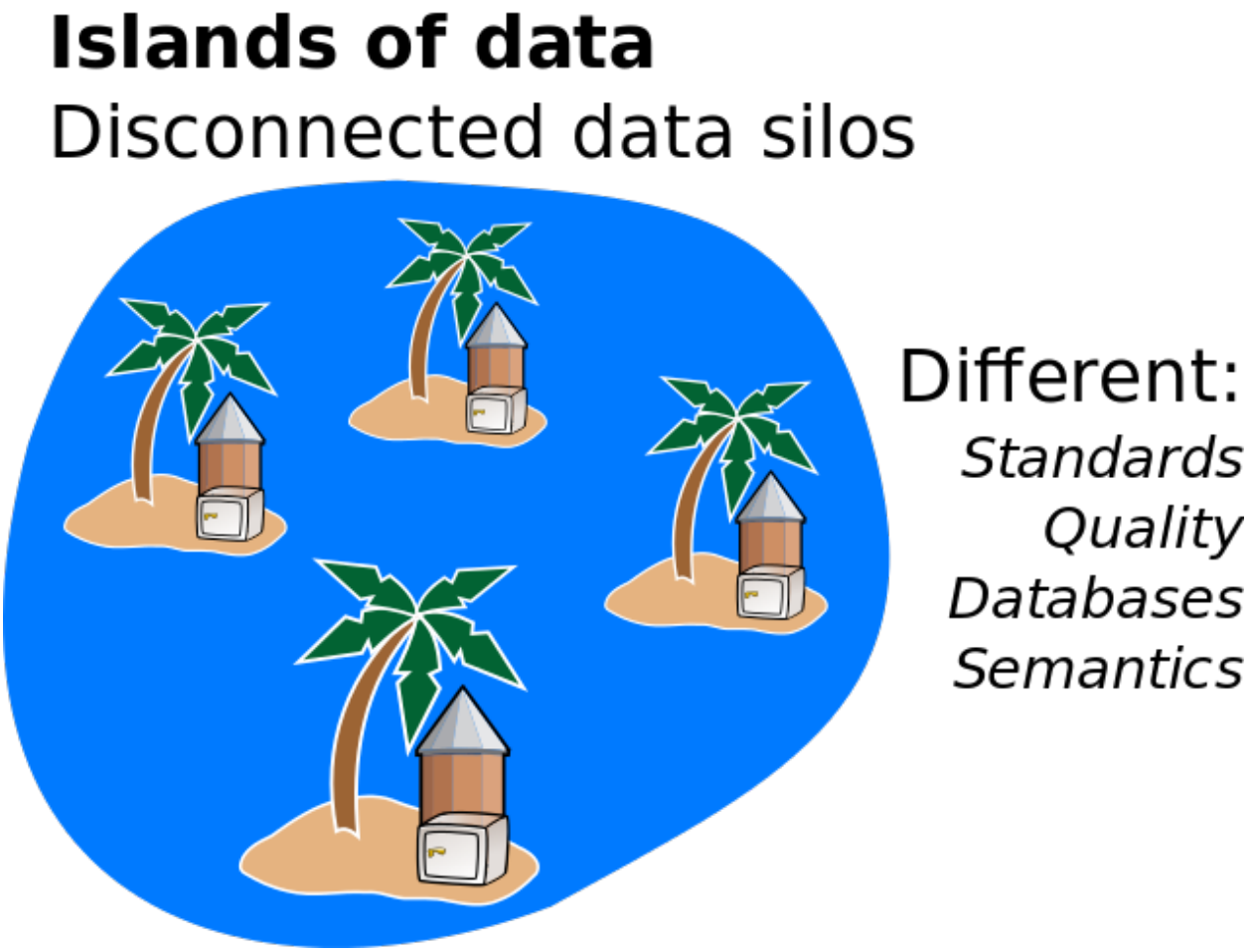


Figure 22: Beck (2015b)

7.4 Licence silos

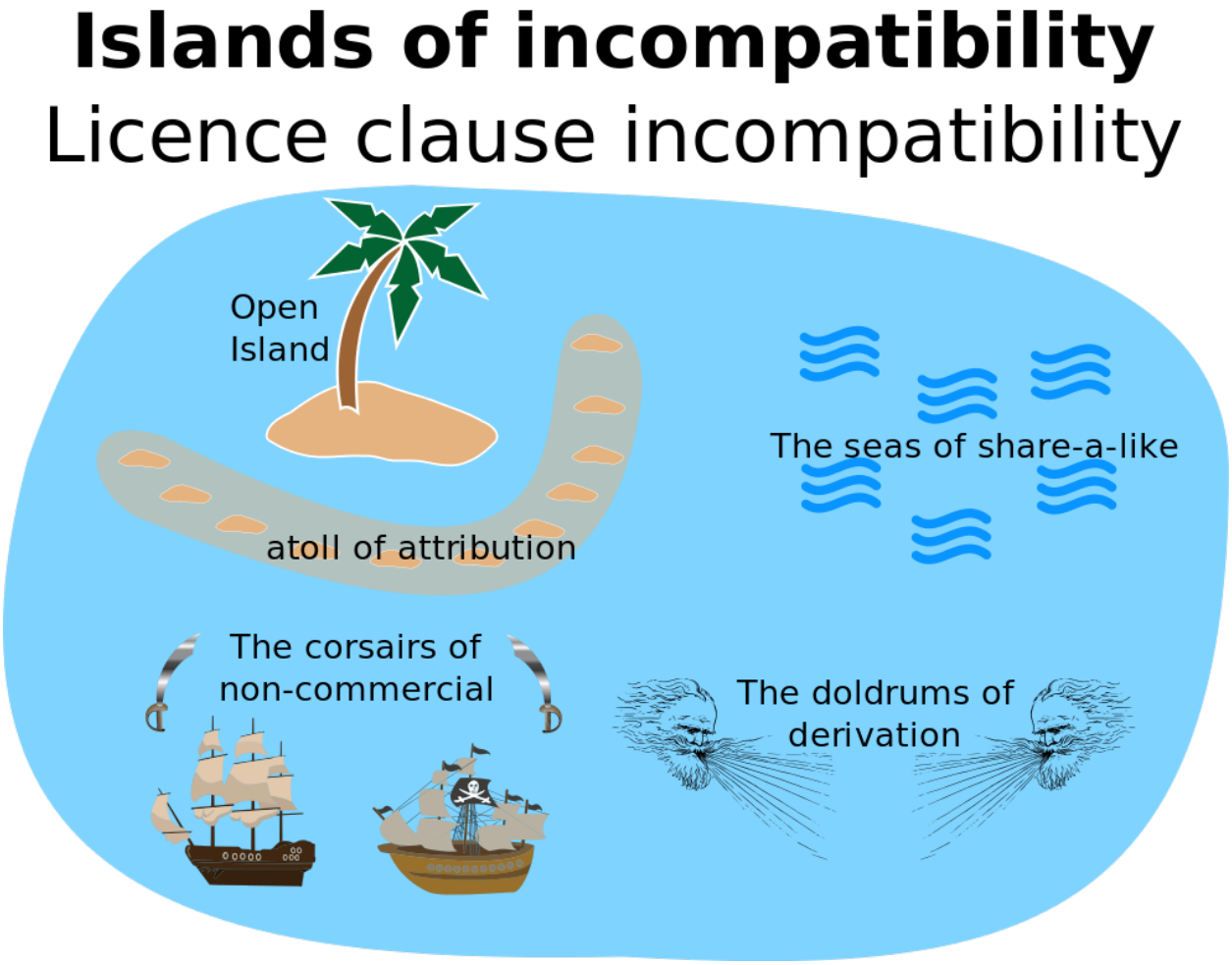


Figure 23: Beck (2016b)

7.5 Addresses are bureaucratic and costly

Figure 24: Schnettelker (2013)

Severely protracted when formal/informal issues are encountered.

7.6 Addresses can be opaque

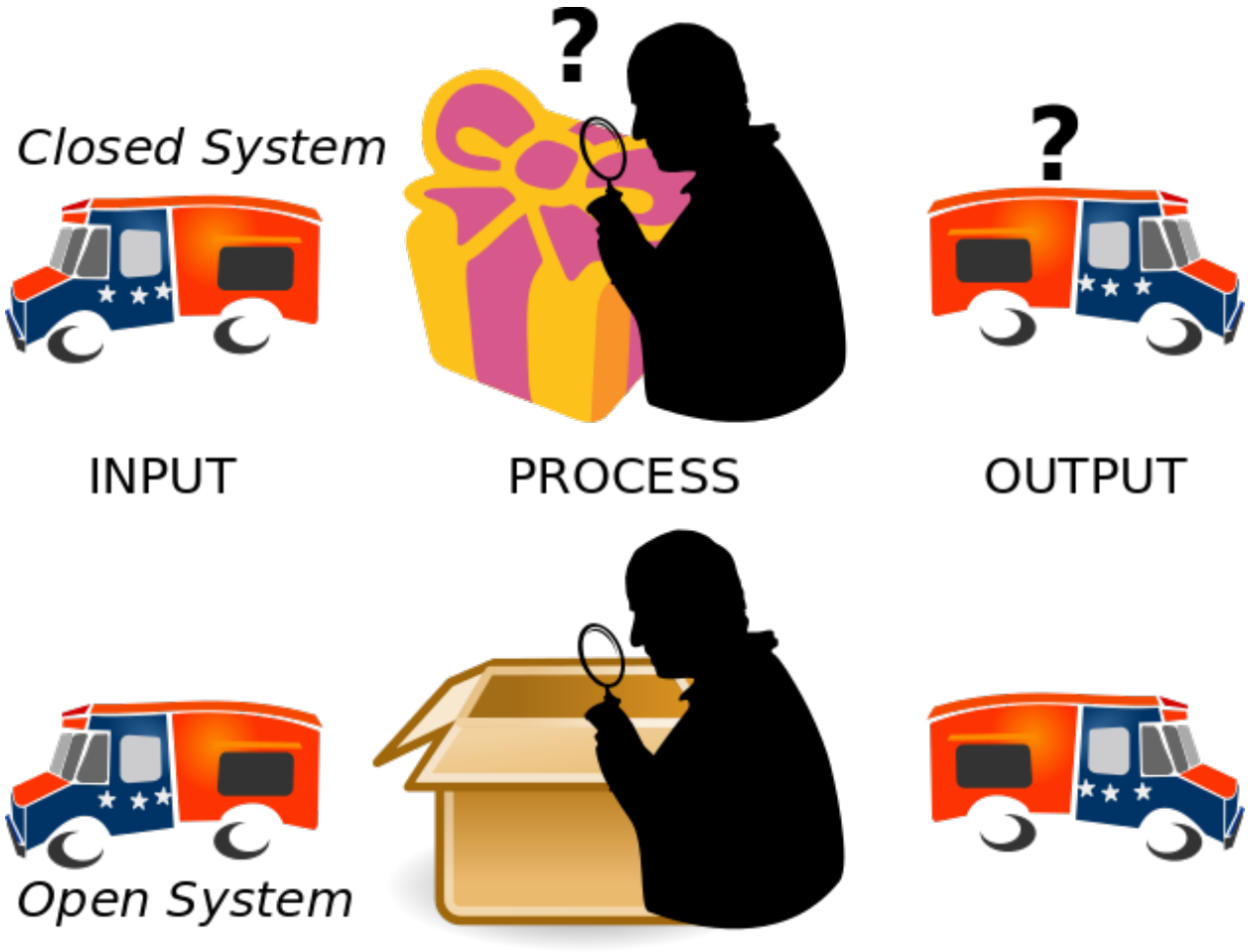


Figure 25: Beck (2015c)

transparent reproducibility critical for those at the beginning and end of the addressing life-cycle

7.7 Addresses are of global significance

Figure 26: Gray (2011)

7.8 Addresses are ripe for disruption

Figure 27: Rain (2007)

8 What about the address disenfranchised?

> It is almost impossible for individuals to be part of society without a legal identity.
>
> 4 billion people are excluded from the rule of law because they do not have a legal identity, and that **establishing such an identity often depends on having an official address**.
>
> Addresses appear to be a key element in aiding the delivery of policies at national and international levels ….

UPU (2012) p. 6

… particularly with regard to:

- governance
- rule of law
- poverty reduction
- disease prevention
- the provision of basic services such as:
  - electricity
  - sanitation
  - water.

UPU (2012) p. 6

> This century is witnessing a fundamental change in our way of life; for the first time in history, half of the world's population lives in towns and cities.
>
> Urban areas are growing faster in developing countries, mostly **through informal settlements.**
>
> The lack of an address, particularly in informal settlements, can also mean the lack of legal identity, equal opportunities for employment and social integration.

UPU (2012) p. 6

Addresses are becoming a ***basic human right***.

8.1 The World Bank have a plan

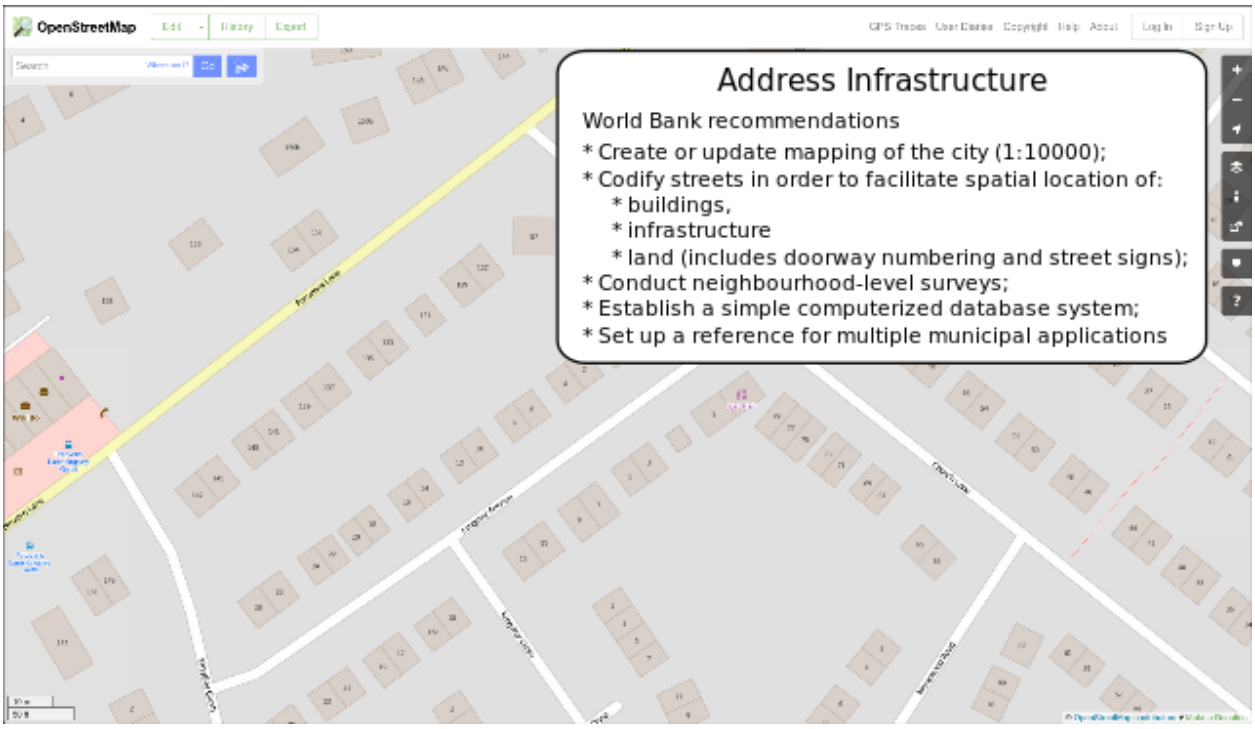


Figure 28: Beck (2015f)

8.2 But in Africa:

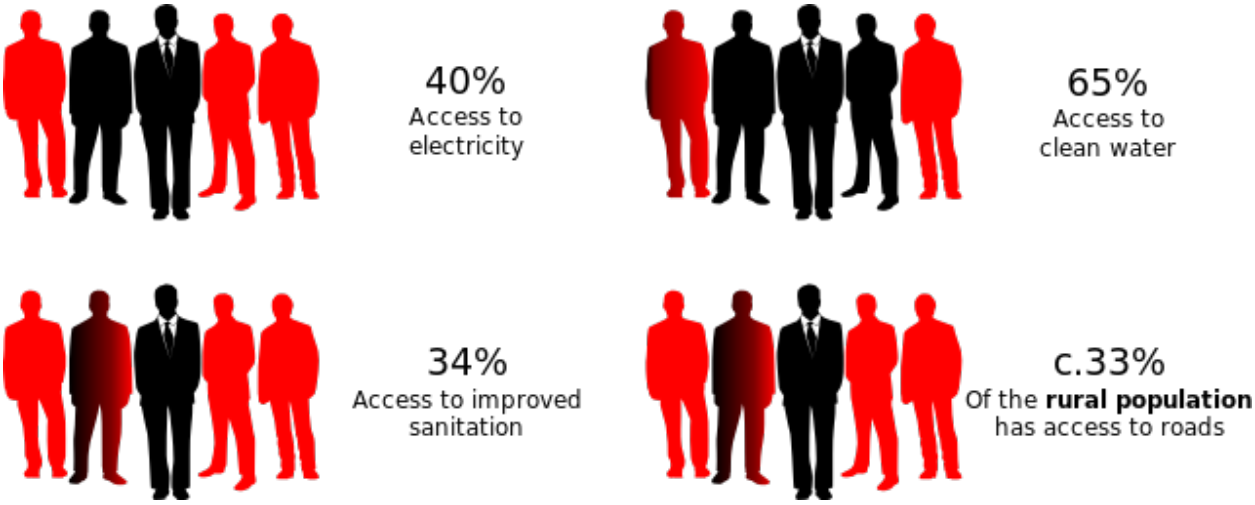


Figure 29: Beck (2015e)

It's difficult to do street based addressing when there are no streets!

The mapping of informal settlements in urban area implies legitamacy - hence it's not done!

And this does exacerbate the urban rural divide.

8.3 Legitimacy

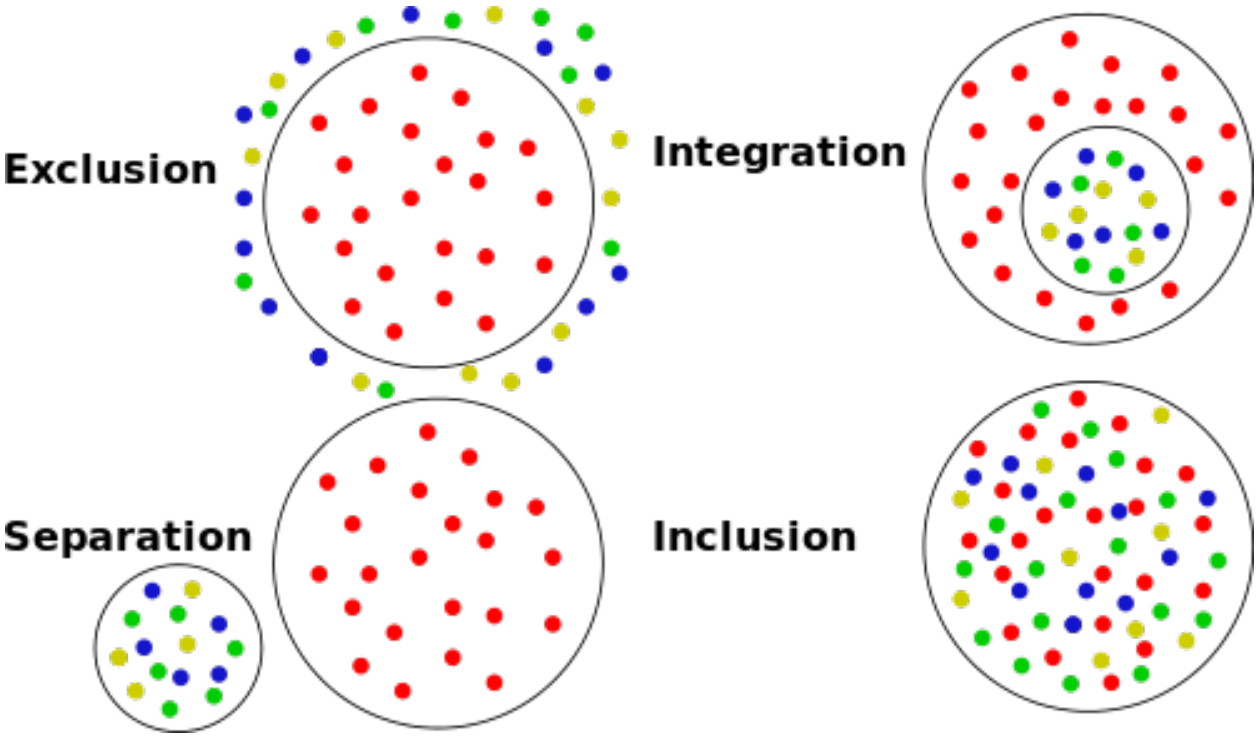


Figure 30: Beck (2015d)

Formal and informal barriers are profound

9 What are the aspirations for a global addressing framework?

Or an addressing commons?

Figure 31: Denelson83 (2008)

9.1 It will need to harmonise the formal and informal

Figure 32: Beck (2016a)

9.2 It should meet the needs of the rural and urban communities equally

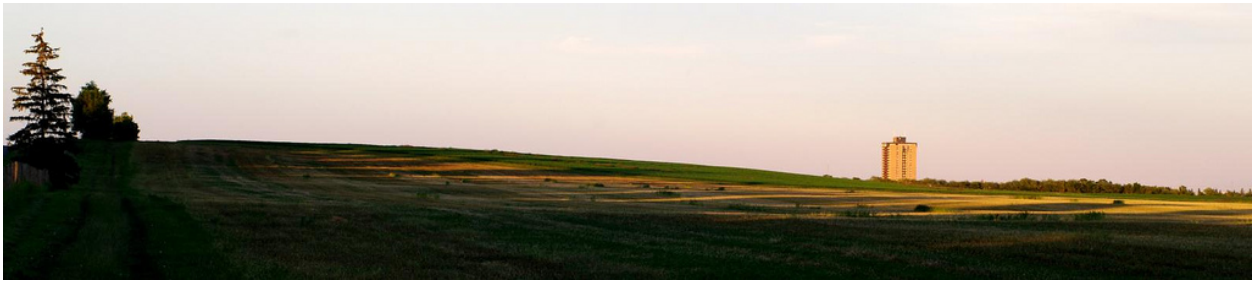


Figure 33: Bauschardt (2015)

9.3 It should be lightweight and cheap to implement

Figure 34: Schnettelker (2013)

9.4 It should be transparent, reproducible and predictable

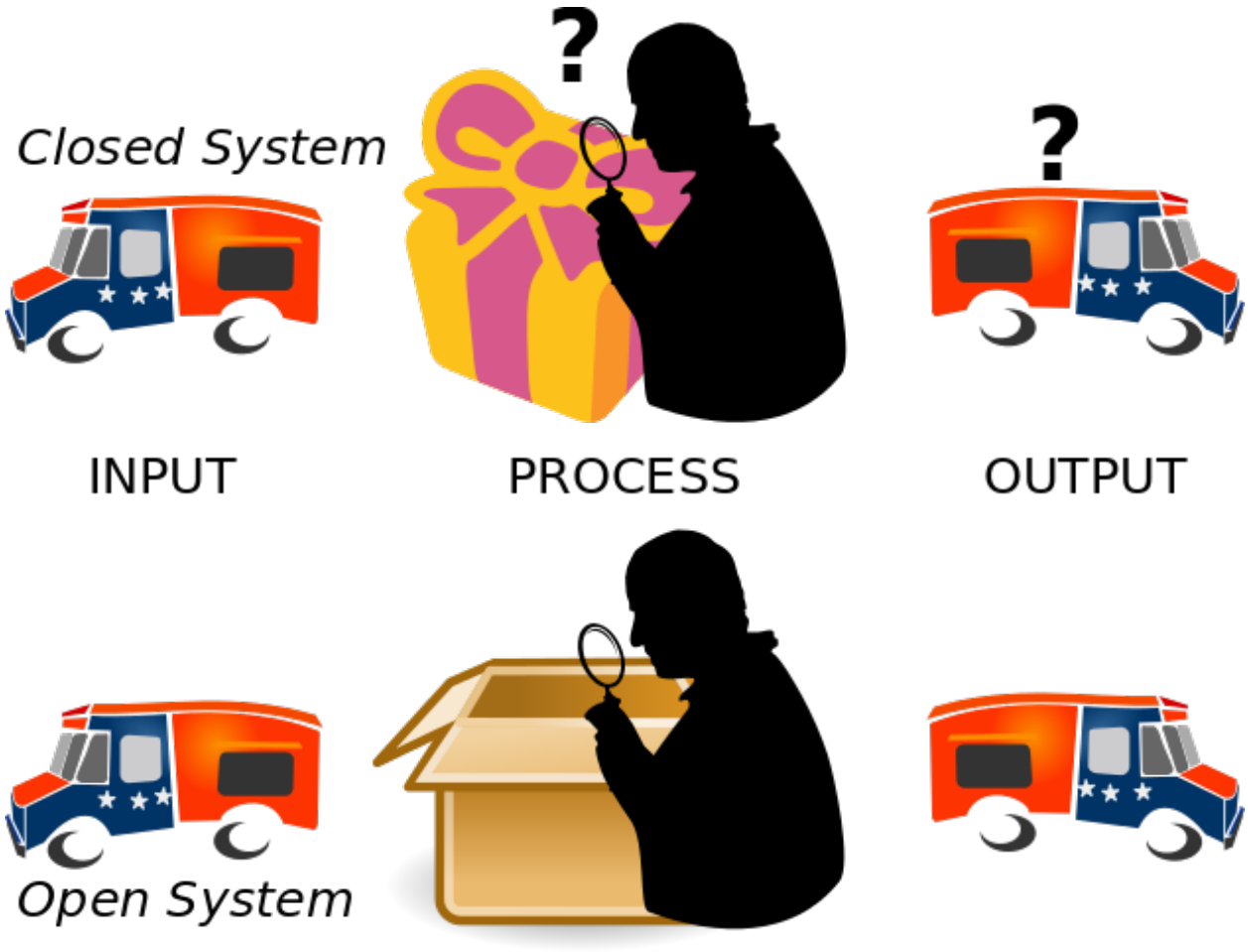


Figure 35: Beck (2015c)

9.5 It should be born spatial and global

An address system should not require specific geocoding services to make it spatial.

Streets are so last century…..

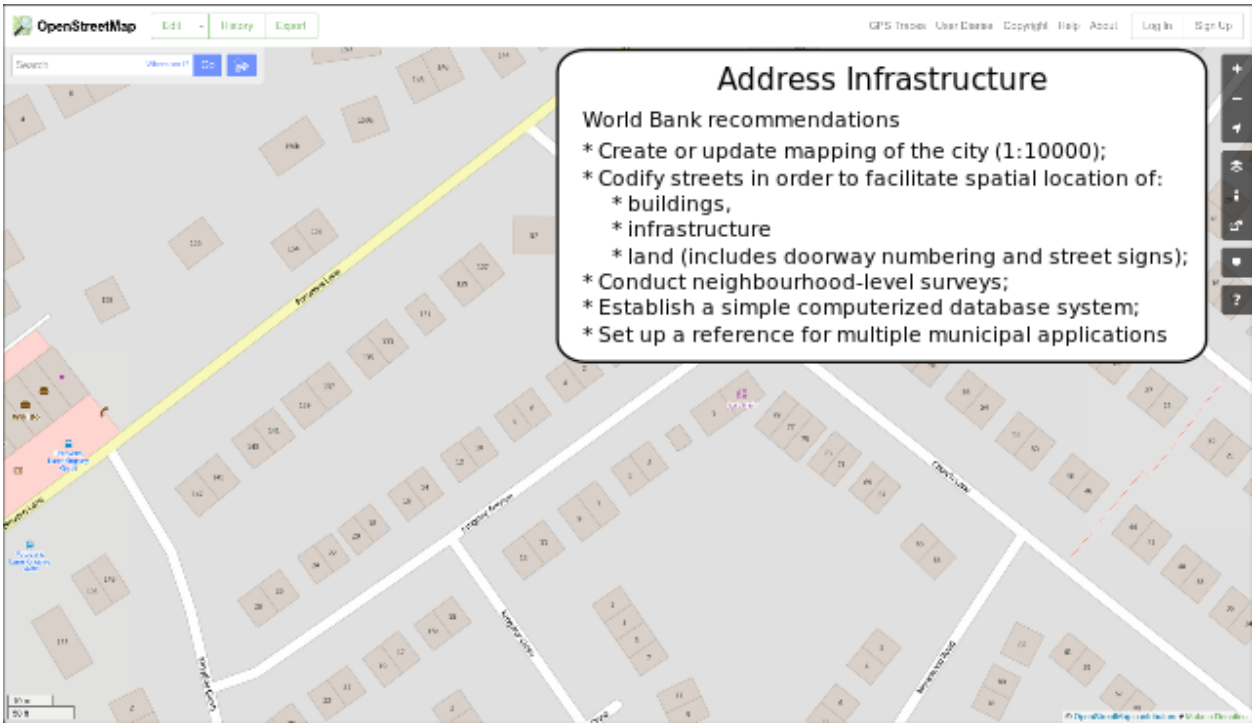


Figure 36: Beck (2015f)

- Ubiquitous GPS/GNSS
- Structured crowdsourced geo-enabled content (wikipedia, OSM)

9.6 It should be an openly licenced Core Reference data set

The situation is best summarised by the open access Danish addressing commons (UPU 2012, p.54):

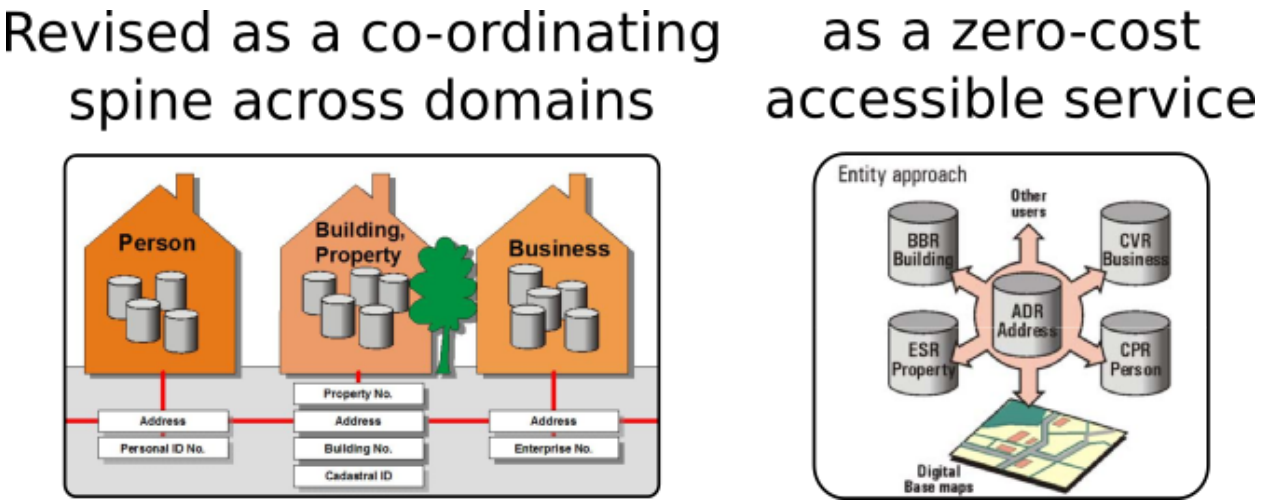


Figure 37: after Lind (2008)

The re-use statistics are staggering: * 70% of deliveries are to the private sector, * 20% are to central government * 10% are to municipalities.

There is no such thing as an unmatched address.

9.7 It should be accessible (on and off-line)

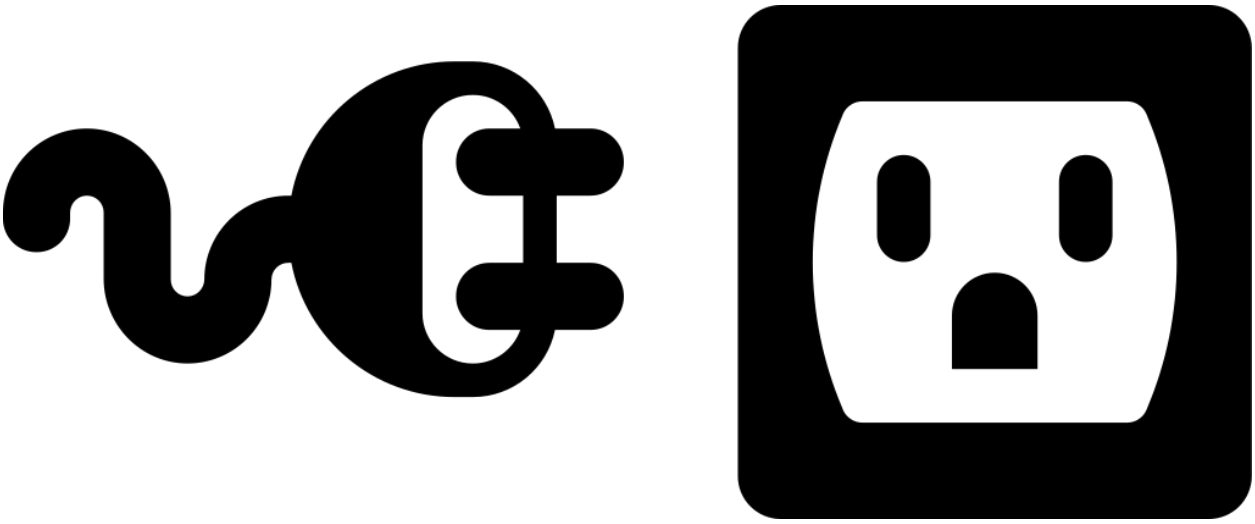


Figure 38: Plugged in

9.8 It should support and enhance business services

Figure 39: Gray (2011)

9.9 It should support many ways of engagement

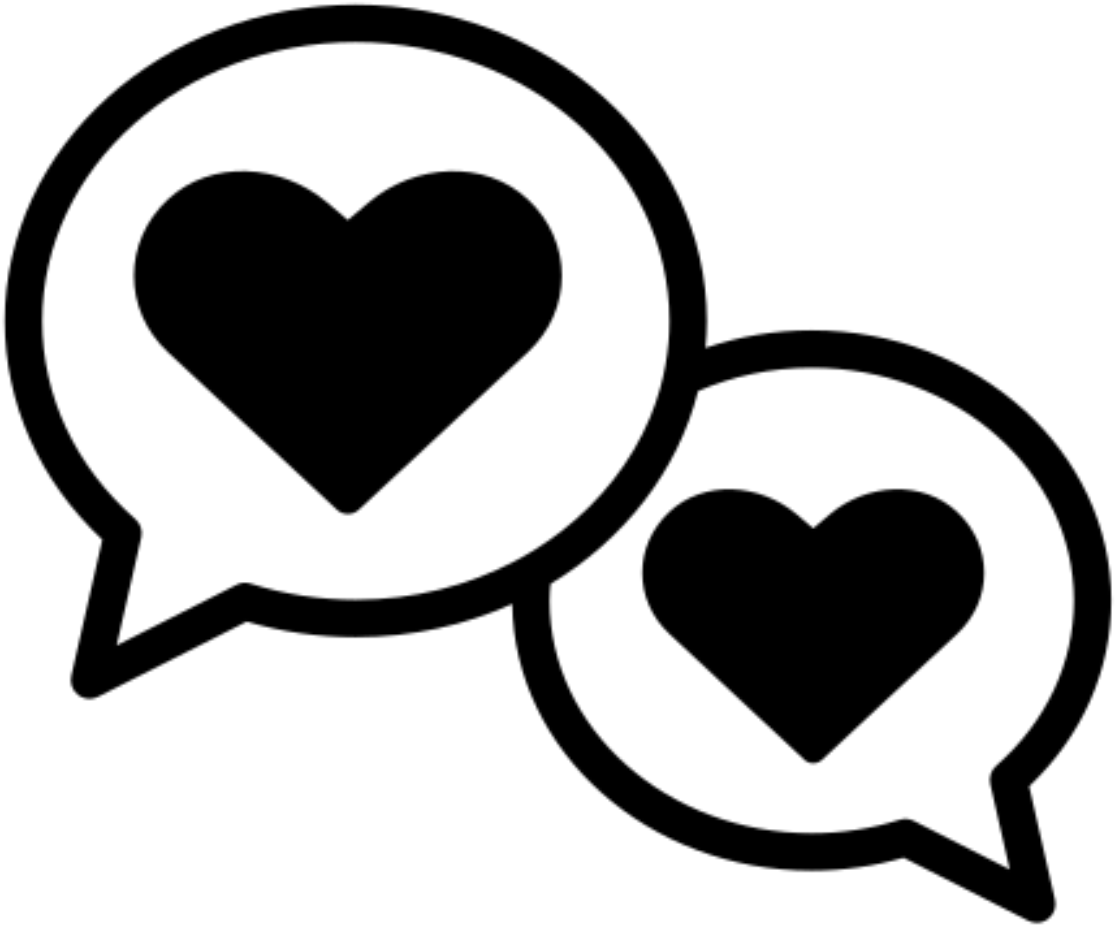


Figure 40: Public domain image from The Love Talk Project

What3Words completely get this!

10 A new global address paradigm?

- Amazon drone delivery in the UK requires
  - A new view over addressing complements streets and buildings but is geo-coded at source
  - and supports accurate delivery throughout the delivery chain using a global referencing system.

Is there a universal approach which allows all avenues to be satisfied?

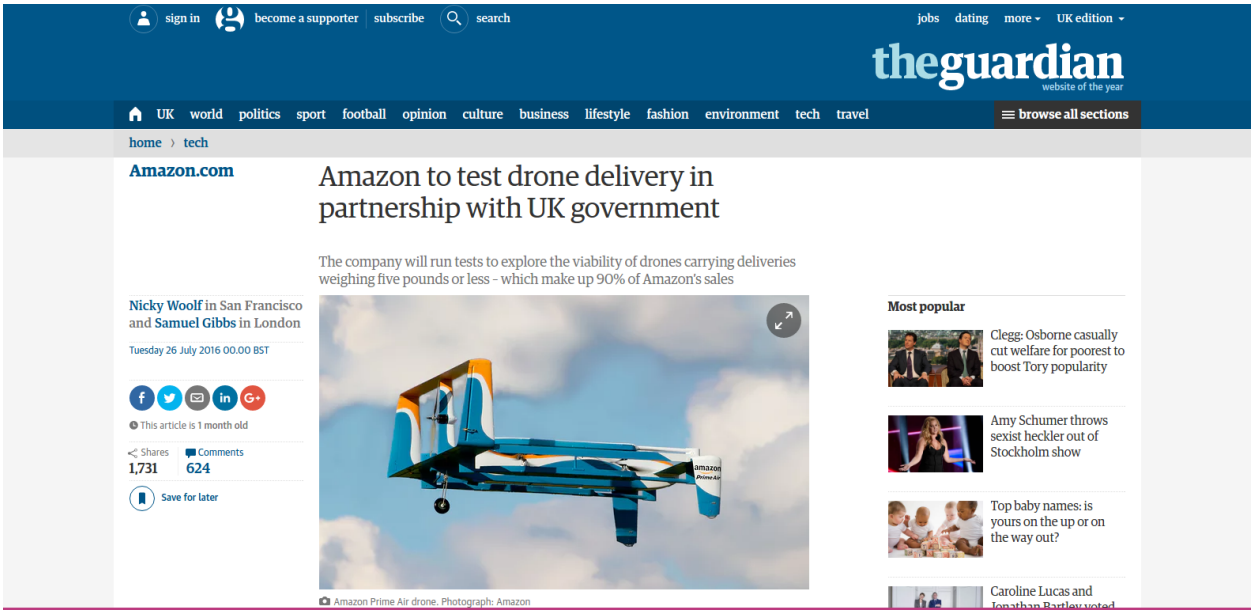


Figure 41: Amazon drone delivery in the UK requires

11 How might this look? CORE

. .

MUST HAVE Core requirements for a Global Address Framework

. .

11.1 WGS84 algorithmic address minting

- **Born spatial**
- **Accessible**
- **Lightweight and cheap to implement**
- **Transparent, reproduceable and predicatable**

Figure 42: Addressing minting: Addison (2009)

11.2 Small footprint

- **Accessible**
- **Lightweight and cheap to implement**

Figure 43: Small footprints: Terwolbeck (2012)

11.3 Short/memorable

Support and enhance business services

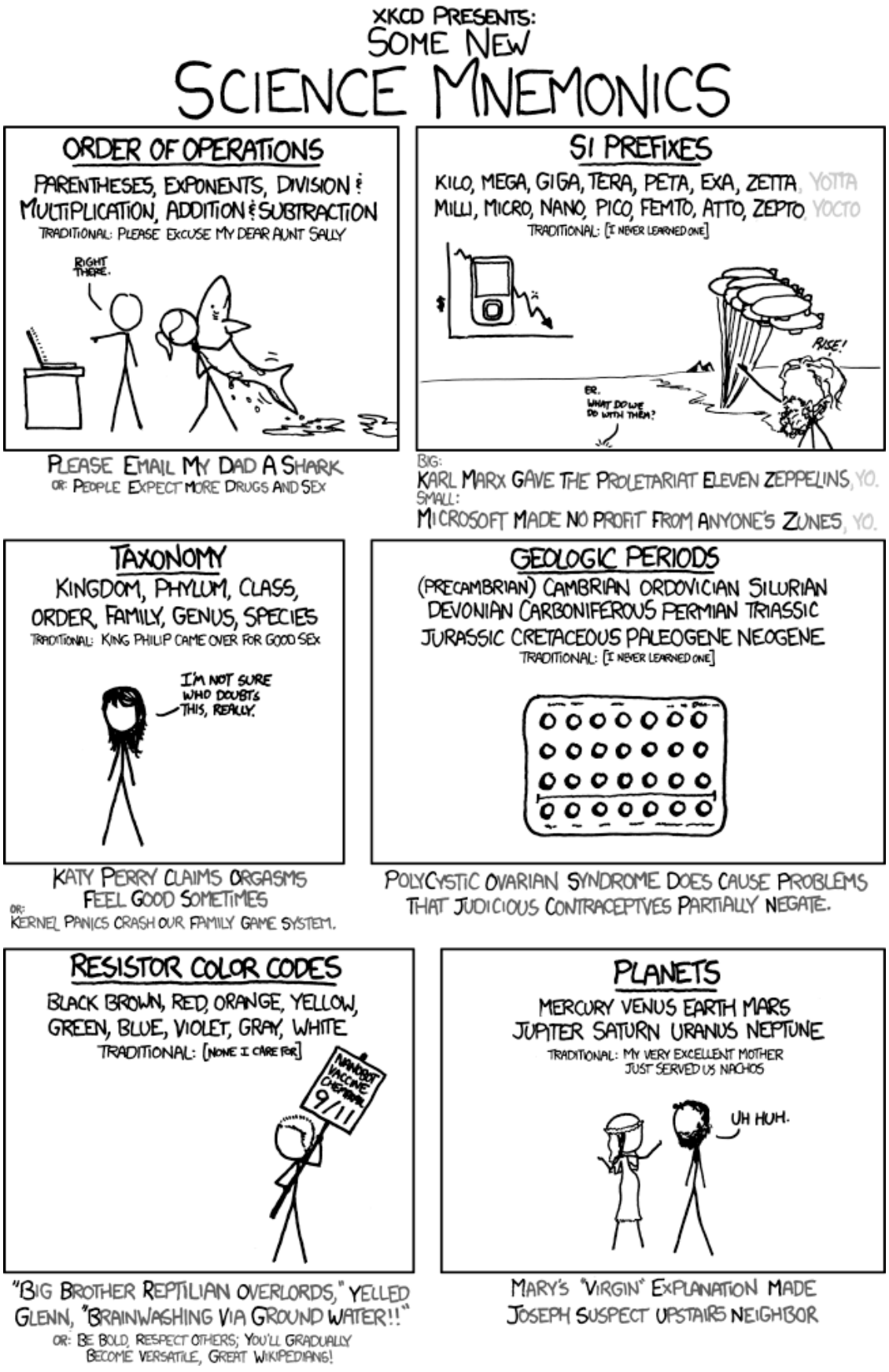


Figure 44: Munroe ()

11.4 Self checking

- **Support and enhance business services**

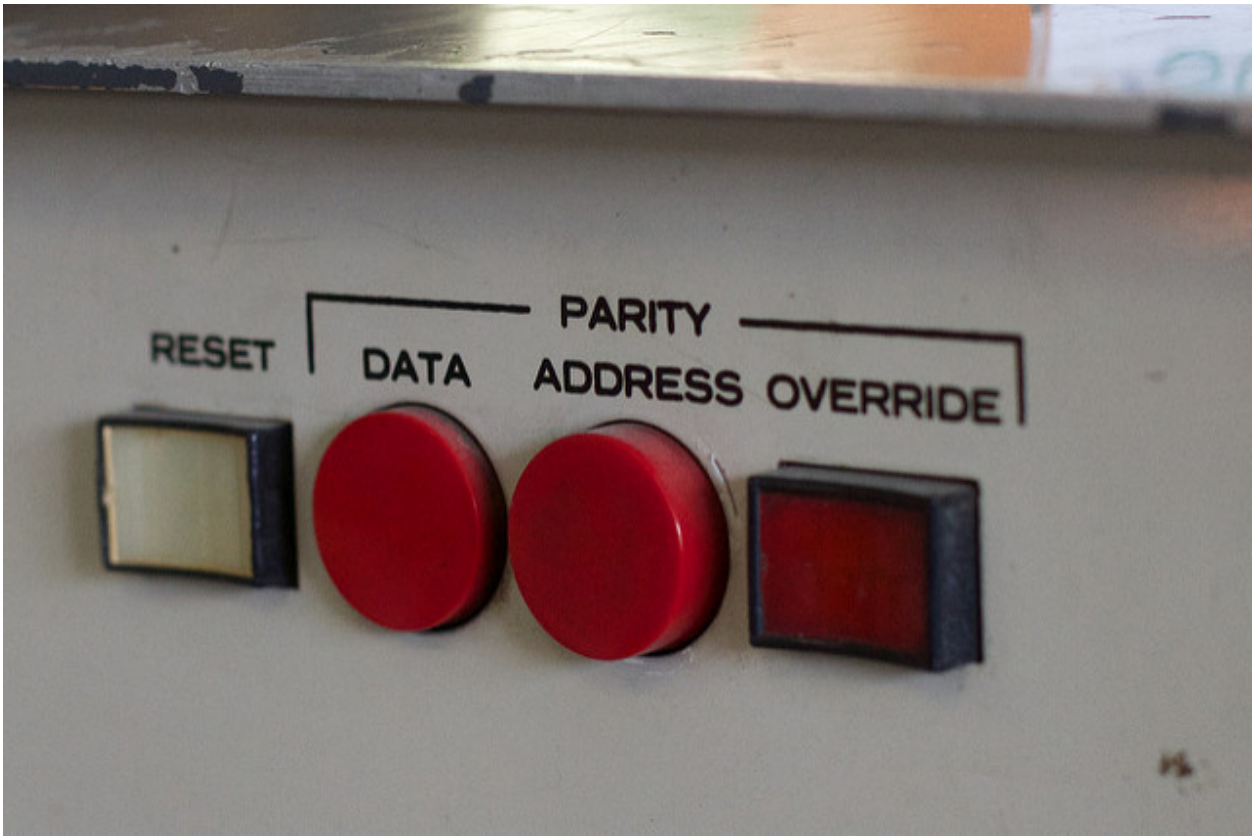


Figure 45: Levine (2014)

11.5 Unlimited spatial recording

- **Support and enhance business services**
- **Formal and informal, Rural and Urban**
  - What are the spatial requirements for the range of addressing options?
    - Manila has a population density of 42,857 people per square km.
    - Map Kibera and OSM has revolutionised service delivery in Kibera (Kenya).
      - Address Kibera could do the same thing for citizenship.

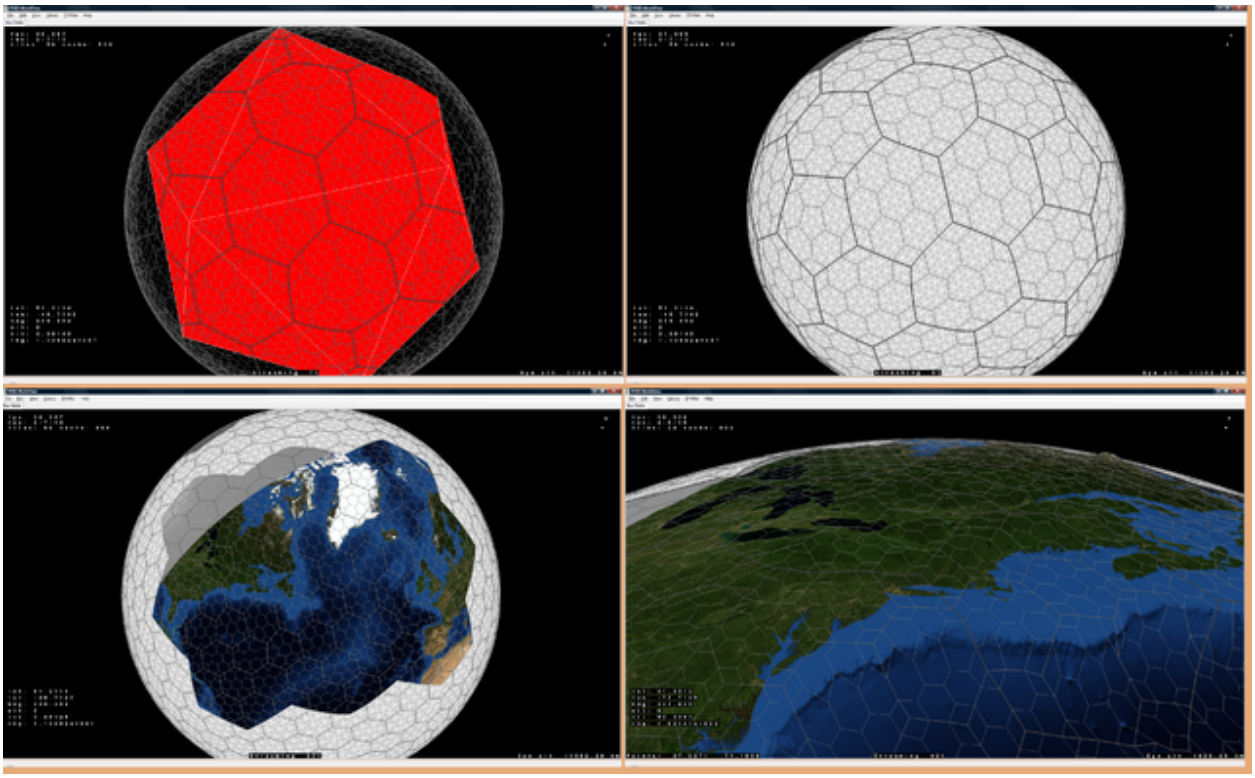


Figure 46: Petersen (2007)

11.6 Open and interoperable

- **Transparent, reproduceable and predicatable**
- **Openly Licensed**

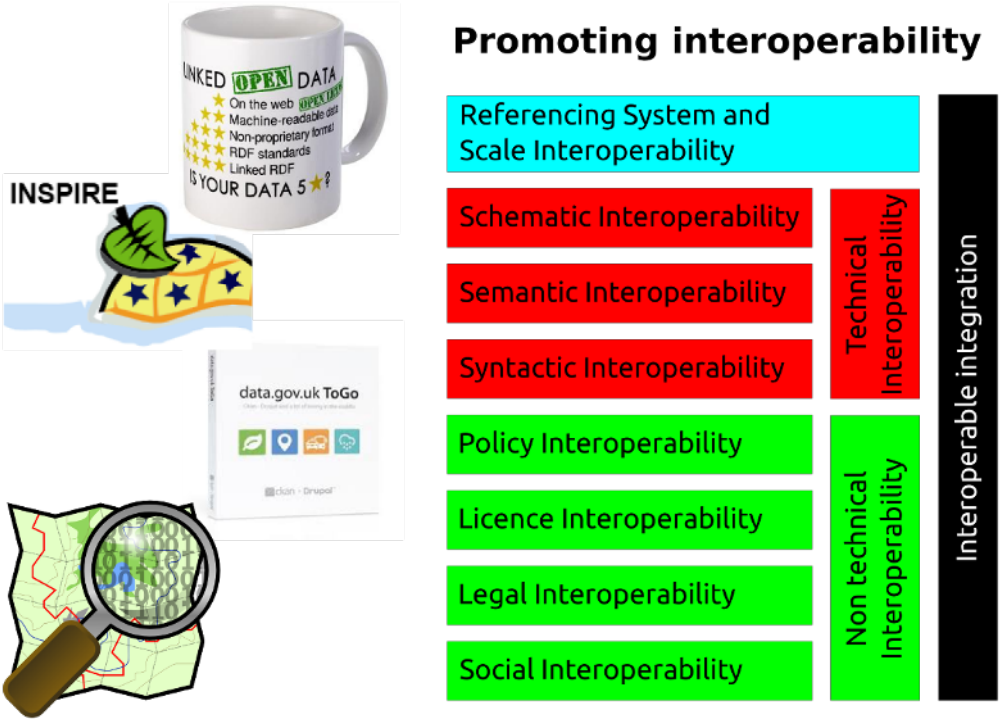


Figure 47:

> the lack of a consistent and transparent legal and policy framework for sharing spatial data continues to be an additional roadblock.

Pomfret & Ramage (2010)

12 How might this look? Nice to haves

. .

Would be nice to have extended requirements for a Global Address Framework

. .

12.1 Indoor use and 3D

- **Support and enhance business services**
- Incorporating wifi-triangulation - *individual room* addressing and navigation.
- Seamless integration with BIM and CityGML.
- *Addressing isn't only about buildings and 2D - think 3D and the Internet of Things*

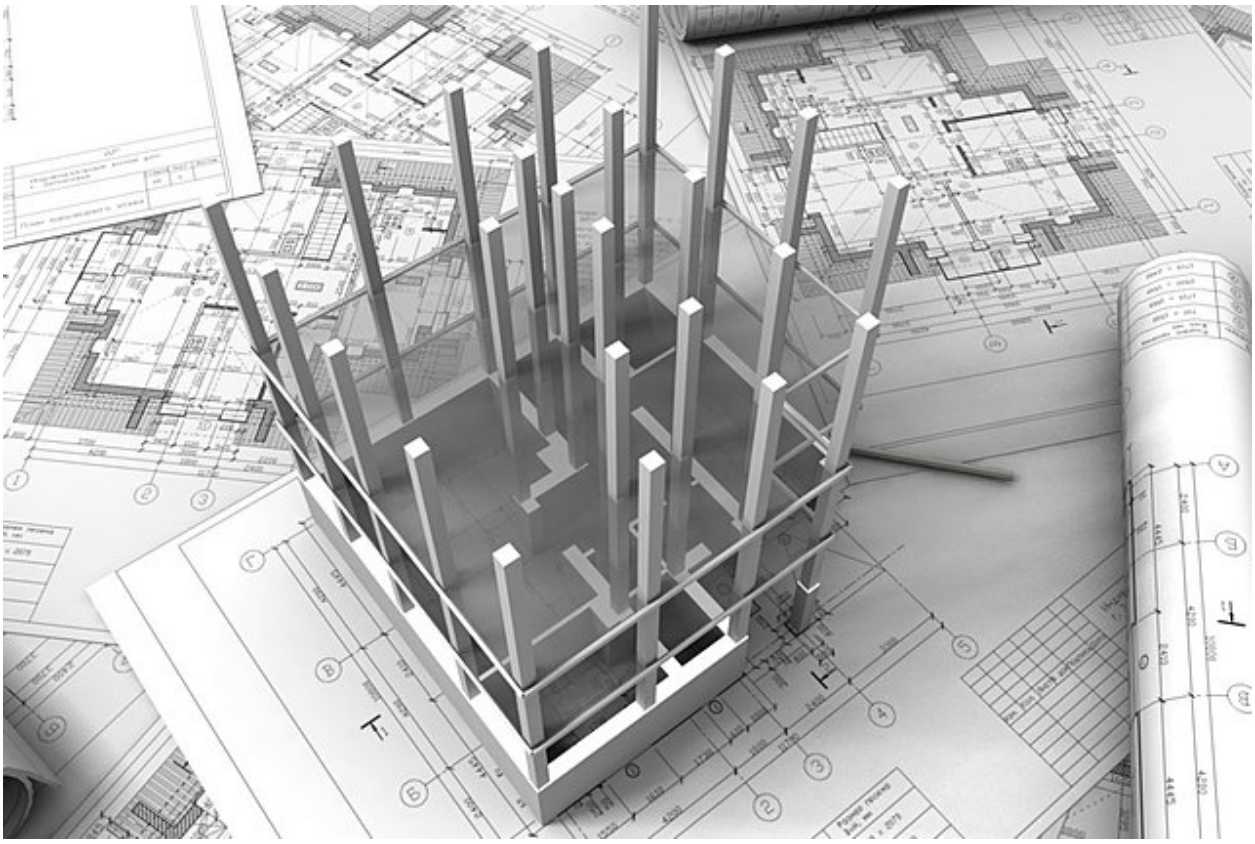


Figure 48: Arup (2013)

12.2 Inherent geo-statistical aggregation (spatially scalable)

- **Support and enhance business services**
- GIS free multi-scale analysis and reporting during disaster scenarios.

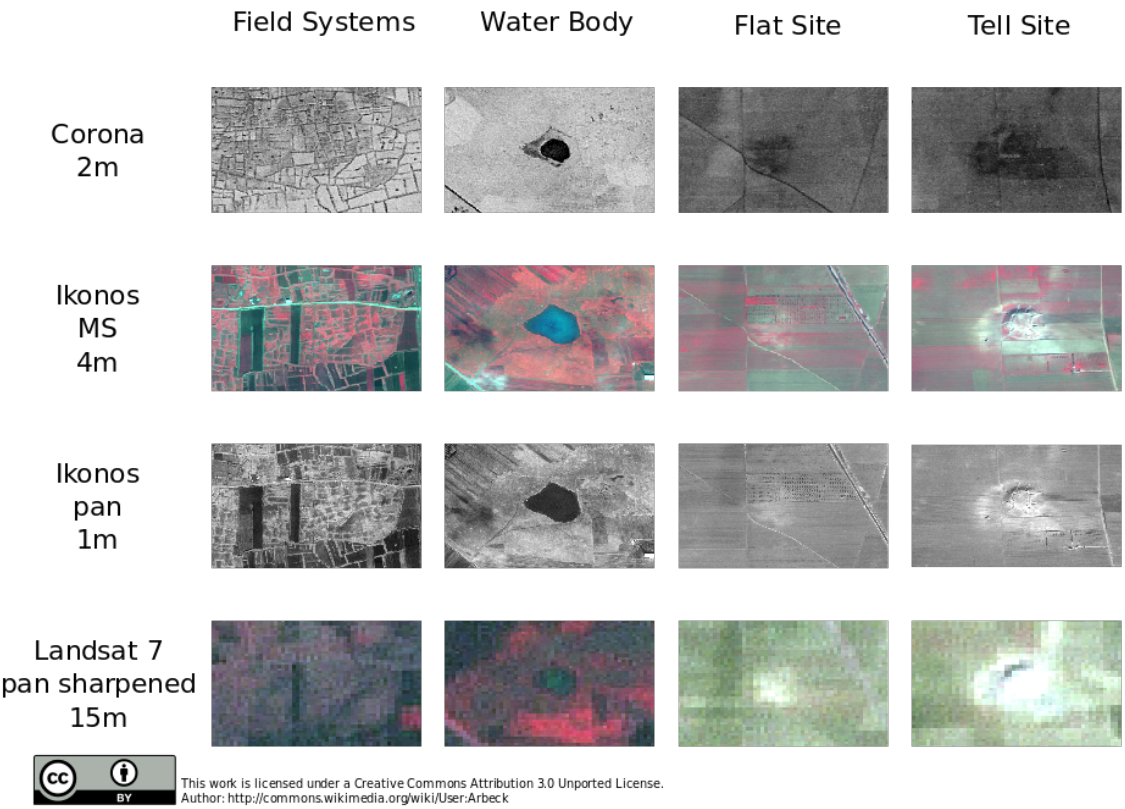


Figure 49: How spatial resolution impacts on feature detection Beck (2012)

12.3 Area representation based on a regular tessellation

- **Support and enhance business services**
  - It is still useable within traditional GIS.

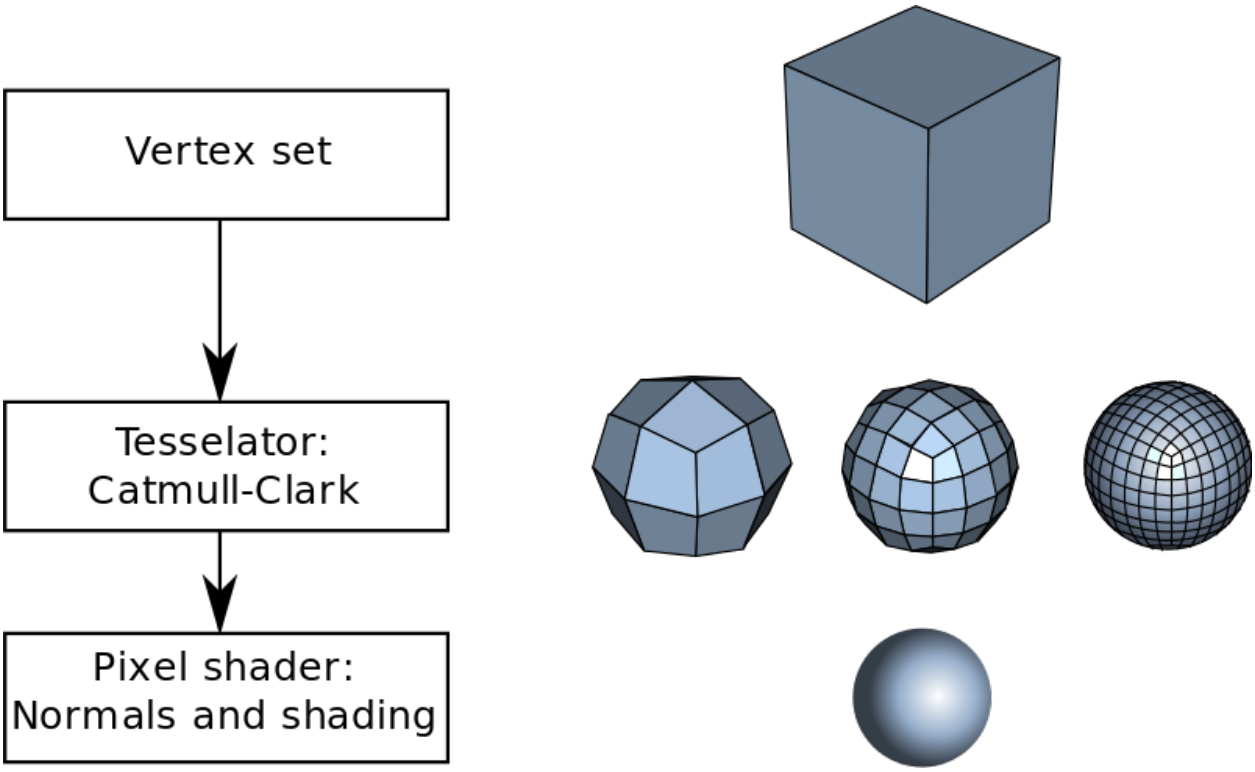


Figure 50: Public domain image

12.4 Spatial adjacency relations within the encoding

- **Support and enhance business services**
  - Understanding localised connectivity relations.

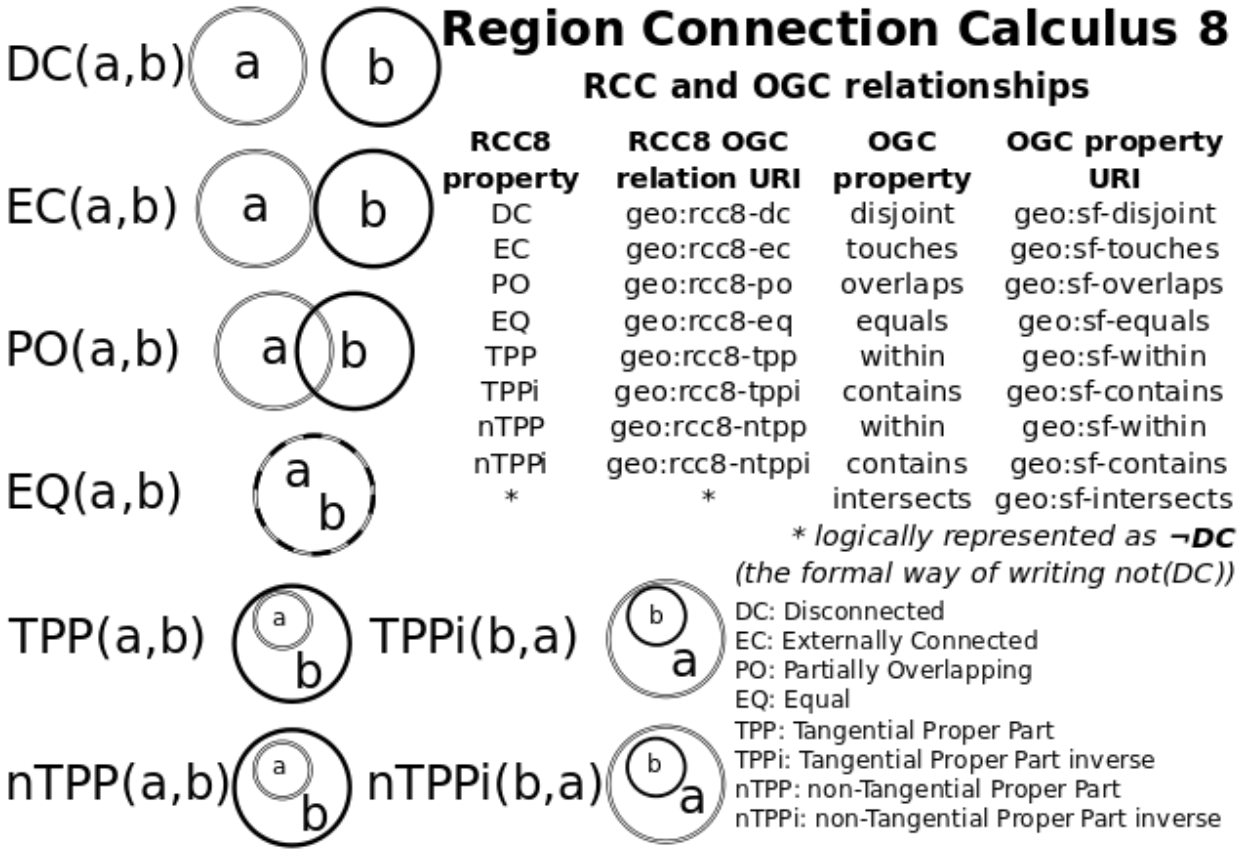


Figure 51: Beck (2013)

13 What do you want your technology candidates to do?

BCS examples (in alphabetical order):

- GeoHash
  - gcpvj1r2vnbp
- Maidenhead Locator System
  - IO85jw (it has a very large footprint)
- MapCode
  - GBR 8PJ.TJ

- Natural Area Code
  - GQ0X1 S9PNR
- What3Words
  - assume.calms.union

13.1 Combining frameworks

- One size doesn't have to fit all.
- Build bridges between Global and National frameworks
- Understand fitness for purpose for each application

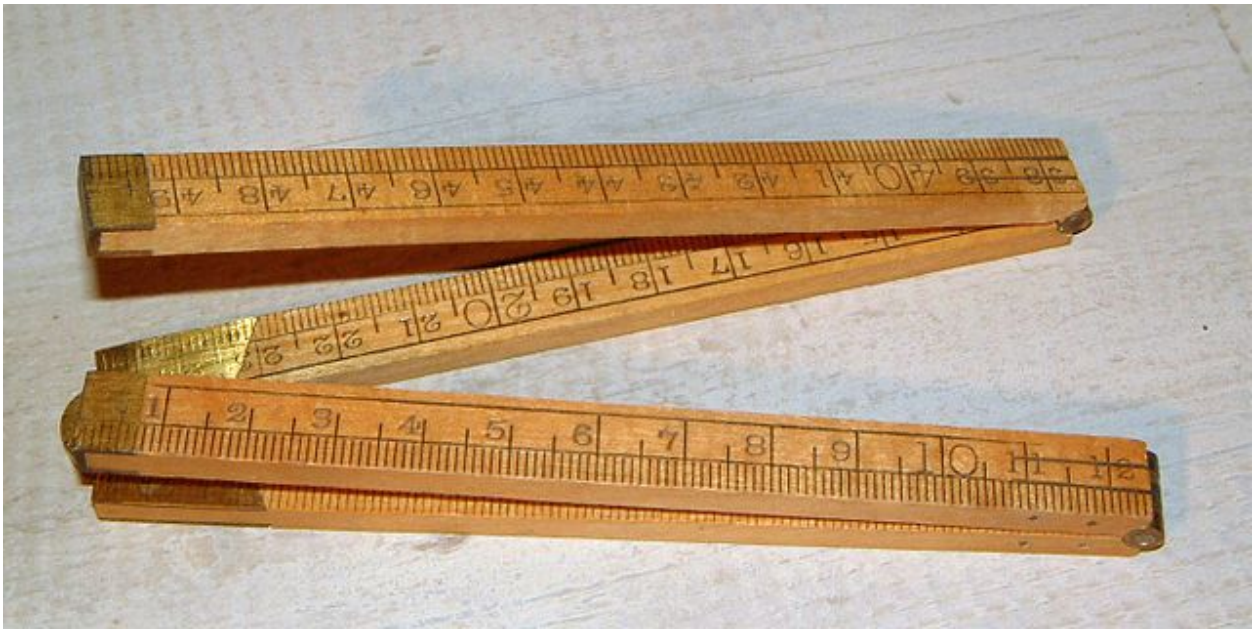


Figure 52: A public domain image

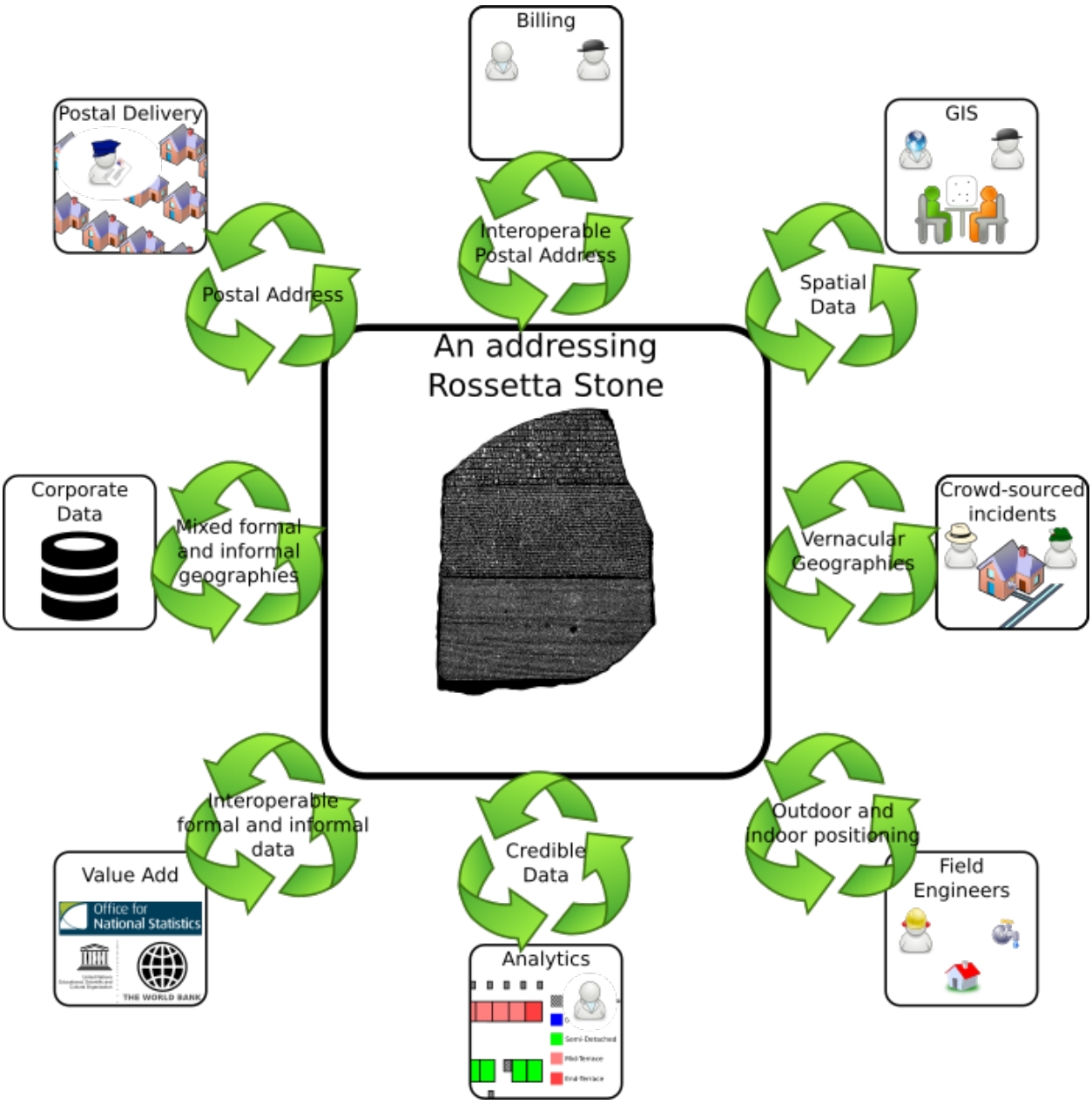


Figure 53: Righs reserved

13.2 Q. How do we encourage such infrastructure development?

Figure 54: Gray (2011)

13.3 A. Support core reference geographies

Bob Barr has described core reference geographies as geographic data which:

- Are definitive
- Should be collected and maintained once and used many times
- Are Natural monopolies (which addresses are)
- Have variable value in different applications
- Have highly elastic demand

Global addresses are a core reference geography.

13.4 Wrap up…. A GeoCommons core supporting formal and informal services

What if global addressing, as a core reference geography, was an inclusive loosely coupled GeoCommons……..

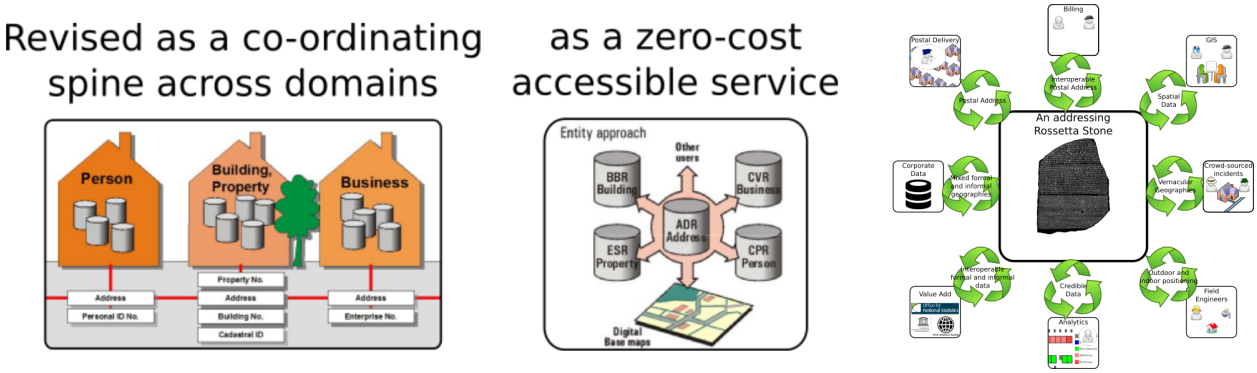


Figure 55: after Lind (2008)

13.5 Questions

Figure 56: It's all about me - details about Anthony Beck

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