

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

Anthony Beck (GeoLytics)

Abstract

Dr. Anthony Beck (GeoLytics Ltd.)

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18:30 - 19:45 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](#)

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This document has been written in CommonMark: an unambiguous implementation of Markdown for scholarly writing.

Contents

1 Bio	4
2 Abstract	4
3 What characteristics are required for Global Address applications in the 21st century?	6
3.1 About me	11
3.2 About this presentation	11
4 Addresses	12
4.1 are part of the fabric of everyday life	12
4.2 Have economic and commercial impact	13
4.3 Support governance and democracy	14
4.4 Support Legal and Social integration	15
4.5 Provide spatial structure.	16
4.6 Bridge gaps	17
5 What is an address?	18
5.1 Address abstraction	18
5.2 Address abstraction	19
5.3 In the beginning was the ledger, the register, the record	20
5.4 Then came formalisation	21
5.4.1 Korea: The Jibeon system - taxation	22
5.4.2 UK Addressing Geoplace - Formal	23
5.4.3 The AddressBase Family	24
5.4.4 Royal Mail - Access and Delivery points	25
5.4.5 Denmark: An addressing commons	26
5.4.6 The World Bank	27
6 Addressing issues	28
6.1 Issues: addresses = postal address.	29
7 Taking stock	30
7.1 Addresses are heterogeneous	30
7.2 Assets can have addresses	31
7.3 National data silos	32
7.4 Licence silos	33
7.5 Addresses are bureaucratic and costly	34
7.6 Addresses can be opaque	35
7.7 Addresses are of global significance	36
7.8 Addresses are ripe for disruption	37
8 What about the address disenfranchised?	39
8.1 The World Bank have a plan	40
8.2 But in Africa:	41
8.3 Legitimacy	42
9 What are the aspirations for a global addressing framework?	43
9.1 It will need to harmonise the formal and informal	44
9.2 It should meet the needs of the rural and urban communities equally	45
9.3 It should be lightweight and cheap to implement	46
9.4 It should be transparent, reproducible and predictable	47
9.5 It should be born spatial and global	48
9.6 It should be an openly licenced Core Reference data set	49

9.7 It should be accessible (on and off-line)	50
9.8 It should support and enhance business services	51
10 A new global address paradigm?	52
11 How might this look? CORE	53
11.1 WGS84 algorithmic address minting	54
11.2 Small footprint	55
11.3 Short/memorable	56
11.4 Self checking	58
11.5 Unlimited spatial recording	59
11.6 Open and interoperable	60
12 How might this look? Nice to haves	62
12.1 Indoor use and 3D	63
12.2 Inherent geo-statistical aggregation (spatially scalable)	64
12.3 Area representation based on a regular tessellation	65
12.4 Spatial adjacency relations within the encoding	66
13 Examples.....	67
14 Wrap up	68

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

Anthony Beck (GeoLytics)



Figure 1: Dystopos (2005)

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Figure 2:

things to do:

- sort out bibliography
- sort out illustration titles and associated biblio
- do wrap
- place on git
 - add in links to pdf and master page
 - update git

```

## PDF output using pandoc

import os

### Export this notebook as markdown
commandLineSyntax = 'ipython nbconvert --to markdown 20190306_Global_Address_Characteristics_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_Global_Address_Characteristics_Presentation.ipynb'

os.system(commandLineSyntax)

ipython nbconvert --to markdown 20190306_Global_Address_Characteristics_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 UseMe_BasedOn2015Presentation.ipynb --to slides --post serve
[NbConvertApp] WARNING | pattern 'UseMe_BasedOn2015Presentation.ipynb' matched no files
This application is used to convert notebook files (*.ipynb) to various other
formats.

WARNING: THE COMMANDLINE INTERFACE MAY CHANGE IN FUTURE RELEASES.

```

Options

Arguments that take values are actually convenience aliases to full
Configurables, whose aliases are listed on the help line. For more information
on full configurables, see '--help-all'.

```

--debug
    set log level to logging.DEBUG (maximize logging output)
--generate-config
    generate default config file
-y
    Answer yes to any questions instead of prompting.
--execute
    Execute the notebook prior to export.
--allow-errors
    Continue notebook execution even if one of the cells throws an error and include the error message
--stdin

```

```

    read a single notebook file from stdin. Write the resulting notebook with default basename 'notebook'
--stdout
    Write notebook output to stdout instead of files.
--inplace
    Run nbconvert in place, overwriting the existing notebook (only
    relevant when converting to notebook format)
--clear-output
    Clear output of current file and save in place,
    overwriting the existing notebook.
--no-prompt
    Exclude input and output prompts from converted document.
--no-input
    Exclude input cells and output prompts from converted document.
    This mode is ideal for generating code-free reports.
--log-level=<Enum> (Application.log_level)
    Default: 30
    Choices: (0, 10, 20, 30, 40, 50, 'DEBUG', 'INFO', 'WARN', 'ERROR', 'CRITICAL')
    Set the log level by value or name.
--config=<Unicode> (JupyterApp.config_file)
    Default: ''
    Full path of a config file.
--to=<Unicode> (NbConvertApp.export_format)
    Default: 'html'
    The export format to be used, either one of the built-in formats, or a
    dotted object name that represents the import path for an `Exporter` class
--template=<Unicode> (TemplateExporter.template_file)
    Default: ''
    Name of the template file to use
--writer=<DottedObjectName> (NbConvertApp.writer_class)
    Default: 'FileWriter'
    Writer class used to write the results of the conversion
--post=<DottedOrNone> (NbConvertApp.postprocessor_class)
    Default: ''
    PostProcessor class used to write the results of the conversion
--output=<Unicode> (NbConvertApp.output_base)
    Default: ''
    overwrite base name use for output files. can only be used when converting
    one notebook at a time.
--output-dir=<Unicode> (FileWriter.build_directory)
    Default: ''
    Directory to write output(s) to. Defaults to output to the directory of each
    notebook. To recover previous default behaviour (outputting to the current
    working directory) use . as the flag value.
--reveal-prefix=<Unicode> (SlidesExporter.reveal_url_prefix)
    Default: ''
    The URL prefix for reveal.js (version 3.x). This defaults to the reveal CDN,
    but can be any url pointing to a copy of reveal.js.
    For speaker notes to work, this must be a relative path to a local copy of
    reveal.js: e.g., "reveal.js".
    If a relative path is given, it must be a subdirectory of the current
    directory (from which the server is run).
    See the usage documentation
    (https://nbconvert.readthedocs.io/en/latest/usage.html#reveal-js-html-slideshow) for more details.

```

```
--nbformat=<Enum> (NotebookExporter.nbformat_version)
Default: 4
Choices: [1, 2, 3, 4]
The nbformat version to write. Use this to downgrade notebooks.
```

To see all available configurables, use `--help-all`

Examples

The simplest way to use nbconvert is

```
> jupyter nbconvert mynotebook.ipynb
```

which will convert mynotebook.ipynb to the default format (probably HTML).

You can specify the export format with `--to`.

Options include ['asciidoc', 'custom', 'html', 'html_ch', 'html_embed', 'html_toc', 'html_with_lenv']

```
> jupyter nbconvert --to latex mynotebook.ipynb
```

Both HTML and LaTeX support multiple output templates. LaTeX includes 'base', 'article' and 'report'. HTML includes 'basic' and 'full'. You can specify the flavor of the format used.

```
> jupyter nbconvert --to html --template basic mynotebook.ipynb
```

You can also pipe the output to stdout, rather than a file

```
> jupyter nbconvert mynotebook.ipynb --stdout
```

PDF is generated via latex

```
> jupyter nbconvert mynotebook.ipynb --to pdf
```

You can get (and serve) a Reveal.js-powered slideshow

```
> jupyter nbconvert myslides.ipynb --to slides --post serve
```

Multiple notebooks can be given at the command line in a couple of different ways:

```
> jupyter nbconvert notebook*.ipynb
> jupyter nbconvert notebook1.ipynb notebook2.ipynb
```

or you can specify the notebooks list in a config file, containing::

```
c.NbConvertApp.notebooks = ["my_notebook.ipynb"]
```

```
> jupyter nbconvert --config mycfg.py
```

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
Populating the interactive namespace from numpy and matplotlib
```

3.1 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

3.2 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

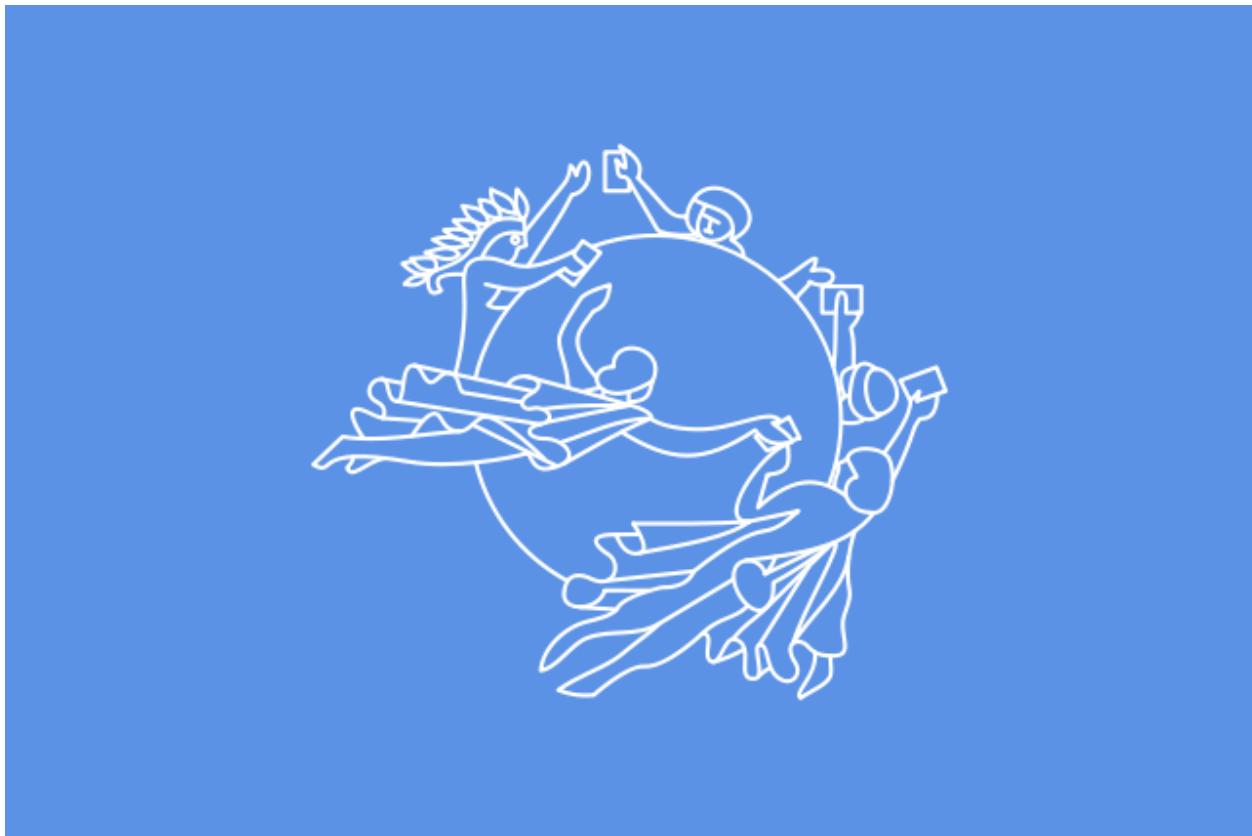


Figure 5: Denelson83 (2008)

4.3 Support governance and democracy

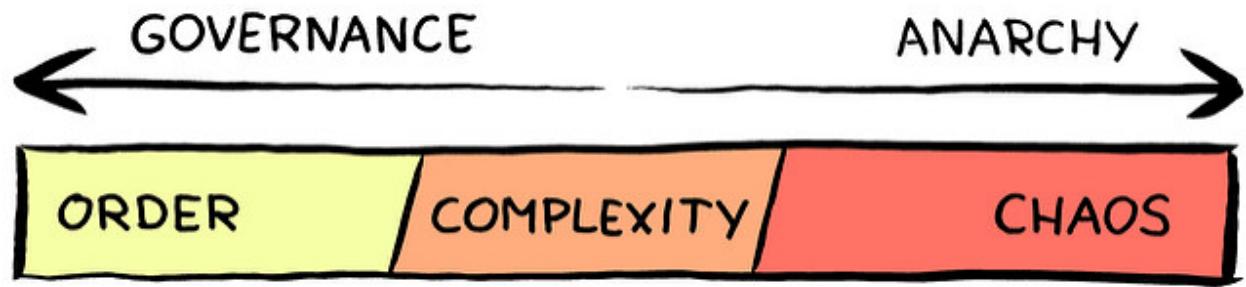


Figure 6: Appelo (2010)

- 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

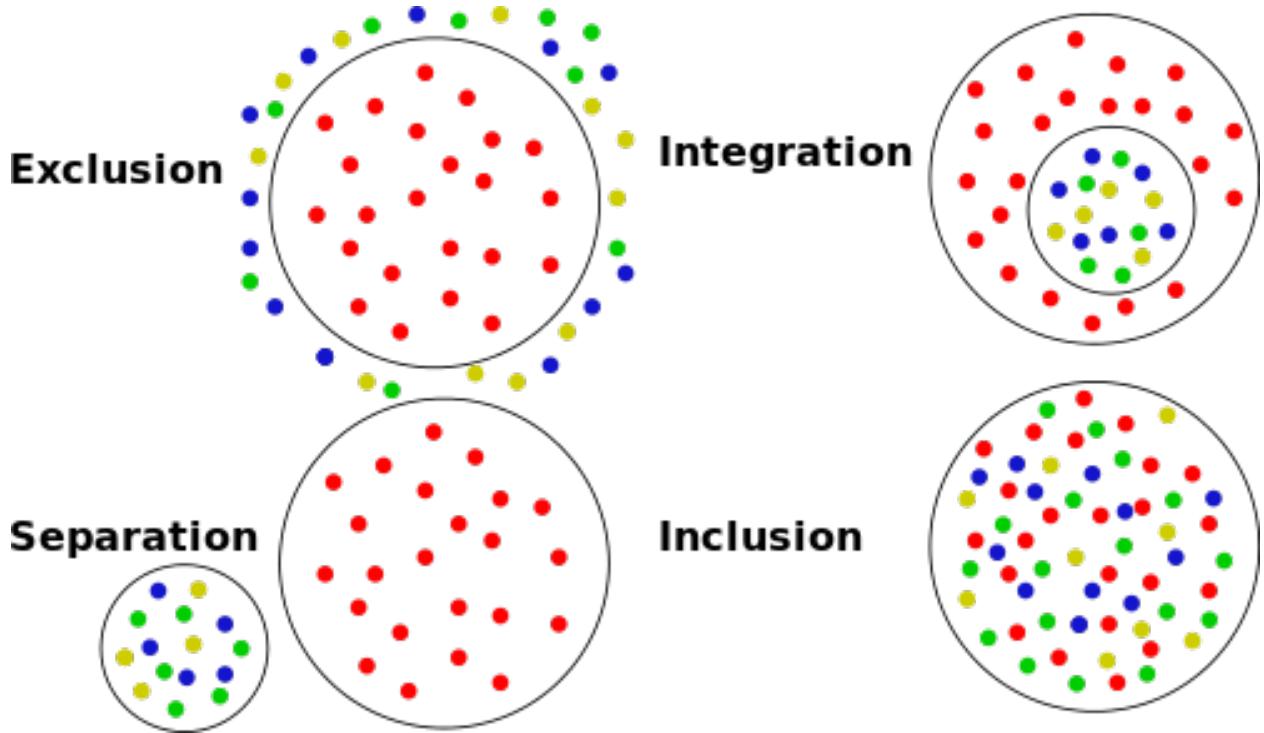


Figure 7: Beck (2015d)

- 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

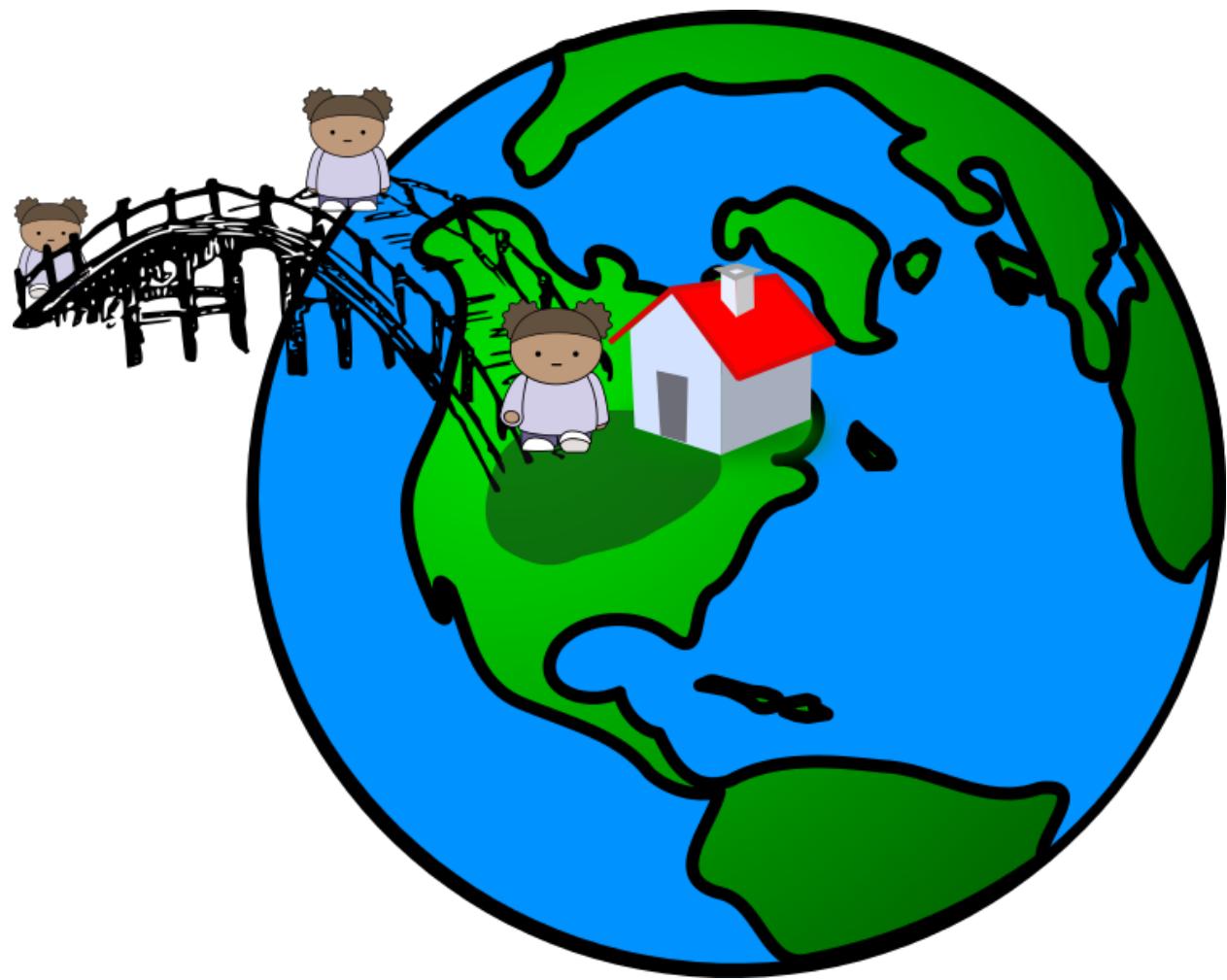


Figure 9:

provide the link between *people* and *place*

5 What is an address?

5.1 Address abstraction

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

5.2 Address abstraction

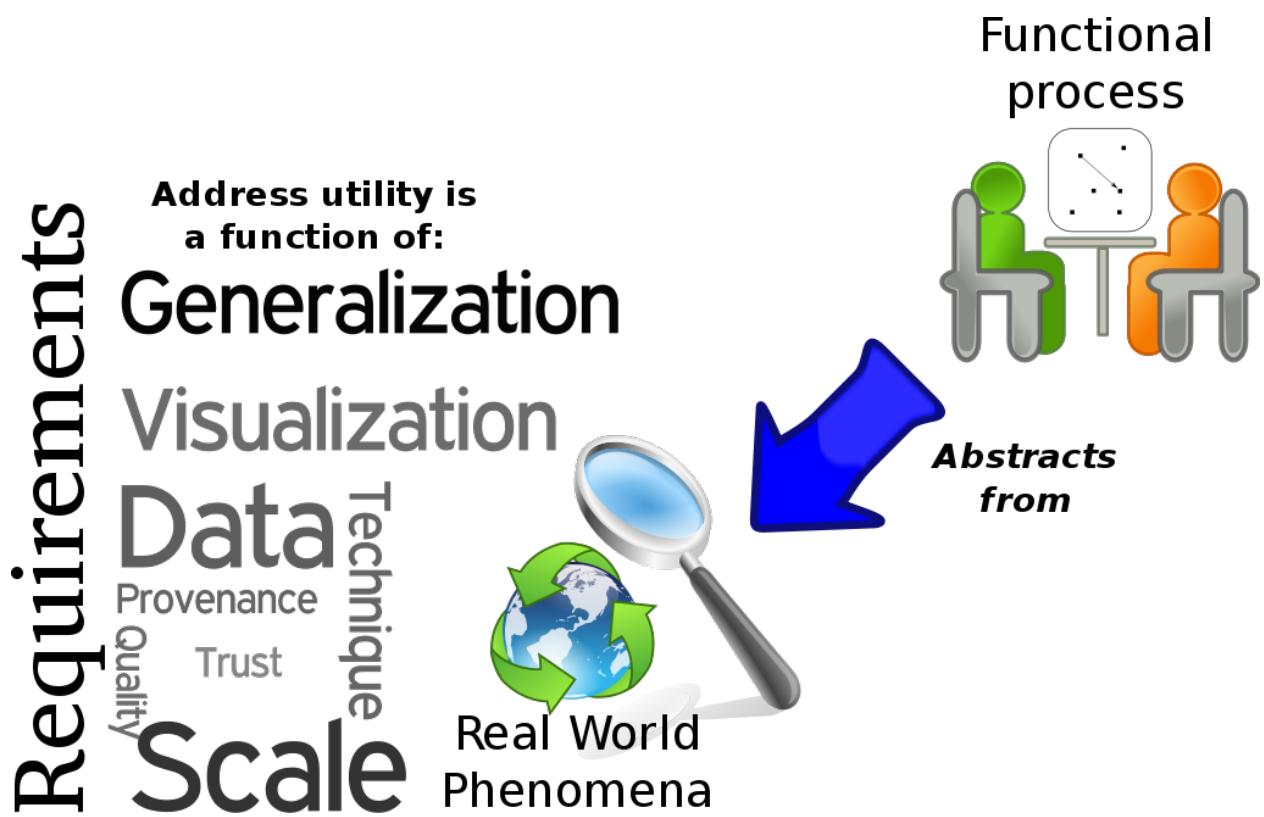


Figure 10: Beck (2016c)

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

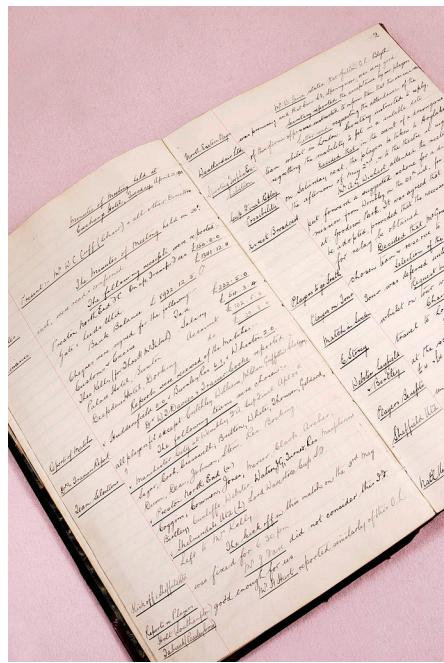


Figure 11: France (2004)

5.4 Then came formalisation

- Royal Mail
- Local Land and Property Gazetteers
- Address Base
- The World Bank
- Etc.....

Let's look at some

5.4.1 Korea: The Jibeon system - taxation



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

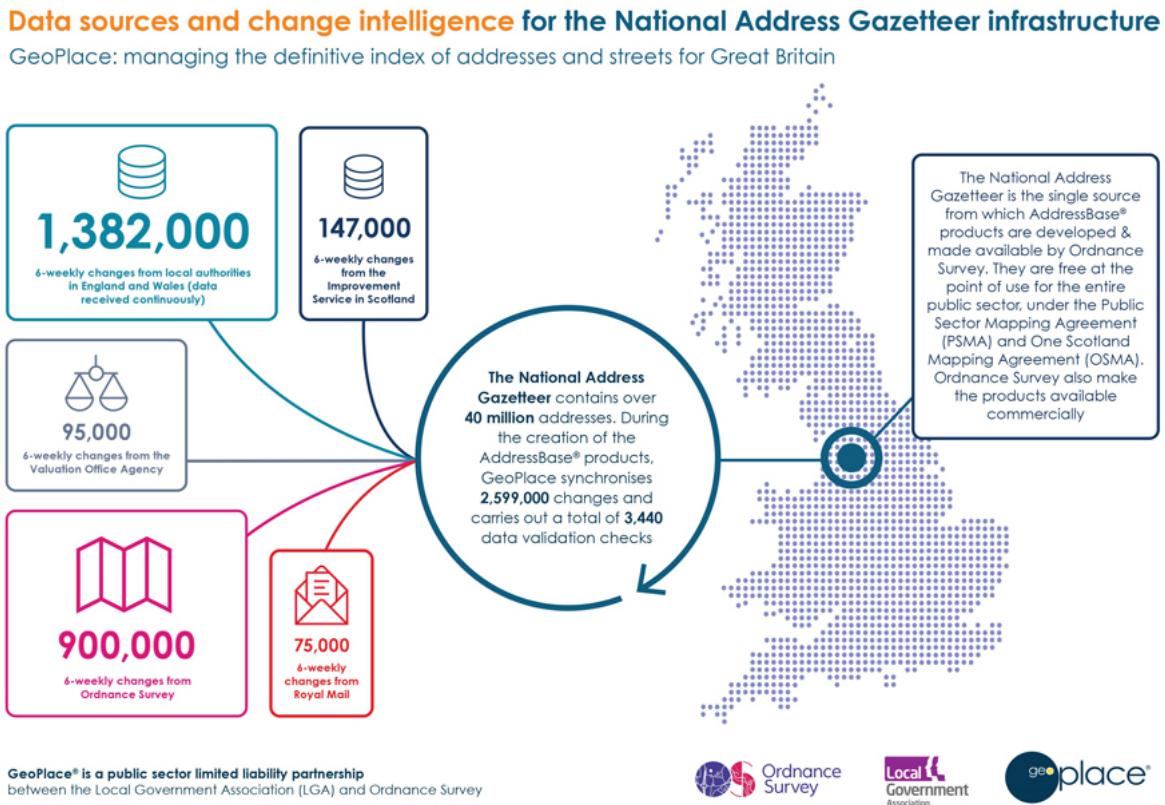


Figure 13: Geoplace graphic

- 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.
- Geoplac 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

Calculating APs and DPs

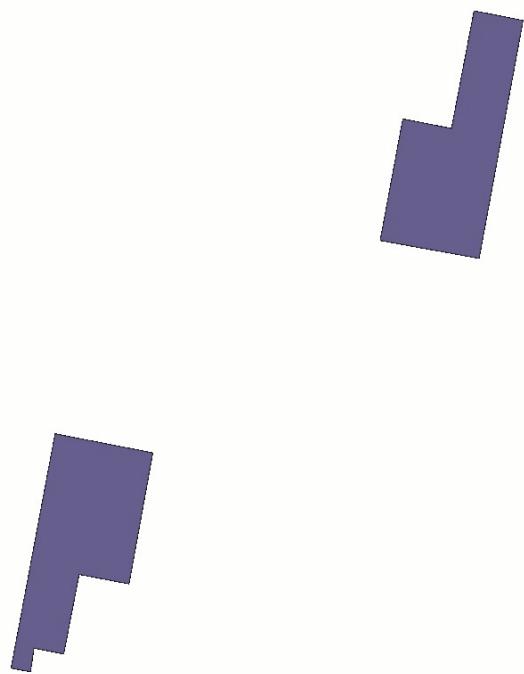


Figure 15: Access Points and Delivery Points

5.4.5 Denmark: An addressing commons

Revised as a co-ordinating spine across domains as a zero-cost accessible service

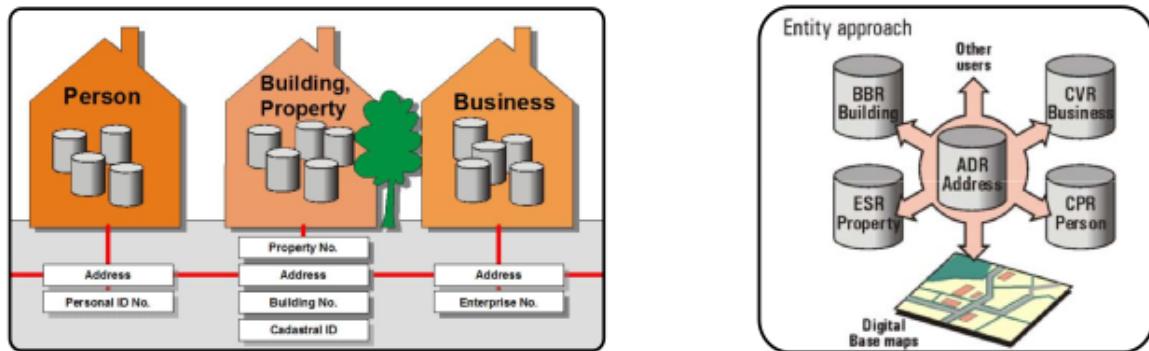


Figure 16: after Lind (2008)

Demonstrating the impact an open approach that is inclusive of all stakeholders can maximise re-use.

- 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 multitude of efficiencies (UPU (2012), pp.50 - 54)

5.4.6 The World Bank

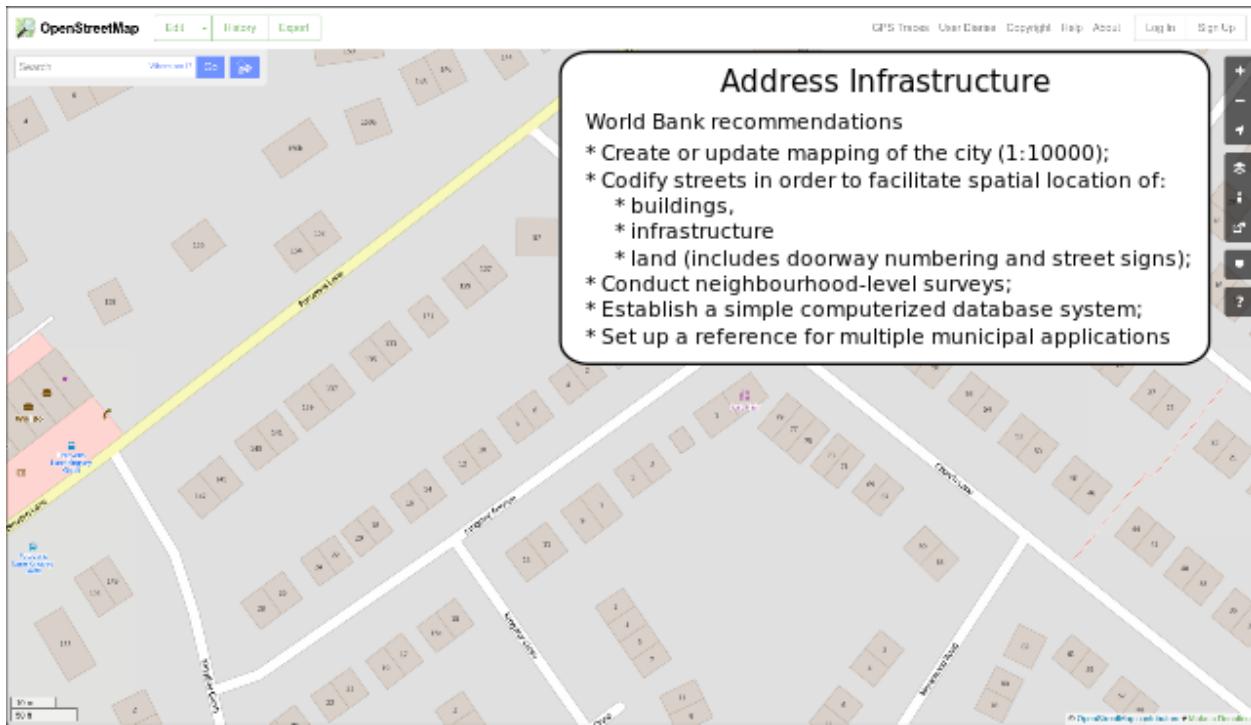


Figure 17: Beck (2015f)

The World Bank has taken a *street addressing* view-point (UPU (2012), p.57). This requires up-to-date mapping and bureaucracy (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 infrastructure 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



Figure 20: Beck (2015a)

In terms of:

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

7.2 Assets can have addresses

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

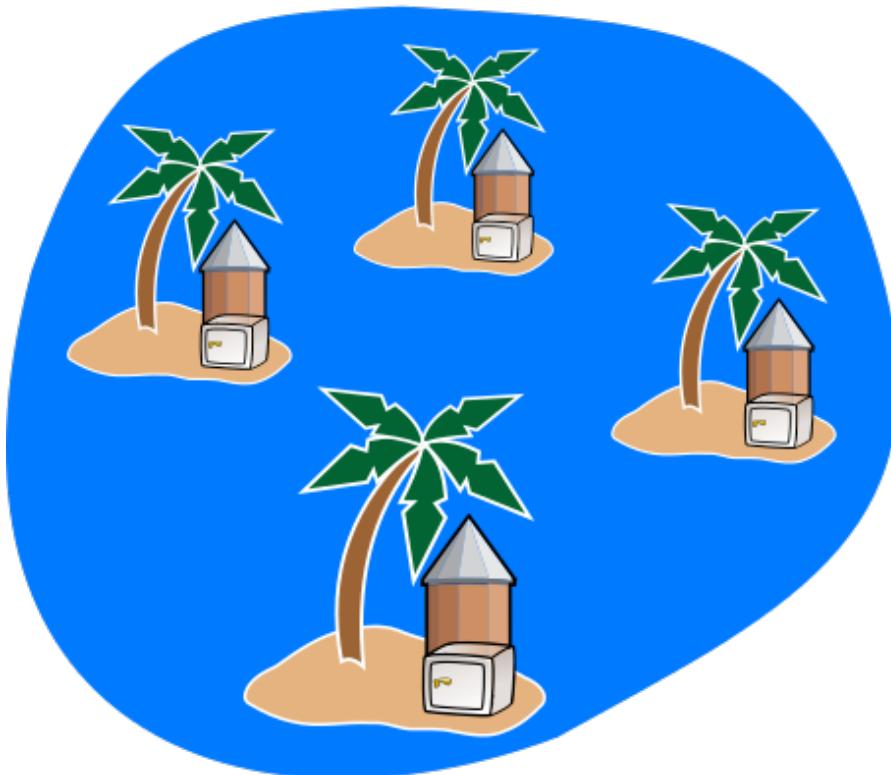


Figure 21: Post box

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.

Islands of data Disconnected data silos



Different:
*Standards
Quality
Databases
Semantics*

Figure 22: Beck (2015b)

7.4 Licence silos

Islands of incompatibility Licence clause incompatibility

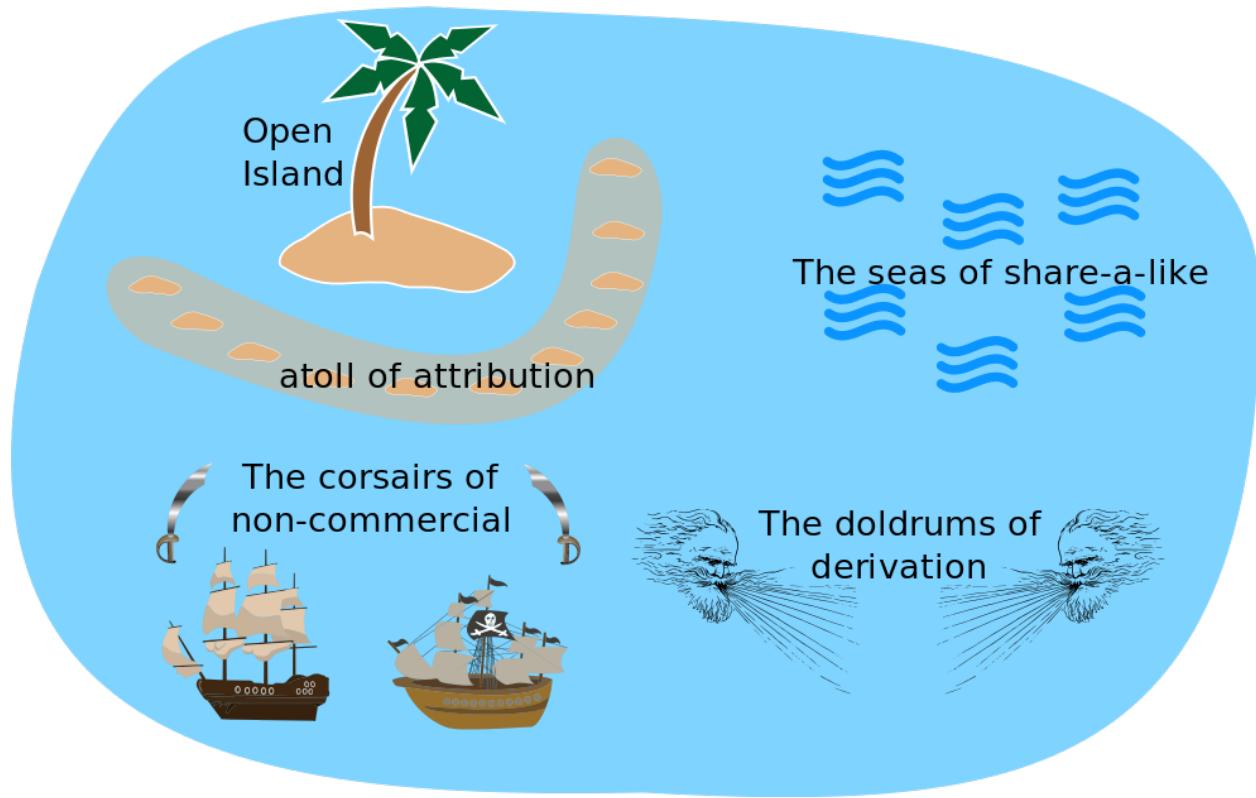


Figure 23: Beck (2016b)

7.5 Addresses are bureaucratic and costly

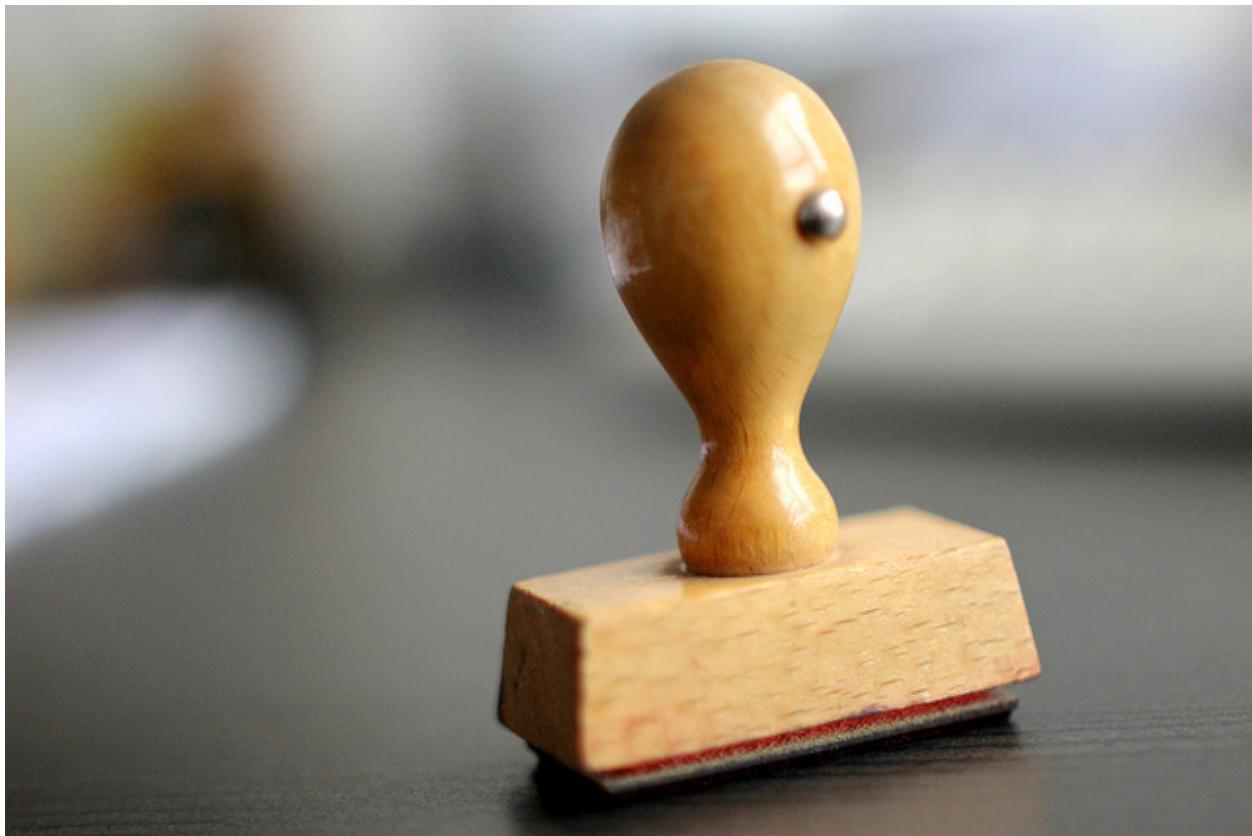


Figure 24: Schnettelker (2013)

Severely protracted when formal/informal issues are encountered.

7.6 Addresses can be opaque

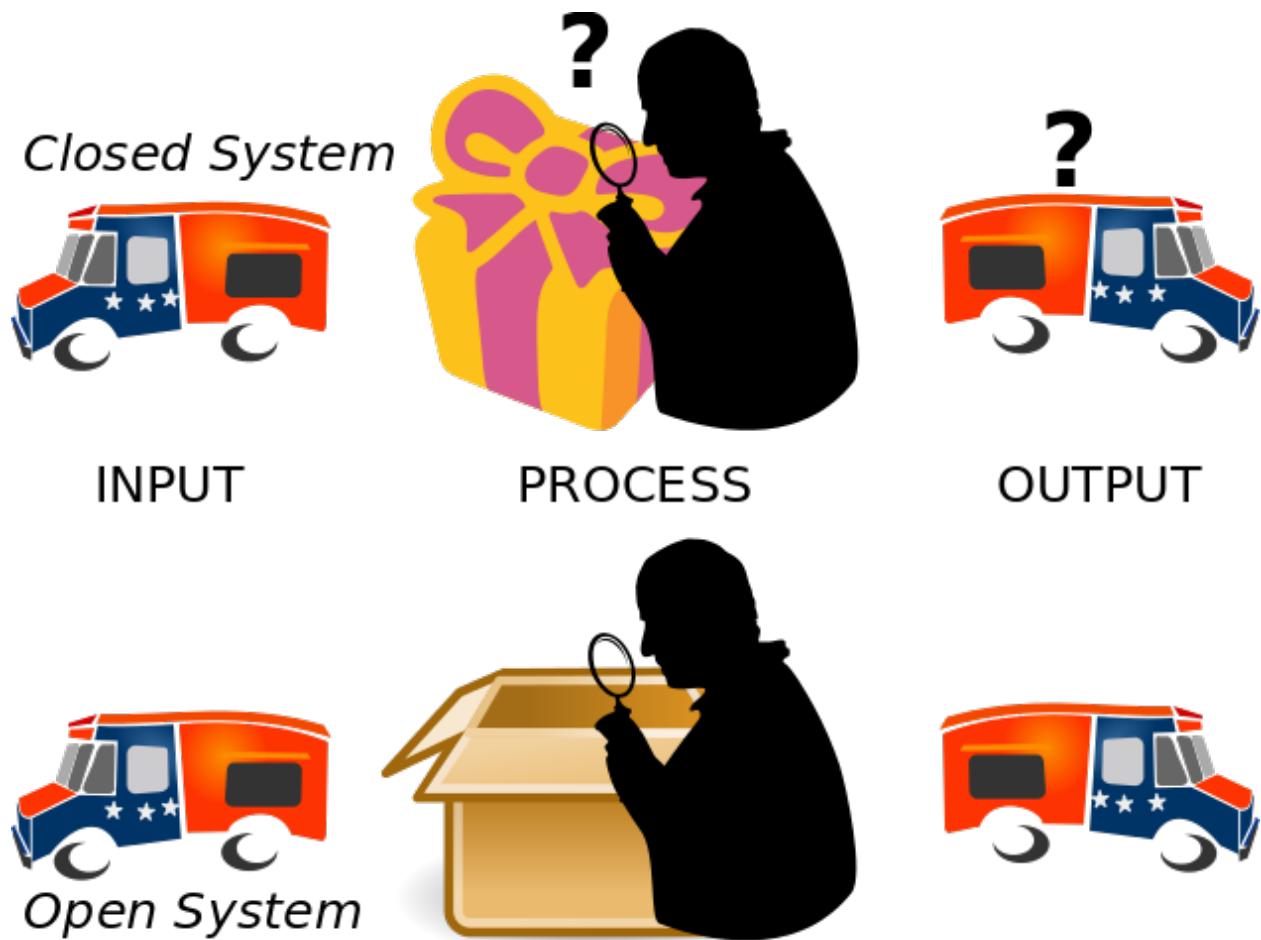


Figure 25: Beck (2015c)

transparent and reproducible?

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

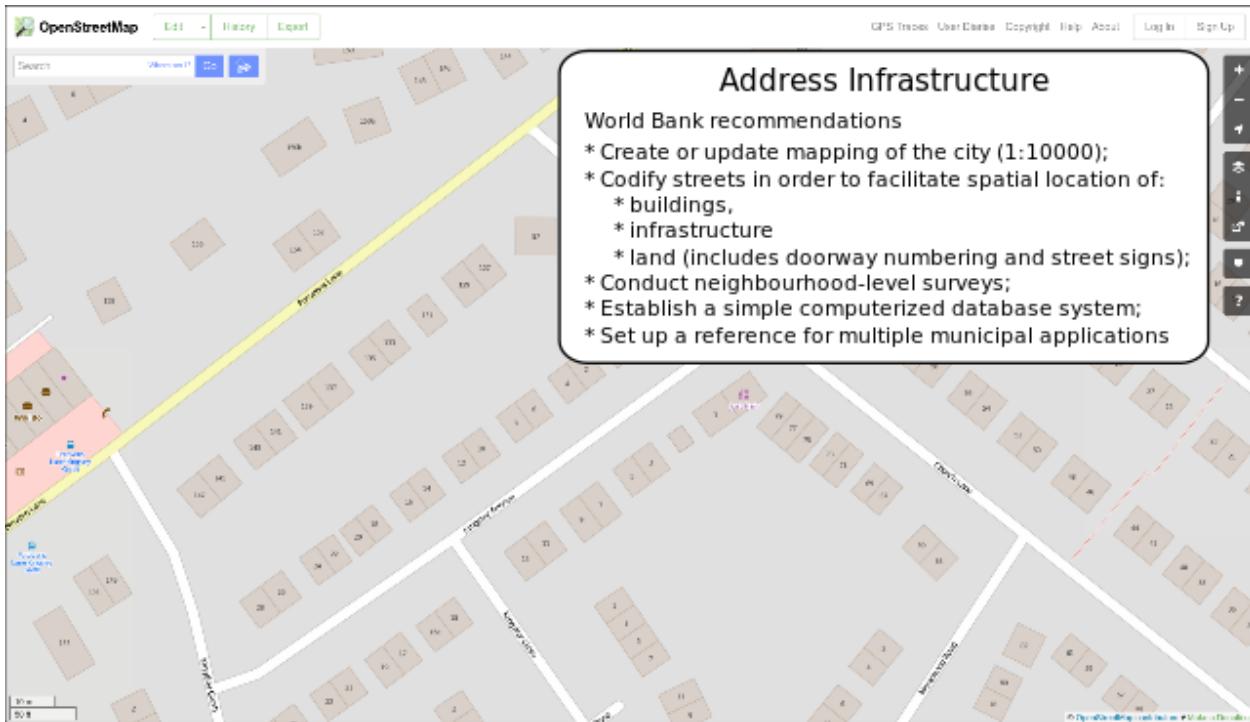


Figure 28: Beck (2015f)

8.2 But in Africa:

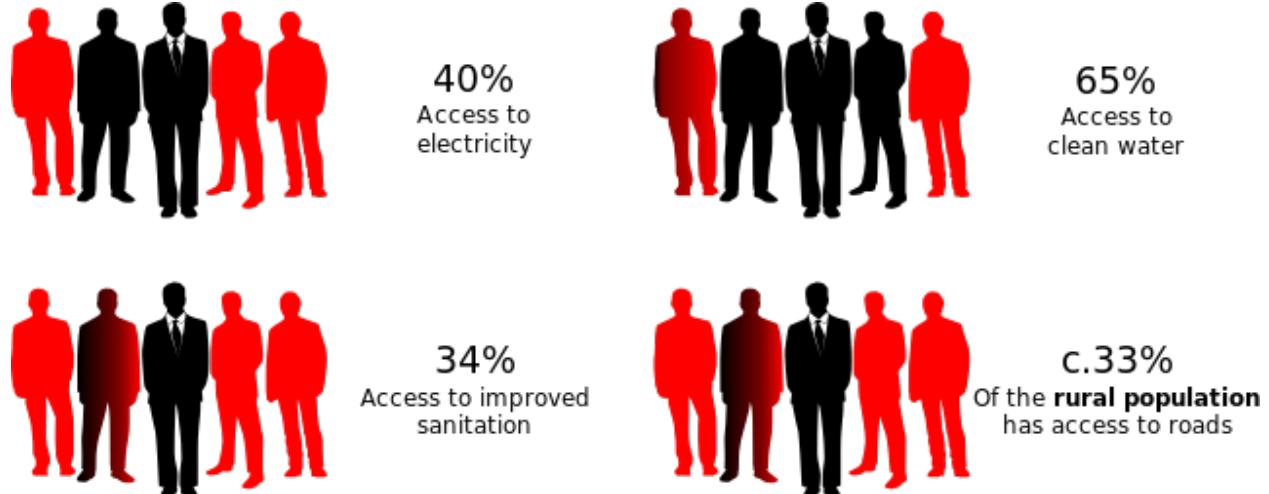


Figure 29: Beck (2015e)

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

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

And this does exacerbate the urban rural divide.

8.3 Legitimacy

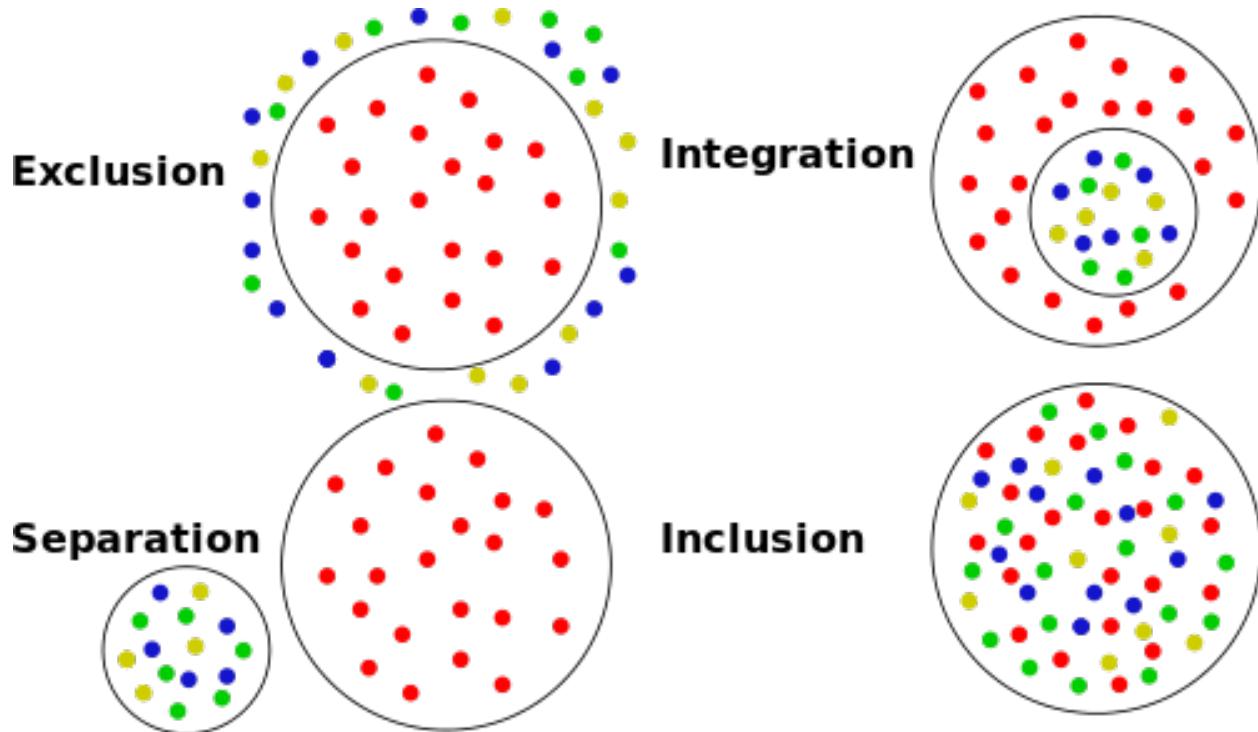


Figure 30: Beck (2015d)

Formal and informal barriers are profound

9 What are the aspirations for a global addressing framework?

Or an addressing commons?

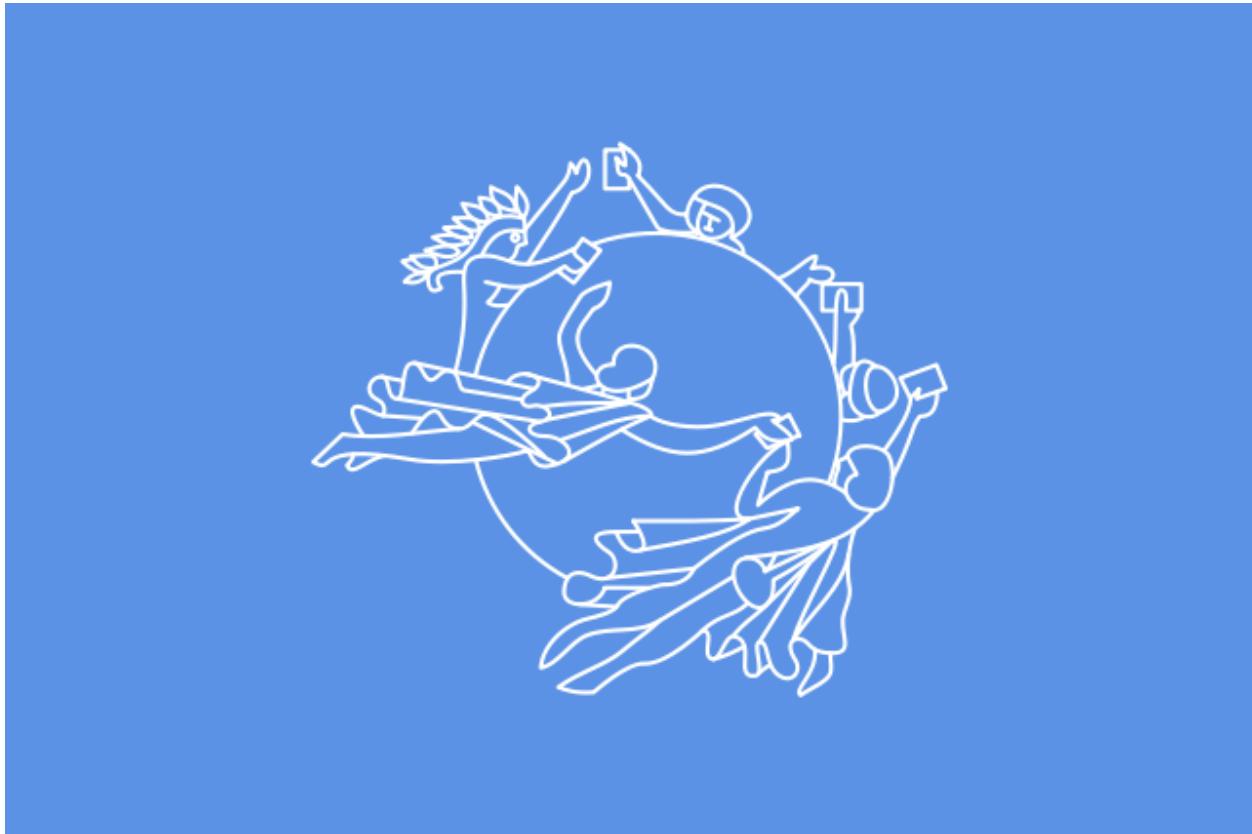


Figure 31: Denelson83 (2008)

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

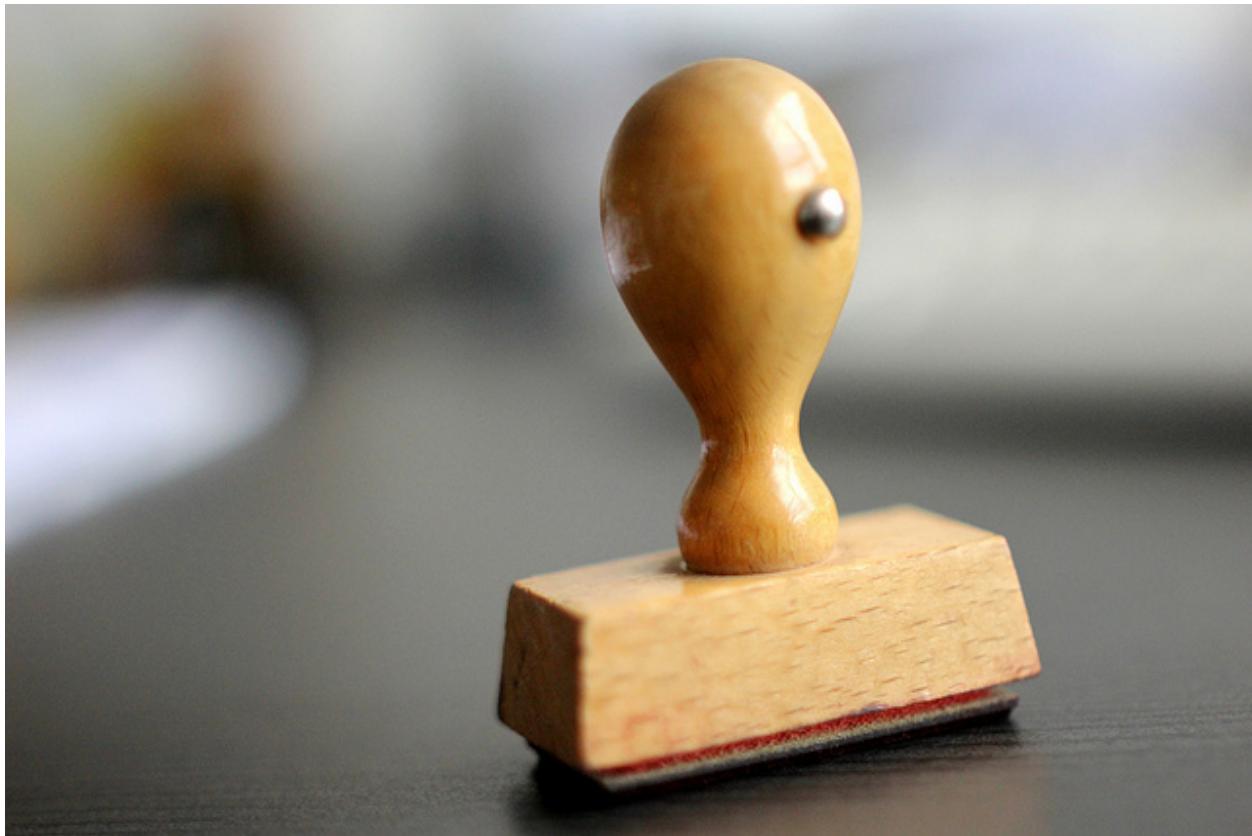


Figure 34: Schnettelker (2013)

9.4 It should be transparent, reproducible and predictable

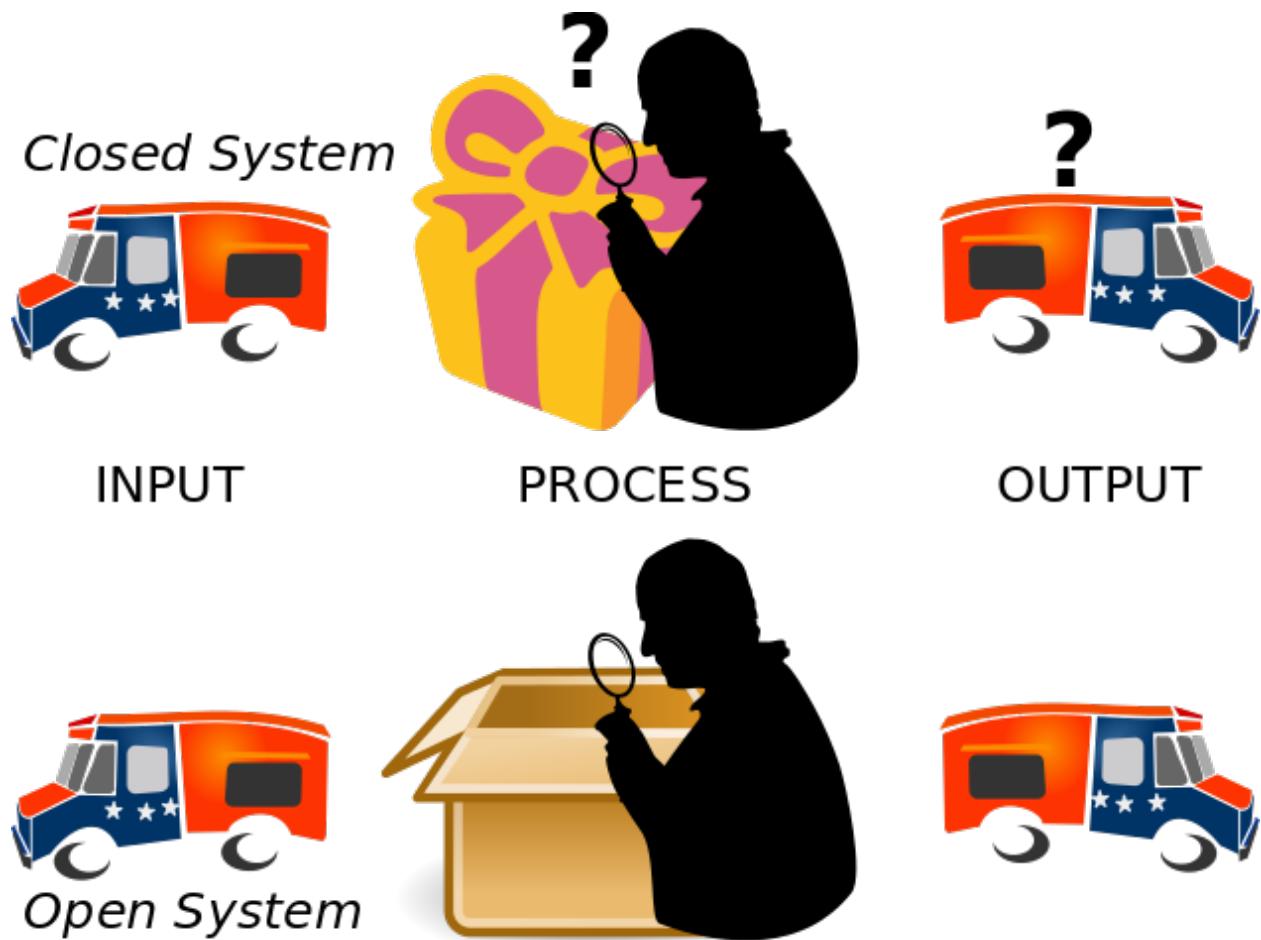


Figure 35: Beck (2015c)

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.....

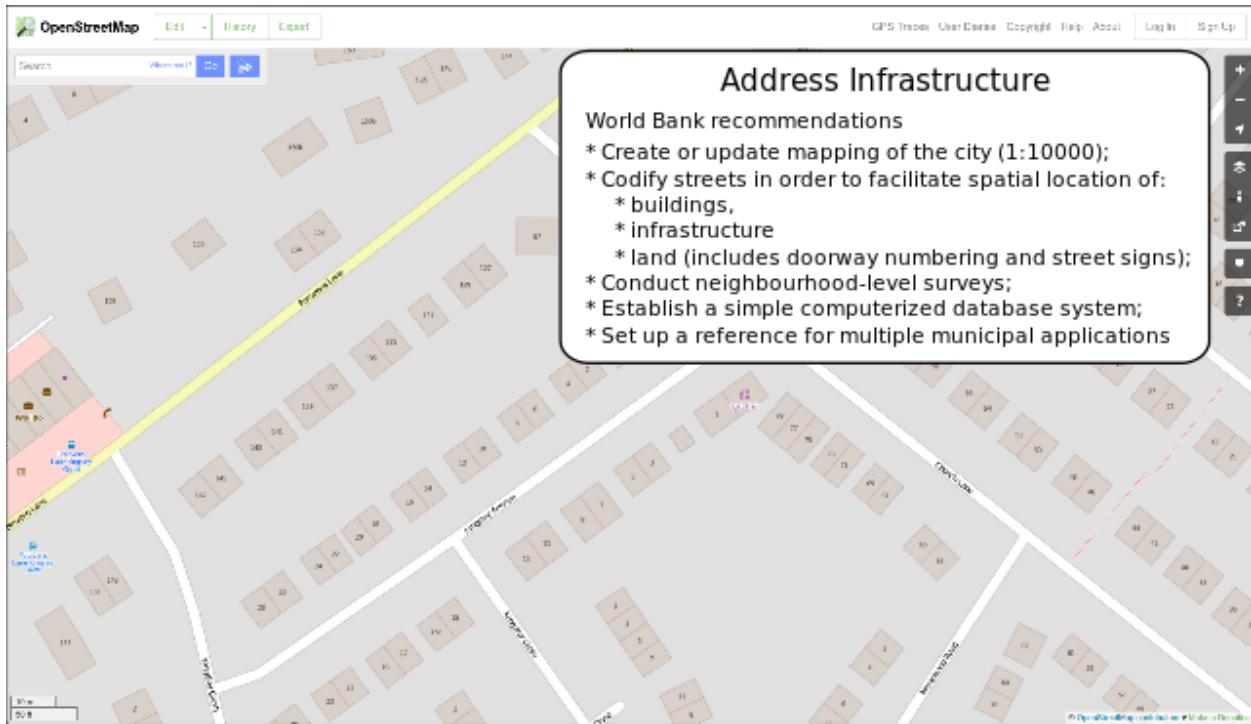


Figure 36: Beck (2015f)

- 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):

Revised as a co-ordinating spine across domains as a zero-cost accessible service

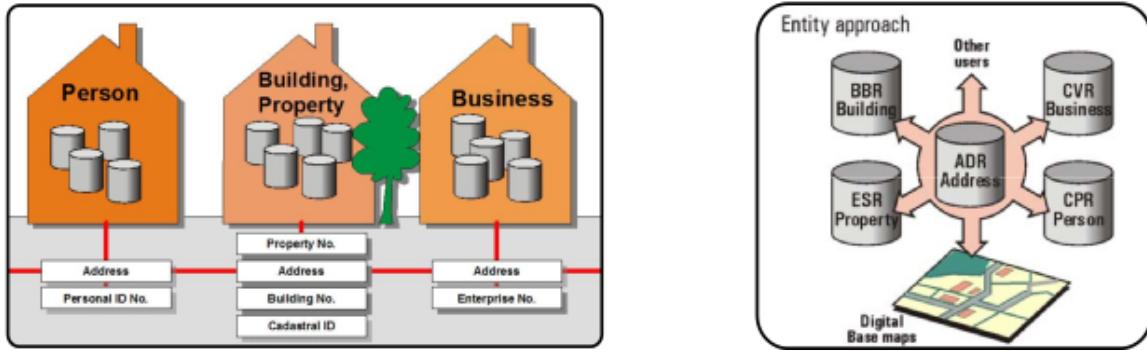


Figure 37: after Lind (2008)

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)

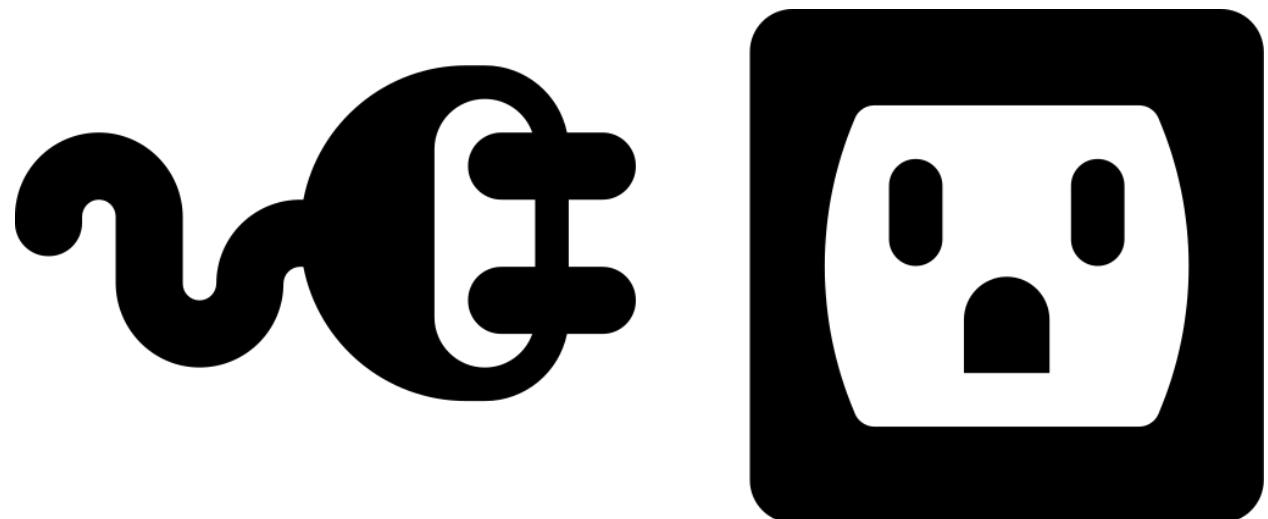


Figure 38: Plugged in

9.8 It should support and enhance business services



Figure 39: Gray (2011)

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?

The screenshot shows a news article from The Guardian's website. The header includes links for 'sign in', 'become a supporter', 'subscribe', 'search', and navigation options like 'jobs', 'dating', 'more', 'UK edition', and 'browse all sections'. The main headline reads 'Amazon to test drone delivery in partnership with UK government'. Below the headline is a sub-headline: 'The company will run tests to explore the viability of drones carrying deliveries weighing five pounds or less - which make up 90% of Amazon's sales'. The author's name, Nicky Woolf, and location, San Francisco, are mentioned. The date is Tuesday 26 July 2016 00.00 BST. The article has 1,731 shares and 624 comments. A large image of an Amazon Prime Air drone is displayed, showing its blue and orange design against a cloudy sky. To the right, a sidebar titled 'Most popular' lists other news items, including one about Osborne cutting welfare and another about Amy Schumer. At the bottom, there's a section for 'Save for later'.

Figure 40: 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



Figure 41: Addressing minting: Addison (2009)

Born spatial

Accessible

Lightweight and cheap to implement

Transparent, reproduceable and predictable

11.2 Small footprint



Figure 42: Small footprints: Terwolbeck (2012)

Accessible

Lightweight and cheap to implement

11.3 Short/memorable

Support and enhance business services

XKCD PRESENTS:
SOME NEW
SCIENCE MNEMONICS

ORDER OF OPERATIONS

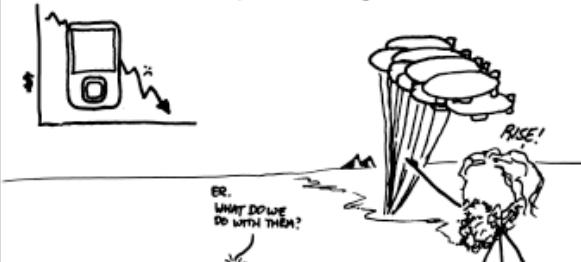
PARENTHESSES, EXPONENTS, DIVISION &
MULTIPLICATION, ADDITION & SUBTRACTION
TRADITIONAL: PLEASE EXCUSE MY DEAR AUNT SALLY



PLEASE EMAIL MY DAD A SHARK
OR: PEOPLE EXPECT MORE DRUGS AND SEX

SI PREFIXES

KILO, MEGA, GIGA, TERA, PETA, EXA, ZETTA, YOTTA
MILLI, MICRO, NANO, PICO, FEMTO, ATTO, ZEPTO, YOCOTO
TRADITIONAL: [I NEVER LEARNED ONE]



BIG:
KARL MARX GAVE THE PROLETARIAT ELEVEN ZEPPELINS, YO.
SMALL:
MICROSOFT MADE NO PROFIT FROM ANYONE'S ZONES, YO.

TAXONOMY

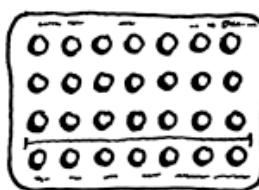
KINGDOM, PHYLUM, CLASS,
ORDER, FAMILY, GENUS, SPECIES
TRADITIONAL: KING PHILIP CAME OVER FOR GOOD SEX



KATY PERRY CLAIMS ORGASMS
FEEL GOOD SOMETIMES
OR:
KERNEL PANICS CRASH OUR FAMILY GAME SYSTEM.

GEOLOGIC PERIODS

(PRECAMBRIAN) CAMBRIAN ORDOVICIAN SILURIAN
DEVONIAN CARBONIFEROUS PERMIAN TRIASSIC
JURASSIC CRETACEOUS PALEOGENE NEogene
TRADITIONAL: [I NEVER LEARNED ONE]



POLYCYSTIC OVARIAN SYNDROME DOES CAUSE PROBLEMS
THAT JUDICIOUS CONTRACEPTIVES PARTIALLY NEGATE.

RESISTOR COLOR CODES

BLACK BROWN, RED, ORANGE, YELLOW,
GREEN, BLUE, VIOLET, GRAY, WHITE
TRADITIONAL: [NONE I CARE FOR]



"BIG BROTHER REPTILIAN OVERLORDS," YELLED
GLENN, "BRAINWASHING VIA GROUND WATER!!"
OR: BE BOLD, RESPECT OTHERS; YOU'LL GRADUALLY
BECOME VERSATILE, GREAT WIKIPEDIANS!

PLANETS

MERCURY VENUS EARTH MARS
JUPITER SATURN URANUS NEPTUNE
TRADITIONAL: MY VERY EXCELLENT MOTHER
JUST SERVED US NACHOS



MARY'S "VIRGIN" EXPLANATION MADE
JOSEPH SUSPECT UPSTAIRS NEIGHBOR

Figure 43: Munroe ()
57

11.4 Self checking



Figure 44: Levine (2014)

Support and enhance business services

11.5 Unlimited spatial recording

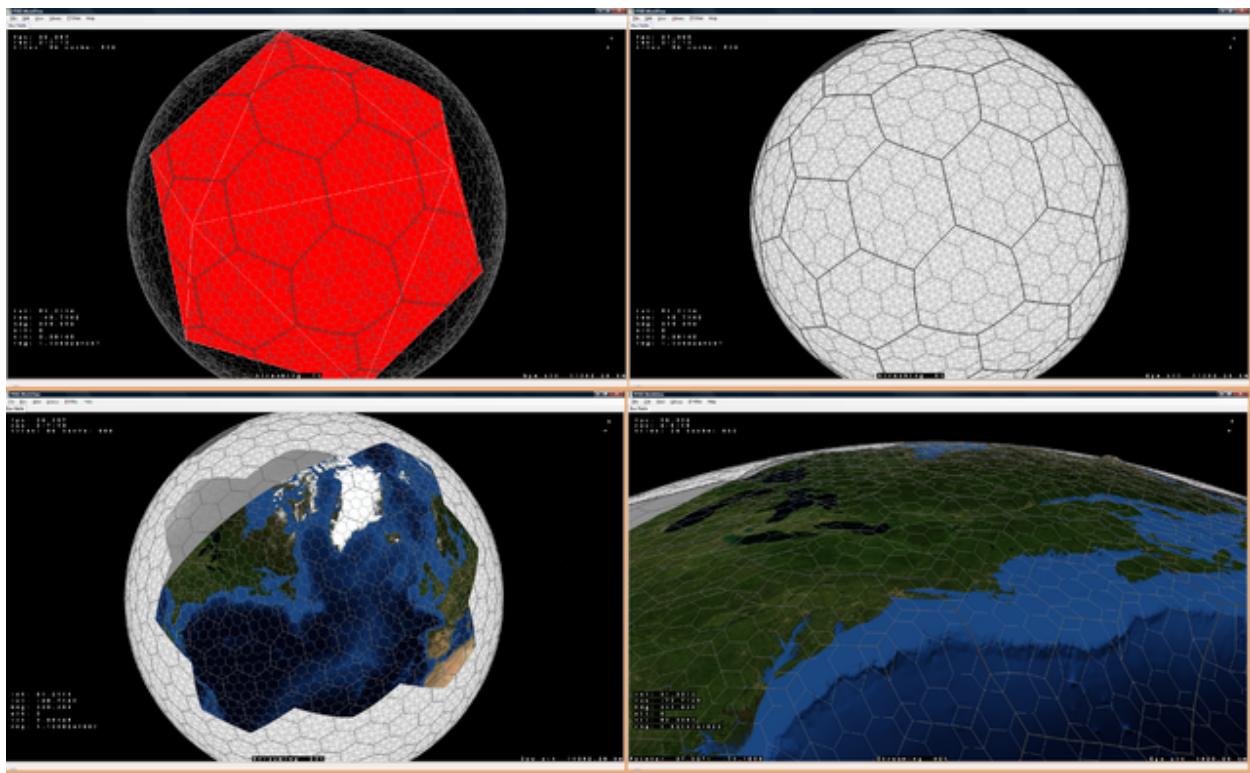


Figure 45: Petersen (2007)

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.

11.6 Open and interoperable

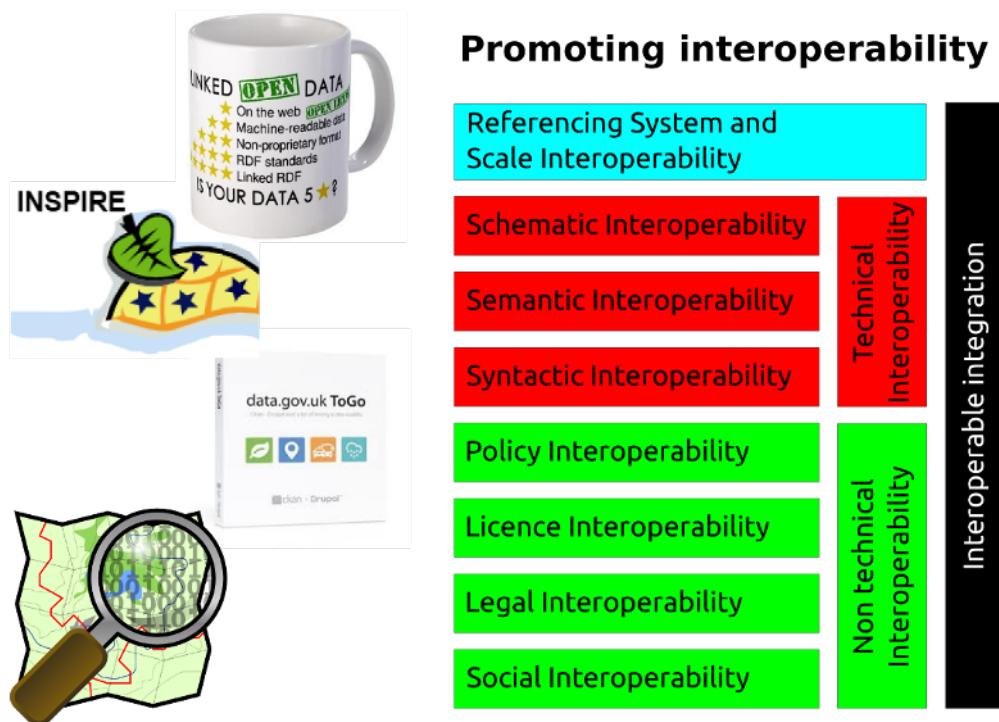


Figure 46:

Transparent, reproducible and predictable

Openly Licensed

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



Figure 47: Arup (2013)

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 - think about the Internet of Things

12.2 Inherent geo-statistical aggregation (spatially scalable)

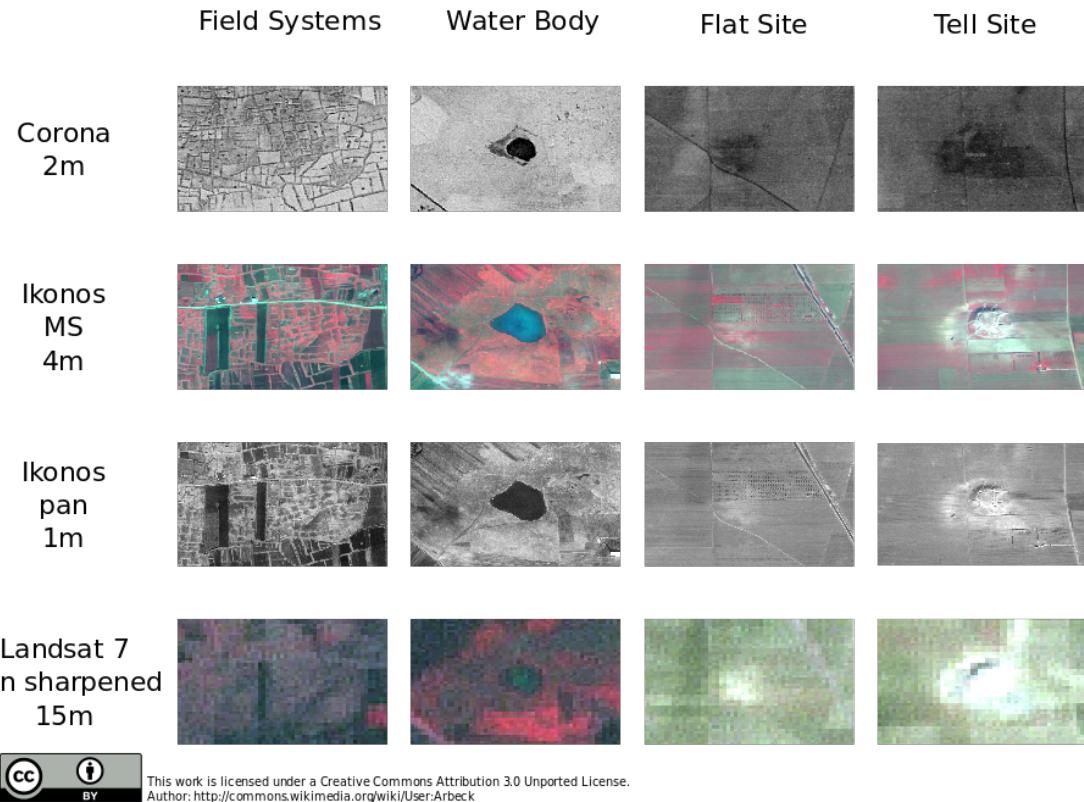


Figure 48: How spatial resolution impacts on feature detection Beck (2012)

Support and enhance business services

GIS free multi-scale analysis and reporting during disaster scenarios.

12.3 Area representation based on a regular tessellation

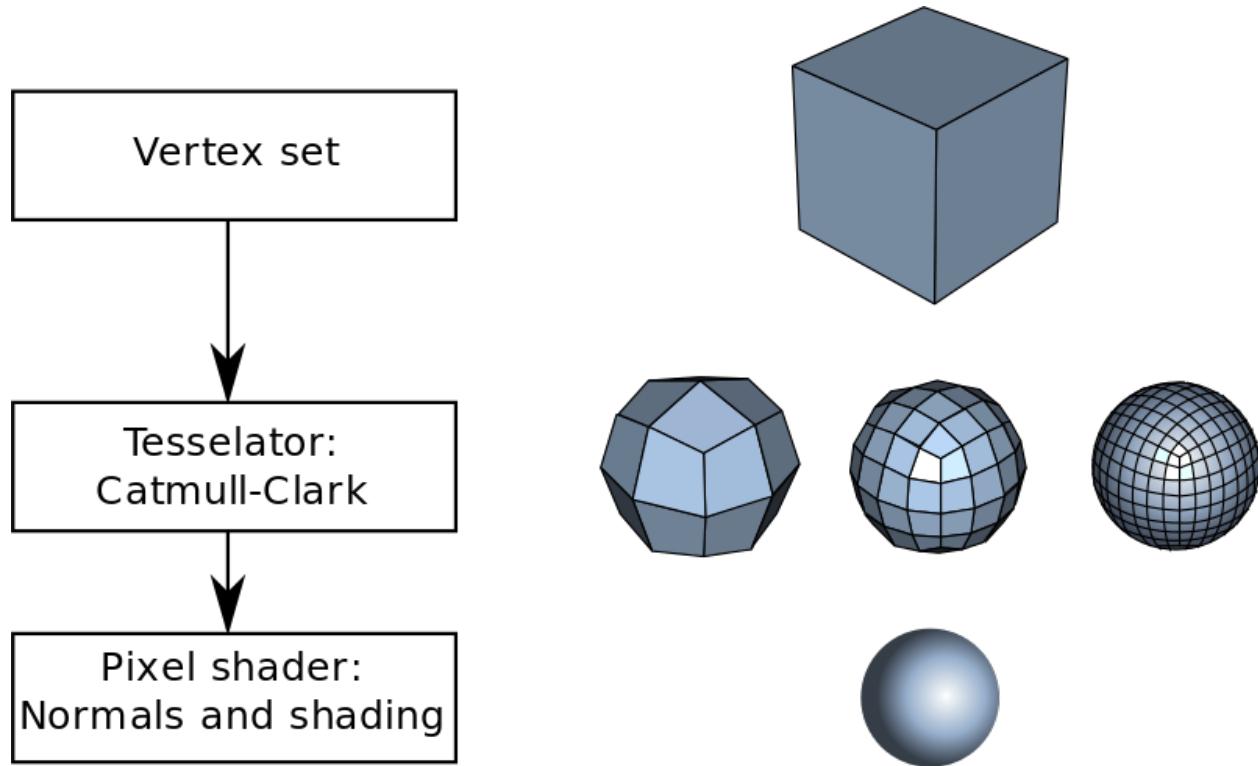


Figure 49: Public domain image

Support and enhance business services

It is still useable within traditional GIS.

12.4 Spatial adjacency relations within the encoding

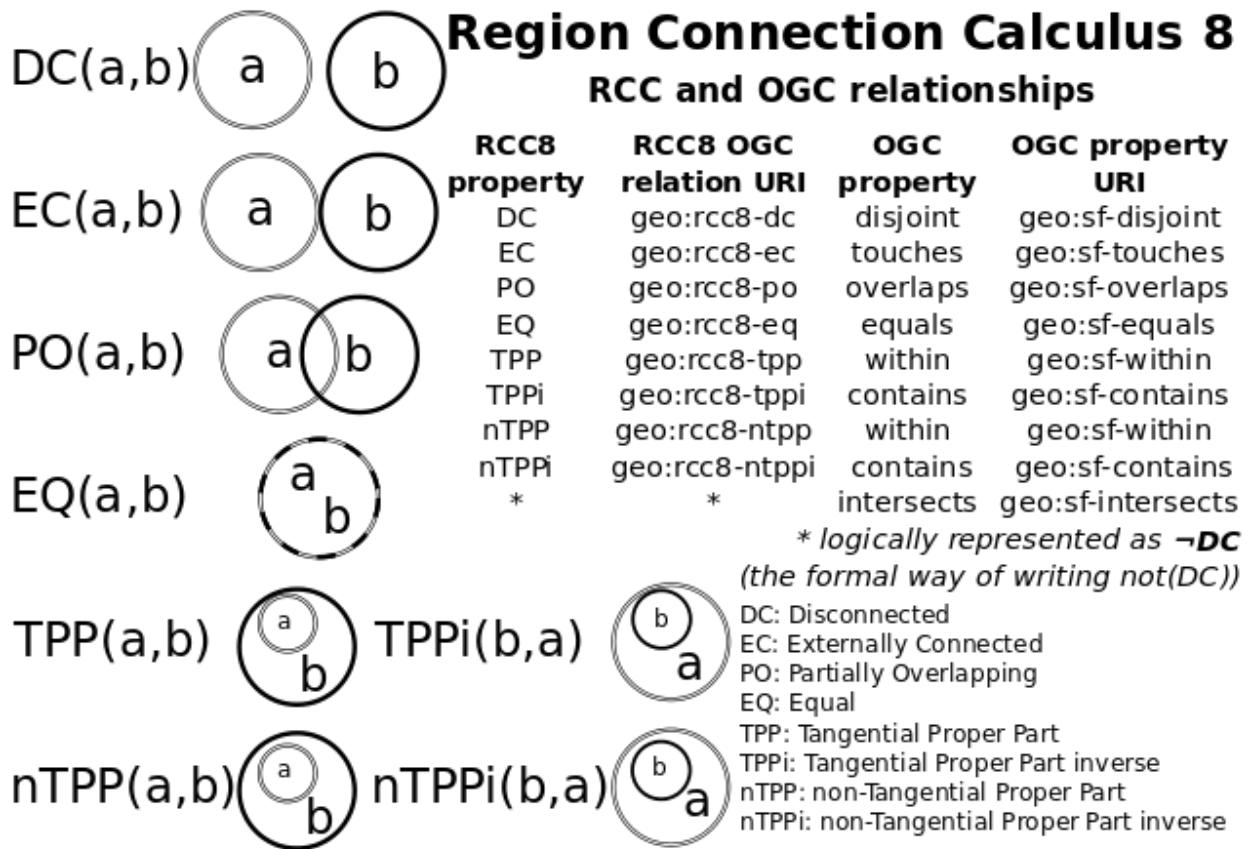


Figure 50: Beck (2013)

Support and enhance business services

Understanding localised connectivity relations.

13 Examples.....

14 Wrap up

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