

De-situating Spectrum:
Rethinking radio policy using non-spatial metaphors

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Introduction

Earthrise

- Taken by Apollo 8 crewmember Bill Anders on December 24, 1968
- “The most influential environmental photograph ever taken” - wilderness photographer Galen Rowell
- No new facts, but a new way of looking at an old problem
- Metaphor: Earth as a small, vulnerable ball - “whole earth” (catalog)

Central argument

- Metaphors matter
- Wireless dominated by spectrum as space metaphor
- There are viable alternative metaphors which can stimulate alternative solutions

Metaphor

Metaphors

- Explain unfamiliar/abstract/complex in terms of familiar/concrete/simple
- Status quo not right or wrong, simply more or less useful in a particular context

Why need new metaphors?

- status quo metaphors have weaknesses
 - Like approximations, highlights some features, suppress others
 - Based on old tech: frequency div mult access
 - Doesn't support RF propagation, intermod interference, diversity of DSA solutions
- In a moment of crucial long-term decisions about wireless rights: need all conceptual tools on the table

Scaffolding

This talk will focus on metaphorical scaffolding

- BUT: why bother, if metaphor isn't reality, only a model?

Scaffolding determines what's built, even after it's gone

- Rules and metaphors depend on each other – each makes sense of the other



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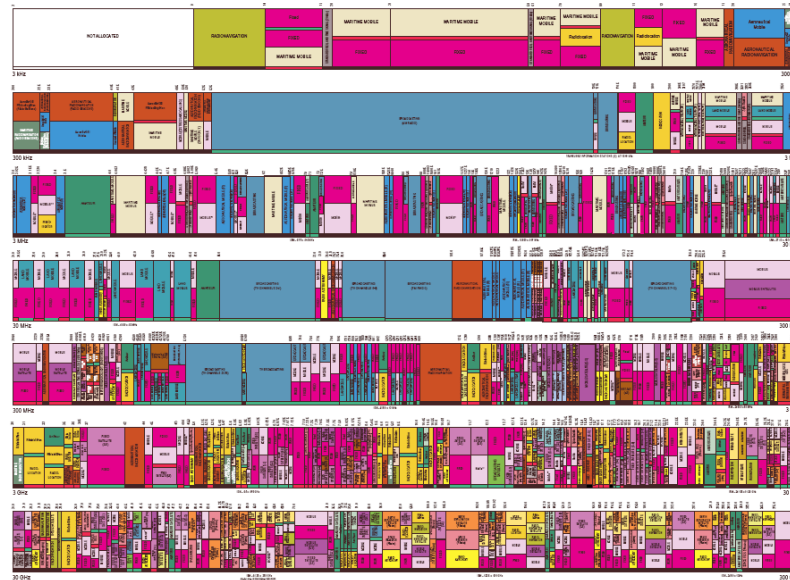
Wireless as spectrum as Real Estate

Status quo concepts: Spectrum, signals, radios

Spectrum metaphors

- As Resource: use, value, stockpiling or warehousing, availability, efficiency, amount ...
- As Space: filled and vacant space, swath; adjacent channels; buffer; bands fill up, empty

Combine resource + space → real estate



Wireless ← Spectrum Mapping

Wireless	Real Estate		
Spectrum; a resource part	All land; a place		
Signals, operation	Making and hearing sounds (or throwing objects)		
Radio	A person using a place		
Interference	Nuisance (eg, noise) or trespass		
Operating permissions	Lease or title to a place		

Wireless ← IP Mapping

First step:

- Map frequencies to IP addresses
- Radios are nodes, signals are packets
- Interference is when IP address conflict, like two radios on same frequency

Same concept frames, mapping structure, as “Real Estate”

Notes to table (next slide)

1. No distinction between spectrum/resource and operation/signals
2. Generalize to DNS (not shown): from numbers to names, everything goes through
 - BUT: if human is node, can get interference in perception even if machines aren't confused - fraud

Wireless ← IP Mapping

Wireless	Real Estate	Internet Protocol DNS	
Spectrum; a resource part	All land; a place	All IP addresses; IP address range	
Signals, operation	Making and hearing sounds (or throwing objects)	Exchange of IP packets	
Radio	A person using a place	Network node	
Interference	Nuisance (eg, noise) or trespass	IP address conflict between two devices	
Operating permissions	Lease or title to a place	Issuance of an IP address	

Trademark - Introduction

A trademark distinguishes product or service

- words, phrases, symbols, product shapes, images, colors, sounds (MGM lion's roar and NBC's chime), smells (scent for a line of embroidery yarns and threads), motion (animations) and texture (Braille)

Use or lose

- First-in-use protection
- Indefinite grant BUT must be maintained through active use, typically over the course of five years

Rights obtained by registration (in some places first use)

- Registrar makes a prospective judgment about whether a proposed mark is so close enough to an existing one to cause confusion through a comparison with existing marks



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“Wired” examples

(illustration on next slide)

Metaphor – let words be like frequency bands

Just because letters are the same doesn't mean there's infringement

- Depends on other parameters: context of use, appearance etc.
- 27 registrations for “wired” at USPTO end Sep 08

Applied to wireless

- just because frequencies overlap doesn't necessarily mean there's harmful interference
- Trademark law looks at totality of operating business in face of confusion/interference, so better at incorporating issues beyond freq/geo

WIRED

(cologne)

WIRED

(art supplies)

WIRED

(magazines)

WIRED

(information & entertainment)

WIRED

(energy drinks)

Wired

(stationery)



(electronic door chimes)

WIRED

(automobile wheels)

Wireless ← Trademark Mapping

Metaphor table (see next slide)

- Resource, operation: trademarks
- Just like IP, no spectrum/signal distinction
- Radios: merchants, customers
- Interference: customer confusion in communication
- Interference is confusion of that communications

Notes

1. no distinction between resource and signals (spectrum redundant)
2. “spectrum” not necessary
3. Interferences explicitly references receiver performance
4. Rights specified by operator/owner at registration (*CUE next*), not predefined by government

Wireless ← Trademark Mapping

Wireless	Real Estate	Internet Protocol	Trademark
Spectrum; a resource part	All land; a place	All IP addresses; IP address range	All trademarks; a trademark
Signals, operation	Making and hearing sounds (or throwing objects)	Exchange of IP packets	Using a trademark to influence/make a purchasing decision
Radio	A person using a place	Network node	Exhibitor or perceiver of a mark
Interference	Nuisance (eg, noise) or trespass	IP address conflict between two devices	A mark which confuses a potential customer
Operating permissions	Lease or title to a place	Issuance of an IP address	Trademark registration

Acquiring radio rights by registration

Provide enough info for upfront determination of non-interference through description of system operation

- Transmitter parameters “what you can do” - autonomy
 - Power spectral density
- Receiver protection “what others can’t do to you” - exclusivity
 - Distinguish receiver protection (yes) vs. receiver standards (no)

Registrar compares overlaps with prior operating parameters

- Test: add new registrant pfd to existing, see if it exceeds receiver protection mask of all existing

Why wouldn't one just register everything?

- Registrar validates that for system in use, not speculative
- If take parameter space not used, will lose
- Can trade balance of space not used, to keep in use

Managing interference after the fact

After the fact: balancing test for plausible confusion and harm

- Evidence of actual confusion // harm
- Strength of mark // interference-resistant receivers
- Similarity of marks // overlap of operating parameters
- See next slide for more

Note: done by courts, agency not involved

Balancing Tests

Wireless interference	Trademark infringement
<p>Evidence of harm to operation</p> <p>Interference-resistance of receivers</p> <p>Overlap in the overall operation entailed by the two sets of parameters</p> <p>Similarity of the functioning of the systems as a whole</p>	<p>Evidence of actual confusion</p> <p>Strength of the mark, i.e. conceptual distinctiveness</p> <p>Similarity of the marks, incl. appearance, phonetic similarities, and underlying meanings</p> <p>Proximity or relatedness of the goods or services</p>

Comparing - Similarities

Trademark-inspired approach supports all the usual concepts as well as Real Estate

- Both can convey right to exclude others
 - Real property rights, vs. registered marks
- But also other spectrum assignment models like unlicensed
 - collective or certification marks, eg, USDA organic seal – cf. class license
- Governance via agencies first, conflict resolution in the courts
 - Trademark *post hoc* conflict resolution doesn't use agency
- Can evolve alongside legacy command & control

Differences (table on next slide)

Worldview

- Trademark focuses on operation, not (fictional) substance

Resource

- primary regulatory consideration: permission to act in particular way
- use of “spectrum resource” is redundant

Registrants define scope of protection, not regulator

- Auctions possible, but not necessary

Duration

- Indefinite terms but use/lose – cf spectrum warehousing

Non-resource conditions: public safety, “open networks”, content rules (eg obscenity)

- common in real estate zoning, but not trademarks

Compare & Contrast

Attribute	Real Estate	Trademark
Worldview	Substance (spectrum)	Process (operation)
Resource/scarcity	Frequencies, geography	Concurrent operation
Rights issuance	Auction by government	Registration by operator (auction possible)
Duration	Limited (with renewal)	Indefinite (while in use)
Added conditions	Common	Rare

Objections & Rebuttals

Walk away with farm, spectrum grabs, receiver protections!

- No: use/lose

At auction, overgenerous protection would get higher price, sold later!

- No: in economic terms no loss, since just a transfer

No incentive to improve utilization!

- No: Coasian bargaining occurs if rules clear enough (could have high transaction costs, but all approaches have this problem)

Open questions

System parameters

- Use of propagation models in registration, adjudication
- Transmitter: power at antenna, or field strength everywhere/at boundaries?
- Receiver protection: need to specify D/U in addition to max U? Cf. interference temperature, but here description of buyer's "state of mind"
- How to define minimal set

Legal, economic analysis

- Formulation of rights
- Which metaphor better when?
- Auctions of trademark-like rights

Summary

Metaphors shape thinking

Policy makers typically think about radio in terms of spectrum

- imagined as a space-like resource
- leads to a bias for real estate-like property rights.

Non-spatial metaphors, e.g. trademark, are just as viable, but

- have different implications for regulation
- particularly in the formulation, issuance and adjudication of rights

Discussion

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