Spectrum Buyouts
A Proposal for the Transition to Open Spectrum

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FCC: “Exclusive Rights” Approach

- SPTF: end of “command and control”
  - Technically progressive
  - Economically poor
  - Circularity: justify exclusive rights by “scarcity” created by exclusion

- Property rights for frequency
  - Incentives for incumbents to relocate
  - Segmentation and monopoly
False Theories

- Faulhaber-Farber: confused
  - Sticks to legacy technologies
  - Trading private property -> commons?
    - Buyers buy the assets that will become worthless
    - Or monopolize them by proprietary protocols

- “Big Bang” auctions (Kwerell-Williams)
  - Buying and selling simultaneously
  - Dangerous and Irreversible
    (e.g., 700MHz, NextWave)
Spectrum: Neither Property nor Commons

<table>
<thead>
<tr>
<th>excludable</th>
<th>non-excludable</th>
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<tbody>
<tr>
<td><strong>rival</strong></td>
<td><strong>Common Pool Resources (CPR)</strong></td>
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<tr>
<td></td>
<td>road, park, fishery</td>
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<td><strong>non-rival</strong></td>
<td><strong>Club goods</strong></td>
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<td>software subscription services</td>
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<td><strong>excludable</strong></td>
<td><strong>Public goods</strong></td>
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<td>national defense mathematical theorem</td>
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“Commons” Approach

- Open spectrum as public use
  - Technically efficient
  - Politically difficult

- No valuation and priority
  - Congestion and interference
  - Infinite bandwidth: OK, but how?

- No incentives for relocation
  - Lack of mechanism to take back spectrum
Spectrum Buyout

Transition strategy
  – Providing incentives without monopoly

Reverse auction by government
  – Buying the spectrum from incumbents
  – Release for unlicensed band

Expense:
  – General account
  – “radio tax” for all terminals/Hz
Auction Design

- The **lowest** bidder per band: winner
  - PCS auctions: the most efficient user
  - Reverse auctions: the **least efficient** user

- Band should be vacated nationwide
  - Price: **sum of bidders**

- Continuous band is valuable
  - Requirement for the **minimum bandwidth**
Bids for the Band Groups (example)

Billion yen

GHz

3/4/2003 ISART
Bids will approach equipment prices

- **Bid** = opportunity cost
  - $Q_k(x) = v_k + (1-q)v_k + (1-q)^2v_k + \ldots + (1-q)^x v_k + z_k$.

- $q$: probability of taking
- $v$: monopoly rent
- $z$: value of equipment

- **Equilibrium price**
  - $p^* = \frac{v_k}{q} + z_k \rightarrow v_k + z_k \rightarrow z_k$
Hybrid Approach

30MHz

Legacy (exclusive)

Easement (overlay)

Open spectrum (public use)

2GHz