ITU Kaleidoscope 2011
The fully networked human?
Innovations for future networks and services

Cooperative Wi-Fi Sharing: Encouraging Fair Play
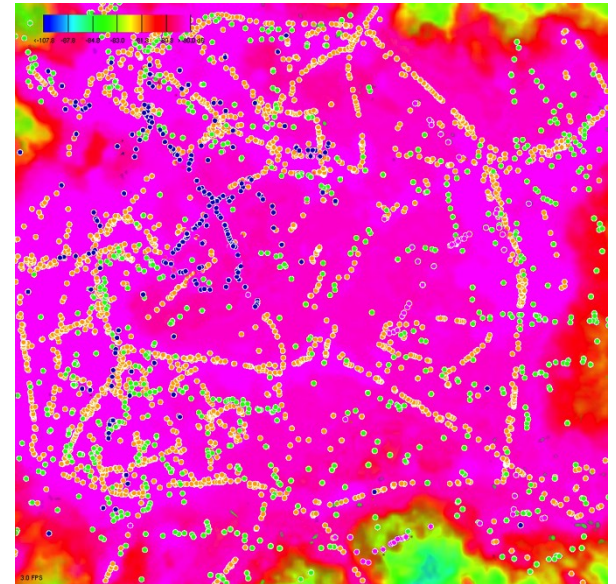
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Wi-Fi Sharing

- ❑ Broadband Internet and Wi-Fi
  - ❑ Ubiquitous in private homes, companies
  - ❑ Not fully utilized
  - ❑ Good city coverage

- ❑ Wi-Fi Sharing
  - ❑ Allow others to use Wi-Fi
  - ❑ Access at foreign APs

Centralized Wi-Fi Sharing

❑ Commercial network provider

   ❑ Provides infrastructure & hardware

   ❑ Controls traffic

   ❑ Monitors user participation

❑ Examples:

Cooperative Wi-Fi Sharing

❑ User-provided network
  ❑ Community concept
  ❑ Fully decentralized

❑ Community members
  ❑ Service providers
  ❑ Network users
  ❑ Stakeholders

Affected Parties

- Insiders
  - Take part in the network
    - Users
    - Commercial network provider
  - Own interests

- Outsiders
  - ISPs
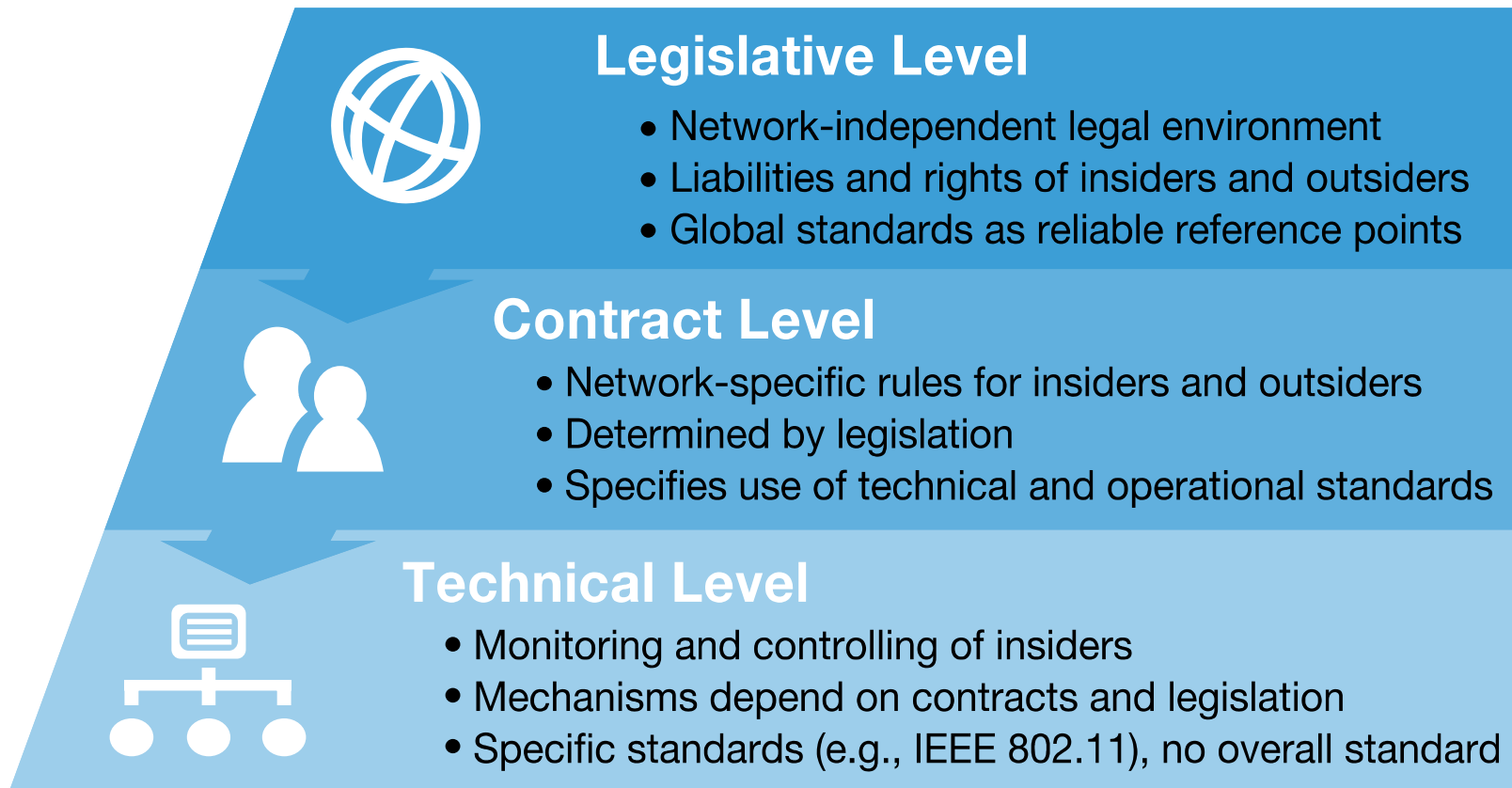 - Affected by network *operation*

Defective Behavior

- Selfish user actions
  - Failure to *contribute*
  - Failure to *behave*

- In Wi-Fi sharing
  - No/limited AP provision

- Handle defection
  - Framework that provides rules

Frameworks

❑ Incentives to *contribute* and *behave*

Legislative Level
- Network-independent legal environment
- Liabilities and rights of insiders and outsiders
- Global standards as reliable reference points

Contract Level
- Network-specific rules for insiders and outsiders
- Determined by legislation
- Specifies use of technical and operational standards

Technical Level
- Monitoring and controlling of insiders
- Mechanisms depend on contracts and legislation
- Specific standards (e.g., IEEE 802.11), no overall standard
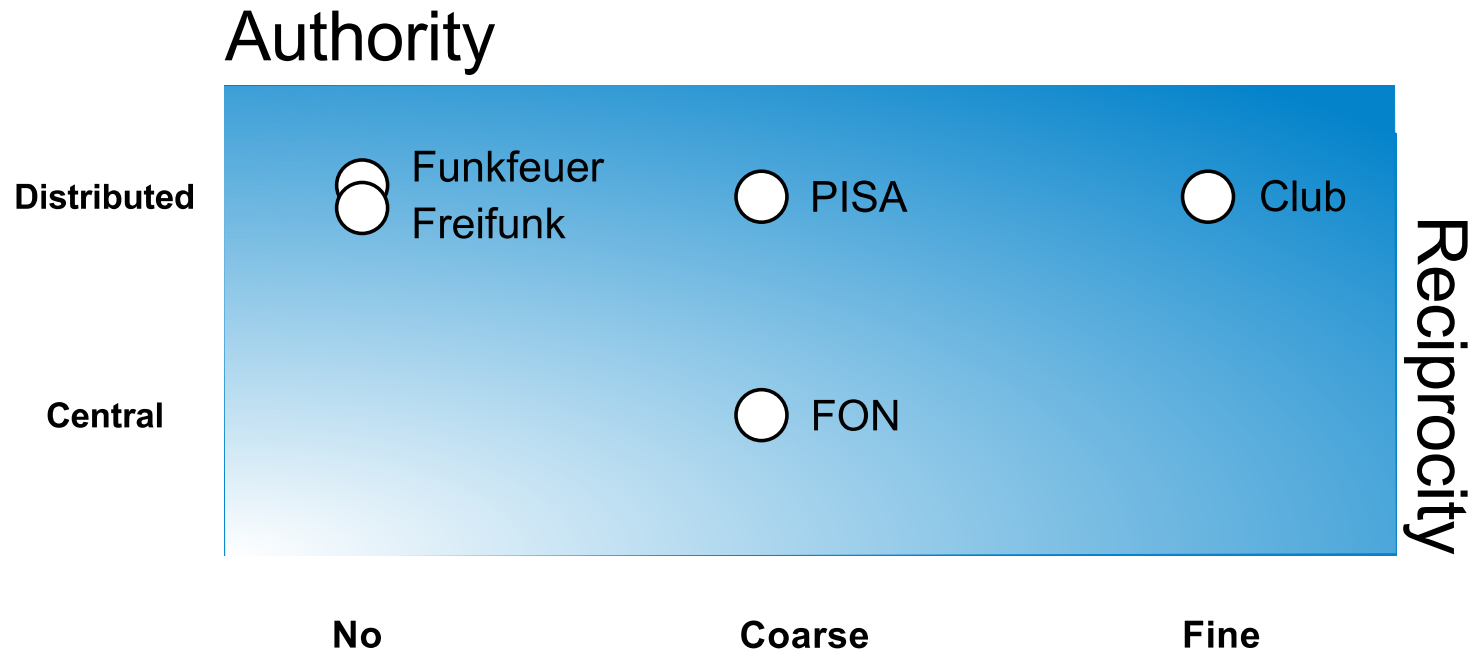
Incentives to Contribute

❑ Basic incentive
  ❑ Benefit from own contribution
  ❑ Gain should outweigh investment

❑ **Reciprocity**
  ❑ Defective behavior lucrative first
  ❑ Reciprocity lucrative in the long run

❑ How to monitor user reciprocity?

Reciprocity

❑ Reciprocity in Wi-Fi sharing systems

Authority

Distributed   ◯◯ Funkfeuer
                  Freifunk   ◯ PISA   ◯ Club

Central   ◯ FON

Reciprocity

No   Coarse   Fine

Coarse-Grained Reciprocity

- Simple access control scheme
  - Revoke user access on defection

- FON
  - Central login-server
  - Check for AP availability

- Mobile ACcess
  - Certificate revocation

Fine-Grained Reciprocity

❏ Better reward user contribution
  ❏ Isolated APs vs. frequented APs

❏ Club Network
  ❏ Measure transferred data volume
  ❏ Issue receipt
  ❏ Hand in receipt at foreign AP
 ❏ Teams include isolated AP owners

Incentives to Behave – I

- Misuse of shared resources
  - Overuse
  - Criminal actions

- Missing perception
  - Responsibility
  - Legal liability

- Non-Repudiation
  - Attribute actions to specific user
  - Manage consequences for user

Good Behavior Award

Incentives to Behave - II

- **Centralized**
  - Logging
  - *Service*-based control
  - *Traffic*-based control

- **Decentralized**
  - Route traffic over home AP
  - Responsibility for traffic
  - Revoke AP certificate
    - Prevent Internet access
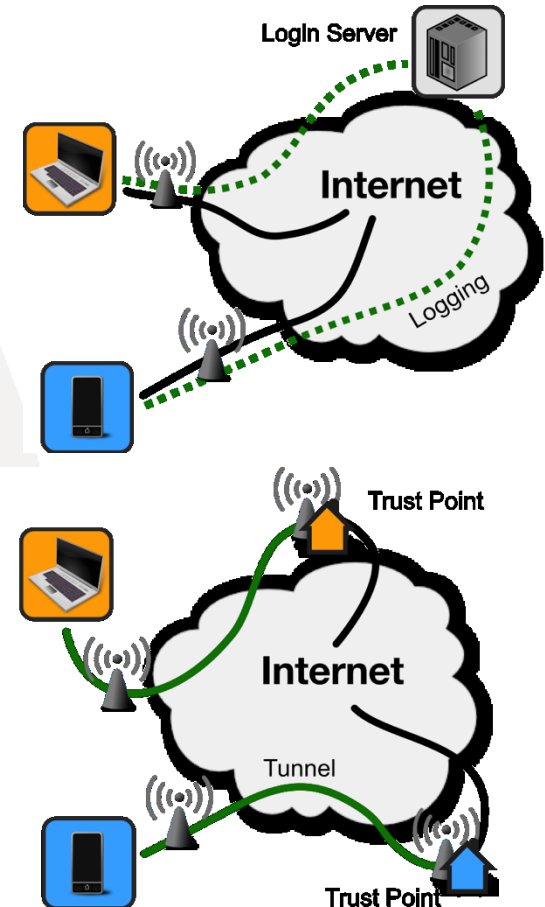
Cooperation by Contract

- Network-specific framework
  - Benevolent user actions
  - Consequences of malicious actions
  - Role and obligations of a user

- Economic aspect of Wi-Fi sharing
  - Monetary agreements with ISPs
  - Legal tools

- Technical standard necessary
  - Reference for contracts

Cooperation by Law

- Laws define Wi-Fi sharing networks
    - Establishment
    - General operation context
    - Liabilities

- Highly dependent on national laws

- Highly dependent on standardization
    - Consistent reference points
    - Neutral recommendation

Conclusion

- Wi-Fi sharing as an alternative
  - Cost-efficient
  - Pervasive

- Frameworks needed
  - Unified network operation

- Standardization needed
  - Push ISPs to support Wi-Fi sharing

That's It

Thank you for your attention!

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