

welcome

Microsoft

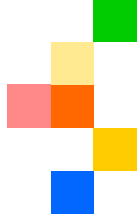




# Wireless Integration

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**IEE World Without Wires  
Richard Black  
Thursday 5th December 2002**



# Overview

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- Current wireless platforms
- Opportunities
- Challenges
- Innovation



# Laptop and Tablet PCs

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- Most Tablets PCs have 802.11
  - <http://www.microsoft.com/windowsxp/tabletpc/default.asp>
- Many new laptops have 802.11
- This form factor enables the “hot-spot”
- WLANs mostly in the enterprise
- Spreading to the home



# Smart Phone

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- GSM/GPRS
- Windows CE
- Integrating “Knowledge Worker” with telephony
- USB connection to PC
- Based on ARM CPU
  - <http://www.microsoft.com/mobile/smartphone/default.asp>

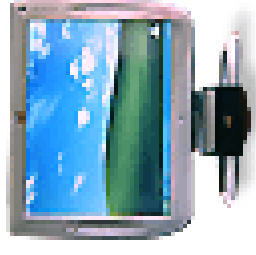


# ■ Home Networking

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- Combined Solution
  - Ethernet Switch
  - Wireless Base Station
    - <http://www.microsoft.com/hardware/broadbandnetworking/>
- Also
  - Extranet Ethernet
  - Firewall
  - High end NAT
  - UPnP control





## ■ Mira: “Smart Displays”

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- Detachable monitor, wireless touch pad
- Wireless touch pad, charging cradle that also has keyboard and mouse
  - <http://www.microsoft.com/windowsxp/smartdisplay/>
- **Wireless is changing the PC**





# Wireless Systems Issues

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- Smart Phone
- Corporate LAN
- Home LAN
- Ad-Hoc LAN (Meeting)
- “Hot Spot” Internet access
- Disaggregated computer (Mira)
- Community Mesh
  - (Wireless multi-hop community network)



# Video

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- A video was shown
- It can be found at

[http://research.microsoft.com/~bah/MS\\_Projects/Videos/Pitch.mpg](http://research.microsoft.com/~bah/MS_Projects/Videos/Pitch.mpg)

# ■ Self Organising Wireless Mesh

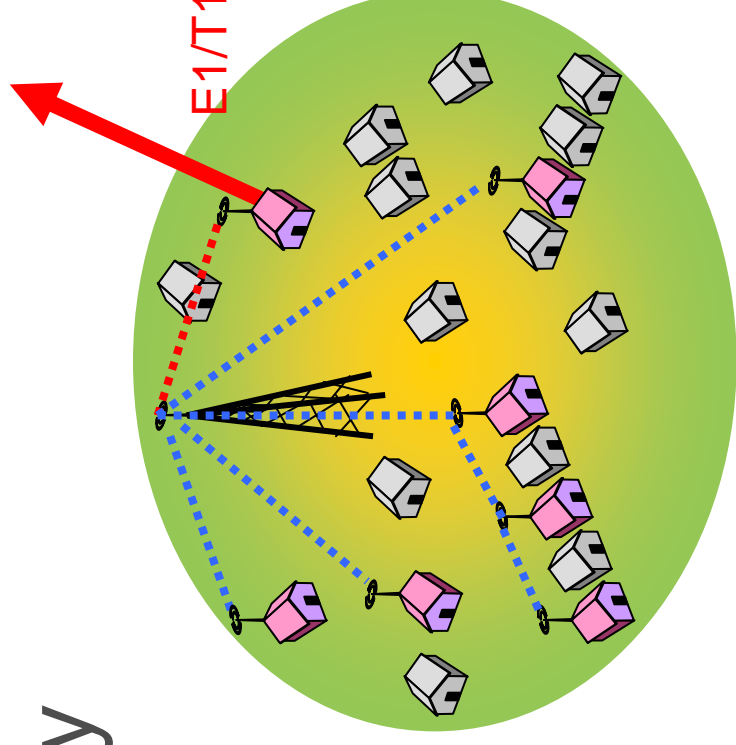
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- Mesh means multiple hops
- Original Mesh Vision
  - Completely dynamic self-organising topology
- Scenarios
  - Small sensor networks
  - Battlefield use
  - Or Emergency response
  - Or Cars on a highway
  - Maybe at airports or meetings? (large ad-hoc)

# ■ Community Wireless Mesh

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- 20-50 people; WiFi to share leased line
  - Radiant, Invisible, Enthusiasts
- Simple static topology
- ITAP nodes
  - Internet Access Point
  - Manages the connection
  - How do people trust their “ISP”?



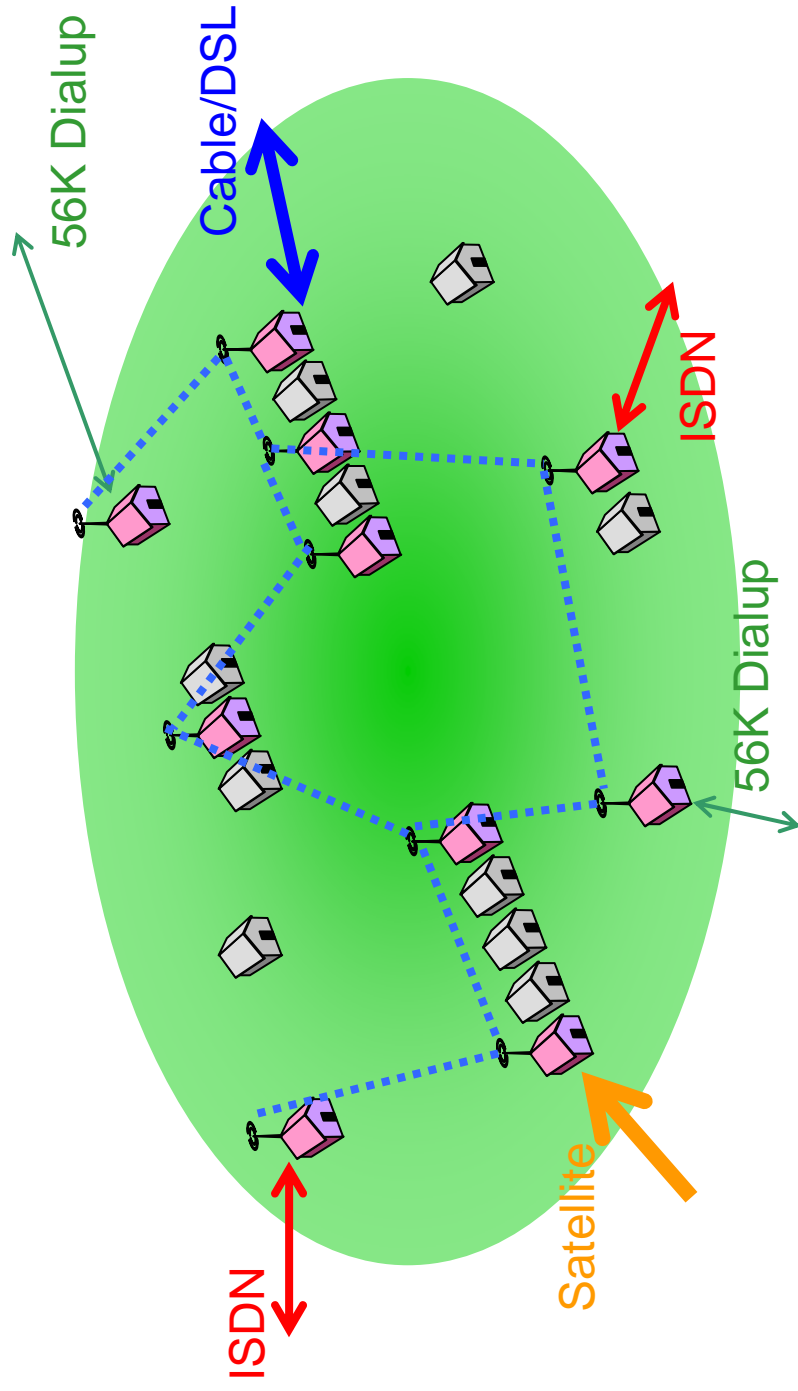
# ■ Community Net Opportunities

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- File backup
- Shared web cache
- Shared content download and distribution
- Local on-line games
- Shared processing
  - e.g. WMV encoding

# RAIN Mesh

- Radio Aggregation of Idle Networking



# RAIN Mesh

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- Use Mesh to share unused Internet capacity with other people?
  - Each user gets own bandwidth plus share of idle
  - “Very lightweight peering” – tick a check-box vs. 1 year contracts
- Route traffic according to QoS requirements?
  - games → ISDN, FTP → Satellite, video → DSL



# Mesh Challenges

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- **Public / Legal Perception**
  - What is an Internet Identity?
  - Is it an IP address?
- **Fairness / Service**
  - Who ensures I get the right service level?
- **Security**
  - What is trusted? What is managed? Who is responsible? What is guaranteed?
- **Interaction with home wireless**



# Technology...

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- Most interesting problems are in the Mesh
- Once solved there we can apply elsewhere
- What technology do we have available
- ...



## Microsoft's 802.11 Vision

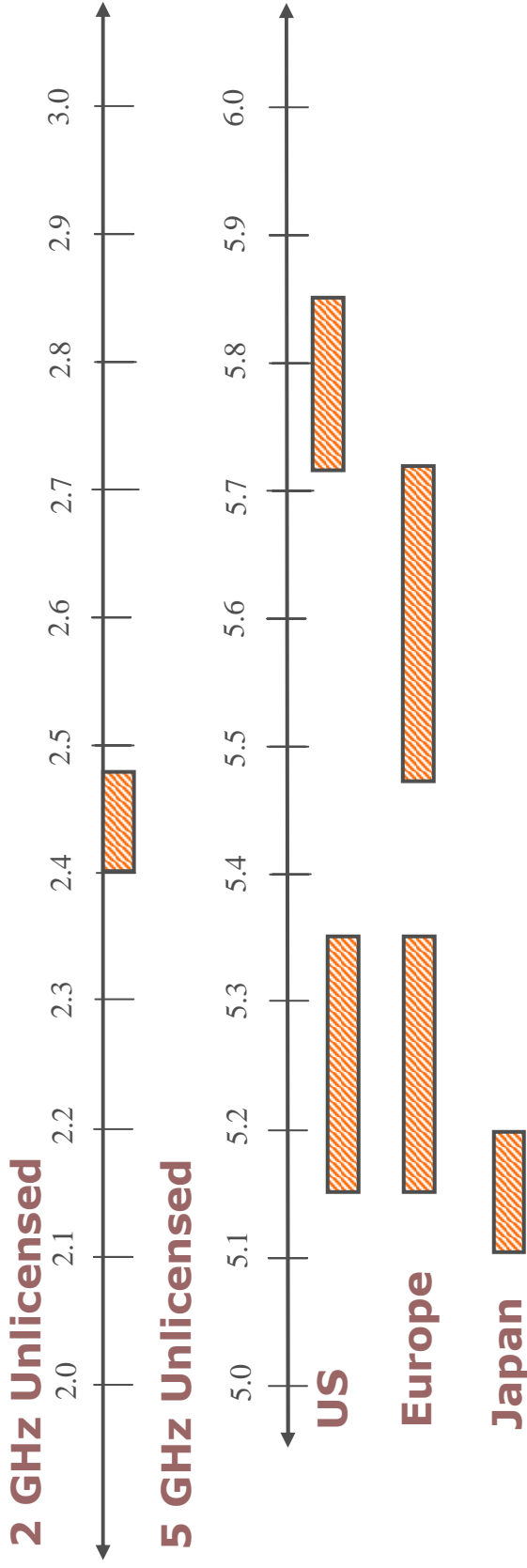
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- “Facilitate broad deployment of 802.11b networks to provide users high speed data connectivity and enable them to exploit the richness of Windows, mobility services, and the .NET infrastructure”



# 802.11 Spectrum

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- 802.11b is 11 Mbps in 2 GHz spectrum
- 802.11a is 54 Mbps in 5 GHz spectrum
- 802.11g is 54 Mbps in 2 GHz spectrum



## Microsoft's view of a,b,g,...

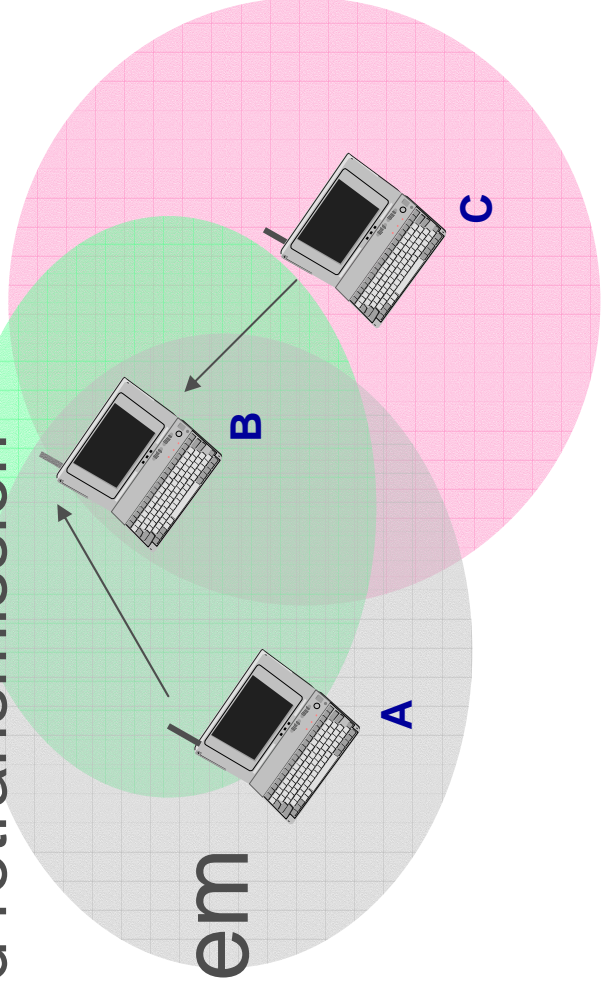
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- Significant 802.11b deployment
- Important not to confuse customer
- Hence compatibility important
- Therefore b with everything
- May become a logo requirement

# How 802.11 works

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- Packet mode (Ethernet size)
- Spread Spectrum
- Data-link uses CSMA/CA
  - Acknowledgement and retransmission
  - Exponential back-off
- Hidden node problem
  - RTS / CTS
  - Reduces problem



## ■ Multiple Hop 802.11

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- Mesh **is** the hidden node problem
  - We are forwarding to increase the range
- RTS/CTS is important in the mesh
- Necessarily expect lower throughput
- What will happen at large scale and high utilisation?



## 802.11 not like 802.3

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- Not CSMA/CD
- Link retransmission
- Variable capacity
- Not transitive
- Maximum utilisation
- Packet overhead
- Bandwidth Asymmetry
- Dynamic Topology



# One thing that doesn't work

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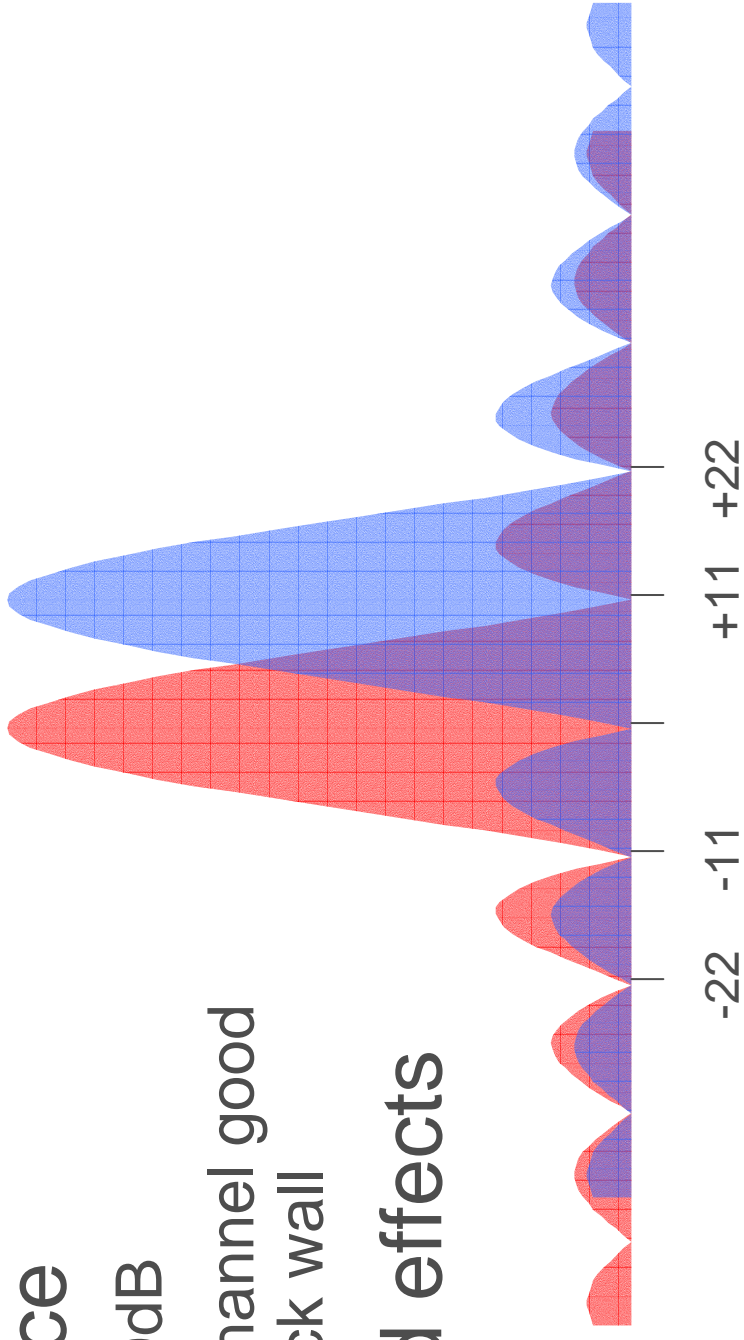




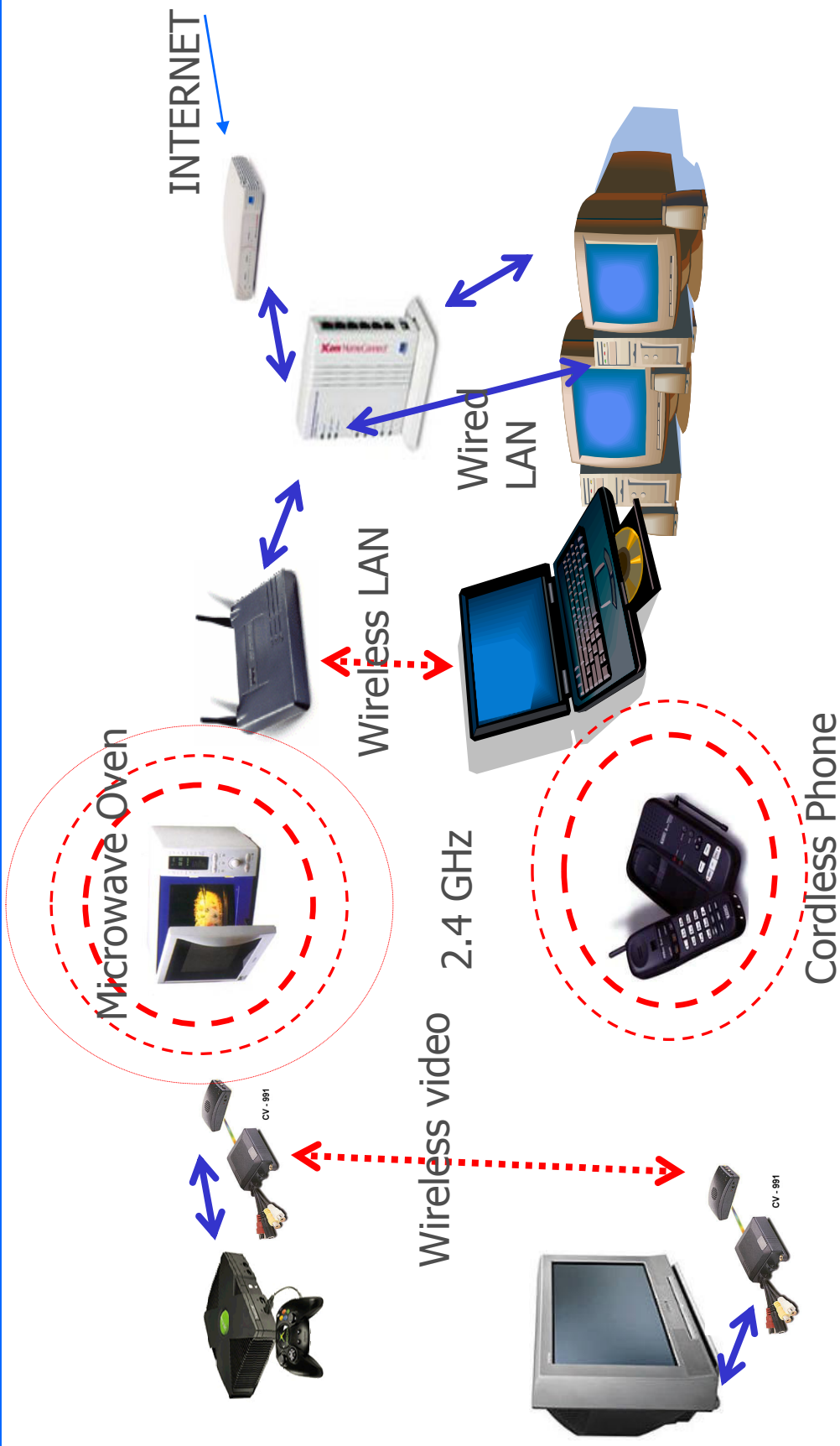
# 802.11 Interference

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- 3 “distinct” channels
- Interference
  - 30dB or 50dB
  - “distinct” channel good for one brick wall
- Near Field effects



# Interference in the Home



# ■ WLAN Security

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- Primer on security
  - <http://www.microsoft.com/windowsxp/pro/techninfo/administration/wirelesssecurity/default.asp>
- Enterprise uses 802.1x plus RADIUS
  - <http://www.microsoft.com/windowsxp/pro/techninfo/deployment/wireless/default.asp>
- 802.1x provides certificates
  - Windows XP had first implementation
  - Allows a base station to authenticate a node
  - Remote Access Dial-in User Service for policy
  - Use Active Directory for key distribution

# ■ How does a Hotspot work?

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- DHCP + local server for sign-in
- Usually Ethernet MAC authentication
  - Fairly easy to spoof
- Usually no encryption
  - Fairly easy to intercept
- No differentiated services
- Business models vary
  - Credit card, account, or cookies for cash

# ■ The MS-Choice Hotspot

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- Done by Victor Bahl
  - <http://www.mschoice.com>
- Protocol for Authorization and Negotiation of Services (PANS)
  - Passport for identity and billing
  - User is protected from provider
  - Service differences based on ID
  - Authenticated and Encrypted traffic
  - Implemented as NDIS intermediate driver

# Community Mesh Vision

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- If we solve all the technology problems
- This is what it might look like
- A Video demonstrated
  - The community shared backup service (Farsite)
    - <http://research.microsoft.com/sn/Farsite/>
  - The ideas of community shared networking
  - The ideas of community applications

# Microsoft®

