



# Networking Tonga from the Ground Up and the Sky Down

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# Agenda

- Historical Perspective
- Regulatory Issues
- Kingdom of Tonga Project
- AN-MSI Project
- Questions



# Star Trek as a Model

- Well known cultural icon
- \$2 Billion per year industry
- Great Broadband Data model
  - Communicator
  - Holodeck
  - Transporter
  - Tricorder
- How do we get there from today???



# Amateur Radio Efforts

- First packet radio networks in '80
- Outgrowth of earlier efforts
  - ALOHA - Univ.. of Hawaii
  - PRNET, SURAN



# AX.25 Path

- Spin on X.25
- Terminal Node Controller (TNC)
- TAPR Work
  - TNC-1
  - TNC-2
- Part 97 Rule changes in '85



# AX.25 Today

- PBBS Network
- Worldwide deployment
  - VHF/UHF for local links
  - HF for long distance
- Low-cost global Internet



# IP Path

- Started in '85
- Based on KA9Q IP Package
  - First cross platform PC IP effort
- Provided base for new HW
  - 56 Kbps in '86



# IP Today

- Global wireless Internet
- TCP/IP based
  - VHF/UHF for local
  - AX.25 over IP tunneling
  - RSPF routing
- Low cost HW to 3 Mbps





# Amateur Radio Summary

- No commercial use allowed
- No Morse code required for 28 MHz and up
- Higher priority in most unlicensed bands
- Starting to make more use of unlicensed bands



# Unlicensed Radio History

- FCC Part 15 in 1985
- WLAN products
- WMAN products
- Data-PCS at 1.9 GHz in '94
- Data-PCS at 2.9 GHz in '96
- U-NII Band in '97



# Wireless LAN Thoughts

- Lackluster sales until recently
- IEEE 802.11 standard in '96 impact
- Bluetooth et al
- IrDA standards
- Is IR really better for most indoor situations??



# Wireless MAN Thoughts

- Sales to date have been slow in US until recently
- No standards on the horizon
- Hard to deploy
- Not easy to scale up



# Role of FCC

- Communications Act of '34
- Spectrum Management & Policy
- 'Tragedy of the Commons' Problem
- SS NOI in '81



# Regulatory Tidbits

- Old Model
  - Bits/Hz
- New Model
  - Bits/Hz/Meter/Time
- Sun vs. Apple - The untold U-PCS story
- En Banc Hearings on Spectrum
  - 1996, 1999
- Technological Advisory Council



# New Problems

- Internet Appliances
- UWB = More Bandwidth!!!
- Smart Radios??
- Convergence
- Negroponte 'Flip'



# Regulatory Wrap-up

- Regulatory issues are the biggest problem in the way of a paradigm shift for wireless!
- More technology available than we know what to do with!
- Need to find a place where wireless regulatory issues are absent!!





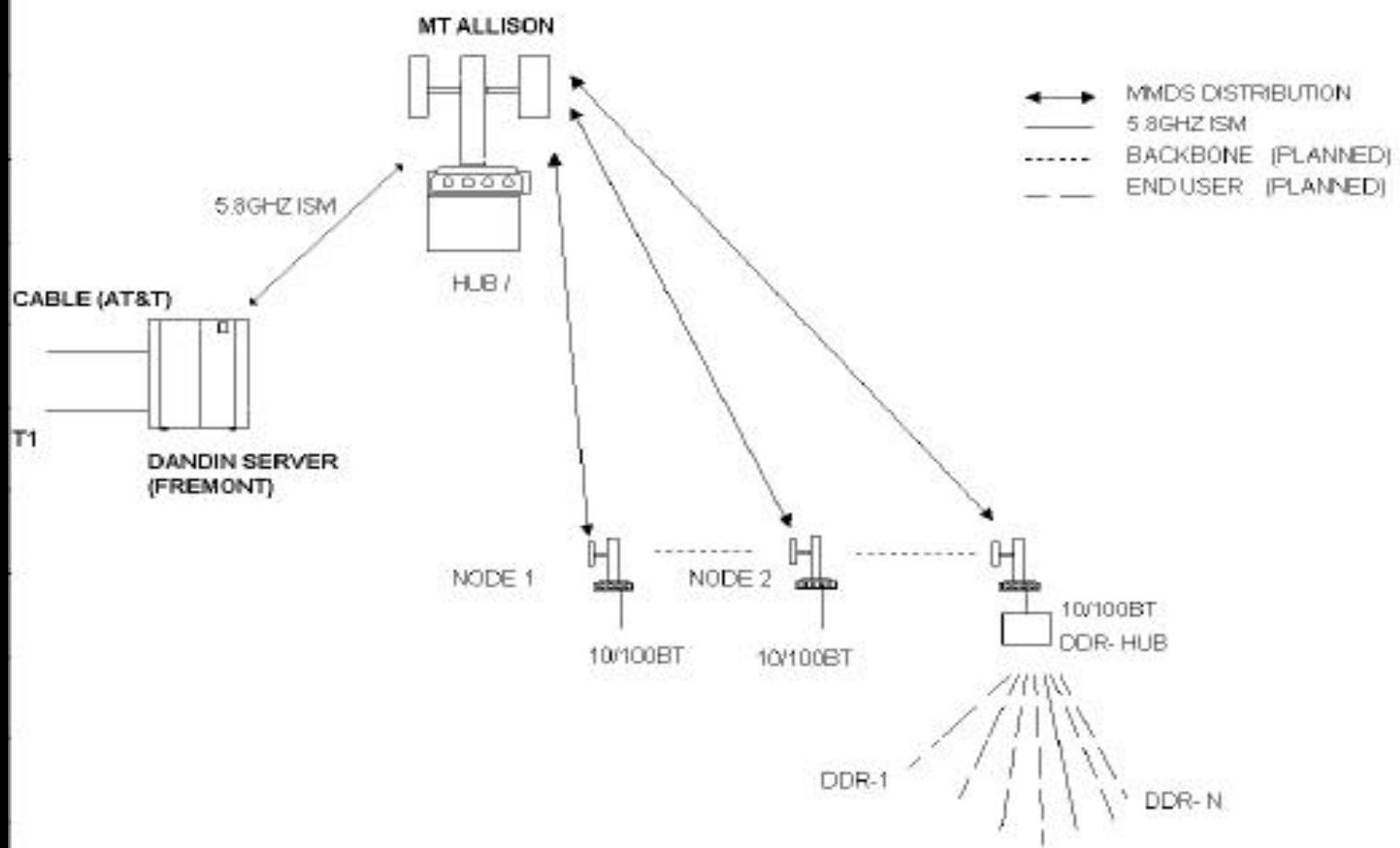
# SF Bay Area Testbed

- In operation since Fall '96
- Combo of Part 15 and Part 97 devices
- Pt to Multipoint service over 30 mile area
- Proof of concepts
  - Part 15 can do more than imagined
  - Limitations of current approaches



# SF Bay Area

## DANDIN INTEGRATED WIRELESS NETWORK BAY AREA SYSTEM



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# Kingdom of Tonga Project

- Island group in the South Pacific
- About 170 islands, 70 inhabited
- 110K people in Tonga, about the same number outside Tonga
- Agricultural exports main source of \$
- One of the last true monarchies



# Downtown Nuku'alofa





# HRH & Villa







# RSS & Local Technology





# Dandin Group (Tonga), Ltd.





# The Task

- Business project of the Crown Prince
- Move country from wired to totally wireless infrastructure
- Two Phases
  - International
  - Domestic
- No regulatory issues!!!





# Basic Stats

- 60K Households
- 6500 phone customers
- 8 yr. waiting list to get a phone
- Cable & Wireless handles international
- Tonga Telecom handles domestic



# Technology

- **Wireless Multiservices IP Network**
  - Scalable, fully meshed network
- **Use of wideband wireless devices**
  - Spread Spectrum
  - Ultrawideband
- **New two-way VSAT technologies**
- **Support for new Internet appliances**
  - New PDA's
  - Playstation II
- **Goal of CPE cost of about \$300**

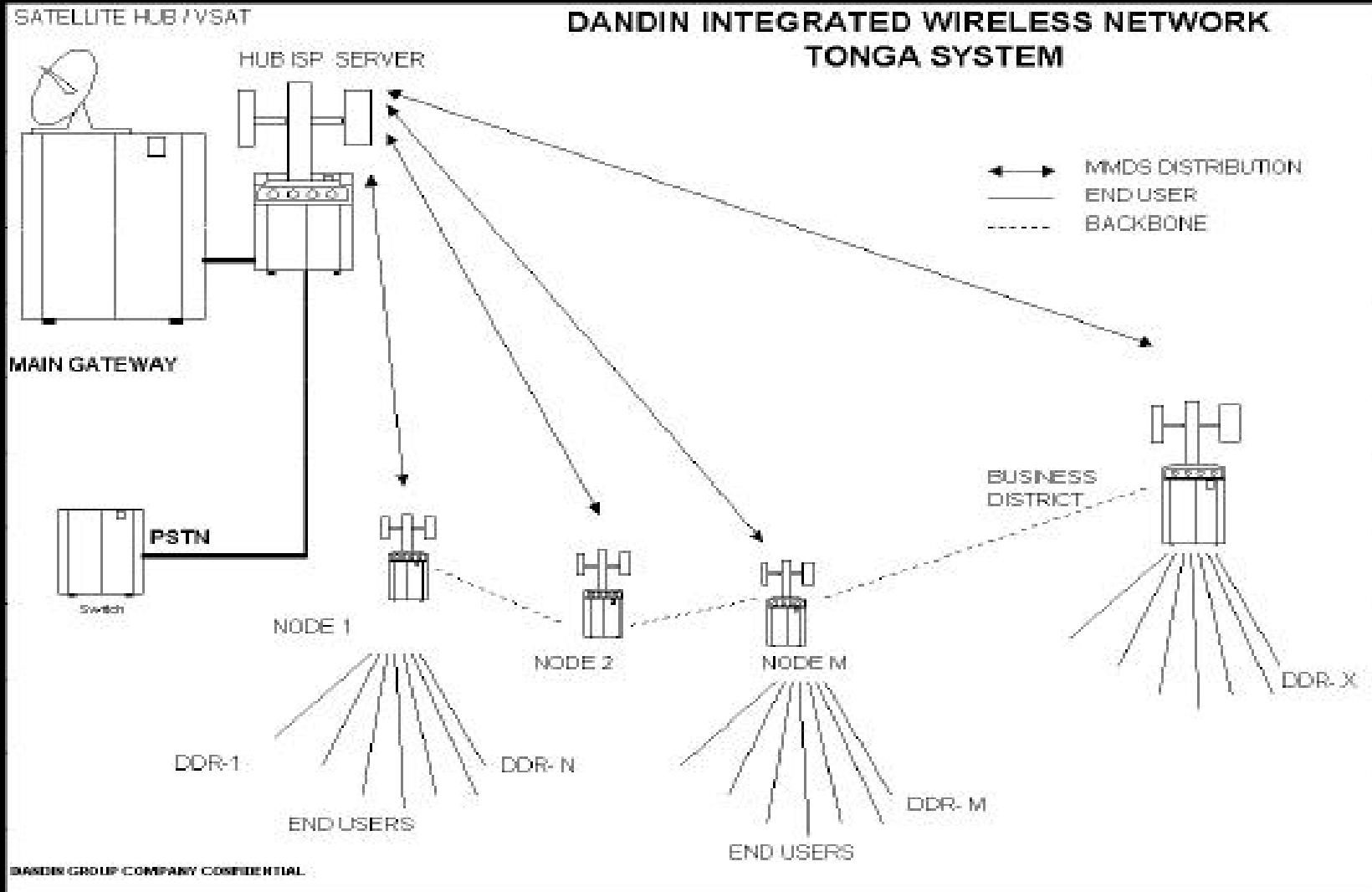


# Services

- VoIP for telephony
- Internet data
- Video
- Introduce 'Smartcard' for access to services, billing



# Kingdom of Tonga



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# AN-MSI Project

- Deploy pilot projects in Tribal Lands
- Use similar architecture and technologies as in Tonga
- Adapt to US environment
- Innovative use of two-way satellite and terrestrial wireless



# Questions?

- Handout
  - Paul Baran paper
- For more info on amateur packet radio:  
<http://www.tapr.org>
- For more info on unlicensed wireless devices:  
<http://wireless.oldcolo.com>