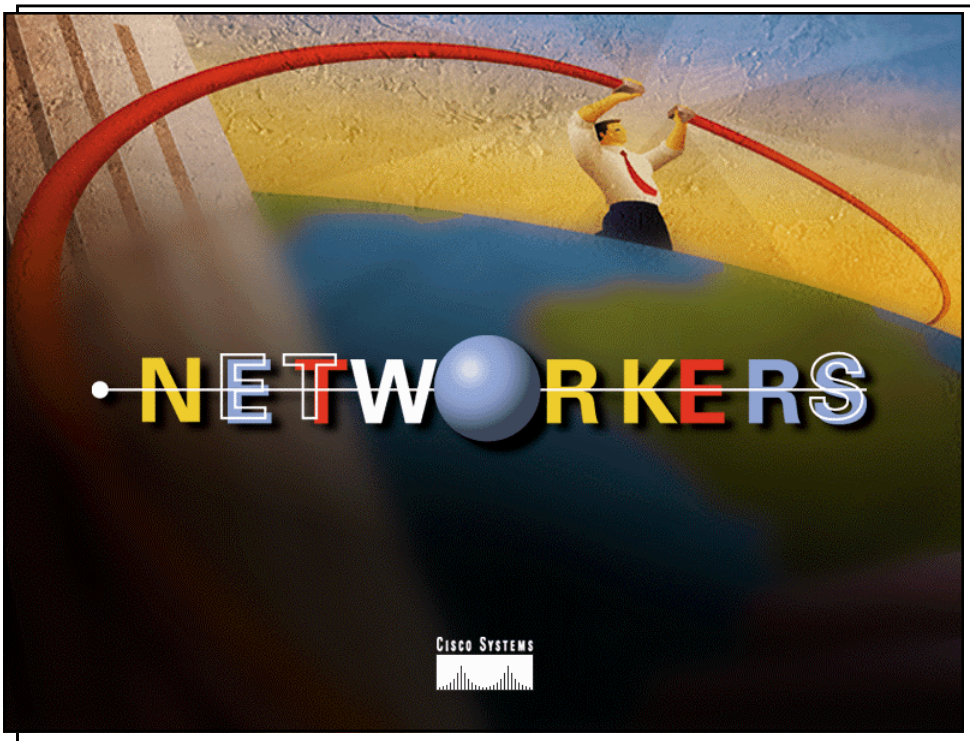
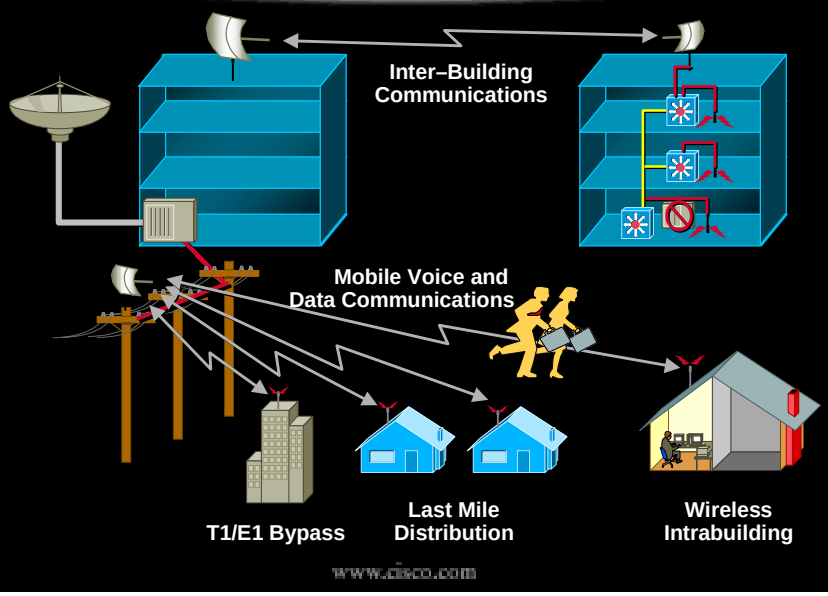


Agenda

- Roadmap for the Marketplace
- Technology Alternatives
- Technology for Data Mobility—Mobile IP
- Partnerships
- Summary

www.cisco.com

Wireless Data Networkers



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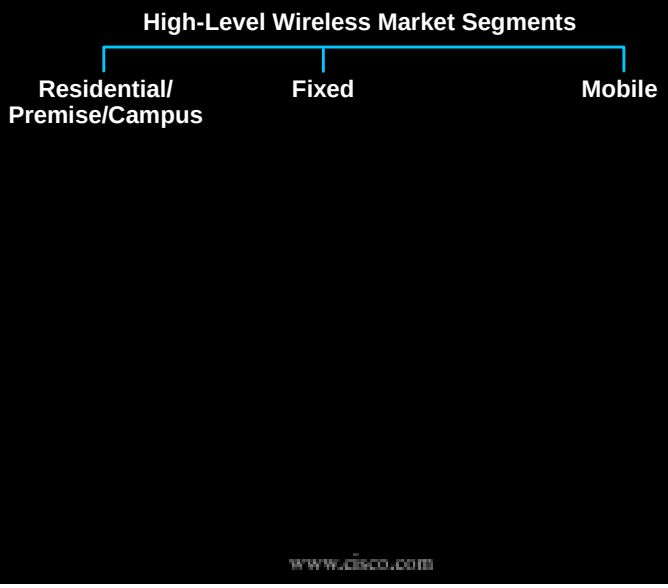
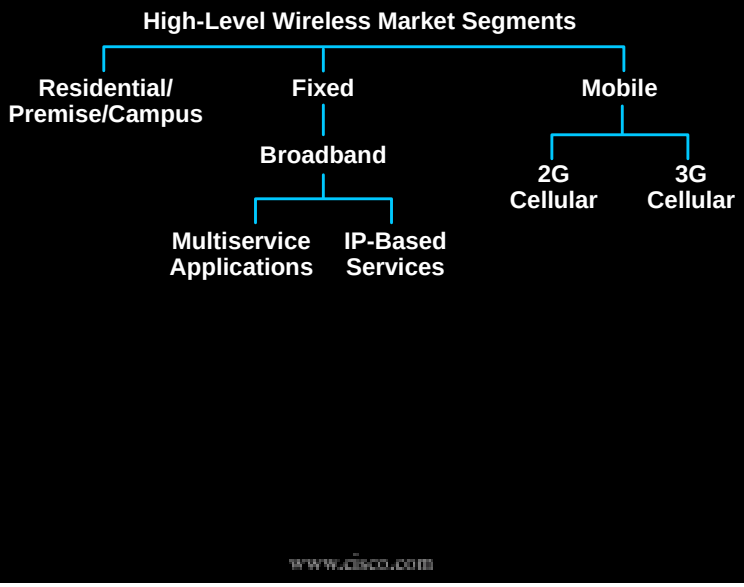
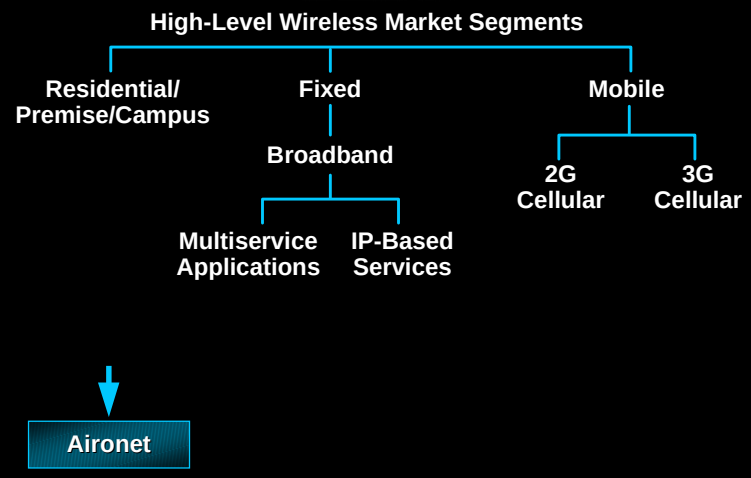
Roadmap for the Marketplace



Roadmap for the Marketplace



Roadmap for the Marketplace



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Broadband Wireless

- Multiservice wireless applications
- Sufficient bandwidth to support
  - Data, voice, and video services
- Potential for dynamic allocation of bandwidth
  - Better utilization and flexibility

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Spectrum Coverage

- MMDS (Multichannel Multipoint Distribution Service)
  - 180 MHz of total BW
  - Good RF propagation and CPE cost
- UNII—5.8 GHz
  - 100 MHz bandwidth
  - Unlicensed—any customer can use band in USA
- LMDS (Local Multipoint Distribution System) 28 GHz
  - 1 GHz total bandwidth
  - Poor RF propagation (rain fades) and higher cost CPE
  - Spectrum is typically licensed

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SpectraPoint™

- New joint venture between Cisco/Motorola
  - TI/Bosch original owners
  - Majority owned by Motorola
  - 200+ personnel in Dallas
  - Joint board representation
- Market focus
  - Common vision for broadband wireless market
  - Focused initially on LMDS (28 Ghz) technology space
  - $5–8B in infrastructure planned over next four years
- Industry leader in LMDS technology

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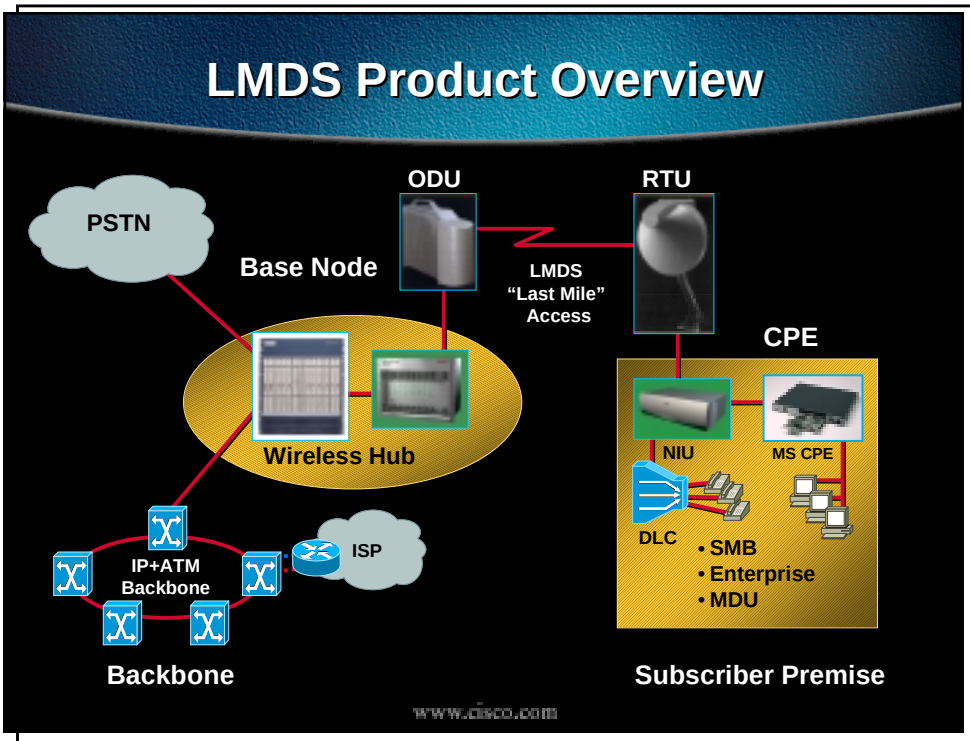
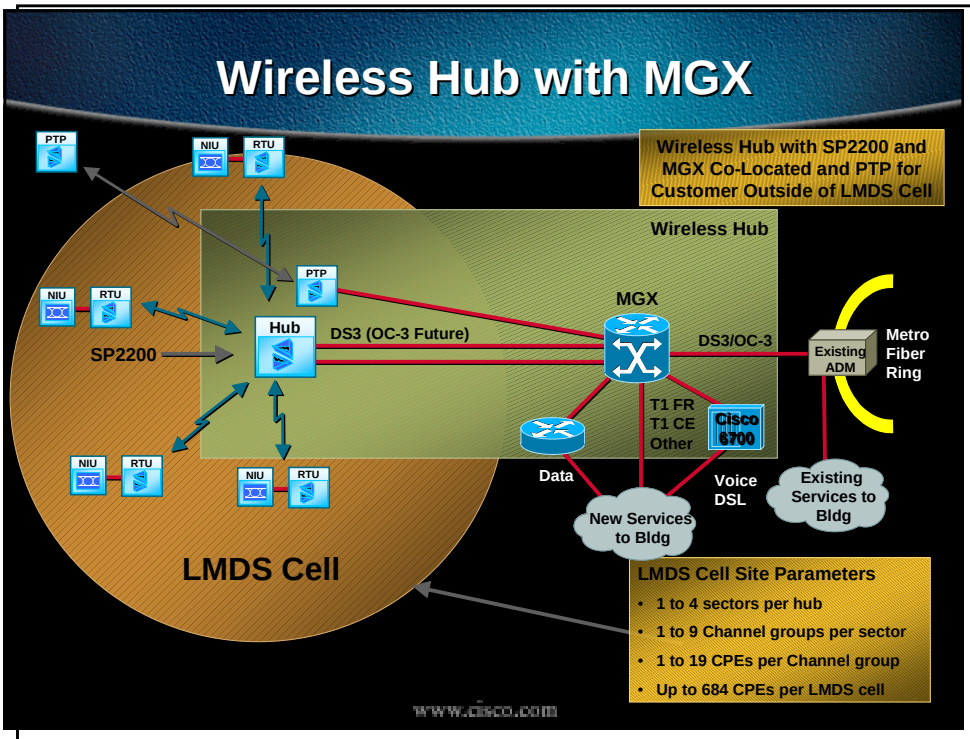
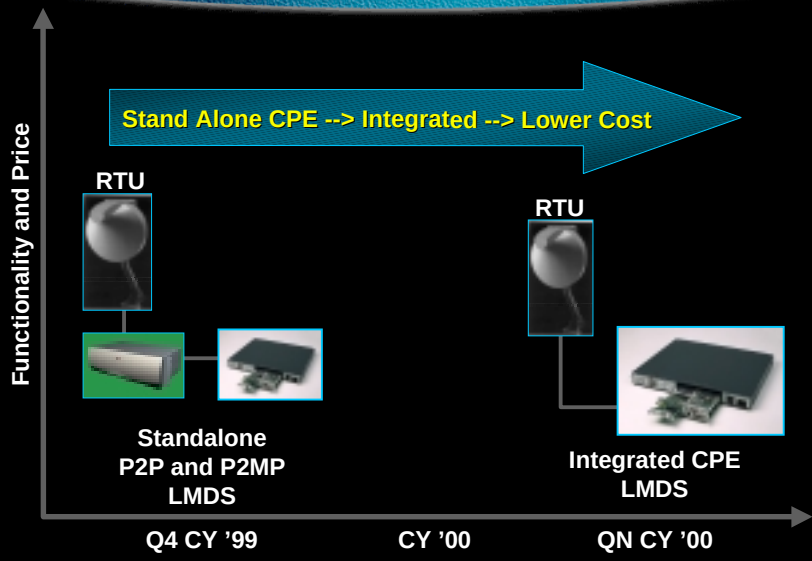




LMDS Product Roadmap



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Fixed Wireless LMDS Summary

- Integral part of Cisco's last mile access strategy
- Partnership brings broad range of capabilities to the table
- Significant market opportunity
- Cisco Powered Network offers operators/customers
  - Broad service offering
  - Wide range of deployment platforms

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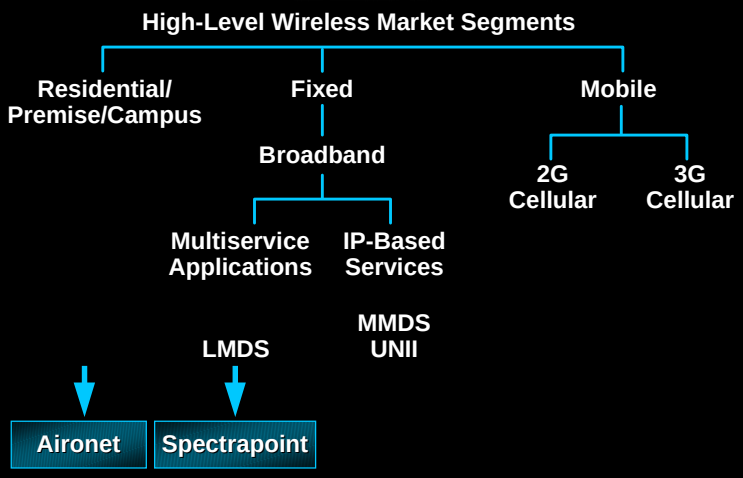
Roadmap for the Marketplace



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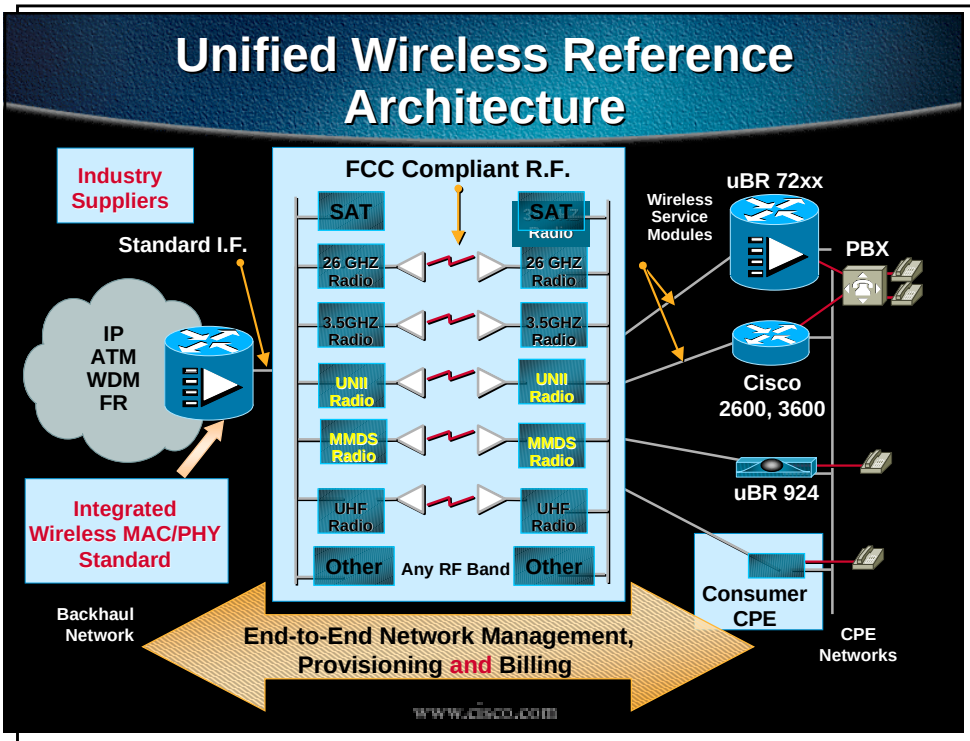
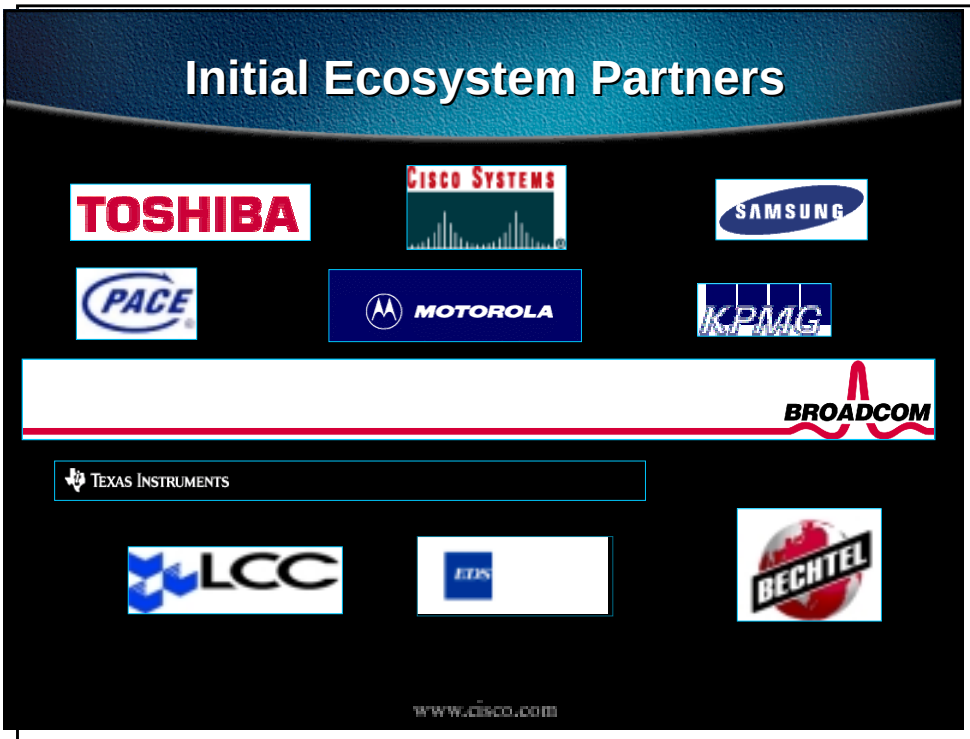
Cisco Wireless

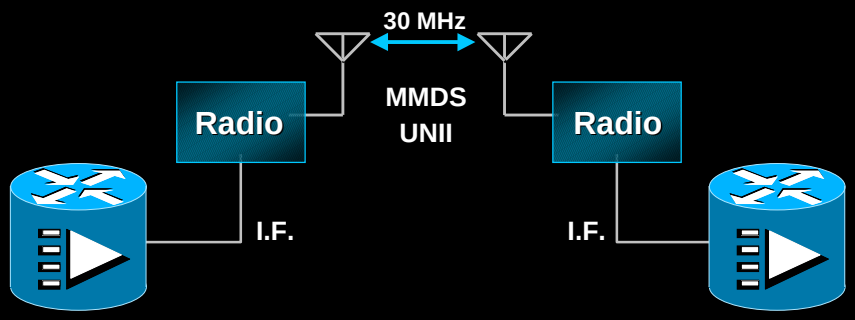
- Uses multipath to break through the line-of-site requirement
  - Tolerates high-delay spread
  - Cost-effective data rates using multipath 90 Mbps demonstrated
- Adaptive space-frequency diversity
  - Uses two antennas to improve frequency and time fading
  - Lower complexity, higher performance than QAM
- Product goal:
  - Technically superior, easier to deploy, more robust

www.cisco.com





Wireless IP



- Combination of cable Cisco UBR7200 platform with wireless-based technology
- Symmetrical 44.4 Mbps serial PPP link

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Wireless IP Product Features

- Fiber-quality link
  - Greater than 10-11 BER for data; greater than 10-8 BER for voice
- MMDS (2.5 GHz) and UNNI (5.7 GHz) bands
- Encryption support for 40 and 56 bit DES with RSA key management
- Antenna diversity—3–5km nonLOS
- Configurable channel bandwidths (6 and 12 MHz)
  - Configurable data rates at each bandwidth
- Interface to the uBR 7246 and uBR 7223

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Universal Broadband Router (uBR)—NEBS Compliant Scalable Wireless Hub

- **Product leadership**
  - Low cost modular rack-mount solution
  - World-class multifunction routing and switching in single platform
  - Full DOCSIS 1.1 QOS MAC
  - RF ruggedized chassis
    - Dedicated or shared wireless solutions
- **Solid and proven foundation**
  - Standard Cisco 7200 base
  - Broad LAN/WAN interface selection:
  - POS, ATM, HSSI, DS3, NXT1, Fast Ethernet, Wireless DS3 (MMDS, UNII)
- **Best-in-class support**
  - Training, consulting, CCIE
  - 24 x 7 x 365 multilevel support

uBR 7246

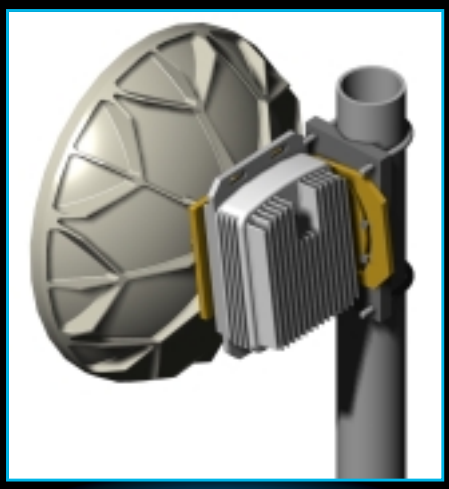
Universal Broadband Router

Data
Voice
Video

www.cisco.com

Back–Haul ODU Configuration

- **Range of greater than 40 km at 44.4 Mbps in clear LOS channel with 1.2m dish**
- **3–5km non LOS**



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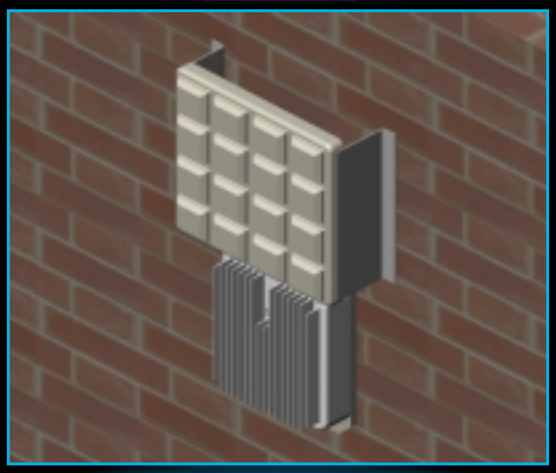
Short–Hop ODU Configuration



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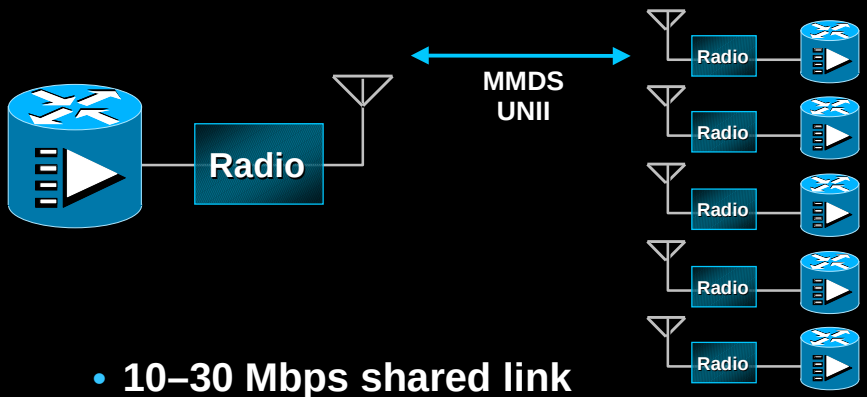
Phase Two: Shared Access



- 10–30 Mbps shared link
- Same MCNS DOCSIS 1.0/1.1 MAC
- 1–2 Mbps average, 22 Mbps burst

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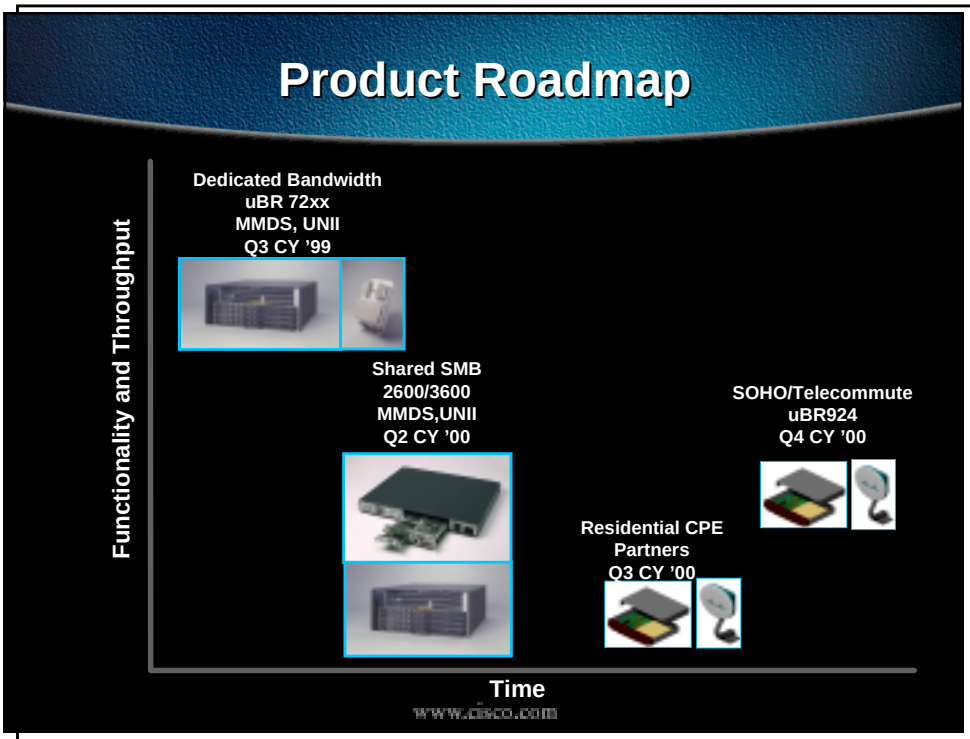
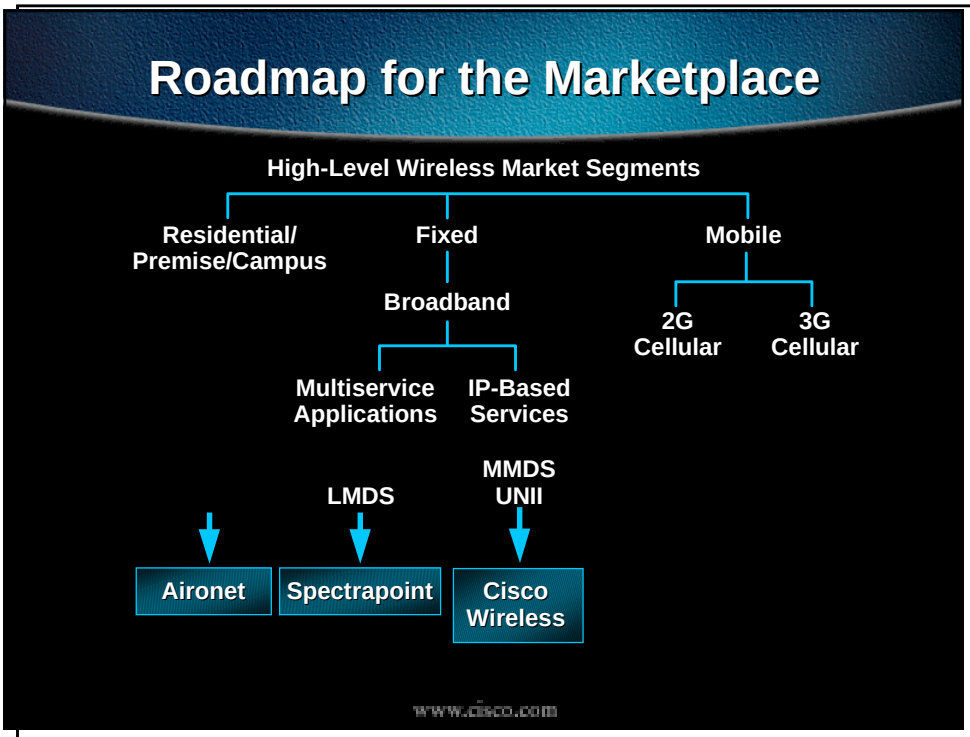
Product Roadmap



Roadmap for the Marketplace



Wireless Data Network Drivers

- Information access
- PDAs
- Network computers
- Alpha paging, information distribution
- Web technology

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Services Most Often Requested

After Basic Wireless Telephony Service

Call Forwarding	37%
Paging	33%
Internet/E-Mail	24%
Traffic/Weather	15%
Conference Calling	13%
News	3%

Data Applications

Source: CTIA Web Page
Peter D. Hart Research Associates, March 1997

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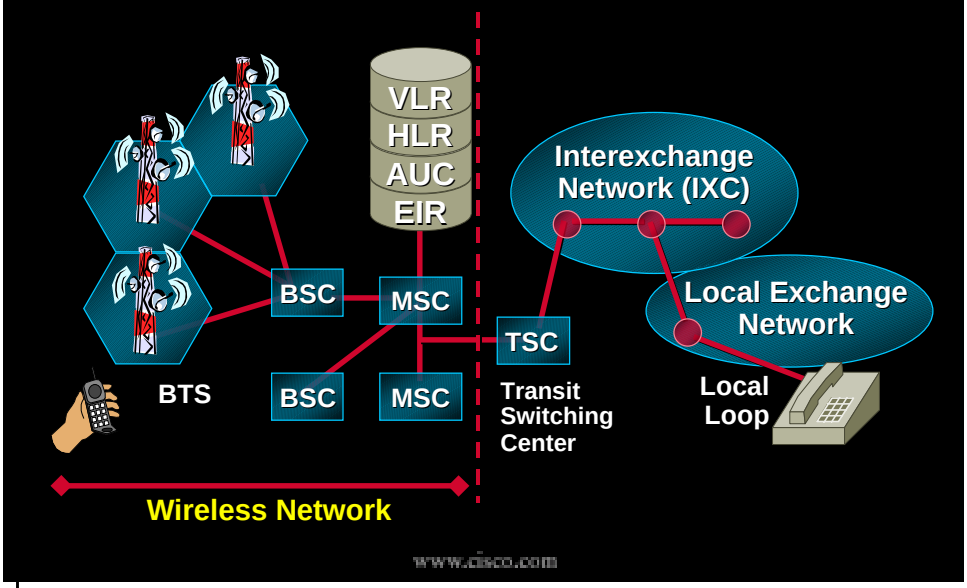
Cellular Telephony Network



Cellular Telephony

- Service deployment worldwide
- Many standards
  - AMPS, TDMA, GSM, CDMA, PHS, PACS, W-CDMA, TD-CDMA, UMTS, IMT-2000…
- Many frequency allocations
  - GSM in North America vs. GSM in Europe (1800 and 1900 MHz vs. 900 + 1800 MHz)
- Multimode, multiband phones

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Packet-Based Data Allows

- True mobility—not tied to a circuit
- Always on and always connected
  - Without continuous airtime charges
  - Billing based on packets sent, reflecting real resources used
- With mobile IP:
  - The ability to tie into the home network and the Internet
  - Roaming while retaining connectivity and identity

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Digital PCS Wireless Data

- GPRS = General Packet Radio Service the GSM packet data standard
  - Provides access to Internet via TCP/IP
  - Carrier owned fixed-IP addressing
  - Example: Alcatel
- Mobile IP = CDG proposed CDMA packet data standard
  - Provides access to Internet and intranet
  - Carrier-based and destination-based addressing
  - Example: Qualcomm

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Cisco's GPRS Solution

- GSGN (Gateway GPRS Support Node)
  - Functionality integrated into Cisco IOS
  - Supported on 72xx routers
- SGSN (Serving GPRS Support Node)
  - T-SGSN (Telecom functionality)
    - Offered through Telecom partners
  - D-SGSN (Datacom functionality)
    - Integrated into Cisco IOS routers
    - Supported on 72xx routers

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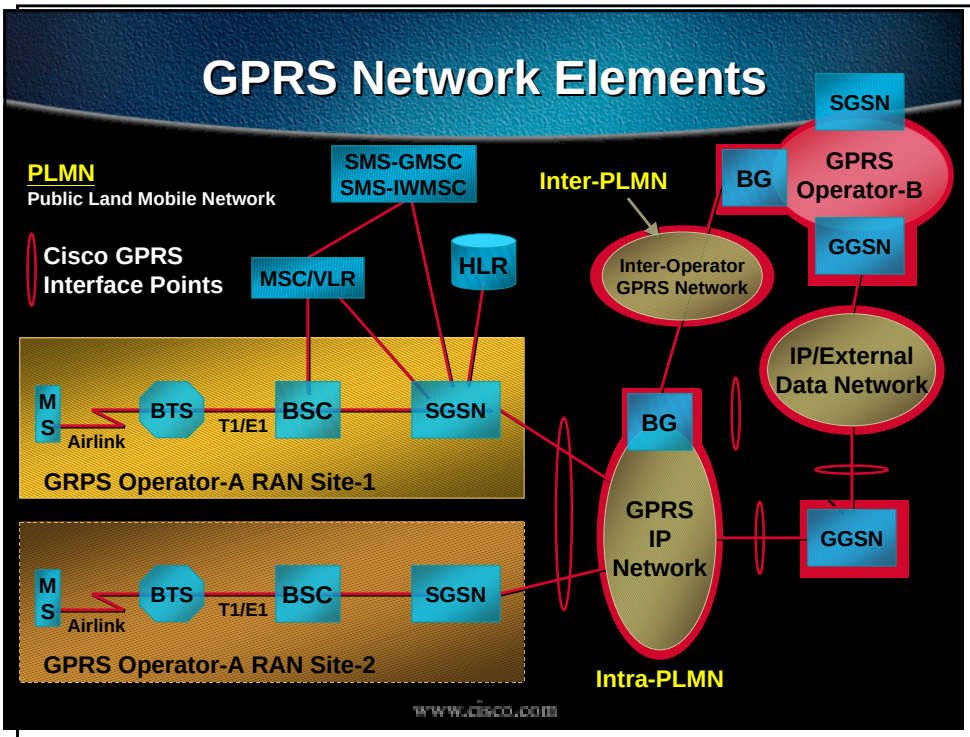
GPRS Network Elements



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Cisco GGSN Feature Set
RAN Vendor Independent

ETSI Defined Feature Set

- GTP tunneling
- Network access and subscription control
- Mobility management
- Internet/intranet interworking
- GPRS packet routing and transfer
- Backbone network management
- Charging data management
- Quality of service

+

Cisco IOS® Value-Added Feature

- IP routing feature set
  - LAN support, WAN optimization, IP routing, multimedia and quality of service, management and security
- IP tunneling
- Access control and firewall
- Hot stand-by routing protocol
- Fast switching of GTP packets
- DNS, DHCP and RADIUS

GGSN Architecture

- Cisco IOS-based
- 7200 is the first hardware platform
- Ultimately, any Cisco IOS platform

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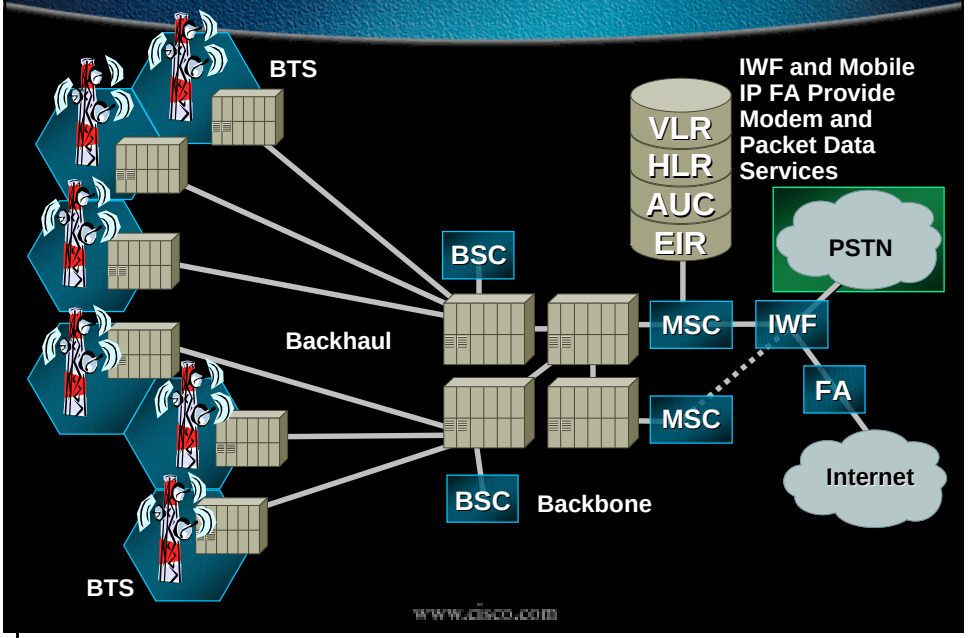
CDMA Cellular Packet Data



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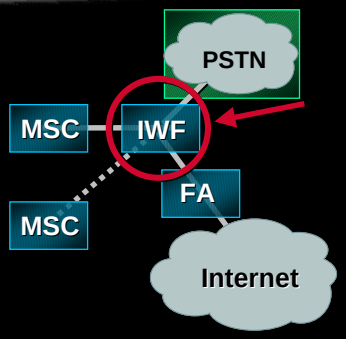
IWF

- Circuit–mode data gateway
- MSC to IWF via L–interface
  - Channelized T1 with Frame Relay
  - Two major flavors of L-interface control channel
  - On signaling channel of T1—on Ethernet
- IWF modems to PSTN support dial data and fax
- Network connection to Mobile IP Foreign Agent (FA)



IWF Looks Like an Access Server with L–interface Protocol Support

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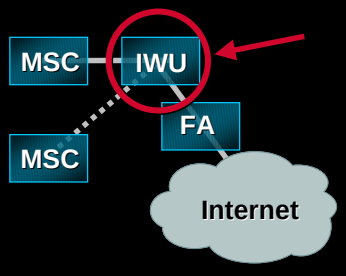
IWU

- Packet-data gateway
- L–interface to MSC
  - Channelized T1 with Frame Relay SVCs
  - Two major flavors of L-interface control channel
  - On signaling channel of T1—on Ethernet
- Terminates PPP session from mobile node (MN)
- Network connection to home network via Mobile IP Foreign Agent (FA)



IWU and FA Can Be Combined to Reduce Cost and Improve Scalability for the Operator

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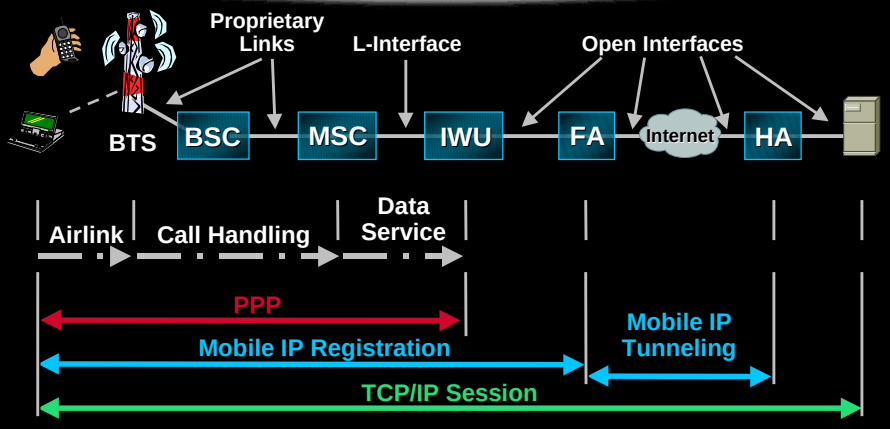
CDMA Mobile Data Operation



- Airlink and PPP session can disappear and reappear while Mobile IP state and TCP/IP session is maintained

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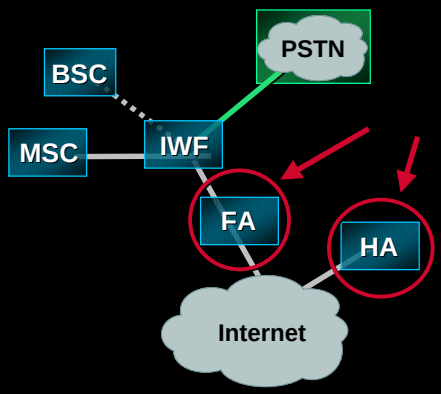
Mobile IP HA/FA

- Mobile IP Foreign Agent (FA)
  - Defined by RFC 2002–2006
- Agent for TCP/IP data access
  - Home Agent (HA) provides destination-controlled authentication, service specification and address assignment
  - Supports both corporate-intranet access and carrier-Internet service access
- Implemented in Cisco IOS Software
  - Available today as an 11.x EFT
  - Wide availability with 12.0(1)T
- Deployed in carrier networks



FA and HA Support Are Integrated into Cisco IOS Software for Any Cisco IOS Platform

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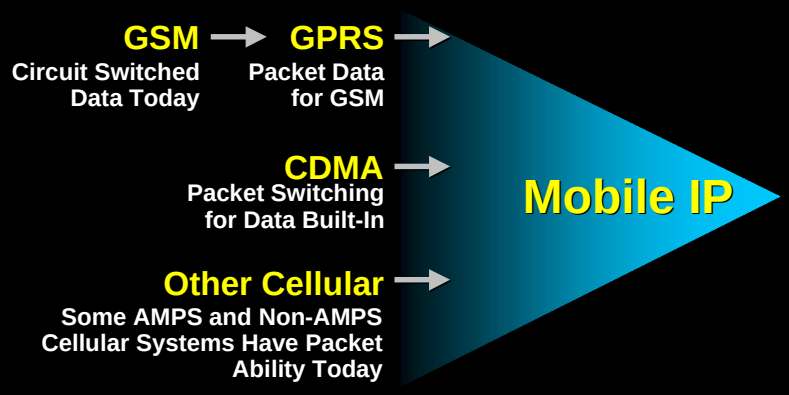
Evolution of Data Services



Cellular Systems Are Moving Toward Support for Packet Data; This Is the Foundation for Mobile IP

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Mobile IP

- The IETF proposed standard solution for mobility at Layer 3
- RFC 2002–2006 define the functionality
- Protocol works over any intermediate media
- Movement is transparent to hosts who communicate with the mobile user
- No IP address changes are needed to allow mobility

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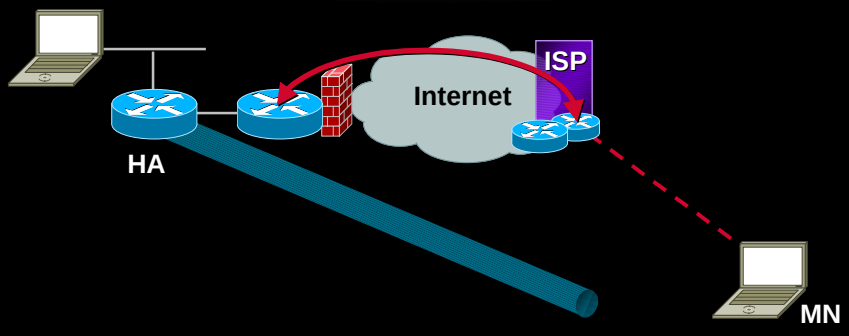
Overview: Mobile IP Functionality



Mobile IP Forms a Layer 3 Tunnel from a Home Agent (HA) to the Mobile Node (MN), Which Can Continue to Use Its Home Address to Receive IP Datagrams

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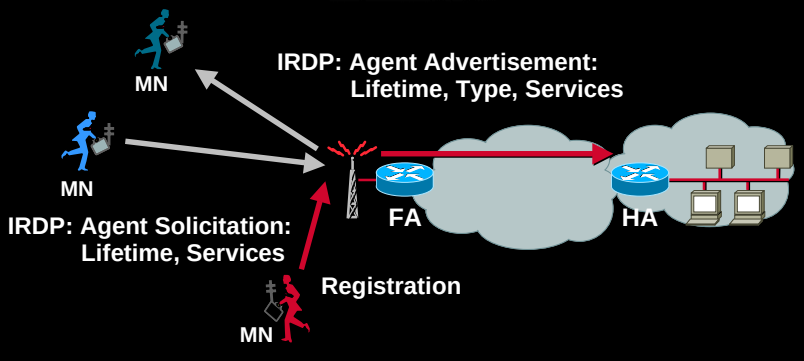
Mobile IP: Registration



- Care-of or co-located addresses
- Agree on services
- Register with the home agent

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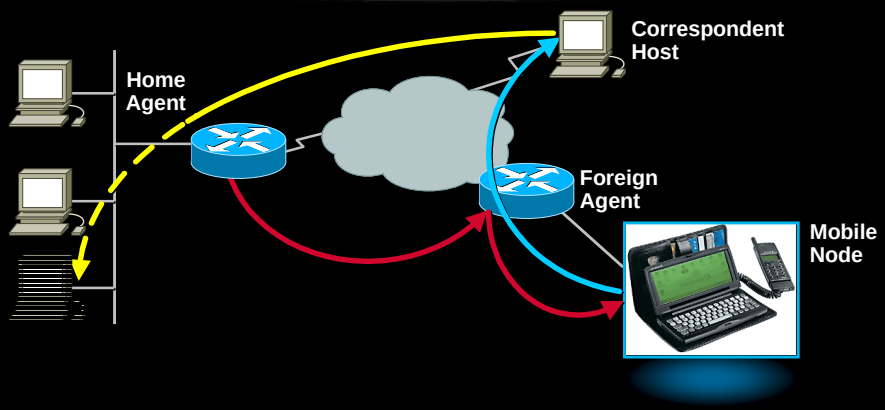
Mobile IP: Packet Forwarding



The Home Agent Intercepts Traffic for the Mobile Node and Tunnels to Its Current Location. Traffic from the Mobile Node Can Go Directly to the Correspondent Host

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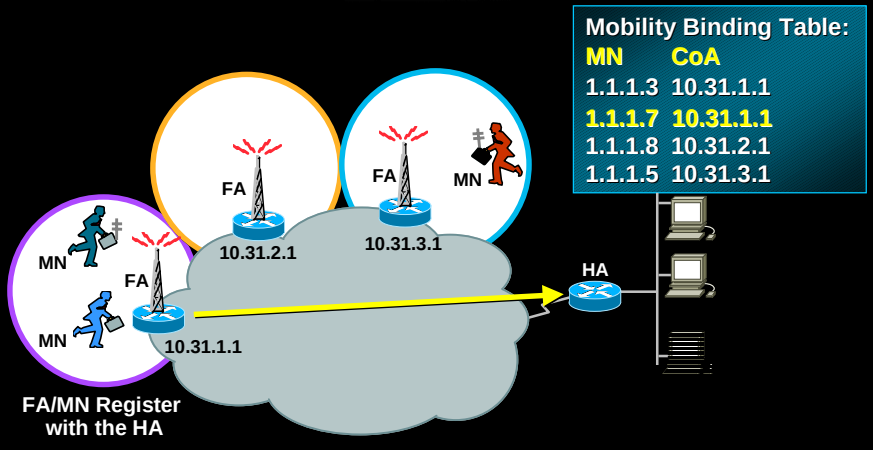
Mobile IP: True Mobility, Transparent Roaming



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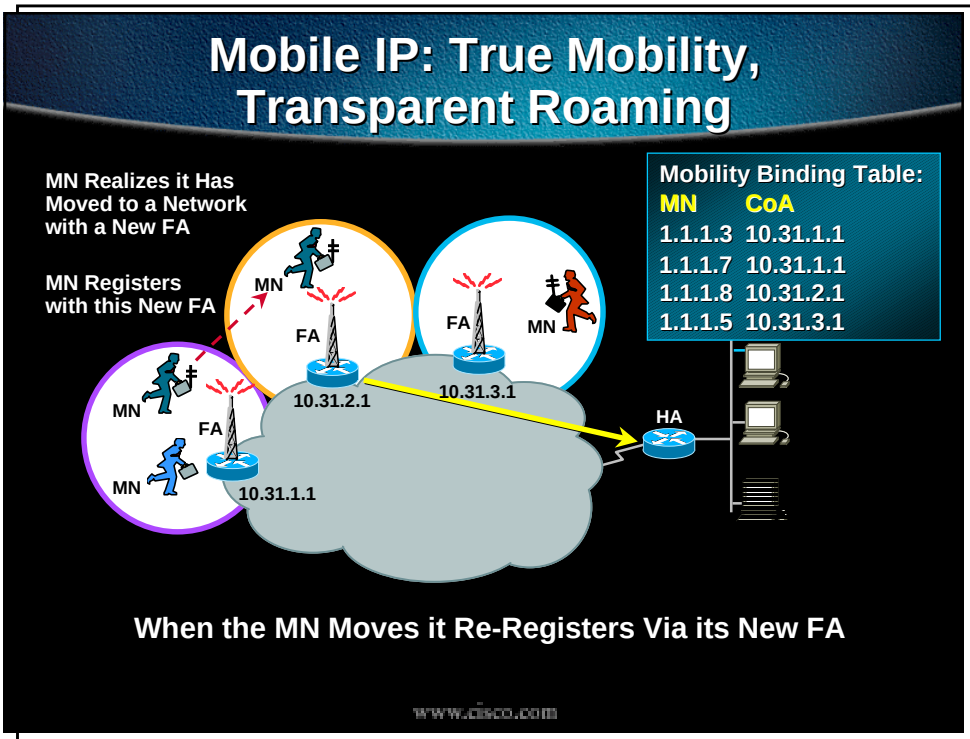
Mobile IP: True Mobility, Transparent Roaming



When the MN Moves it Re-Registers Via its New FA

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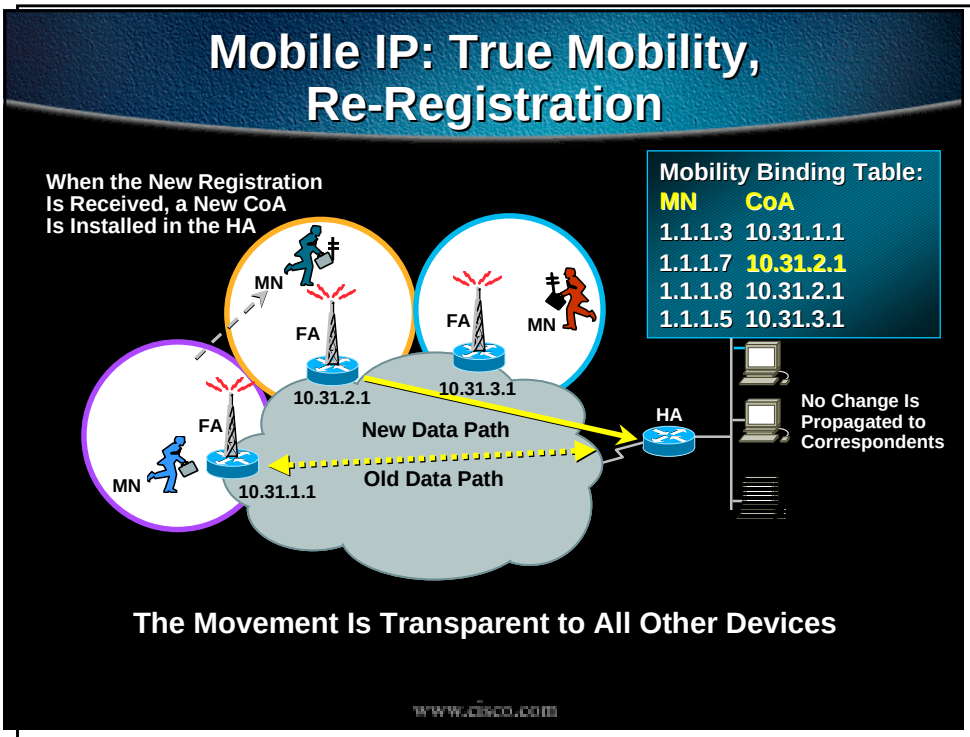
Mobile IP: True Mobility, Re-Registration



The Movement Is Transparent to All Other Devices

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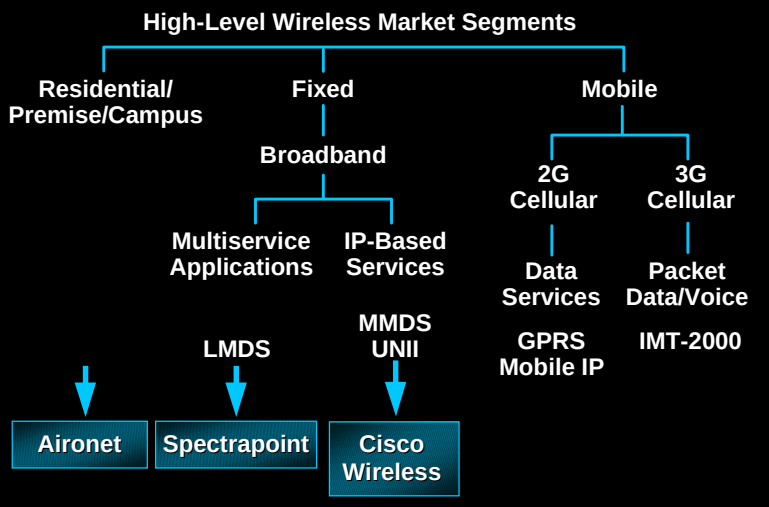
Roadmap for the Marketplace



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Motorola and Cisco

A Strategic Alliance to Deliver Global Wireless Solutions Based on a Packet and IP-Services Architecture

MOTOROLA

CISCO SYSTEMS

www.cisco.com

Motorola and Cisco Alliance

- Wireless architecture
  - Packet-based supporting IP services
  - Open and standards—based
  - Services enabling
  - Common services globally, wireless and wireline
- Strategic alliance
  - Collaborative product development
  - End-to-end, go-to-market delivery including sales and marketing
  - Centers of excellence
  - System integration capabilities to support customer deployment

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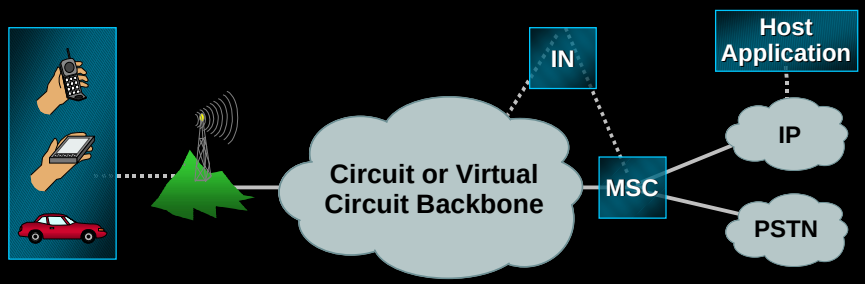
Existing Architecture

- Hierarchical
- Switch and IN-services bottlenecks
- Bandwidth inefficiency and recurring costs
- Services are specific to equipment supplier
- Access and transport oriented



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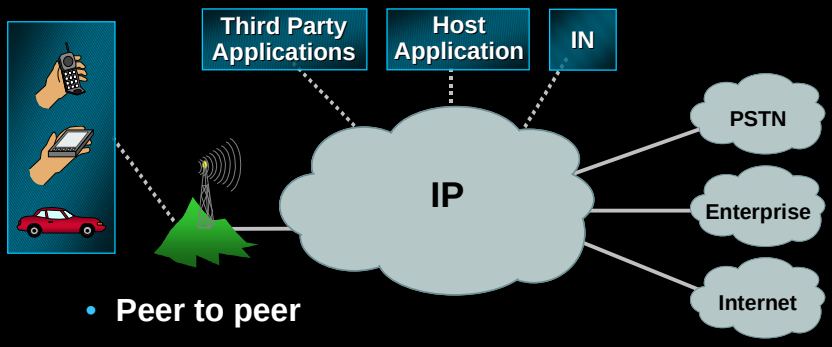
IP Architecture



- Peer to peer
- Service and transport independence
- Services ecosystem (e.g., ISVs, in-house…)
- Bandwidth efficient
- Greater addressable market

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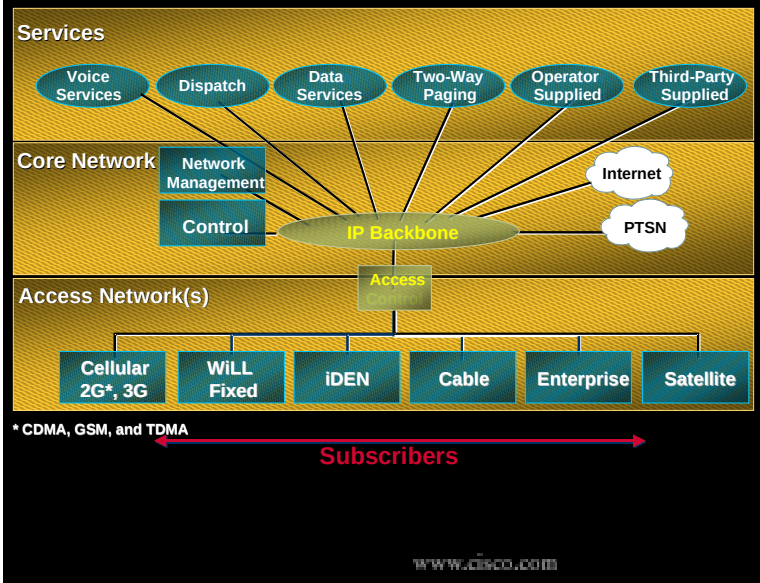
IP Unifies Wireless Architecture



Services
- Subscriber management
- Subscriber services
- Authentication

Core Network
- Session establishment
- Service request processing
- Network resource mgmt.
- Network features
- Gateway to circuit world
- Billing information

Access Network(s)
- Subscriber access to the core network
- Radio link integrity
- Intra and inter-RAN mobility
- Resource management
- Network mgmt interface
- Service request procedures
- Location status procedures

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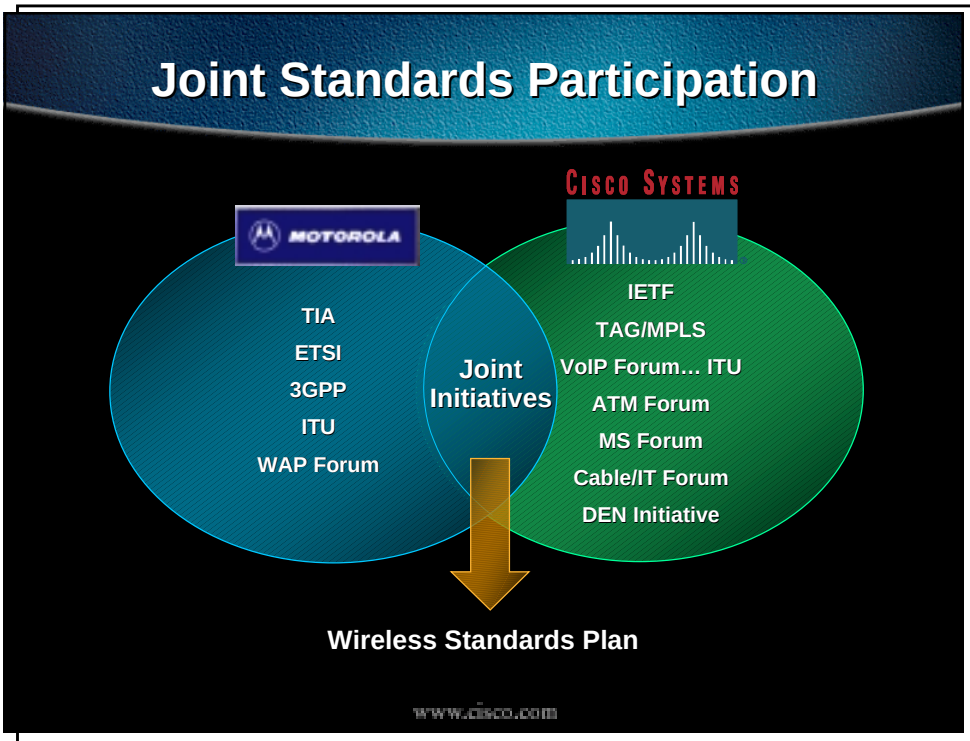

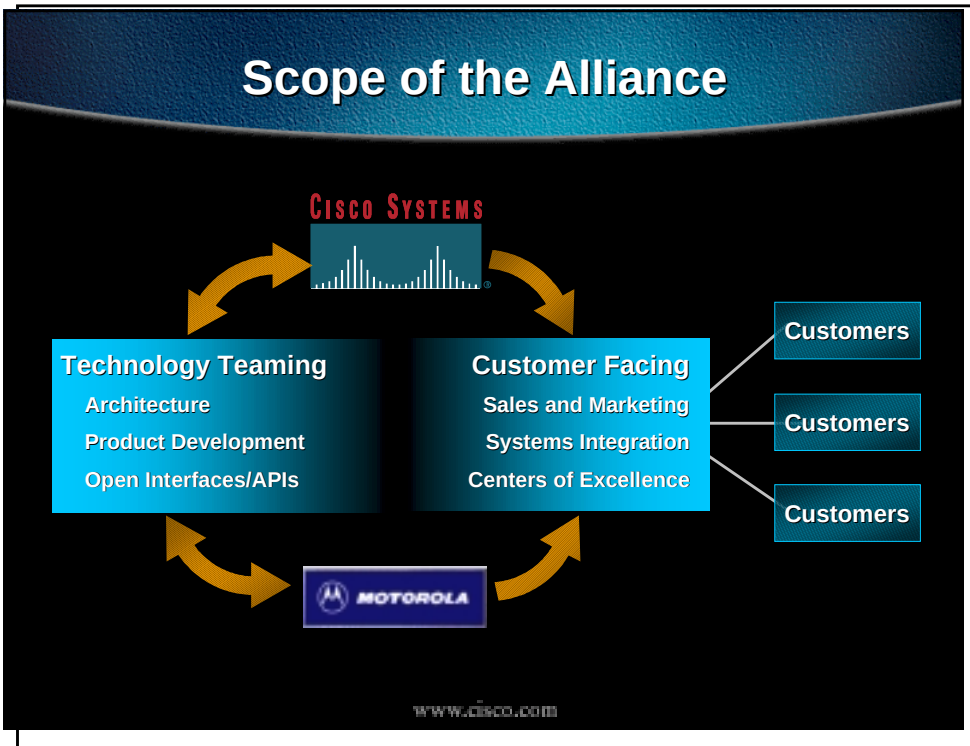

Motorola/Cisco Partnership

Cisco Contribution	Motorola Contribution
• TCIP/WAN Switching Customers (wireline/less) Voice switching and control systems, VoIP/signaling gateways,call processing software Packet network design Reliable execution Certain applications	• Cellular, RF, handsets, IC Technology • Customers (wireless) • Systems integration and project management • Handset applications • Consumer manufacturing/ design capabilites • Certain applications

Joint Contribution

Systems Integration Joint Venture(Mobile)
Spectrapoint Entity (Joint Venture LMDS)
Project Finance

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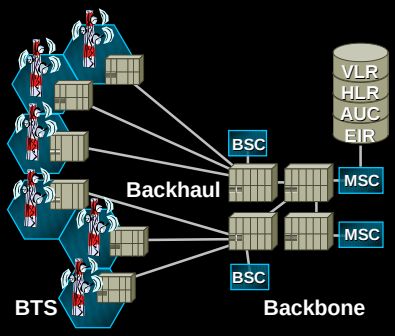
Cellular Network Transition

Cisco Brings Low-Cost Infrastructure Migration to the Circuit-Based Wireless Network with Services Enhancement

Today's Wireless Voice Network



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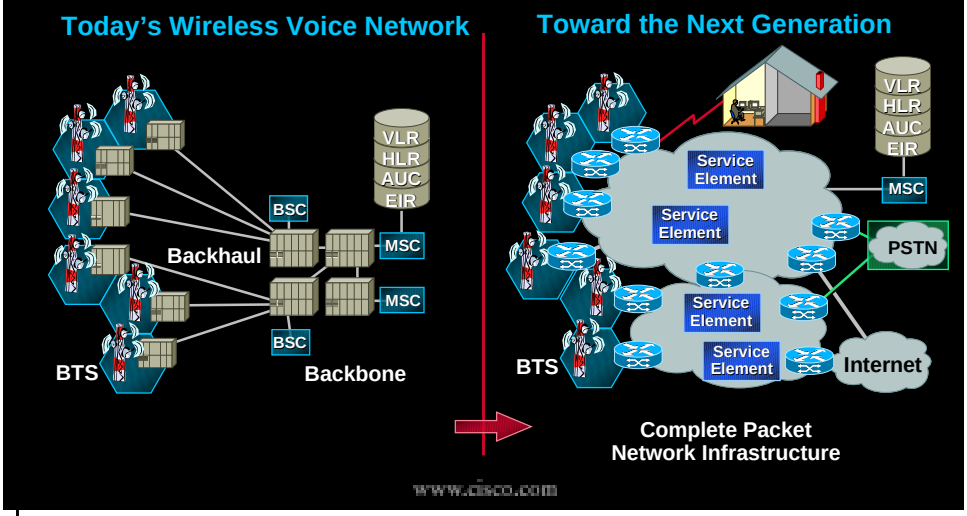
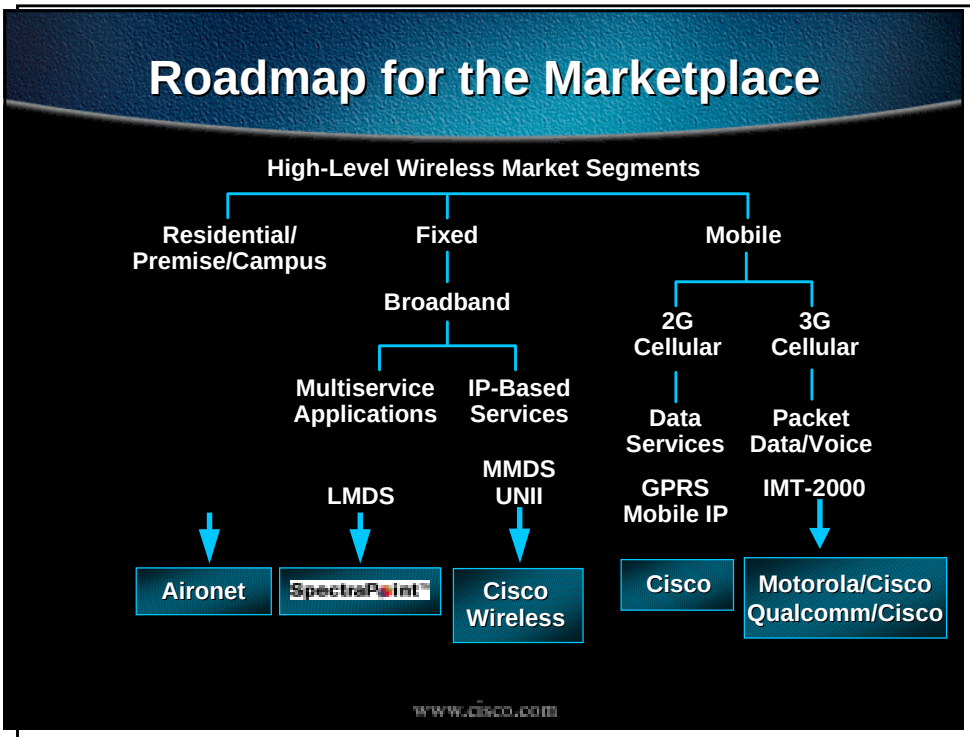


Roadmap for the Marketplace



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Questions?