Key Technology Enablers

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Financial Analyst Meeting
Mobility Solutions Demo Day

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Mobility Solutions

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Outline

- **Operators: Challenging road to profitability**
  - **Mobile High Speed Data is the answer**

- **Making the Linkage to Profitable Services: Key enabling technologies**
  - **Network Integration – "A Network of Networks"**
    - "End - to - End" packet networks and services
  - **Advanced base stations**
  - **Intelligent Antennas**
  - **Self-Optimizing wireless networks**

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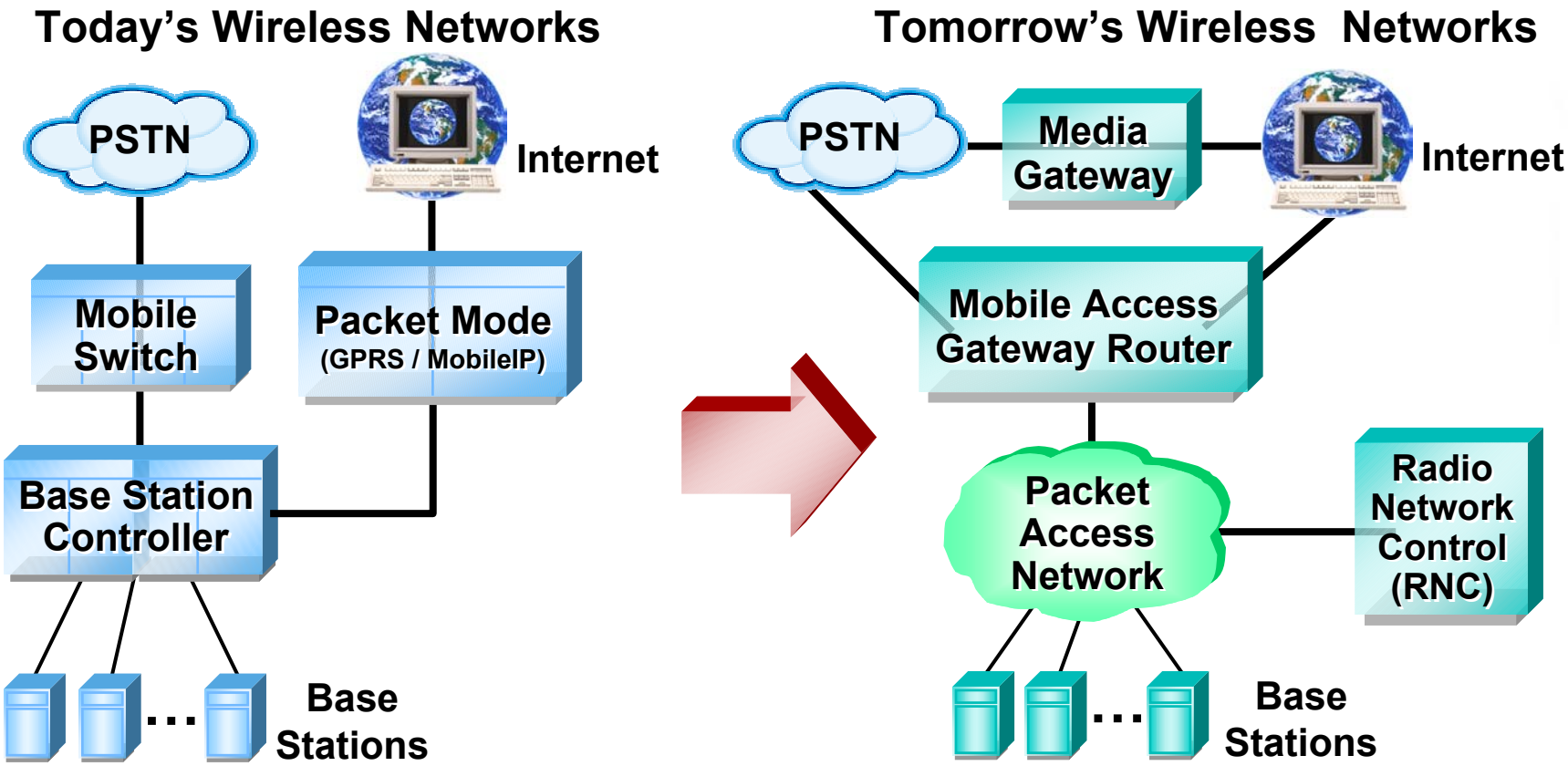
Key Enabling Technology: Packet Core Networks



Evolve to Provide "End-to-end" Network and Services

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Packet Core Network Evolution Benefits

Goal: migrate wireless mobile access networks to IP

- **Investment protection as networks evolve from circuit to packet**
- **Support the anticipated explosive growth of the wireless Internet**
  - merging of services for ***wireline and wireless*** networks
  - merging of wireless ***voice and data*** networks
  - merging of wireless ***indoor and outdoor*** networks
- **Reduced product and operational costs of IP infrastructure**
  - increased efficiency of packet-based networks for combining voice and data

Enable new revenue sources with high performance and ubiquitous access

"voice, video, data all on one connection"

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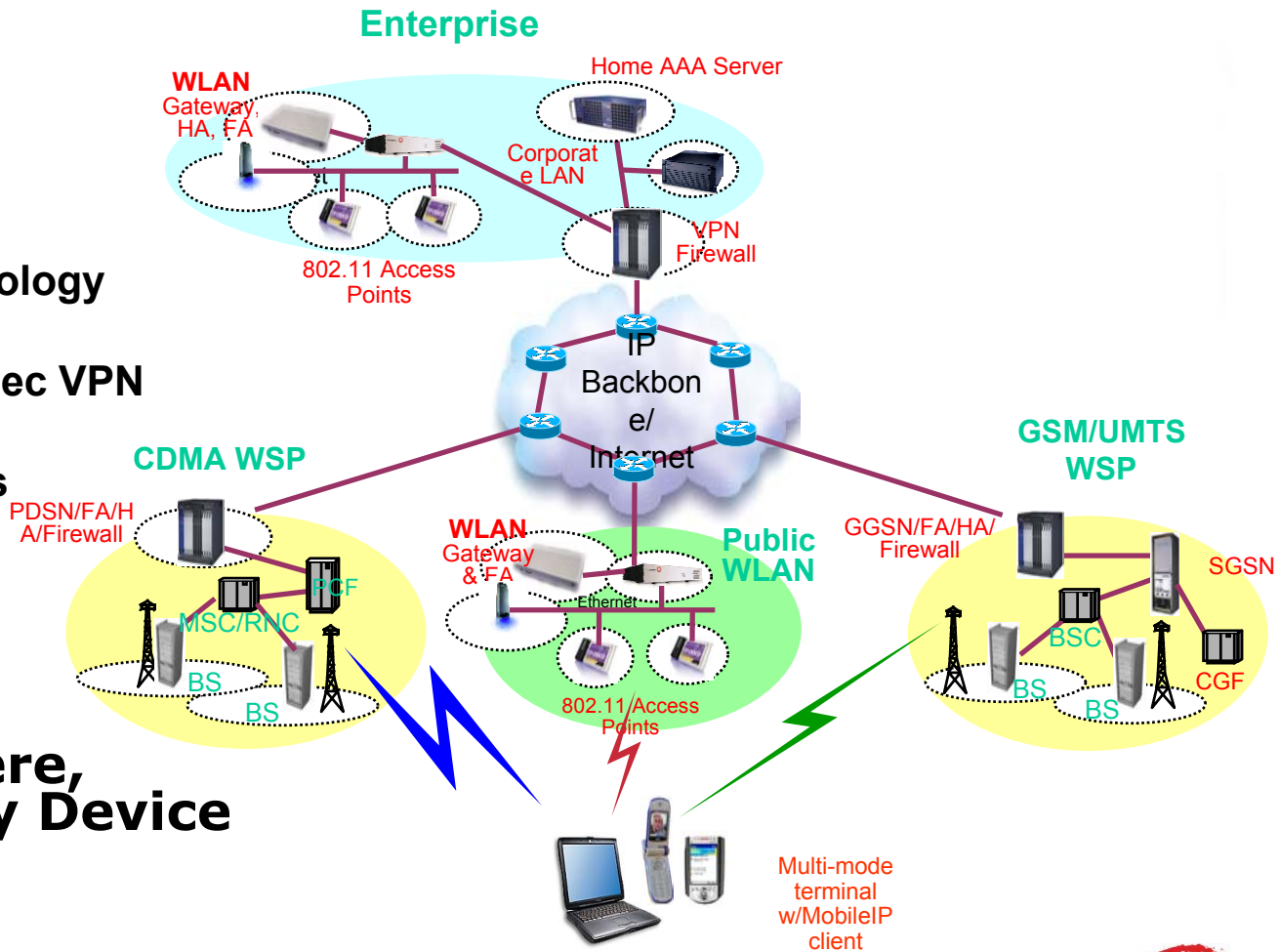
Key Enabling Technology: "A Network of Networks"

Seamless CDMA2000, GSM/GPRS/UMTS, and WiFi services

- SDHLR for inter-technology subscriber care
- Secure end-to-end IPSec VPN
- Terminals cards and client SW partnerships for inter-technology mobility
- Fast provisioning for end-users in all technologies
- **Access Anywhere, Anytime on Any Device**



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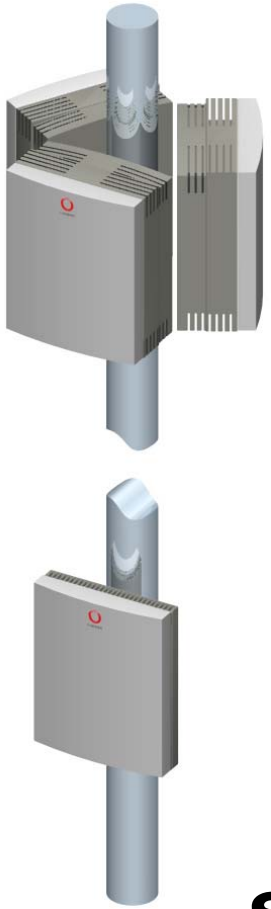
Key Enabling Technology: Advanced BaseStations



Next Generation Base Station

- Extreme Integration through the use of ultra-high density ASICs
  - Very high channel densities, reduce cost and improve performance
  - Integration of multiple technologies
  - ASICs at every level, channelization, RF
- Wideband Radios
- High Efficiency Amplifiers

Shrinking cell footprint...
The Capacity of a Macrocell in a Picocell Box

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Key Enabling Technology: Intelligent Antennas

- **Despite improvements in 3G systems over 2G, there is a predicted need for more capacity than will be supported by conventional antenna and processing configurations.**
- **Intelligent Antenna (IA) technology provides a means to use multiple antennas and extensive signal processing to achieve significant improvements in channel performance and interference reduction**
  - ***The result is increased capacity (higher data rates)***
  - ***Lucent's approach is based on a combination of architecture/cost balances and performance tradeoffs***

Intelligent Antenna technology significantly improves cell capacity and channel quality

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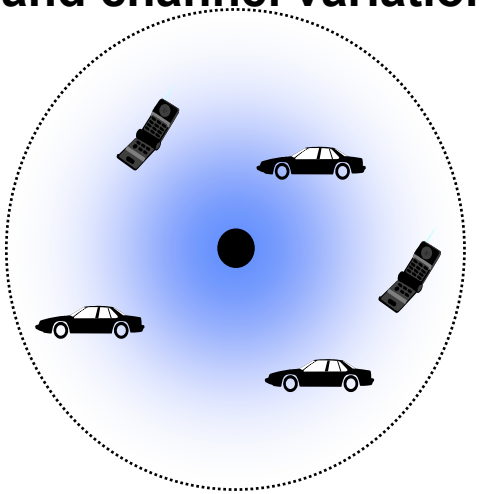
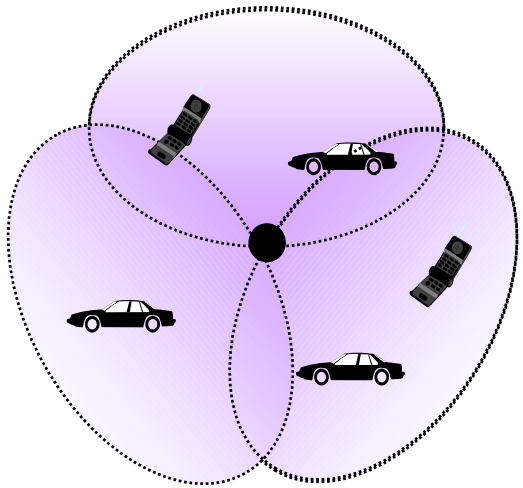
Intelligent Antennas – Spatial Domain Processing

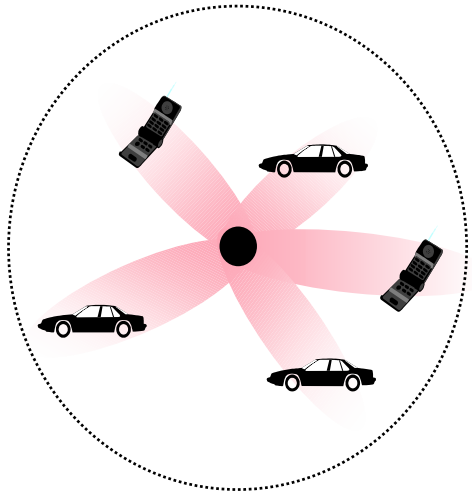
- **A multiple antenna element system**
- **Combined with a base station architecture and signal processing techniques designed to dynamically form an "optimum" beam pattern for each user**
- **Per-user beam pattern updated in real-time to track user movement and channel variation**



Omni-directional Cell Site



Three Sector Cell Site



Intelligent Antenna Cell Site

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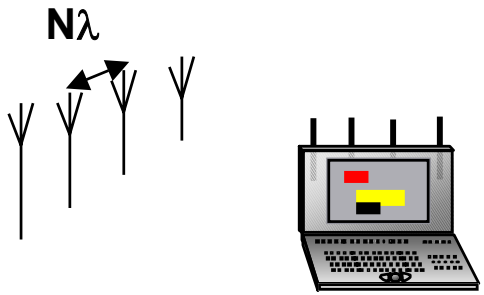
BLAST: Bell-Labs Layered - Space-Time

- Antenna elements are configured for four-branch diversity.
- Spatial characteristics of the radio link provides additional degree of freedom. Exploit to achieve higher peak data rates.
- Data is de-multiplexed so that different data streams appear at each antenna.
- Data rate increases linearly with number of antennas – 4 antennas lead to another factor of 2 increase over Intelligent Antenna solution
- Signal Processing is confined to channel-element ASIC



BLAST has been introduced into the Standards bodies as an efficient way to handle high-speed data

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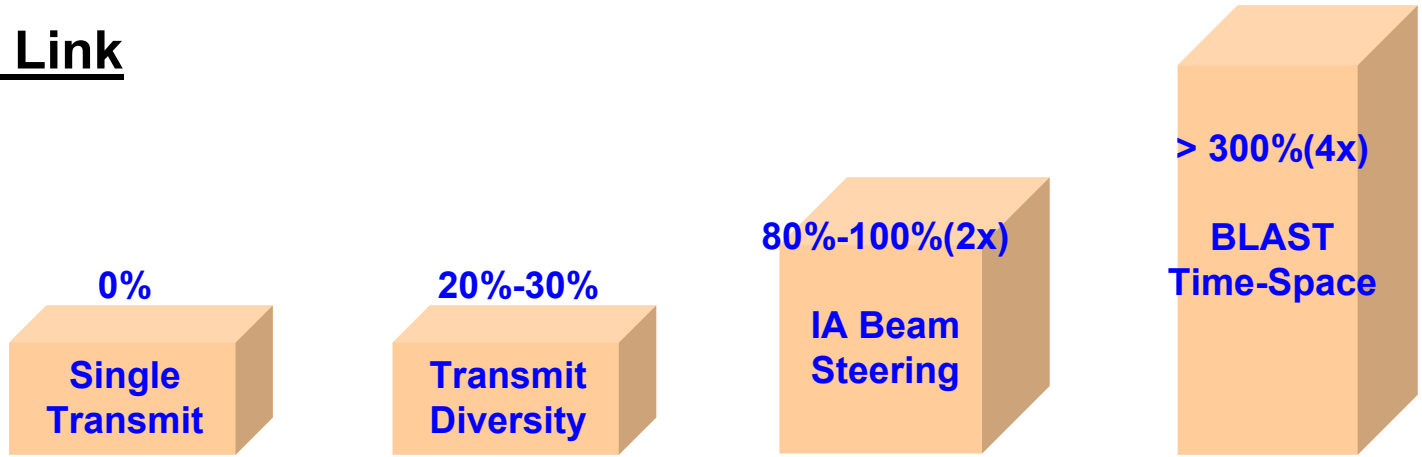
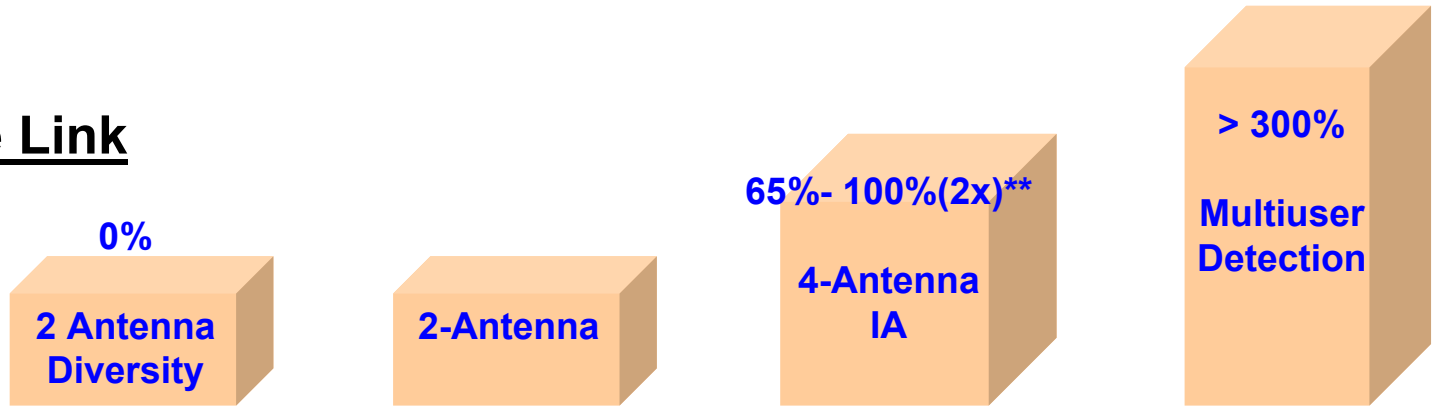
Intelligent Antenna / BLAST Evolution Summary

Forward Link



Reverse Link



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Key Enabling Technology: Self-Optimizing Wireless Networks

- **Deployment - Deploy network quickly in a nearly optimized state - eliminate costly drive testing**
- **In-Service - Optimize operating networks to increase performance of existing infrastructure investment**
- **Dynamic - Network adapts to changing conditions, such as data traffic, loading, outages, growth-continuous optimization based on service measurement data.**

Benefits:

- **Reduce deployment and operation costs**
- **Improve network performance (capacity, coverage, and reliability)**
- **Adapt to changing network conditions**

Optimization Powered by Ocelot™ Software

Used with success by Lucent Worldwide Services in many field trials and deployments

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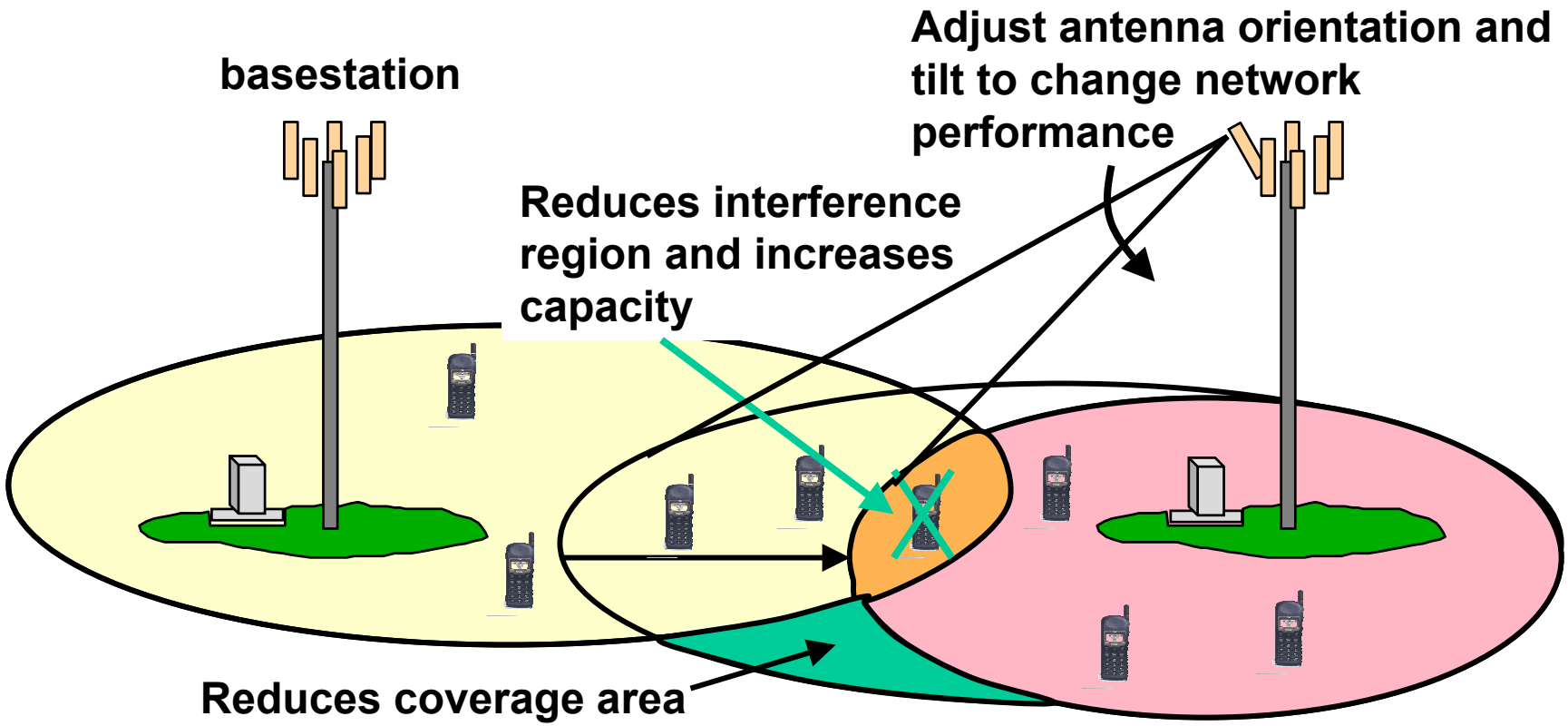
Cellular Network Optimization



- The performance of a wireless network depends critically on the antenna orientation, tilt, transmit power, hand-off parameters, etc. to minimize interference.
- The network performance can be optimized for coverage and/or capacity by matching the antenna configuration to traffic density.

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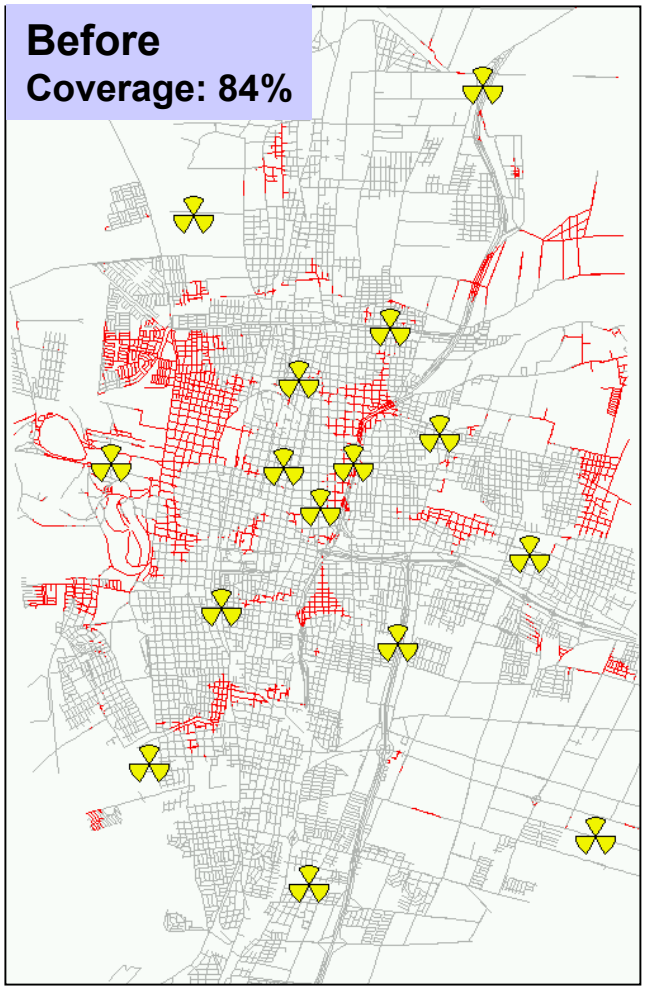
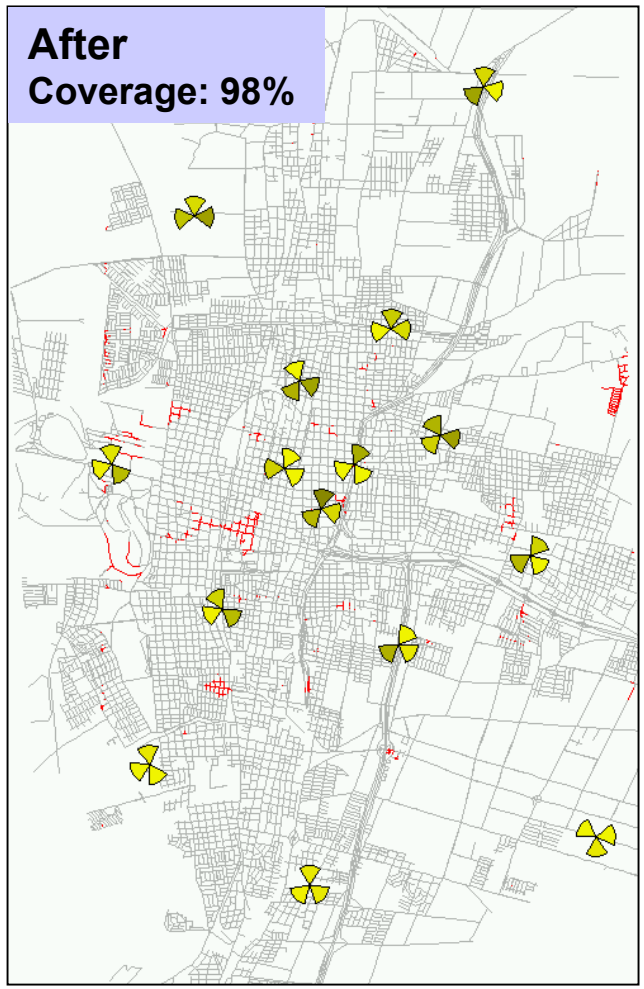
Improved Coverage





Uncovered Areas.
Covered Areas.

Sectors colors: Tilt

0^0 7^0

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Conclusions

- **Pent-up demand for High Speed wireless data in the enterprise space**
  - **Enabling new business segments and eventually new consumer segments**
  - **Success requires low “end-to-end” network costs, lower cost/bit and therefore key technology enablers**
- **Making the linkage to these services requires continued technology evolution providing higher capacity and data rates at lower cost/bit**
  - **Packet Core networks, WLAN integration, High density low cost infrastructure, Intelligent Antennas/MIMO, Network Self - Optimization**

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