41% employee-owned devices used to access business applications — Forrester

40% of college students/young employees prefer a lower-paying job that has more flexibility — CCWTR

56% Of US information workers spend time working outside the office — Forrester

100% of IT staff is struggling to keep up with mobility trends — Gartner
Mobility Changes Everything!

- **7.7 billion** Wi-Fi (a/b/g/n) enabled devices will enter the market in the next five years.*

- By 2015 there will be **7.4 billion** 802.11n devices in the market.*

- **1.2 billion** smartphones will enter the market over the next five years, taking over the handheld market.

- Smartphone adoption growing **50%+ annually.**

- Currently **16%** of mobile data is diverted to Wi-Fi, by 2015 this number will increase to **48%**.*

- In 2012, more than **50%** of mobile devices will ship without wired ports.***

---

*Source: *ABI Research, **IDC, *** Morgan Stanley Market
Mobility Changes Everything!
It changes how we connect and where/how we work…

Simple | Secure | Scalable

ANYONE | ANY DEVICE
ANYWHERE | ANYTIME
IT Challenges to Mobile Freedom

Securing Any Access

Managing Complexity And Scale

Delivering High-Quality Experience
BYOD and beyond....
Uncompromised Experience for Any Workspace

Device Onboarding and Guest Access  Unified Policy  Uncompromised Experience  Simplified Operations

BYOD  Beyond BYOD
Huge Demand on Wireless Network

THE NETWORK
Access Preference Shift
• From Wired to Wireless
• Expect the Same Performance

THE DEVICE
Proliferation of Devices
• More Devices Per Person
• More Types of Devices

THE APPLICATION
Mobile Apps. Have Changed
• Profiles Changed
• Usage Changed
• Media Rich
  
HIGH-BANDWIDTH
LATENCY-SENSITIVE
INCREASED UPLINK & DOWNLINK DEMAND
MOVING TO CLOUD

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Cisco Mobility Architectures
Choice and Flexibility for IT

Cisco Prime-Network Control System

- Centralized Control Plane
- Centralized Data Plan
- Centralized Policy
- Central RF Management
- Central Config Management

- Central Image Management
- Centralized IDS Management
- Guest Tunneling
- Survivability

- Higher AP Scalability
- Survivability
- Client Resiliency

Cloud Controller (Flex Mode)

- Flexible Control Plane
- Distributed Data Plane
- Distributed Policy

WLAN Controller

- Distributed Control Plane
- Distributed Data Plane
- Independent Operation

Autonomous Access Point

- CAPWAP Plug & Play Access Points

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Cisco’s Unified Access Portfolio
Control and Visibility for IT / Device Choice and Predictability for Users

Mobility Services Engine
- Physical or Virtual
  - 3310 & 3355

Wireless LAN Controllers
- Branch Controller
  - 2500 Series
- Campus Controllers
  - 5500 Series
- Cloud Controller
  - Flex 7500

Access Points
- Indoor
  - 1040 Series
  - 1140 Series
  - 1260 Series
  - 35/3600e Series
- Teleworker
  - 600 Series
- Outdoor
  - 1550 Series
- Density
  - 3500p Series

Access Switches
- Compact
  - 2960-S
- 3750-X/3560-X
- 4500E

Identity and Policy Data Integration
- NCS (Physical or Virtual)
- ISE (Physical or Virtual)

Distribution Switches
- 6500 Series

Control and Visibility for IT / Device Choice and Predictability for Users
- Mobility Services Engine
- Wireless LAN Controllers
- Access Points
- Access Switches
- Identity and Policy Data Integration
- Distribution Switches
Do you agree …
Work from any Device, Anywhere, in the Cloud

“Any Device” can access the data
Content & Apps follow the user

Client choice is enabled
Real Time Collaboration

Be productive from anywhere

Security Policy
The network is the platform
Cisco's CleanAir Technology
Industry’s first chip level proactive and automatic interference protection

BEFORE
Wireless interference decreases reliability and performance

AFTER
CleanAir mitigates RF interference improving reliability and performance

Cisco CleanAir – Improves Performance and Predictability
Why is Cisco’s CleanAir Technology so Unique?
High resolution interference detection, classification, and mitigation at chip level

- CleanAir Radio ASIC (Silicon Based)
- Detect Wi-Fi and non-Wi-Fi interference sources (SI)
- Assess impact to Wi-Fi performance
- Proactively change channels when interference occurs
- Monitor air quality

Detect | Classify | Locate | Mitigate
Radio Management with CleanAir

**Channels 11, 6 and 1** are optimized for maximum performance and minimum interference.
Radio Management with CleanAir

Wireless LAN Controller

Channels 11, 6, and 6. Channel 6 Air Quality is affected by performance and the list of preferred channels to resolve conflict...

PERFORMANCE

AIR QUALITY

Scanning available channels...

RRM
Radio Management with CleanAir

Wireless LAN Controller

Conflict resolved. Information is being relayed to RRM.

Changing to Channel 11
Cisco's ClientLink / ClientLink 2.0 Technology
Advanced beam forming technology improves wireless client performance

**BEFORE**
Beam not directed towards clients resulting inconsistent performance from MultiPath (SS)

- 802.11a/g (ClientLink) or 802.11a/g/n (ClientLink 2.0)

**AFTER**
Beam directed towards client resulting in consistent experience and better performance

- 802.11a/g (ClientLink) or 802.11a/g/n (ClientLink 2.0)

Cisco ClientLink - Improves Predictability and Performance
ClientLink 2.0 Battery Life Improvement Test

- 30ft Distance from Access Point to Motorola Xoom
- Download a file via FTP till complete and observe battery drop.
Battery Life Improvement Results

- 38% Better Than CompetitorX

- 100% Battery Drain Test (Total Data DL’d)
  - Cisco = 73.33GB
  - Competitor X = 45.83GB

<table>
<thead>
<tr>
<th></th>
<th>Start Battery</th>
<th>End Battery</th>
<th>Total Battery Drop</th>
<th>Download Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco 3600e</td>
<td>75%</td>
<td>60%</td>
<td>15%</td>
<td>56 min</td>
</tr>
<tr>
<td>Competitor X</td>
<td>75%</td>
<td>51%</td>
<td>24%</td>
<td>70 min</td>
</tr>
</tbody>
</table>
With a MacBook Pro (2010), three spatial stream client performance is an average of **24% better** with Cisco 3600 AP.
Cisco BandSelect Technology
Automatic band steering and selection for 5GHz capable devices

BEFORE
All clients crowd the 2.4GHz spectrum lowering performance

AFTER
5GHz capable clients are automatically moved to cleaner 5GHz spectrum

Wireless Client Performance

Cisco BandSelect - Improves Predictability and Performance
Cisco’s Radio Resource Management
Simplify IT operations with automatic / dynamic RF management

BEFORE
Manual RF management

- Manual Channel Assignment
- Manual Transmit Power Adjustment
- Manual Coverage Hole Detection/Mitigation

AFTER
Dynamic RF management

- Dynamic Channel Assignment
- Dynamic Transmit Power Adjustment
- Dynamic Coverage Hole Detection/Mitigation

Cisco RRM- Improves Predictability and Performance
Cisco VideoStream Technology
Wired-like video delivery over wireless

BEFORE
No resource reservation, degraded voice and video, cannot deliver multicast

AFTER
Stream prioritization, resource reservation, reliable multicast over wireless

Global Enterprise

CEO Meeting | M&A Negotiation | Sports Event

CEO Meeting | M&A Negotiation | Sports Event

Cisco VideoStream – Improves Predictability and Performance
Why Is Cisco’s VideoStream so Unique?
We optimize end-to-end starting at the Access Point

Multicast to Unicast Conversion at the AP

Selectable Stream Prioritization

Resource Reservation Prevents Oversubscription

Multicast Stream

UNICAST STREAMS

AP

TESTED FOR 30X LESS BANDWIDTH CONSUMED AND DOUBLE THE PERFORMANCE OF COMPETITORS

High Priority Event
Meeting Room Event
Live Sporting Event

WLC  AP

Miercom

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Cisco AnyConnect Technology
Industry’s first context-based and persistent VPN Connectivity

BEFORE
Unmanaged devices
- risk of data loss and lack of access

AFTER
Always-on VPN connectivity

Mobile Worker

- Acceptable Use / Access Control
- Reliable User Experience
- Data Loss Prevention

Cisco AnyConnect = Always On VPN Connectivity
Cisco's Unified Policy Management / Guest Access

Industry’s first context-based Wired+Wireless+VPN policy/guest management

BEFORE
Separate policy and guest management

AFTER
Unified context-based policy management for employees and guests across the network

Wired | VPN | Wireless

AAA + PP = Secure BYOD
Simple | Unified | Automated

Cisco ISE – Provides Unparalleled Control

Identity Services Engine (ISE)

User Authentication

Network helps Identify Device

Corporate Resources

Policy Decision

Enforce Policy in the Network

Internet Only

Full or Partial Access Granted

HTTP
NetFlow
SNMP
DNS
RADIUS
DHCP
NMAP

Identity

User Authentication

Company Asset

Personal Asset

Profile/Posture of the Device

Unified Access Management

Cisco Identity Services Engine (ISE)

Network helps Identify Device

Corporate Resources

Policy Decision

Enforce Policy in the Network

Internet Only

Full or Partial Access Granted

HTTP
NetFlow
SNMP
DNS
RADIUS
DHCP
NMAP

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Native Supplicant Provisioning

Supported Endpoints

- Supplicant Provisioning on all major platforms:
  - Windows – XP, Vista & 7
  - MAC – OS X 10.6 & 10.7
  - iOS – iPhone 3G, 3GS, 4 and 4S, iPad
  - Android – 2.2 and greater
- Common 802.1X profile on all platforms or/and platform specific, profile push (screen lock password, camera, app install)
Cisco’s Unified Policy Management (Prime)
Single Pane of Glass View and Management of Wired+Wired+Identity

BEFORE
Separate Management Systems

Wireless

Wired

Identity

Siloed Inefficient Operational Model
Repetitive Manual correlation of data
Error Prone Consumes time and resources

AFTER
Comprehensive user and access visibility with advanced troubleshooting

Wireless
Wired
Identity

Simple Improves IT efficiency
Unified Single view of all user access data
Advanced Troubleshooting Less time and resources consumed

Cisco Prime NCS–Provides Unparalleled Visibility
Prime - Monitoring and Troubleshooting

Centralized Monitoring of the entire WLAN and LAN

Device Tracking and monitoring
Identify and diagnose RF Interference events, air quality and interference security threats with Cisco CleanAir

Robust fault event and alarm management

Guided step-by-step client troubleshooting tools

Ever-present search for cross network historical information

Cisco ISE and ACS views for additional endpoint data

- Efficiently assess, prioritize and manage RF interference issues
- Analyze problems and misconfigurations for all client devices across all connection media
- Troubleshoot large-scale LAN and WLAN environments with minimal IT staffing
- Quickly discover events occurring outside baseline parameters
Why Cisco?
# Cisco Mobility – Best-of-Breed and Best-in-Class

## Best-of-Breed and Best-in-Class Mobility Predictability

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CleanAir</td>
<td>Chip level proactive and automatic interference mitigation</td>
</tr>
<tr>
<td>ClientLink</td>
<td>Chip level proactive and automatic electronic beamforming</td>
</tr>
<tr>
<td>Radio Resource</td>
<td>Simplified advanced RF management</td>
</tr>
<tr>
<td>Management</td>
<td>Proactive and automatic band steering for 5GHz capable clients</td>
</tr>
<tr>
<td>BandSelect</td>
<td>Chip level wired multicast over a Wireless network</td>
</tr>
<tr>
<td>VideoStream</td>
<td>Persistent context-aware VPN connectivity</td>
</tr>
</tbody>
</table>

## Best-of-Breed and Best-in-Class Policy and Network Management

- **ISE (Control)**
  - Who?
  - What?
  - How?
  - When?
  - Where?

- **NCS (Visibility)**
  - Who?
  - What?
  - How?
  - When?
  - Where?
Cisco Mobility Market Leadership

Mobility / WLAN market credentials

- 10+ years of market share leadership
- $1.5+ Billion fast growth business
- 300,000+ enterprise customers
- Largest patent portfolio in the industry
- Largest IEEE involvement in the industry
- FIPS, Common Criteria, PCI certified
- 96% Fortune 1000 selected Cisco WLAN

Source: Gartner (June 2012)
Cisco Mobility Innovation Leadership
Led Every Major Change in Mobility/WLAN for 15+ Years

- 1997
  - Autonomously Access Points
  - Controller and Coordinated Access Points
  - 1 and 2 802.11n Spatial Streams with Spectrum Intelligence
  - Unified Policy and Network Management

- 2013
  - Virtual Controller & Hotspot 2.0
  - 3SS 802.11n, BYOD, & IPv6
  - 802.11ac Wi-Fi Requirements
  - Gigabit Wi-Fi

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Cisco Public 33
802.11ac – The next Step in Wi-Fi

Next gen multi-gigabit Wi-Fi – spec’d up to 6.9 Gbps
AP3600 – Investment Protection
802.11ac Wave 1 Module

• A field-upgradable 802.11ac module add-on to the AP3600

• 802.11ac Wave 1 – 5 GHz AP3600 Module
  5 GHz radio module
  Supporting 802.11a and n clients along with ac clients
  1.3 Gbps PHY / ~1 Gbps MAC (throughput)
  3 Spatial Streams, 80 MHz, 256 QAM
  Explicit Beamformingsupport as per the 802.11ac standard

• AP3600 maintains dual-band support 2.4 and 5 GHz
  Supporting b/g/n on 2.4 GHz and a/ac/n on 5 GHz

• Power requirement with the 802.11ac Module installed
  Power draw with 802.11ac Module exceeds 15.4 Watts (802.3af), and will require either:
    Enhanced PoE, 802.3at PoE+, Local Supply or Power Injector 4
Cisco Compatible Extensions (CCX) Leadership

- Over 90% of the Mobility / WLAN industry silicon is CCX compatible
- Over seventy-five (75) Partners license CCX in the CDN Program
- Over 350 Devices & Tags are CCX Certified (“Cisco Compatible”)
- Over 730 Companies in the CDN Program across Cisco CDO
Only Cisco Can Bring it All Together

Unified Access
Wireless and wired policy and management
Identity-based access control

Security/Policy
Data loss and threat prevention
Context aware access to data

Experience
Uncompromised video, voice in any deployment mode
Consistent, portable across platforms

Management
Single system for wired / wireless / VPN
Provisioning and Mobile Device Management

Applications
Native or virtual application delivery
Collaborative and corporate applications
Thank you.
Cisco BYOD
Comprehensive View


- EMPLOYEE
  - At work
- CONTRACTOR
  - At home
- GUEST
  - On the road
- VM Client

What? Tools, Content, Data

Cloud/SaaS
DC/VDI
Storage
Websites
Web Apps
Services
Social

Context Aware Enforcement
Dynamic Policy
Integrated
Manage & Deploy
Cloud
Context Aware Enforcement

Intelligent Network

Secure, Personalized, and Contextual Service Experience
Seamless - Fast - Reliable

- Corp Owned
- Personal

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WebEx & Jabber
One Network

COLLABORATE ANYWHERE
With presence, IM, Voice, Video, Web conferencing over wired and wireless networks

ANY PLATFORM
New support for mobile device platforms: Windows, Mac, iPad, iPhone, Android, Blackberry, Cius

WORK FLEXIBLY
Enable flexible work use cases: mobile collaboration as good as from your desk, improve productivity and customer service

INTEGRATED SECURITY
Secure collaboration with integrated AnyConnect Secure Mobility Solution
IEEE 802.11ac, the Next Generation Wi-Fi, is “Just Around the Corner”

<table>
<thead>
<tr>
<th>Use cases</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Similar to 802.11n</td>
<td>• Extension of 802.11n in 5GHz only</td>
</tr>
<tr>
<td>• Voice/video/data for consumer/enterprise</td>
<td>• Few cool, new features, eg MU-MIMO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Similar range to 802.11n</td>
<td>• First usable draft standard in early 2012</td>
</tr>
<tr>
<td>• Faster than 802.11n – realistically up to ~2.5Gb/s</td>
<td>• First wave of certification in early 2013</td>
</tr>
</tbody>
</table>
802.11ac compared with 802.11n

- The next generation of wireless building upon 802.11n, designed to provide better bandwidth and better coverage
- Focused on driving wireless data rates from 1Gbps, up to 6.9Gbps

<table>
<thead>
<tr>
<th>Feature</th>
<th>802.11n Standard</th>
<th>802.11ac Draft 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band supported</td>
<td>2.4 GHz and 5 GHz</td>
<td>5 GHz only</td>
</tr>
<tr>
<td>PHY Rate Band</td>
<td>65 Mbps - 600&lt;sup&gt;a&lt;/sup&gt; Mbps</td>
<td>290 Mbps - 6.9&lt;sup&gt;a&lt;/sup&gt;Gbps</td>
</tr>
<tr>
<td>MAC Throughput&lt;sup&gt;*&lt;/sup&gt;</td>
<td>45* Mbps - 420*Mbps</td>
<td>194* Mbps - 4.8*Gbps</td>
</tr>
<tr>
<td>MAC Throughput&lt;sup&gt;<em>&lt;/sup&gt;</em></td>
<td>4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td># of Spatial Streams</td>
<td>4&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Modulation</td>
<td>64 QAM</td>
<td>256 QAM</td>
</tr>
<tr>
<td>Channel Width</td>
<td>20, 40MHz</td>
<td>20, 40, 80, 80+80,160 MHz</td>
</tr>
<tr>
<td>MIMO</td>
<td>Single User MIMO</td>
<td>Multi User MIMO</td>
</tr>
<tr>
<td>802.11 protocol support</td>
<td>b,g,n and a,n</td>
<td>a, ac, n</td>
</tr>
</tbody>
</table>

<sup>*</sup>: MAC throughput calculated @ 70% the defined PHY capability
<sup>a</sup>: Theoretical Maximum as per the respective standards/specifications

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802.11ac: First 2 Waves

- The 802.11ac standard will come to market in 2 phases “Waves”
- Each Wave of 802.11ac will require new chip sets - and introduce new HW

<table>
<thead>
<tr>
<th>Feature</th>
<th>Wave 1 – 2013</th>
<th>Wave 2 – 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY Rate</td>
<td>290 Mbps - 1.3 Gbps</td>
<td>3.5 Gbps</td>
</tr>
<tr>
<td>MAC Throughput</td>
<td>194* Mbps - 910* Mbps</td>
<td>2.4* Gbps</td>
</tr>
<tr>
<td># of Spatial Streams</td>
<td>3(^b)</td>
<td>4(^b)</td>
</tr>
<tr>
<td>Modulation</td>
<td>256 QAM</td>
<td>256 QAM</td>
</tr>
<tr>
<td>Channel Width</td>
<td>20, 40, 80 MHz</td>
<td>20, 40, 80, 80+80,160 MHz</td>
</tr>
<tr>
<td>MIMO</td>
<td>Single User</td>
<td>Multi User</td>
</tr>
<tr>
<td>802.11 protocol support</td>
<td>a, n, ac</td>
<td>a, n, ac</td>
</tr>
</tbody>
</table>

\(^*\): MAC throughput calculated @ 70% the defined PHY capability
\(^b\): Commercial chipset dependent, subset of theoretical max defined in the standard
### 802.11ac Mainly Just Extends 802.11n Technology … and Adds MU-MIMO

<table>
<thead>
<tr>
<th>Feature</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 GHz only</td>
<td>Avoids interference-plagued 2.4 GHz</td>
</tr>
<tr>
<td>80MHz channels</td>
<td>Optional 160MHz and 80+80MHz</td>
</tr>
<tr>
<td>256QAM</td>
<td>802.11n has lower modulations</td>
</tr>
<tr>
<td>Up to 8 spatial streams</td>
<td>1 SS mandatory, 2 SS for non-battery APs at WFA</td>
</tr>
<tr>
<td>MU-MIMO</td>
<td>Cool new technology! MU = Multi-User</td>
</tr>
<tr>
<td>Beamforming</td>
<td>Single mechanism this time</td>
</tr>
<tr>
<td>RTS/CTS</td>
<td>Improvements for wider bandwidths</td>
</tr>
<tr>
<td>Better secondary CCA</td>
<td>Detects energy in secondary channel</td>
</tr>
<tr>
<td>Deletes stuff</td>
<td>“Dark corners of 802.11n left to die” 😊</td>
</tr>
</tbody>
</table>