Cisco Networkers 2011
May 19, Toronto, Canada

Knowledge Is Power.
Learn. Share. Collaborate.

Service Provider (SP) WiFi "3G Offload" solution overview

Presented by Malcolm Smith

Market Overview

Global Mobile Data Traffic Growth

Mobile Video Driving Traffic Explosion

There will be 5B mobile devices and 2B M2M nodes

Global mobile traffic will grow 26X to 6.3 EB/mo

Video will be 66% of all mobile traffic by 2015

Source: Cisco Visual Networking Index (VNI) Global Mobile Data Forecast, 2010–2015

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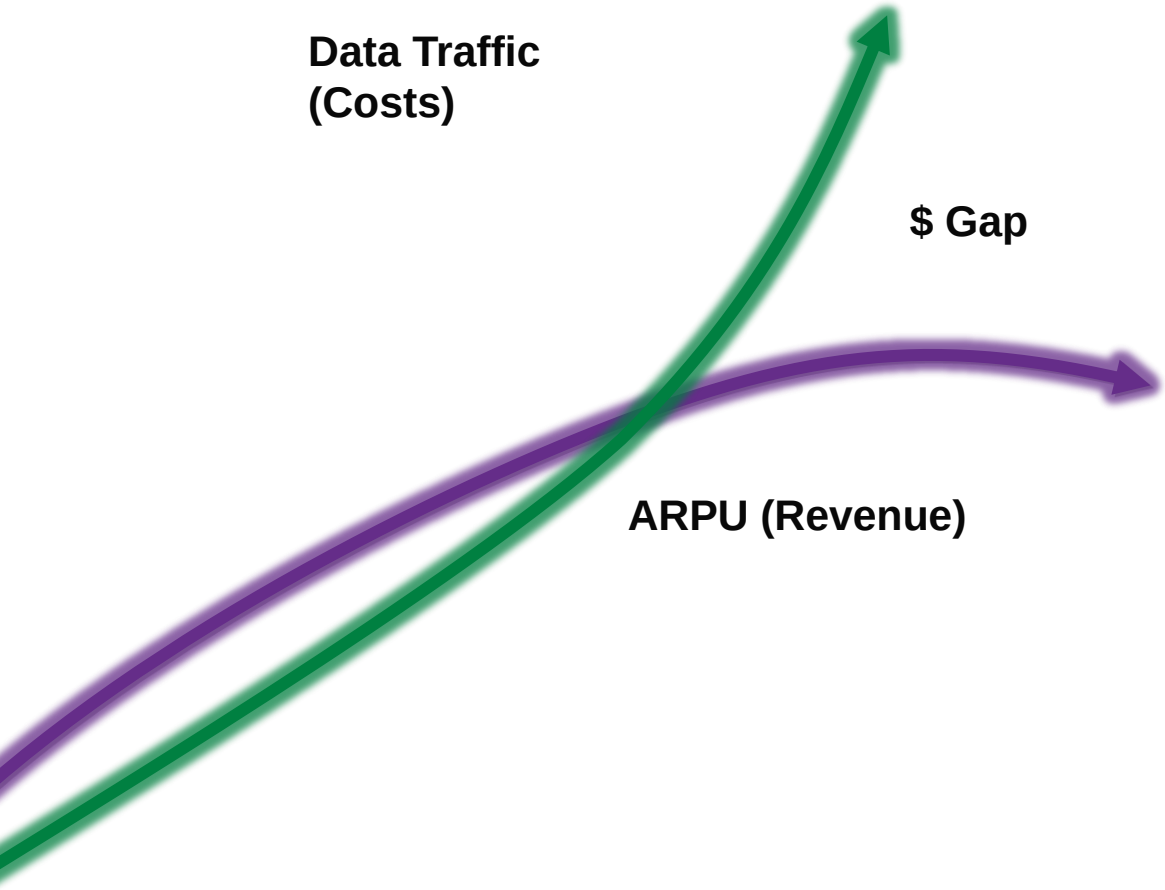
Service Provider Challenge



Increase Revenues

New business models

New services and partnerships

Reduce Costs

Manage "Over The Top"

Optimize use of expensive assets

Improve Experiences

Three-screen experience and sessions

Video quality experience

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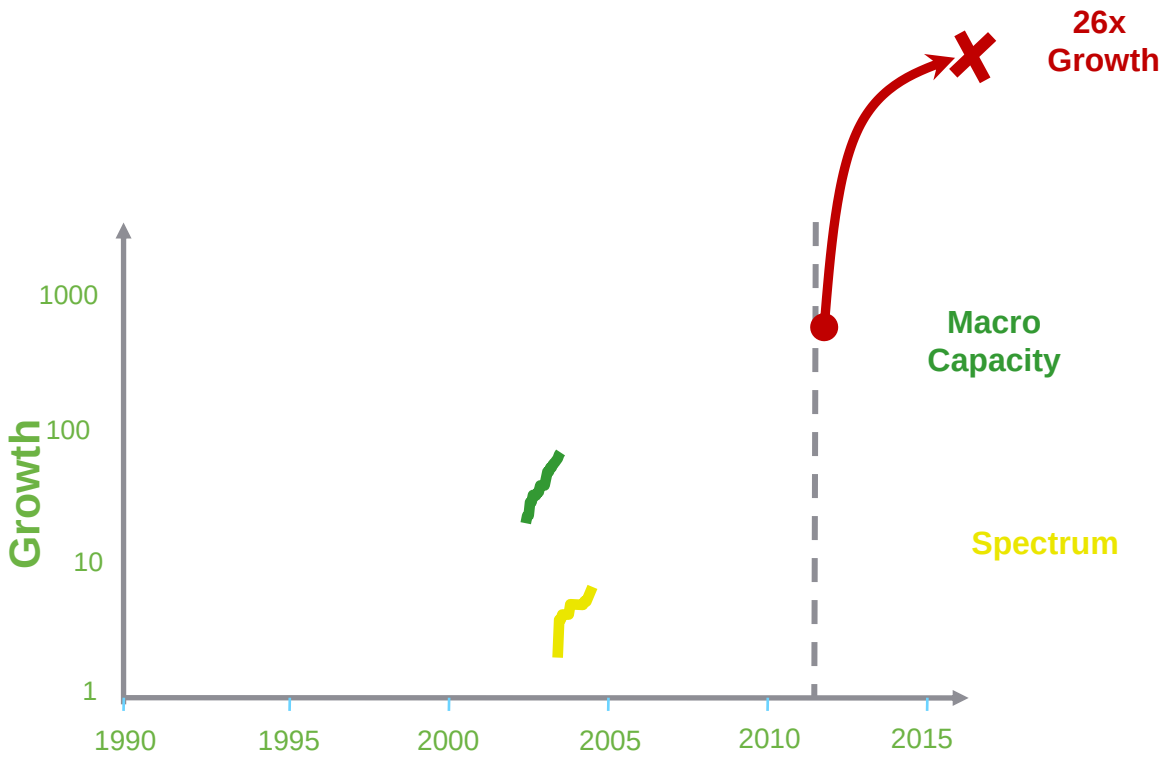
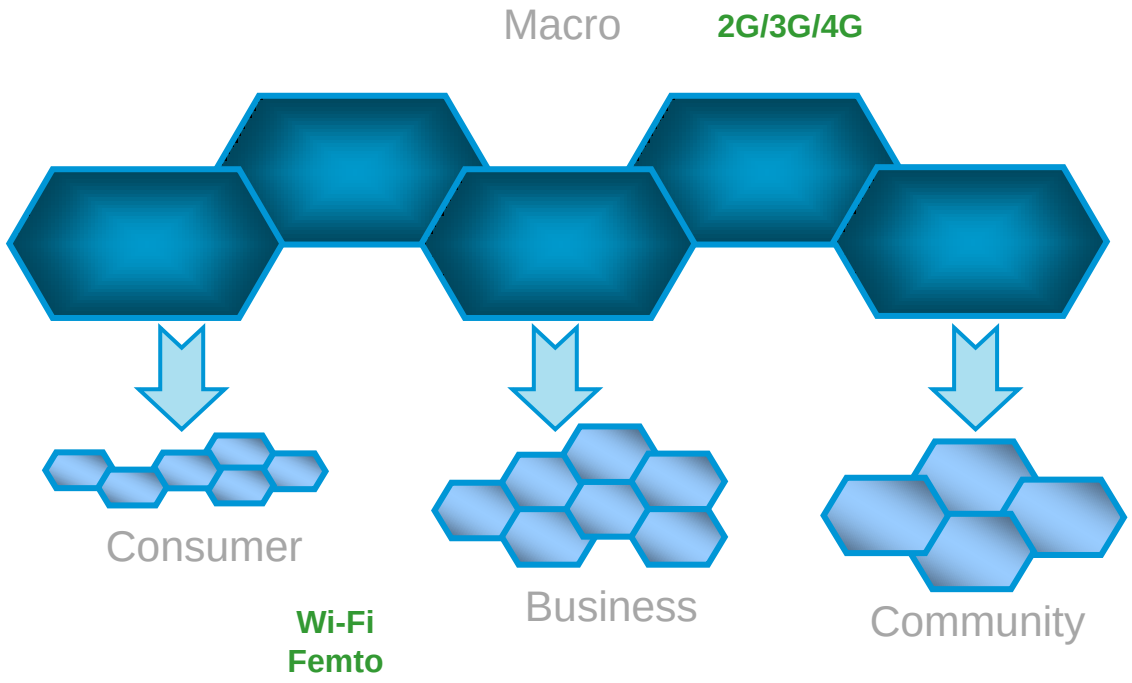
Overall Capacity Not Keeping Pace with Data Demand



Small Cells Increase Existing Capacity



Future networks supporting the mobile Internet will need to integrate smaller cell architectures to scale

Source: Agilent

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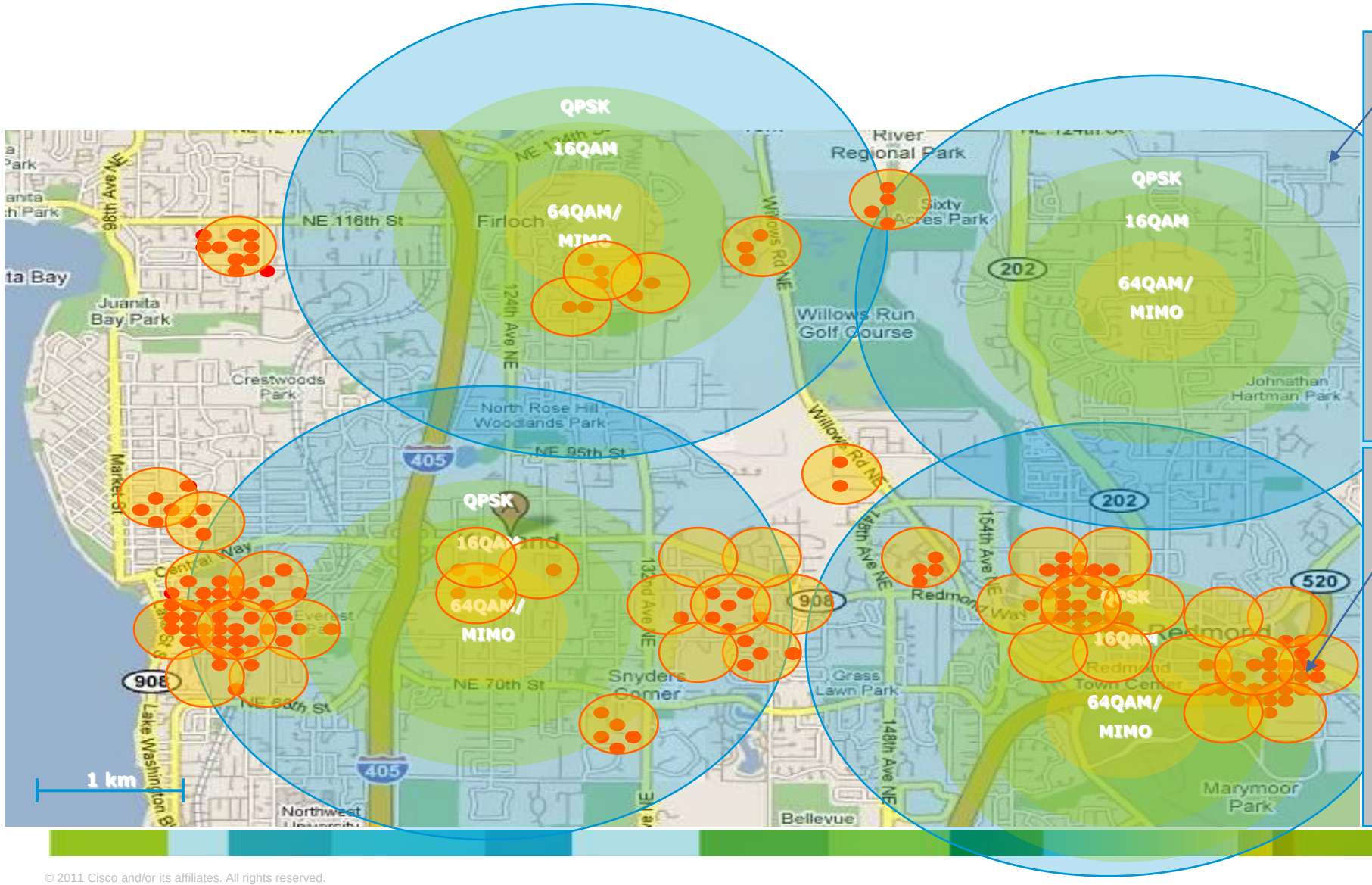
What Small Cells Can Deliver . . .



Macrocell (3G/4G)

- Voice coverage with uniform bandwidth, but not always where people are
- Limited data capacity
- Sub-optimal delivery of high BW to POPs
- High CapEx/OpEx: $400K
- Poor spectral efficiency
- New sites: Zoning issues

Wi-Fi/Femto/Pico

- Delivers targeted coverage and capacity
- Support high-capacity data
- Precision delivery of high BW to POPs
- Lower CapEx/OpEx
- Good spectral efficiency
- Low environmental impact

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Solution Overview

Service Provider Wi-Fi Solution
Four Pillars

- Unified Architecture
  - Controller-based fast, scale-able L2 & L3 handoff (w/ fast-roaming)
  - Single security / inter-operability point
  - Centralized radio-resource-management (RRM) & FCAPS/OAM
- Seamless User Experience
  - Effortless authentication and roaming
  - Open or encrypted access with expanded hotspot eco-system (roaming partners and devices)
- Converged Core
  - Intelligent Gateway (rich media services)
  - Centralized access and control (e.g. 3G offload)
  - Charging and policy-enforcement (e.g. Tiered-services)
- Intelligent and secure Access Radio

CAC: Call Admission Control
WCS: Wireless Controller System

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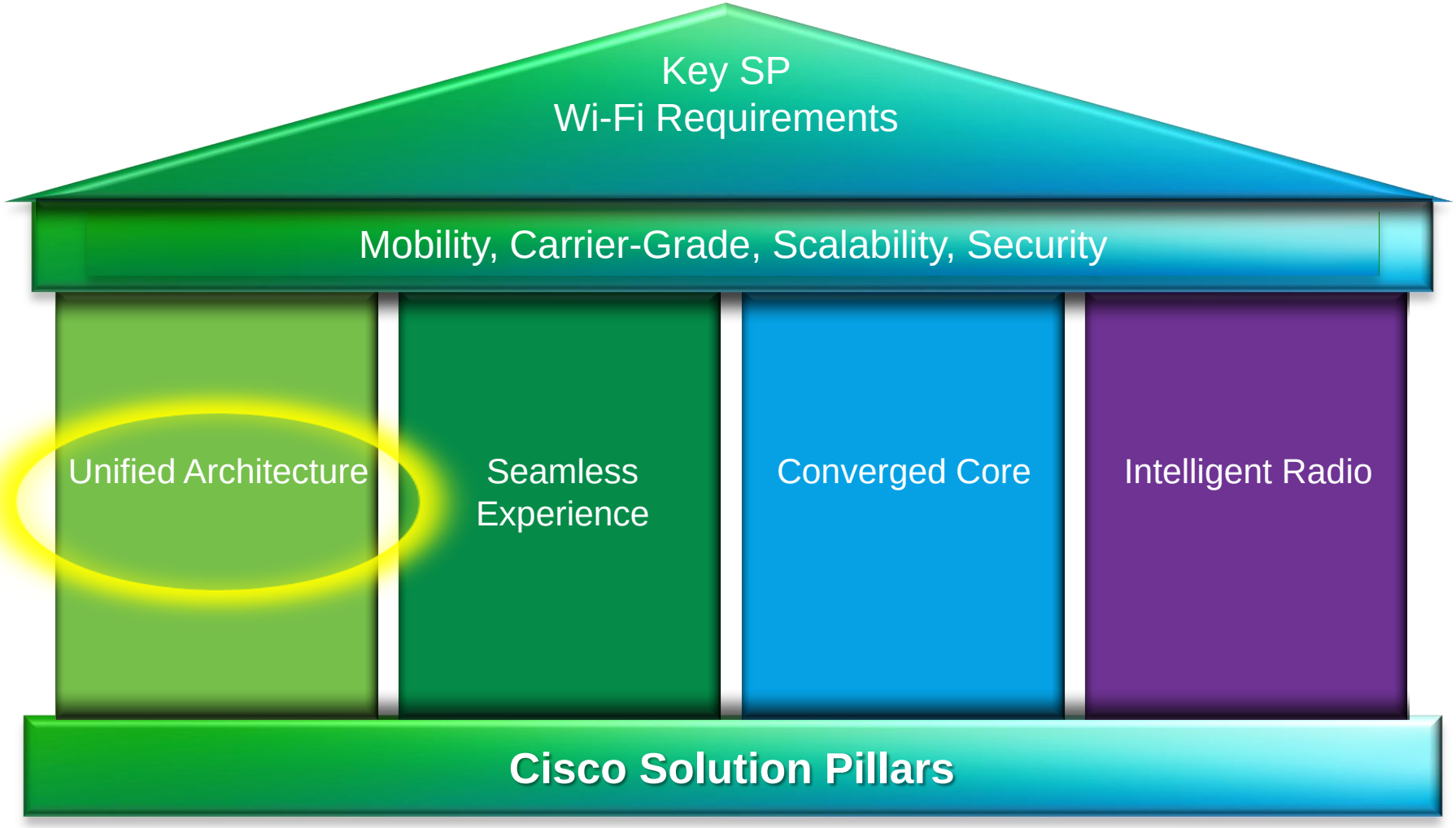
Unified Architecture



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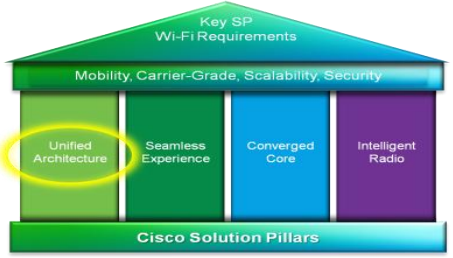
Unified Architecture



- Why a Unified Controller-based Architecture?
  - All successful commercial mobility networks are based on concept of centralized control & aggregation of the radio access network (RAN) using a radio network controller (RNC)
  - Next-Gen 4G LTE wireless networks also support centralized RAN control (C-plane) and allow separation from the data (U-plane)
- RNC Provides mobility networks with:
  - Radio Resource Management (RRM) to maximize coverage and capacity through network-wide RF quality and *interference-aware* resource allocation
  - Controlled handoff
  - Single security & inter-operability point between RANs
  - Single access control, SLA and policy-enforcement point

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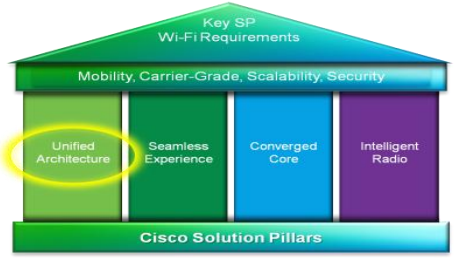
Cisco Wi-Fi “RNC” Architecture

Wireless Access Controller (WAC)



- Wireless Mobility Controller (WMC)
  - Fast and seamless handoff for L2 &L3 services (802.11r/k)
    - Controls handoff between APs (intra/inter WMC)
    - Uses RF parameters in mobile-assisted handoff
  - CleanAir & RRM provide industry-leading interference mitigation
    - Capacity and coverage booster for all deployments
    - Licensed spectrum “experience” in unlicensed band
  - LAN, MAN or WAN Connected (L2 or L3 transport)
    - Not limited by size of L2 domain or transport technology
- Wifi Access Gateway (WAG)
  - Per user (PCEF) and per VLAN/SSID policy
  - WiFi access control (e.g. EAP-SIM, WebAuth, etc)
  - Inter-network mobility - Proxy Mobile IP (3G-Wi-Fi, inter-vendor)

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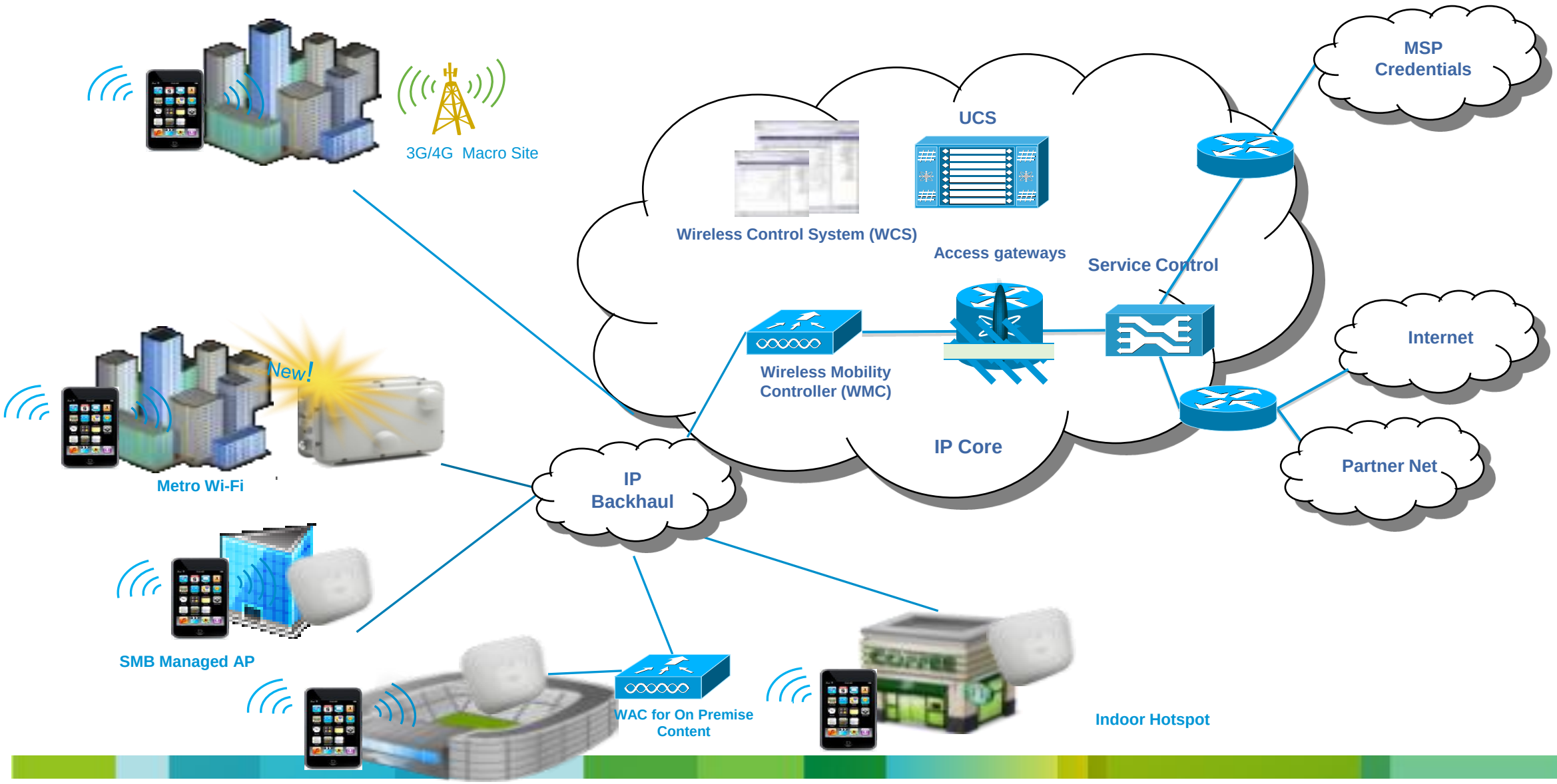
Cisco Service Provider Wi-Fi

Complements 2G/3G/4G Network



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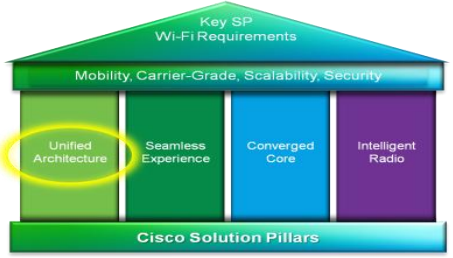
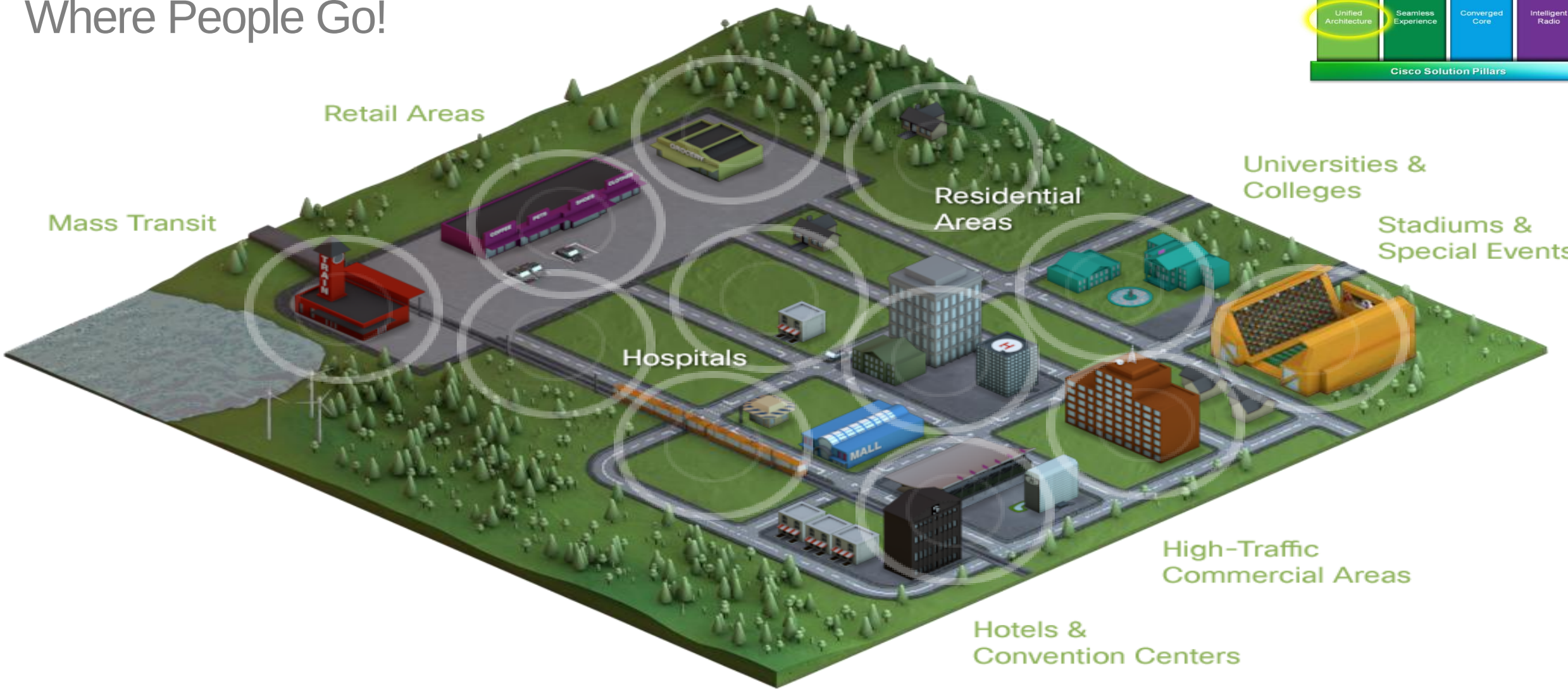
Target Areas for Wi-Fi Offload

Where People Go!





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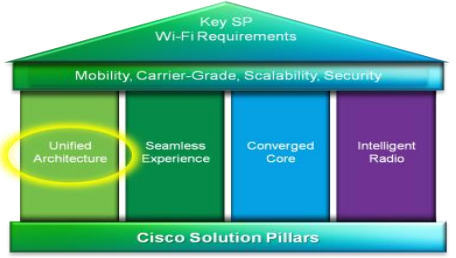
One Architecture – Many Applications



- HotZone (e.g. stadium, public venues, metro)
  - Contiguous coverage area served by full Unified WMC → micro-mobility/handoff anchor
  - WMC co-located with access gateway (WAG) for charging & Internet offload
- HotSpot (e.g. public access retail)
  - Single facility co-located with access router (e.g. ISR) for charging & Internet offload
  - Typically a discontinuous coverage area (limited need for micro-mobility)
  - C-plane only WMC → centralized mgmt, provisioning, RRM, etc
- SMB (managed services)
  - Dual SSID (for MSP) with bundled services (e.g. VPLS, IP-PBX, FMC, etc)
  - Similar coverage as HotSpot and typically supported with C-plane only WMC
- Residential (MDU)
  - Clusters of semi-contiguous coverage areas
  - Similar coverage as HotSpot and full or C-plane only WMC depending on mobility/capacity required

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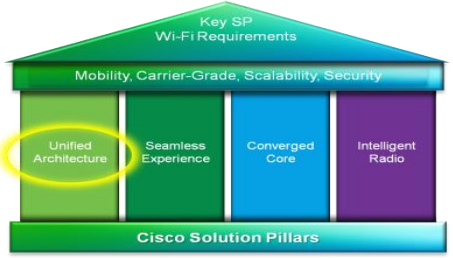
Side-By-Side



	Controller Based (L2/L3)	Controller-Less (L2-only)
Data mobility (layer 2 & layer 3)	✓	✓
Real-time mobility (layer 2 & layer 3)	✓	✘
Network capacity optimization	✓	✘
Network security + intrusion detection	✓	✘
Best user experience	✓	✘
Large scale deployment manageability	✓	✘
Future proof architecture	✓	✘

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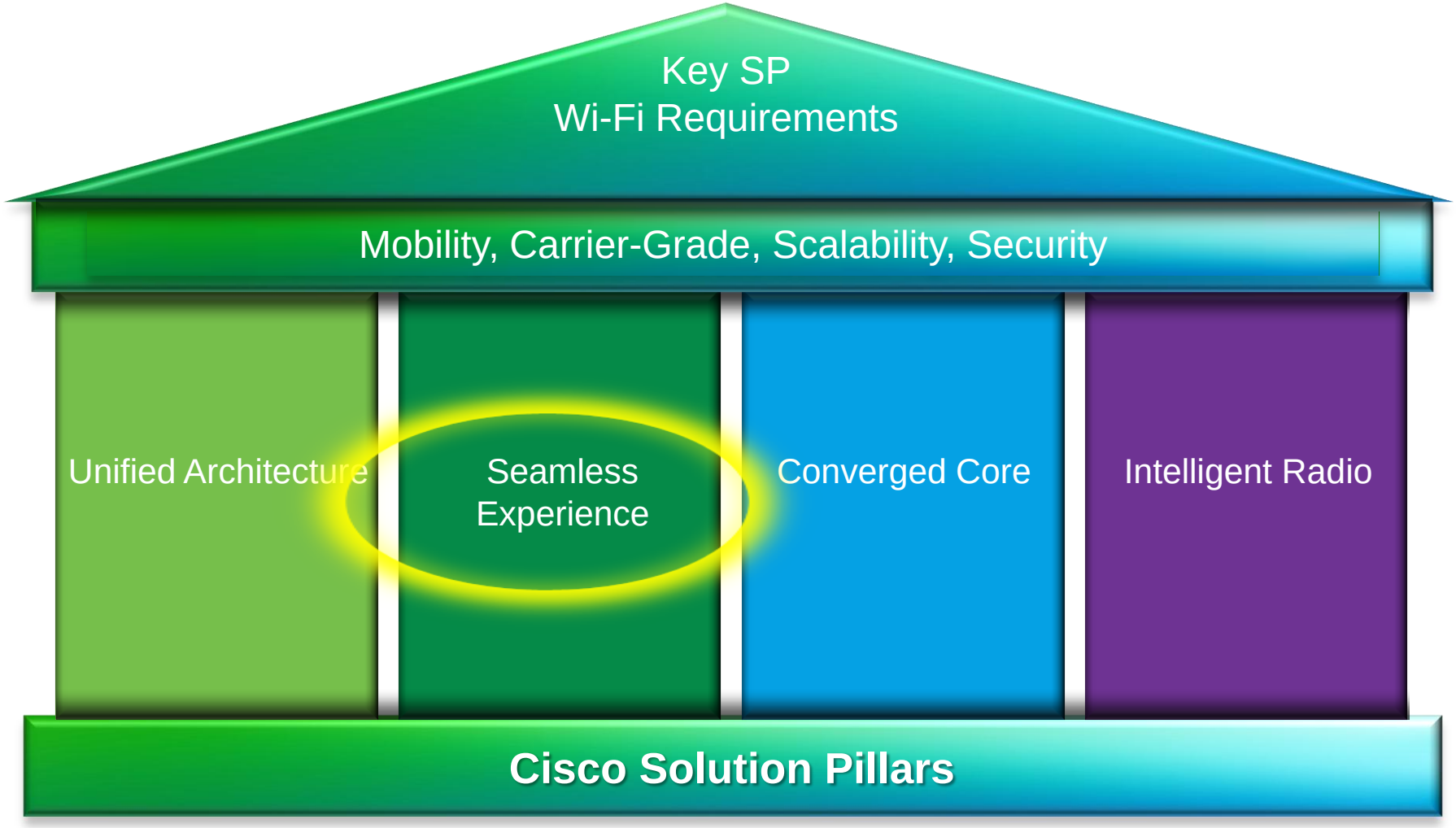
Seamless Experience



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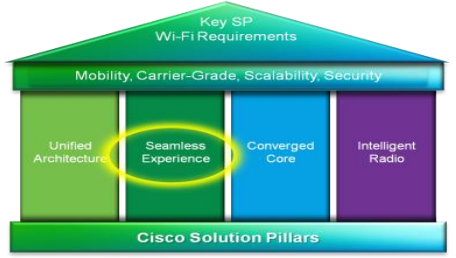
Seamless Mobility & Roaming



- Cisco's controller-based Wi-Fi architecture provides real-time mobility & seamless roaming covering majority of the user-experience within the Wi-Fi cluster
- Mobile IP provides IP service continuity using client-based (CMIP/iWLAN) or network-based methods (PMIP). This addresses non-SP provided WiFi (e.g. residential) and inter-network (e.g. Wi-Fi metro -> 3G WAN)
- Seamless Wi-Fi roaming between operators (e.g. 3G offload) is provided by widely available and emerging authentication techniques and complements client-based methods (e.g. iWLAN) dependent on Wi-Fi roaming

CMIP: Client Mobile IP
PMIP: Proxy Mobile IP

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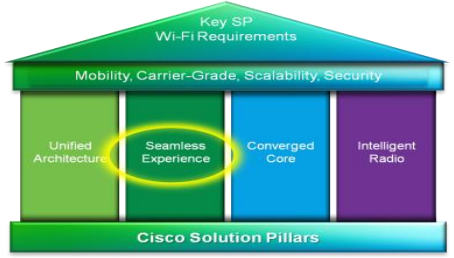
Roaming Across Wi-Fi and Cellular (Today)



Complexity

MAC-TAL

MAC

Un-Encrypted Credentials

WISPr1.0/2.0

WEB-Name/Pwd.

HTTPS Encrypted Credentials

802.1x

EAP (SIM)

EAP (Cert)

Encrypted Wi-Fi (Data & Credentials)

IPSEC IKEv2*

Encrypted E2E Data

Security

*3rd-party device client required (e.g. iWLAN)

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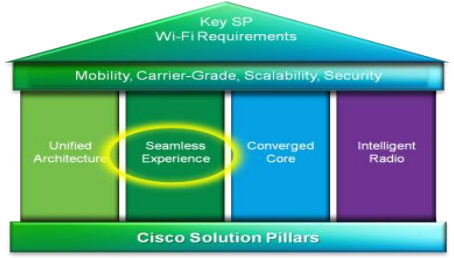
Next Generation Hotspot (Future)
Roam, Authenticate, Monetize



1

2

3

4

802.1x , EAP-SIM

802.11i

802.11u

Mobile Service Advertisement Protocol (MSAP)

RELIABLE
Carrier class solution

SEAMLESS
Simplifies network discovery and selection for seamless cellular data offload

SECURE
Extends existing SIM-based authentication techniques over encrypted Wi-Fi

PROFITABLE
Enables location-based and value-added services

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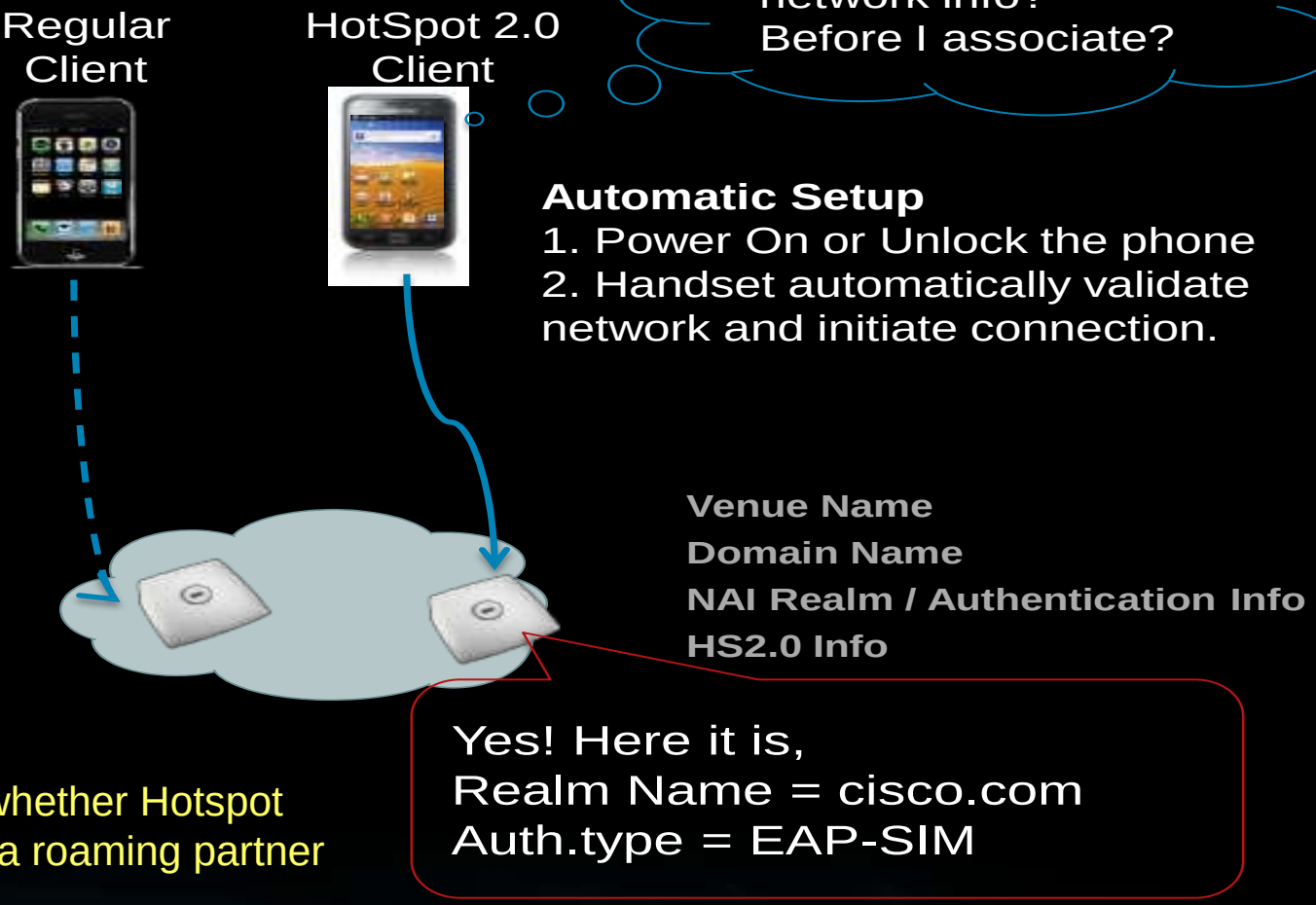
802.11u Setup

Manual Setup
1. Power On or Unlock the phone
2. Select WiFi network from pop-up but has vulnerability to access Rogue AP*
3. Go to Web-auth
4. Browse Web-page and had to put right credential usually ID/PWD
5. Choose roaming plan
6. Start Internet



- Enables device to automatically figure out whether Hotspot provides Internet Access by home SP or by a roaming partner

- Enables device to automatically provide the authentication credentials required by Hotspot
- Faster network discovery and selection
- Makes WiFi easy-to-use and secure like 3G Cellular

Customer Experience Transformation

Trial of Mobile Concierge with MSAP

T-Systems Multimedia Solutions

Reach customers at the moment of choice

A New Mobile Experience for Mobile Subscribers

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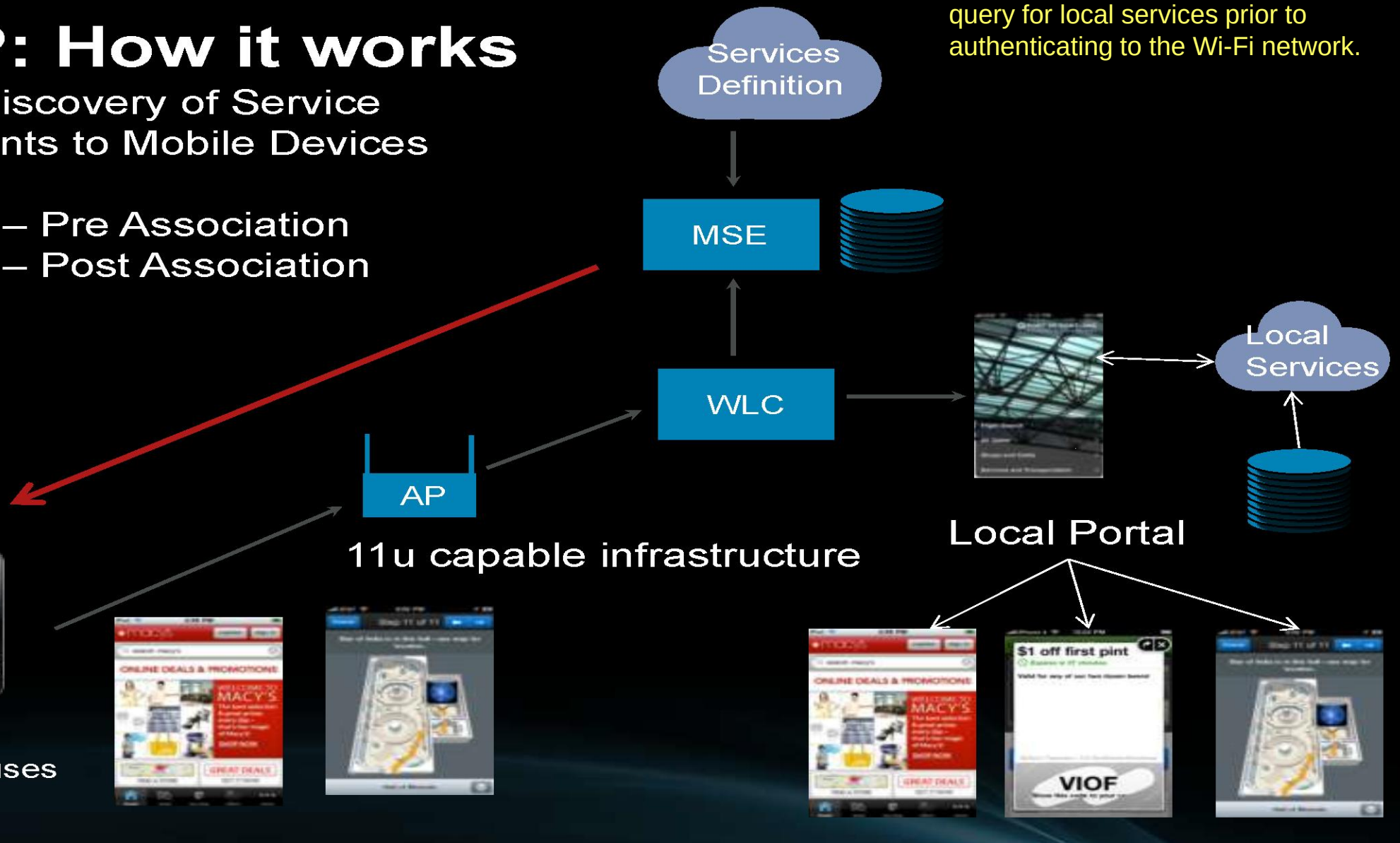
MSAP: How it works

- Facilitates discovery of Service Advertisements to Mobile Devices
- Two flavors
  - Layer 2 – Pre Association
  - Layer 3 – Post Association

Mobility Services Advertisement Protocol (MSAP)
query for local services prior to authenticating to the Wi-Fi network.



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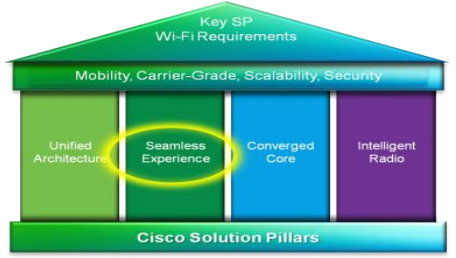
Enabling Inter-Service Provider Roaming



- Standardize the authentication process and enable seamless Wi-Fi roaming
- Industry initiative led by Cisco along with Wireless Broadband Alliance
- Demonstrated with these partners at Mobile World Congress 2011

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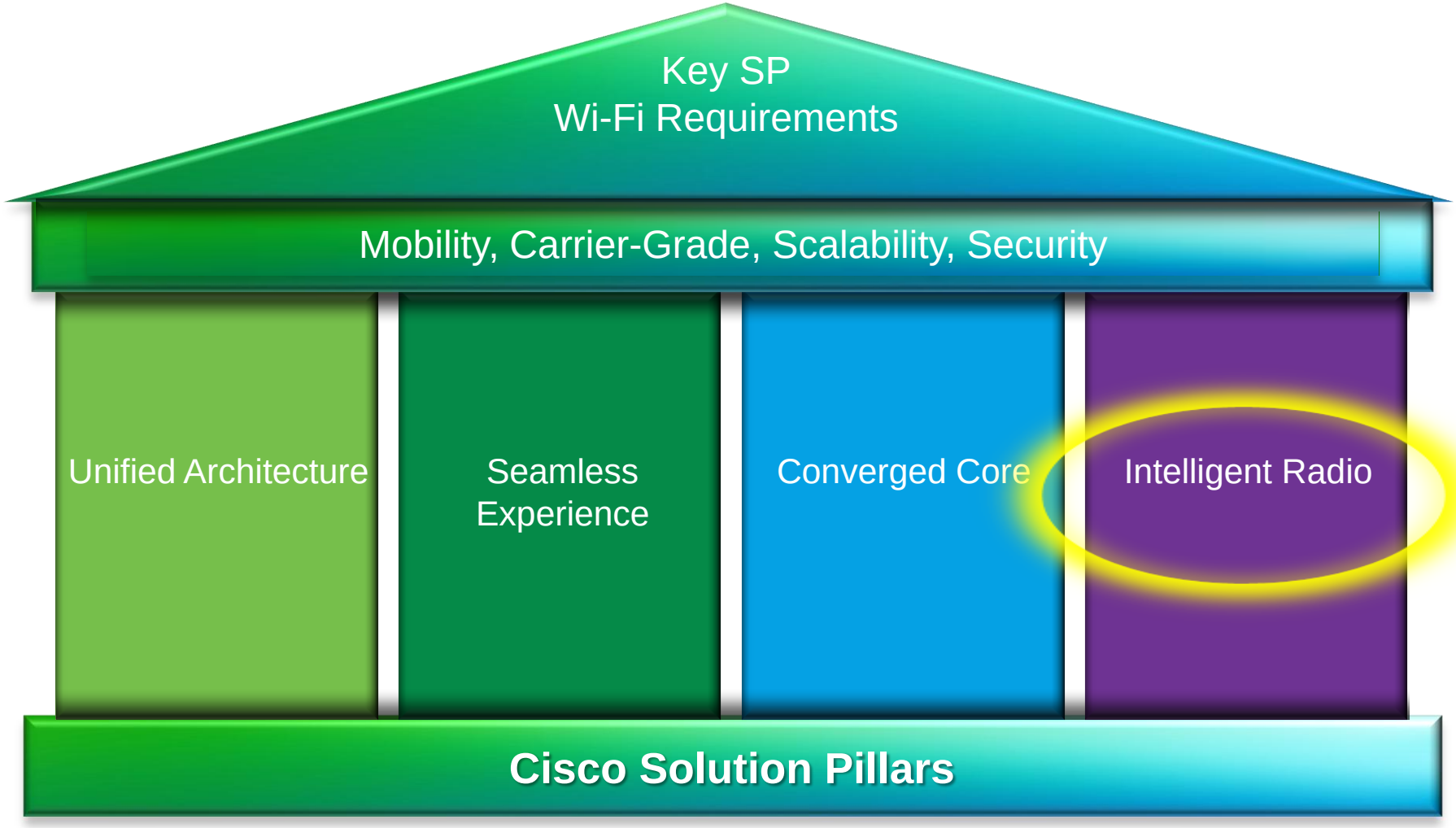
Intelligent Radio



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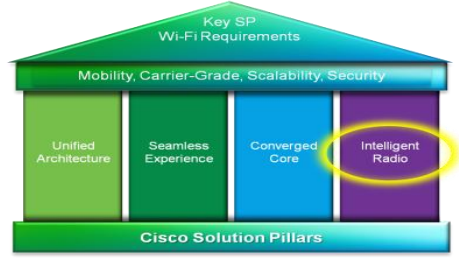
RF Performance Matters



- Coverage – Higher Tx power and additional receiver path increase coverage area up to 25%
- Signal Strength – Higher Tx power and integrated antenna design increase signal strength 2–7 dB for greater coverage and a better user experience
- Total Throughput – Increases total network capacity by 27% per independent testing by Miercom
- Fully loaded network; mix of 11a, 11g, and 11n clients
- Legacy Performance—ClientLink boosts performance of 11b/g clients up to 87%
- QoS—VideoStream brings security and bandwidth efficiency to real-time video applications

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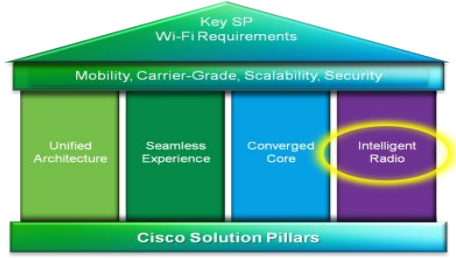
RF Performance Matters

Not all Access Points Are the Same



ClientLink

Best in class Radio Resource Management coupled with beamforming to deliver focused power to clients.

Improves Network Throughput and Coverage

CleanAir

Sophisticated spectrum Intelligence to monitor the airwaves, detect, locate and classify interference, alert Ops and reconfigure the network to avoid

Improves Network Reliability

Band Select

Optimized RF utilization by moving 5 GHz capable client out of the congested 2.4 GHz channels.

Improves Network Throughput

Video Stream

Extends reliable multicast into the wireless network by converting multicast to unicast at the AP.

Quality Video over WLAN

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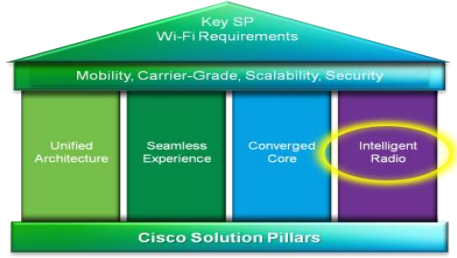
Cisco Aironet 1550 Series

High Performance 802.11n Outdoor Wireless



- CleanAir for mission critical performance and reliability
- ClientLink for high density coverage
- Video Stream for quality video
- Band Select for optimized throughput
- DOCSIS 3.0 option
- Internal or External Antennas

Seamless Mobility, Security and RF Excellence

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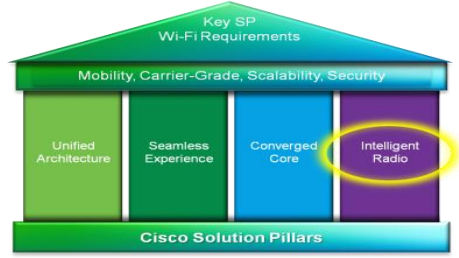
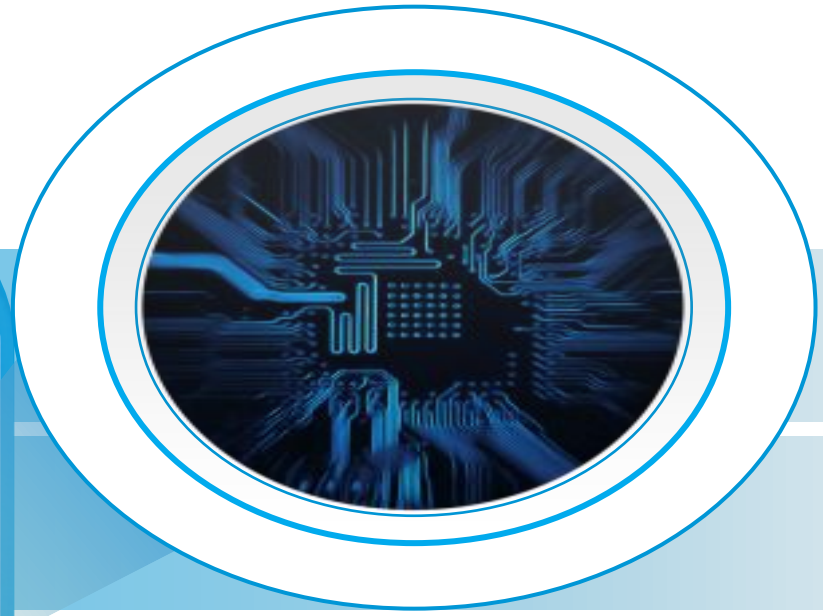


Introducing CleanAir for the Outdoors

New!



Mitigate

Shared under NDA/Embargo Until Feb 14, 2011

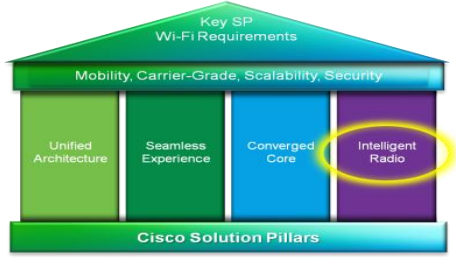
Cisco CleanAir

A system-wide feature that uses silicon-level intelligence to automatically mitigate the impact of wireless interference, optimize network performance and reduce troubleshooting costs

Reduce TCO with automated interference mitigation and troubleshooting

Cisco Aironet 802.11n AP Portfolio

Carrier-Grade Performance



Outdoor

- 1550 Series – 4 models
- DOCSIS 3.0 and EuroDOCSIS 3.0 option
- Dual radio APs and dual band stick antennas
- RF excellence with:
  CleanAir
  ClientLink
  RRM

Indoor

- 1140 or 1260 Series
- 2x3 MIMO
- RF excellence with:
  ClientLink
  BandSelect
  RRM
  VideoStream

  For reliable, high-performance rich media experience

- 3500 Series
- 2x3 MIMO
- RF excellence with:
  CleanAir
  RRM
  ClientLink
  VideoStream
  Band Select

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Wireless Mobility Controller (WMC) Portfolio

HotZone

5508 (500AP)

WiFi Aggregation

and/or

WiSM2 – 1000 AP/blade

Up to 7 blades/chassis

+

Catalyst 6500 (7000 AP)

HotSpot

Flex7500 (appliance)

HREAP mode

(2000+ AP)

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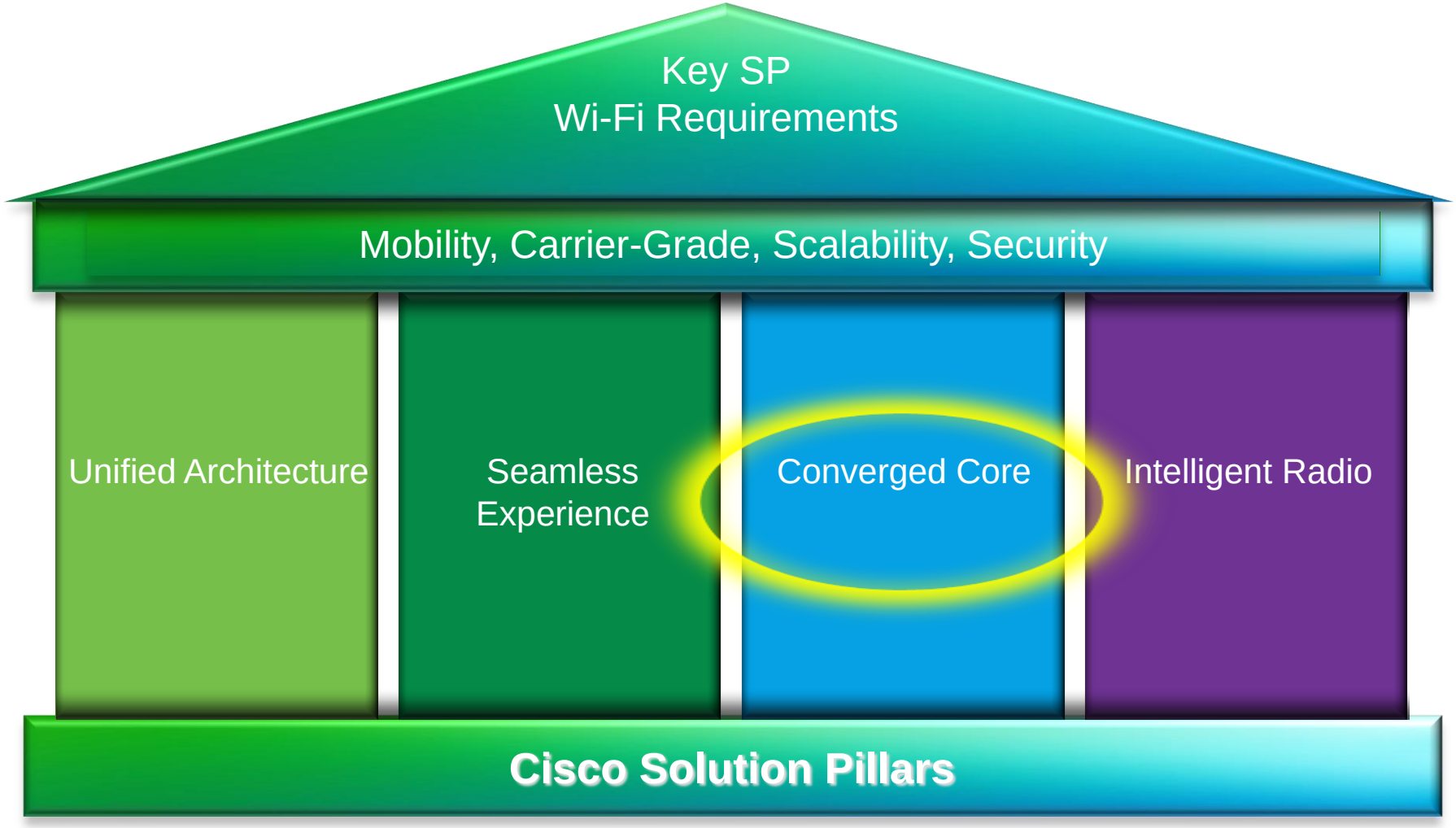
Converged Core



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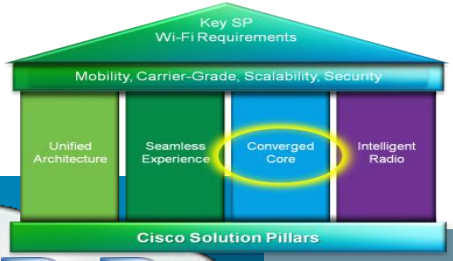
One Unified SP Wi-Fi Architecture



Internet

Application Partners

Converged Subscriber Control

AAA DHCP Captive Portal WCS Policy Mgmt Svcs Reporting

Cloud Services, Applications, & Operations

Wi-Fi Controller and Backhaul

Cloud TR-069

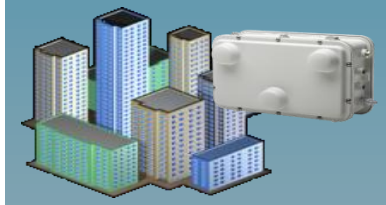
Stadium / Large Venue

Indoor Hotspot

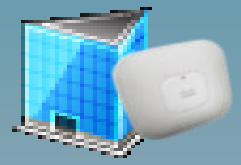
CMTS DSL Fiber

Own or 3rd party broadband access

symbian



Metro Wi-Fi



SMB Managed AP

Residential Managed AP

Metro/ Hotspot Access

Residential Access

Client Centric/ Un-trusted Access

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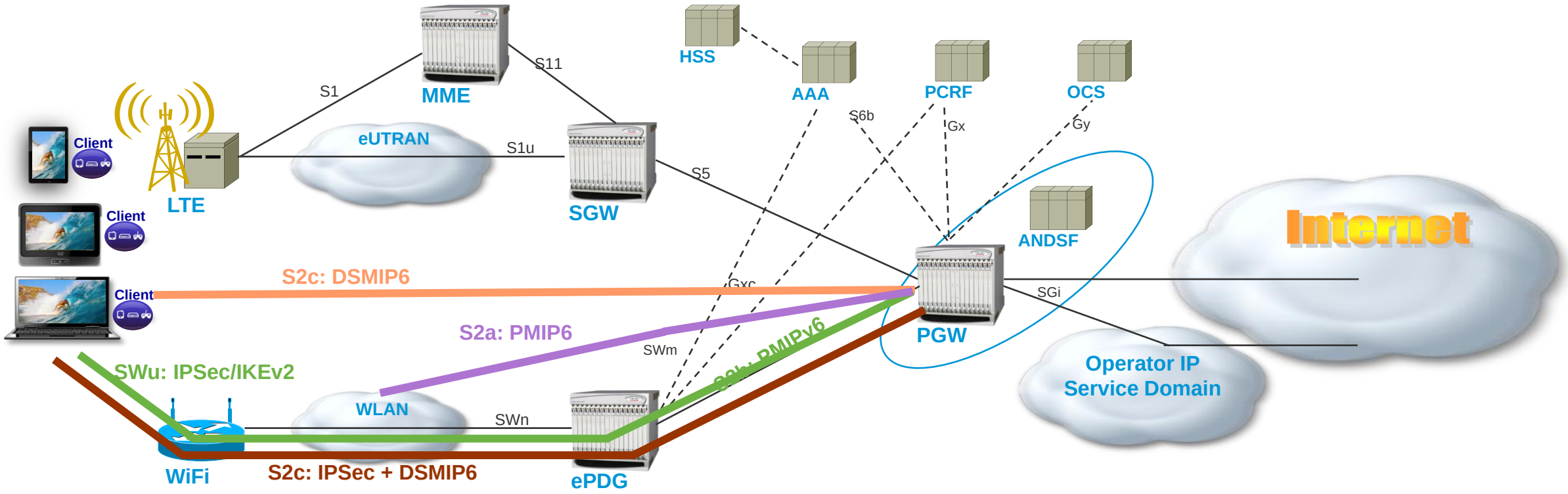
WiFi Integration Architecture



- **Untrusted WiFi access [emerging client ecosystem]**
  - **SWu + S2b - IPSec tunnel to ePDG switched to PMIPv6 to PGW;**
  - **S2c – DSMIPv6 over IPSec**
- **Trusted WiFi access (802.1x over the air)**
  - **S2a - PMIPv6 infrastructure tunnel from MAG in WiFi to PGW**
  - **S2c – DSMIP tunnel from device to PGW**

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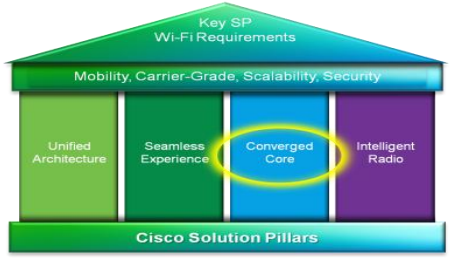
Service Provider Advantage:
IP Intelligence



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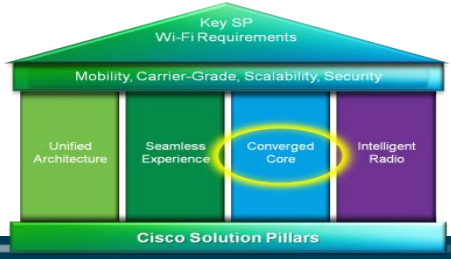
Intelligent Gateway



- PDP QoS termination (BW parameters)
- Per user ACLs
- Dynamic Policy control
- Real Time Charging
- Parental Control/ Content filtering
- NAT
- BW Shaping
- Roaming based policy
- Integrated Offload
- Analytics

- P2P detection
- Dynamic Policy control
- Parental Control/ Content Filtering
- Per-Subscriber Firewall
- Application Detection
- URL Re-write
- Advertising filters
- Fair Usage Control
- Analytics

- Application proxy
- TCP Optimization
- Header Enrichment
- HTTP Compression
- URL Re-write
- Advertising filters
- Analytics

- Video Pacing
- Media Optimization
- Transrating
- Analytics

IP Point of Attachment | Deep Packet Inspection | Traffic Packet Optimization | Video Gateway

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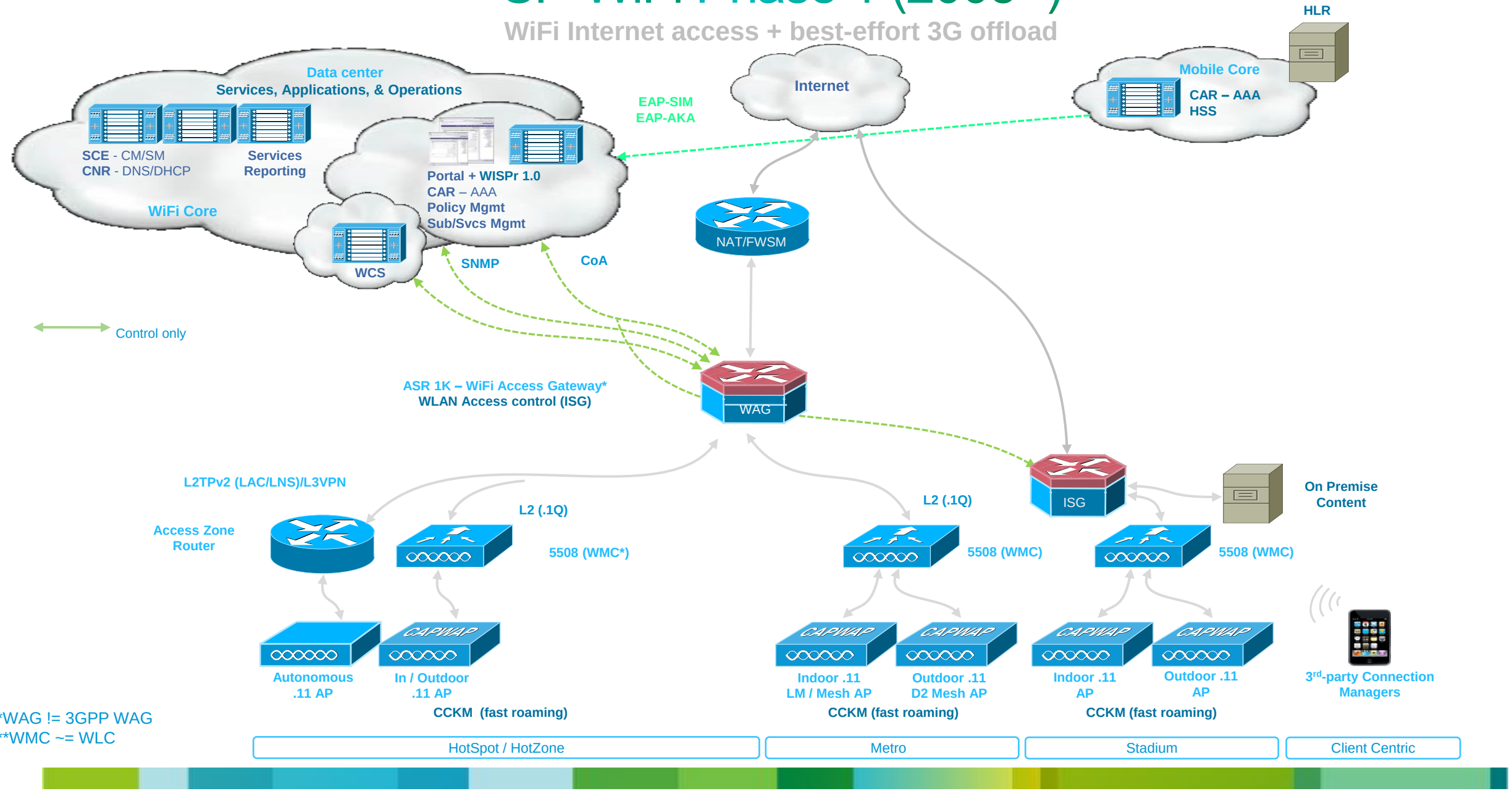
NETWORK ARCHITECTURE

SP-WiFi Phase 1 (2005+)

WiFi Internet access + best-effort 3G offload



*WAG != 3GPP WAG
**WMC ~= WLC

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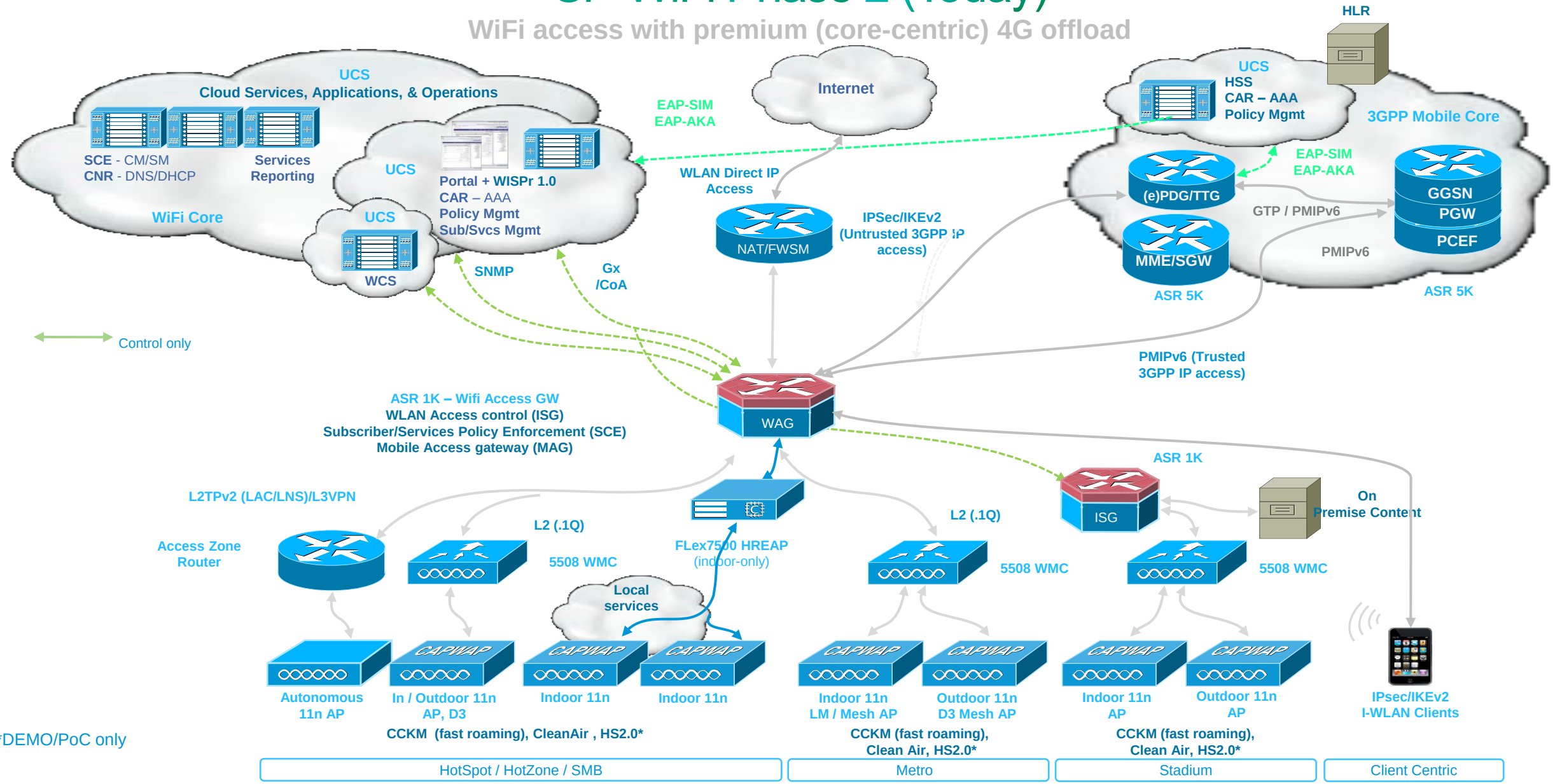
SP-WiFi Phase 2 (Today)

WiFi access with premium (core-centric) 4G offload



*DEMO/PoC only

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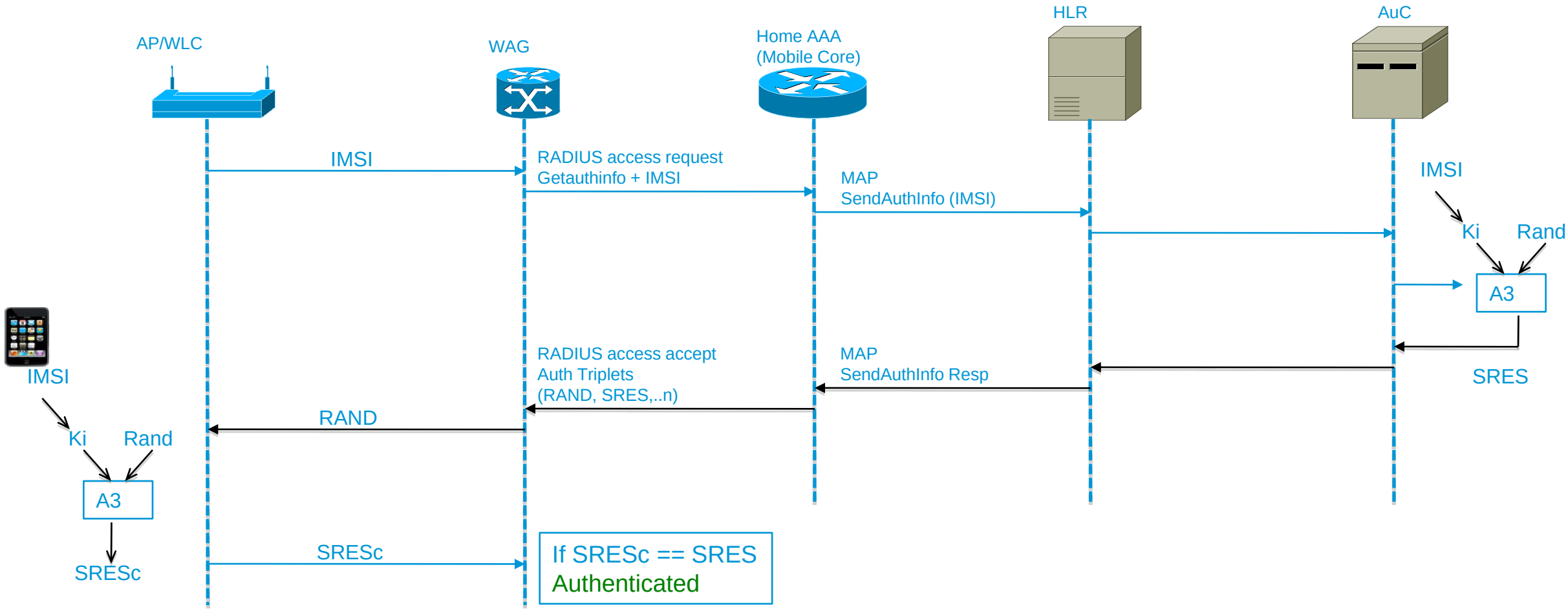
E2E EAP-SIM Authentication (realm-based)



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Solutions for each mobile operator scenario

Infrastructure-based: Operator deploys WiFi for data access & offload

- Build Trusted WiFi N/W (802.11i)
  - Evolving from open/WiSPr1.0 based N/W to secure 802.1X-based N/W
- **(Preferred) N/W based tunnel** (PMIPv6)
  - local access/QoS
  - 3GPP core access
  - WiFi-WiFi mobility (e.g. inter-MSO)
  - WiFi-4G (w/ client virtual adapter)
- NextGen Hotspot (NGH) for seamless WiFi roaming & L2 security
  - N/W discovery/selection & service advertisement (802.11u)
  - Auto login & online sign-up

Client-based: Mobile operator needs ubiquitous WiFi access to 3GPP mobile core services

- **(Preferred)** Trusted WiFi N/W
  - NGH/802.1X + PMIP for E2E security & WiFi/4G IP mobility
  - ConnMgr uses trust indication (3GPP 33.402/RFC4187) to skip iWLAN tunnel
- Un-trusted WiFi N/W (residential, 3rd-party operator, etc)
  - Security: **Client Triggered Tunnel** (iWLAN-IPSec/IKEv2)
  - WiFi-3GPP IP mobility:
    - 3G/UMTS: CMIPv4
    - 4G/LTE: DSMIPv6 (w/opt **IP Flow Mobility** for local access)

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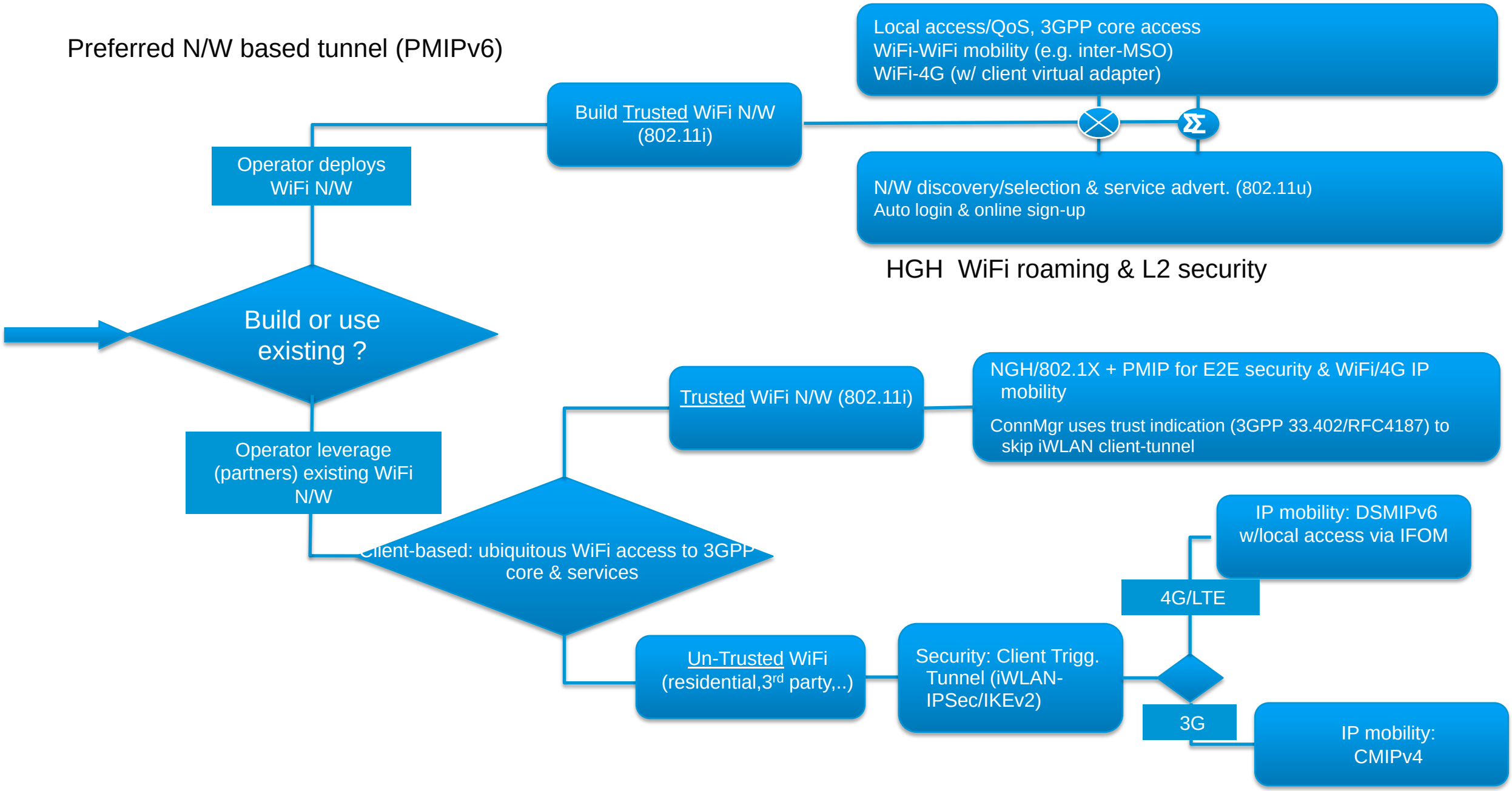
Preferred N/W based tunnel (PMIPv6)



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Case Studies

Business Cases for SP Wi-Fi

- Optimization – increases network capacity and reduce 3G data traffic overload by offloading traffic with SP Wi-Fi.
- Monetization – creates new revenue streams by taking advantage of advanced technology that provides secure delivery of location-based services to mobile devices
- Churn Reduction – expand a physical footprint with a cost-effective Wi-Fi solution to keep customers on the service provider network as they move from home to the train to the office.

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Service Provider Wi-Fi – Convention Center

Mobile World Congress 2011

- Operate free Wi-Fi Hotspot network for attendees
  - CleanAir – Intelligent Reliability
  - ClientLink – High Density Coverage
  - Video Stream – Quality Video
  - Band Select – Optimized Throughput
- Cisco Cloud Connect
  - Managing wireless cloud services

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Service Provider Wi-Fi – Stadium

Optimization through 3G Offload

- Wi-Fi broadband connectivity free to thousands of fans
- 3G offload for all smartphone and broadband devices through transparent authentication
- On-net video instant replay live during game or show

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Service Provider Wi-Fi - Stadium

Monetization through Premier Services

- Wi-Fi Replay – Video highlights
- Food Finder – Local food & coupons
- Fan Captions – Closed captioning of PA announcements
- Game Tracker – Scores, statistics and player profiles
- Interactive Games – Play virtual games with other fans
- Concierge – Stadium history and local information

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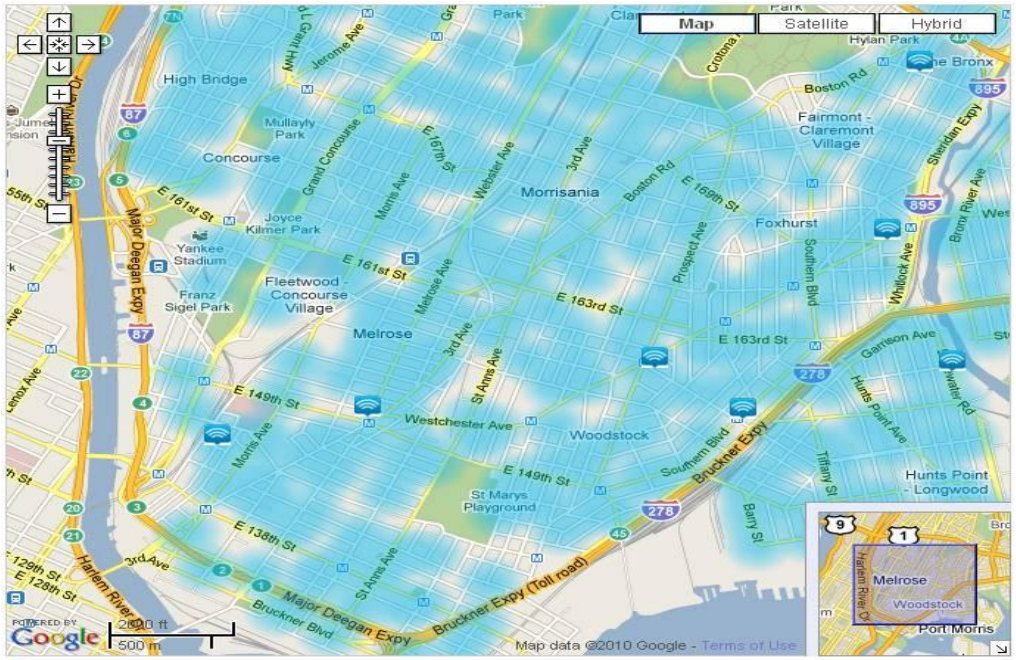
Wi-Fi Deployment – Transportation

Churn Reduction at Cablevision

- Continuous coverage for NY metro area with more than 25,000 APs (indoor and out)
- Now installed on ferry and commuter trains
- Large convention coverage in Madison Square Garden and Radio City Music Hall
- Increases customer “stickiness” with differentiated Wi-Fi service for reduced churn

Outdoor Heat Map NYC



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Comcast/TWC/Cablevision Wi-Fi Alliance

One AP for 3 MSOs
Cisco Aironet 1260

SSID = optimum Wi-Fi
SSID = Xfinity (Comcast)
SSID = TWC Wi-Fi

Cablevision, Comcast, TWC Hook Up On Wi-Fi

Operators Let Broadband Subs Access Any Hotspot in New York Region

By Todd Spangler -- Multichannel News, 4/15/2010 12:28:44 PM

Cablevision Systems, Comcast and Time Warner Cable announced reciprocal agreements Thursday to let their broadband subscribers access any of the operators' Wi-Fi hotspots across the New York metro area.

According to the cable companies, no money is changing hands as part of the agreement. As of April 15, authentication for all three operators is present on every access point.

Verizon Communications, the primary telco in the market, offers access to thousands of Wi-Fi hot spots nationwide through a deal with Boingo Wireless to FiOS Internet users who subscribe to a plan with download speeds up to 20 Mbps or higher.

Cablevision began **building out Wi-Fi access points in 2008**, and now operates thousands of Optimum Wi-Fi locations in New York, New Jersey and Connecticut. The MSO had previously estimated the cost of the buildout to be about $330 million over two years.

Cablevision and Comcast already had such a reciprocal agreement in place, covering part of Comcast's New Jersey footprint and its Wi-Fi access points at certain NJ Transit rail stations.

For its part, **TWC last month launched Wi-Fi service** in seven New York City parks and eight commuter rail platforms on the Long Island Railroad, and had already put a system in place to cross-honor access with Cablevision.

"This agreement -- the first of its kind and, we believe, the first of many -- combines the reach and the value of our respective Wi-Fi deployments and delivers fast and free

Wi-Fi broadband connectivity free to 3 MSOs – more than 5M subs

MSO Wi-Fi Press release Link

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Summary

Key Benefits

Service Provider

- Optimizes network and reduces cost by offloading data traffic to Wi-Fi
- New service and revenue opportunities
- Visibility into RF spectrum to manage interference and prevent unexpected downtime

End User

- Enhanced user experience with Wi-Fi
- Secure roaming between networks
- Faster download speeds with Wi-Fi

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Q & A

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