Public WiFi
Metropolitan Outdoor Wireless and Hot Spots

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Agenda

▶ System Overview

▶ Building the First Square Mile

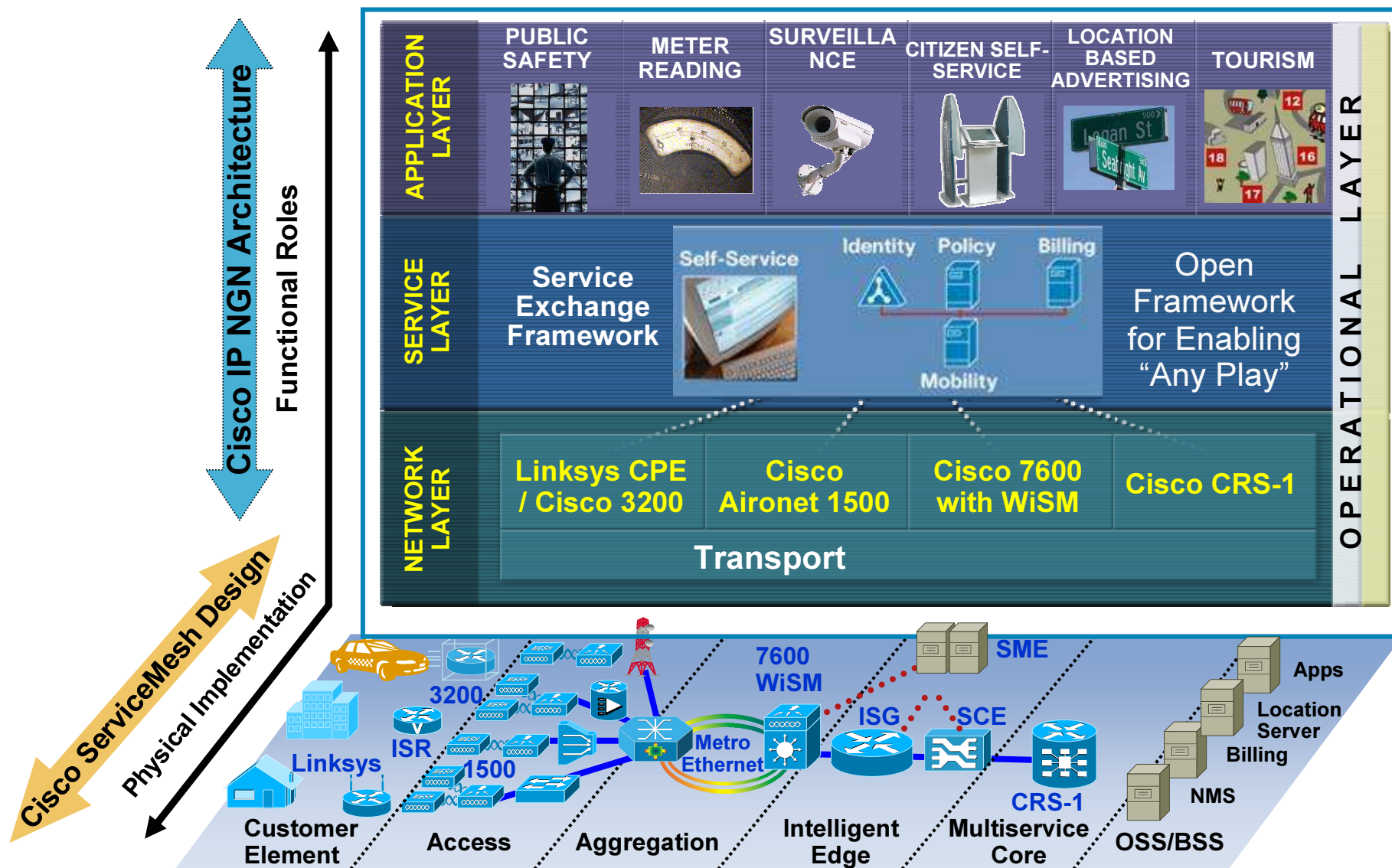▶ Applications

▶ Deployments

System Overview

Key Market Segments for Outdoor Wireless

Enterprise Outdoor
Moving Indoor WiFi Outside

- **Universities & Healthcare**
  - Extending WiFi coverage throughout the entire campus
- **Hospitality/Hotels**
  - Indoor/Outdoor mesh can open up new hospitality markets (MEA)
- **Manufacturing - Shipping & Receiving**
  - Inventory applications, hand-held scanner, RFID, etc.
- **Large Corporate Campuses**
  - Creating "blanket" coverage for access and asset tracking
- **Utilities**
  - Vehicle Fleets and Sensor Networks

Service Provider
Managed WiFi Services

- **"Hot Zones"**
  - Expanding the concept of Hot Spot coverage into Hot Zone coverage
- **Wireless ISPs**
  - Competitive Last-mile access providers using WiFi for Broadband service
- **Cable & Wireline Operators**
  - Extend the network offering beyond the cable and wireline plant

Public Sector
State, County & City

- **Public Safety/Homeland Security**
  - Police, fire and 1st responders
  - Licensed and Unlicensed Wireless Infrastructure, Vehicles & Clients
- **Wireless Access for Fixed Applications**
  - Video Surveillance, Sensors
- **Public Service**
  - Hot Spot access for city workers, utilities, inspectors
- **Digital Divide & Economic Development**
  - WiFi Broadband Access in under-served communities

Defense
Secure Communications and Sensor Networks

- **Outdoor Wireless Perimeter**
  - Utilize Secure Wireless for Video and Sensor Equipment
- **On-demand Wireless Networks**
  - Ruggedized equipment in vehicles, transit cases, and out doors
- **Security Certifications**
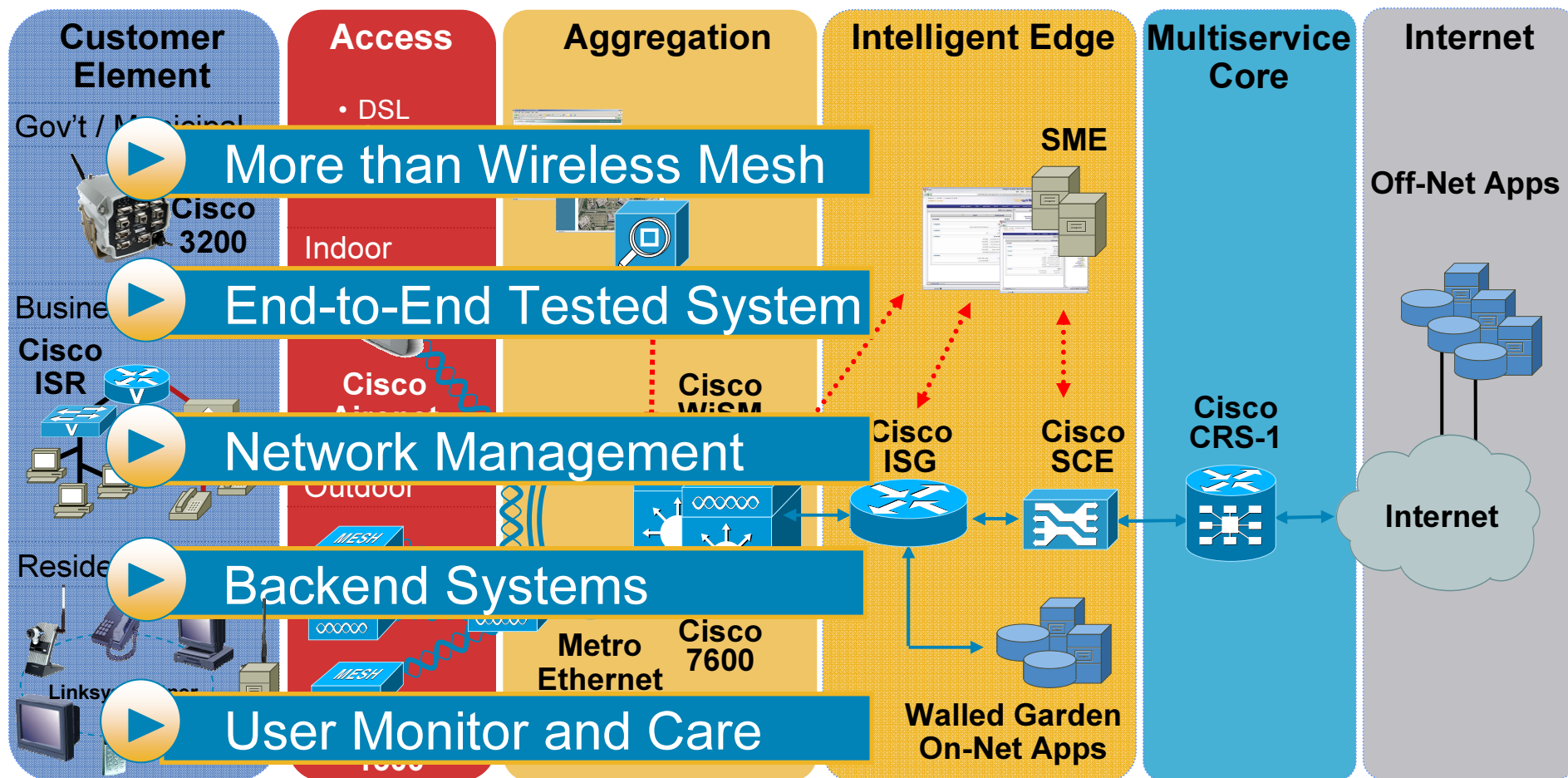 - FIPS Certification Meeting US Military Requirements for Security

Cisco IP NGN Architecture and ServiceMesh Design
Enabling Network Convergence

Cisco IP NGN Architecture — Functional Roles

Cisco ServiceMesh Design — Physical Implementation

APPLICATION LAYER

PUBLIC SAFETY	METER READING	SURVEILLANCE	CITIZEN SELF-SERVICE	LOCATION BASED ADVERTISING	TOURISM

SERVICE LAYER

Service Exchange Framework

Self-Service · Identity · Policy · Billing · Mobility

Open Framework for Enabling "Any Play"

NETWORK LAYER

Linksys CPE / Cisco 3200	Cisco Aironet 1500	Cisco 7600 with WiSM	Cisco CRS-1

Transport

OPERATIONAL LAYER

3200 · ISR · Linksys · 1500 · Metro Ethernet · 7600 WiSM · SME · ISG · SCE · CRS-1 · Apps · Location Server · Billing · NMS · OSS/BSS

Customer Element | **Access** | **Aggregation** | **Intelligent Edge** | **Multiservice Core**

Cisco ServiceMesh Design
Municipal/SP/ISP Deployments

Customer Element	Access	Aggregation	Intelligent Edge	Multiservice Core	Internet

- More than Wireless Mesh
- End-to-End Tested System
- Network Management
- Backend Systems
- User Monitor and Care

Gov't / Municipal

Cisco 3200

Business

Cisco ISR

Residential

Linksys

- DSL
- Indoor

Cisco Aironet

Outdoor

MESH

MESH

Metro Ethernet

Cisco WiSM

Cisco 7600

SME

Cisco ISG

Cisco SCE

Walled Garden On-Net Apps

Cisco CRS-1

Off-Net Apps

Internet

Cisco ServiceMesh Design

Customer Element	Access	Aggregation	Intelligent Edge	Multiservice Core	Internet

Clients	Access Agg	Intelligent Edge - Backoffice	Intelligent Edge - Control	Intelligent Edge - App Inspect
CCX/3200/Linksys	**Aironet**	**Broadhop SME Cisco CAR/CNR**	**ISG (7K, C10K)**	**SCE**
▪ C3200 Integration for Public Safety in-vehicle networking ▪ Extend Mesh to indoor ▪ 800/ISR: managed SMB CPEs ▪ Linksys and SciAtl CPEs for subscriber access ▪ QoS for data/voice ▪ CCX devices ▪ PDA	▪ LWAP Tunnels ▪ Mobility Groups ▪ SSID mapping ▪ Basic Web redirect ▪ Wireless Mgt ▪ DOCSIS backhaul ▪ WiMAX **7600 / WiSM** ▪ Network Provisioning ▪ Network Monitoring ▪ Element Management ▪ Element configuration ▪ SNMP Monitoring	▪ Portal ▪ AAA/ DHCP / DNS ▪ AAA Proxy ▪ Sub Database ▪ Sub Self care ▪ Service Creation ▪ Session Management ▪ Subscriber Portal/Self-care ▪ Service Accounting ▪ Integrated Policy	▪ L4 Redirection ▪ Service based routing ▪ AAA Accounting ▪ PPP/L2TP/IP Sessions ▪ Per sub QoS ▪ Walled Garden ▪ Wireless+wired auth ▪ **On net control**	▪ Packet Flow Optimization ▪ Application Discovery ▪ Application Accounting ▪ Application/sub QoS ▪ **Off Net control**

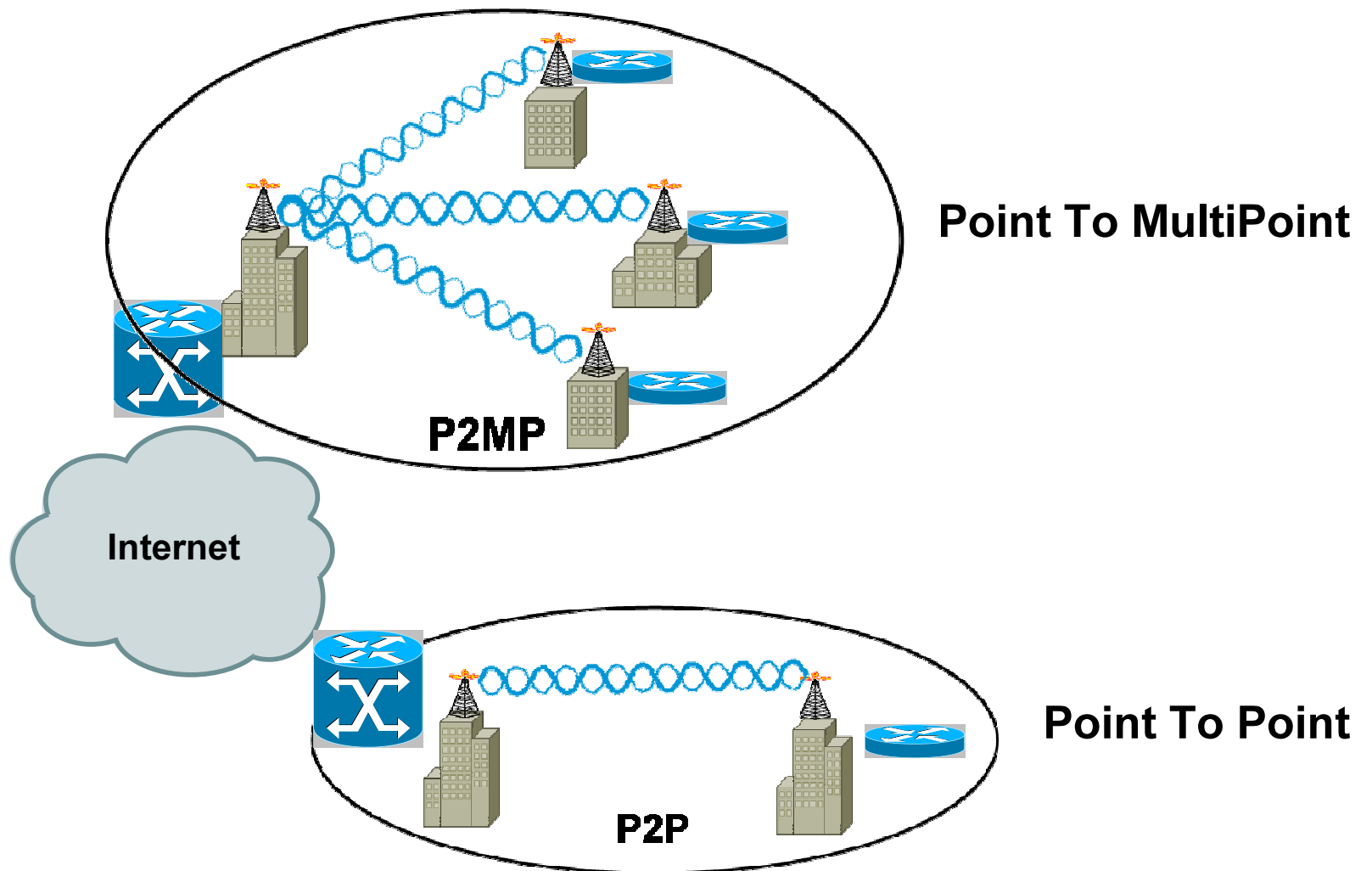**L1-L2**   **L3-L4**   **L4-L7**

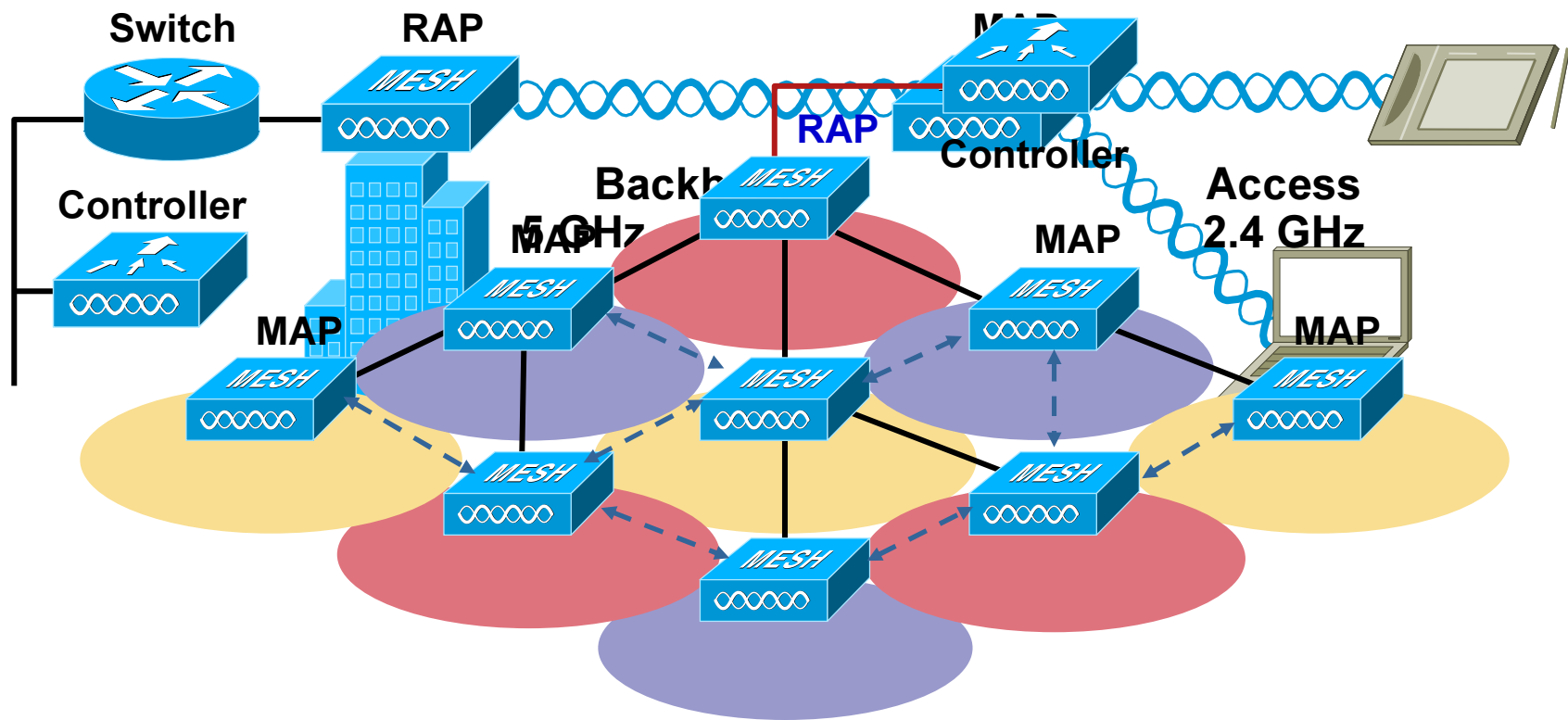# Building the First Square Mile

Building the First Mile Access/Aggregation
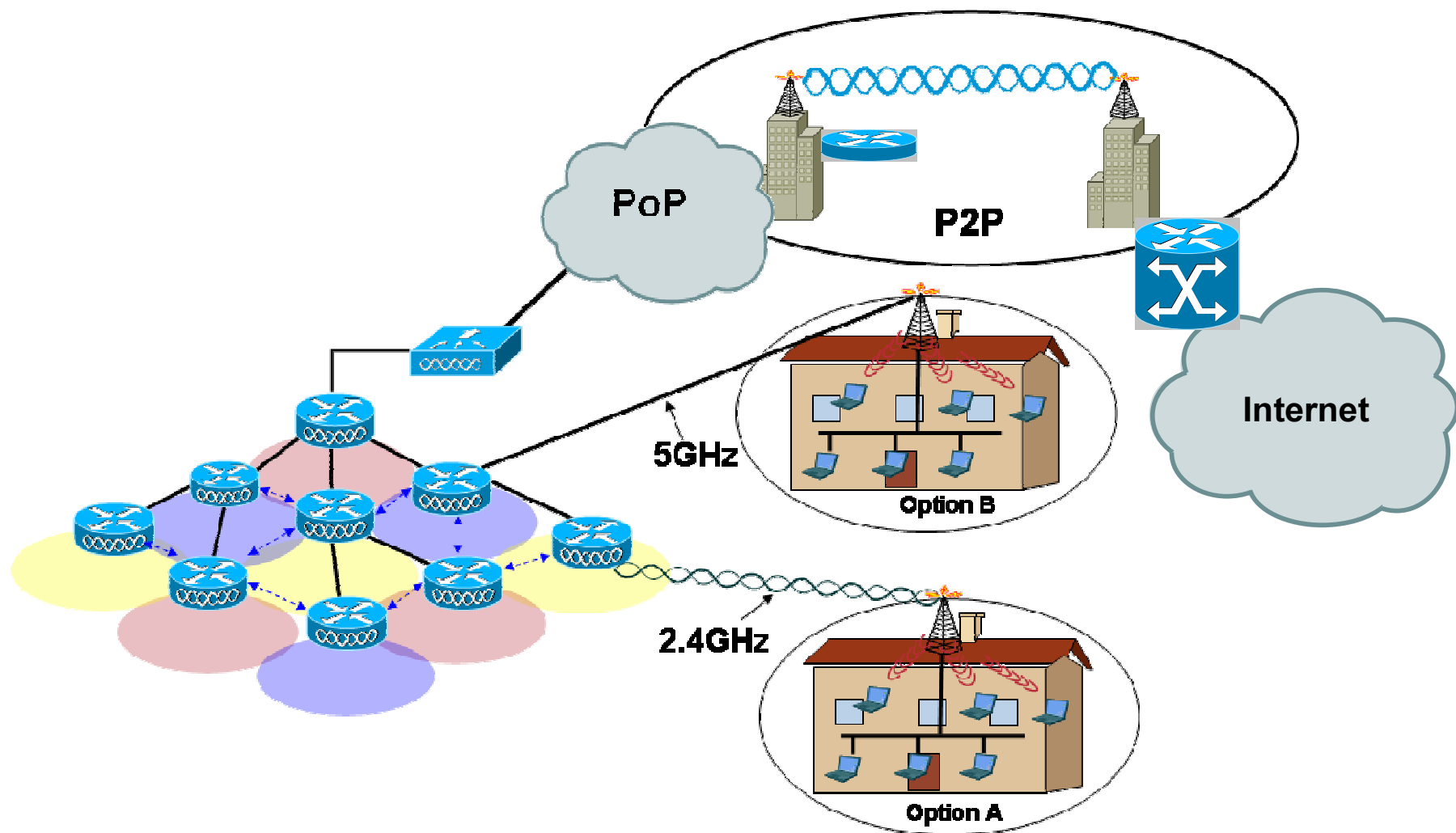
- Lets start with the wireless mesh components

Access
- DSL
- Cable
- ETTx

Indoor

Aironet AP's

Outdoor

MESH

MESH

MESH

MESH

Aironet 1500

Aggregation

WCS

WiSM

Metro-Ethernet   7600
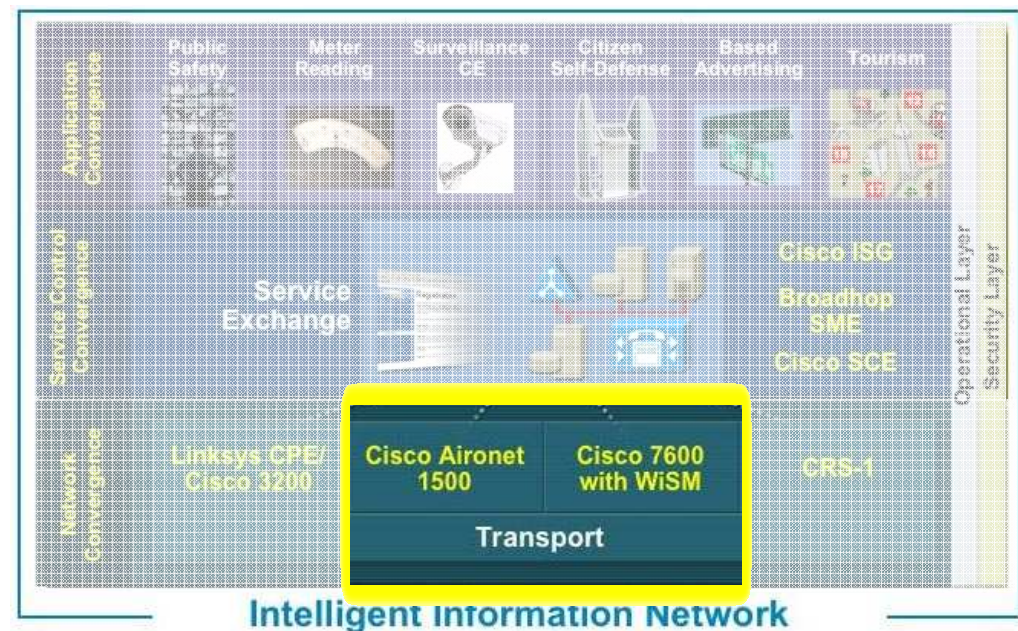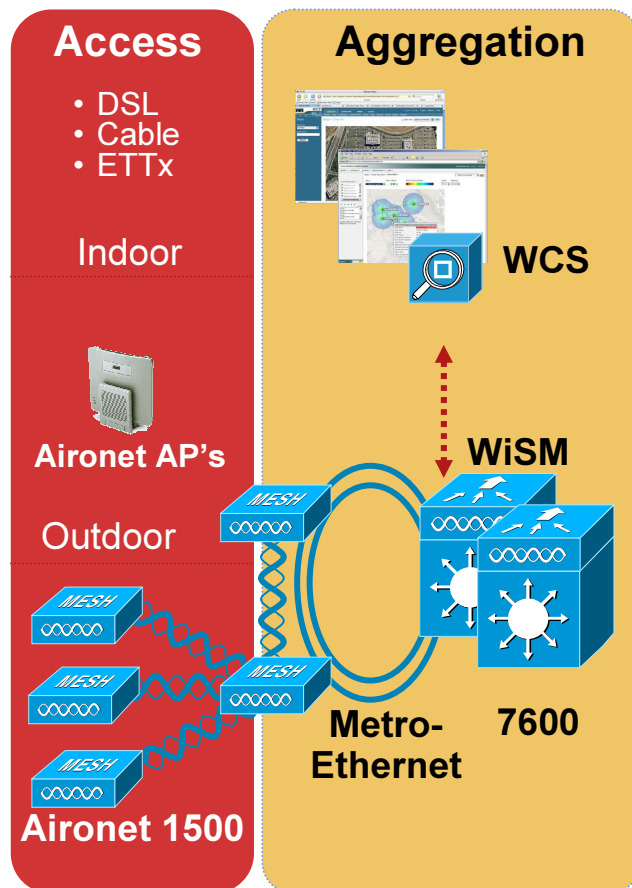
The need for outdoor connectivity: lan-to-lan

Point To MultiPoint

P2MP

Internet

Point To Point

P2P

Advanced Wireless Bridging/Mesh Architectures

Going further with Wireless Mesh access

PoP

P2P

5GHz

Option B

Internet

2.4GHz

Option A

Outdoor Wireless Products

- Cisco has a comprehensive suite of products for Outdoor Wireless connectivity

  - AP1242 IOS/LWAPP

  - BR1310 2.4GHz Bridging

  - BR1410 5GHz Bridging

  - 3270 Mobile Access Router

  - AP1510 Mesh

  - AP1522 Mesh

  - AP1242/AP1131 Enterprise M

The industry's 1st intelligent Wireless Mesh solution

- **Engineered for ease of deployment** and management

  Identical indoor/outdoor management

  Based on LWAPP (Capwap RFC)

- **Self-configuring, self-healing** Mesh

  Zero-touch configuration

  Cisco's Adaptive Wireless Path (AWPP) Protocol for fault-tolerant Mesh deployments (base of future **802.11s**)

- Robust embedded **security**

  EAP Fast encrypted Backhaul links
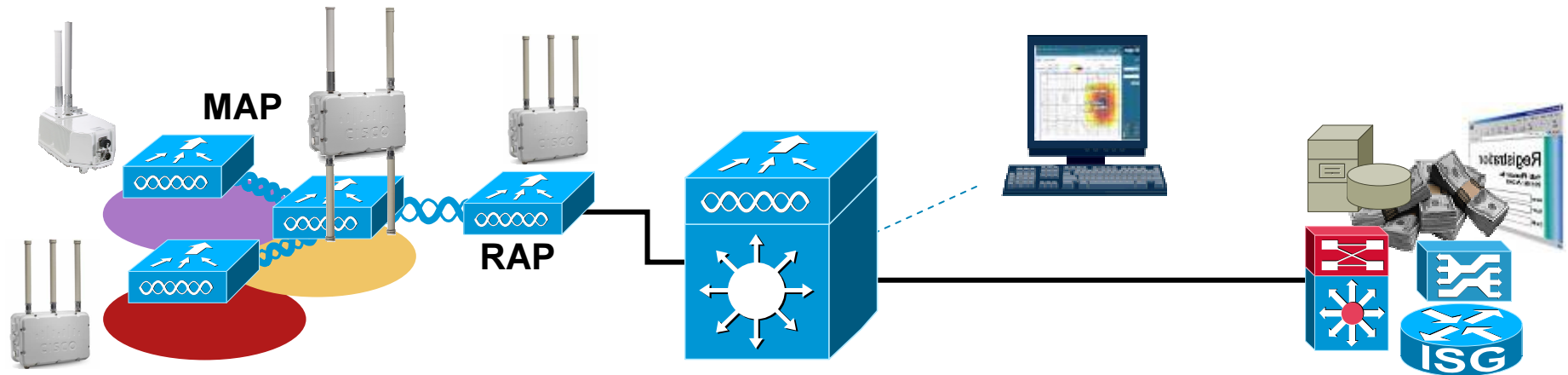
  Embedded 802.11i

- Provides **seamless L3 mobility**

  Fast, secure intra and inter subnet roaming, maintaining 802.1x security

Controller
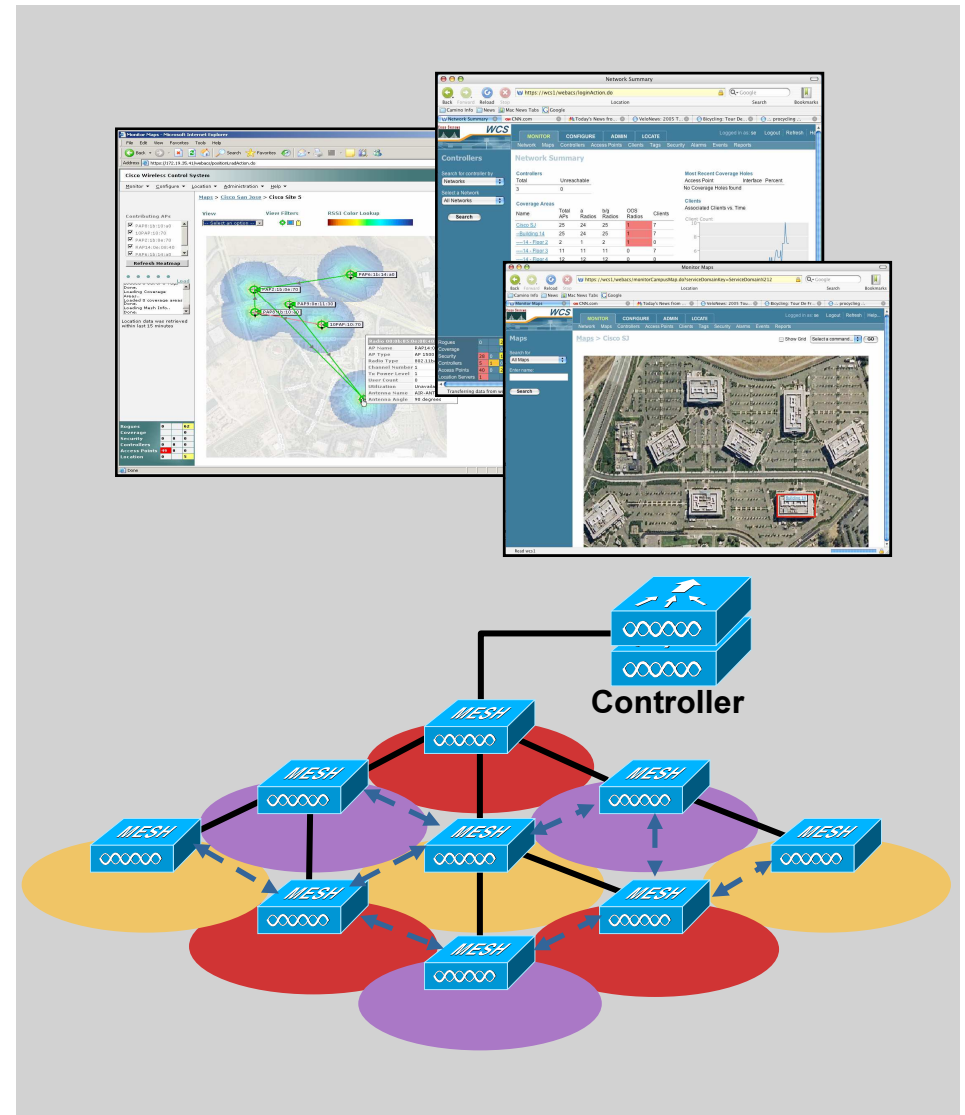
Mesh Overview

Outdoor Wireless Mesh Solution Components

MAP

RAP

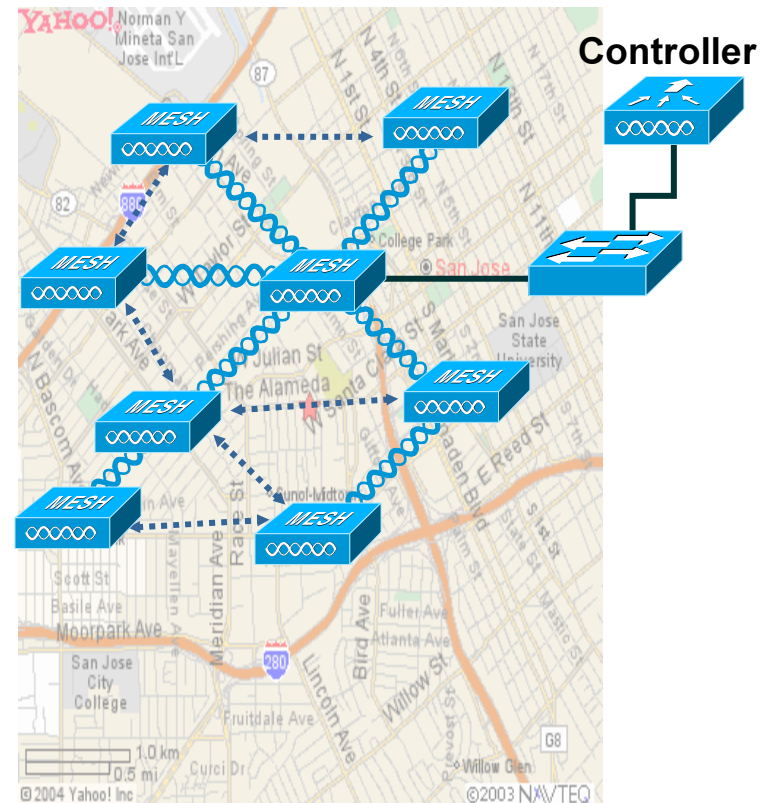| Mesh Access Point	Root Access Point	Wireless LAN Controller	Wireless Control System (WCS)	Back Office Systems
• 802.11b/g client access • Connects to Root AP via 802.11a • AC/DC power; PoE capable • Ethernet port for connecting peripheral devices (POE) • Battery backup	• Serves as "Root" AP to the wired network • Typically located on roof-tops or towers • Connects up to 35 Mesh APs using 802.11a • Access QoS and encryption	• 7600 Module links Wireless Mesh APs to wired network • Handles RF algorithms and optimization • Seamless WiFi mobility • Provides security/ mobility mgt	• Wireless Mesh Management System enables network-wide policy configuration and device management\ • SNMPv3, Syslog, IPSec, AAA, etc	• Bandwidth Monitoring and Management • Policy Definitions • Subscriber Database Management • Billing and OSS Systems

Industry Proven Devices at Every Layer

Reliable Hardware

Dynamic, Intelligent Path Selection
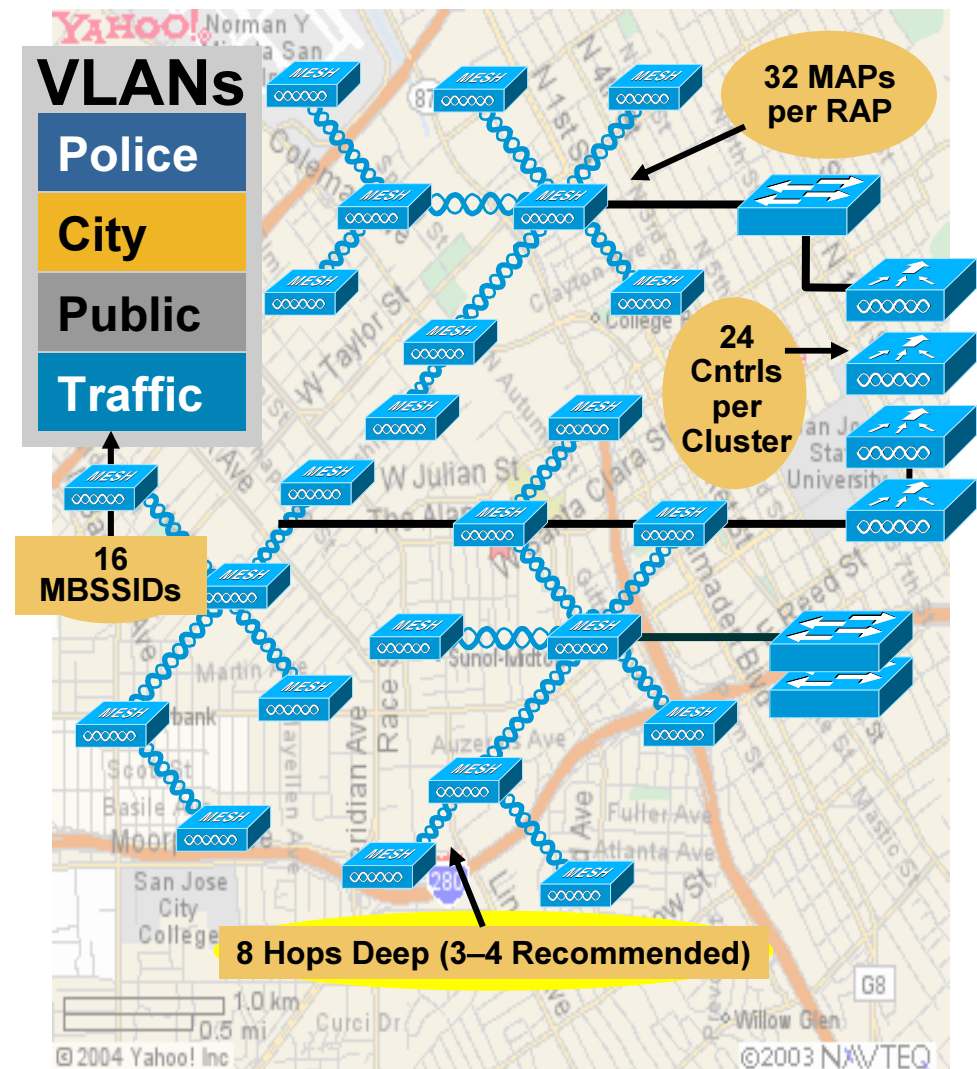## Cisco Extends Routing Leadership to Wireless

- Adaptive Wireless Path Protocol (AWPP)

  Cisco AWPP is part of the IEEE **802.11s** committee

- AWPP establishes an best (easiest) path to the Root

- Background Scanning maintains neighbor and feasible successor list

- Optimal parent selection selects the path ease across each available backhaul channel

- AWPP integrates 802.11h DFS for radar detection and avoidance

Controller

Note: AWPP Uses a "Parent Sticky" Value to Mitigate Route Flaps

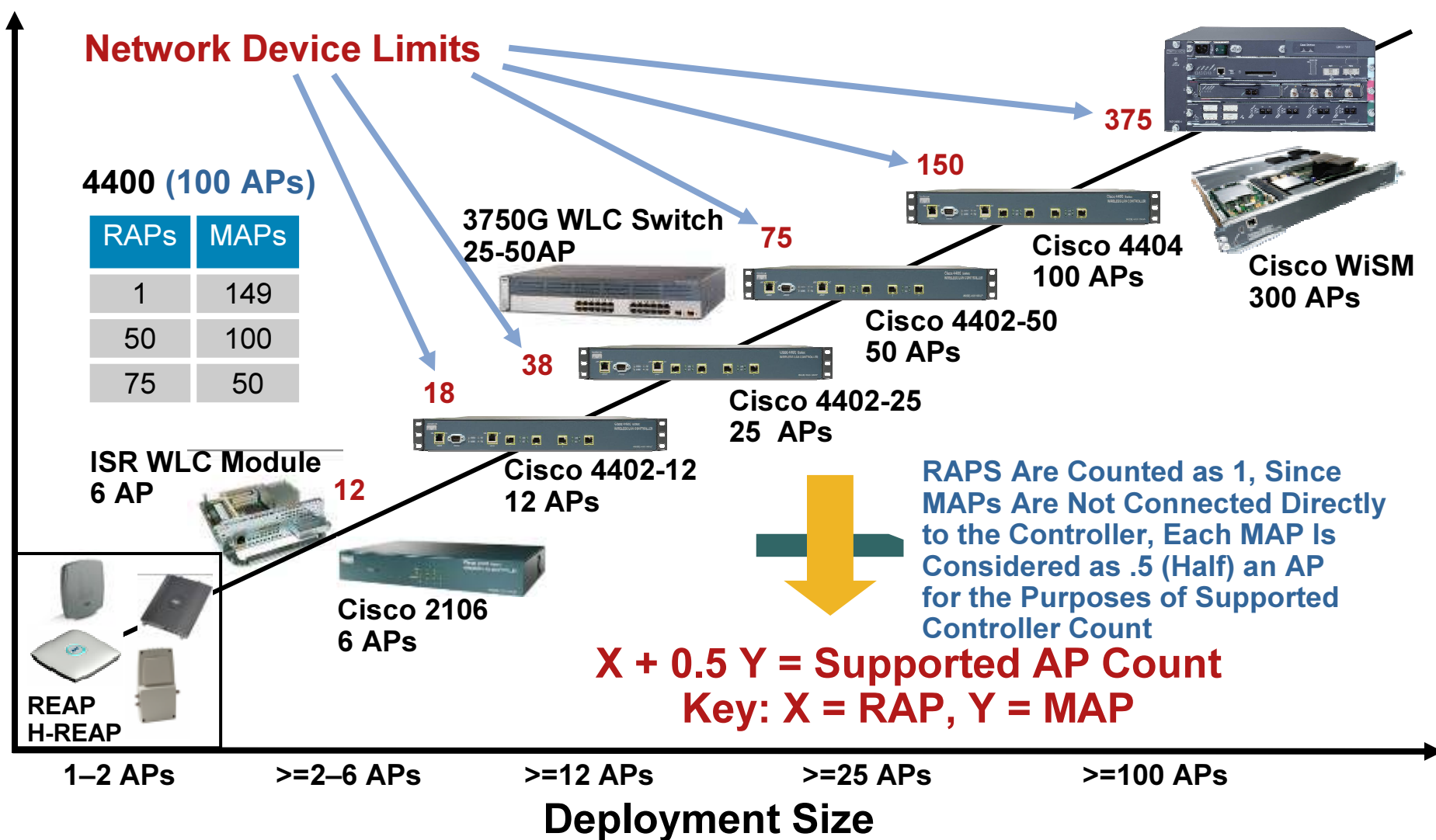**Dynamic Foundation** — **Self-Configuring, Self-Healing, Dynamic Path Optimization**

Mesh Easily Scales as the Network Grows

- Increase AP density

- Add additional RAPs

  Mesh APs will join new RAPs with better path metrics

- Easily add Controllers

  Up to 24 Controllers can be part of an N+1 cluster

- Architecture is ready for additional radios when extra capacity is required

- Mesh radio links can be viewed and managed graphically using WCS

- WCS Navigator manages up to

  20 WCSs & 20,000 APs

VLANs
- Police
- City
- Public
- Traffic

16 MBSSIDs

32 MAPs per RAP

24 Cntrls per Cluster

8 Hops Deep (3–4 Recommended)

Cisco Wireless Controller Family

4400, WiSM(6500/7600) & 2106 Platforms supported for Mesh

Network Device Limits

375

150

4400 (100 APs)

RAPs	MAPs
1	149
50	100
75	50

3750G WLC Switch 25-50AP

75

Cisco 4404 100 APs

Cisco WiSM 300 APs

Cisco 4402-50 50 APs

38

Cisco 4402-25 25 APs

18

ISR WLC Module 6 AP

12

Cisco 4402-12 12 APs

RAPS Are Counted as 1, Since MAPs Are Not Connected Directly to the Controller, Each MAP Is Considered as .5 (Half) an AP for the Purposes of Supported Controller Count

REAP H-REAP

Cisco 2106 6 APs

X + 0.5 Y = Supported AP Count
Key: X = RAP, Y = MAP

| 1–2 APs | >=2–6 APs | >=12 APs | >=25 APs | >=100 APs |

Deployment Size

Adding Controller Intelligence to Outdoor Networks

- Automatic service load-balancing across Wireless LAN Controllers

  LWAPP communicates Controller load to APs

  APs register with lightly loaded Controllers

- Dynamic RF optimization

  Dynamic channel assignment

  Transmit power control

  Coverage hole detection

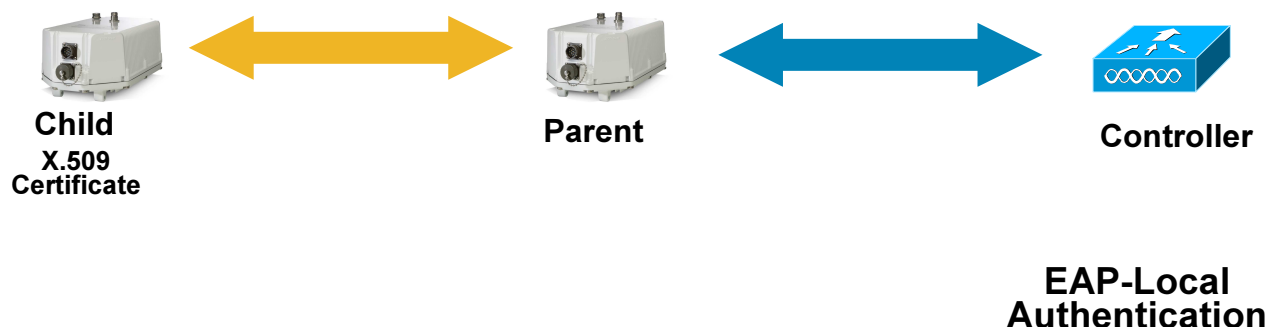 APs learn secondary and tertiary Wireless LAN Controllers at "Network Join"
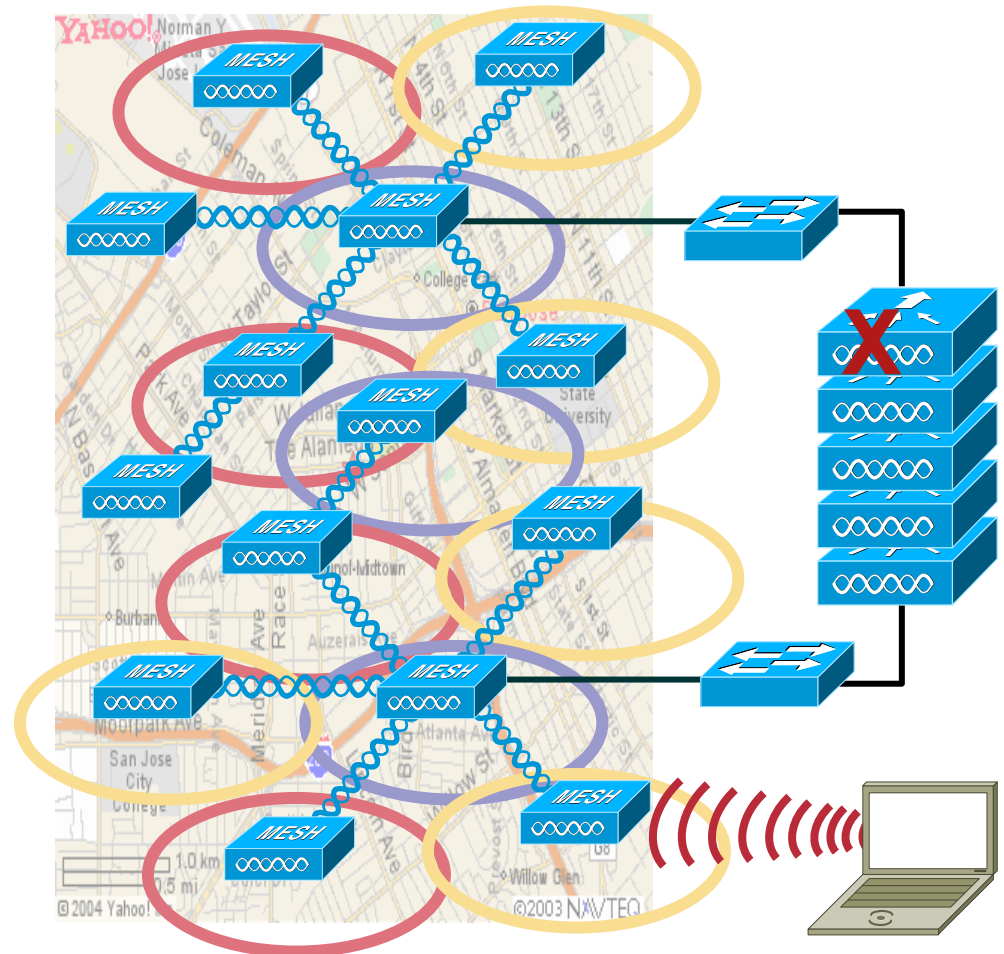
Secure Control

Delivering Mission-Critical Wi-Fi Access

Mesh Security

Zero Touch Configuration for Provisioning Security

Child
X.509
Certificate

Parent

Controller

EAP-Local
Authentication

- ## EAP-Local Authentication of APs

  Certificate-based Authentication of APs

  4-way handshake and key derivation

- ## PSK Authentication

External Authentication Server for Mesh APs is being supported in the next software release

Providing Security at Each Step
The Most Robust Security in the Outdoor Wireless Industry

AP X.509 Certificate Authentication

Integrated Wireless IDS

AMR

Internet

802.1x WPA/WPA2

Mutual Mesh AP Auth

Controller

Muni

Dynamic VLAN Assignment

MESH

EAP for Encrypted Mesh Links

MESH

IPSec VPN

Public Safety

Departmental MPLS VPNs
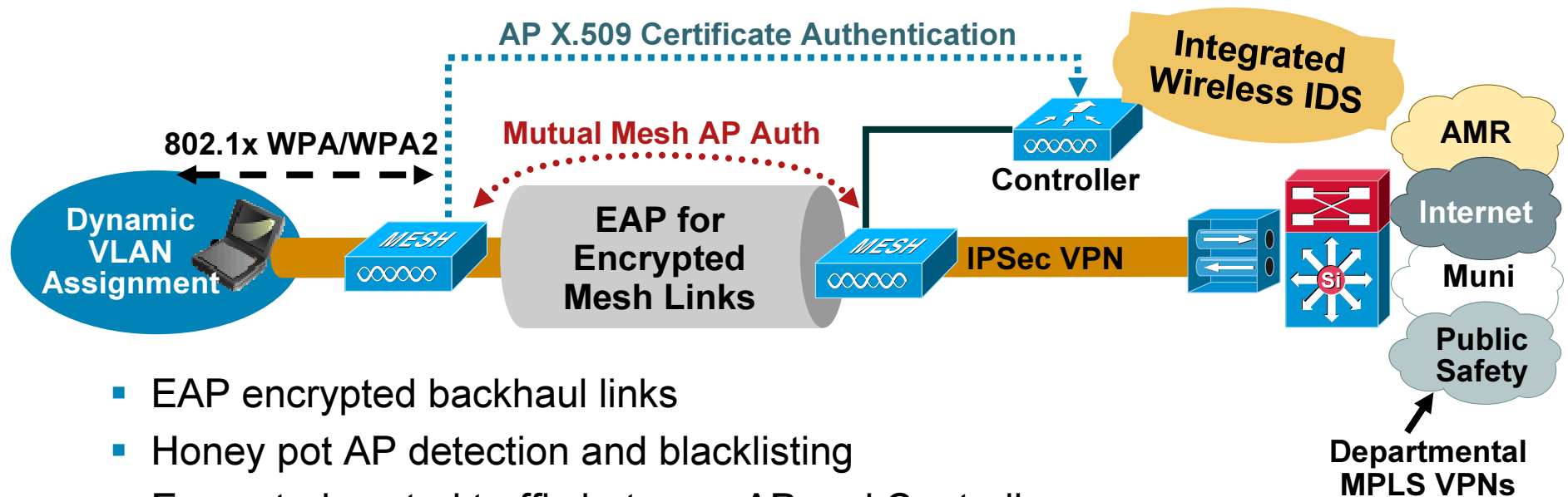
- EAP encrypted backhaul links
- Honey pot AP detection and blacklisting
- Encrypted control traffic between AP and Controller
- Integrated Wireless IDS and Attack correlation software
- Dynamic WLAN VLAN assignment + 802.11i WPA/WPA2 security
- Mobile IPSec VPNs for "confidential" mesh client traffic

  Cisco's new Mobile VPN Client uninterrupted IPSec roaming between Wi-Fi, cellular, etc. networks

Secure Control

Delivering Mission-Critical Wi-Fi Access
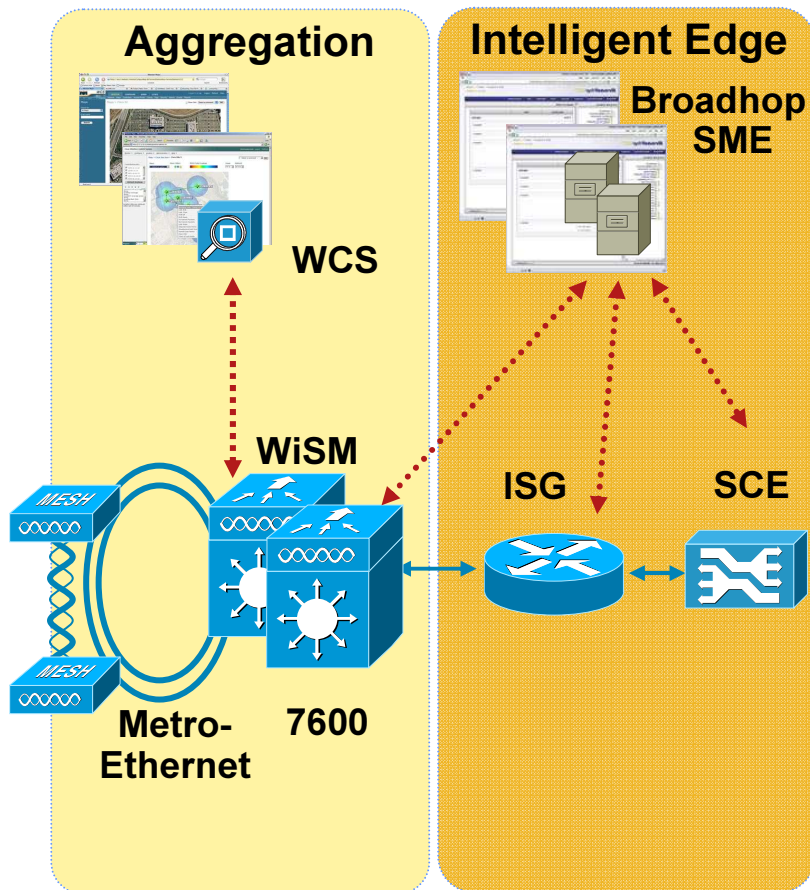
ServiceMesh Backend

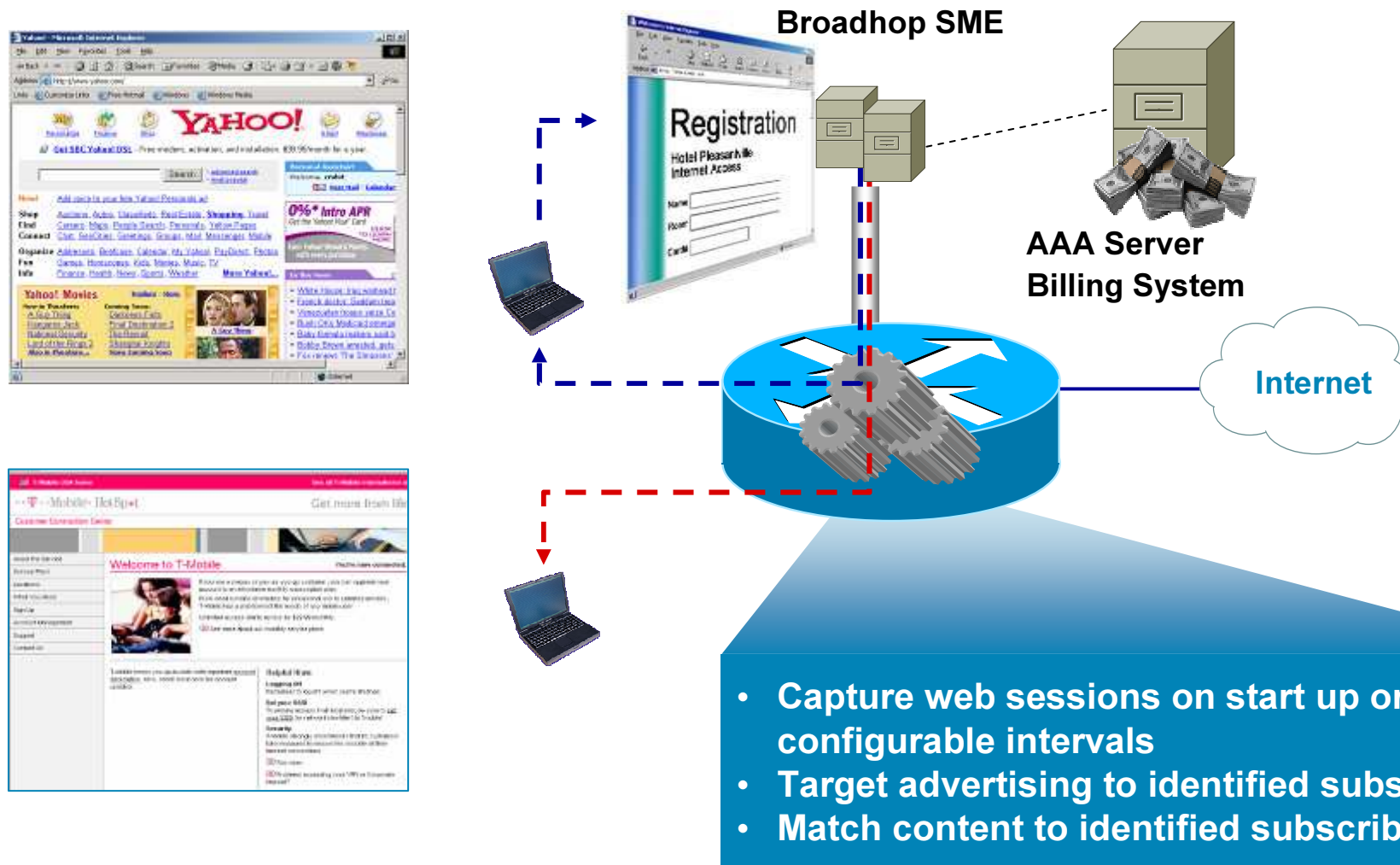# Building the First Mile Aggregation/Control
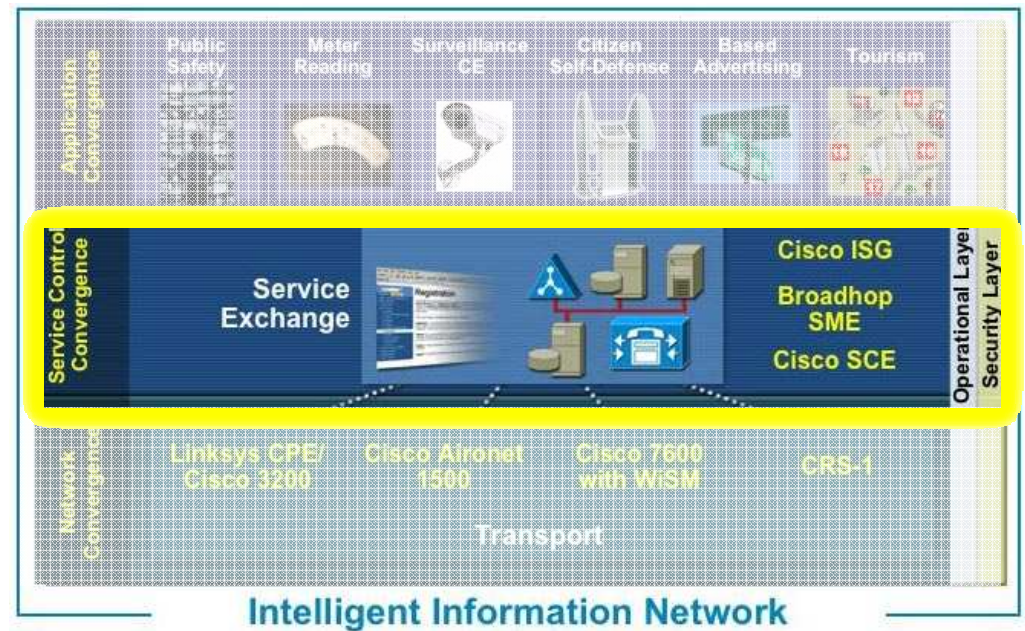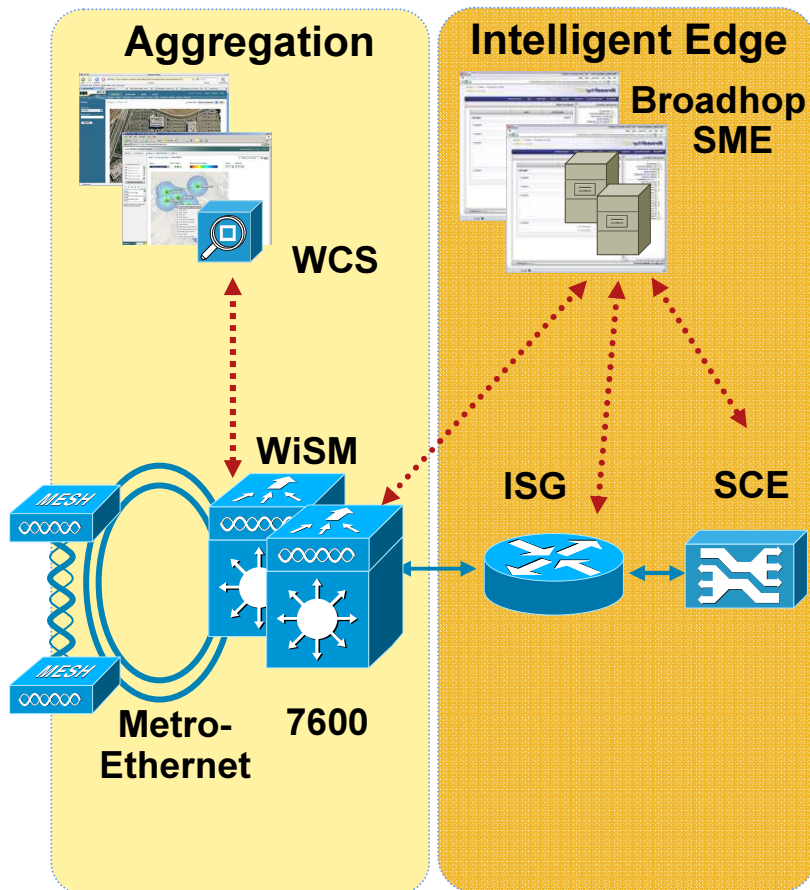
- Service control

Building the First Mile Aggregation/Control

- Service Control—ISG
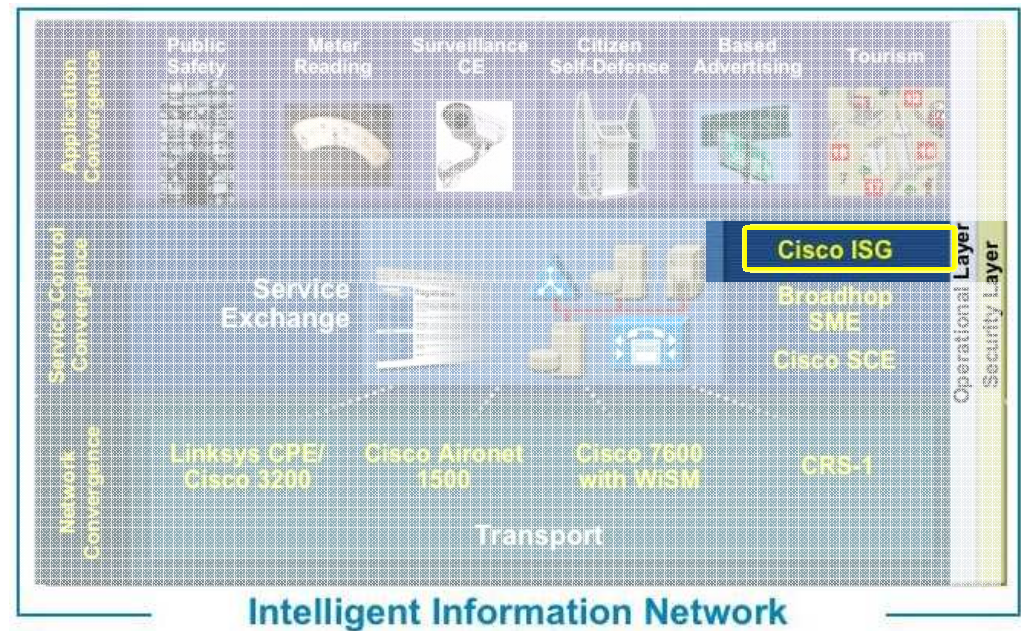
Captive Portals for ServiceMesh Access
Intercept Customers and Force Them to Log On

Broadhop SME

**AAA Server
Billing System**

Internet

- **Capture web sessions on start up or at configurable intervals**
- **Target advertising to identified subscribers**
- **Match content to identified subscribers**

Residential Portal and Self Care
Example of Service Definition and Enforcement

Applications

Cisco ServiceMesh Applications

Municipal

- Pubic safety (video&voice)
- Land management
- RFID tracking applications
- Surveillance
- Meter reading (utility/parking)
- Traffic management

Residential

- Data connectivity
- Choice of payment method
- Turbo-button
- Family member additions
- Parental Control
- Location-based applications

Businesses

- Data connectivity
- Guest access
- Hospitality offerings

Tourism

- Convention directions
- City events and sightseeing
- Emergency help

Many more application examples and partners available at
wwwin.cisco.com/go/servicemesh

Public Safety
In-Vehicle Intelligent Wireless Video

Vehicle with Cisco 3200 Series Router

5 GHz and Cellular
Diversity Antennas

Video
Camera

Mug
Scanner

Phone

Printer

Hand
Held

Networked
Video Recorder
(NVR)

Cisco 3200
Series Router

POLICE
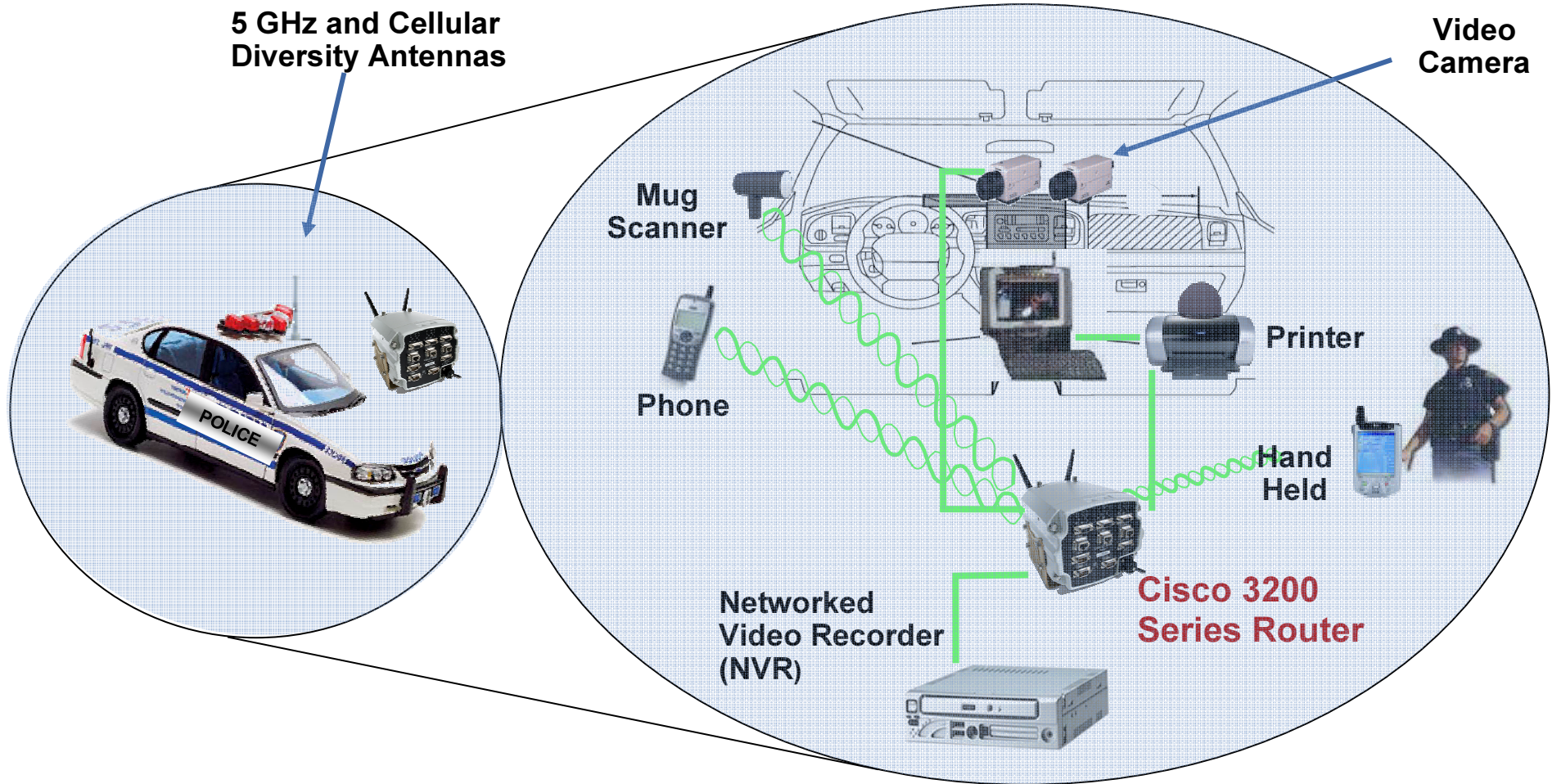
OTT Revenue Generation Revenue Sharing with Service Providers

YAHOO!

Google

AOL

msn

- Location-based ADs
- Location-based Search
- Local content
- Music distribution
- Video cast

Location-Based Services
Web Portal Advertising Insertion

Local Banner

Local Search

Local Content

Local Ads

Local Roaming

Deployments

City of Luxembourg

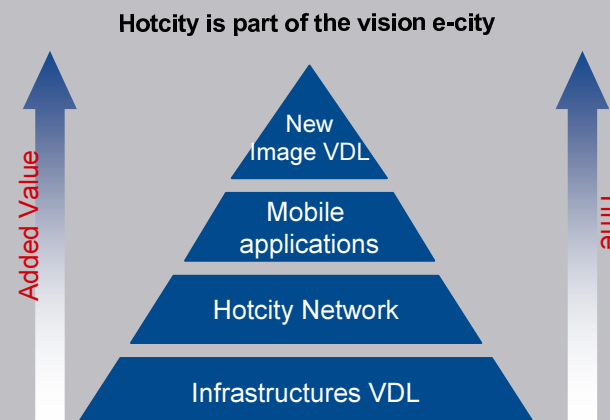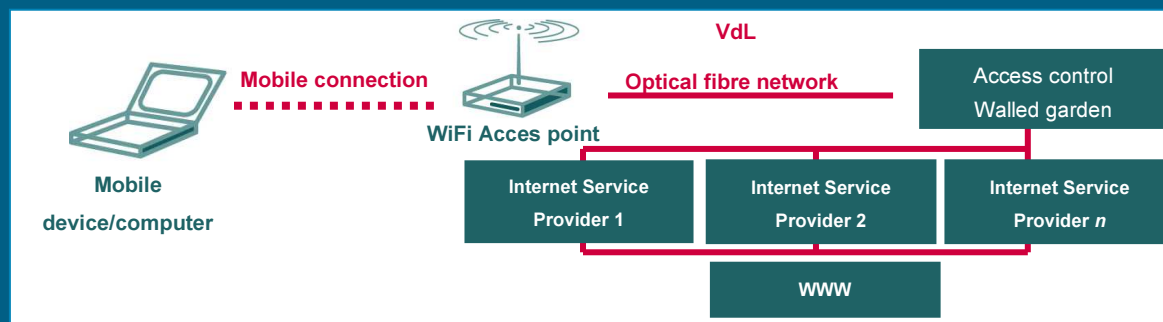## The Challenges

- Create a unique project
    - Open and Focus on consequent partnership
    - Leverage of existing projects at VDL
    - International know how in a global approach
    - The key to success: a synergetic and symbiotic approach in;
        - Technology
        - Content
        - Marketing & Sales
- Progressively attract the following target groups :
    - Early adopters & young people
    - Businessmen & Commuters
    - Smart Shoppers & Citizens
    - Seniors / Tourists / Disabled People
- Why HotCity? Not a concept, it was the result of a research study
    - Hotcity has been planned in the « Livre blanc » e-city
    - It is a platform that will enable innovative e-services
    - It is a capitalization of former investments in infrastructure
    - It offers new City management perspectives
    - It is positioning the city in a global competitive perspective

HOT CITY

...embourg goes wireless

Hotcity is an initiative of the City of Luxembourg

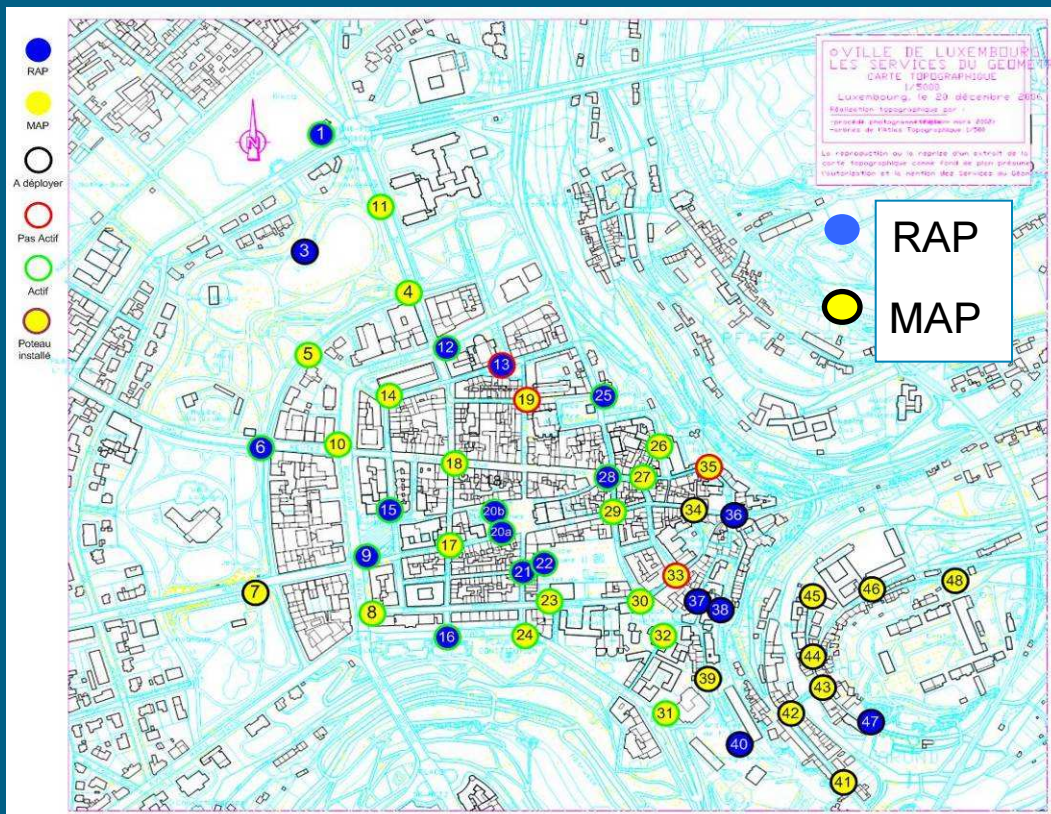# City of Luxembourg

The Solution

- Based on 1510/1522 APs, 7301-ISG and BroadHop SME
- Building on existing assuring consistency
  - Maximizing existing infra, leading and branding the project.
  - Creating dialog and stake holder cooperation
  - Being open, transparent and collaborative platform
- More than a technical Infra
  - Long-term commitment,
  - Community and stake-holder based approach
  - Hotcity is part of e-city, a key city opportunity

Hotcity is part of the vision e-city

Added Value

Time

- New Image VDL
- Mobile applications
- Hotcity Network
- Infrastructures VDL

VdL

Mobile connection

Optical fibre network

Access control
Walled garden

WiFi Acces point

Mobile
device/computer

Internet Service Provider 1	Internet Service Provider 2	Internet Service Provider n

WWW

City of Luxembourg

The Solution (Phase 1 & 2)

Hotcity is a technical infrastructure for wireless mobile internet connection in the city of Luxembourg

City of Luxembourg

Customer Benefits

- Hotcity is a unique opportunity for all stakeholders:
  - Promotional platform for local trade and business
  - Technical framework for service providers
  - Technical platform for research and science
  - Economical trigger: training, job creation
  - Boosting up the dialogue between stakeholders
  - Technical benchmark for the Greater Region

Internet Public Applications:
- SOS Seniors
- Ludo- educative Games
- Mobility
- Tourist Guide

Commercial Applications :
- Find a friend
- Find a commerce
- Mobile Marketing

A Sustainable Business model **HOT**CITY based on various partnerships

Institutional Partners:
- Restena
- Lela
- Police

Telecom Operators:
- Internet Access
- CMTS mixed offer
- VOIP
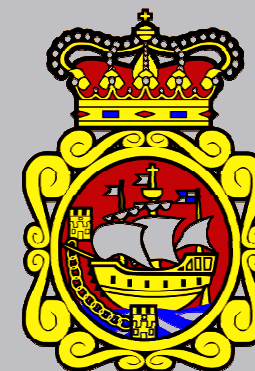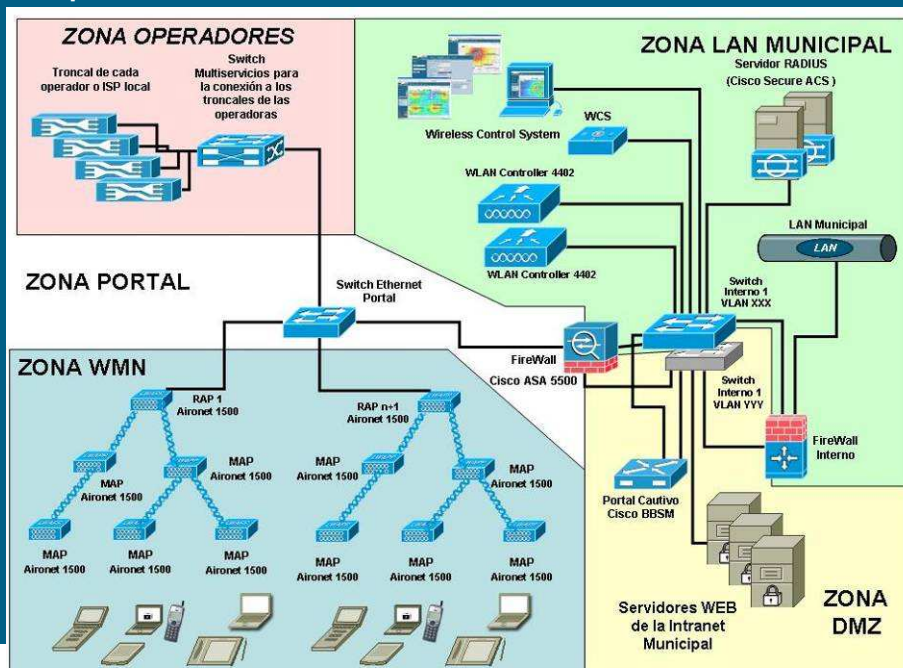
Internal Services:
- BCS
- GIS
- Connectivity

City of Aviles, SPAIN

- GOAL

Design, develop, deploy and manage a public metro WiFi network to provide broadband connection to public services.
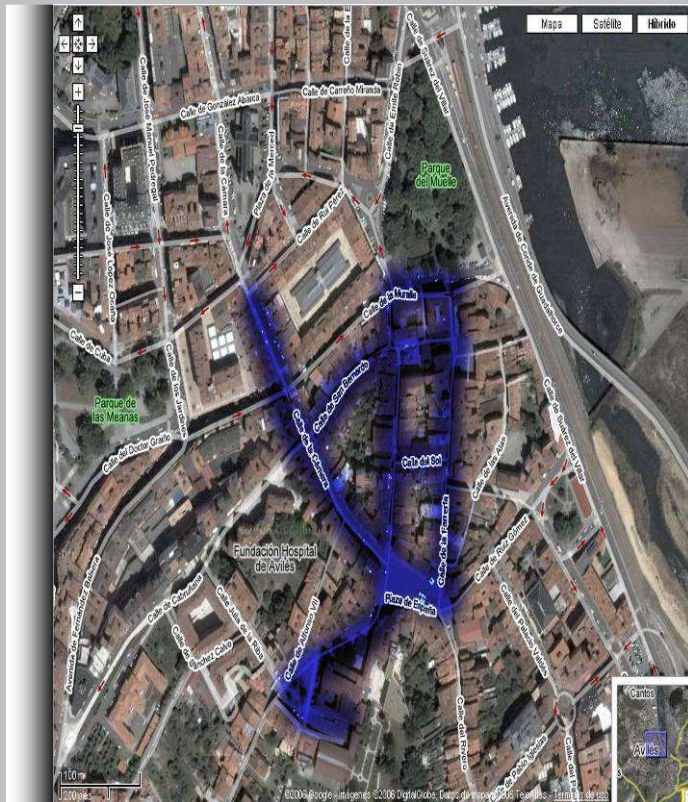
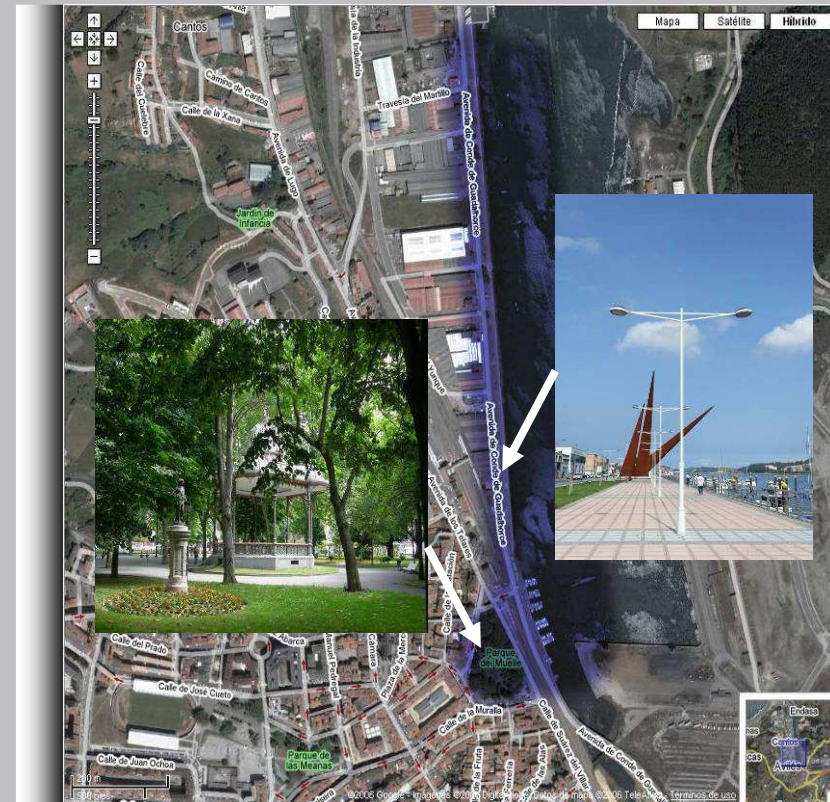To provide coverage on main streets, squares and sea side pedestrian area.

Customer:
        Avilés Council
Program:
        Avilés, Digital City.
Investment:
        Turn-Key for 2 years.

City of Aviles, SPAIN

The Solution (Areas of Deployment)

Historic Center

Sea-Side Park/Walk
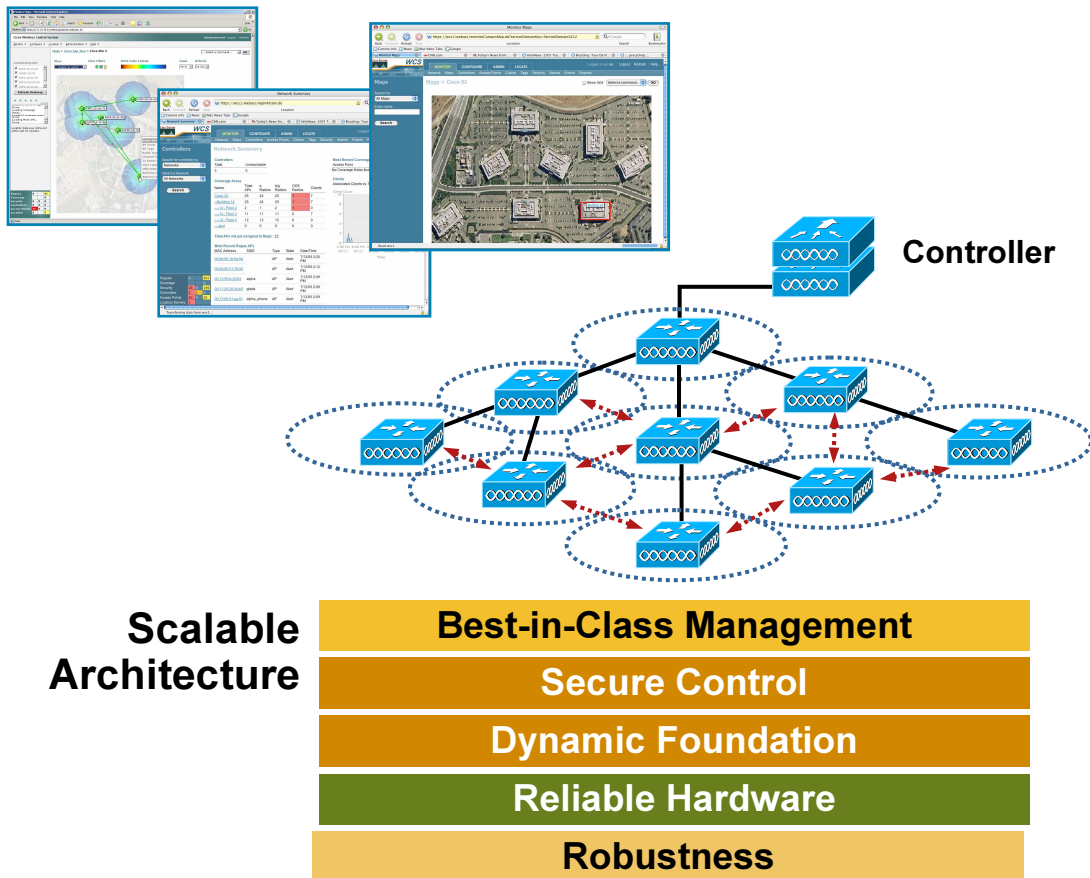
City of Aviles, SPAIN

Customer Benefits

- Citizens and tourists have access to broadband services in outdoor areas such as city parks, downtown shopping areas

- Enhanced business opportunities through access to the wireless network

- Attracting tourism

Wireless Mesh Networking
Summary

Controller

Scalable Architecture

Best-in-Class Management
Secure Control
Dynamic Foundation
Reliable Hardware
Robustness

- Cisco's best-in-class indoor/outdoor wireless solution changes the game

- Wired + wireless integration enables unified policy definition and management

- Cisco's wireless mesh networking architecture is secure, reliable, scalable, and easy to deploy and manage

System   A Unified Indoor/Outdoor Wireless Solution