



Altai Technologies

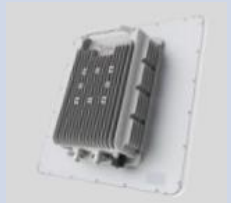
Altai Solution Basic Introduction Training

Date: By Technical Support
May 13, 2016

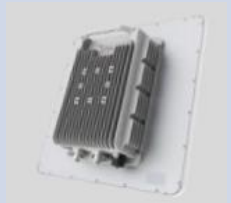
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ALTAI PRODUCT INTRODUCTION

Macro Coverage — A8n series

A8n Super WiFi	A8-Ein		A8in		A8n	
Technology		8x8 MIMO DBDC		8x8 MIMO DBDC		8x8 MIMO DBDC
Standards		a/b/g/n		a/b/g/n		a/b/g/n
LOS access		1.7 km x 100°		1 km x 360°		1 km x 70° to 360
LOS bridge		30 km 5GHz		30 km 5GHz		30 km 5GHz
Data rate		300+300 Mbps		300+300 Mbps		300+300 Mbps
Antenna		Int. 19dBi 2.4GHz Ext. 5GHz		Int. 14dBi 2.4GHz Ext. 5GHz		Ext. 14dBi 2.4GHz Ext. 5GHz

Macro Coverage — A8n (ac) series

A8n Super WiFi	A8-Ein (ac)		A8in (ac)		A8n (ac)	
Technology		8x8 MIMO DBDC		8x8 MIMO DBDC		8x8 MIMO DBDC
Standards		a/b/g/n/ ac		a/b/g/n/ ac		a/b/g/n/ ac
LOS access		1.7 km x 100°		1 km x 360°		1 km x 70° to 360
LOS bridge		30 km 5GHz		30 km 5GHz		30 km 5GHz
Data rate		300+867 Mbps		300+867 Mbps		300+867 Mbps
Antenna		Int. 19dBi 2.4GHz Ext. 5GHz		Int. 14dBi 2.4GHz Ext. 5GHz		Ext. 14dBi 2.4GHz Ext. 5GHz

Micro Coverage — A3 series

A3 3x3 802.11ac	A3-Ei		A3w Indoor		A3c Indoor	
Technology		3x3 MIMO DBDC		3x3 MIMO DBDC		3x3 MIMO DBDC
Standards		a/b/g/n/ ac		a/b/g/n/ ac		a/b/g/n/ ac
LOS access		1 km x 60° 2.4GHz 250 m x 80° 5GHz		800 m x 55° 2.4GHz 200 m x 55° 5GHz		500 m x 360° 2.4G 200 m x 360° 5GHz
LOS bridge		11 km 5GHz		NA		NA
Data rate		450+1300 Mbps		450+1300 Mbps		450+1300 Mbps
Antenna		Int. 12dBi 2.4GHz Int. 13dBi 5GHz		Int. 9dBi 2.4GHz Int. 9dBi 5GHz		Int. 3dBi 2.4GHz Int. 8dBi 5GHz

Micro Coverage / Wireless Bridge — A2 series

A2 AP/Bridge	A2-Ei		A2		A2e	
Technology		2x2 MIMO DBDC		2x2 MIMO DBDC		2x2 MIMO DBDC
Standards		a/b/g/n		a/b/g/n		a/b/g/n
LOS access		1 km x 60° 2.4GHz 350 m x 80° 5GHz		500 m x 360° 2.4G		900 m x 37° 2.4GHz
LOS bridge		NA		25km 5GHz		50km 5GHz
Data rate		300+300 Mbps		300+300 Mbps		3000+300 Mbps
Antenna		Int. 14dBi 2.4GHz Int. 15dBi 5GHz		Ext. 5dBi+ 2.4GHz Int. 16dBi 5GHz		Int. 13dBi 2.4GHz Ext. 20dBi+ 5GHz

Micro Coverage / Wireless Bridge — A2 series

A2 AP/Bridge	DAS WiFi AP	
Technology		
Standards		b/g/n
LOS access		NA
LOS bridge		NA
Data rate		150 Mbps
Antenna		To be DAS

Long Wireless Bridge — B5 series

	B5 PTP 23 dBi	B5 PTP 28 dBi	B5 PTP ext. ant.	B5 Lite PTP 19 dBi	B5 Lite PTP 23 dBi
Transmit power	23 dBm	23 dBm	23 dBm	18 dBm	18 dBm
Antenna type	Int. panel	Int. panel	Ext. 1.2 m dish	Int. panel	Int. panel
Antenna gain	23 dBi	28 dBi	32 or 34 dBi	19 dBi	23 dBi
Maximum throughput	300 Mbps	300 Mbps	300 Mbps	300 Mbps	300 Mbps
Distance (up to)	20 km	50 km	80 km	10 km	15 km

	B5 PTMP 16 dBi	B5 PTMP 16 dBi	B5 PTMP ext. ant.	B5 CPE 19 dBi	B5 CPE 21 dBi	B5 CPE ext. ant.
Transmit power	23 dBm	23 dBm	23 dBm	18 dBm	18 dBm	18 dBm
Antenna type	Int. sector	Int. sector	Ext. sector	Int. panel	Int. panel	Ext. panel
Antenna gain	16 dBi	16 dBi	16 or 17 dBi	19 dBi	21 dBi	19 or 24 dBi
Maximum throughput available	40 Mbps	300 Mbps	300 Mbps	8 Mbps	8 Mbps	8 Mbps
	300 Mbps			50 Mbps	50 Mbps	50 Mbps
				300 Mbps	300 Mbps	300 Mbps
Distance (up to)	20 km	35 km	20 km	7 km	10 km	35 km

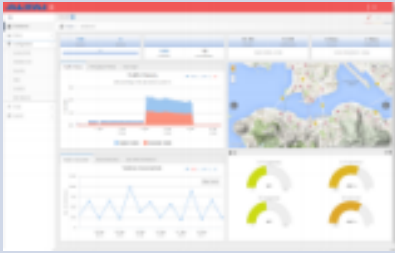
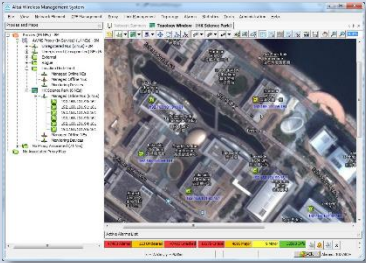
Pico Coverage / CPE — C1n series

C1n Super CPE	C1n		C1an		C1xn/C1xan	
Technology		2x2 MIMO		2x2 MIMO		2x2 MIMO
Standards		a/b/g/n		a/b/g/n		C1xn b/g/n C1xan a/n
LOS access		600 m x 70° 2.4GHz		250 m x 45° 5GHz		C1xn 900 m x 85° C1xan 300 m x 60°
LOS CPE		4 km to A8-Ein 3 km to A2-Ei		1 km to A8-Ein 2 km to A2-Ei		C1xn/C1xan 5.5/1 km to A8-Ein
LOS bridge		NA		13km 5GHz		C1xan 40 km 5GHz
Data rate		300 Mbps		300 Mbps		300 Mbps
Antenna		Int. 10dBi 2.4GHz		Int. 14dBi 5GHz		C1xn ext. 2.4GHz C1xan ext. 5GHz

USB CPE — U1

	U1	
Antenna	USB CPE for laptop 	Int. 10 dBi $\pm 45^\circ$ patch 2.4GHz
Beamwidth		30°H, 70°V 2.4GHz
LOS access		N/A
LOS CPE		3.5 km to A8-Ein 3 km to A2-Ei
LOS bridge		N/A
Standards		b/g/n
Data rate		150 Mbps
Dimensions		177 x 80 x 18 mm

Network Management

Network Management	AltaiCare/AWMS
Throughput	Fast deployment & low cost
Network interface	 
Feature	■ Network/AP management ■ Cloud-based zero configuration ■ Service control management ■ Location-aware content management ■ Big data analytics (coming) ■ Visual fault alert via network map ■ Real time system performance/NE traffic statistics

Network Management

Network Management	Service Controller	
Throughput	Authentication & bandwidth control 	■ 2 models available (SC200, SC1600) ■ 200 to 12000 Mbps ■ 5 FE ports to 12 GE ports
Network interface		
Feature	■ Bandwidth control ■ Access control ■ Backhaul routing, firewall ■ VPN server ■ DHCP and proxy servers ...	

Network Management

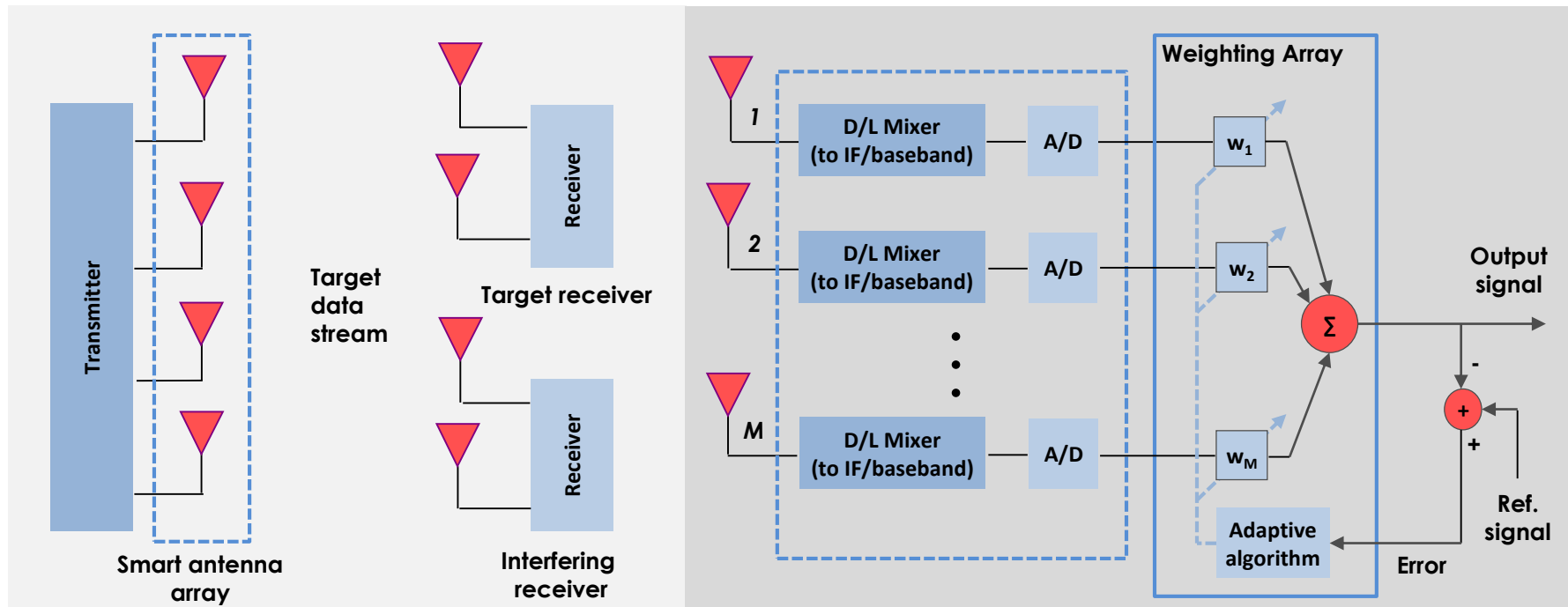
Network Management	Access Controller	
Throughput	CAPWAP tunneling 	■ 5 models available (SC200, SC500, SC2000, SC4000, SC12000)
Network interface		■ 12 to 1152 Gbps ■ 0 to 36 10GE-SR ■ 2 to 24 GE ■ 4 to 288 GE SFP ports
Feature	■ User behavior control ■ Authentication and security ■ Intelligent RF management ■ Wireless control ■ Network management ■ Centralized forwarding	

ALTAI TECHNOLOGY BENEFITS

Altai Solution Benefits — Smart Antenna Technology

■ Paths Optimization

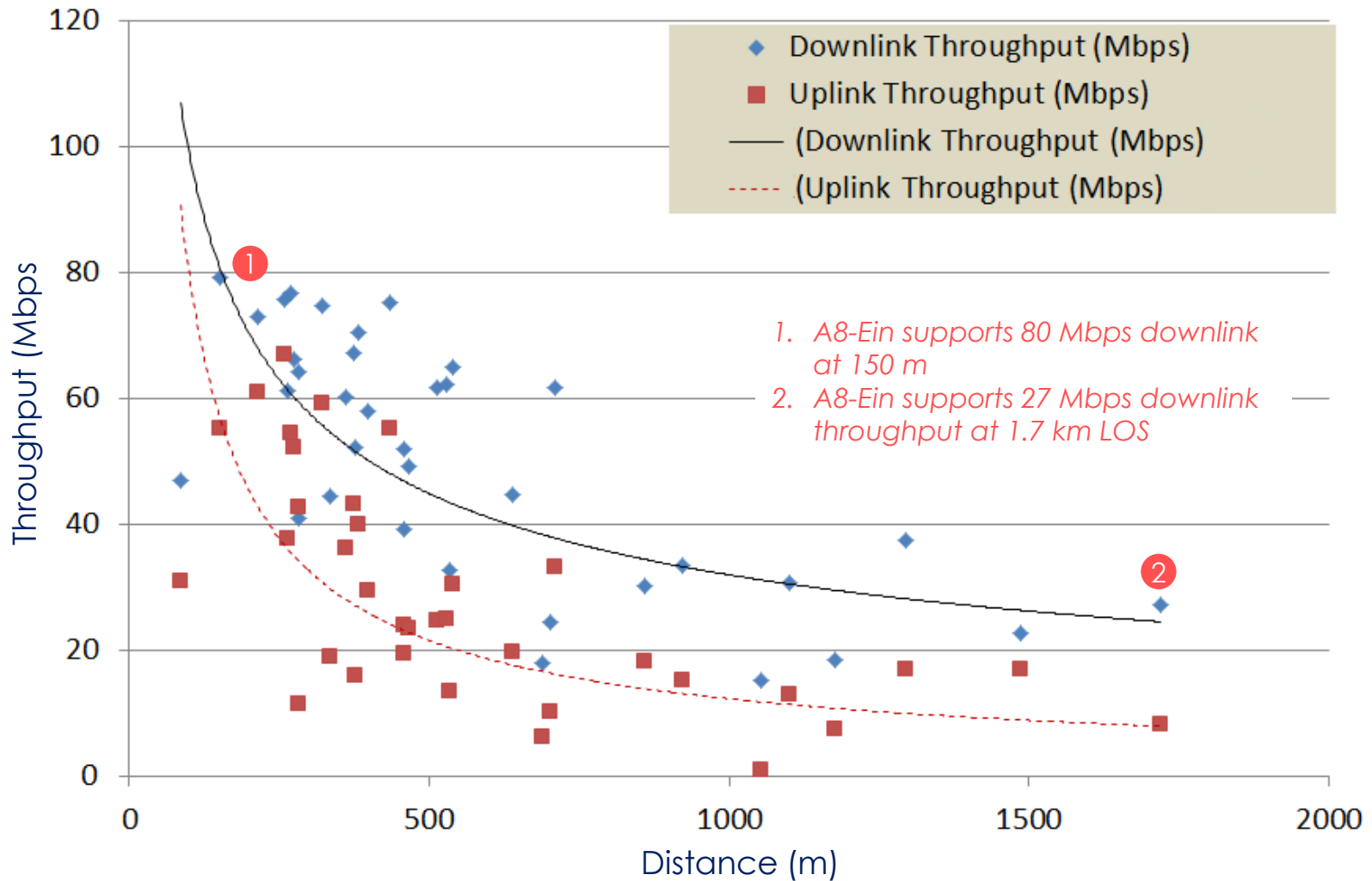
- The A8n series can transmit and receive in the best possible paths by means of analyzing the receiving paths information and adjusting the weighting factors in transmit paths
- When there is a change in a target signal, the self adaptive algorithm in the A8n weighting array will automatically adjust the signal paths direction.



Altai Solution Benefits — Smart Antenna Technology

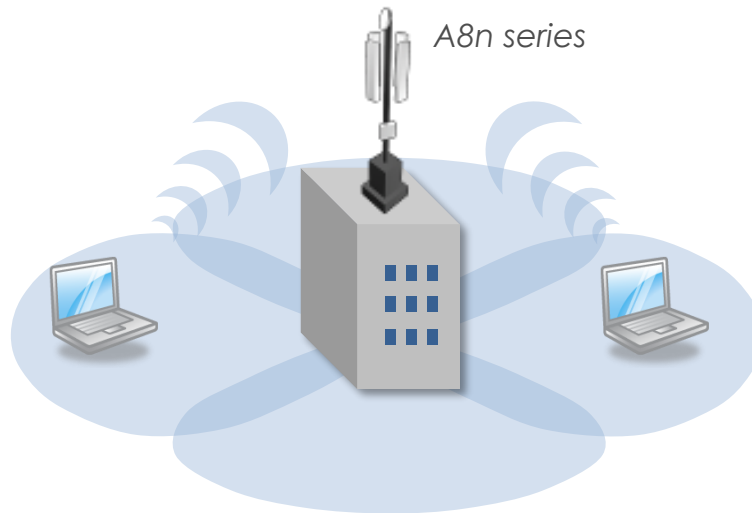
- Greater Coverage & Capacity
 - Take advantage of multi-path signals with very high diversity gain in NLOS environments
- Improve Uplink Performance
 - High receive diversity gain gives much better uplink performance especially favorable to low-powered devices
- Better Interference Mitigation
 - Multiple antennas minimize interference influence

Altai Solution Benefits — Longer Range



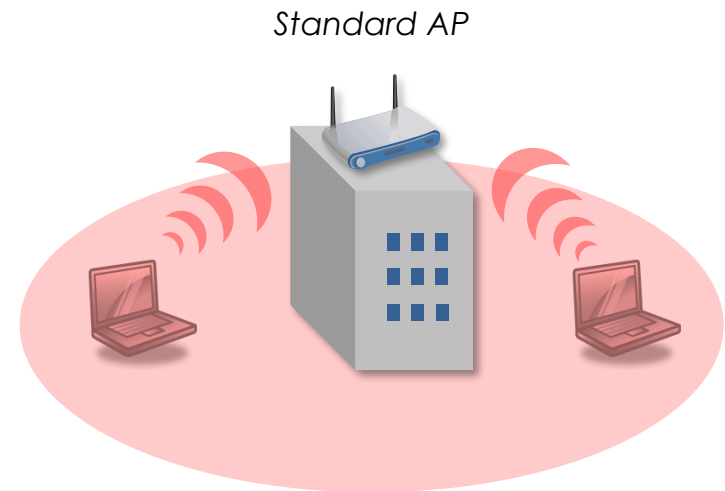
Altai Solution Benefits — More Efficient

Signals from hidden clients can be received by different antenna sectors simultaneously without collision



Multiple-radio/sector coverage

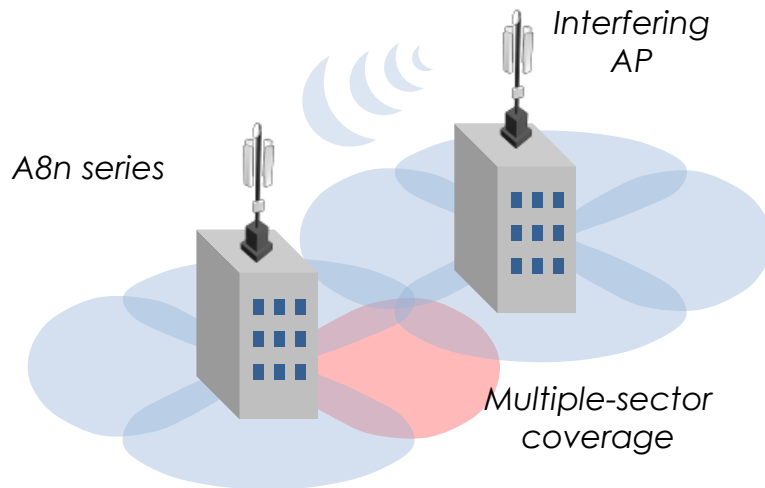
Signals from hidden clients will be collided and have to be resent resulting in lower active user capacity



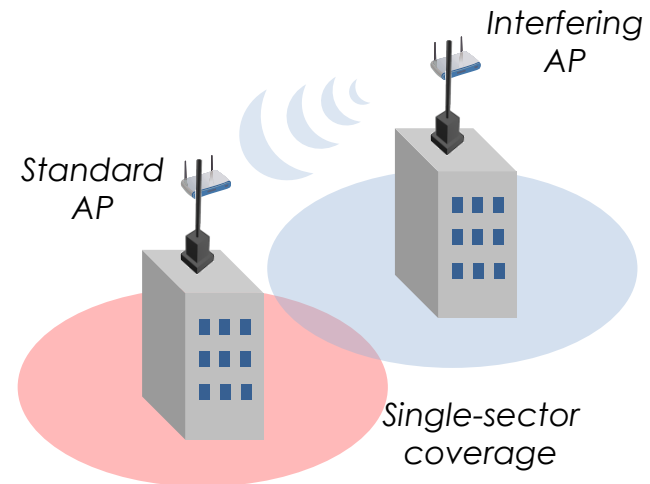
Single-radio coverage

Altai Solution Benefits — Better Interference Mitigation

When the base station is interfered by adjacent site, only one sector affected and other sectors can still work properly

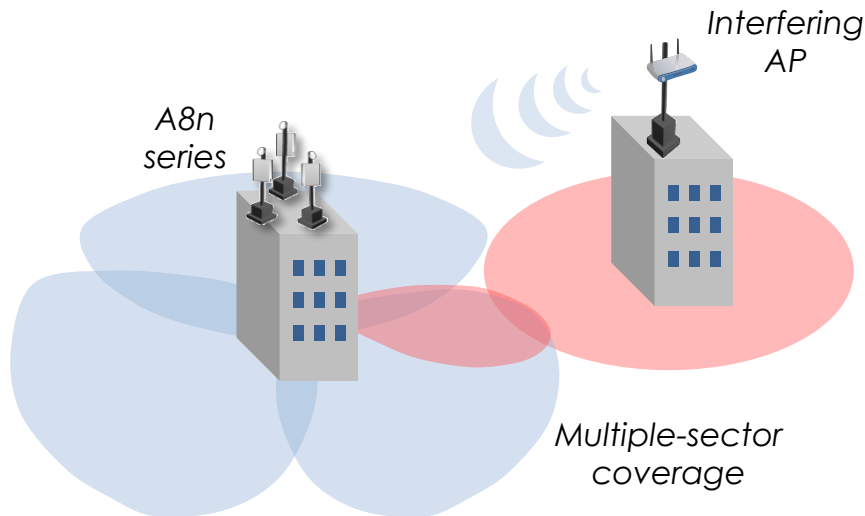


When the AP is interfered by adjacent site, the whole omni sector is affected

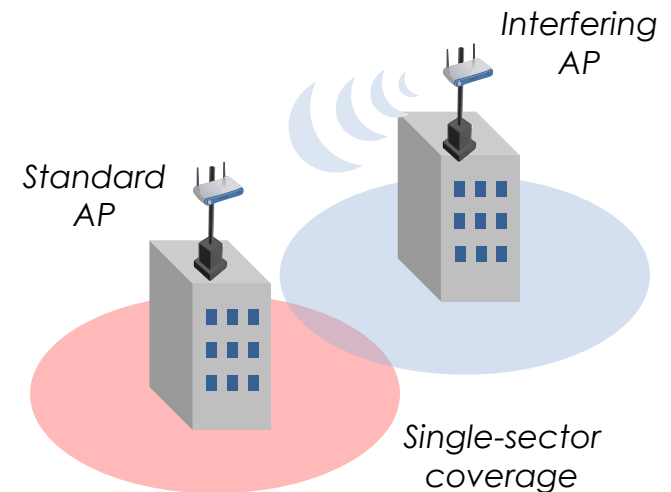


Altai Solution Benefits — Better Interference Mitigation

When the A8-Ein is interfered by adjacent site, only part of a sector is affected and other part of the sector can still work properly

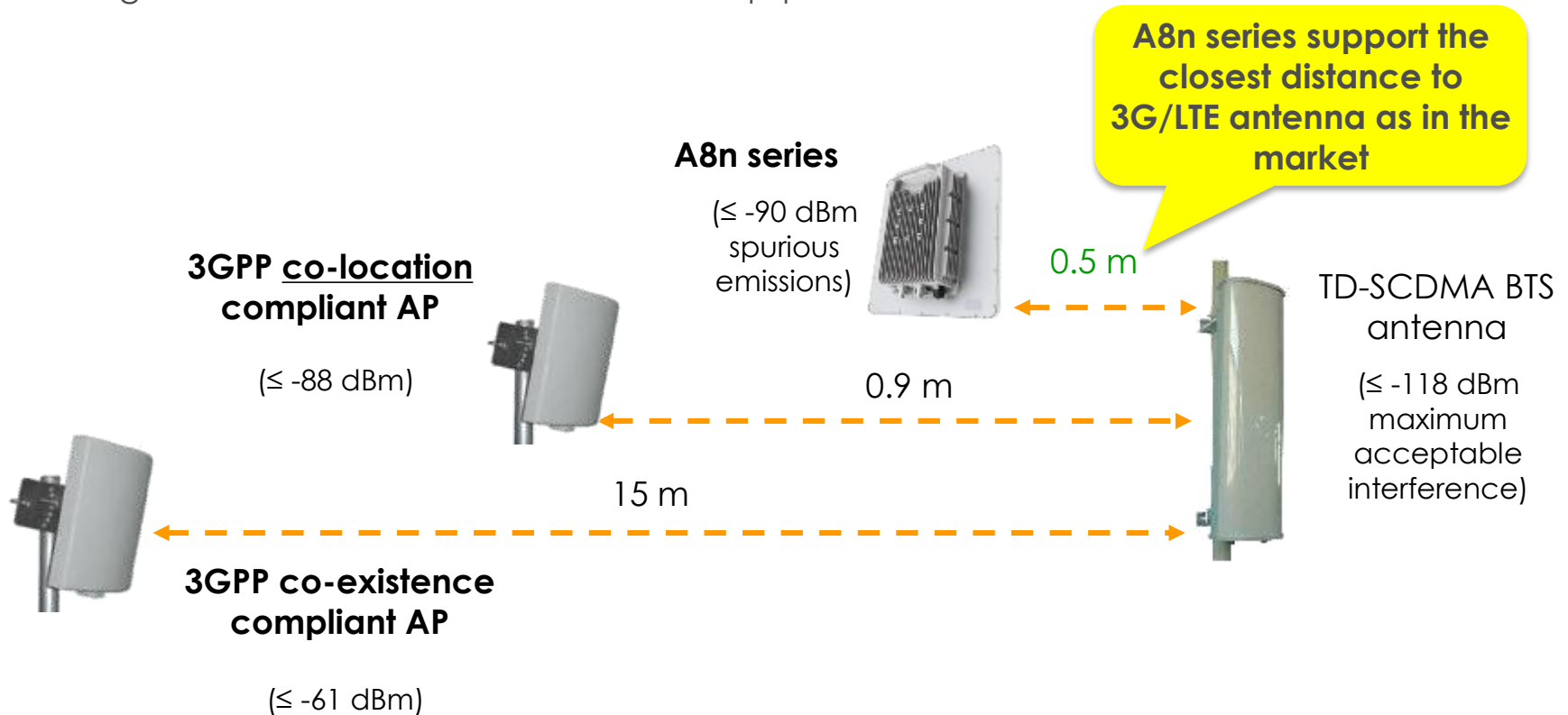


When the AP is interfered by adjacent site, the whole omni sector is affected



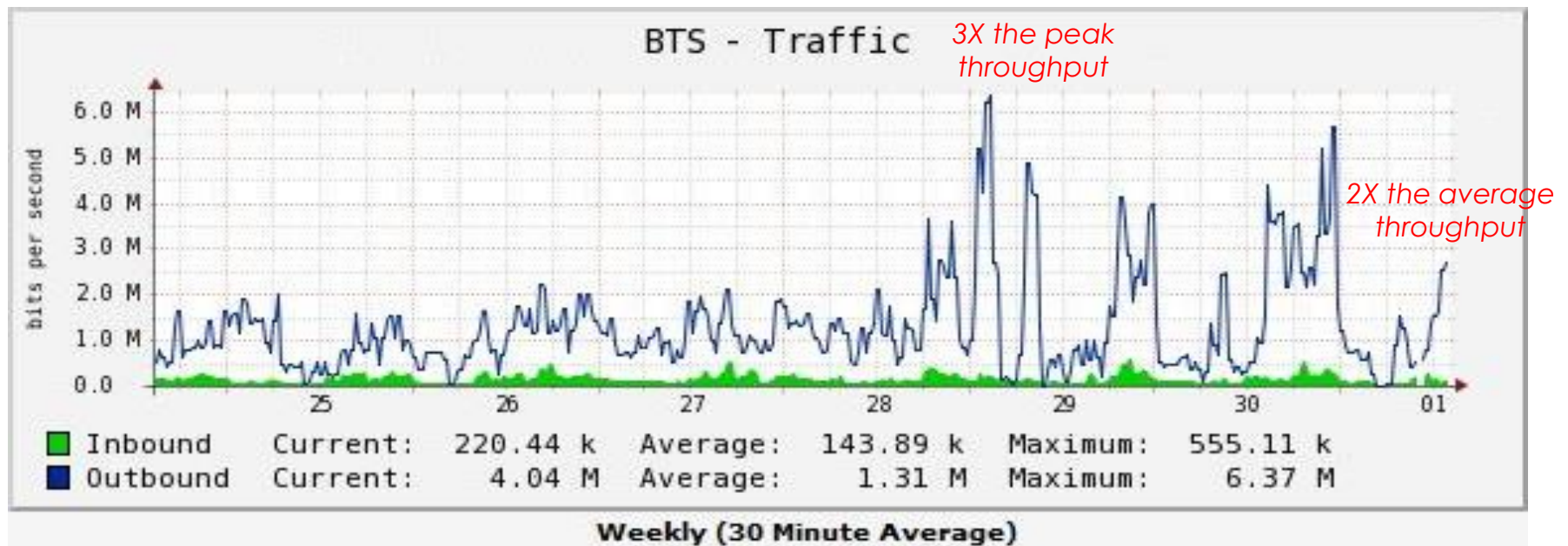
Altai Solution Benefits — Cellular Co-Location (Proven 3G/LTE Co-location)

- Extremely low spurious emissions ≤ 90 dBm design
- As close as 50 cm co-locate with TD-SCDMA antenna
- No gradation to either cellular and WiFi equipment



Altai Solution Benefits — AirFi Throughput Optimization

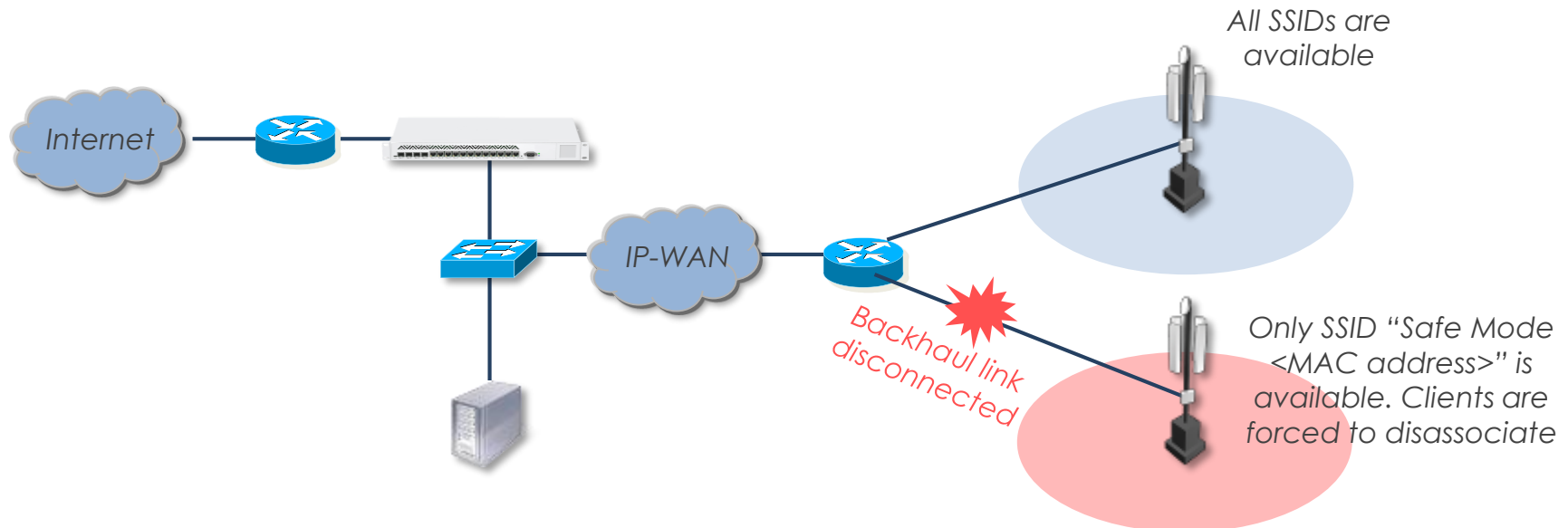
- The Altai AirFi throughput optimization algorithm implemented at the WiFi layer, increasing its average throughput capacity by a factor of 2 and more
- Great improvement in response time from 3,000 to 50 ms was recorded
- The optimization is most significant when the throughput degradation is due to slow speed clients



←-----→
AirFi OFF AirFi ON

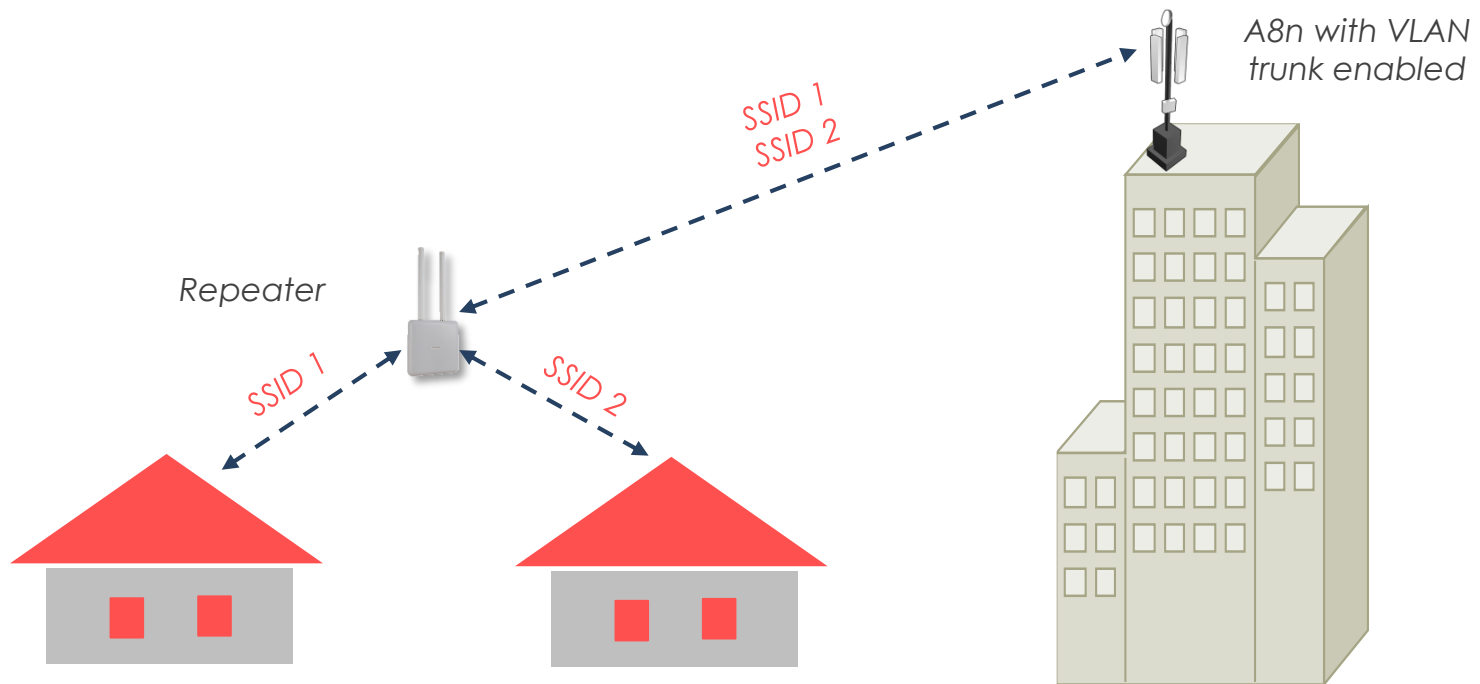
Altai Solution Benefits — Safe Mode

- Safe Mode is to provide alternative way for the clients to resume its connectivity when the current backhaul is unavailable
- When Safe mode is enabled, clients will be forced to disassociate from the AP if the AP loses its backhaul connectivity. Only VAP 0 will be on service with SSID "Safe Mode <MAC address>" and other VAPs will turn down
- The AP will check the backhaul connectivity by pinging the given host within a given interval setting by customer



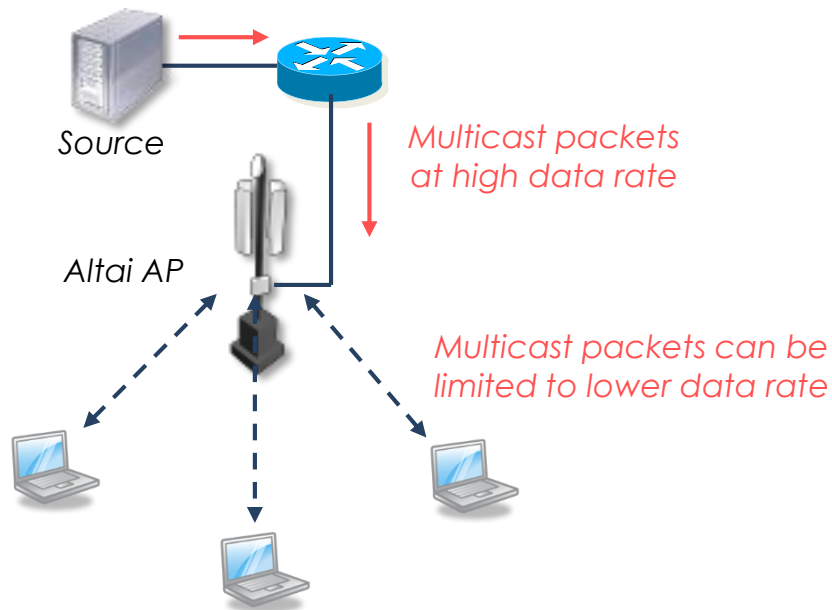
Altai Solution Benefits — VLAN Trunking

- All SSIDs (VLAN/VAP) enabled under AP will be repeated under the repeater device
- Multi-SSID service coverage can be extended through the use of repeater



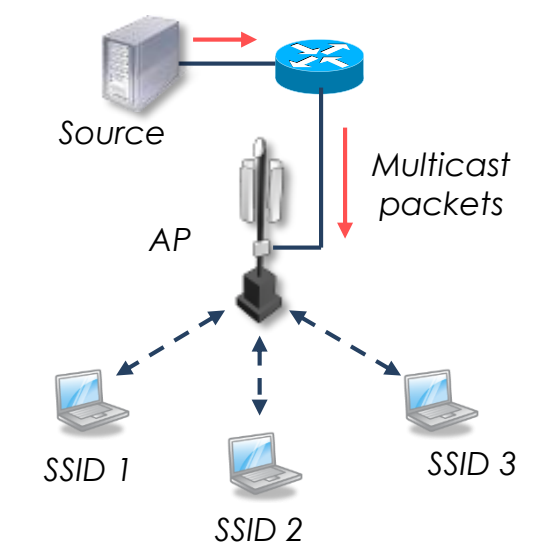
Altai Solution Benefits — Multicast Traffic Filter

- A8n can be set to drop all multicast traffic or to limit multicast traffic to certain data rate
- The user benefits include 1) limit unnecessary multicast traffic and 2) improve bandwidth utilization

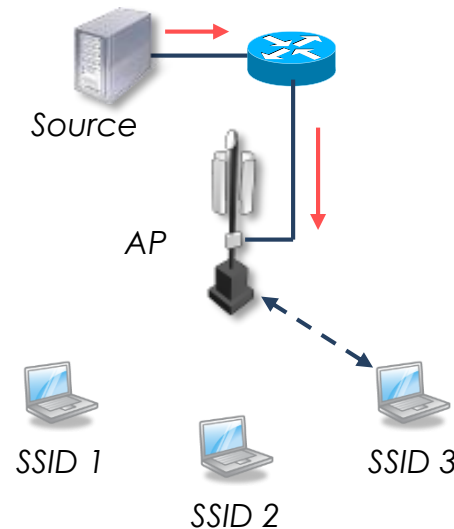


Altai Solution Benefits — IGMP Snooping

- Multicast traffic from a client in one SSID will only broadcast to the clients within that multicast group of the same SSID
- The user benefits include 1) reduce multicast storm and unnecessary traffic and 2) improve bandwidth utilization



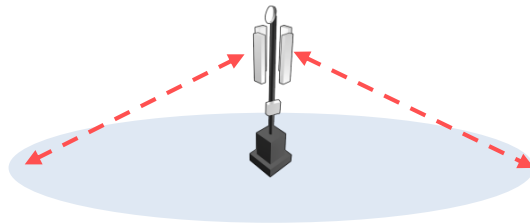
Without IGMP snooping, multicast packets will be transmitted to all clients across all SSIDs



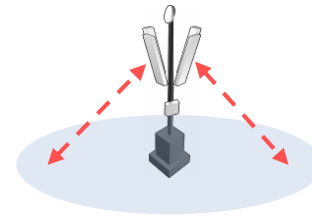
With IGMP snooping, multicast packets will only be transmitted to the registered clients under the same SSID

IGMP: Internet Group Management Protocol

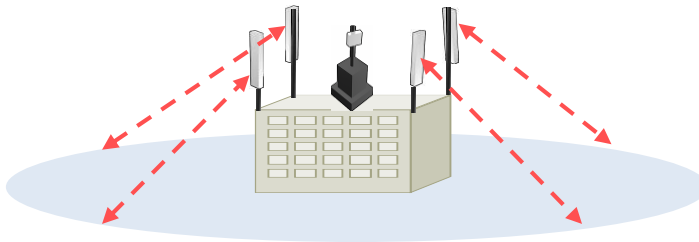
Altai Solution Benefits — Flexible Antenna Mounting



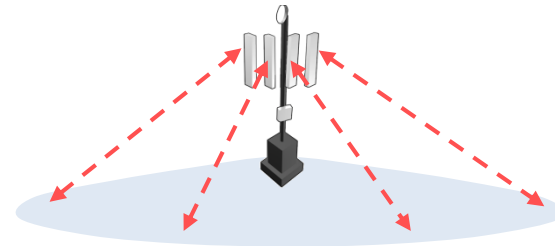
*Less down tilt for
farthest reach*



*More down tilt for
larger density*



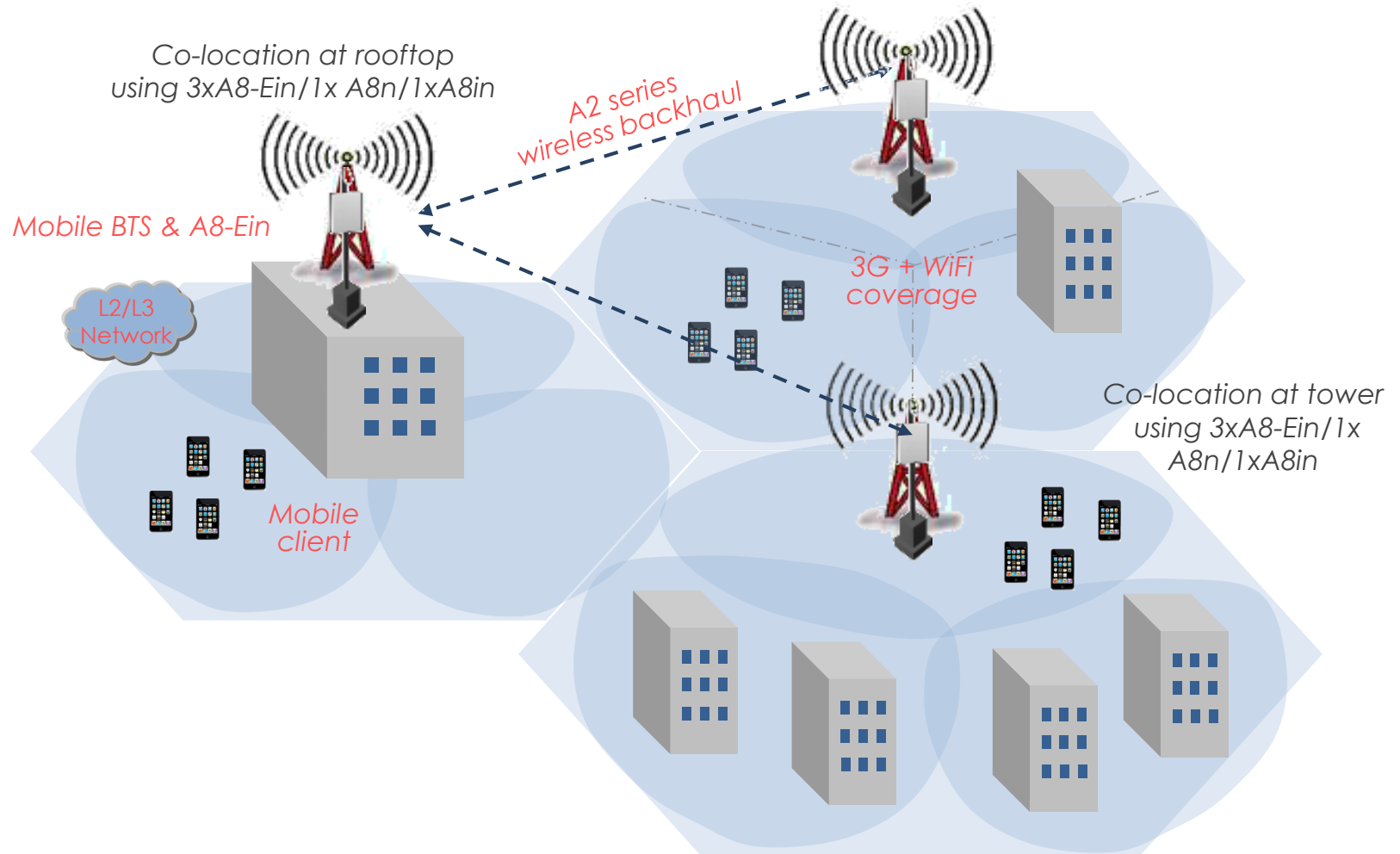
*Rooftop corner mounting to
provide 360° coverage
without building self-blocking*



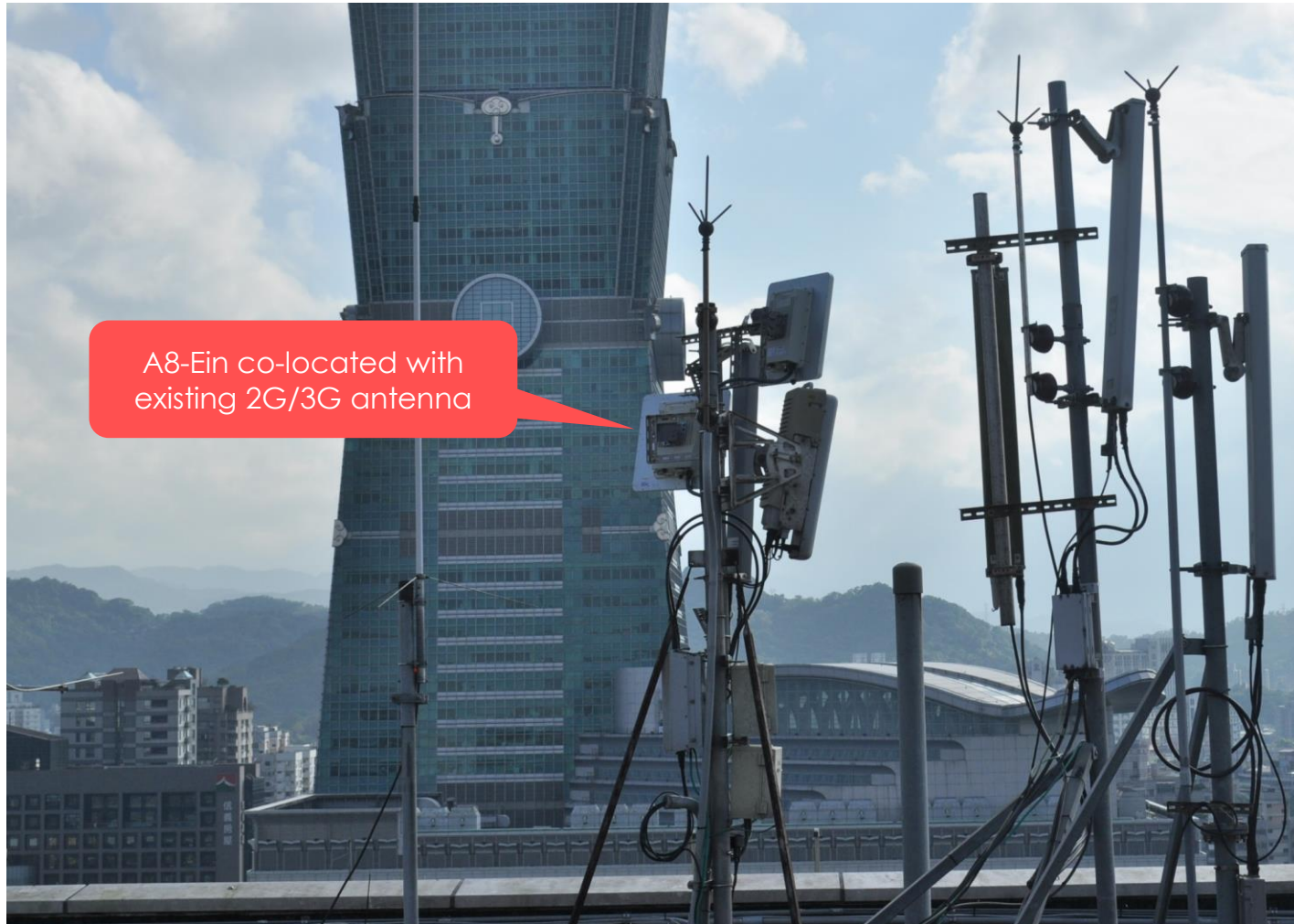
*Single-sided mounting for
dedicated direction coverage
or for wall mount convenience*

ALTAI MARKET APPLICATION

Altai Market Application — 3G Data Offload Application



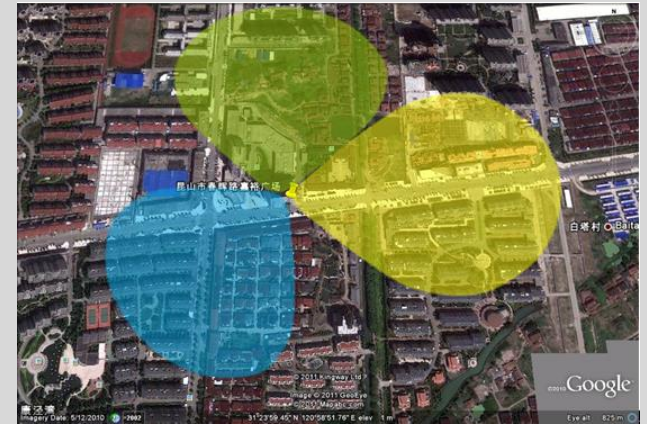
Altai Market Application — 3G Data Offload Application



Altai Market Application — 3G Data Offload Application

Jiangsu Mobile, China Mobile

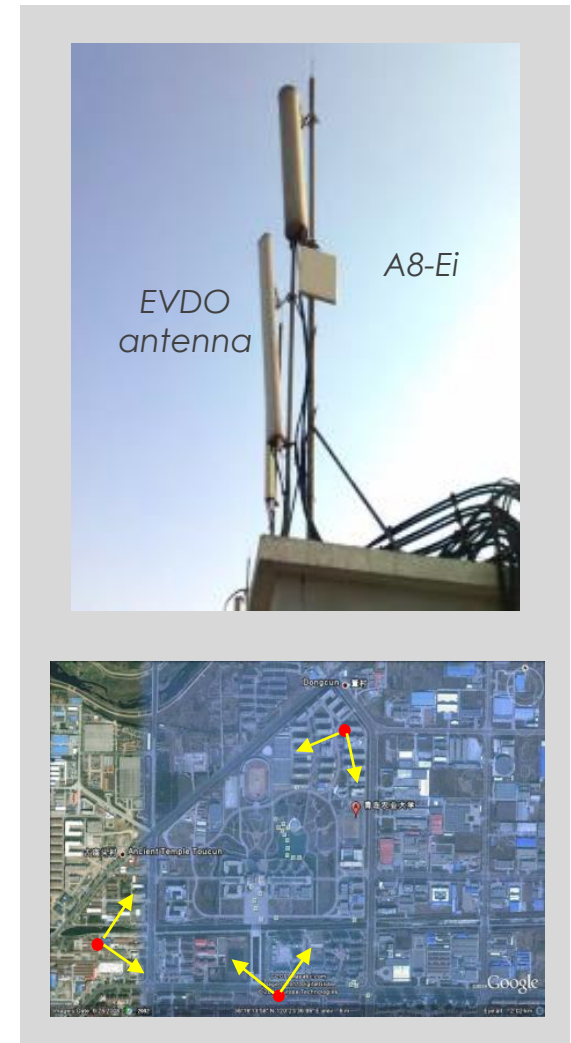
- **Location:** Kunshan, Jiangsu, China
- **Application:** 3G data offload by co-location
- **Product:** A8 and A8n Super WiFi series
- **Quote:** *"The Altai Super WiFi base station can be co-located with the existing TD cellular site, providing 360° or sector coverage with robust performance. It is very flexible in deployment and highly scalable for future expansion."*
- **Challenge:** Highly NLOS environments, serious interference, high user capacity
- **Solution:** 3 A8-Ei were installed co-located with TD-SCDMA base station
- **Result:**
 - Both A8-Ei and TD base station operate properly without interference to each other
 - Maximum throughput 20 Mbps was measured
 - 6.5 Mbps downlink and 5.6 Mbps uplink at 650 m were measured
 - **Over 80 concurrent users under one A8-Ei** was reported at peak hour
 - Over 300 sets of A8, A8-Ei and A8-Ein were deployed in Jiangsu eventually



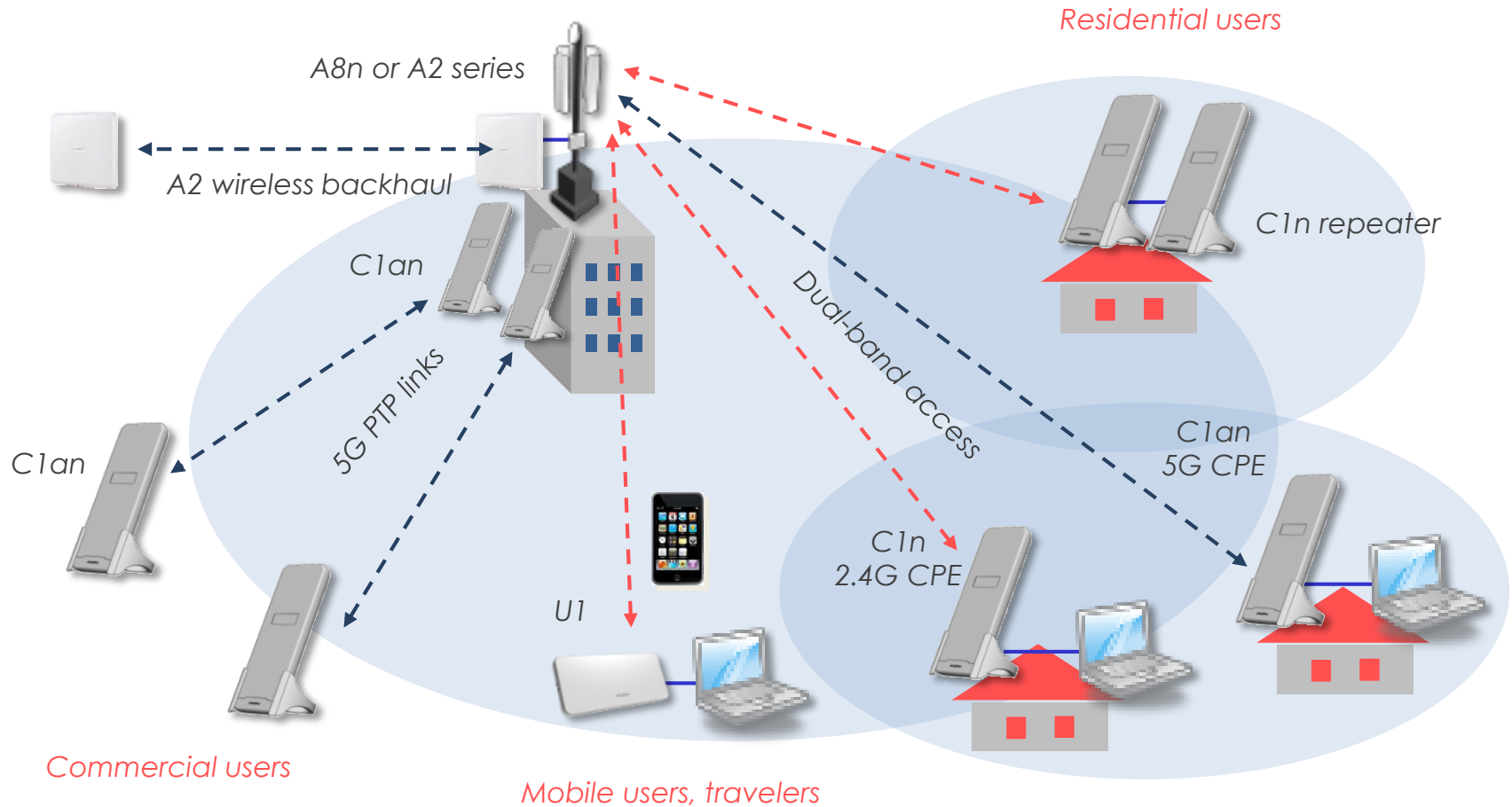
Altai Market Application — 3G Data Offload Application

Qingdao China Telecom

- **Location:** Qingdao, Shandong, China
- **Application:** 3G data offload by co-location for university campus
- **Product:** A8-Ei Super WiFi series
- **Challenge:** With increasing data traffic from an university, the EVDO data capacity is overloaded
- **Solution:** Offload existing traffic by WLAN making use of existing EVDO site
- **Result:**
 - 3 A8-Ei were installed at existing EVDO site
 - Covering the university campus and surrounding areas
 - Both A8-Ei and EVDO BTS operate properly without interference to each other
 - One month later, **the data traffic of 2 of the A8-Ei exceeded the EVDO**
 - Peak daily traffic of 38.3 GB was recorded



Altai Market Application — Wireless Broadband



Altai Market Application — Wireless Broadband Dekal Wireless

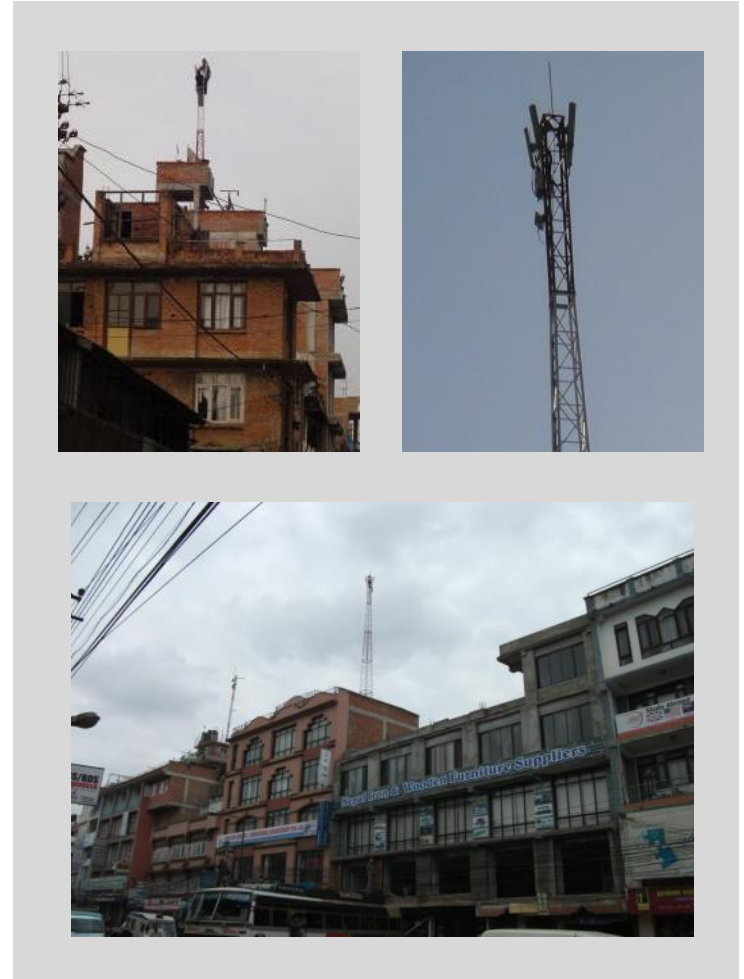
- **Location:** Jamaica, Caribbean Sea
- **Application:** Wireless broadband for residential and commercial users
- **Product:** A8, A2, B5 and C1 series
- **Quote:** *“We are delighted to have partnered with Altai whose team effort in completing the network has been fantastic. We have proved that WiFi does not need to be confined to hotspots and can be deployed as a typical cellular wireless service.”*
- **Challenge:** Lack of Internet outlet, power supply, difficult to acquire installation site
- **Solution:** A8 and A2 were installed at city for major coverage, C1 as CPE for remote user, A2 for wireless backhaul; end-to-end solution including service control, billing and pre-paid card systems
- **Result:**
 - Over **300 A8 and A2** were installed in **30 major towns** which serve over a million of the population
 - The wireless Internet service is subscribed on a pre-paid basis. The connection speed can be up to 10 Mbps.
 - Local residences and tourists from US and the world can now enjoy Super WiFi service across the island using the same login name and password via their WiFi-enabled device



Altai Market Application — Wireless Broadband

Broadlink, Internet Service Provider

- **Location:** Kathmandu, Nepal
- **Application:** Wireless broadband for city-wide coverage
- **Product:** A8, A8n, C1 and C1n series
- **Quote:** *“The performance of C1 CPE with A8 is impressive – the service area and the client throughput have been boosted up substantially.”*
- **Challenge:** The geographical terrains of Nepal have been a major constraint in making internet accessible. Severe radio interference exists in Kathmandu. Electricity supply is not stable. Competition with state-owned operator – Nepal Telecom exists
- **Solution:** 100 A8 and 40 A8-Ein were installed in Kathmandu and some other major towns and cities. Over 1,000 C1 were used for indoor coverage.
- **Result:**
 - After 9 months' free trial, Broadlink officially launched the WiFi service in Nov 2010
 - The WiFi service is on pre-paid basis
 - **Around 7,000 subscribers with 600 concurrent users were recorded**



Altai Market Application — Wireless Broadband Colombia “Vive Digital” National WiFi

- **Location:** Colombia municipalities
- **Application:** Wireless broadband for towns and villages – a National Plan to improve access to information and promote the mass use of Internet services through WiFi for hard to reach areas
- **Product:** A2 series
- **Quote:** *“Currently the Vive Digital plan is considered a pioneer in the world for its great social impact.”*
- **Challenge:** Lack of site and high tower
- **Solution:** A2 with external high gain omni antenna for flexible coverage; central management using AWMS. Installation sites started with municipalities, fire stations, hospitals, libraries and schools.
- **Result:**
 - **220 A2 were installed in 80 towns**
 - The project is currently expanding to 40 additional municipalities



Altai Market Application — Wireless Broadband

Union Square Park, New York

- **Location:** New York City, USA
- **Application:** Wireless broadband for park visitors - a WiFi service program launched by the Union Square Partnership, comprised of 800 businesses. The purpose is to create leading edge WiFi network to support local community and business
- **Product:** A8 series
- **Quote:** *"The extraordinary capabilities of Altai A8 WiFi base station have make it our antenna of choice. For cutting through noisy RF environments and giving people the range and quality they want and expect in public W-Fi, there is nothing like it."*
- **Challenge:** Highly NLOS environment, best to be installed at locations not easily noticeable by the public
- **Solution:** 2 units of A8 were good enough to cover the entire Union Square and the surrounding storefronts. The A8 were sprayed the same color as the building for camouflage
- **Result:**
 - Supports Wi-Fi enabled cell phones, laptops etc. to surf the Web or the neighborhood for free via local community portal
 - **Each A8 supports 100 simultaneous users**



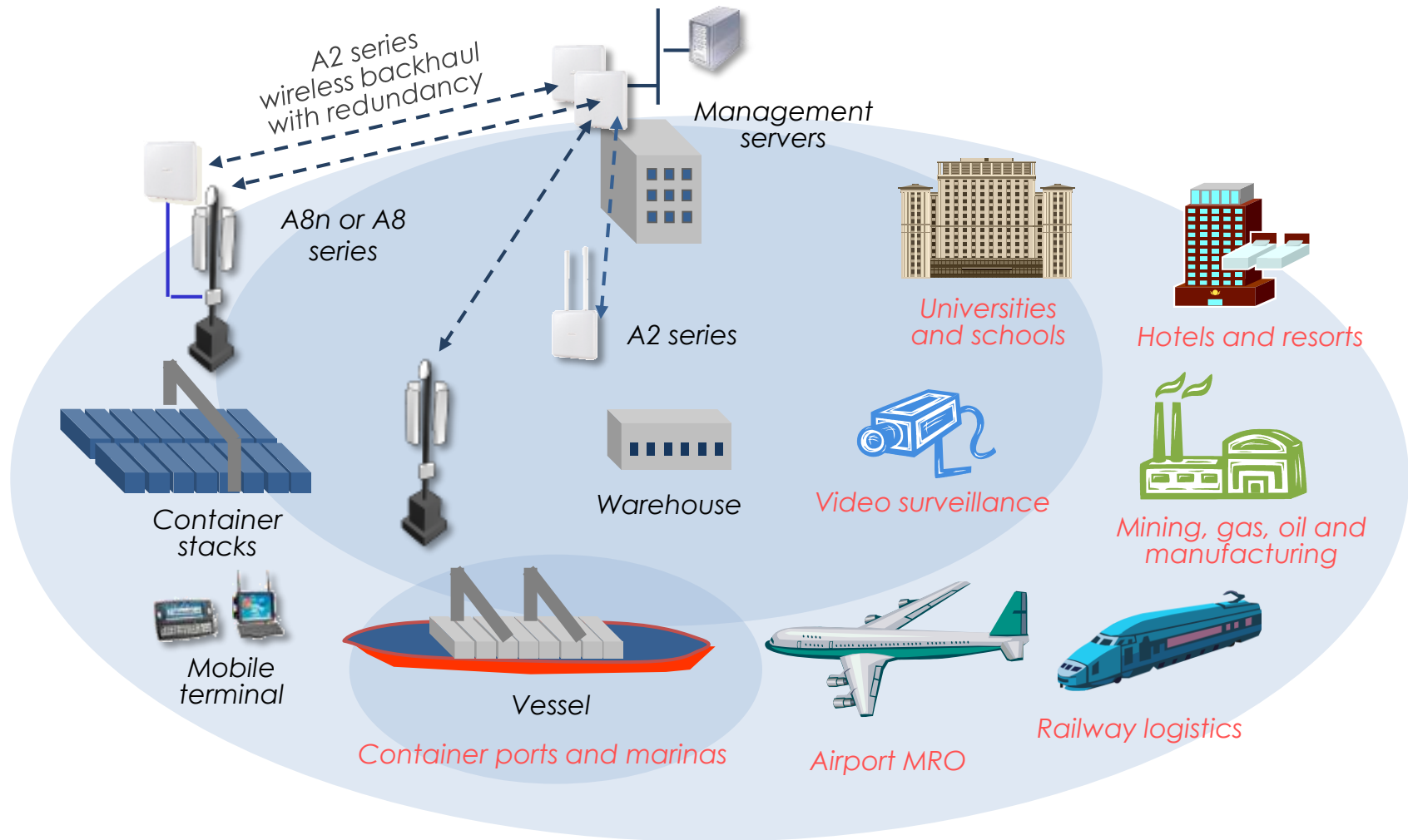
Altai Market Application — Wireless Broadband

Bryant Park, New York

- **Location:** New York, USA
- **Application:** Wireless broadband for park visitor
- **Product:** A8 series
- **Background:** Bryant Park is one of the world famous park in New York. It is also a venue for the world famous Fashion Week New York which was held twice a year and during that time it was converted to a temporary multiple tents showplace
- **Challenge:** Blockage by trees in the park, limited time for deployment and large bandwidth requirement for media transmission during the fashion show
- **Solution:**
 - 2 A8 were installed permanently for free Internet access of visitors
 - Special tube antenna for A8 was used
 - **During Fashion Week, extra A8 were installed rapidly for higher capacity and were dismantled easily after use**

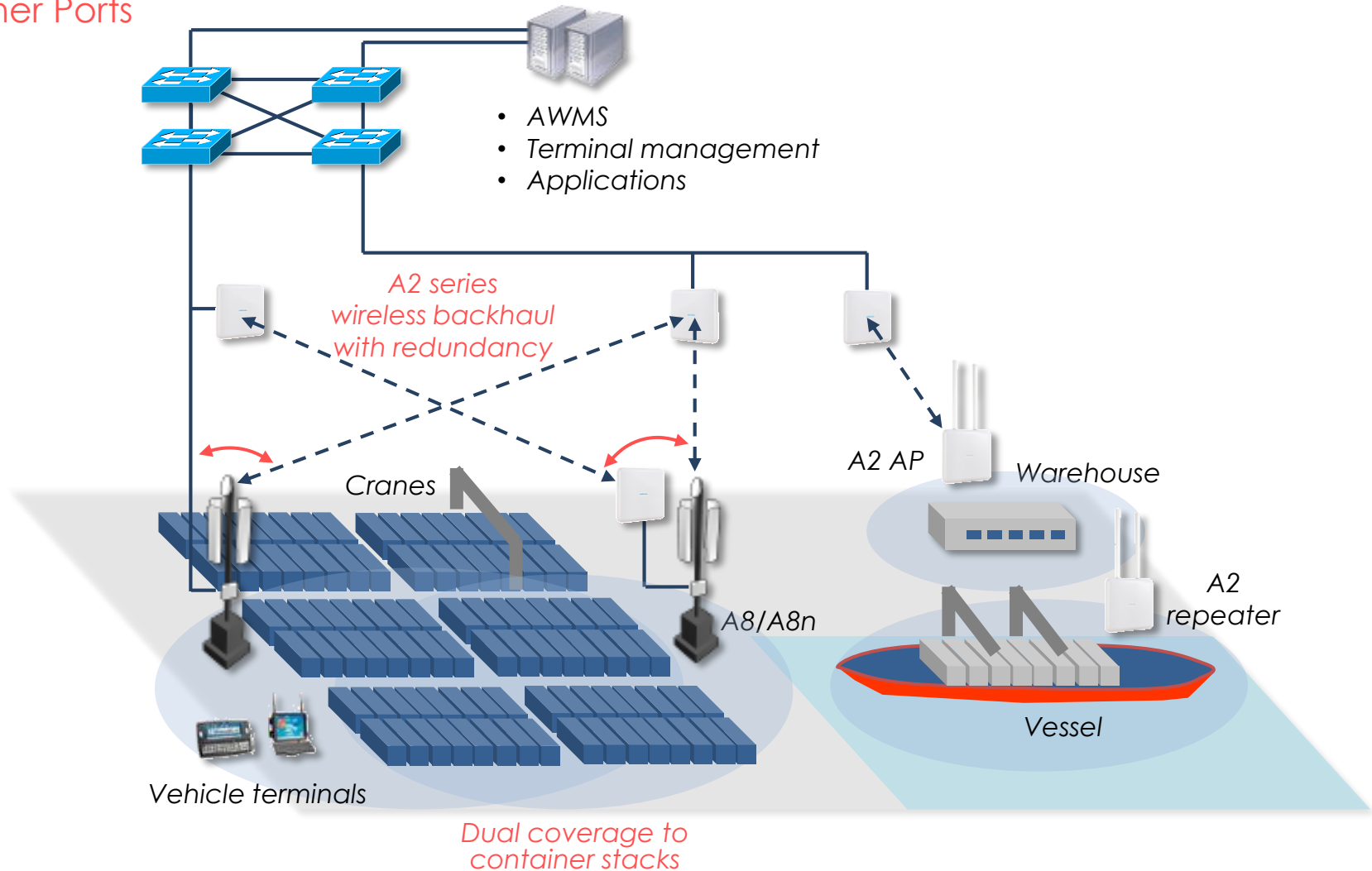


Altai Market Application — Private Network Applications



Altai Market Application — Private Network Applications

Container Ports

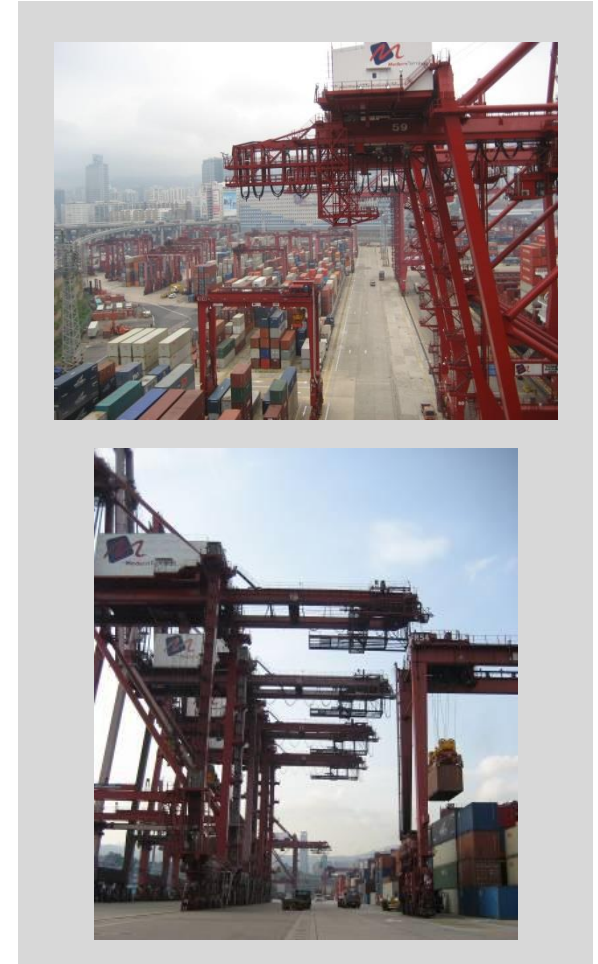


Altai Market Application — Private Network Applications

Modern Terminal Limited, MTL

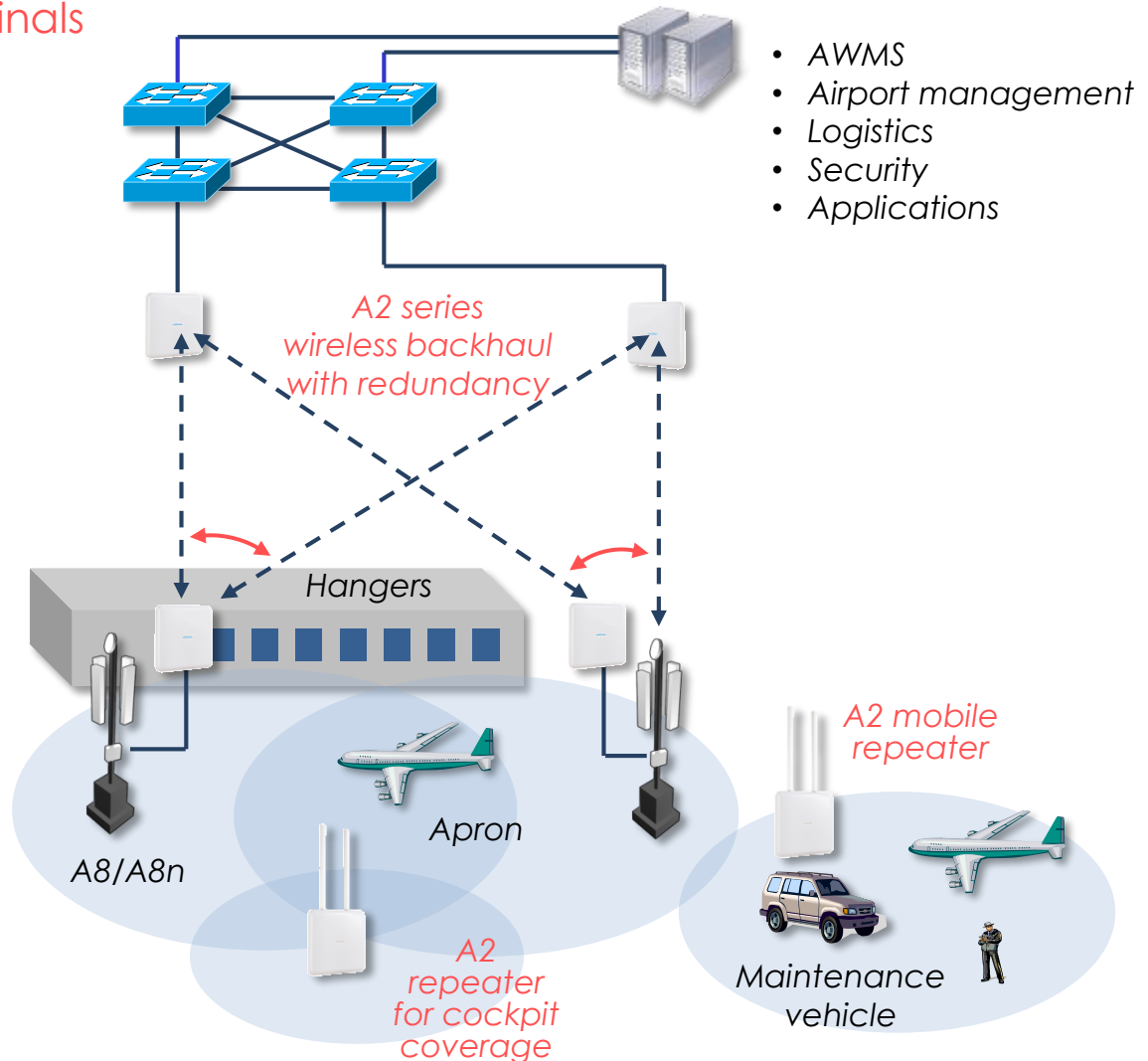


- **Location:** Hong Kong
- **Application:** Logistics control for mobile data terminals, trucks and quay cranes
- **Product:** A8, A8-Ei and A2 Super WiFi series and AWMS
- **Quote:** *“Over six months’ testing on stability and performance, the results proved that the Altai A8 WiFi system not only meets all the specifications but also exceeds our expectation. The same test was conducted for another AP at the same time, and all the test results of Altai outperform that of traditional AP”*
- **Challenge:** Have to provide stable WiFi signal. Require multiple base stations coverage to every client. Only limited sites are available for installation
- **Solution:** 20 A8 were installed for full redundancy coverage. A2 were used for local coverage. AWMS was used for monitoring the network performance
- **Result:**
 - 8X increase in area coverage (7 BTS/km² vs. original 60 AP/km²)
 - 600 m range over cranes and 300 m NLOS over container stacks
 - Reduced the number of mounting locations, this help minimizing the entire cost of deployment and maintenance
 - The AWMS not only provide performance and fault monitoring on network, but it also provides a lot of statistical information on mobile client management



Altai Market Application — Private Network Applications

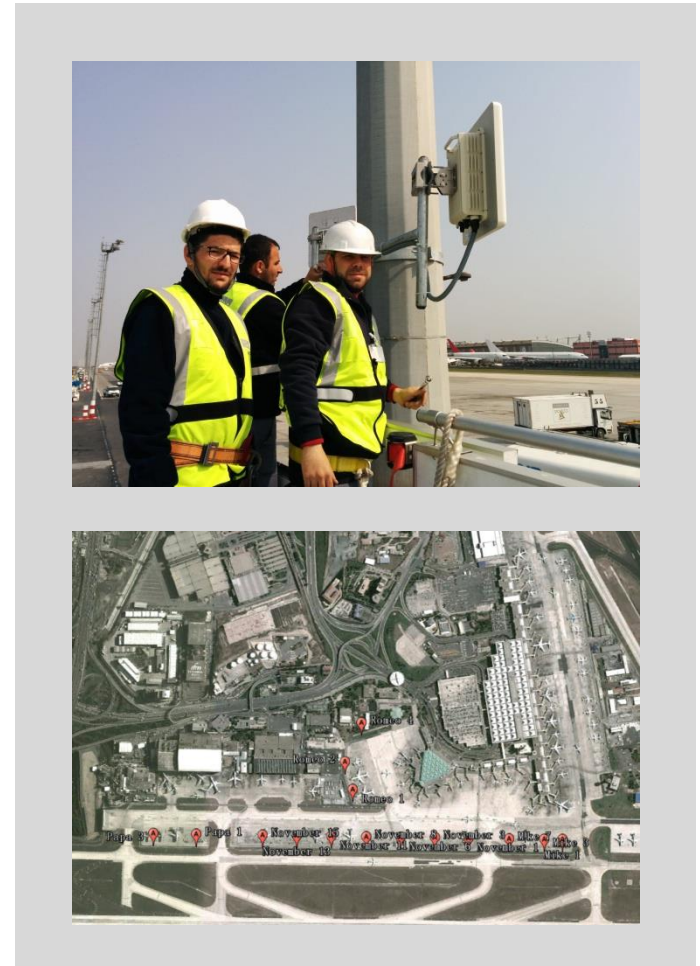
Airports and Railway Terminals



Altai Market Application — Private Network Applications

Turkish Ground Service (TGS)

- **Location:** Ataturk Airport, Istanbul, Turkey
- **Application:** Private network – airport ground service support including Internet access, mobile surveillance, VoIP, luggage tracking and other ground support applications. TGS is the biggest airport ground service provider in Turkey, providing airport security, passenger ground transportation and luggage transportation
- **Product:** A8-Ein, A2 and AC 2000
- **Challenge:** Large area coverage, limited installation site, network robustness in highly aircraft blockage apron areas
- **Solution:**
 - 40 A8-Ein were installed at poles and lampposts in the apron areas for access coverage
 - A2 were equipped on ground service vehicle top and connected to camera for mobile surveillance
 - Access controller is used for dynamic VLAN assignment



Altai Market Application — Private Network Applications

Turkish Ground Service (TGS)



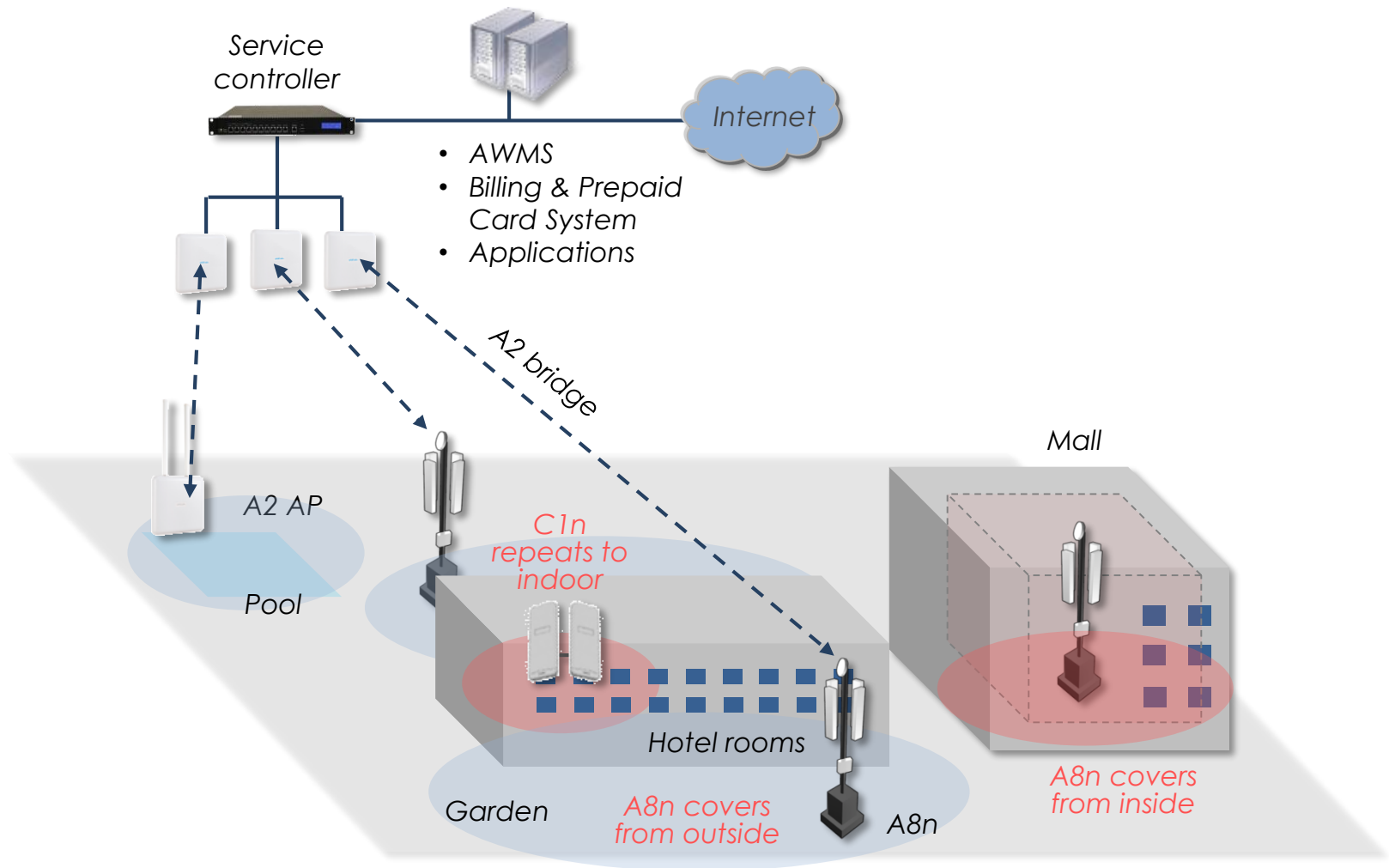
A8-Ein was installed for apron coverage

A2 was installed at vehicle top (photo was taken during testing, actual mounting is nicer) connected to camera for mobile surveillance



Altai Market Application — Private Network Applications

Hotels, Resorts and Malls



Altai Market Application — Private Network Applications

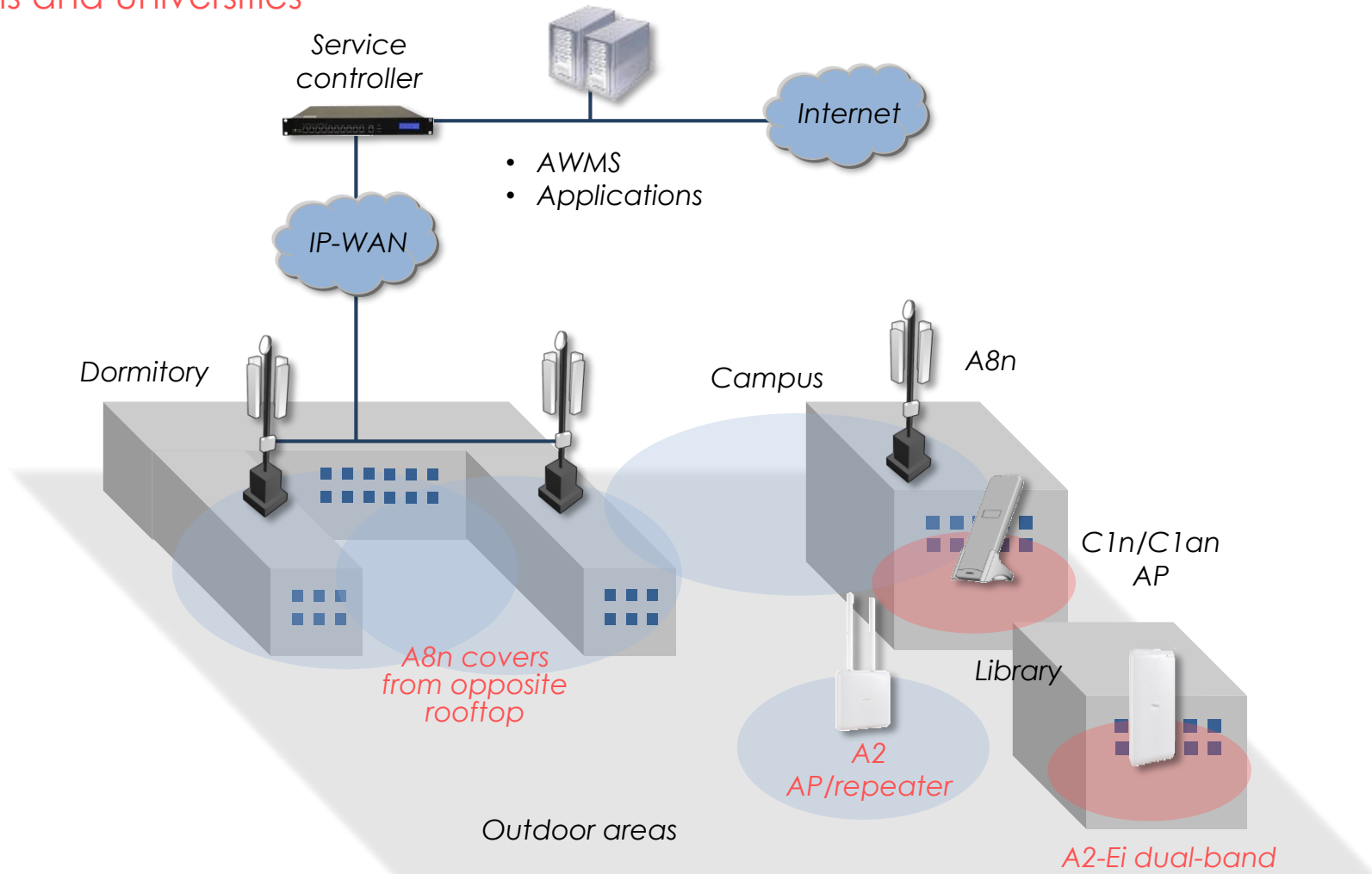
City Square Shopping Mall

- **Location:** Johor, Malaysia
- **Application:** Shopping Mall WiFi service – Largest shopping mall near Singapore custom. Large demand for WiFi in café & shops
- **Product:** A8 and C1 Super WiFi series
- **Quote:** *"The new network gives the City Square the opportunity to expand and enhance the range of digital entertainment experiences for its shoppers, to increase the traffic in the shopping mall and to bring more convenience to its visitors."*
- **Challenge:** Large amounts of simultaneous Internet users. Have to provide full indoor WiFi coverage from the basement to level 7 and around the complex
- **Solution:** 1 A8 for 5 floors shops coverage. CPE for extended basement coverage. Pre-paid cards for visitors
- **Result:**
 - 100% coverage in both indoor and outdoor areas was recorded
 - Deployed in just a few days
 - **High speed and stable WiFi**



Altai Market Application — Private Network Applications

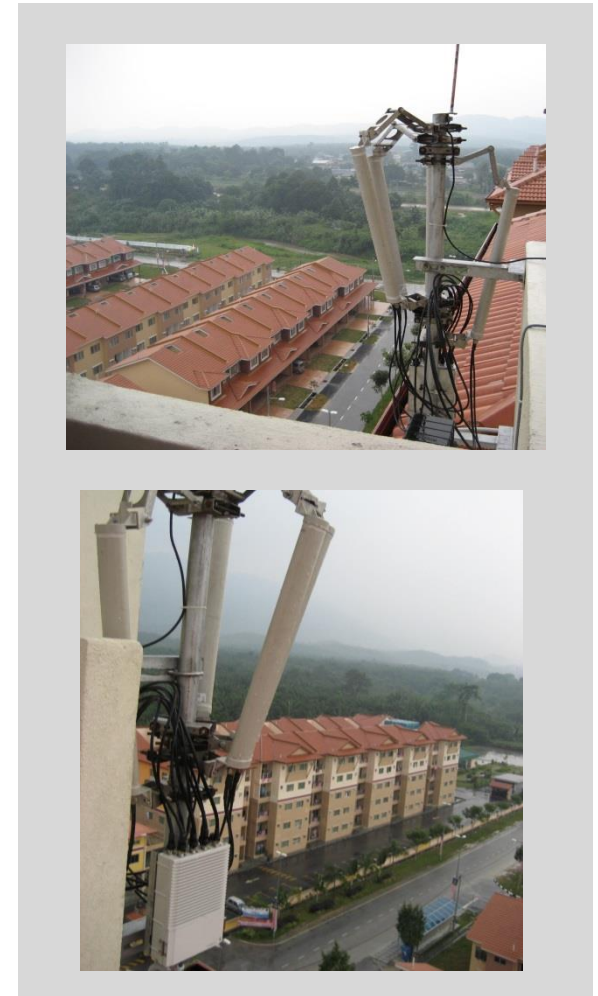
Schools and Universities



Altai Market Application — Private Network Applications

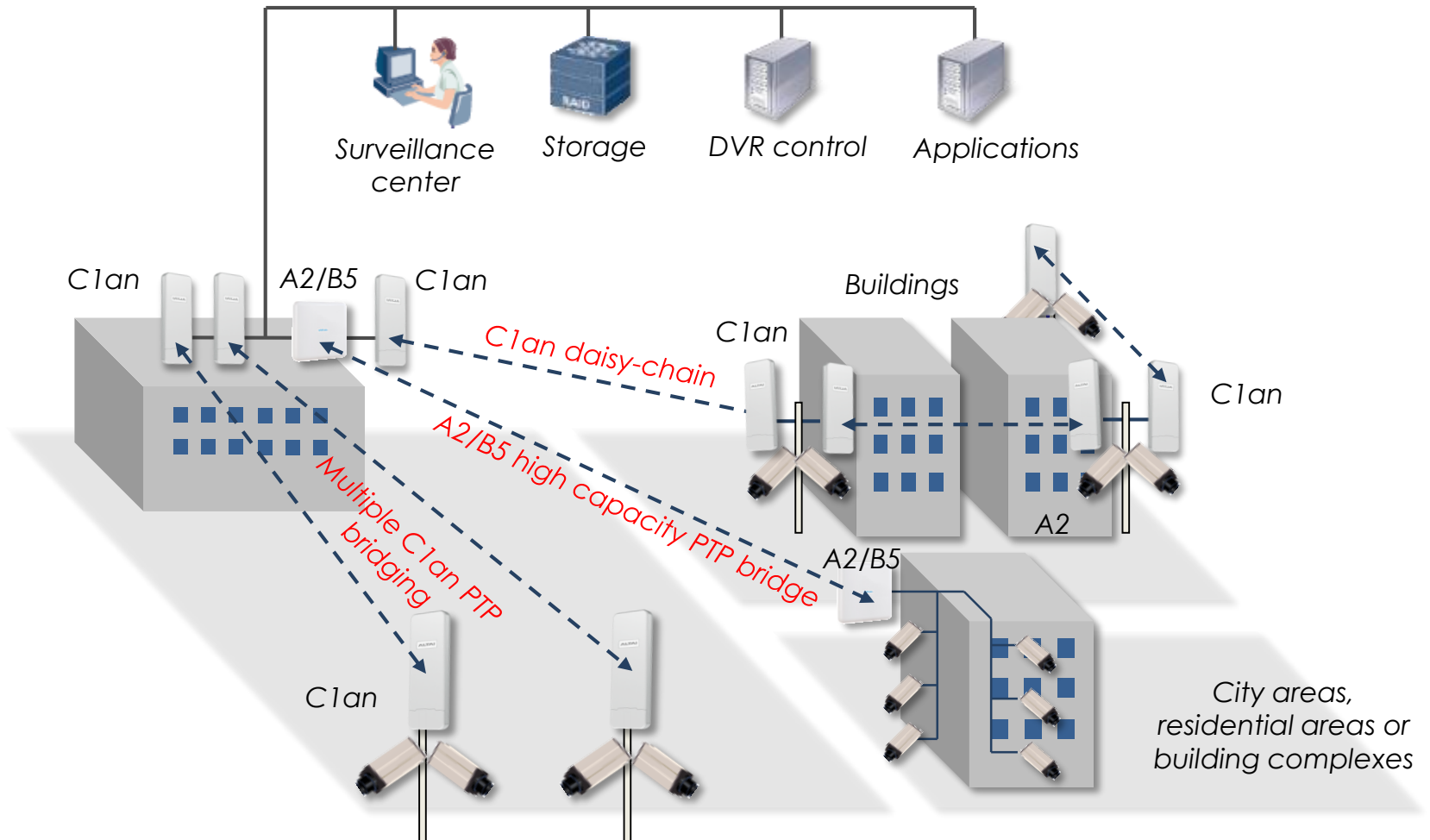
Sultan Idris University of Education, Malaysia

- **Location:** Malaysia
- **Application:** University WiFi network – one of the oldest institutes of higher learning
- **Product:** A8 Super WiFi series
- **Challenge:** Have to cover 1 square km site in the town of Tanjung Malim that straddles across Perak and Selangor states. Expensive, long deployment time using Ethernet cabling
- **Solution:** A8 were installed to serve the academic buildings, dormitories and campus areas
- **Result:**
 - Normally over 50 students associated to each BTS, and goes up to 100 students at peak hours
 - Average 1 to 2 Mbps throughput per user was recorded



Altai Market Application — Private Network Applications

Video Surveillance



Altai Market Application — Private Network Applications

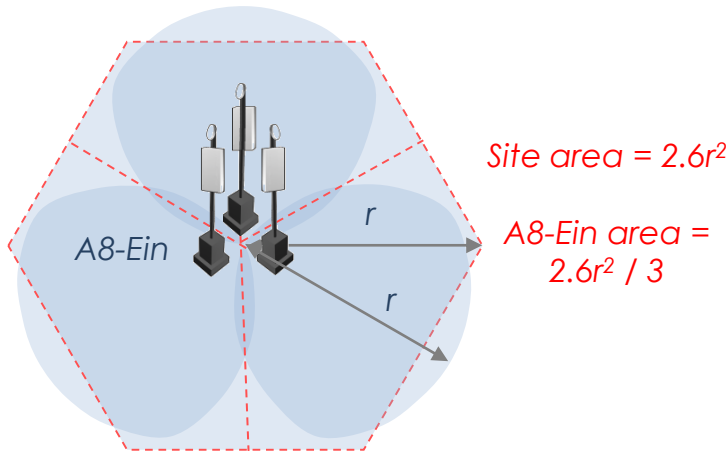
Westports Malaysia

- **Location:** Kuala Lumpur, Malaysia
- **Application:** Container port surveillance
- **Product:** A2 and C1 series
- **Challenge:** Limited installation points and limited budget
- **Solution:** A2e WiFi AP were installed at rooftop (18 floors) and installation posts (15 m) for sector coverage. Each IP camera was connected to a C1 CPE pointing to an A2e (up tilt)
- **Result:**
 - 4 IP cameras per A2e (total 12 cameras) fully meeting customer requirement of 1.5 Mbps throughput over 300 m
 - Camera directly under A2e at NLOS conditions can meet requirement



ALTAI TYPICAL DEPLOYMENT

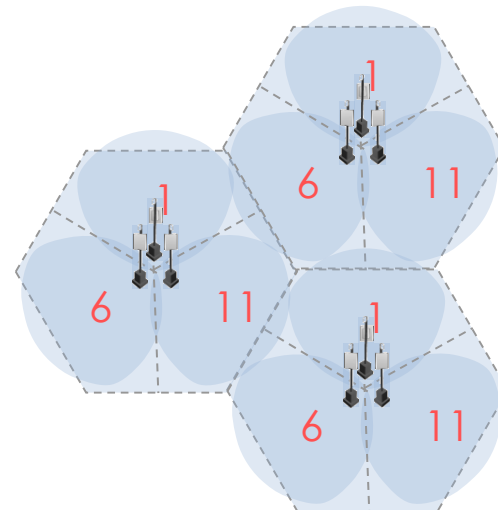
Altai Typical Deployment — Large Outdoor Coverage



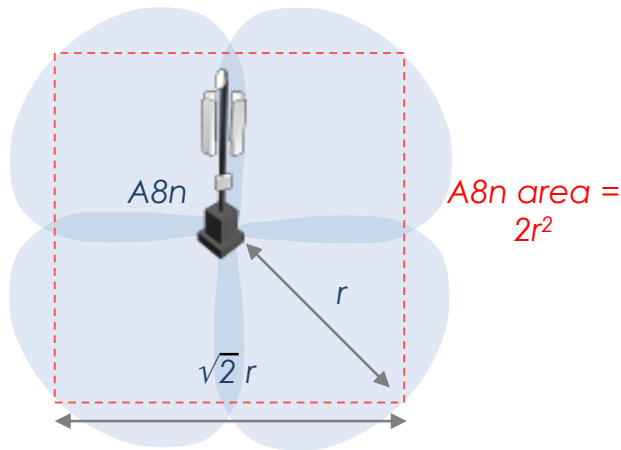
Environment	A8-Ein range	Coverage area	No. of A8-Ein per km ²
Open area (LOS)	1.7 km	2 km ²	0.5
Rural (NLOS)	0.8 km	0.5 km ²	2
Sub-urban (NLOS)	0.5 km	0.2 km ²	5
Urban (NLOS)	0.35 km	0.1 km ²	10
Others	r	$\frac{2.6r^2}{3}$	$\frac{3}{2.6r^2}$

- Estimate the A8-Ein range of your targeted coverage area using the table here, and calculate the total no. of A8-Ein required
- E.g. to cover 10 sq. km with 80% rural and 20% sub-urban,
 No. of A8-Ein required
 $= 10 \times 80\% \times 2 + 10 \times 20\% \times 5$
 $= 16 + 10 = 26$ sets
- No. of site required = $26/3 = 9$ sites, a significant saving in site requirement
- The A8-Ein can be co-located at the site of other telecom equipment

Cellular architecture and frequency reuse



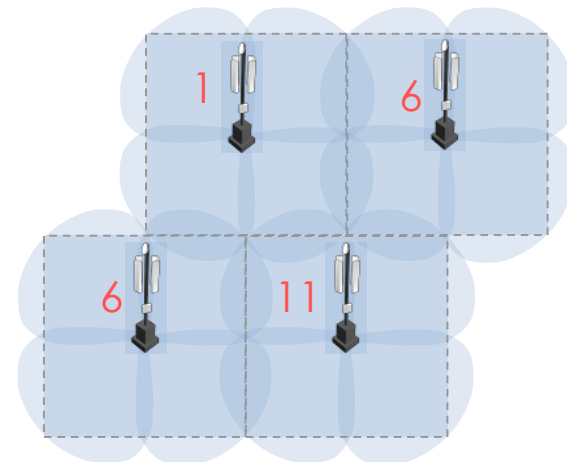
Altai Typical Deployment — Large Outdoor Coverage



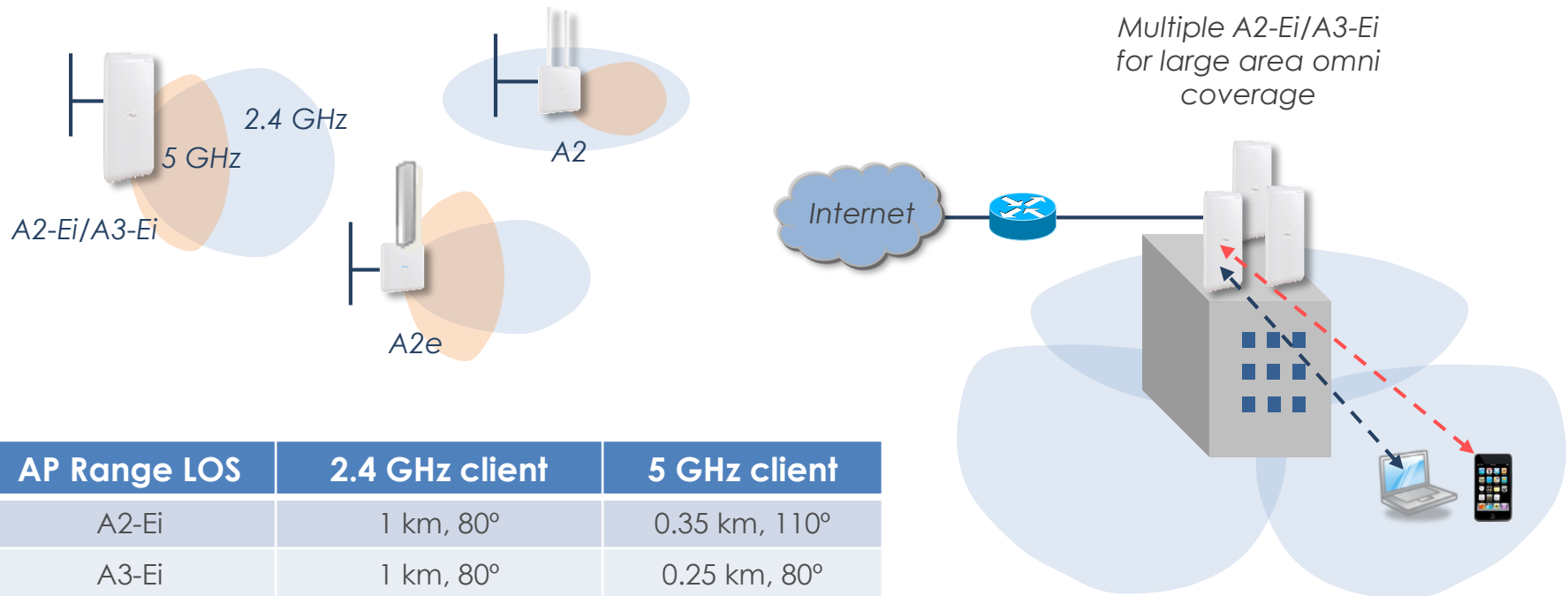
Environment	A8n radius	Coverage area	No. of A8n per km ²
Open area (LOS)	1 km	2 km ²	0.5
Rural (NLOS)	0.5 km	0.5 km ²	2
Sub-urban (NLOS)	0.35 km	0.25 km ²	4
Urban (NLOS)	0.25 km	0.125 km ²	8
Others	r	$2r^2$	$1 / 2r^2$

- Estimate the A8n radius of your targeted coverage area using the table here and calculate the total no. of A8n units required
- E.g. to cover 10 sq. km with 80% rural and 20% sub-urban,
 No. of A8n required
 $= 10 \times 80\% \times 2 + 10 \times 20\% \times 4$
 $= 16 + 8 = 24$ sets
- No. of site required = 24 sites
- A8n is rooftop, pole or tower mounted; A8n is street level lamppost or pole mounted

Cellular architecture and frequency reuse

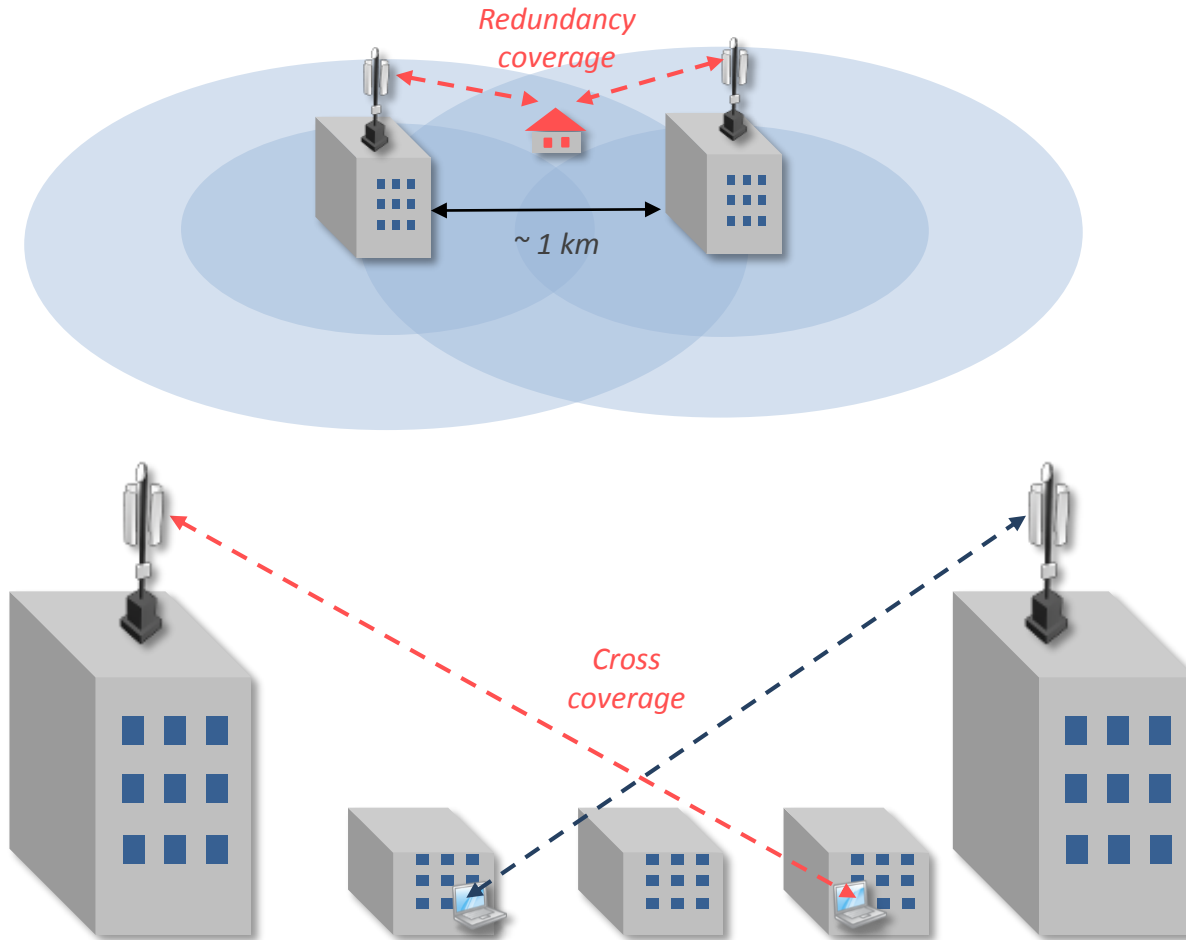


Altai Typical Deployment — Micro Outdoor Coverage



AP Range LOS	2.4 GHz client	5 GHz client
A2-Ei	1 km, 80°	0.35 km, 110°
A3-Ei	1 km, 80°	0.25 km, 80°
A2e 5G 16dBi patch	0.9 km, 37°	0.35 km, 100°
A2 2.4G 5dBi omni	0.5 km, 360°	0.35 km, 20°

Altai Typical Deployment — Outdoor Coverage Enhancement Redundancy Coverage Design

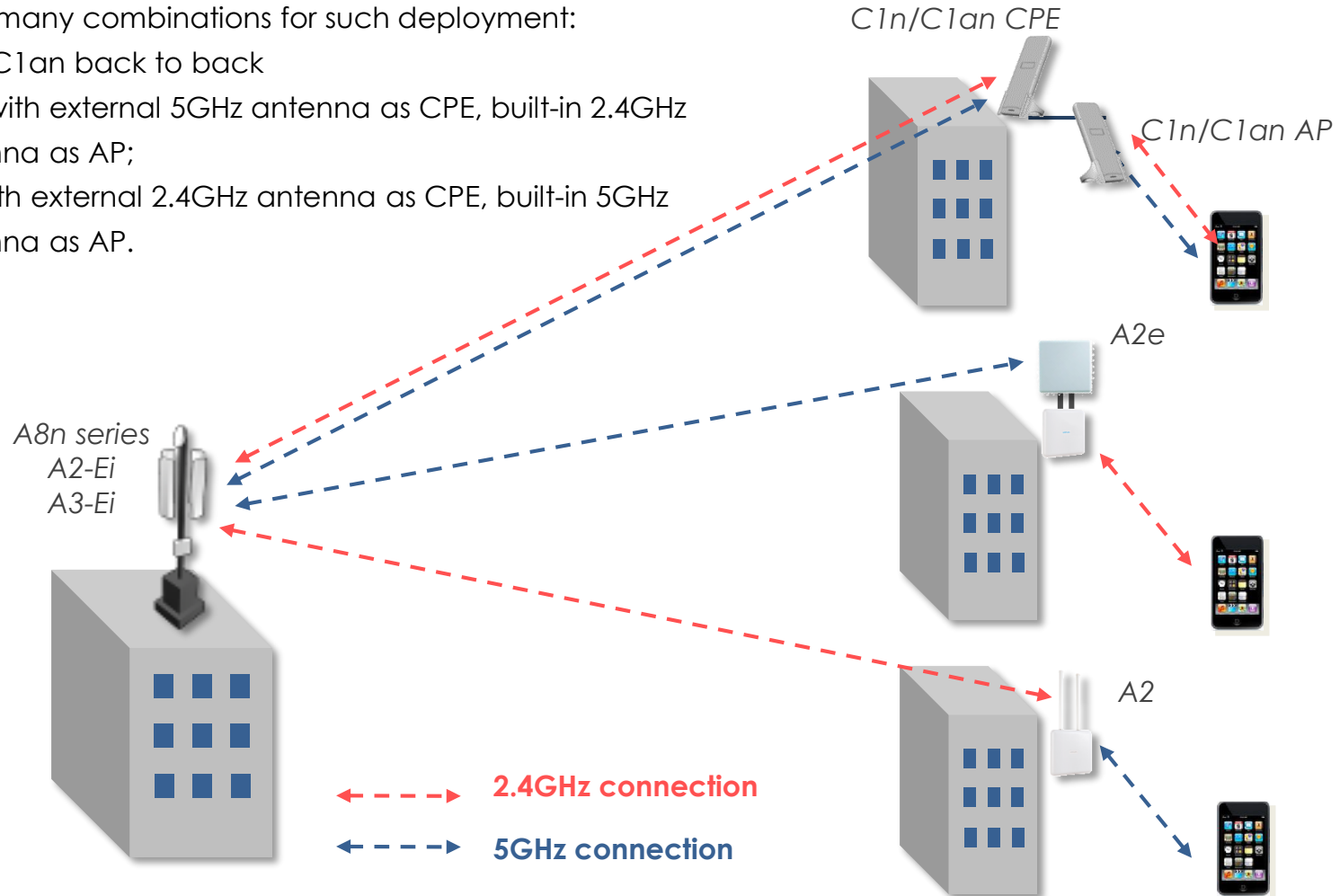


Altai Typical Deployment — Outdoor Coverage Enhancement

Coverage Enhancement

There are many combinations for such deployment:

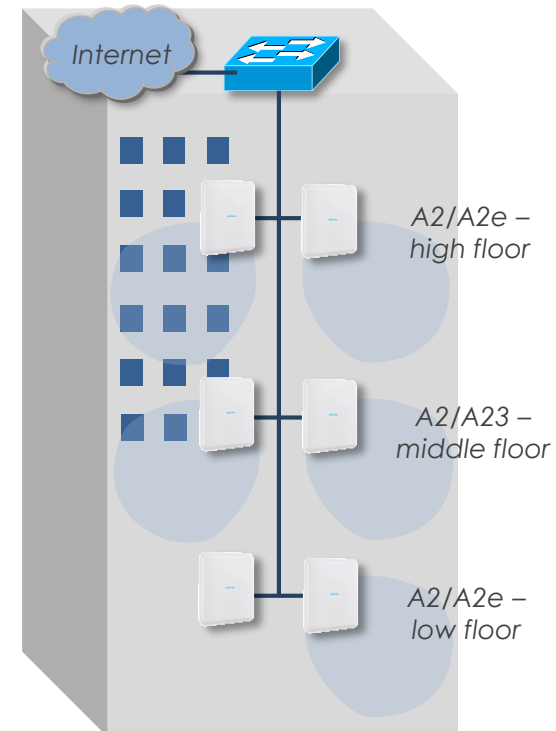
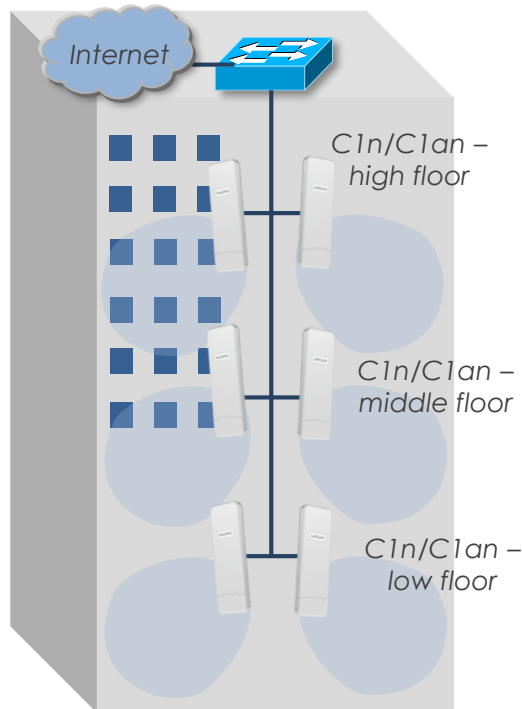
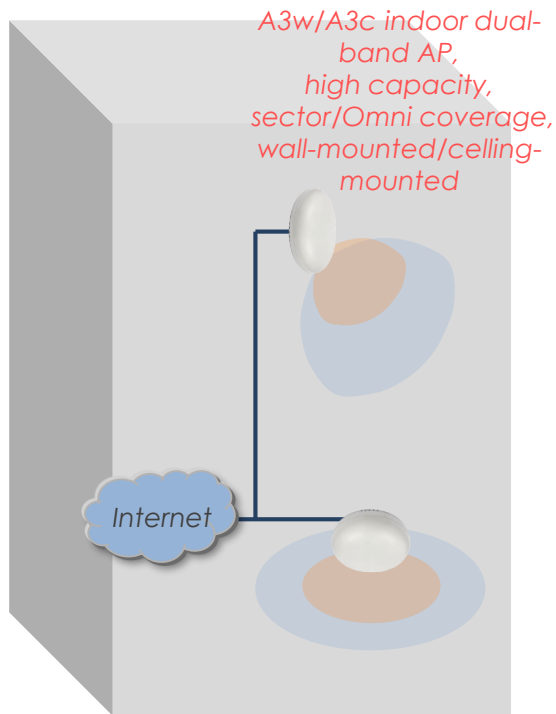
- 1) C1n/C1an back to back
- 2) A2e with external 5GHz antenna as CPE, built-in 2.4GHz antenna as AP;
- 3) A2 with external 2.4GHz antenna as CPE, built-in 5GHz antenna as AP.



Altai Typical Deployment — Indoor Coverage

There are two kinds of deployment for indoor coverage based on the wire backhaul connection available or not.

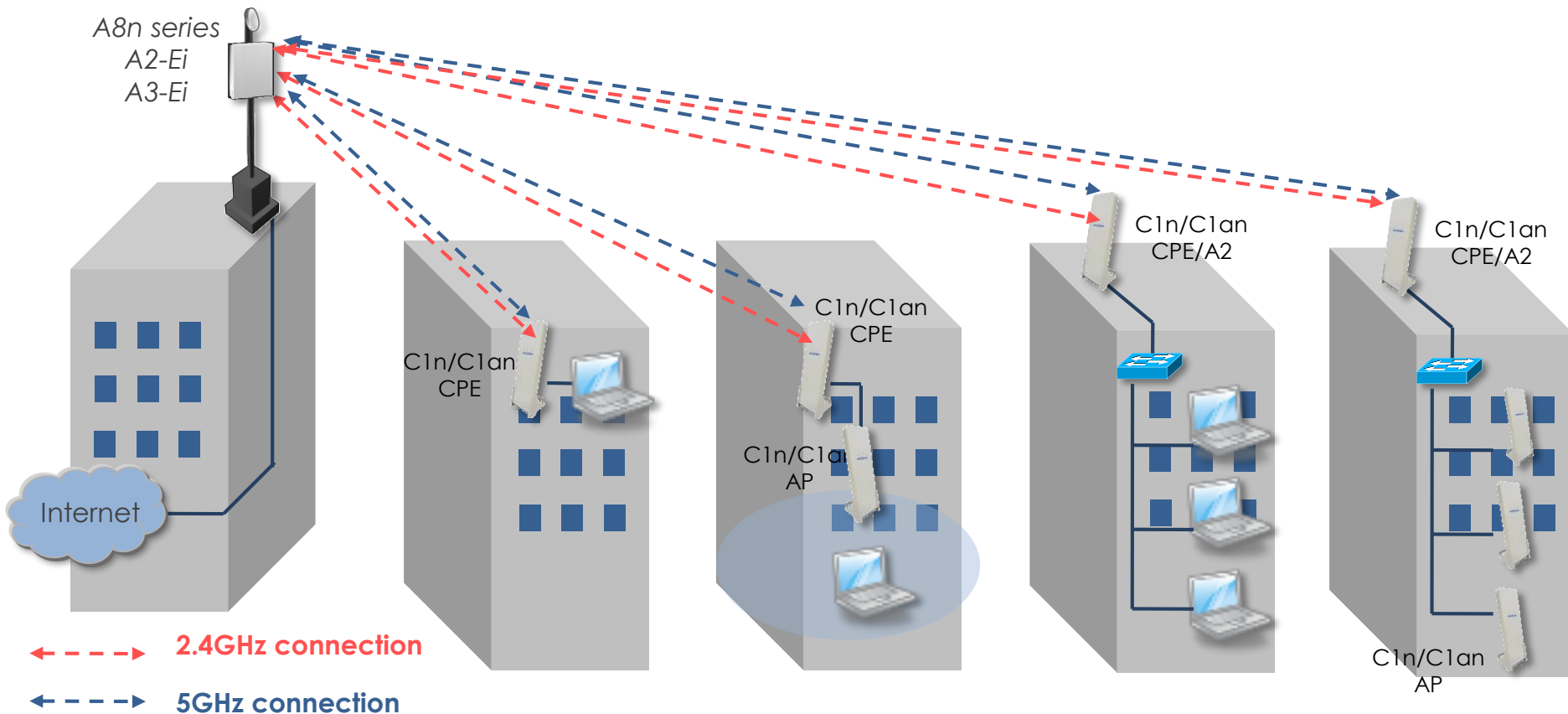
Wire Backhaul Connection available



Altai Typical Deployment — Indoor Coverage

There are two kinds of deployment for indoor coverage based on the wire backhaul connection available or not.

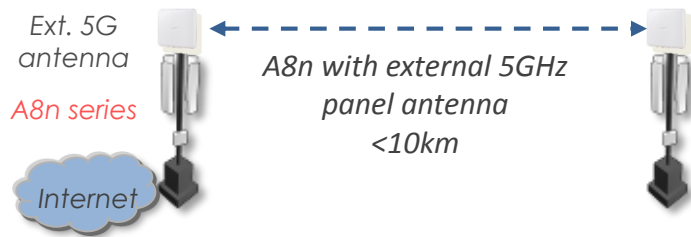
Wire Backhaul Connection unavailable



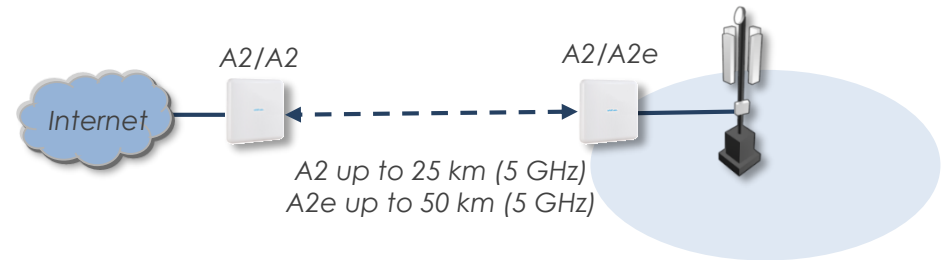
Altai Typical Deployment — Wireless Backhaul

Altai provide full solutions for the wireless backhaul deployment.

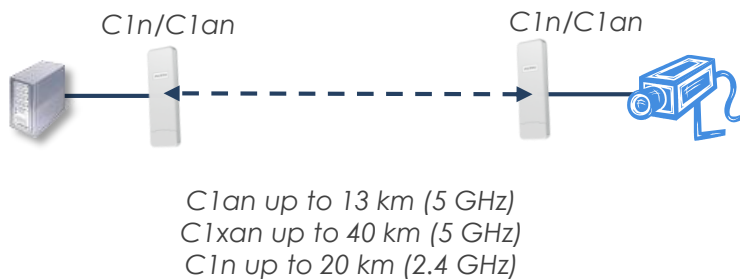
Short range PTP/PTMP backhaul



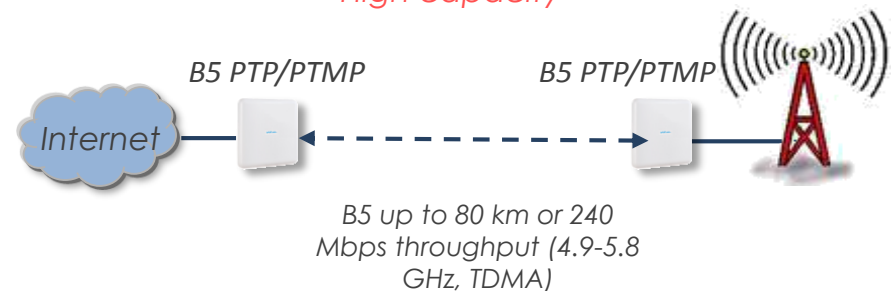
Long range PTP/PTMP backhaul



Cost effective



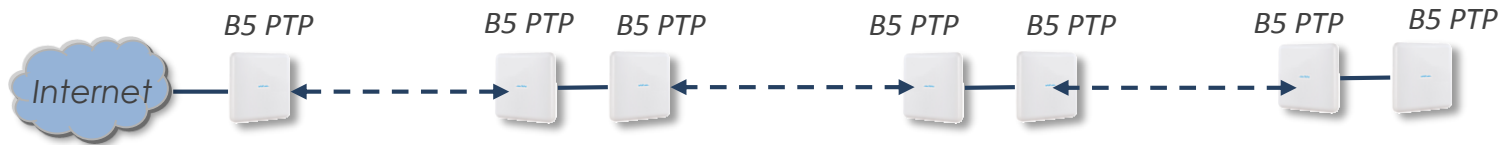
High capacity



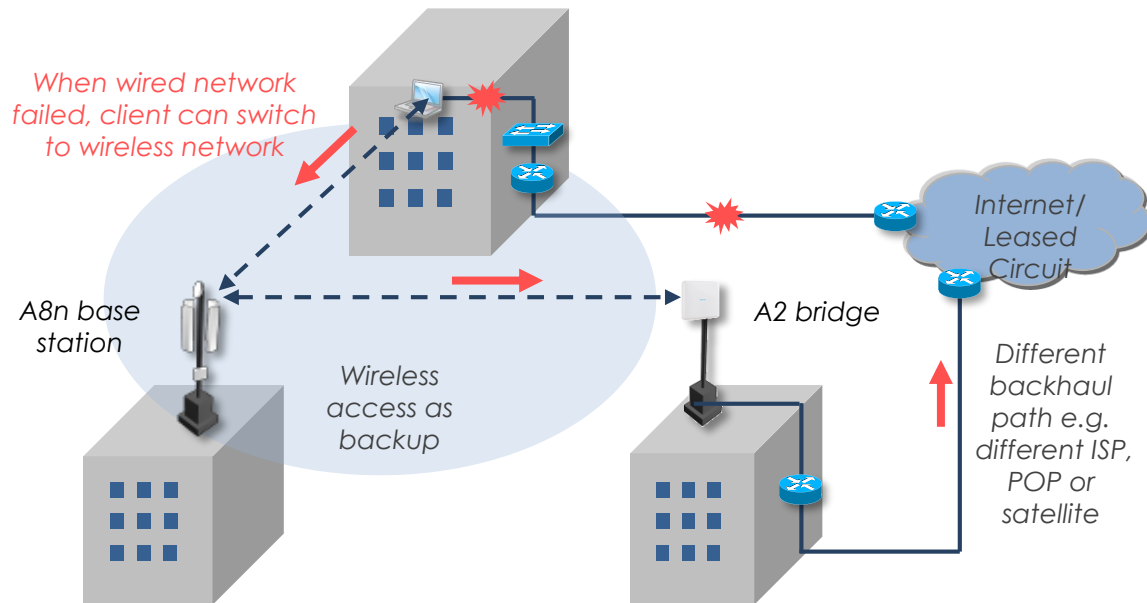
Altai Typical Deployment — Wireless Backhaul

With the Altai wireless backhaul solution, more advance deployments will be available.

Extreme long distance wireless backhaul



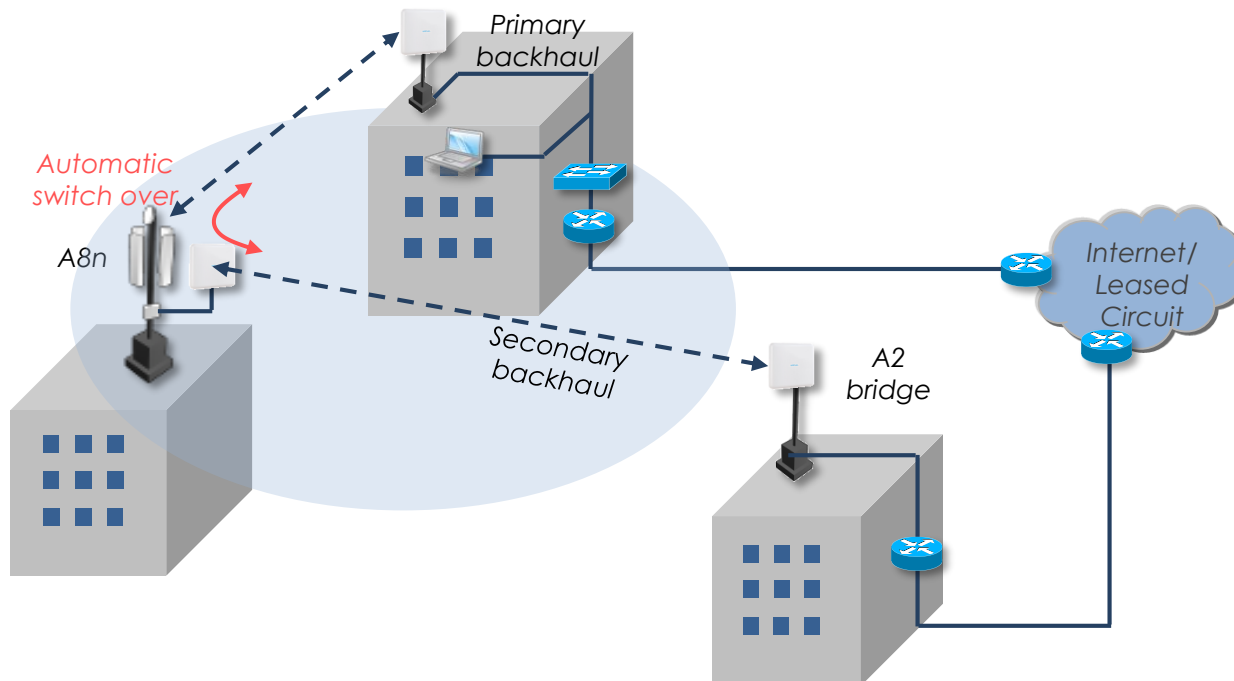
Disaster Recovery Backup



Altai Typical Deployment — Wireless Backhaul

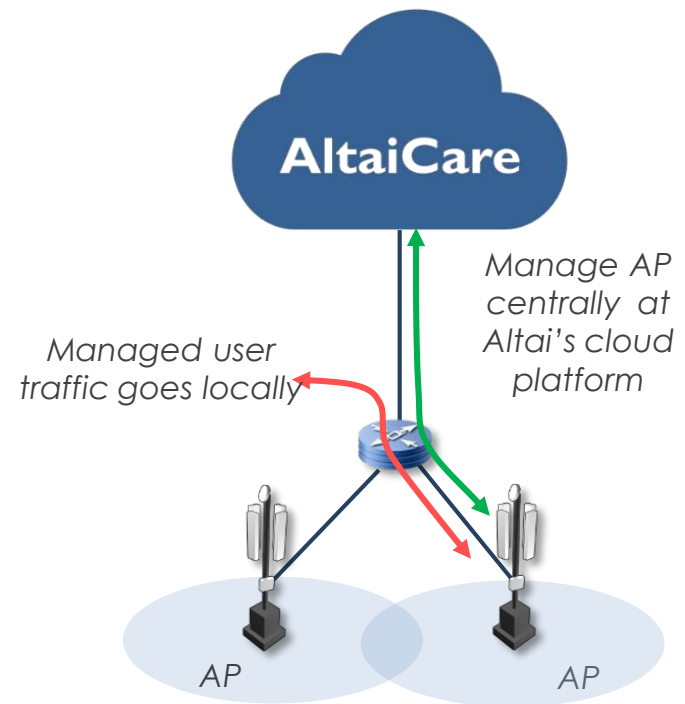
With the Altai wireless backhaul solution, more advance deployments will be available.

Redundancy in Backhaul Backup



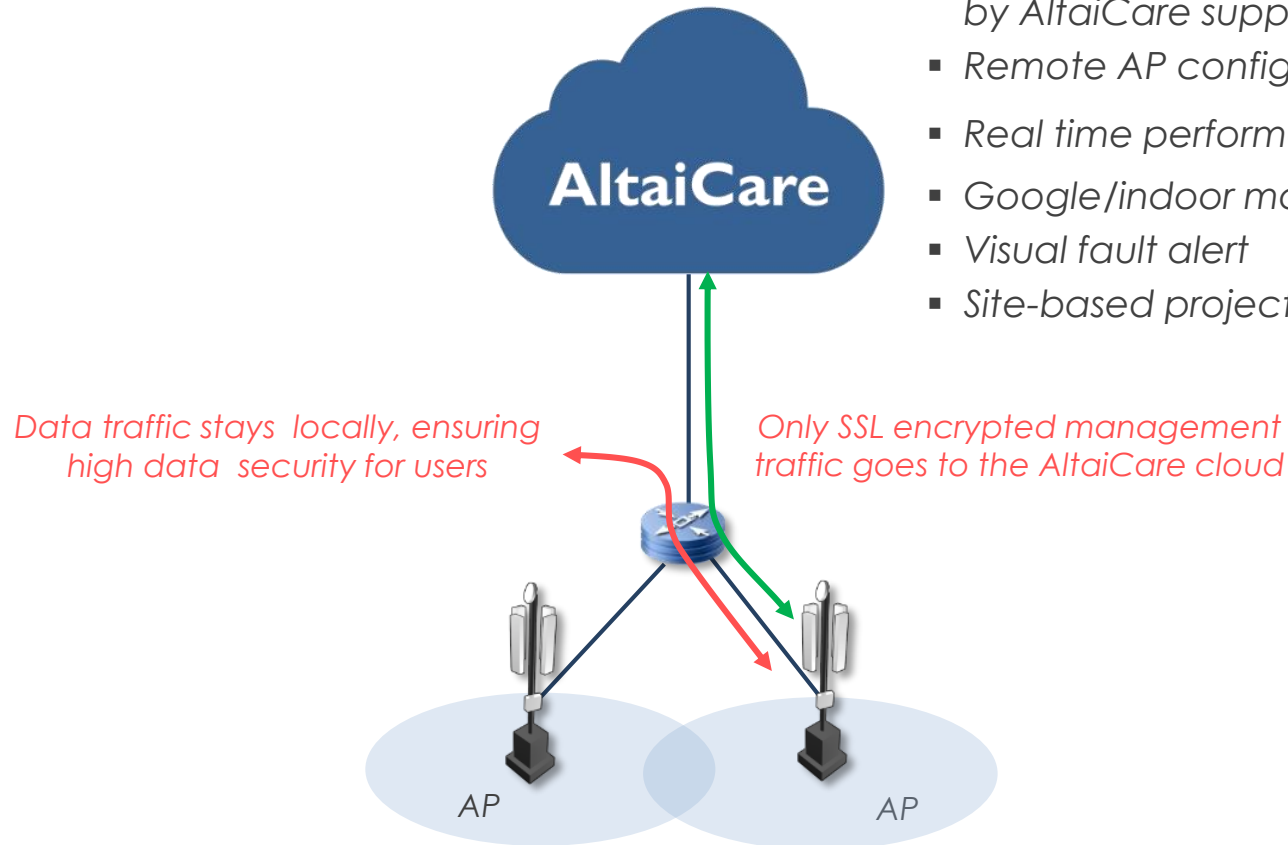
Altai Typical Deployment — Backend Deployment_AltaiCare

AltaiCare : AltaiCare is a cloud-based network management and service control software system.



Altai Typical Deployment — Backend Deployment_AltaiCare

Secured AP Management



- All APs can be centrally managed by AltaiCare supporting
- Remote AP configuration
- Real time performance statistics
- Google/indoor map
- Visual fault alert
- Site-based project administration

Altai Typical Deployment — Backend Deployment_AltaiCare

Service Control



- *AltaiCare supports service control features without deploying a physical controller*
- *Support EAP, MAC address and captive portal authentications*
- *Support pre-paid, post-paid and guest access billing models*
- *Support per user bandwidth control*

Our latest AP firmware has built-in service controller features that work with AltaiCare

Altai Typical Deployment — Backend Deployment_AltaiCare

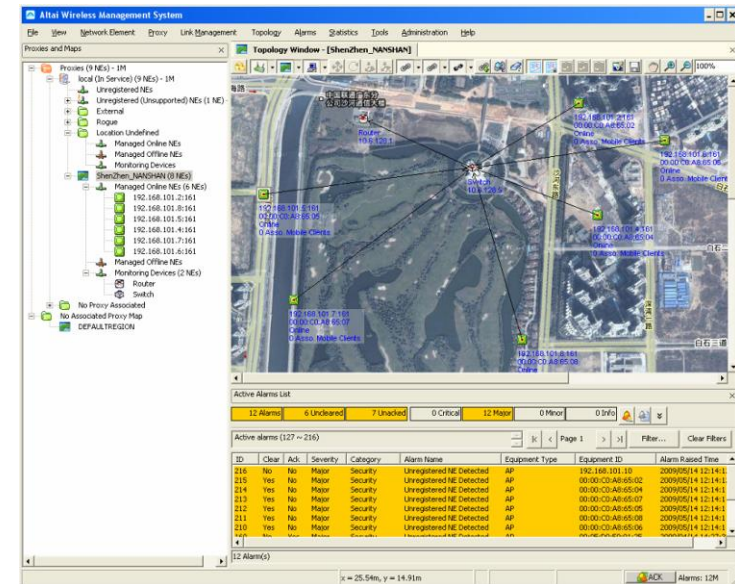
Location-aware Advertising



Altai Typical Deployment — Backend Deployment_AWMS

Altai Wireless Management System provides network operators a full suite of element and network management functions for WiFi networks. AWMS is a windows-based software which provide the AP management and monitoring locally.

- Configuration Management
- Fault Management
- Performance Management
- Security Management
- Firmware Management

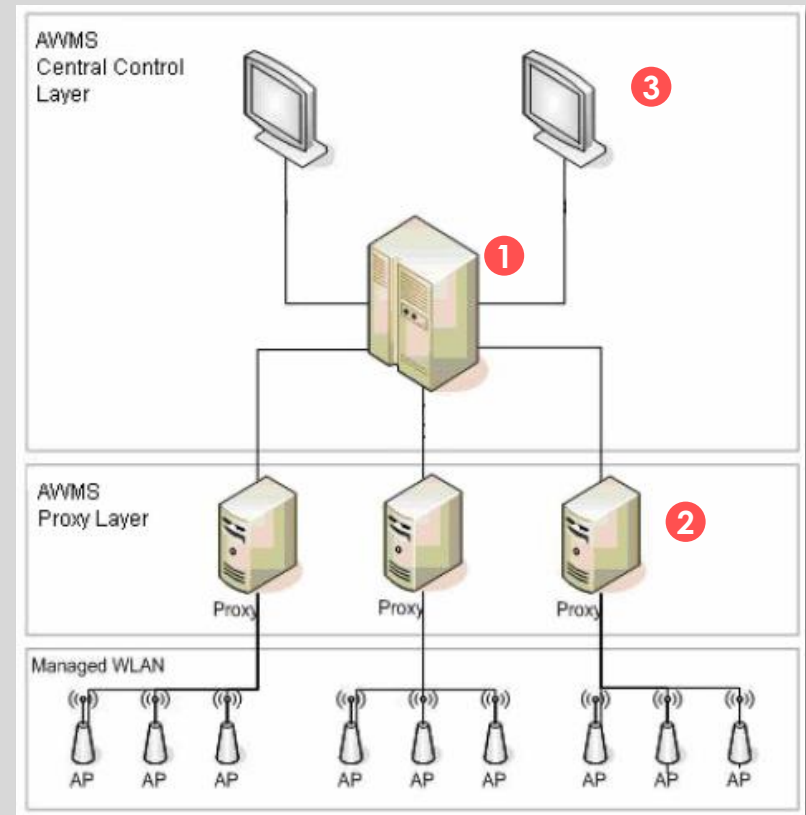


Altai Typical Deployment — Backend Deployment _ AWMS

System Architecture

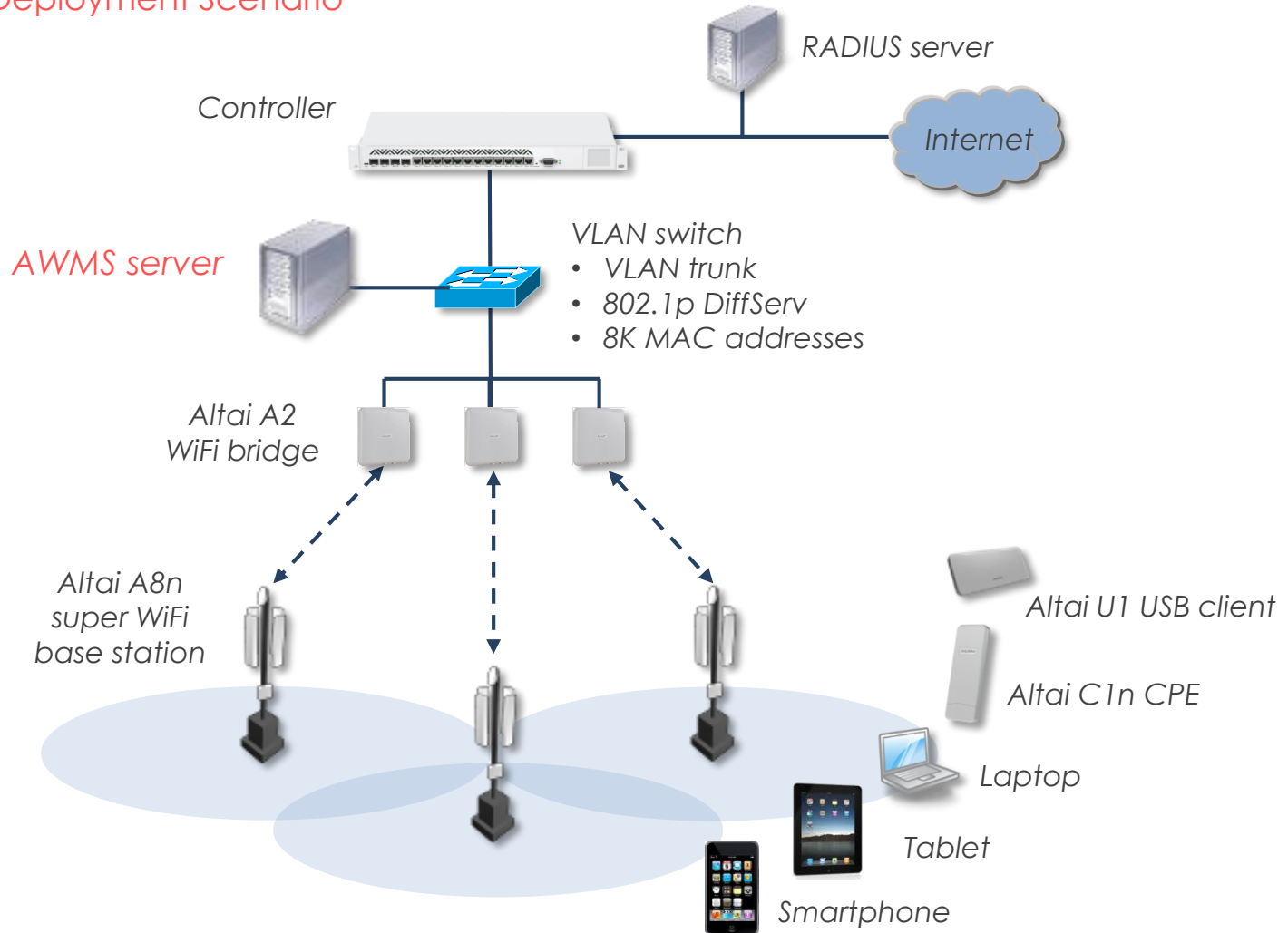
1. AWMS server
2. Proxy server
3. AWMS client

The above 3 subsystems can be installed in one or different hosts



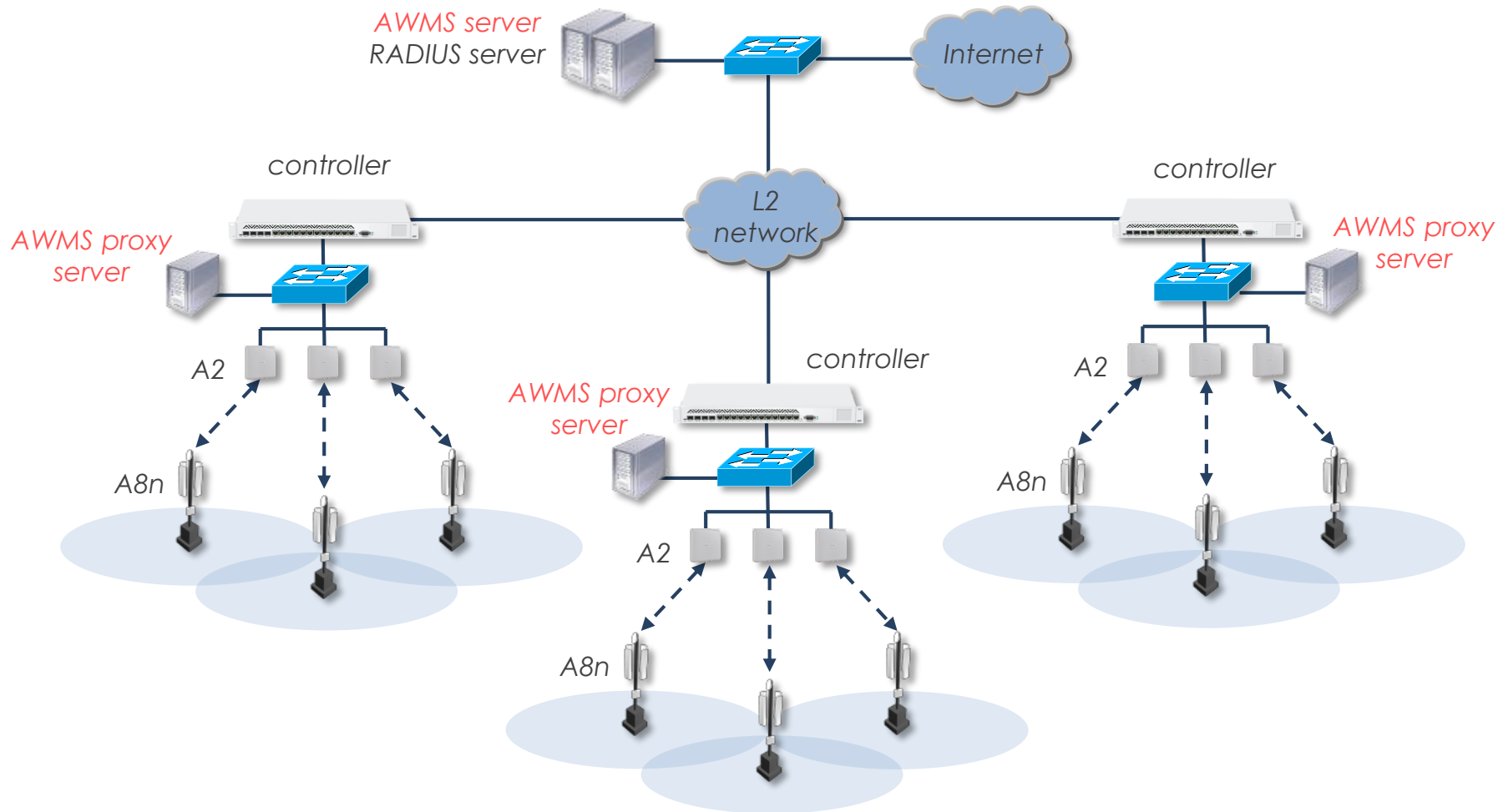
Altai Typical Deployment — Backend Deployment _ AWMS

Single Region Deployment Scenario



Altai Typical Deployment — Backend Deployment _ AWMS

Multiple Regions Deployment Scenario



Altai Typical Deployment — Backend Deployment _ Service Controller

The Altai service controller is designed to be used in Altai Super WiFi systems as bandwidth controller, access control, backbone router, firewall, DHCP server and VPN server.

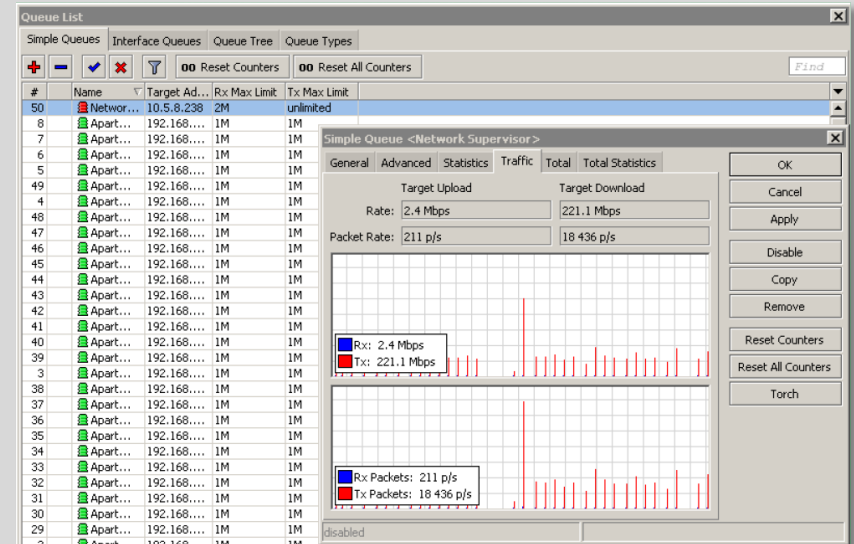
Service controller + AWMS normally used for (service controller for user service control like access control, authentication and so on; AWMS for AP monitoring and management):

- 1) Small WISP project
- 2) School/University WiFi Project
- 3) Terminal Port
- 4) Hotel/Shopping malls

Altai Typical Deployment — Backend Deployment _ Service Controller

Bandwidth Control

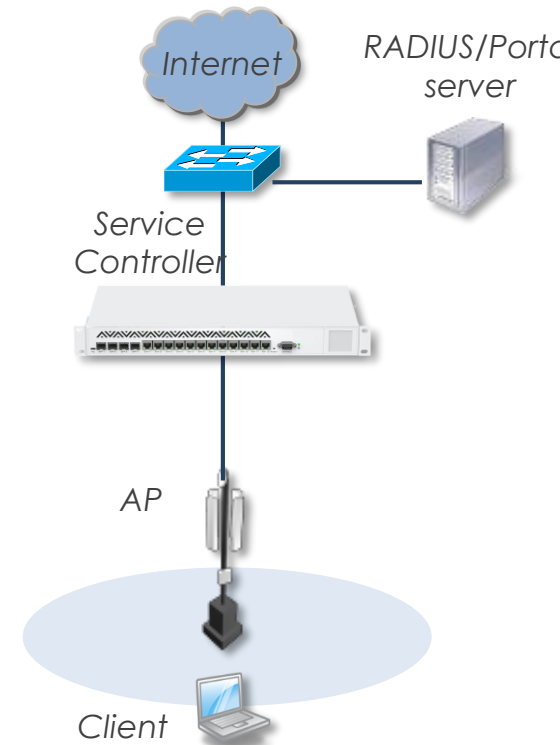
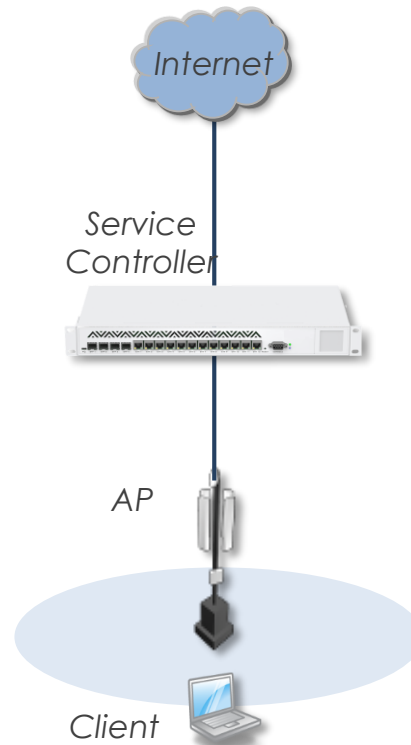
- Network traffic control
- Limit data rate for all traffic passing through
- Hierarchical HTB QoS system with burst
- Per IP/ Protocol/ subnet/ port/ firewall mark
- PCQ, RED, SFQ, FIFO queues
- CIR, MIR, contention ratios
- Dynamics client rate equalizing (PCQ)
- Bursts, peer-to-peer protocol limitation



Altai Typical Deployment — Backend Deployment _ Service Controller

Access Control

- Captive portal (built-in or external)
- MAC address authentication
- RADIUS support (built-in or external)
- True plug-n-play access for network users
- Authentication of local network clients
- User accounting



Altai Typical Deployment — Backend Deployment _ Access Controller

The Altai access controller is a leading wireless controller in the industry, designed to be used in Altai Super WiFi systems as access controller.

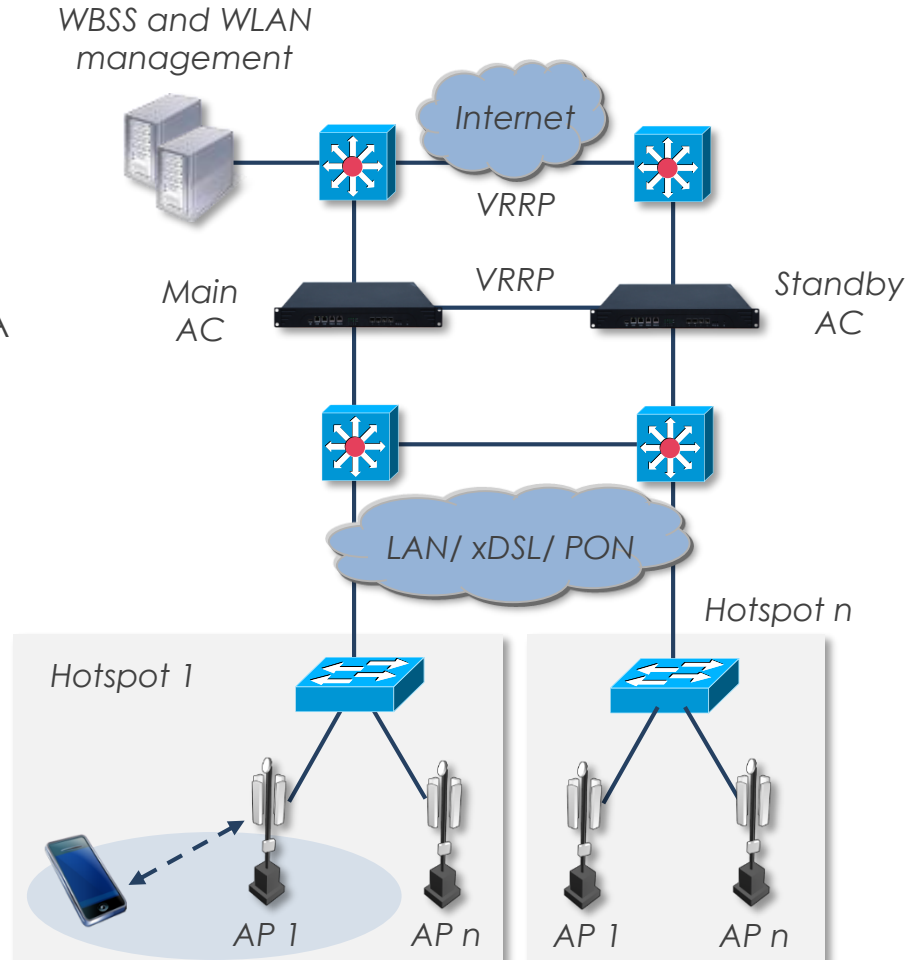
Access controller + AWMS normally used for (Access controller for AP/user management and AWMS for AP monitoring/performance report) city-wide WiFi operator or the case require captive portal and 3G offload.

	AC 200	AC 500	AC 2000	AC 4000	AC 12000
AP license	256	512	2,048	4,096	12,288
Concurrent user	16,000	32,000	128,000	256,000	768,000
Ethernet Throughput	12 Gbps	16 Gbps	192 Gbps	384 Gbps	1,152 Gbps
802.11 capacity	2.5 Gbps	5 Gbps	20 Gbps	40 Gbps	120 Gbps
MTBF	150,000 hours				
MTTR (max.)	30 minutes				
Availability (min.)	99.999%				

Altai Typical Deployment — Backend Deployment _ Access Controller

Access Controller Overview

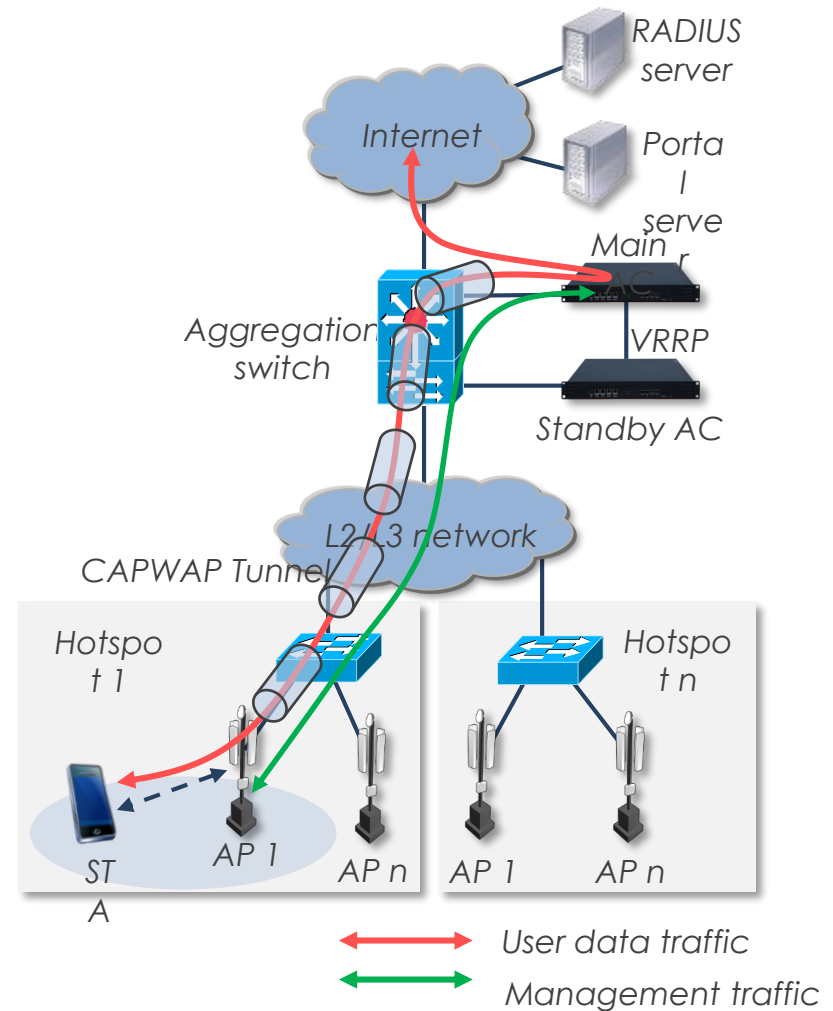
- CAPWAP tunneling to APs
- Centralized AP and RF management
- Authentication support such as captive portal, MAC address, EAP-SIM and EAP-AKA
- 1 + 1 hot standby



Altai Typical Deployment — Backend Deployment _ Access Controller

Deployment Scenario 1 (Thin AP Mode, Concentrated Forwarding Mode)

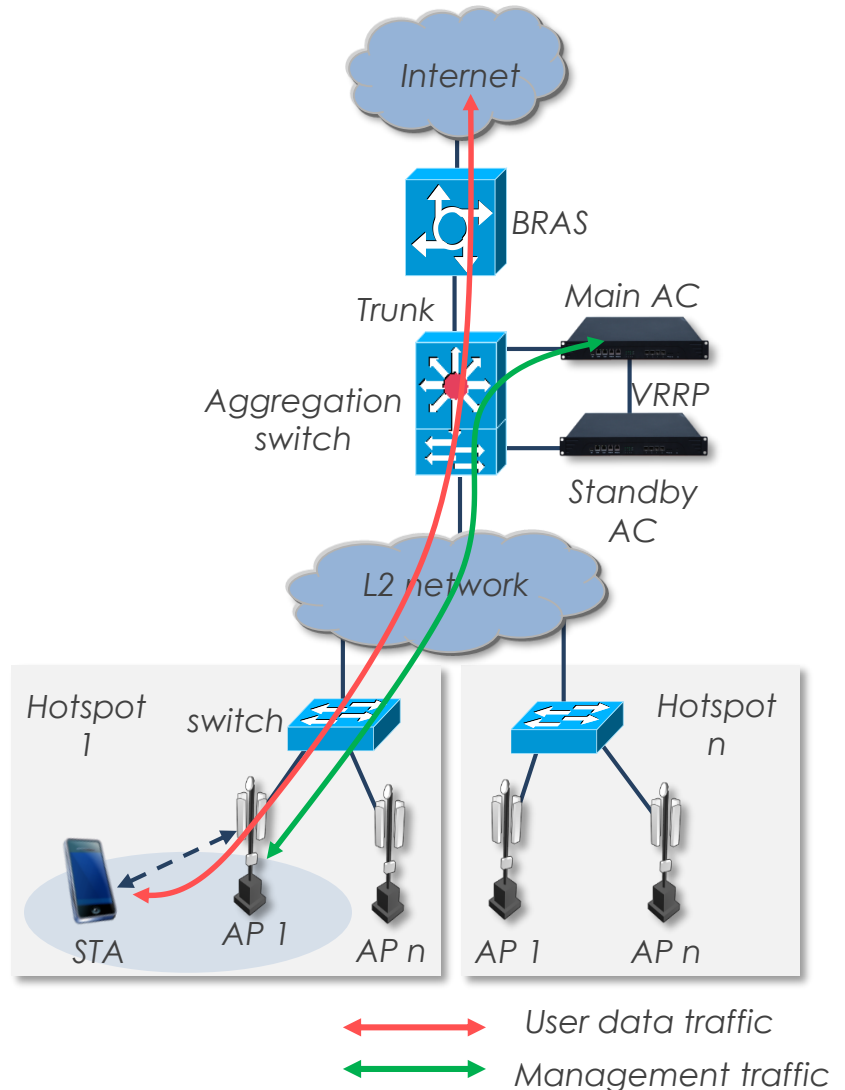
- AC manages AP and user
- Control wireless user traffic in a centralized manner
- User data is transmitted between AP and AC over CAPWAP tunnel and forwarded to Internet after decapsulated by AC
- AP connects to AC over layer 2/3 network
- Distributed forwarding mode is commonly used for overlay network deployment and used in scenario that needs AC also to be a NAS



Altai Typical Deployment — Backend Deployment _ Access Controller

Deployment Scenario 2 (Thin AP Mode, Local Breakout Mode)

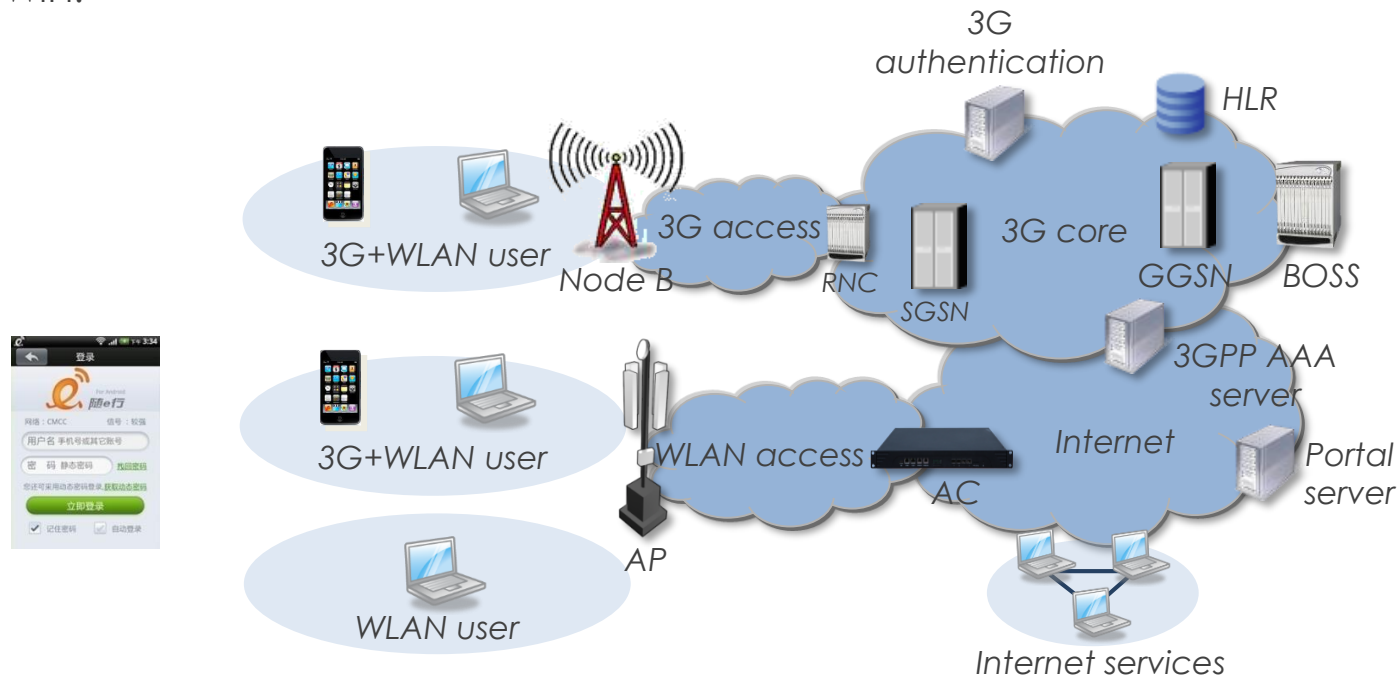
- AC only manages AP
- Wireless user data does not be processed by AC but forwarded to BRAS by the Layer 2 network
- BRAS perform SSID/VLAN based authentication
- Layer 2 connection between AP and BRAS
- AP connects to AC over layer 2/3 network
- Local forwarding mode is commonly used for facilitating the usage of the existing BRAS



Altai Typical Deployment — Backend Deployment _ Access Controller

Case Study – China Mobile

- For 3G mobile data offload and hotspot application
- WiFi authentication using EAP-SIM/AKA and captive portal
- Both 3G and WiFi access can use SIM card for authentication, seamless roaming between 3G and WiFi.



Thank You