



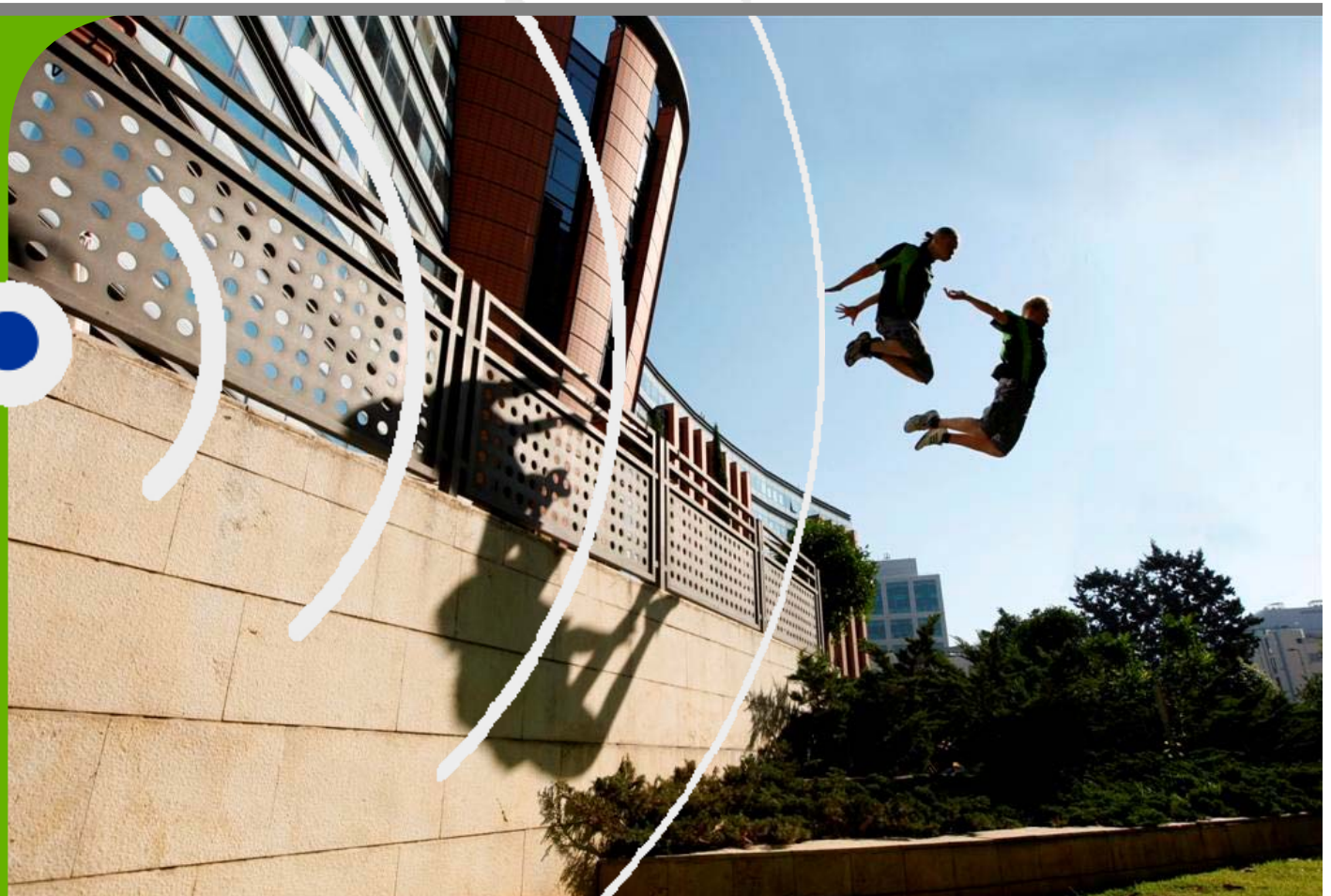
BreezeMAX[®] Extreme 5000 Product Presentation

December 2009



Proprietary Information

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Disclaimer

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Scope



- **The Challenge**
- **The Solution**
- **Market and Deployment Scenarios**
- **The Power of Enhanced Radio Systems**
- **Leverage WiMAX 16e QoS**
- **Network Management System**
- **BreezeMAX Extreme Roadmap**
- **Summary**

The Challenge



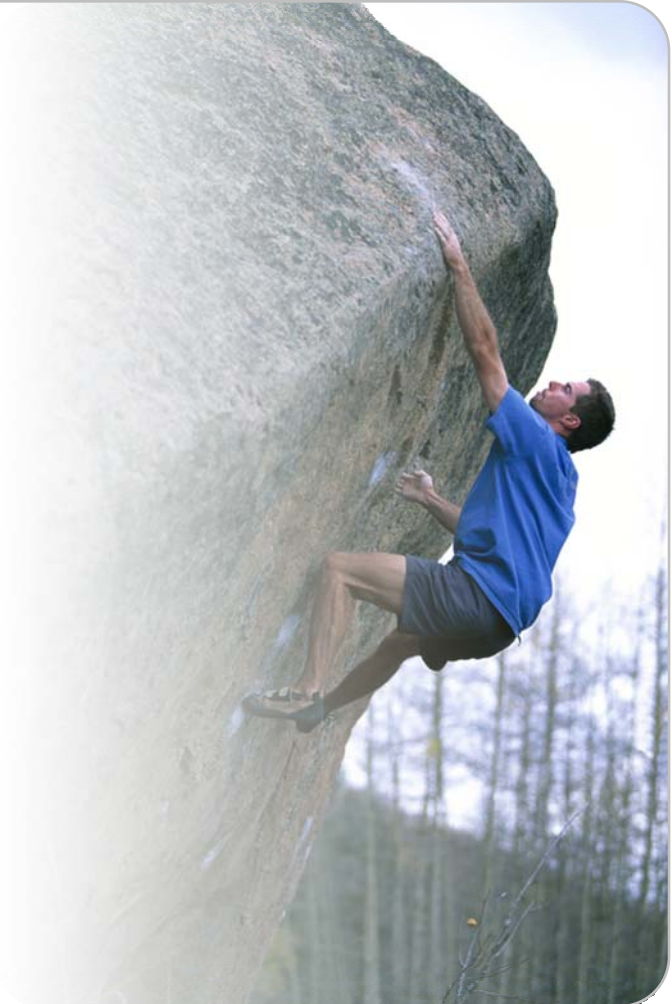
The Challenge

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To provide cost-effective data, voice and video connectivity in urban and rural areas

While:

- **Minimizing CAPEX and OPEX**
- **Easily and quickly overcoming geographical deployment challenges**
- **Providing ubiquitous service**
- **Sustaining a manageable high end service**



Wired Solution Challenges



- Availability of wires in desired location
- New wire rollout → high deployment costs (CAPEX)
- Leased line → high operation costs (OPEX)
- Limited flexibility for changes and expansion
- Limited scalability
- No ad hoc capability



The Need for Wireless



Wireless Solution Benefits



- **Cost-effective**
- **Flexible and scalable**
- **High-capacity**
- **Robust**
- **Mobile**
- **Ad hoc capabilities**



The Wireless License-exempt Solution



Advantages

- Reduced OPEX
- Enables avoiding expensive and long term frequency auction

Challenges

- Frequency is shared by independent users
- Requires advanced interference mitigation techniques



The Need for an Extreme Solution



The Solution



Introducing BreezeMAX Extreme 5000



**First
WiMAX 16e
in 5 GHz**



Alvarion's Point-to-Multipoint 5 GHz Solutions



BreezeMAX Extreme

First WiMAX™ 16e solution for 5 GHz market

BreezeMAX Extreme is designed to complement existing 5 GHz product offering



Complementary Solution: BreezeMAX Wi²



Wi²

BreezeACCESS® VL



AU-BST



AU-SA



SU-3 / SU-6 /
SU-54 / SU-V



SU-3L / SU-6L /
SU-12L

BreezeACCESS EZ



EZ-AU



EZ-SU

BreezeMAX Extreme 5000 Meets the Challenge

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Carrier-class

WiMAX 16e is now a reality for 5 GHz license-exempt market



All Outdoor

All-in-one, all outdoor solution for profitable up & go services



WiMAX 16e Quality-of-Service

For enhanced and swift delivery of triple-play services



Interference Resistant

Powerful interference mitigation techniques overcoming obstacles













Broadband Anywhere

Efficient delivery of broadband applications to any environment

BreezeMAX Extreme 5000 Meets the Challenge



 Carrier Class	 All Outdoor	 WiMAX QoS	 Interference Resistant	 Broadband Anywhere
 Carrier-Class WiMAX 16e is now a reality for 5 GHz license-exempt market				
 All Outdoor All-in-one, all outdoor solution for profitable up & go services				
 WiMAX 16e Quality-of-Service For enhanced and swift delivery of triple-play services				
 Interference Resistant Powerful interference mitigation techniques overcoming obstacles				
 Broadband Anywhere Efficient delivery of broadband applications to any environment				

BreezeMAX Extreme Meets the Challenge: Carrier-class



Carrier Class



All Outdoor



WiMAX QoS



Interference Resistant



Broadband Anywhere

Carrier-class WiMAX 16e is now a reality for 5 GHz license-exempt market

- **Bringing state-of-the-art standardized technology to license-exempt markets**
- **Supporting interoperability and certification and complying with WiMAX Forum® guidelines**
- **Enabling ecosystems to benefit from WiMAX 16e economy-of-scale**
- **Offering environment friendly products**

BreezeMAX Extreme Meets the Challenge: All Outdoor



Carrier
Class



All
Outdoor



WiMAX
QoS



Interference
Resistant



Broadband
Anywhere

All-in-one, all outdoor solution for profitable up & go services

- Enabling reduced CAPEX and OPEX for low cost of ownership and fast ROI
- Offering an all-in-one solution by integrating base station, antenna, ASN-GW and GPS receiver
- Supporting a fully outdoor and easy to deploy solution
- Enabling flexible installations on communication towers, rooftops and street light poles with diverse power feeding as well as backhaul and antenna options
- Providing a range of models to meet various deployment needs: single sector or dual sector for maximized capacity or coverage

BreezeMAX Extreme Meets the Challenge: WiMAX QoS



Carrier
Class



All
Outdoor



WiMAX
QoS



Interference
Resistant



Broadband
Anywhere

Leverage WiMAX 16e QoS for enhanced and swift delivery of triple play services

- Benefit from inherent WiMAX QoS to simultaneously support multiple applications using service differentiation
- Support real time triple-play (voice, video) and non real-time applications simultaneously
- Extend your application offering to businesses, residential access and carrier of carriers over same radio access network

BreezeMAX Extreme Meets the Challenge: Interference Resistant



Carrier
Class



All
Outdoor



WiMAX
QoS



Interference
Resistant



Broadband
Anywhere

Powerful interference mitigation techniques for overcoming obstacles

- Intensifying Mobile WiMAX 16e to better-fit license-exempt deployments
- MIMO A/B*, STC and MRC advanced antenna techniques in both base station and CPE
- HARQ: state-of-the-art error correction coding techniques
- Best non-line-of-sight with SOFDMA and up to 1024 FFT size
- Support for Dynamic Frequency Selection (DFS) and Dynamic Channel Selection* (DCS)

* In future release
Proprietary and Confidential

BreezeMAX Extreme Meets the Challenge: Broadband Anywhere



Carrier
Class



All
Outdoor



WiMAX
QoS



Interference
Resistant



Broadband
Anywhere

Designed to fit: efficient delivery of broadband applications to any environment

- Superior sector capacity and coverage for best implementation of fixed, nomadic and mobile applications in rural and urban deployments
- Supporting multiple applications such as voice, Internet access, video surveillance, data access, public safety and enterprises
- Providing optional single or dual* sector support to maximize on capacity or coverage
- Offering flexibility: start with what you need and grow-as-you-go
- Maintaining low entry price options
- Featuring a small footprint

* In future release
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BreezeMAX Extreme 5000 Specification Highlights

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	Base Station	CPE
Standard	WiMAX 802.16e Wave 2 compliant	
Model	Single or dual* sector	Outdoor, MIMO
Channel Bandwidth	5, 10, 20 (2x10)* MHz	5,10 MHz
Max Tx Power	21dBm	20dBm
Power Consumption	Up to 57W	Up to 16.5W
Diversity	2x2, MIMO A/B*, MRC	2 Rx, 1 Tx
Bands	4.9 - 5.35 GHz, 5.47 - 5.95 GHz	4.9 - 5.95 GHz
Dimensions	51 x 28 x 15 cm, 11 kg (mounting: + 5 kg)	23 x 23 x 6.3 cm, 2 kg
Installer Aid	Advanced Spectrum Analyzer and DCS (Dynamic Channel Selection)*	Freq. Scan, Best AU, Preferred AU, SAU
DFS	EN 301 893 v1.5.1, FCC	
ASN-GW	Integrated or external	
Networking	IPCS, ETHCS	
Security	AES WiMAX 16e	
Authentication	AAA centralized over RADIUS Local provisioning (SU MAC-based, fixed network)	

* In future release
Proprietary and Confidential

Market and Deployment Scenarios



Market Needs

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WISPs

- Provide premium broadband access and voice services
- Extend telecommunications and broadband services to smaller satellite townships and residents
- Quickly satisfy demand for high capacity



Enterprises

- Build self-owned Intranet infrastructure across buildings and towns
- Replace E1/T1 links cost-effectively
- Back-up communications for faster disaster recovery



Municipalities

- Connect public safety and community buildings with access and voice services for better inter-agency collaboration
- Increase public safety with remote video surveillance monitoring
- Connect schools and universities



Wide Range of Applications

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Access



Public Safety



Business Applications



Remote Office



Utilities



Mining



Fleet Management



Meter Reading



Emergency Services



Municipality Applications



BreezeMAX Extreme 5000: A Network That Works for You (1)

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CURRENT APPLICATIONS



Access

- Quality of Service enabling additional services
- Capacity: designed for high occupancy
 - Scheduled, multiple access protocol
- Ease-of-use: centralized provisioning and management



Business

- Diverse services and deployment scenarios:
 - Combined Eth.CS and IP.CS services
 - QoS with diverse classifiers
- Security: AES encryption, keys generated per session by AAA
- Enhanced ROI: carrier of carrier



Remote Office

- Centralized provisioning: nomadicity
- Access anywhere (potential ROI - roaming)
- Improved efficiency, reach, and service

BreezeMAX Extreme 5000: A Network That Works for You (2)

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PLANNED APPLICATIONS



Video / Public Safety

- Leveraging 16e QoS for video
- Multicast, broadcast and unicast
- Enhanced performance
 - Video centric service profile
 - Optimized video delivery



Municipality



Fleet Mgmt.

- 16e separates between access and service
 - Ability to lease part of access network to local vendors
- QoS for diverse municipality services
 - Inter-building connectivity, remote office, video surveillance, first responders, fleet management



Mobility

- True vehicular mobility powered by 16e
- 5 GHz suits vehicular mobility
 - First responders, trains, buses, watercraft
- Special subscriber under development

Adam Internet, Australia

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Customer Type	Internet Service Provider
Country / Region	Australia
URL	http://www.adam.com.au
Application	Broadband services for residential and business customers

The Result

- ☐ Rated within top-ten ISPs in Australia, serving over 80,000 DSL subscribers
- ☐ Deploying WiMAX 16e in 5 GHz spectrum
- ☐ Part of the Australian Government's Broadband Guarantee Program (BGP)
- ☐ Targeting 55,000 underserved customers metropolitan Adelaide (across 5000 square km)



Greg Hick's, Chairman of Adam Internet

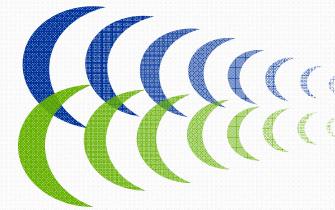
"...WiMAX offers a high-capacity network that is quick to deploy and very economical to operate. The excellent performance results of BreezeMAX Extreme 5000 coupled with its compact flexible outdoor design configuration enables us to significantly reduce our upfront network investment and accelerate our return on investment.."

MIMO Single Sector Model

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MIMO Single Sector 2x2

- Superior performance utilizing 2nd order diversity
- Maximal sector capacity (MIMO B)*
- Maximal sector coverage (MIMO A)
- Supports 5, 10, 20(10+10)* MHz per sector
- Max UDP Capacity:
 - MIMO A: 27 Mbps (10 MHz), 54 Mbps (20 MHz)
 - MIMO B: 32 Mbps (10 MHz), 65 Mbps (20 MHz)
- Integrated or external antenna



BreezeMAX
Extreme 5000



Best Fit for

- High-capacity driven deployments
 - Urban
 - Video
- NLOS conditions

* In future release

Proprietary and Confidential

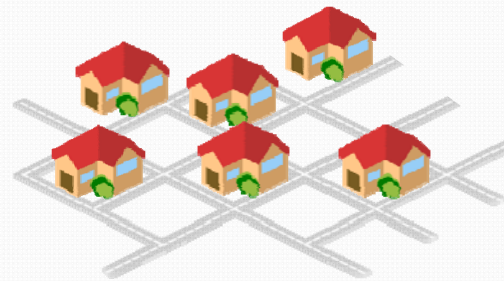
SISO Single Sector Model

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SISO Single Sector 1x1

- Single sector
- Supports 5, 10, 20(10+10)* MHz per sector
- Integrated or external antenna
- Max UDP sector capacity
 - 5 MHz: 13 Mbps
 - 10 MHz: 27 Mbps
 - 20 MHz: 54 Mbps

Suburban/Rural



Best Fit for

- Capacity-driven deployments
 - Suburban
 - Rural

* In future release

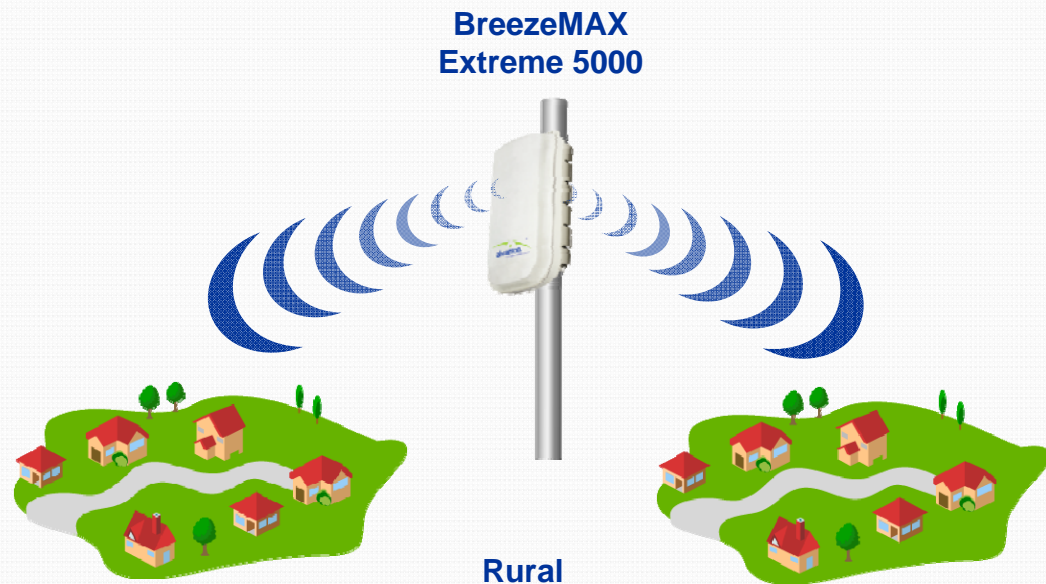
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SISO Dual Sector Model*

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SISO Dual Sector 1x1*

- Dual sector served by a single unit
 - Full functional sectors, enabling reduced CAPEX and OPEX
- Up to 10 MHz per sector
- Max UDP sector capacity
 - 5 MHz: 13 Mbps
 - 10 MHz: 27 Mbps
- External antenna only



Best Fit for

- Coverage-driven deployments with lower capacity requirements
 - Rural

* In future release

Proprietary and Confidential

Summary of Configuration Benefits



Best Fit for Deployment Needs

- Wide range of models
- Multiple models can coexist in a single deployment
- Maximized deployment efficiency



Swift ROI



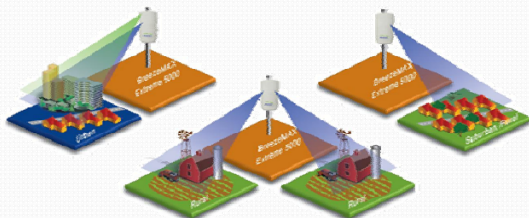
BreezeMAX Extreme 5000

The Power of Enhanced Radio System



Extreme Radio System

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Built for best fit and ease-of-use



Above standard capabilities

WiMAX 16e



Advanced radio technology



WiMAX 802.16e Facts and Benefits

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Fact	Benefit
WAN Protocol	WAN (Wide Area Network) protocol Designed for large scale, broadband outdoor delivery
FFT size of 2048 / 1024 / 512	Improves interference mitigation and better overcomes multipath, rich sub-channelization capabilities
ACM	Adaptive code and modulation maximize bandwidth utilization per SNR <ul style="list-style-type: none"> • Modulations QPSK, QAM16, QAM64 • Forward Error Correction based on Convolutional-Turbo-Code: 1/2, 2/3, 3/4, 5/6
OFDMA	Multiple access OFDM for better resource allocation and sector performance Intensifying scheduling with two dimension (time and frequency)
SOFDMA	Scalable OFDMA Using sub-channel structures that scale with bandwidth, providing enhanced protection against multipath and Doppler shift
Enhanced sub-channelization	Supporting several permutation schemes (Adjacent sub carrier, distributed sub carrier) optimizing performance under various scenarios
HARQ	Hybrid Automatic Repeat Request Reliable data transmission at the PHY level combined with Forward Error Correction significantly improves each burst detection probability

Powerful Interference Mitigation Techniques

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WiMAX 802.16e Facts and Benefits

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Fact	Benefit
MAPs repetition	Enhance interference mitigation For scheduled protocol in noisy environments
Advanced antenna techniques	MRRRC, STC, MIMO A and MIMO B; Increases data throughput and link range without additional bandwidth or transmit power
Open standardized protocol	Clear reference points and interfaces enabling interoperability
Mobility	Inherently supports mobile applications using same infrastructure
Standard management scheme	TR-69 based CPE management scheme

Powerful Interference Mitigation Techniques

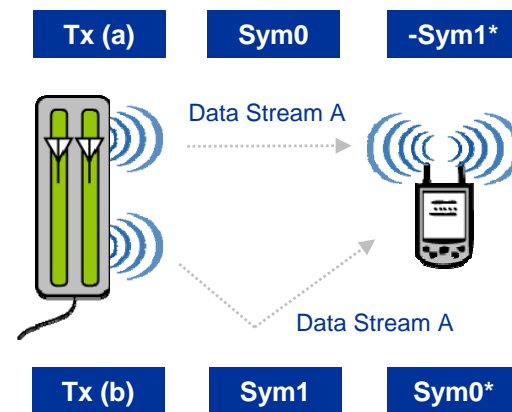
MIMO A

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MIMO A (Diversity)

- Base station transmits same data over two transmission paths
- Transmissions are coded in time and space
- 2nd order diversity is featured in downlink

MIMO Matrix A Space Time Block Coding (STBC)



Benefits:

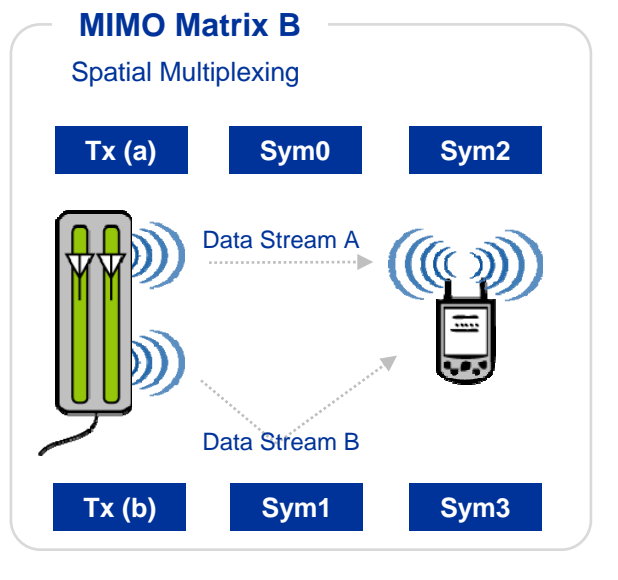
- Increased coverage due to redundant and parallel paths
- Less re-transmission on cell edge with multiple path

MIMO B*

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MIMO B (Capacity)

- Base station transmits two different data streams over same channel
- Same number of sub-carriers, twice as many QAM symbols to MAP interleaving



Benefits:

- Increased capacity due to reuse of bandwidth channel

* In future release

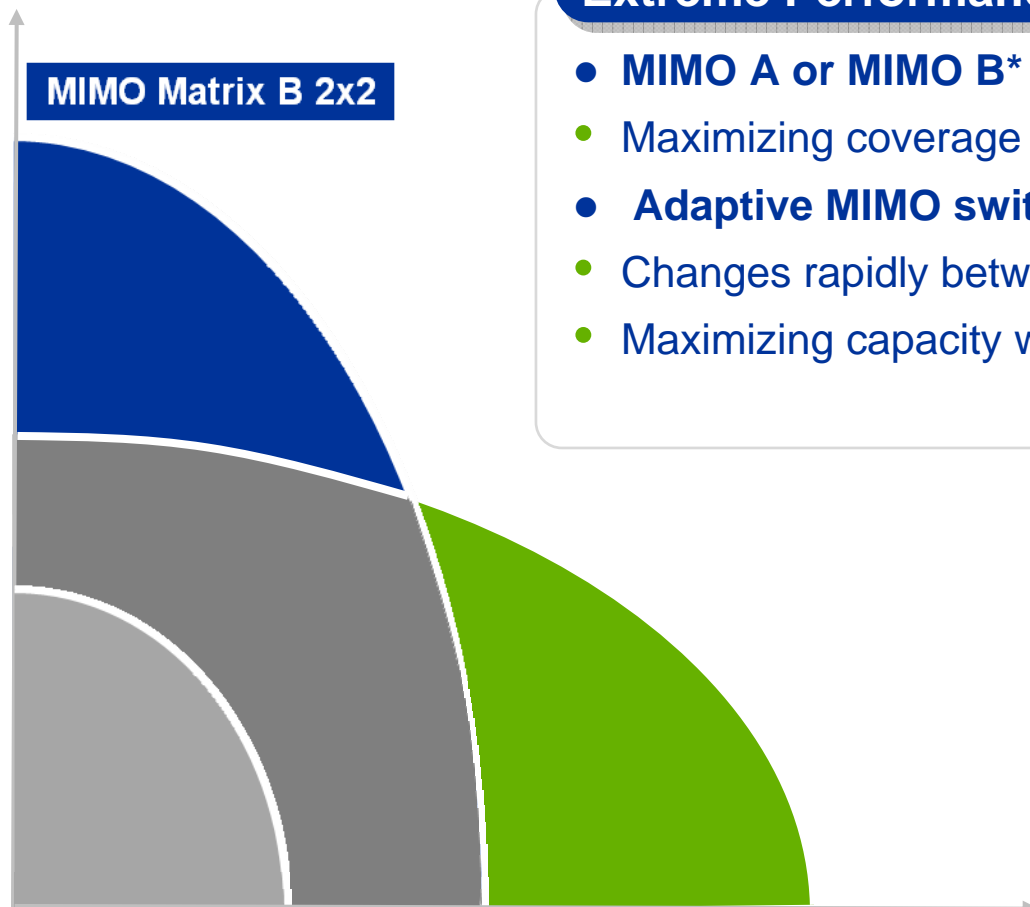
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MIMO A/B*

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Capacity

MIMO Matrix B 2x2



Ref: SISO
1x1

MIMO Matrix A 2x2
(Rx Diversity)

Coverage

Extreme Performance with MIMO A/B Switching

- **MIMO A or MIMO B* utilization**
 - Maximizing coverage or capacity per deployment type
- **Adaptive MIMO switching**
 - Changes rapidly between Matrix B and Matrix A
 - Maximizing capacity while maintaining connection

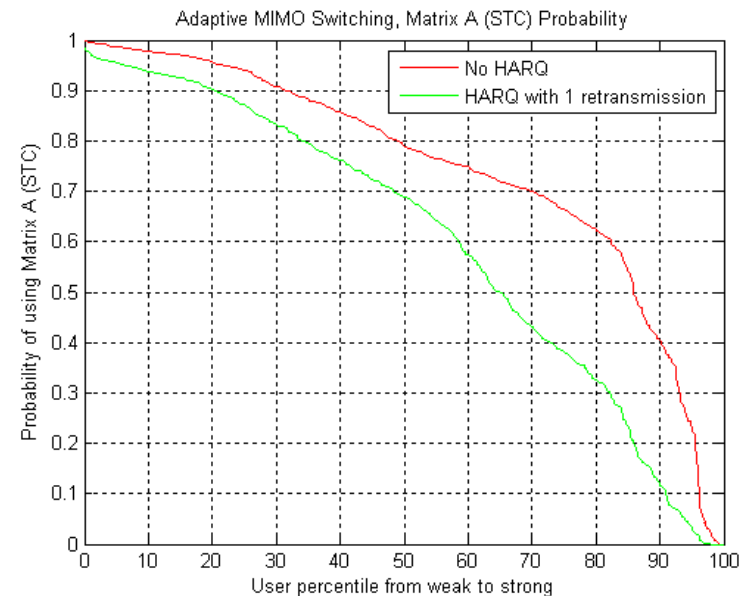
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* In future release

Hybrid Automatic Repeat reQuest (HARQ)

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- **Reliable data transmission at PHY level combined with forward error correction**
- **Significantly improves each burst detection probability**
- **Like ARQ, reduces error rate by retransmitting error bursts**
- **Unlike ARQ: stores and combines error bursts rather than discarding them**



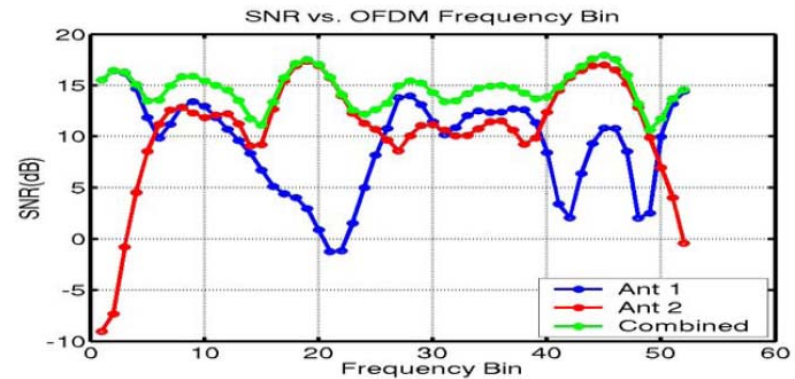
Benefits:

- **Allows an extensive use of matrix B to maximize capacity**
- **Improves performance under interference / fading changes**

Maximum Receive Ratio Combining (MRRC)

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- Combining signals from antennas at each frequency
- Improve overall gain, especially in multipath environments
- Increase uplink gain
- Reduce imbalance between uplink and downlink power budgets



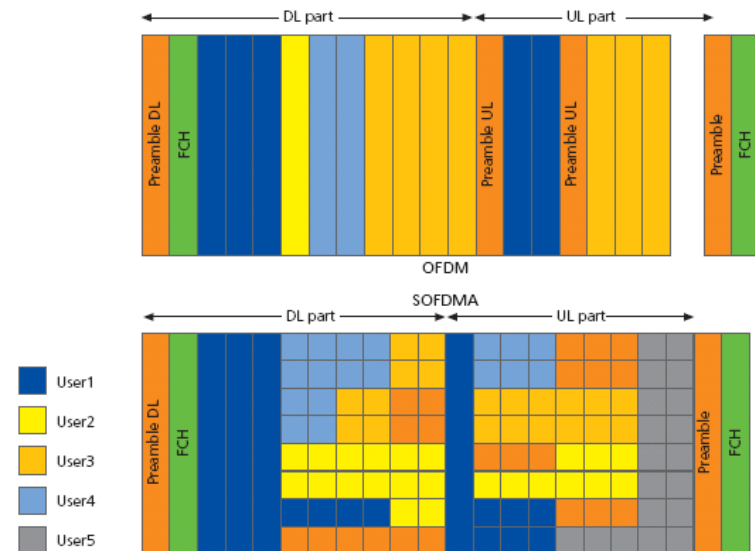
Benefits:

- Enhanced system gain
- increased sector coverage and capacity
- Improved business case

OFDMA

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- Two dimensional (time and frequency) based scheduling
- Dynamic allocation of sub-channels to best fit link budget and capacity demand
- Increase SNR and improved modulation rate
- Increased flexibility for enhanced throughput and robustness

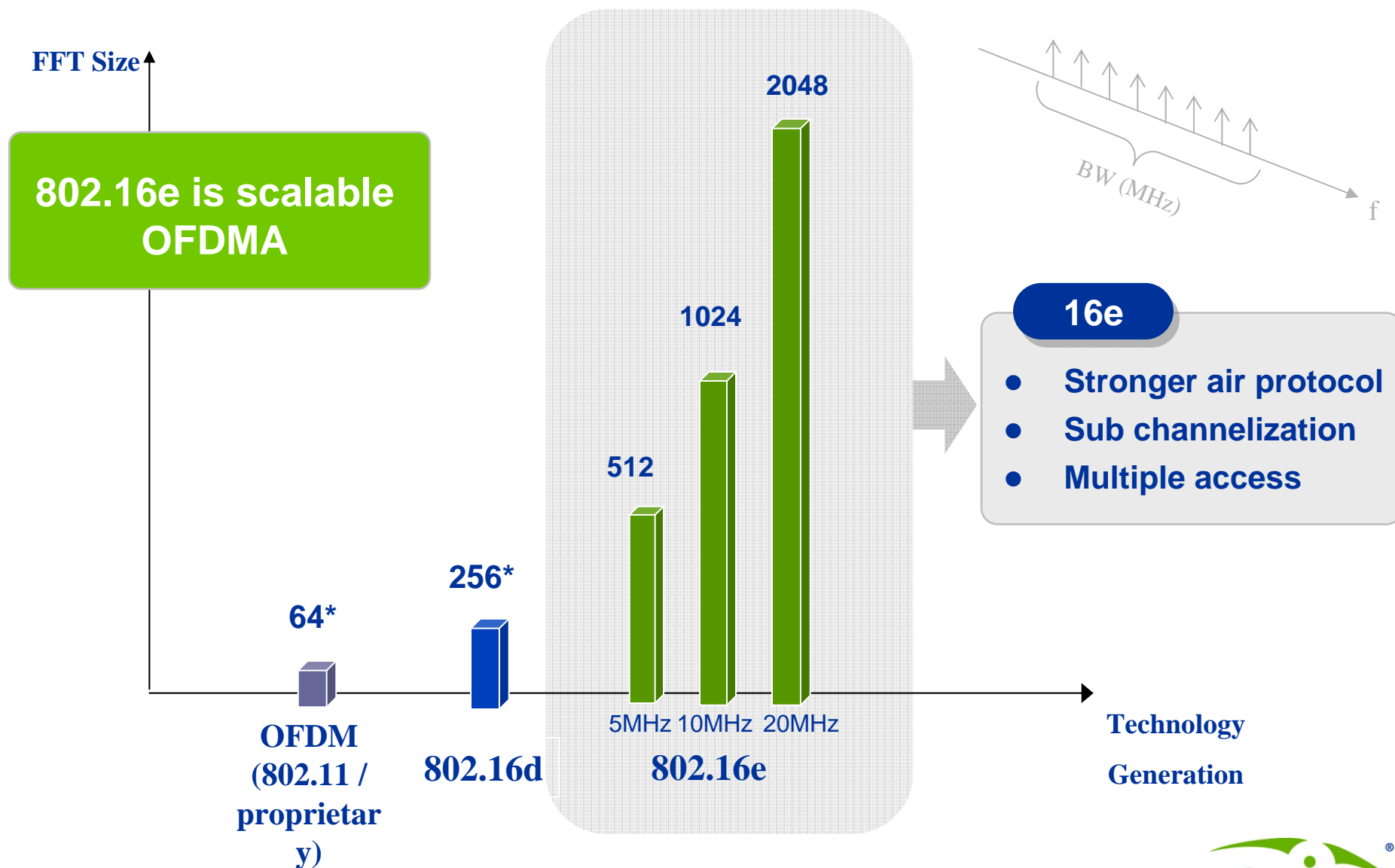


Benefits:

Connect subscriber units (SUs) with relatively poor link conditions

- Increase maximum transmit power of SU by 3, 6, 9 or 12 dBm
- Better bandwidth utilization enabling several SUs to simultaneously share bandwidth

OFDM Technologies: Differences

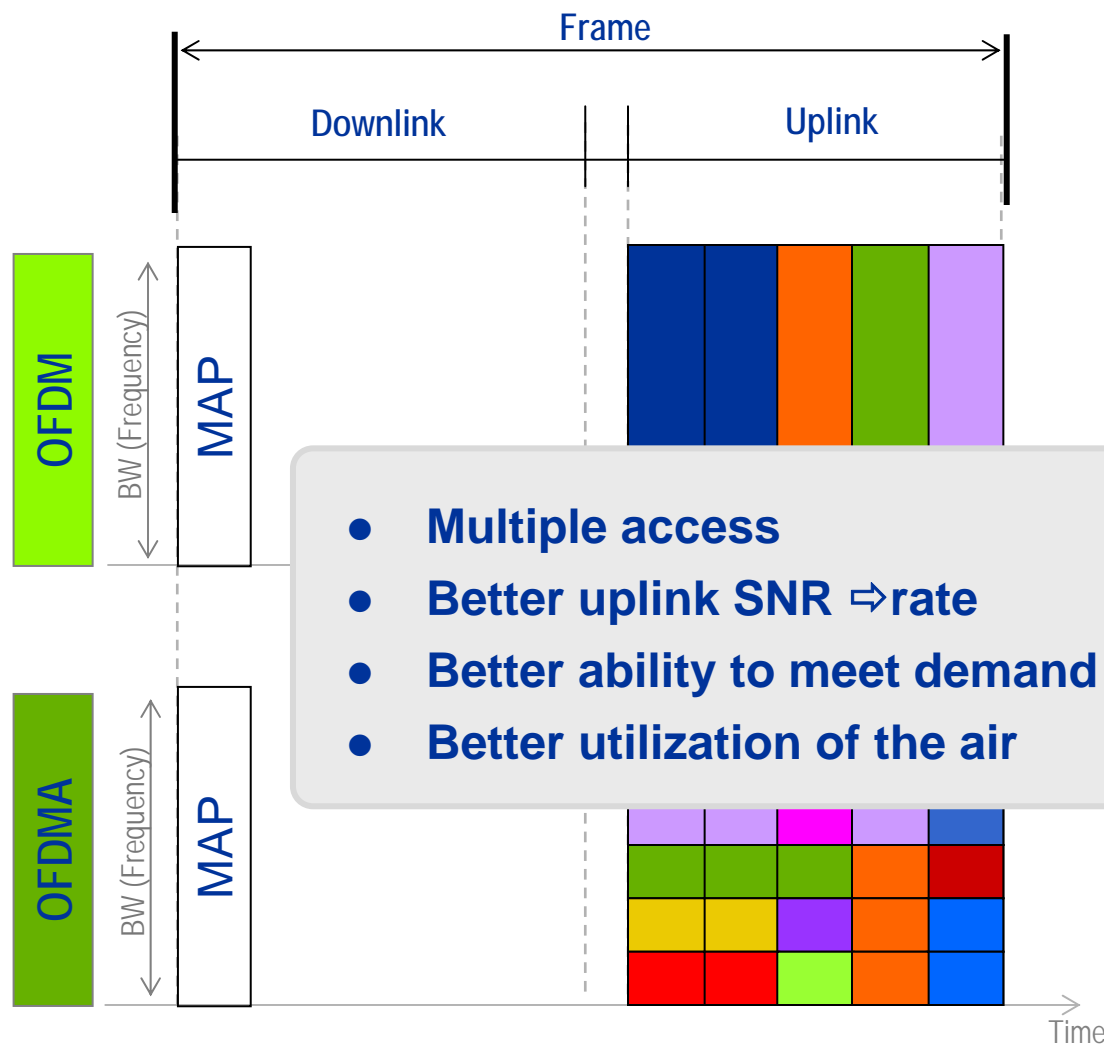


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* Fixed for any channel

Scheduled OFDM vs. OFDMA

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Advanced Spectrum Awareness

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DFS

Compliant with

- ETSI 5.4 GHz: EN 301 893 v1.5.1
- FCC**
- ETSI EN 302 502 v1.2.1*

DCS*

Advanced Spectrum Analyzer and Dynamic Channel Selection

- Integral spectrum analyzer with the unit
- Supports channel selection based on best performance



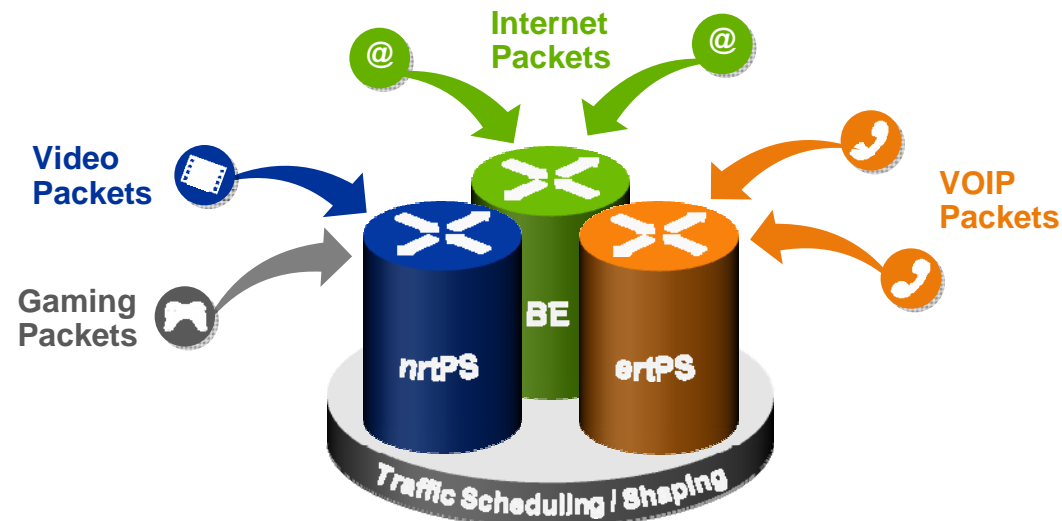
* In future release

** Upon FCC grant availability

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Classification Rules

- Packets received by base station or CPE are sorted
- Cross classification of application to QoS service flow
- Classification performed according to fields in packet header:
 - IP-CS: e.g. DSCP
 - Eth-CS: DSCP, PPPoE (EtherType), VLAN ID (.1q), VLAN Priority (.1p), Any



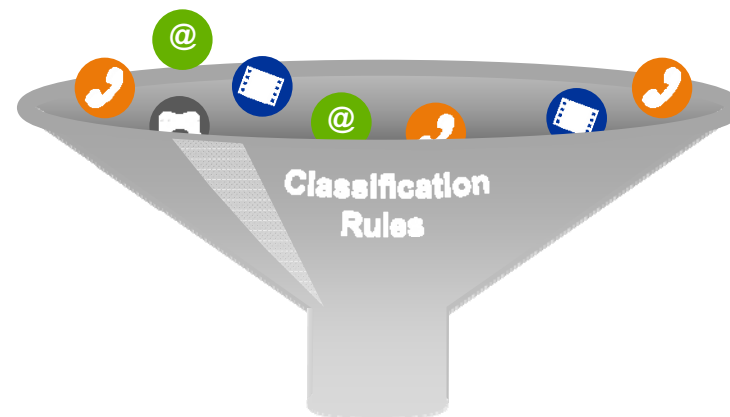
QoS

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Application Types




Better bandwidth utilization for an improved business case



802.x Broadband Wireless Technologies Positioning



 802.16 Wide Area Network	WiMAX 802.16d	WiMAX 802.16e
	Fixed licensed technology	MIMO fixed, nomadic and mobile technologies

- Designed for outdoor high-capacity wireless broadband
- Designed for QoS IP services
- Designed for fast-fading (mobile) conditions

Suitable for license-exempt markets

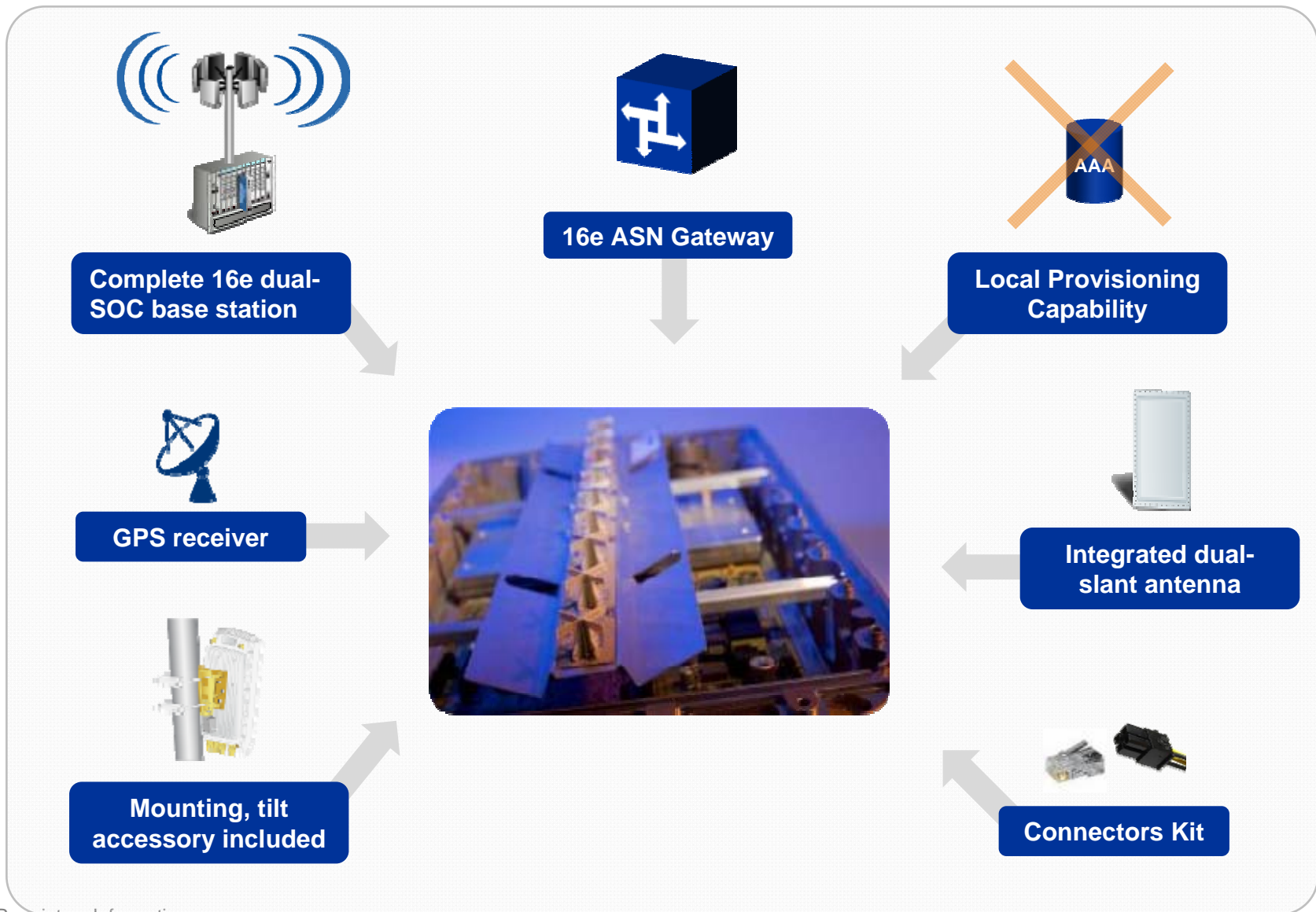


BreezeMAX Extreme 5000 Solution Building Blocks



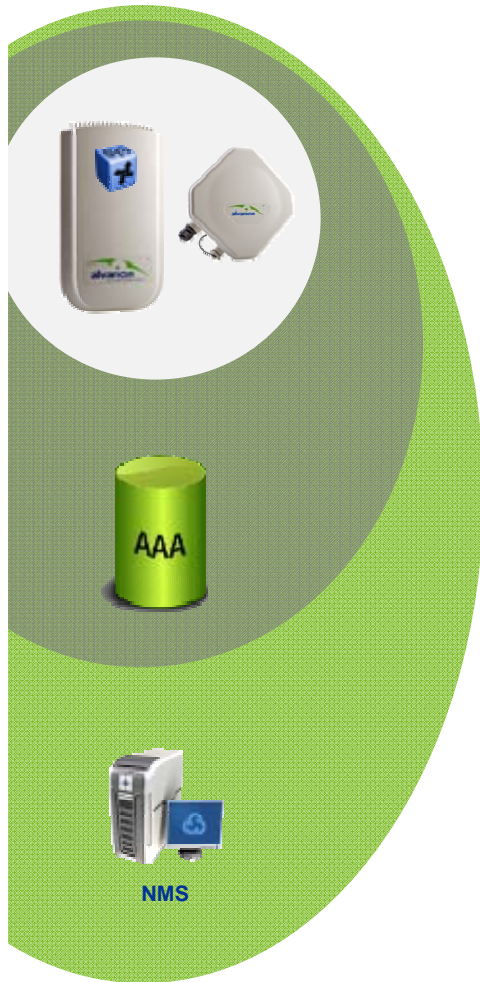
Distribution in Mind: Making it All-in-One

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BreezeMAX Extreme 5000 Building Blocks

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Base Station and CPE

- Integrated ASN-GW, GPS receiver and antenna on BTS
- Local provisioning (with no AAA)
- Local management (base station: Telnet, CPE: Web)
- Licensed features available for base station and CPE

Optional AAA Server

- Authentication, Accounting, Authorization
- Centralized provisioning
- Encryption

IOT in progress for Radiator and Alepo

Optional NMS

- AlvariStar: base station management
- StarACS: TR069 based for CPE management
- AlvariCRAFT: installation assistance tool

Network Management System





Star Management Suite

Star Suite

**Alvarion Star management suite
ensures successful deployment of
WiMAX broadband services**

AlvariStar

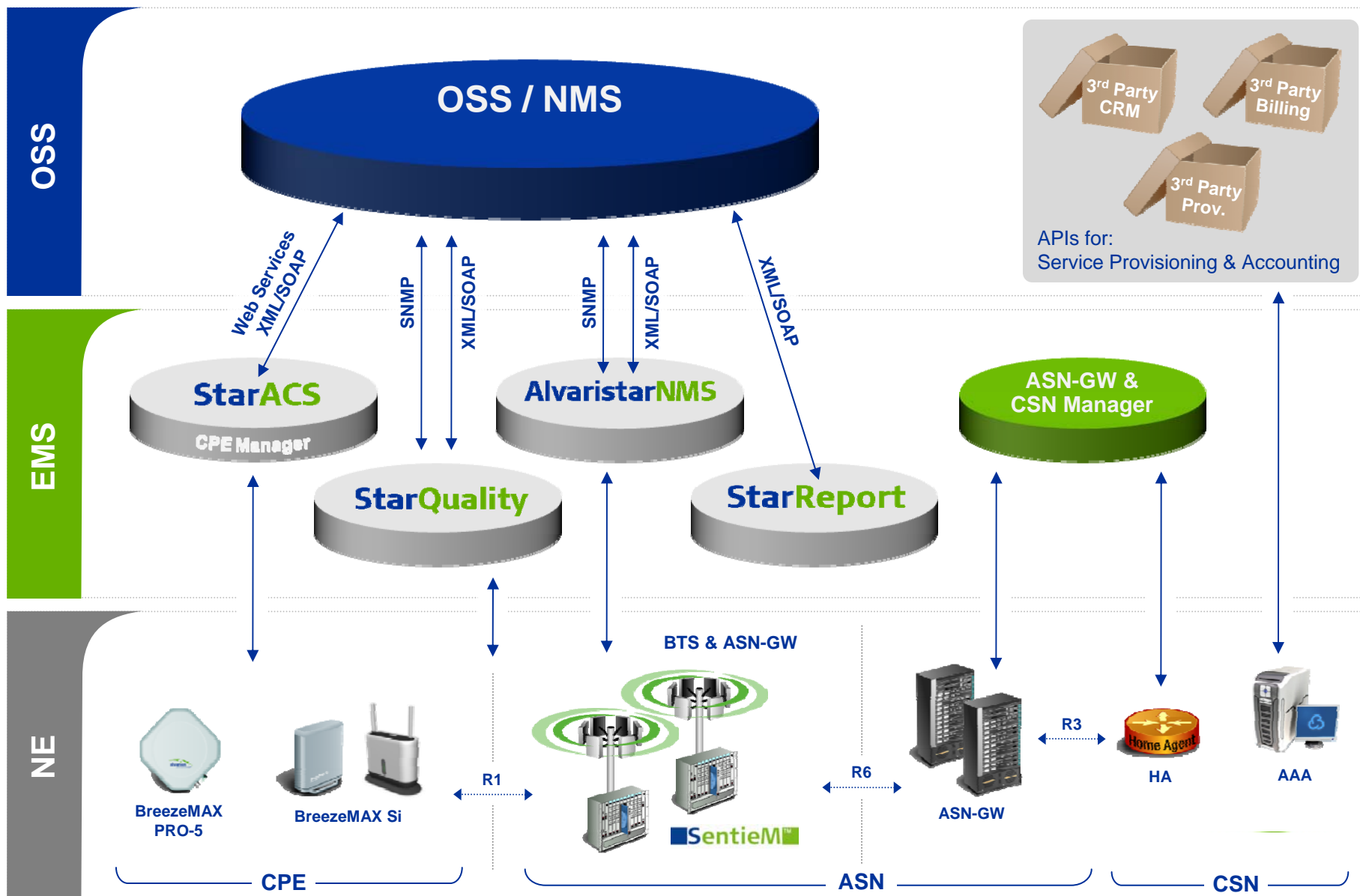
StarACS

StarQuality

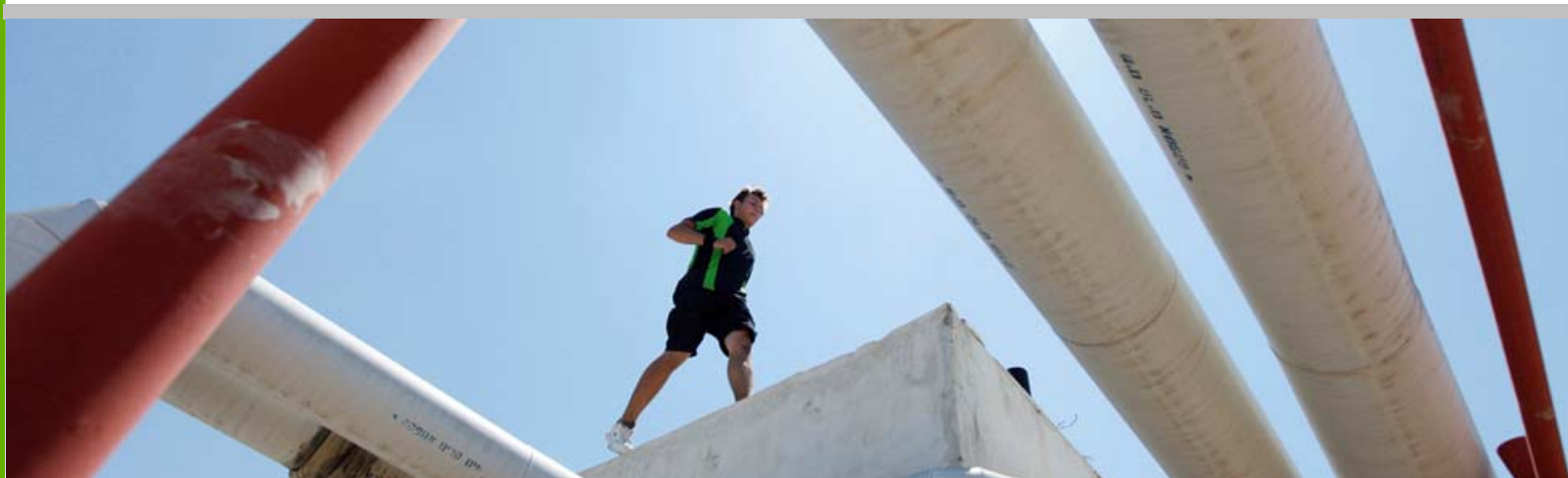
StarReport

OSS Management Approach

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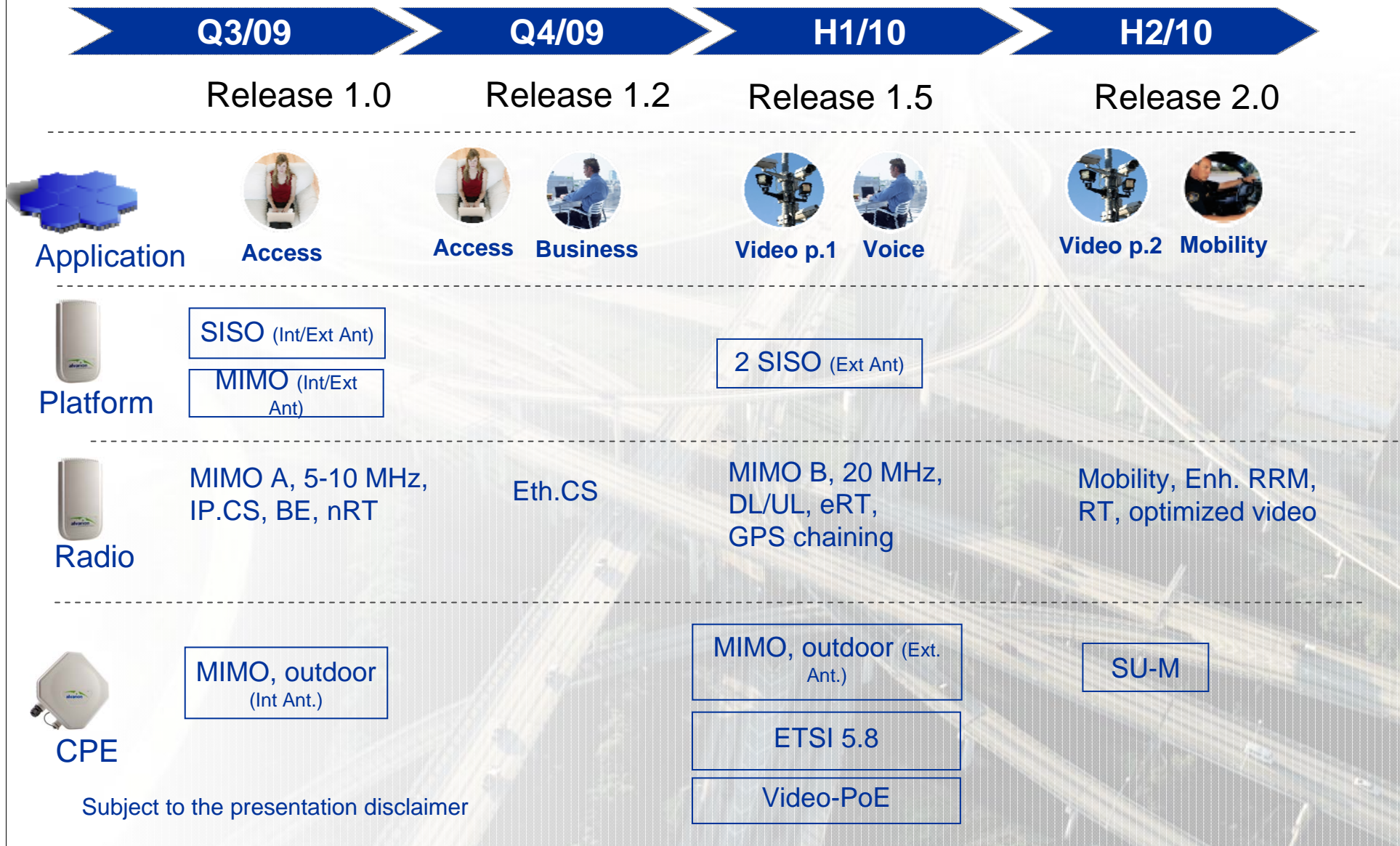


BreezeMAX Extreme 5000 Roadmap



BreezeMAX Extreme 5000: High Level Roadmap

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BreezeMAX Extreme 5000 Roadmap (1)

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2009 - 10			
	H2/09		H1/10
Schedule	Release 1.0 GA: Q3 2009	Release 1.2 GA: Q4 2009	Release 1.5 Beta: Q1 2010 GA: H1 2010
Release	Product introduction	Eth CS Enabling	Feature enhancements
Frequency	5470 – 5950 MHz (5.4GHz, 5.8 GHz – without ETSI) 4900-5350 MHz 3650 – 3700 (3.65 GHz) Channel BW: 5 MHz, 10 MHz		Channel BW: 2*10 MHz ETSI certification in 5.8 GHz
Configuration	Single sector SISO (A/E) Single sector MIMO (A)		Dual sector SISO Single sector MIMO (E)

(A/E) – Attached/External Antenna

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BreezeMAX Extreme 5000 Roadmap (2)



2009 - 10			
	H2/09		H1/10
Schedule	Release 1.0 GA: Q3 2009	Release 1.2 GA: Q4 2009	Release 1.5 Beta: Q1 2010 GA: H1 2010
End-to-End	<ul style="list-style-type: none"> • CPE: Outdoor – 4.9-5.9 GHz • ASN-GW: internal • AAA: <ul style="list-style-type: none"> • Radiator, Alepo, • Local configuration (non secured) • Management: AlvariStar, StarACS 		<ul style="list-style-type: none"> • ASN-GW: Alvarion 4Motion® standalone • CPE ETSI 5.8 • GPS Chaining • AAA: FreeRadius
Features	<ul style="list-style-type: none"> • MIMO A • IPCS • QoS: BE, nRT • DHCP transparent • DFS support (5.4 GHz) 	•Eth-CS	<ul style="list-style-type: none"> • MIMO B • QoS: eRT (mainly for voice) • Configurable DL/UL ratio • Video surveillance reliable mode • Inference mitigation (spec. analyzer and DCS) • Mobility phase I: Fast Network Entry

(A/E) – Attached/External Antenna

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BreezeMAX Extreme 5000 Roadmap (3)



2010	
	H2/10
Schedule	Release 2.0 GA: H2 2010
Release	Feature enhancements
Frequency	4.4 - 4.9 GHz
Features	<ul style="list-style-type: none">• Mobility phase II• Advanced interference mitigation techniques• Advanced RRM• Video surveillance enhancements

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Regulation / Certification Map



Low Band (4.9-5.3 GHz)

- Universal (4.9)
- 4.9 FCC
- 5.1 FAA (no certification profile)
- 5.2-5.3 ETSI

High Band (5.4-5.9 GHz)

- Universal (5.4, 5.9)
- 5.4 ETSI
- 5.4, 5.8 Australia
- 5.8 FCC

Plans

- 5.4 FCC (DFS): pending FCC (not before Q1 2010)
- 5.3 FCC (DFS): pending FCC (not before Q1 2010)
- 5.8 ETSI (DFS, CPE): release 1.5 (H1/10)
- 4.9 Japan: finalizing certification plan (during Q1/10)

Alvarion and BreezeMAX Advantages



Alvarion Advantage

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Largest number of WiMAX deployments

- 250+ commercial networks
- 10k+ sectors, 100k+ CPEs
- 100+ countries



Strong network of partners to fulfill customer requirements for solution almost anywhere



Largest WiMAX pure-player committed to customer long term success



Leader of innovation in broadband wireless IP technologies



Financial strength and stability



Over 7 years of WiMAX experience Over 15 years of broadband wireless IP experience



BreezeMAX Extreme 5000 Advantage



Cutting-edge Technology	=	Future	=	Superior Performance		
Mainstream Standard	=	Ecosystem, IOT Economy-of-Scale	=	Future Proof, Business Case		
All-in-One All Outdoor	=	Easy, Compact Deployment	=	Potentially Reduced CAPEX and OPEX		
Enhanced 16e QoS	=	More Services Higher Quality	=	Fast ROI		
Channel Friendly	=	Easy to Order	=	Flexible Configuration	=	Inventory Mgmt, Rapid Deployment
Interference Mitigation	=	Perform Instead of Stall	=	Better QoS and User Experience		
WiMAX 16e Strength	=	Do More with Less	=	More CPEs/Sector More Services/Sector More Capacity and Range		

Thank You

