Axxcelera
BROADBAND WIRELESS

NEXTURECOM
BEYOND MOBILE TECHNOLOGIES

AXXCELERA BROADBAND WIRELESS

OVERVIEW

넥스쳐컴
BEYOND MOBILE TECHNOLOGIES

WWW.AXXCELERA.COM

a Moseley company
Wireless Solutions Group

Axxcelera Broadband Wireless

Axxcelera Broadband Introduction

Moseley Business Units

Broadcast Access

- Digital Trans Systems
- COFDM Product for ENG Apps
- Studio-to-Transmitter Links (70% of the world market)
  - Radio: T1/E1, Linear Uncompressed, Remotes, Aural RF, Digital Audio over Composite
  - Television: spectrum-scalable PTP digital
- Moseley uses proprietary technologies with more than 50 patents of its own.
- In 2006 the company had revenues in excess of $108 million and enjoyed a mature business EBITDA in excess of 28%.

Broadband Access

- ExcelMAX (3.3 – 3.8 GHz)
  - point to multipoint wireless access system
  - Multi-service supports Triple Play (data, voice, video)
  - Highest spectral efficiency and range among 3.5 GHz products
  - ExcelMAX shipped since Q1'06
- AB-MAX (5.47 - 5.85 GHz)
  - point-to-multipoint wireless access system
  - AB-MAX shipped since in Q4'07
- ExcelFlex – Licensed point-to-point wireless backhaul system
- AB-Full Access II – Unlicensed point-to-point wireless backhaul system

Carrier Access

- Software Defined IDU
- Scalable, economical RF solutions
  - From 8 Mbps to 311 Mbps
  - From 6 GHz to 38 GHz
- Licensed and Unlicensed band backhaul solutions
- E1/T1 up to 2xSTM1 (311 Mbps)
- Gig E interface

Axxcelera Selected Customers

Etisalat

COUNTIESPOWER

Sify

INTRACOM

Neptuno Networks
Your Broadband & Telecommunication Source

Winncom Technologies
Distributing Wireless, Networking, Voice and Data Solutions

CEDARCOM

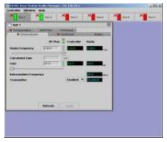
Axxcelera Broadband Wireless

WiMAX Introduction
and
Axxcelera Product Line

WiMAX™

- WiMAX™ – Worldwide Interoperability for Microwave Access
- 802.16-2004 (Final IEEE standard)
  - 802.16d (draft 5)
- The WiMAX Forum creates profiles which 802.16 products are tested against.
- In order for equipment to become WiMAX certified it must pass:
  - Radio Conformance
  - Protocol Conformance
  - Interoperate with at least 2 other products that have also passed the above tests.

Axxcelera PMP Portfolio Summary

	FDD SPECTRUM	TDD SPECTRUM
Base Station Products	 ExcelMAX Access Point	 ExcelMAX Access Point  AB-MAX Access Point
CPE Products	 ExcelMAX Full Duplex CPE  ExcelMAX Half Duplex CPE  ExcelMAX Half Duplex Indoor CPE	 ExcelMAX TDD CPE  ExcelMAX Half Duplex Indoor CPE  AB-MAX CPE
NMS Solutions	 Enterprise - WEB BASED  WISP – Scalable to 250 users  Carrier – Scalable to 10K users	

Axxcelera Broadband Wireless

ExcelMAX 3.3 – 3.8 GHz

ExcelMAX Overview

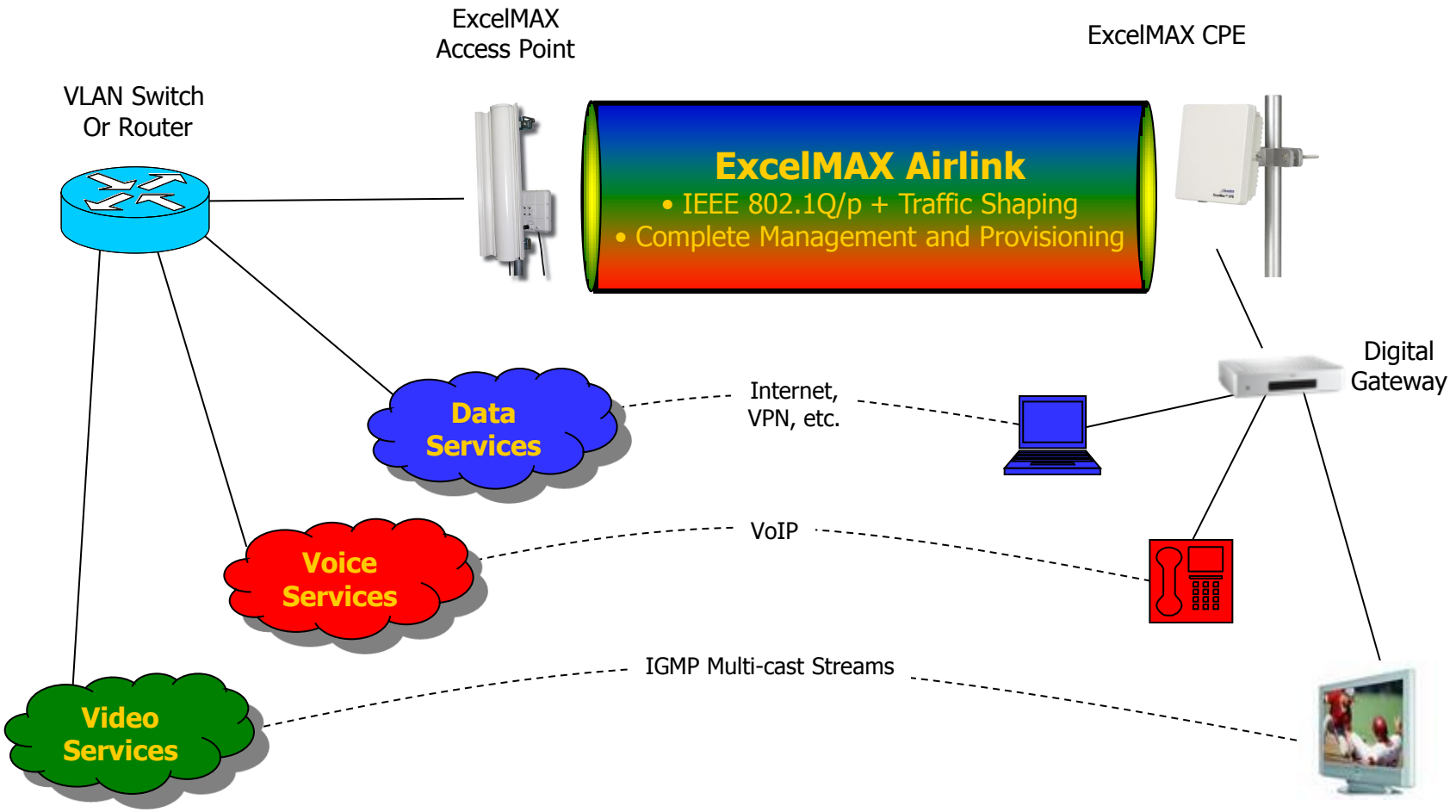
- 3.3 – 3.4 GHz, TDD
- 3.4 – 3.6 GHz, TDD & FDD
- 3.6 – 3.7 GHz, TDD
- 3.7 – 3.8 GHz, TDD & FDD (future)

- WiMAX 802.16d-2004 Compliant NLOS Operation
- Access Point Architecture:
  - Low Cost Outdoor Access Point
  - Scalable, “Pay as you Grow”
- CPE Solutions:
  - Outdoor CPEs for Internet Access and VoIP
  - Indoor CPE for residential markets

ExcelMAX Overview

- Single Platform, Multiple Services
  - VoIP
  - High Speed Data / VPN/VLAN/Video Conferencing
  - Internet Access
  - Multimedia Applications – Video Multicast
- Support for IP-Based Services, e.g.
  - 802.1p - MAC layer QoS
  - 802.1Q – VLAN Termination
- Standards Based
  - Ethernet, WiMAX, IP, SNMP

APPLICATION EXAMPLE: TRIPLE PLAY



ExcelMAX Access Point (AP)

- 3.3 – 3.8 GHz frequency band FDD & TDD Operation
- Outdoor Access Point:
  - Integrated Modem and Radio with External Antenna
- Power-over-Ethernet, CAT-5 cable
- Different channel BW options
  - 3.5 MHz or 7 MHz
- Adaptive modulation and coding rates
  - BPSK, QPSK, 16-QAM, 64-QAM
  - Coding Rates: 1/2, 2/3, 3/4

ExcelMAX Access Point (AP)

- Multiple antenna options:
  - 60 degrees (Gain = 16.5 dBi)
  - 90 degrees (Gain = 14 dBi)
  - Omni (Gain = 10 dBi)
- Aggregate Net Throughput per sector:
  - 40 Mbps (7 MHz channel FDD)
  - 19 Mbps (7 MHz channel TDD)
- GPS network synchronization (TDD Mode only) (optional for additional interference management)

ExcelMAX Access Point (AP)

- Rx Sensitivity
  - -100 dBm
  - -112 dBm (Uplink Sub-channelization)
- Comprehensive QoS (CIR and PIR) and VLAN support
- SNMP Proxy Agent in Access Point allows monitoring from Central Network Management System
- Power Supply Options:
  - 220VAC
  - -48VDC

ExcelMAX CPE

- Supports Data (Internet Access, VPN, VLAN) and VoIP Services
- Integrated Outdoor Antenna, RF Transceiver, and Modem
- Rx Sensitivity: -93 dBm
- Enhanced NLOS Features
  - Uplink Sub-channelization (12 dB gain on the uplink)
- Directional Antenna
  - 16 dBi, 22 deg antenna
- Comprehensive QoS (CIR,PIR) support
- 8 different priority levels per CPE
- Power Supply: 120/240VAC

ExcelMAX Indoor TDD CPE

- TDD Operation for mass residential deployments
- Internet Access and VoIP Services
- Indoor, Self Installable and Self Configurable CPE
- Rx. Sensitivity = -93 dBm
- Integrated Omni Antenna: 10 dBi antenna gain
- Net Aggregate Throughput: 19 Mbps (7 MHz channel)
- Comprehensive QoS (CIR, PIR) support
- Axxcelera Operating System
  - QoS: 802.1p/ToS priority levels, traffic shaping, VLAN
  - Centrally provisioned, comprehensive management toolset
- 10/100 Ethernet Interface
- Power Supply: 120/240VAC

ExcelMAX QoS

- Advanced service flow classifiers: layer 2 & layer 3 & layer 4
- Service flow parameters: PIR, CIR, priority
- Multiple scheduling types: BE, nrtPS, rtPS, ertPS, UGS
- FEC, ARQ
- Payload Header Suppression (PHS)

QoS - Service Flow Classifiers

- Layer 4
  - Source port
  - Destination port
- Layer 3
  - IP Diff-Serve Code Point / TOS
  - Protocol Type
  - Masked IP Source Address
  - Masked IP Destination Address
  - Protocol Port Source Range
  - Protocol Port Destination Range
- Layer 2
  - IEEE802.1D User Priority
  - IEEE802.1Q VLAN ID
  - Ethernet MAC Source Address
  - Ethernet MAC Destination Address

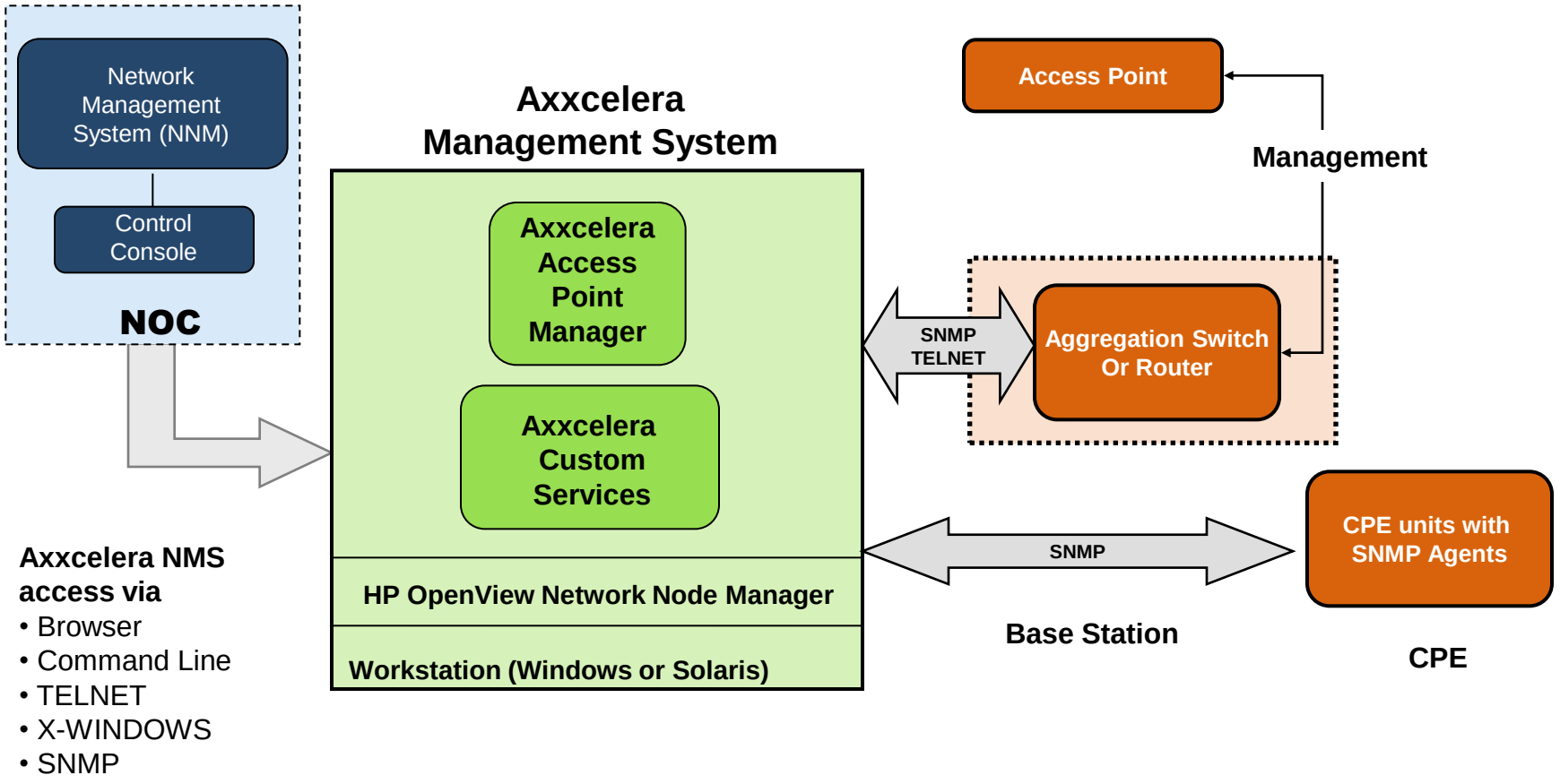
ExcelMAX Network Functions

- Native IP transport: Ethernet-to-Ethernet
- Layer 2 transparent bridge per IEEE802.1D (no spanning tree)
- VLAN termination and forwarding at CPE per IEEE802.1Q
- Packet filtering at CPE: layers 2-4
- Passive IGMP agent in CPE
- Transparent transport for layer 3+ services: PPPoE, VPN, etc.

Management & Provisioning Tools

- Element Management System (EMS)
  - Provided with equipment purchase
  - AP Manager
  - CPE Manager
- Axxcelera Provisioning System (APS)
  - Provided with equipment purchase
  - Centralized management and provisioning
  - Allows firmware upgrades through the entire network
- Network Node Manager (NNM)
  - Axxcelera Management System built on HP Network Node Manager
  - Network management platform with Axxcelera custom views
  - Provides a wide range of network management functions

Axxcelera Management System



Axxcelera NMS access via

- Browser
- Command Line
- TELNET
- X-WINDOWS
- SNMP

Axxcelera Provisioning System - APS

- Centralized solution for ease of scalability and operation
- WiMAX-based authentication, authorization, and admission solution
- Integrated Policy Server (PS) acting as a policy decision point for service flow activation
- Configuration File Generator bridges the gap between configuration database and Axxcelera CPE products (data to TLV)
- Includes support for the ‘SNMP MIB Object’ enabling generic MIB variable setting via provisioning

Axxcelera Broadband Wireless

ExcelMAX FCC Certified 3.65 GHz

ExcelMAX FCC Certified 3.65 GHz Overview

- 3.650 - 3.675 GHz TDD Applications
- WiMAX 802.16d-2004 Compliant NLOS Operation
- Access Point Architecture:
  - Low Cost Outdoor Access Point
  - Scalable, “Pay as you Grow”
- CPE Solutions:
  - Outdoor TDD CPEs for Internet Access and VoIP
  - Indoor CPE for residential markets (FCC Certification Pending)

ExcelMAX FCC Certified 3.65 GHz Overview

- Single Platform, Multiple Services
  - VoIP
  - High Speed Data / VPN/VLAN/Video Conferencing
  - Internet Access
  - Multimedia Applications – Video Multicast
- Support for IP-Based Services, e.g.
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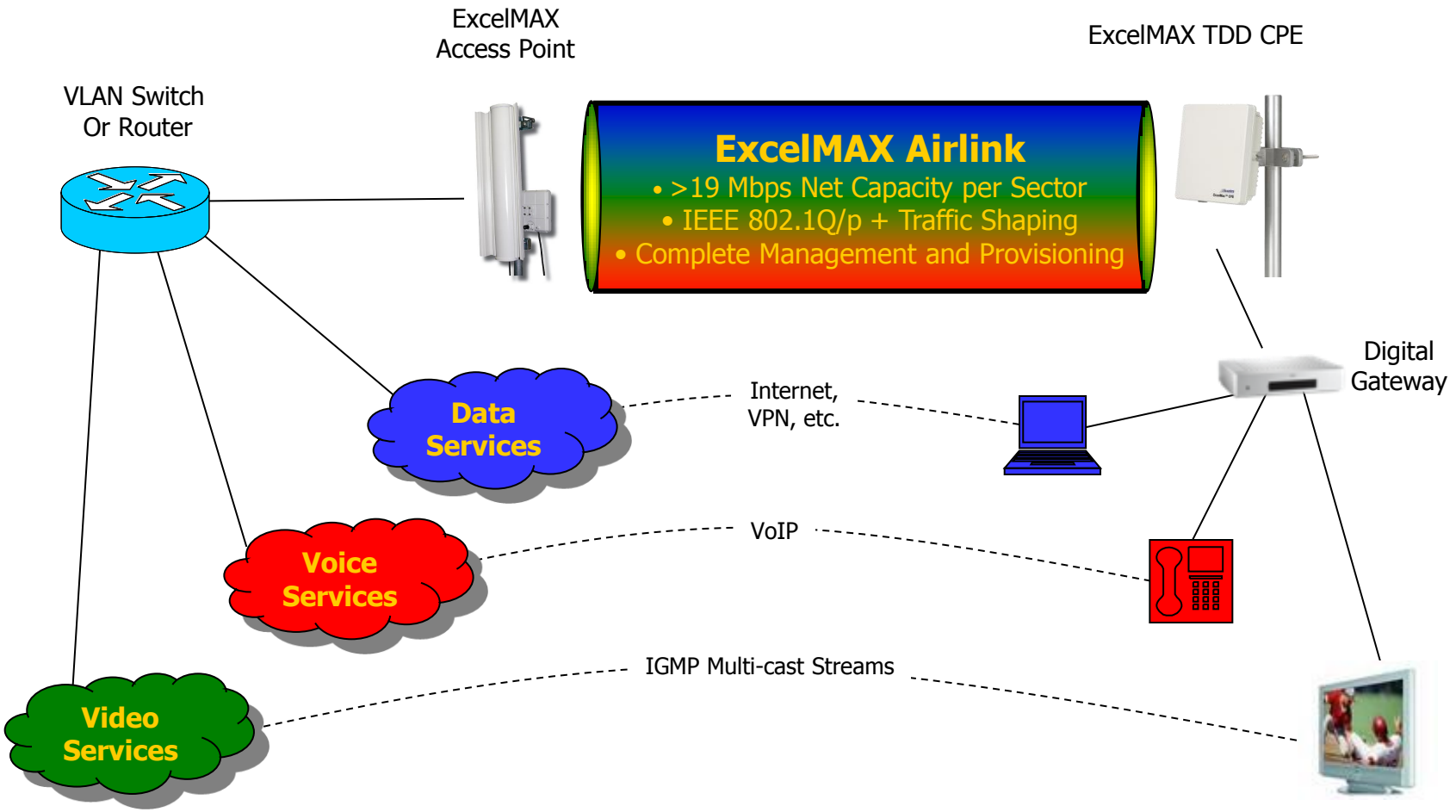

ExcelMAX FCC Certified 3.65 GHz Access Point (AP)

- 3.650-3.675 GHz frequency band; TDD Operation
- Outdoor Access Point:
  - Integrated Modem and Radio with External Antenna
- Power-over-Ethernet, CAT-5 cable
- Different channel BW options
  - 3.5 MHz or 7 MHz
- Adaptive modulation and coding rates
  - BPSK, QPSK, 16-QAM, 64-QAM
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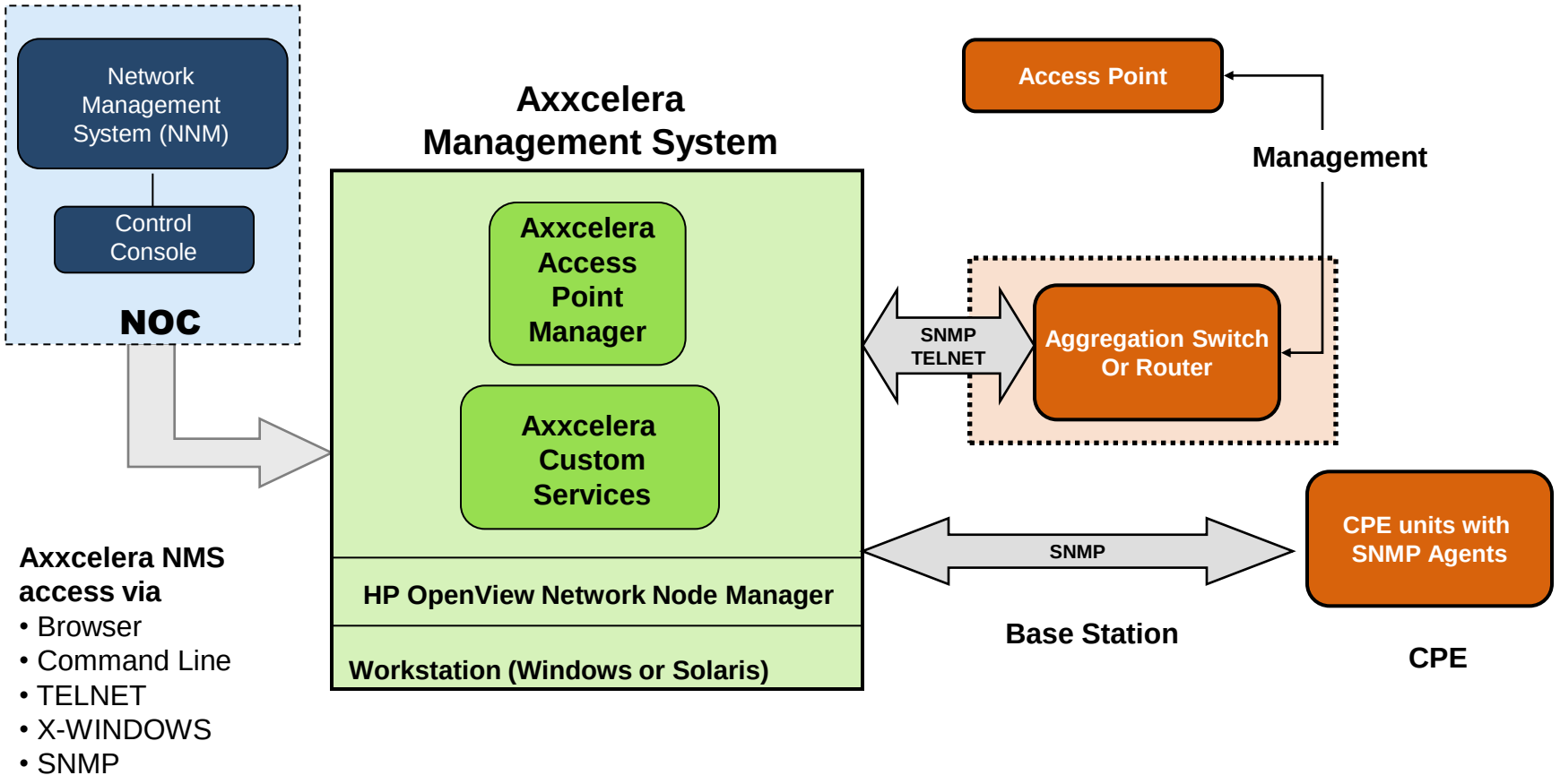

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Axxcelera Broadband Wireless

AB-MAX 5 GHz

Axxcelera AB-MAX Product

- The Axxcelera WiMAX product range in the 5GHz band is centered around one core product called AB-MAX.
- AB-MAX is the logical migration from AB-Access the legacy point to multi-point product and its development is based on the experience of successfully deploying tens of thousands of systems worldwide.

AB-MAX AP

- AB-MAX Access Point (AP)
  - Self contained 60º sector base station unit, or Access Point, providing a single 100BaseT Ethernet interface
  - Power over Ethernet
  - Available with high gain antenna (16 dBi) or external antenna option

AB-MAX CPE

- AB-MAX Customer Premise Equipment (CPE)
  - Self contained Subscriber Unit providing a single 100BaseT Ethernet interface
  - High performance unit aimed at the SME and MDU market
  - Available with high gain antenna (18 dBi) or external antenna option

AB-MAX Features

- AP supports multi-bands (D5/D6/D7) and a dual-pole antenna
  - D5: 5.47 - 5.60 GHz, D6: 5.60 - 5.725 GHz, D7: 5.725 - 5.85 GHz
- CPE supports multi-bands (D5/D6/D7) and single-pole antenna
- GPS network synchronization
  (optional for additional interference management)
- 256 OFDM
- Configurable channel widths - 5MHz, 10MHz, 15MHz

AB-MAX Features

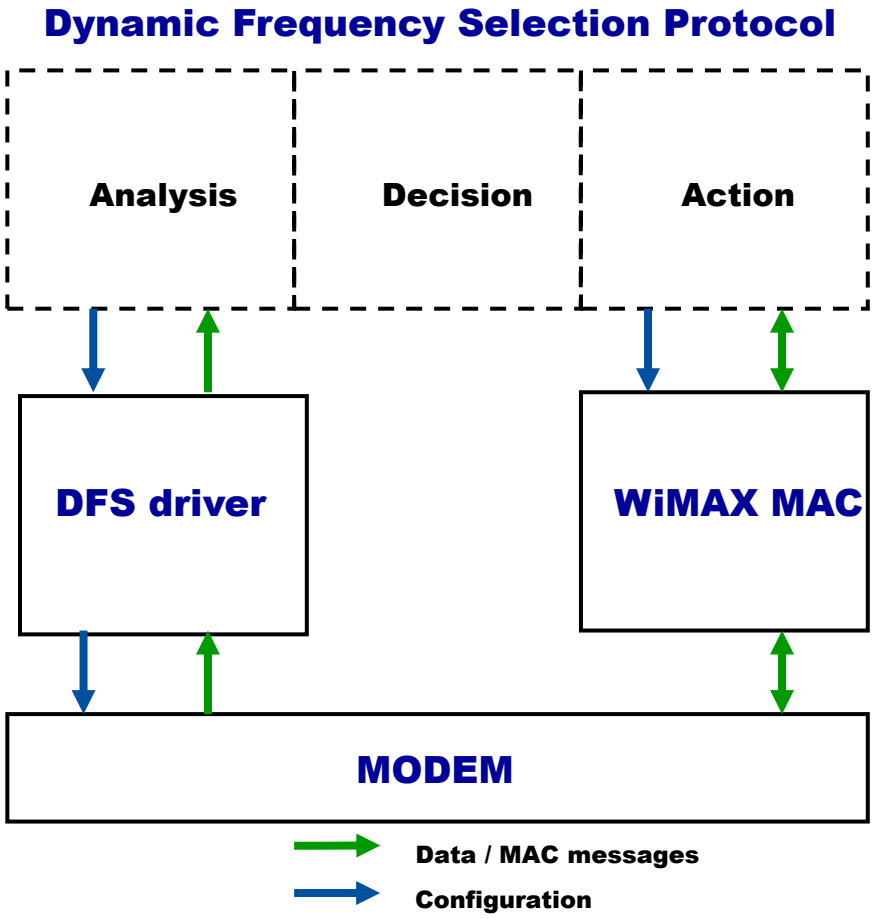
- DHCP Relay Support (option 82)
- VLAN termination for CPE (not just pass-through)
- Adaptive RF Modulation
  - BPSK, QPSK, 16-QAM, 64-QAM
  - CPEs in a sector can each use different modulation
- Traffic Shaping / Control
  - Packet filtering
  - Multiple Scheduling types: BE, nrtPS, rtPS, ertPS, UGS
- 10/100 Ethernet Interface

AB-MAX Features

- AB-MAX is equipped with a Spectral Scan Feature
- WiMAX standard supports two types of data encryption
  - CBC-Mode 56-bit DES (128bit 3DES key)
  - AES-CCM Mode (128bit key)
- FEC & ARQ
- DFS - Programmable in 5MHz steps

DFS Architecture

- Primary objective – detect and avoid 5GHz radars
- Upon detection of an incumbent signal, the DFS algorithm will move the link to another channel
- Can be used to detect other signal types as well
- 802.11a is not necessarily an incumbent signal



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AB-MAX Competition

- Market availability of WiMAX compliant equipment in the 5GHz frequency is very limited
- Several companies are making WiMAX-like product claiming OFDM and QoS, however they may not be following the standard
- WiMAX was created because WiFi wasn't originally intended for large capacity and scalability
- Axxcelera's WiMAX products use the Sequans Chipset which has proven exceptional in meeting the WiMAX standard

Axxcelera Broadband Wireless

ExcelFlex Licensed Point to Point

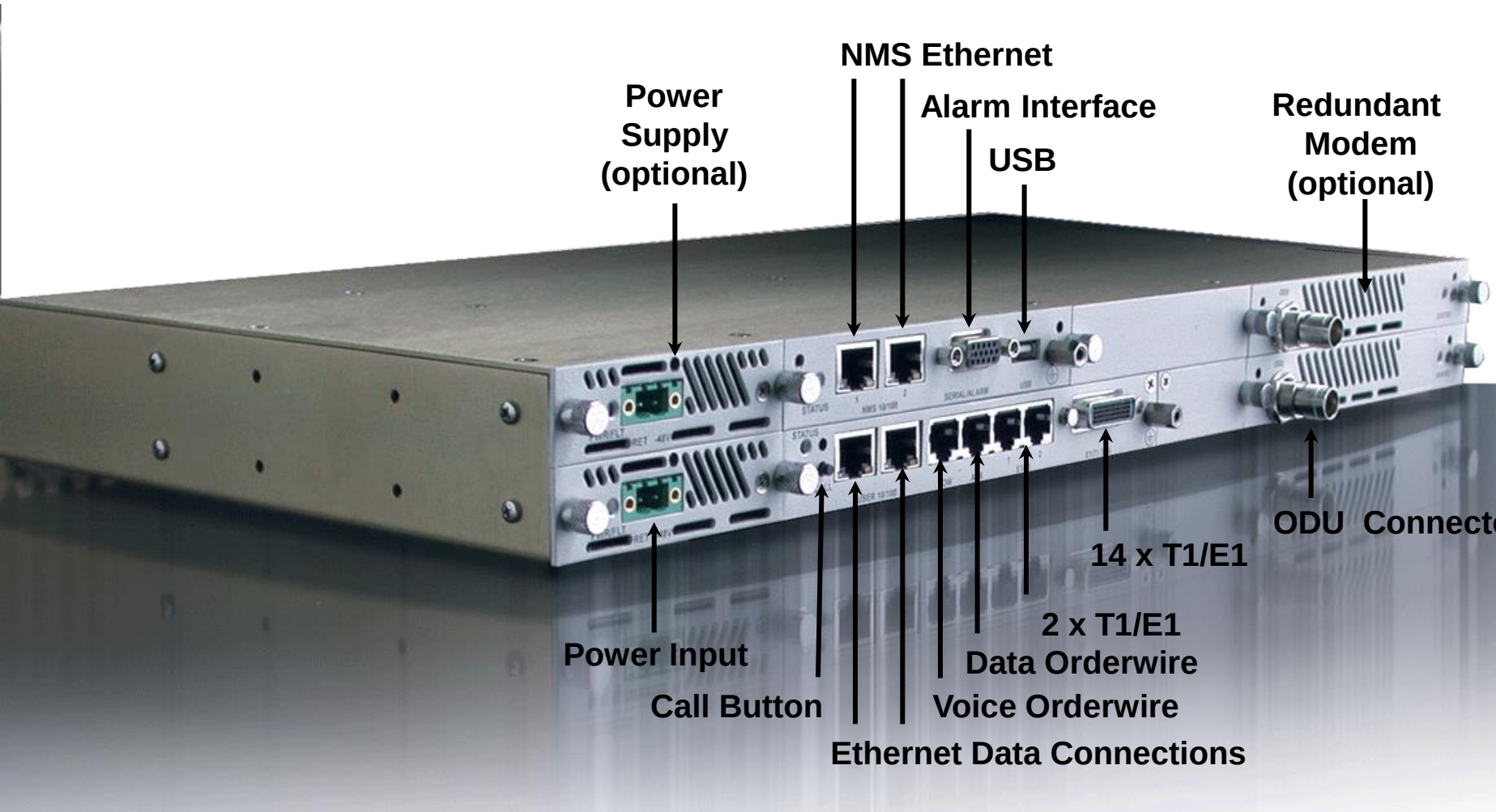
Axxcelera ExcelFlex Point to Point

- Licensed Frequencies 6 - 38 GHz
- Up to 100 Mbps Ethernet
- Up to 42 T1/E1 circuits
- Configurable bandwidth
- FDD architecture
- Modular design allows for customization of interfaces and payload
- Gig E interface with up to 155Mbps Ethernet over the air
- SNMP Mgmt-MIB2/Enterprise MIBs
- Web Browser/GUI Management Tool
- 2 – STM1 interfaces (fiber, BNC, or SFP)

ExcelFlex for Wireless Backhauls

- 99.999% Carrier-Class reliability
- Price Competitive
- One Pipe: Wide range of high-performance solutions
  - Voice, Data and Video
- Licensed Frequencies
- Modular design allows for customization of interfaces and payload
- IDU plus ODU architecture
  - For different RF spectrum only the ODU changes
- 1+0 & 1+1/2+0 Configurations
- Advance Forward Error Correction (AFEC) - Powerful Trellis Coded Modulation concatenated with Reed-Solomon Error Correction

ExcelFlex IDU – Interface Overview



ExcelFlex IDU – Expansion Interfaces

- Mini-IO Modules
- Network IO Modules

Network IO Modules
-16 x T1/E1
- 2 x STM-1
-1- GigE

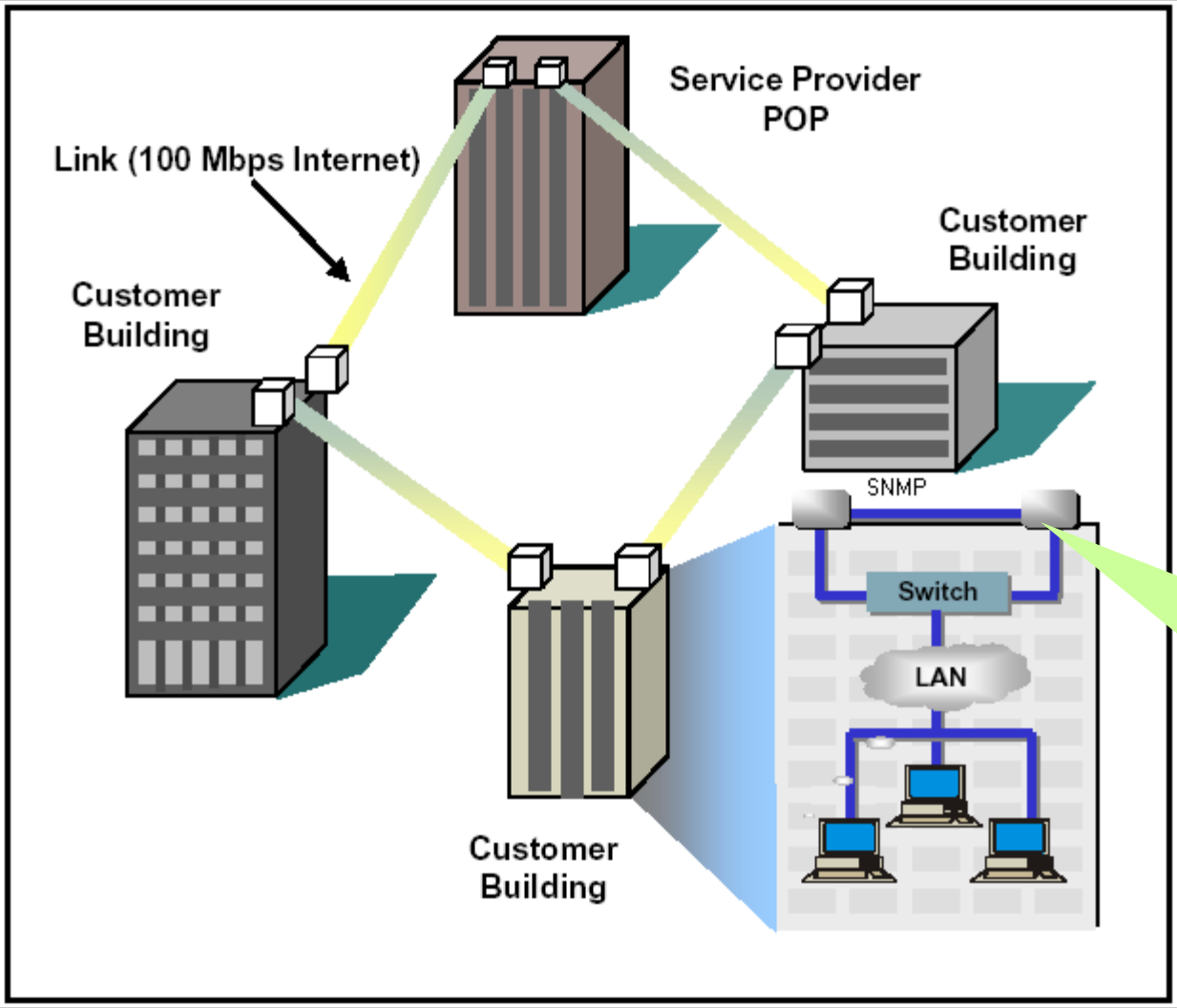
Mini-IO Modules
-DS-3/E3-STS-1
-STM-1

ExcelFlex IDU – Redundancy

- 1+1 Redundancy
  - Supported in single 1RU chassis
  - Second Power Supply and Modem/IF Modules
- 2+0 Repeater or East/West
  - Supported in single 1RU chassis
  - Second Power Supply and Modem/IF Modules

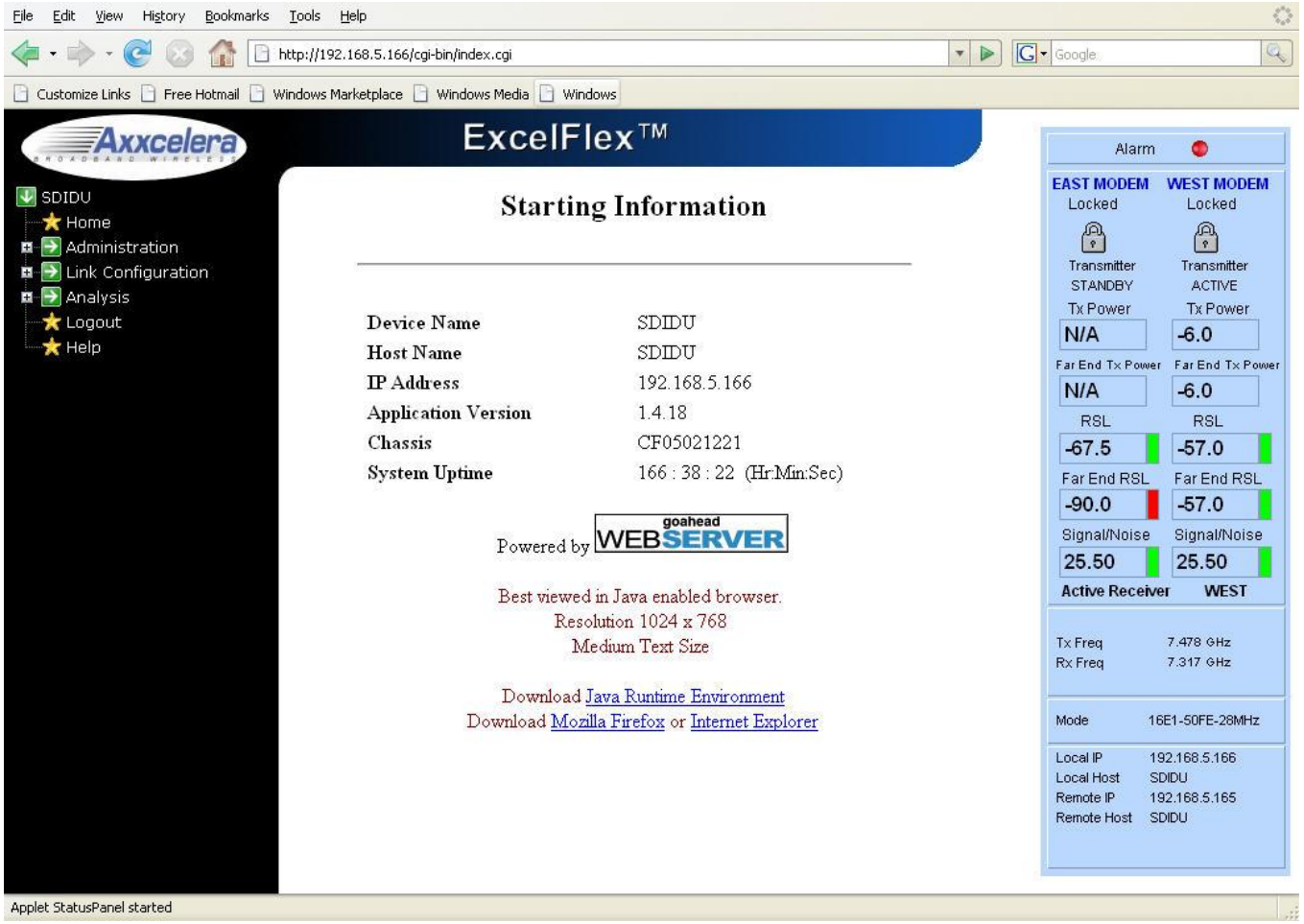
ExcelFlex IDU - Front Panel LEDs

Consecutive Point Architecture



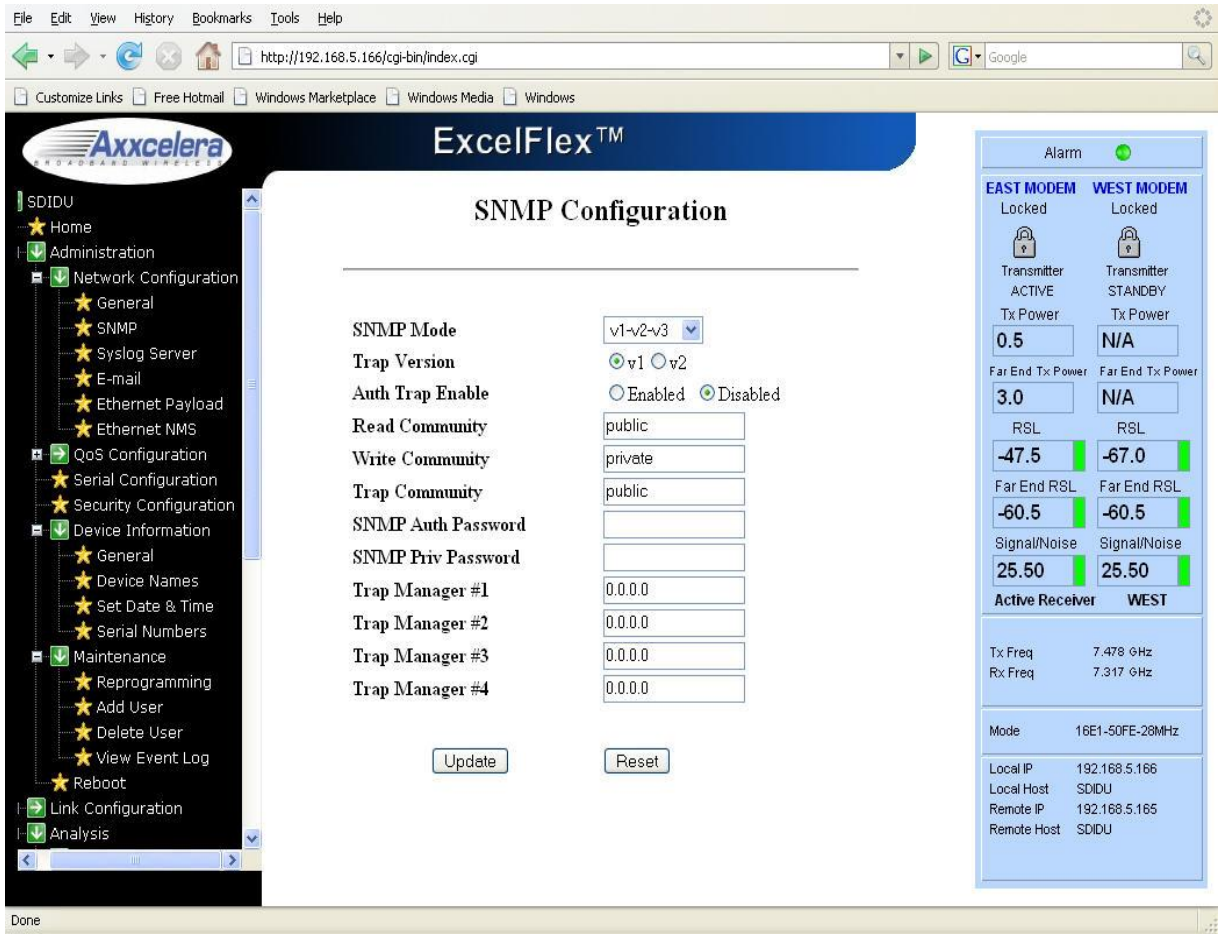
IDU includes built-in Switch for Ethernet and E1; Requires external Add/Drop Mux for other payloads

Management



- Configured & Monitored by Operator
  - Local or Remote
  - Interfaces: Web Page, Telnet, or SNMP
- Includes
  - SNMP Agent
  - HTTP/ HTTPS
  - Telnet/SSH

ExcelFlex SNMP



- Software Defined IDU Supports
  - SNMP v1, v2, v3
  - Extensive MIB
- Works with any SNMP 3rd Party Software
  - HP OpenView

Supported Modulation Formats

- The SDIDU is capable of supporting the following modulations:
  - QPSK
  - 16-QAM
  - 32-QAM
  - 64-QAM
  - 128-QAM (subject to ODU support)
  - 256-QAM (subject to ODU support)
- Provisioning of the air interface modulation is performed by the IDU in response to the payload "mode" that is selected for the point-to-point link
  - All you provision is the payload and the IDU sets the rest

Axxcelera Broadband Wireless

Summary & Roadmap

Summary

- The ExcelMAX 3 GHz and the AB-MAX 5 GHz are high quality, fixed wireless WiMAX products for broadband deployments that provide:
  - Greater coverage range
  - Greater Ethernet throughput
  - Conformance to the 802.16d standard
  - Expanded monitoring/traps/alarms through greater SNMP capabilities
  - Sophisticated QoS Capabilities

Summary

- The ExcelMAX FCC certified 3.65 GHz product uses the 25 MHz of spectrum 3.65-3.675 GHz the FCC opened for WiMAX technology
  - This is unlicensed spectrum, however it does require registration with the FCC
  - Product is built from the proven ExcelMAX 3.5 GHz platform
  - Newness of spectrum provides less risk of congestion

Summary

- The AB-MAX is the most robust 5 GHz WiMAX product on the market
  - Tri-band CPE supports 3 bands (D5, D6, D7) in a single unit (5.47 – 5.85 GHz)
  - Access Points provide optional GPS Synchronization
  - Uses the same firmware as ExcelMAX

Summary

- Advantages of shared firmware from the ExcelMAX 3.5 GHz product:
  - ExcelMAX has been shipping and widely deployed since March 2006
  - Accelerated technology maturity
  - Mature market feature offering

Summary

- ExcelFlex is a secure and dependable licensed backhaul solution
  - Offering multiple payload interfaces
  - Providing payload expansion options
  - Single IDU across multiple frequencies from 6 GHz to 38 GHz
  - Shipping and widely deployed worldwide since October 2006
  - Low-cost of ownership

802.16d Platform Roadmap

ExcelMAX	➢ 5MHz Channel Support ➢ C9 AP and outdoor CPE ➢ Extended Real-time Polling Service (ertPS)	➢ C5 Access Point ➢ Call Admission Control ➢ CPE Alignment Indicator	
AB-MAX	➢ Spectral Scanning ➢ Extended Real-time Polling Service (ertPS) ➢ Multi-band (D5/D6/D7) Dual-pol. AP ➢ Multi-band (D5/D6/D7) Single-pol. CPE	➢ Multi-band Dual-pol. CPE ➢ Call Admission Control ➢ CPE Alignment Indicator	➢ Dual-band (D3/D5) AP and Outdoor (D3/D5) CPE
MaxxLink	➢ Multi-band (D5/D6/D7) Terminals ➢ Transparent bridging	➢ High-power Tx (+21 dBm) Terminals	➢ D3 and D5 Band Support
	Q4-2008	**Q1-2009**	**Q2-2009**

Band Definitions: C5 (3700-3800 MHz), C9 (3650-3675 MHz)
D3 (5250-5350 MHz), D5 (5470-5600 MHz), D6 (5600-5725 MHz), D7 (5725-5850 MHz)

802.16d Management Services Roadmap

Axxcelera Management System	➢ BS/AP Provisioning
	➢ CPE Scan List Provisioning
	➢ Link Status Event Reporting
	➢ DFS Event Reporting
		➢ APS high-availability platform
		➢ APS Web Services I/F for OSS Integration
		➢ Unified Link Health Presentation
		➢ Network Planning
		  ➢ Frequency Planning
		  ➢ Cell/Sector Positioning
		  ➢ Data Export to Google Earth
		  ➢ Support DTED, EOO, ESRI Shape Files
		  ➢ Regulatory Constraint Checking

	Q4-2008	**Q1-2009**

Axxcelera 802.16e Roadmap Summary

- Develop 802.16e products to enhance 802.16d product portfolio
  - Axxcelera will continue to offer/support existing 802.16d products
- Continue to focus on fixed and nomadic applications
- Support business case for deployment of DSL-like service where not currently available
- Competitive distinctions
  - Compact Base Station solution:
    high performance, low capex & opex
  - Advanced MIMO: maximum coverage and spectral efficiency
  - FDD support
  - Integral aggregation and backhaul support

802.16e Product Mix

- CPEs
  - A range of CPEs to meet the requirements of fixed, portable and nomadic systems.
- Compact Base Station
  - A cost effective solution that can be easily installed on existing infrastructure.

802.16e CPEs

- Fixed outdoor/indoor units, portable client devices
- TDD and H-FDD
- MIMO support
- Customer self-install

Axxcelera will work with its ODM partners to offer a competitive range of devices

802.16e Compact Base Station

- Macro performance in a single outdoor enclosure
- FDD and TDD support
- 2x2 MIMO, Wave 2 compliant
- TX 2 W per channel
- 2.5 GHz, 3.5 GHz
- Integral GPS
- Integral GbE / Fast Ethernet switch
  - Local traffic aggregation
- Non-transparent relay support
- Integrated backhaul interface options
  - Ethernet (RJ-45), Fiber-Optic, Wireless

802.16e Compact Base Station Features

		Phase 1.0	Phase 2.0	Phase 3.0
FFT sizes	*512*	X	X	X
	1024	X	X	X
Channel Bandwidth	*3.5MHz*	X	X	X
	5MHz	X	X	X
	7 MHz	X	X	X
	10 MHz	X	X	X
Modulation	*QPSK*	X	X	X
	16QAM	X	X	X
	64QAM	X	X	X
Duplexing	*TDD*	X	X	X
	FDD		X	X
	Support of H-FDD SS		X	X
Frame Lengths	*5 ms*	X	X	X
Multi Antenna	*Rx Diversity (2-antenna, MRC)*	X	X	X
	MIMO-Matrix A (2-antenna)		X	X
	MIMO-Matrix B (2-antenna)			X
General Handover	*Handover initiated by MS*		X	X
	Handover initiated by BS		X	X

802.16e Roadmap

CPEs

Compact BS

Phase 1 Phase 2 Phase 3

H2 09 **H1 10** **H2 10** **H1 11**

WiMAX PMP Product Portfolio @ Begin-2010

	802.16e		802.16d
Base Station Products	 ExcelMAX Compact BS 3.5 GHz FDD and TDD		 ExcelMAX AP 3.5 GHz  AB-MAX AP 5 GHz
CPE Products	 ExcelMAX USB Dongle	 ExcelMAX Half Duplex Outdoor CPE  ExcelMAX Half Duplex Indoor CPE	 ExcelMAX Full Duplex CPE  AB-MAX CPE 5 GHz
NMS Solutions		 Enterprise - WEB BASED  WISP – Scalable to 250 users  Carrier – Scalable to 10K users	