Introduction to ABB Tropos
Outdoor Wireless Mesh Communication
Tropos mesh network overview

Wireless IP networks for mission-critical applications

Connectivity and Coverage

- High capacity, low latency, reliable, secure, adaptable
- Mesh routers, directional radios, management
- Installed for 8+ years
- 850+ customers in 50+ countries
- 60,000+ installed routers
- Mining, utilities, public safety, military, oil and gas, industrial
Predictive Wireless Routing Protocol (PWRP)

continually analyzes the quality of active and inactive mesh links to dynamically configure the ideal combination of paths to optimize network performance

Airtime congestion control (ACC)

enables networks to be operated closer to their capacity limits by detecting signs of congestion and dynamically adjusting airtime resource allocation to clients

Power Curve

Dynamically monitors and adjusts power and rate per-packet, per-link, to deliver maximum capacity

Smart Channel

Provides continuous monitoring of all channels to detect intermittent noise sources
Tropos mesh routers

- Reliable, resilient, tough
  - Self-organizing, fully redundant mesh
  - >99.99% to >99.999% system availability
  - -40°C to 55°C operating range
  - IP67 weather tight (NEMA 6)
  - Optional battery backup
  - High power up to 36 dBm EIRP
  - 165 mph wind survivability
  - Lightning, power surge, EMC protected
  - Salt fog rust resistance per ASTM B117

- Secure
  - VPN and firewall in every device
  - U.S. government certified

- Manageable
  - Monitoring, configuration, upgrades, fault management, security

- Multiple applications
  - High bandwidth: >10 Mbps
  - Low latency: <1 ms per hop
  - Virtual LANs with separate address spaces, security policies and QoS policies

Tropos mesh routers

- Tropos 1410
- Tropos 6320
- Tropos 4310
- Tropos 7320
- Tropos 3320
- Tropos 3200
- Tropos 6200
- Tropos 4200
- Tropos 7200
- Tropos 3200

10/30/2014
Tropos 1410 (Scada Application)

- Wireless mesh router and bridge
  - Configurable via software load
- Integrated firewall and IPsec VPN
- Wired Ethernet or serial connection to field automation devices
- Supports automation protocols including DNP3, Modbus, SEL Mirrored Bits and IEC 61850
  - Facilitates integration of field automation devices
- Available in ruggedized, weatherized enclosures or as an embeddable module
Tropos 63x0 mesh router (Gateway)

- Single (2.4 GHz) and dual-radio (2.4 GHz and 5 GHz) versions
  - Two wired Ethernet connections (backhaul and wired device support)
  - Powered by Power over Ethernet (POE) 11 – 55 VDC

- Next generation wireless
  - Compatibility with 802.11b/g/a/n clients
  - Maximal-Ratio Combining (MRC) receiver for 2.4 GHz radio
  - Enhances rate-at-range
  - Increases mesh capacity

- Small, lightweight
  - Reduces weight and wind loading concerns on mounting assets
  - Skyline gray radome
Tropos 7320 mesh router (Gateway)

- Dual-radio (2.4 GHz & 5 GHz)
  - Two wired Ethernet connections
  - 30 W PoE sourcing capability, 12/24/48 VDC
  - Optional internal battery backup
  - Flexible input power options
    - AC powered version: 100 – 480 VAC
    - DC powered version: 12 – 60 VAC
  - Modular antennas
  - Supports all Tropos Mesh OS software features available in other Tropos routers

- Next generation wireless
  - Supports 802.11a/b/g/n clients
  - Maximal-Ratio Combining (MRC) receiver for 2.4 GHz radio
  - Enhances rate-at-range
  - Increases mesh capacity

- IEEE 1613 for substation installations
Tropos 4310 mobile mesh router

- Trunk or dash-mounted with external antennas
  - Optional GPS
- Each vehicle is a mobile, high-powered hot zone
- Tropos-optimized, high speed roaming
- Reduces node density where full out-of-vehicle coverage not required, e.g., rural applications
  - Light mesh requires 50-75% fewer nodes than heavy mesh in an RF-friendly environment
- Same meshing capability as fixed nodes
  - Extend the mesh infrastructure
  - Use light mesh where full out-of-vehicle coverage not required
Tropos Control
network management systems (NMS)

- Comprehensive control and analysis for wireless networks
- Scalable to manage thousands of routers and directional radios
- Historical captures and trend analysis
- Advanced network optimization
- Performance management to avoid outages
- Identify and isolate client device issues
MESH Concept

Gateway

Node

Cluster

Master Control

Ethernet / PtP Radio

Ethernet / PtP Radio

Alternate Path

Gateway

Cluster

Gateway

Cluster

Gateway

Cluster

Node
Data Rate vs Distance
Point to point (LOS Condition)

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<th>ETSI d (km)</th>
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Tropos Networks Applications
Tropos network architecture for Smart Grid
Installation Photos
Abu Dhabi Electric & Water Authority (ADWEA)
Efficient Resource Management, Emirate-wide

- Over 1 million smart power and water meters in urban, suburban and rural areas connected by Tropos network
- Tropos network spans >3,000 square miles
- Built to support multiple Smart Grid applications simultaneously
  - Advanced Metering Infrastructure (AMI)
  - Real-time SCADA substation control
  - Distribution automation (DA)
  - Mobile workforce connectivity
  - Substation video security
  - Street light control
Abu Dhabi Electric & Water Authority (ADWEA)
Coverage & connectivity
A key element to a smart city roll out

Networks enables valuable applications
- Utility conservation programs
- Equipment telemetry data monitoring
- Intelligent traffic monitoring and controls
- Public safety data and video
- Public internet access

Tropos networks provide the performance and capacity to roll out new applications over time
- >99.999% availability in harsh environments
- >10 Mbps throughput at each node, <1ms per hop latency, multi-application support
- Enterprise-class security
- Mobility

Smart city customers with networks in production include Oklahoma City, Rock Hill, Corpus Christi, Venice, Ponca City and others
Tropos mesh networks for smart cities
Tropos for Smart City Installation
Tropos Application for Power Grid
- Multi Applications (Scada + CCTV + Internet)

- Routers relay traffic between clients and gateway to Internet or intranet
  - 2.4 and 5 GHz mesh links supported
  - Redundant wireless links provide high reliability

RTU560

IP CCTV

Gateway

Internet or intranet

SCADA Control Center

RTU560

Eth
Safe, efficient operation requires real-time communication

Network enable valuable applications
- SCADA
- Safety and security systems
- Wellhead monitoring and logging
- Mobile workforce automation incl. VoIP
- Drill rig communications and diagnostics

Tropos networks meet stringent requirements
- >99.999% availability in harsh environments
- Enterprise-class security
- High-speed, low latency, multi-application support

Oil and gas customers with networks in production include EOG Resources and Newfield
Safe, efficient operation requires real-time communication

High speed, low latency networks enable valuable applications
- Facility access control
- Logistics coordination
- Voice services
- Real-time location tracking
- Customs inspection
- Video security
- Container verification and scheduling
- Telematics

Tropos networks meet stringent requirements
- Can deliver >99.999% availability in harsh environments
- >10 Mbps throughput at each node, <1ms per hop latency
- Enterprise grade security

Port customers with networks in production include LCTPC, Jiangjia, Wuhan, Guangzhou, Qingdao, Yingkou and Beiliang
ABB Tropos for Port / Large Plant
Port / Terminal Automation System

Access to
Operations Office

Future Fibre link

Access to
Data Centre

Future Expansion of
Container Area Coverage

Container Area Coverage

Crane coverage

Future Crane coverage

Todays Requirements

Tomorrows Requirements

Extended Mobility Coverage
Today & Tomorrow
Tropos Application for Mining

Customer need
- Improved operational efficiency and safety in iron ore mines

ABB response
- Tropos wireless mesh routers atop pump-up masts mounted on trailers with photovoltaic solar panels supply power
- Tropos mobile mesh routers on all heavy equipment, including excavators, earth movers, bulldozers, and trucks

Customer benefits
- Fleet Management
- Guidance, telemetry, alignment
- Production monitoring
- Safety monitoring – man down system
- Video cameras – security and safety
Typical mine layout
Using wireless mesh architecture
http://www.tropos.com

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Power and productivity for a better world™