Smart Classrooms Need Smart Wi-Fi!

Content provided by Ruckus
Simply Better Wireless.
Smart Classrooms Need Smart Wi-Fi

GT Hill, Director, Product & Tech Marketing
Erik Heinrich, EDU Business Manager
Former SFUSD IT Director
Fast and Fierce

Formed
2004
Sunnyvale, CA

Customers
44,000+

Partners
11,000+

Patents
100+ Granted
Ruckus has a strong history of internal innovation, from the pioneering of wireless IPTV transport technology to various advances in antenna technology, including being an industry pioneering of adaptive antenna arrays and many other advanced RF functionalities. The company continues to add to and redefine its value proposition.
Introduction

Erik Heinrich
Ruckus Wireless
EDU Business Manager

SFUSD & County Office of Education
Director, IT Infrastructure (Interim CTO)

Enterprise IT (20 yrs.)
  o Pacific Stock Exchange Member Firms
  o SONY Music & SONY PlayStation
  o SEGA of America
The Post-PC Era…

A WORLD GOING Wi-Fi

Annual Unit Shipments

- **220%** Wi-Fi devices
- **65%** Ethernet devices

<table>
<thead>
<tr>
<th>Year</th>
<th>Wi-Fi Devices</th>
<th>Ethernet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>874M</td>
<td>694M</td>
</tr>
<tr>
<td>2016</td>
<td>2.8B</td>
<td>1.1B</td>
</tr>
</tbody>
</table>

Source: iSuppli 2012

- e-Readers
- Smart Phones
- Ultrabooks/Chromebooks
- Security
- Environmental control systems
- Tablets
- Wearables
- Games
- Projectors
Smart Classrooms Today

- Interactive classrooms / eLearning
  - Dynamic floorplans
- BYOD and 1:1 initiatives
- Online Assessments & Common Core
- Educational applications and digital content
  - Online collaboration / eLearning
  - Classroom management
  - Student information systems
- Intuitive and easy-to-use devices for younger learners
- Expectations of students, teachers, staff and parents
  - Doc cams, projectors, microscopes, digital signage, videoconference, printers
Smart Classrooms on the Horizon

- Attendance & Emergency Management
- Wearables
- 3D Holograms
- Community as Classroom
- Transportation Wi-Fi
- IoT devices
Smart Schools & Districts

- Attract top teachers
- Student recruitment (enrollment = funding)
- Guest Access (PTA, visiting educator, speakers, CBO, consultants, and community)
- Improved SPED support
  - Inclusion
- Operational efficiency
  - Online attendance (anywhere)
- Increase campus safety
  - Cameras, LBS & VoWiFi
- Improve comfort & Reduce energy costs
  - HVAC & lighting
- Reduced cabling infrastructure / Increase flexibility
Educators’ Wi-Fi Top 10 List

- Higher speeds (802.11ac)
- More reliable connectivity
- Simplified security, especially BYOD
- Enable high density environments
- Wi-Fi coverage everywhere
- Lower TCO = more funding elsewhere
- No new cabling
- Minimal IT staff support requirements
- Differentiated service/access by user and device
- Flexible deployment options
More is Killing Wi-Fi

Industry Challenges!

1. Interference
   - Dropped packets, low data rates

2. Capacity Constraints
   - Dealing with mobile device capacity and management

3. Flexibility and Scale
   - Product and management solutions for any network
Enter Smart Wi-Fi from Ruckus

1. Half the deployment time at half the cost
2. 100% performance increase over any other WLANs

- Unmatched performance at range
- Flexible, scalable, feature-rich WLANs
- Robust and ultra-simple to use applications
- Complete remote control over remote APs and WLANs

802.11n & ac indoor/outdoor APs with adaptive antenna technology
Scalable Smart WLAN controllers
Smarter WLAN applications
Remote Wi-Fi systems manager
Technology Breakthroughs

**ADAPTIVE ANTENNAS**

- Adaptive antenna technology

**QOS**

- Precision per-user per-traffic class QoS

**MESHING**

- Self-provisioning self-optimizing high speed wireless backbone

**SECURITY**

- Advanced per-user security
Real-Time Adaptation

- Patented technology that combines:
  - Smart antenna arrays
  - Best path selection algorithms
  - Advanced quality of service engine
  - Smart mesh RF routing
  - Centralized Wi-Fi management

- Adapts to real-time changes in environmental conditions

- Extends signal range (Wi-Fi coverage) 2 to 4 times with fewer APs

- Radically simplifies deployment and administration
Automatic Interference Mitigation

Minimizes Packet Loss and Re-Transmissions, Increases Reliability

- Interference mitigated by positioning antenna nulls in specific directions
- Avoiding interference delivers more benefits than a stronger signal
  - Better throughput
  - More predictable connectivity

Signal Gain up to 10dBi from beamforming

Smart Wi-Fi antenna arrays delivers additive gain of up to -17dB from interference avoidance
Transmit Beamforming

Adaptive Antennas and Transmit Beamforming Working Together

Problem

- Client Direction

Best-of-Both-Worlds Solution

- 3dB
  - Conventional TxBF pattern
- 6dB
  - Asymmetric BeamFlex AA pattern

Net Result:

- Better client connection
- Less self-interference than symmetric TxBF pattern

> 15dB OF INTERFERENCE MITIGATION

> 9dB OF SIGNAL TO INTERFERENCE PLUS NOISE (SINR) IMPROVEMENT

Composite BeamFlex 2.0 AA + TxBF pattern

9dB

> 9dB OF INTERFERENCE
BeamFlex+

- Better reception (PD-MRC) for weak and hard to “hear” devices
- Better transmission to devices constantly changing their orientation

5x Device orientation accounts for up to 5x performance differential among products
Dealing With Density

Band Steering for High Capacity Environments

- Steers clients to 5GHz by withholding probe and auth responses on 2.4GHz
- Doesn’t steer clients below RSSI threshold set per WLAN
- Client table in each AP tracks
  - Client probe requests per band
  - Avg. RSSI per band over last minute
- Dual band support
- Table checked before responding to client

Before Band Steering
- 5GHz - 3 (18%)
- 2.4GHz - 14 (82%)

After Band Steering
- 5GHz - 14 (82%)
- 2.4GHz - 3 (18%)
It’s All About Channel Capacity

Competing approaches:

- Go off channel to listen only
- Listen for beacons, frame errors, RF interference
- Take a very small snapshot in time
- Don’t provide a complete view of the entire spectrum
Automating Security and Configuration

Essential Technologies for BYOD

- **ONBOARD**
  - Zero-IT mobile onboarding

- **SECURE**
  - Role based access
  - D-PSK; 802.1X
  - LDAP/AD integration

- **IDENTIFY**
  - Device fingerprinting inventory dashboard

- **MANAGE**
  - Policy enforcement by device and application type

INTRO TO RUCKUS WIRELESS
Device Identification

IDENTIFY

- Device fingerprinting
- Application recognition
- ‘Who is’ information

- Visibility into client types connecting to network
- Assists with quick understanding of “Who’s device is this?”
- Automatically detects client info on WLAN and Wired interfaces
- Operating System Hostname
A modern day, mobile friendly, easy to use Wi-Fi connection option

Provides a Single SSID for Guest Access & BYOD Registration

ONBOARD
- Zero-IT (802.1x, DPSK)
- Mobile device portal

Traditional Guest Access
Proceed to unencrypted internet on BYOD SSID

Easy BYOD Registration
Move Client to Secure SSID
Policy Enforcement

1. Configure device access policy
2. Associate policies to desired WLANs

SECURE
- Access Control
- Role Based Access
- Policy enforcement
Device Access Management

- Limit up to 4 devices per user
- Prevent sharing of user name/password
- Automatically removes expired D-PSK

MANAGE
- D-PSK limits per user
- Bonjour Gateway

Teacher - unlimited device connectivity

Student – limited to 1 device
Extensive Smart Wi-Fi Portfolio

**INDOOR**

<table>
<thead>
<tr>
<th>HIGH END</th>
<th>MIDRANGE</th>
<th>LOW END</th>
</tr>
</thead>
<tbody>
<tr>
<td>3X3, 3-stream dual-band 802.11ac</td>
<td>Enterprise dual-band</td>
<td>Entry level 802.11n</td>
</tr>
<tr>
<td>Mid-range dual band</td>
<td></td>
<td>Entry-level 802.11g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wi-Fi wall switch</td>
</tr>
</tbody>
</table>

**MANAGEMENT**

<table>
<thead>
<tr>
<th>6 to 50 Aps SME</th>
<th>50 to 500 APs Mid-range</th>
<th>50 to 1000 APs High end</th>
<th>Up to 10K APs SP Gateway platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>SME</td>
<td>Mid-range</td>
<td>High end</td>
<td>SP Gateway platform</td>
</tr>
</tbody>
</table>

**OUTDOOR**

<table>
<thead>
<tr>
<th>Small cell + Wi-Fi</th>
<th>3x3:3, 900 Mbps, Dual-band - Omni or 120° sectorized</th>
<th>3x3:3, 900 Mbps Narrow 30° Beam,</th>
<th>Point to point and multipoint bridges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

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INTRO TO RUCKUS WIRELESS
Flexible Deployment Options

- Standalone or centrally-managed APs
- Mesh or hardwire mesh APs
- Option for centralized or remote controllers
- Remote Wi-Fi management over WAN
- Seamless integration with security services
- Distributed controller-less data flow for APs
Apps In The Toolbox

- Apps for:
  - Network visibility
  - Wireless analysis
  - Troubleshooting
  - ZD remote monitoring
  - Finding products

- Available on
  - Ruckus product pages
  - App stores
Performance Monitoring

- What is slowing down my Wi-Fi?
- RF Pollution
  - Metric on impact from Wi-Fi and non-Wi-Fi noise
- Simple yet meaningful metrics
  - Potential Throughput of Wi-Fi
  - Your radio’s Wi-Fi usage (tx/rx)
  - Client & Other AP count
- Monitoring graphs embedded in Client & Radio detail pages
  - Per Radio
  - Per Client
Independent Test Results

AVG. TCP THROUGHPUT

Highest, most reliable performance

Lowest, least reliable performance

Ruckus 7982
Cisco 2602i
Cisco 3602i
HP 430
Aerohive AP330
Aerohive AP121
HP 460
Xirrus 4820
Aruba 135
Aruba 105
Meraki MR24
Meraki MR16
Linksy EA4500
Ubiquiti UniFi Pro

VIDEO ERRORS
Independent Test Results

Industry’s First 3x3:3 802.11n Competitive Testing

Percentage of Vendor Test Wins
(87 tests)
SFUSD Case Study

- 7th largest urban CA school District
- 4th largest employer in SF (8,500+)
- $800m-$900m revenue
- 57,000 students (PreK - AdultEd)
- 821 API average
- 150 sites (7mi. by 7mi.)
- Historical buildings / Circa 1902
SFUSD Case Study

2007
- 10M Internet (57,000 students & 9,000 employees)
- T1 lines (1/16\textsuperscript{th} my home Internet)
- 10Mb hubs (HUBS, not SWITCHES!)
- Beige boxes on carpet (static, fibers, heat)
- School site servers

2014
- 10Gb/s Internet / 10Gb/s content filter(s)
- 10Gb/s fiber ring / 1Gbps fiber links
- 10Gb/s firewall(s)
- 1Gb/s access ports for all LAN drops
- Fully virtualized Enterprise datacenter
- 300 Virtual Servers/Eliminated Site Servers
Decentralized funding
  - Every site a snowflake

Legacy wireless sprawl
  - “NCLB Wireless”, performance adjusted to slowest client
  - Cumbersome warranty support process (Limited Lifetime – very limited)

Eight controllers, four different models, different feature support
  - No support for Bonjour network
  - Expensive hardware, expensive maintenance/support contracts
  - Cumbersome support process
  - High TCO
SFUSD Case Study

- Selection Process with Customer Focus Testing
- Fewest APs required for coverage & density
- Bonjour Support, Mesh, Guest & BYOD
- Feedback from sites has been overwhelming and extremely positive
- Approximately 1200 APs deployed (500 more scheduled incl. outdoor)
- Central reporting shows peaks of over 10,000 concurrent connections
  - Only ONE full time wireless technician (no professional services)
K-12 + e-Rate + Ruckus Wireless
Simply Better Wireless

Ruckus is the Proven Performance Leader
But don't just take our word for it. Listen to what our customers and third party technology evaluators have to say.

Best In Class Wireless
Whether you need to support 100 or 100,000 Wi-Fi clients, Ruckus has you covered. We offer a simple, scalable architecture that provides enterprise-grade services in a single box: BYOD, Guest Access, Mesh Networking, Reporting...no need for additional and costly management systems.

And it’s all delivered on the industry’s most robust RF infrastructure, with patented features designed to make wireless just work.

E-Rate 2.0 Compatible
Our solution qualifies for category 2 funding, and with the FCC’s recent increase in funding for the E-Rate program, you may have an opportunity to attain funding that you could not have accessed in past years.

Learn more now.

Simply Satisfied Customers
Our customers speak volumes. There is nothing more valuable than a peer who understands your needs and can help you meet your goals. Learn how your colleagues around the globe are using Ruckus to keep faculty, staff and students connected.

Get to know them now.

Future Proofed
E-rate offers a time critical opportunity to build the best network to support your school’s educational goals. But we all know technology matures and changes faster than pre-teens...

Ruckus Wireless offers future-ready wireless with the Service Substitution Guarantee. If you buy the Ruckus R700 802.11ac Indoor access point on an E-rate 471 form and a newer Ruckus 802.11ac Indoor AP becomes available prior to shipping of your original order, we will ship you the latest and greatest at no-cost additional cost.*

*Limited time offer available to E-rate program buyers. Please speak with your Reseller or Ruckus representative for full details.

That’s an equation that just makes sense. We want our wireless to work, and we want it to be reliable and simple to use. Ruckus Wireless provides a peerless Wi-Fi experience that far exceeds user expectations, and does so in a way that’s easier to deliver than other systems.

Additionally, Ruckus offers up to 4x the coverage and higher performance using fewer Access Points.

The fact is, Ruckus makes Wi-Fi Simply Better.

www.ruckuswireless.com
Ruckus is pleased to offer K-12 Districts that specify the Ruckus R700 802.11ac access point on their E-rate 471 form a no-cost service substitution to a Ruckus 802.11ac Wave 2 indoor access point if it is shipping at the time of your deployment.

This allows Districts to confidently select Ruckus, knowing they will get the latest Ruckus 802.11ac indoor access point without ANY price increase. If you need to deploy immediately, you’ll get the industry-leading R700 802.11ac access point. If your ultimate purchase and deployment occurs after the newer 802.11 Wave 2 APs are available, you can do a service substitution at no extra charge.

**TERMS AND CONDITIONS:**
- This offer is good for up to the quantity of Ruckus R700 AP’s listed on the form 471.
- Offer is valid for US education organizations applying for E-rate 2015 funding (eRate form 471)
- If you proceed with purchasing the R700 access points, then this offer is no longer valid for the quantity of R700’s purchased. Any remaining access points you purchase, up to the total number of unit’s specified on your 471 form, are still eligible for this offer.
- If you take advantage of this offer and purchase the Ruckus 802.11ac Wave 2 indoor access points, all these access points must be ordered on a single purchase order.
- If you are denied E-rate funding, Ruckus will still honor this offer for up to 3 months after the date of denial of your USAC Funding Commitment denial letter.
- The offer expires June 30, 2016.
- For additional questions, please contact us at [erate@ruckuswireless.com](mailto:erate@ruckuswireless.com) or call your Ruckus VARs.
Resources to learn more about Smart Wi-Fi

- Opportunity to upgrade your W-Fi with E-rate: ruckuswireless.com/erate
- Wi-Fi solution resource for Primary Education: ruckuswireless.com/enterprises/primary-education
- Wi-Fi solution resource for Higher Education: ruckuswireless.com/enterprises/higher-education
- Coming soon: Wi-Fi basics live webinar series in February: ruckuswireless.com/company/webinars
- Follow us on twitter: @ruckuswireless #simplybetterwireless
Thanks.

Questions?
Contact us at erate@ruckuswireless.com