



Shared IT Services for Higher Education & Research

# Conference 2017

## Best Practices for Planning Campus Network Growth

Richard Nedwich | Director of Education | Ruckus

# Agenda

## Planning for Change

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- Vision of success
- Managing the experience
- Facilitating change

## The Checklist

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- Approach framework
- Applications and experience
- Network architecture
- Physical deployment


## Examples

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- Outdoors
- Lecture hall
- Residence hall

# Planning Migration

# It's Time to Make Things Better

 **Greg Tinkler**  
@tink3355 [Follow](#)

When 70% of your homework is online and campus wifi sucks

11:52 AM - 23 Feb 2016

👤 🔄 ❤️ ⋮


 **Sarah Haigh**  
@SarahJean110 [Follow](#)

You know your school's wifi sucks when you cant even facetime someone across campus without it pausing @elayyy95


3  

6:03 PM - 21 Feb 2016

👤 🔄 ❤️ ⋮


 **@\_i\_dvorJCM** [Follow](#)

Maybe this new chancellor can get us better Internet ! This wifi SUCKS !!

RETWEETS 2 

9:44 AM - 8 Feb 2013


👤 🔄 ❤️ ⋮

 **elizabeth mcgowen**  
@14mcgool [Follow](#)

Why is it I get pretty decent campus wifi at the chipotle off campus but it sucks laying in my dorm. 😞

5:51 PM - 10 Feb 2016

👤 🔄 ❤️ ⋮


 **sierra**  
@\_sierramurray\_ [Follow](#)

10 min into class and my professor is still talking about how the campus wifi sucks

9:40 AM - 21 Jan 2016

📍 Findlay, OH


👤 🔄 ❤️ ⋮

 **whatever**  
@x1estabica\_ [Follow](#)




The wifi on this campus sucks. I've basically used all of my data 😞

5:43 PM - 12 Feb 2016

👤 🔄 ❤️ ⋮

 **Aaron**  
@Aaron\_Abrams11 [Follow](#)

The chancellor should take some of that 19% pay raise and donate it to the school for some better wifi. #BRUHHHHH

3   

5:09 AM - 12 Nov 2015

👤 🔄 ❤️ ⋮


 **Allegra Robinson :)**  
@allegrafRB14 [Follow](#)

When the wifi sucks because the entire campus is on Netflix at the same time



2   

10:35 AM - 8 Feb 2016

👤 🔄 ❤️ ⋮

 **Taylor West**  
@tingutisqa [Follow](#)

Waitin for OS X Yosemite is killing me!  
#campuswifisucks #pathetic #wasteofmoney #24hourslater

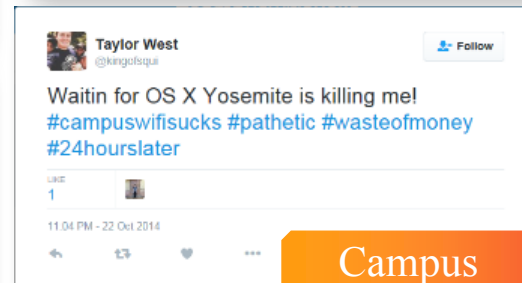
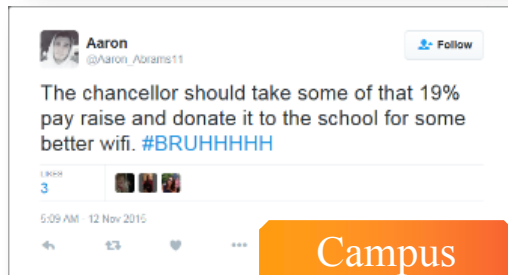
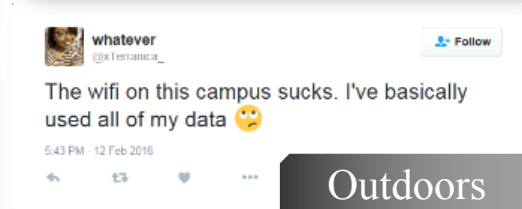
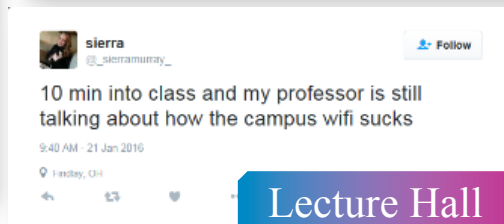
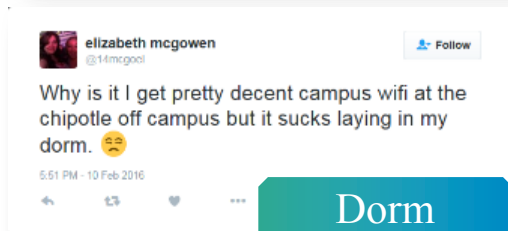
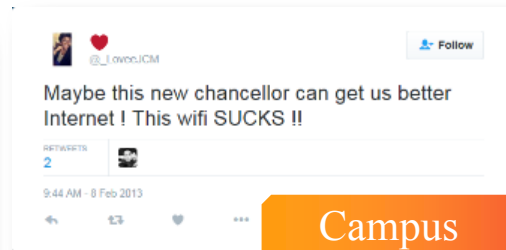
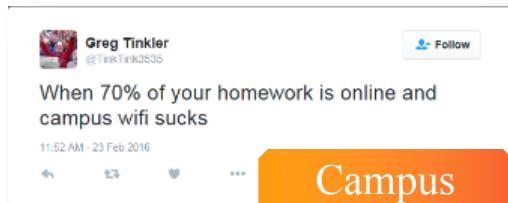
1  

11:04 PM - 22 Oct 2014

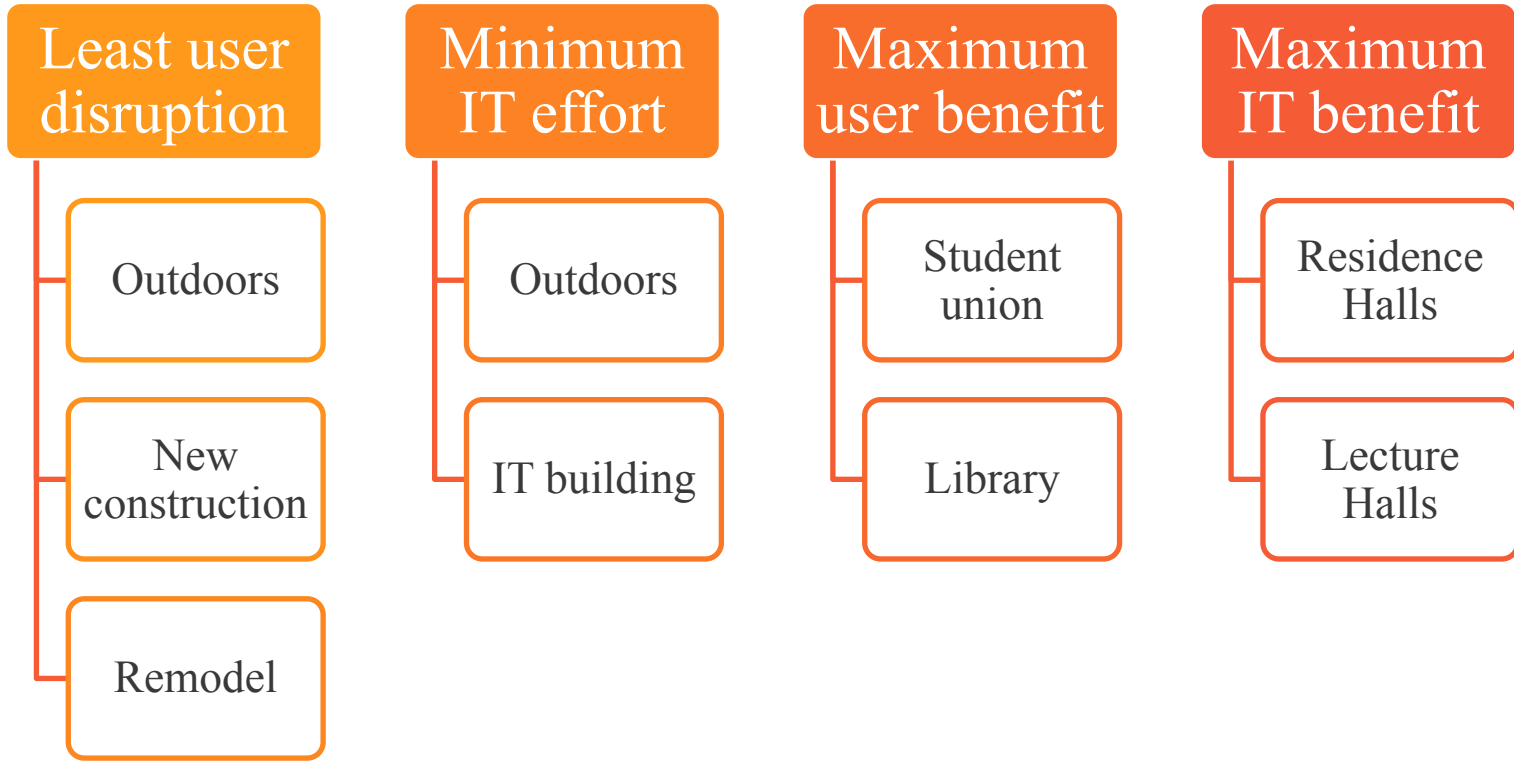
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# Campus-wide, or Targeted?



# What is Your Priority?



# Managing the Experience



## Students want:

- Same devices
- Same applications
- Same or better performance
- No dropped connections
- No new passwords



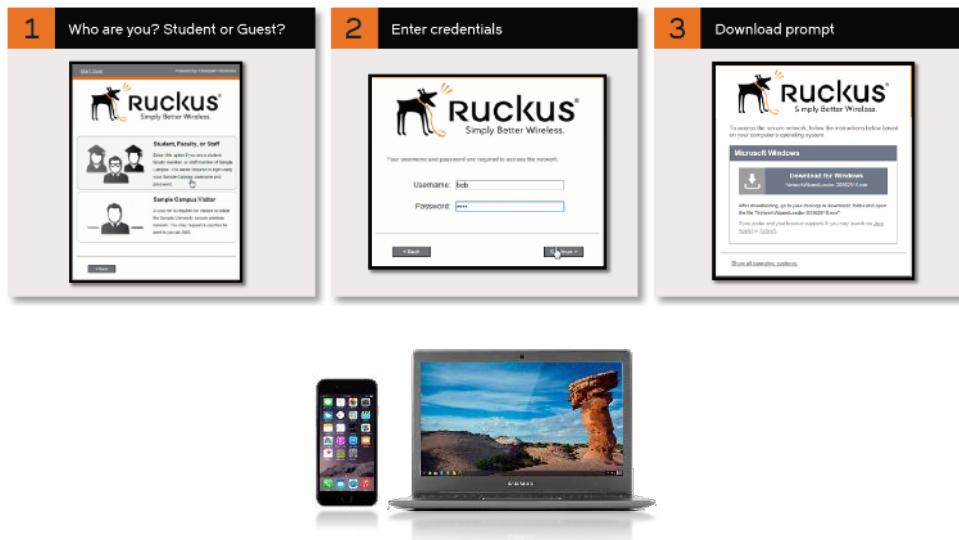
## IT wants:

- Consistent security policies
- Consistent access policies
- Wired or wireless
- Both vendor infrastructures

# Cloudpath Software Facilitates Migration

## What is Cloudpath Enrollment Server (ES)

Cloudpath ES is a security and policy management platform that is agnostic to wired or wireless infrastructure, which simplifies the deployment of several services that are typically disparate and complex to manage. Cloudpath provides a hassle-free access experience to users, while enabling IT to deliver a consistent set of security and access policies using digital certificates.



*Assimilate devices  
quickly & securely  
without IT involvement.*



**Policy Management** with self-service onboarding to keep BYOD separated from IT assets.



**Device Enablement** for basic NAC and MDM such as posture check during onboarding



**Certificate Management** for secure connections with user identity tied to IT policies

# Cloudpath ES

## Automated Onboarding

24/7 Self-Service Portal  
Automatically Provisions Devices  
For Network.



## Certificate Infrastructure

Policy-Enabled Certificates Tie  
User, Device, and Policy Together  
Without Passwords.



## Device Visibility

Tracks Who, What, & Why  
Of Every Device On Your  
Network.



## Cloudpath ES

Designed To Deliver The Best  
User Experience on **Vendor**  
**Agnostic**  
Wired & Wireless Networks



## Secure Simply

Gold Standard Security That Is  
Simple For Users &  
Administrators.



## Rich Policy Control

VLANs, ACLs, & Policies Based  
On User, Groups, Device & More  
Give Per-Device Control.



## Broad Device Support

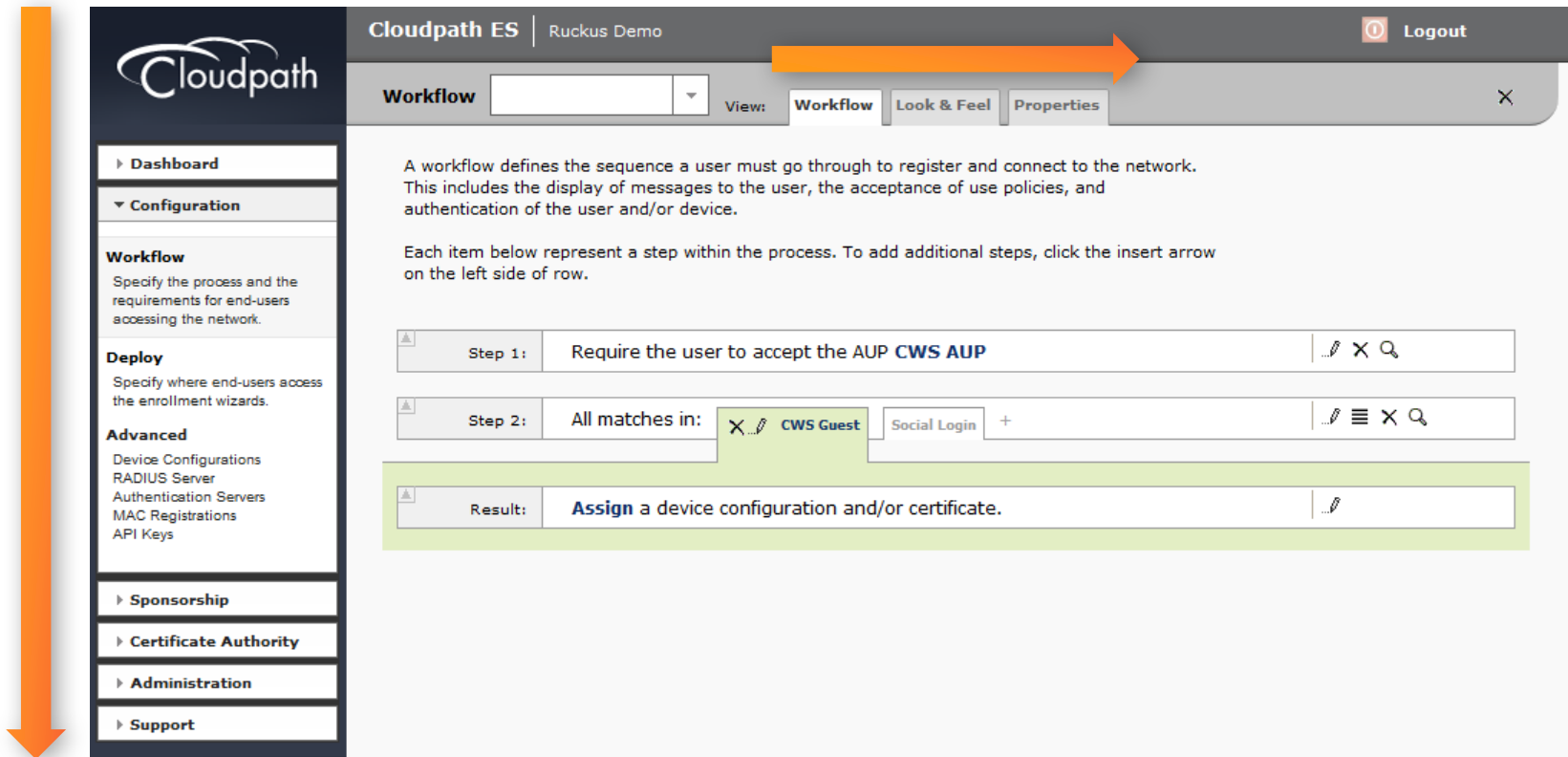
iOS, Android, ChromeOS,  
Mac OS X, Windows, Linux &  
More.



## Wi-Fi Reliability

Eliminates Password-Related  
Disconnects and Re-logins,  
Lowers Support Costs

# Cloudpath ES – Administrative Workflow



**Cloudpath ES** | Ruckus Demo Logout

**Workflow**  View: **Workflow** Look & Feel Properties

**Dashboard**

**Configuration**

**Workflow**  
Specify the process and the requirements for end-users accessing the network.

**Deploy**  
Specify where end-users access the enrollment wizards.

**Advanced**  
Device Configurations  
RADIUS Server  
Authentication Servers  
MAC Registrations  
API Keys

**Sponsorship**

**Certificate Authority**

**Administration**

**Support**

A workflow defines the sequence a user must go through to register and connect to the network. This includes the display of messages to the user, the acceptance of use policies, and authentication of the user and/or device.

Each item below represent a step within the process. To add additional steps, click the insert arrow on the left side of row.

**Step 1:** Require the user to accept the AUP **CWS AUP**

**Step 2:** All matches in: **CWS Guest** Social Login +

**Result:** Assign a device configuration and/or certificate.

# Self-Service Onboarding

## Day 1

### BYOD Devices



- Students
- Faculty/Admin
- Contractors
- Partners/Vendors
- Guests

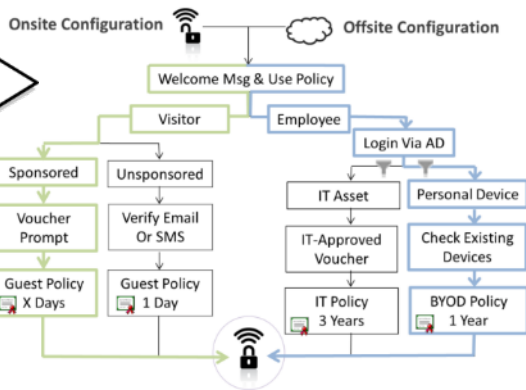
### IT Devices



- Managed Chromebooks
- IT-Owned MacBooks
- IT-Owned Mobile Devices
- Scanners
- Printers



24/7 Self-Service  
Onboarding Portal for  
All Users, All Devices



## Day 2+

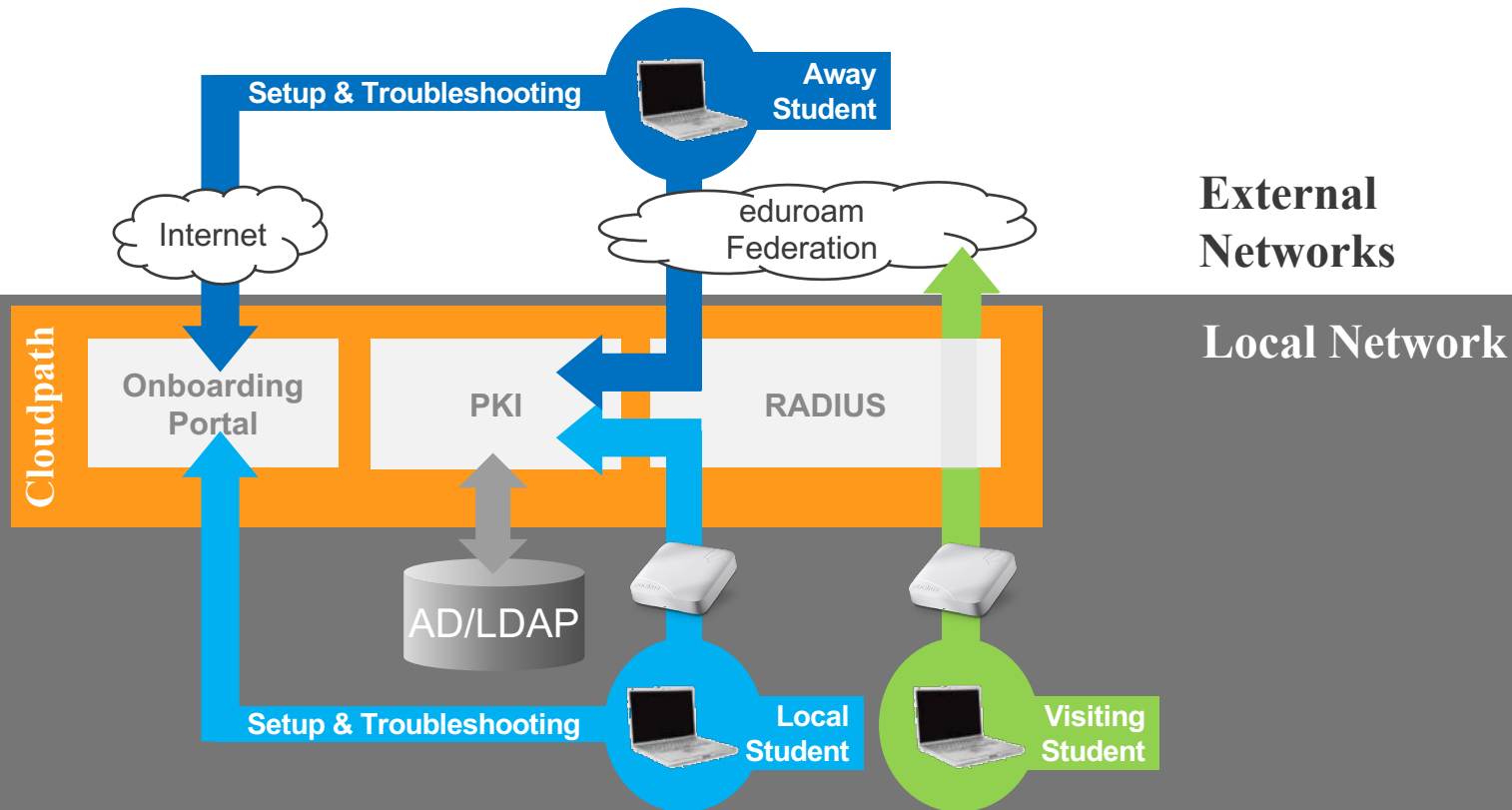


Wi-Fi “Just Works”

- Automatically connects
- Add headless devices too
- No need to login repeatedly
- No passwords to remember
- Good until cert expires
- No need for IT to touch device

# Solution – eduroam

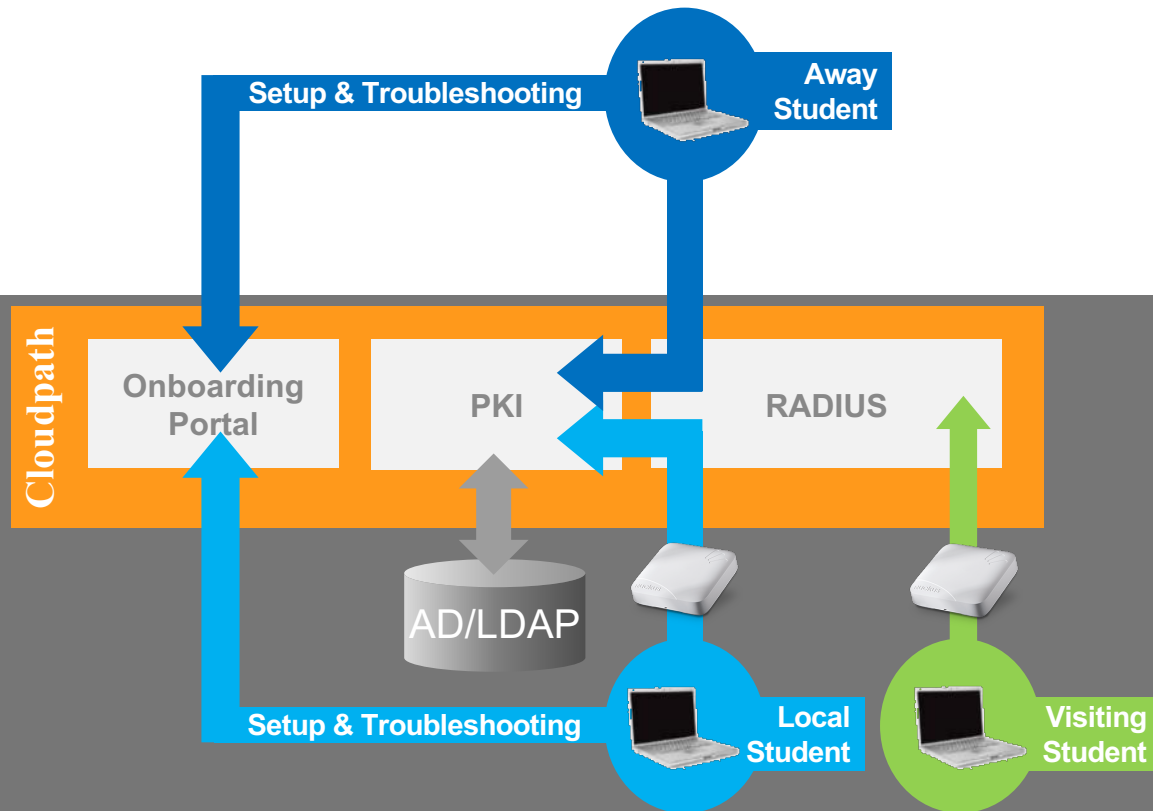
*A proven method in HEDU for inter-campus roaming*





# Solution – ‘Intra-campus eduroam’

*Think of it as ‘eduroam within your campus’*



**New Network**

**Legacy Network**

# Network Considerations

**Legacy Network**

**New Network**

**Network Boundary**

**OSI model**

Layer	Name	Example protocols
7	Application Layer	HTTP, FTP, DNS, SNMP, Telnet
6	Presentation Layer	SSL, TLS
5	Session Layer	NetBIOS, PPTP
4	Transport Layer	TCP, UDP
3	Network Layer	IP, ARP, ICMP, IPsec
2	Data Link Layer	PPP, ATM, Ethernet
1	Physical Layer	Ethernet, USB, Bluetooth, IEEE802.11

**Wireless Coverage Map**

LEGEND

- Good Wireless Coverage
- Intermittent Wireless Coverage
- Poor to No Wireless Coverage

COMMUNICATIONS SYSTEMS, INC.

**Legacy Network**

**New Network**

**Network Boundary**

**LEGEND**

- Good Wireless Coverage
- Intermittent Wireless Coverage
- Little to No Wireless Coverage

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COMMUNICATIONS SYSTEMS, INC.

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**New Network**

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**Wireless Coverage Map**

COMMUNICATIONS SYSTEMS, INC.

# Boundaries

❑ ***Define Your Boundary Lines:** Start with a clear sense of which vendor will cover which areas. Whenever possible, ensure that vendor coverage areas align with the natural boundaries of the physical environment, such as:*

- ❑ ***Indoors** – Define coverage boundaries by specific building(s), dorm(s), or wings.*
- ❑ ***Outdoors** – Define coverage areas for quads, athletic fields, or the whole campus.*
- ❑ ***Within a building** – For larger structures, define internal coverage boundaries if necessary, such as between the west and east wing of a building.*



❑ *Think about how these boundaries may change over time. When possible, plan your rollout schedule by area.*

# Layer 4-7 - Applications

- ❑ *Applications and the User Experience*
  - ❑ *Think through the applications and needs of users in each coverage area.*
  - ❑ *Determine whether the applications supported will be educational, recreational, or a combination.*
  - ❑ *Decide whether or not to allow streaming media services.*
  - ❑ *Think through the policy implications for network traffic.*



# Layer 3 - Network Architecture

- ❑ ***Routing Packets***
  - ❑ *Decide whether traffic will be routed via centrally tunneled WLANs or a local breakout.*
  - ❑ *Think through the implications of boundary crossings for Layer-3 services such as DHCP, DNS, and others.*
- ❑ ***Access Points grant network access***
  - ❑ *Network boundary*
  - ❑ *IP address scheme*
  - ❑ *VLAN scheme*

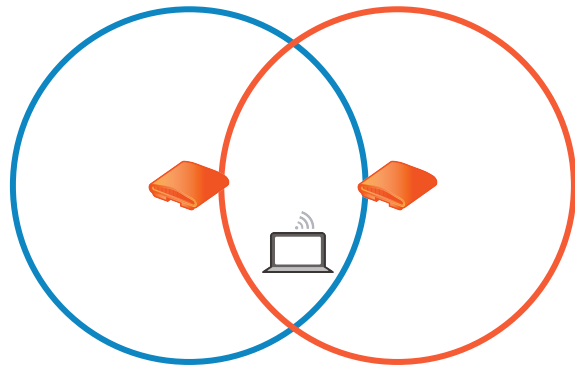




# Layer 2 – Roaming & SSIDs

## ☐ *VLANs and Broadcast Domains*

- ☐ *Consider common or different SSID names*
- ☐ *Consider managed sharing with student VLANs*
- ☐ *Think through how the system will handle Bonjour and other broadcast protocols.*
- ☐ *Think through the implications for “hotspot” areas (libraries, student unions) such as client isolation with Internet access.*
- ☐ *Evaluate whether switches need to be refreshed*
- ☐ ***Consider the Power-over-Ethernet (PoE) budget you will need for new access points***
  - ☐ *Is port budget sufficient for each POE technology?*
  - ☐ *Is power sufficient for new AP's?*
  - ☐ *Can AP run effectively in low-power mode, to fit existing POE?*



# Layer 1 – Physical Environment

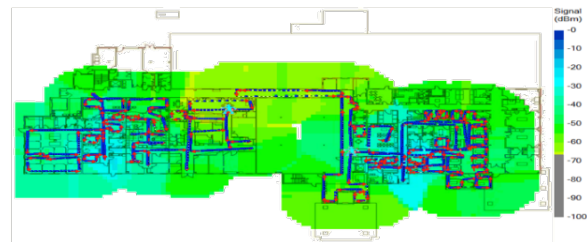
- ☐ *Channel Selection and Radio Resources*
  - ☐ *AP placement planning*
    - ☐ *Re-use locations, or new?*
    - ☐ *Single, dual or multi-gig cables?*
  - ☐ *Group APs by vendor*
  - ☐ *Define your coverage cells and, whenever possible, align with natural or constructed boundaries.*



Green is good  
Grey is bad



4 Cisco access points



Green is good  
Grey is bad



2 Ruckus access points



# Extend the OSI Model for Design Within Zones

# Example: Outdoors

*Users onboard their devices with Cloudpath*

- **Boundary: Quad perimeter; campus borders**
- **L1: Mesh AP mount to light post; sectorized antenna AP on building roof corner; P2P from rooftops**
- **L2: QoS, client isolation**
- **L3: Guest access, flat network?**
- **L4-7: IPTV, Social Media, FaceTime, Skype, Spotify**

# Example: Lecture Halls

*Users onboard their devices with Cloudpath*

- **Boundary:** room walls, ceiling, floor
- **L1:** “Should we mount under seats?” Perhaps, if permanent two-vendor solution; no, if temporary – ceiling/walls better
- **L2:** minimum base rate 11mbps; 5GHz w/20MHz channels
- **L3:** lecture hall VLAN
- **L4-7:** Evernote, Blackboard, Google, AirPlay, Polling, Office365  
Policy management (academic vs. recreation)

# Example: Residence Halls

*Users onboard their devices with Cloudpath*

- **Boundary: Building perimeter**
- **L1: H510 in wall plate; corridors**
- **L2: 2.4GHz for legacy devices; personal VLANs; DPSK for headless**
- **L3: Student or room VLAN; open ports for gaming; Bonjour gateway; block/throttle**
- **L4-7: Printing, browsing, IPTV, gaming, speakers, AirPlay, etc.**



# Key Take-Aways

## Set Priority

- Least disruption, least effort, service showcase, cure the headache

## Manage the experience

- eduroam within your campus

## Use Checklist

- Align network and physical borders and consider OSI Model framework

Thank you!

Questions?

[Rich.Nedwich@brocade.com](mailto:Rich.Nedwich@brocade.com)

