

CORNING

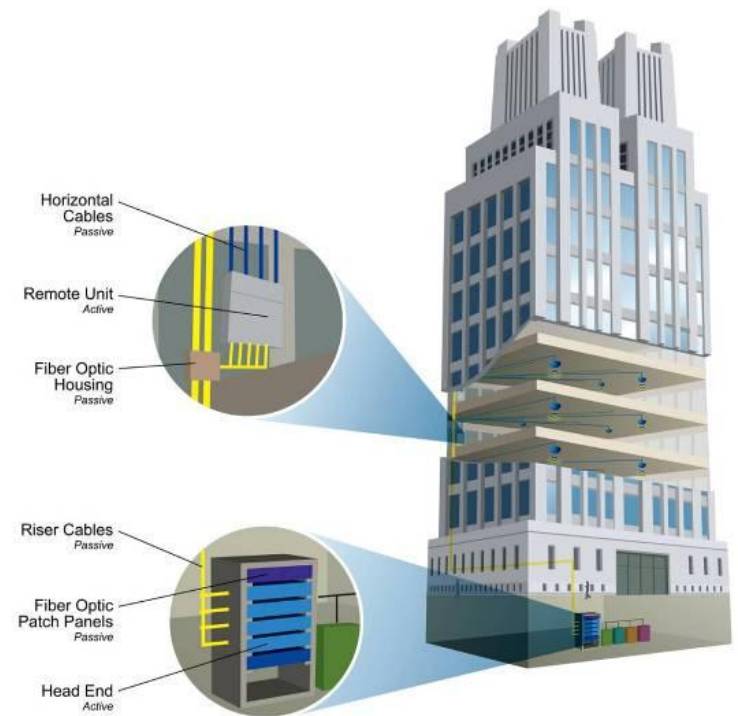
MobileAccess
Wireless Solutions

DAS: A Small Cell Solution with Big
Broadband Benefits

February 1, 2012

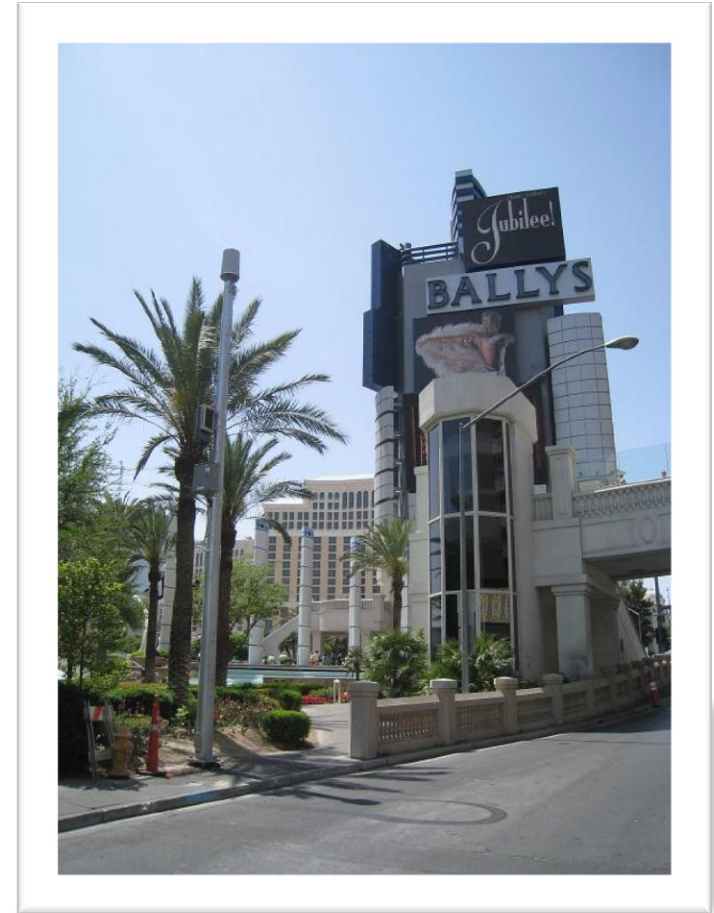
Distributed Antenna System - defined

- DAS Forum definition: A network of spatially separated antenna nodes connected to a common source via transport medium that provides wireless service within a geographic area or structure.



History of DAS

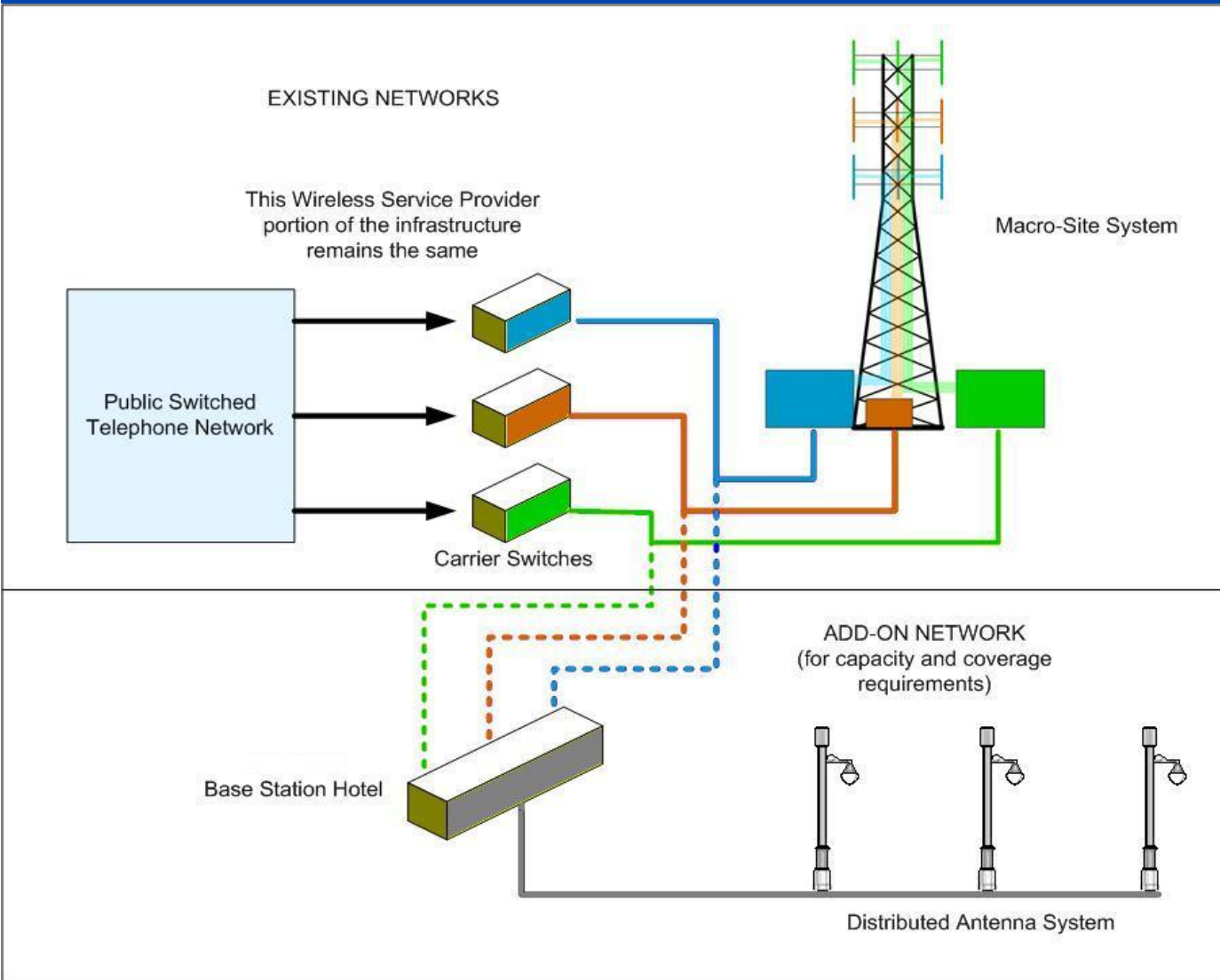
- ❖ Fiber was used to carry RF signals to discrete modules in the early Phased Array Radar systems designed in the 1970s.
- ❖ DAS networks became commercially viable in the late 1980s with the advent of optical fiber as a transport medium.
- ❖ First commercial analog fiber DAS network in 1989.
- ❖ First outdoor digital DAS network in 1993.
- ❖ Today, DAS networks are deployed indoors and outdoors across the country.



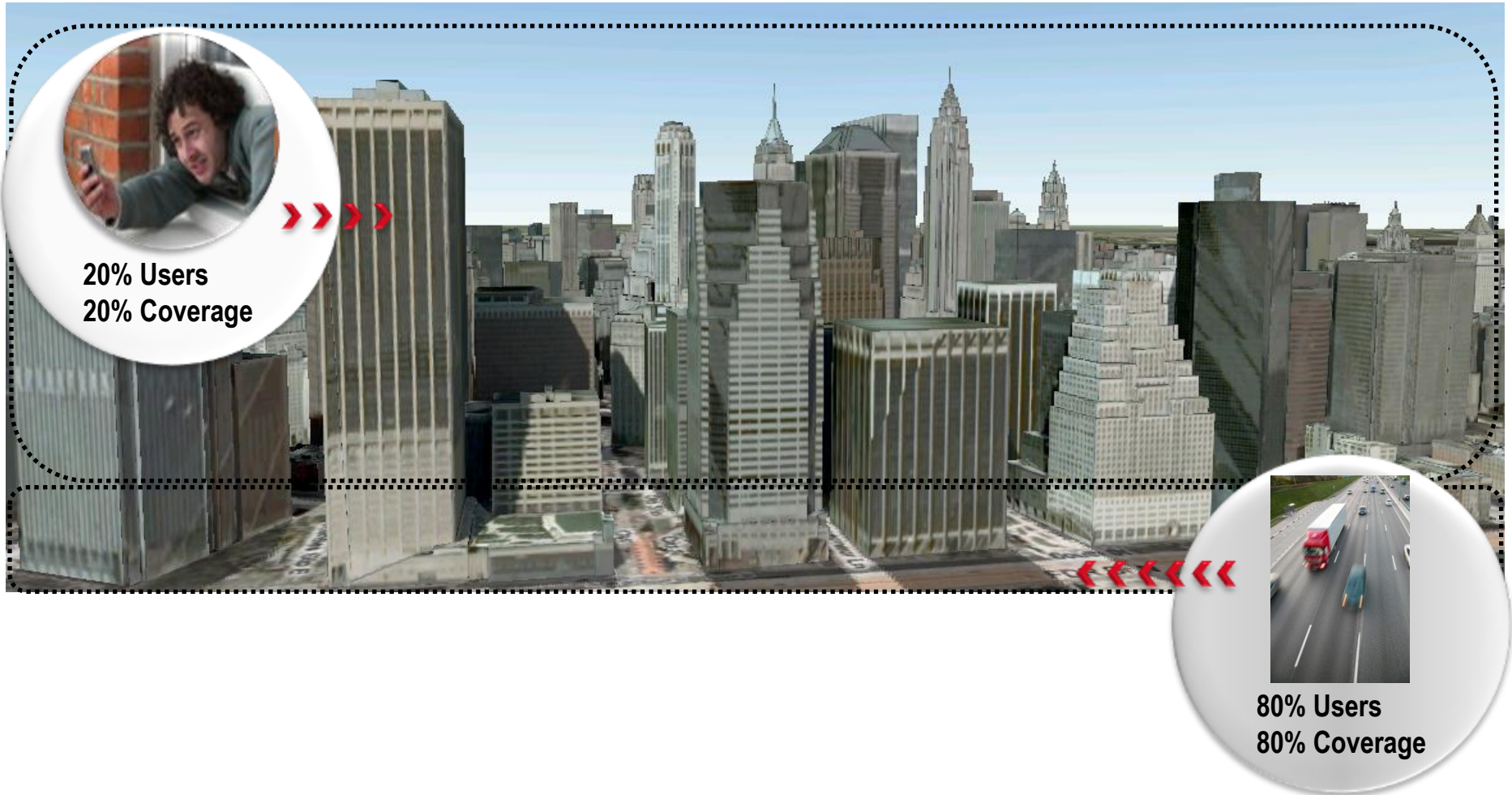
Benefits of DAS

- 📶 **Coverage:** DAS provides coverage in areas underserved by traditional sites.
- 📶 **Capacity:** DAS can closely align capacity to actual market requirements, managing available radio resources.
- 📶 **Spectrum:** DAS uses available frequency spectrum efficiently through multiple low-power transmission points.
- 📶 **Interference:** DAS reduces interference through low radiation centers and lower output power.
- 📶 **Data:** DAS provides better data throughput given signal strength and proximity of transmission points to user equipment.
- 📶 **Scalability:** DAS is a scalable network that can meet future capacity requirements, or additional carriers, by adding additional nodes.
- 📶 **Adaptability:** DAS can respond to market dynamics, equipment architecture changes and new technologies.

Comparing DAS to a macro site

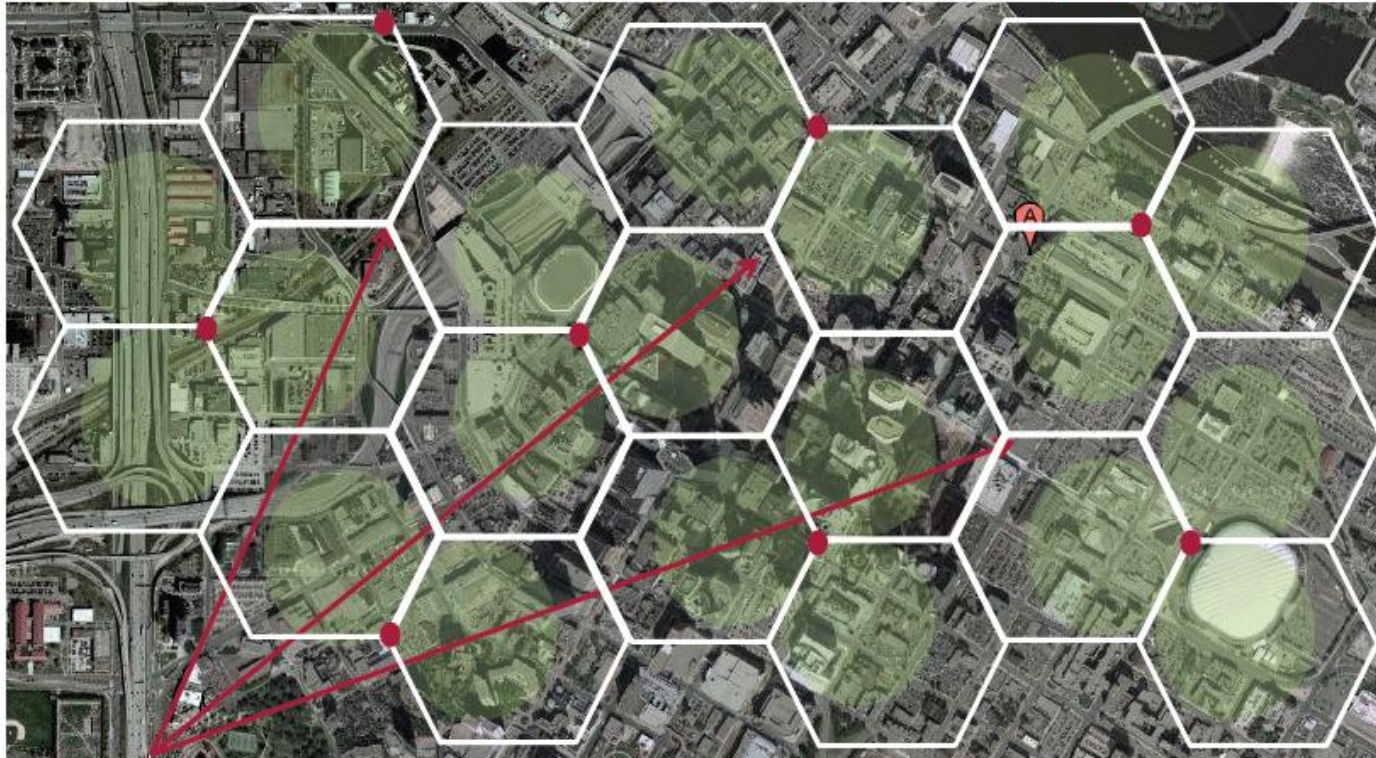


Drivers for DAS



Outdoor DAS – Coverage and Capacity

- Networks support current generation technologies
 - New services, frequencies can create coverage gaps
- DAS fills in interstitial gaps
 - Smaller cells support increased capacity



Coverage Gaps

Drivers for DAS

Rapid changes in the wireless world...

- Wireless penetration in US approaching 100%¹
 - Wireless only households approaching 30%¹
 - Connected devices make up majority of growth in US²
 - Tablets, e-readers, M2M, etc
 - Predicted to be >10% of market by year end
 - Average consumer spends 50-60% of time in an indoor environment³
 - 80% of all worldwide data connections initiate inside a building⁴
 - Estimates for global usage include:
 - 200,000 text messages sent every second
 - 35 hours of YouTube video uploaded every minute
 - Average 21-year old has spent 10,000 hours on a mobile phone
- 1 www.ctia.org; 2 Chetan Sharma Consulting ; 3 www.wirelessweek.com; 4 AT&T, 2011

Drivers for DAS



80% Users
20% Coverage

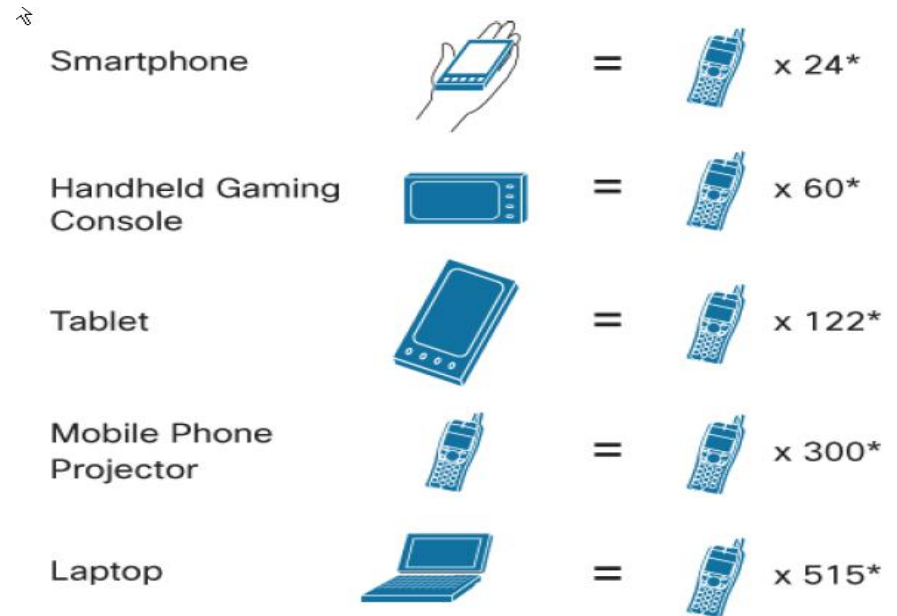
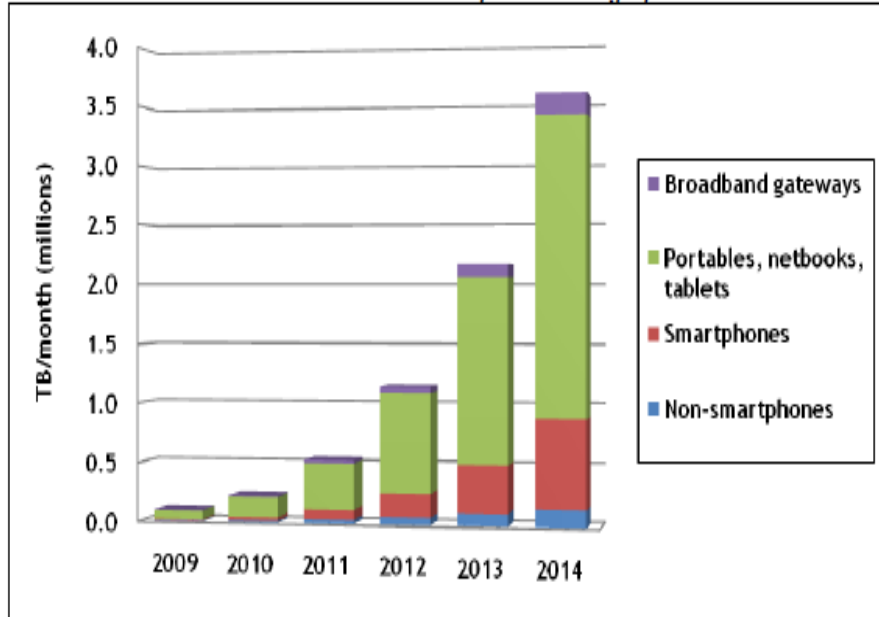


20% Users
80% Coverage

DAS Drivers

Data's impact on the network

Global Forecast for Mobile Data Traffic Growth by Device Category



Smaller cells provide the keys to providing reliable high speed data delivery:

1. Get the user closer to the source
2. Limit the number of users in the cell

DAS Value Proposition

- Benefits to the end-user
 - Better voice quality with fewer dropped calls
 - Faster Internet access
 - Longer battery life
 - Seamless handoffs with the macro network
 - No dead zones
- Benefits to the venue owner
 - Reduced customer complaints about wireless service
 - Competitive advantage for obtaining/retaining customers
- Benefits to the wireless carriers
 - Increased customer satisfaction and lower associated churn
 - Dedicated coverage and capacity for facility
 - Multi-carrier, multi-band, multi-technology solution
 - Offload traffic from the macro
 - Solves the “tall building” problem in dense urban environments

Summary

- Changing device usage patterns require carriers to deploy new coverage and capacity strategies
- Wireless, new connected devices, and DAS are powerful tools for helping communities bridge the “digital divide”
- DAS is a proven tool gaining new importance
- DAS provides benefits which match up well with end-user, venue, and carrier needs