



UNIK4230: Mobile Communications

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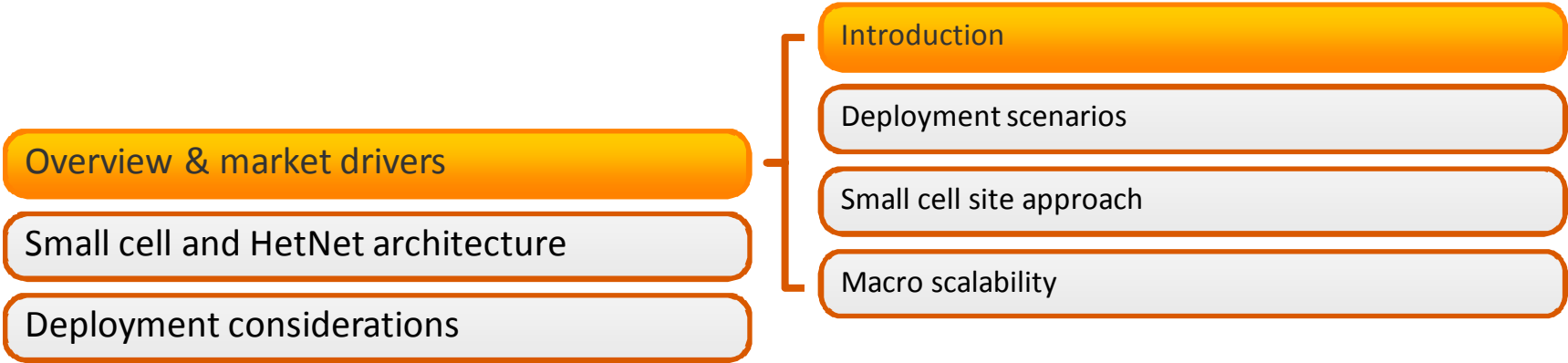


Small cells and HetNet

15.05.2014

Materials contribution: Nokia Siemens
Networks

Contents



Drivers for small cells

Coverage

Improve indoor coverage



Fill coverage gaps & holes



Fill new coverage areas



Enterprise solutions



New services



Fixed mobile convergence



Capacity

Macro not feasible



Dense hotzone capacity




Offload from macro




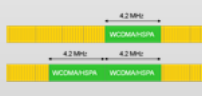
New opportunities

Tools to manage network evolution with lower TCO


Maximize macro usage



6-sector Active antenna Baseband pooling

Spectral efficiency Re-farming



New radio technologies

Utilize traffic management solutions



Caching



Content optimization



QoS & DPI



Network mgmt automation & SON

Deploy small cells to complement macro



Micro



Pico



Femto

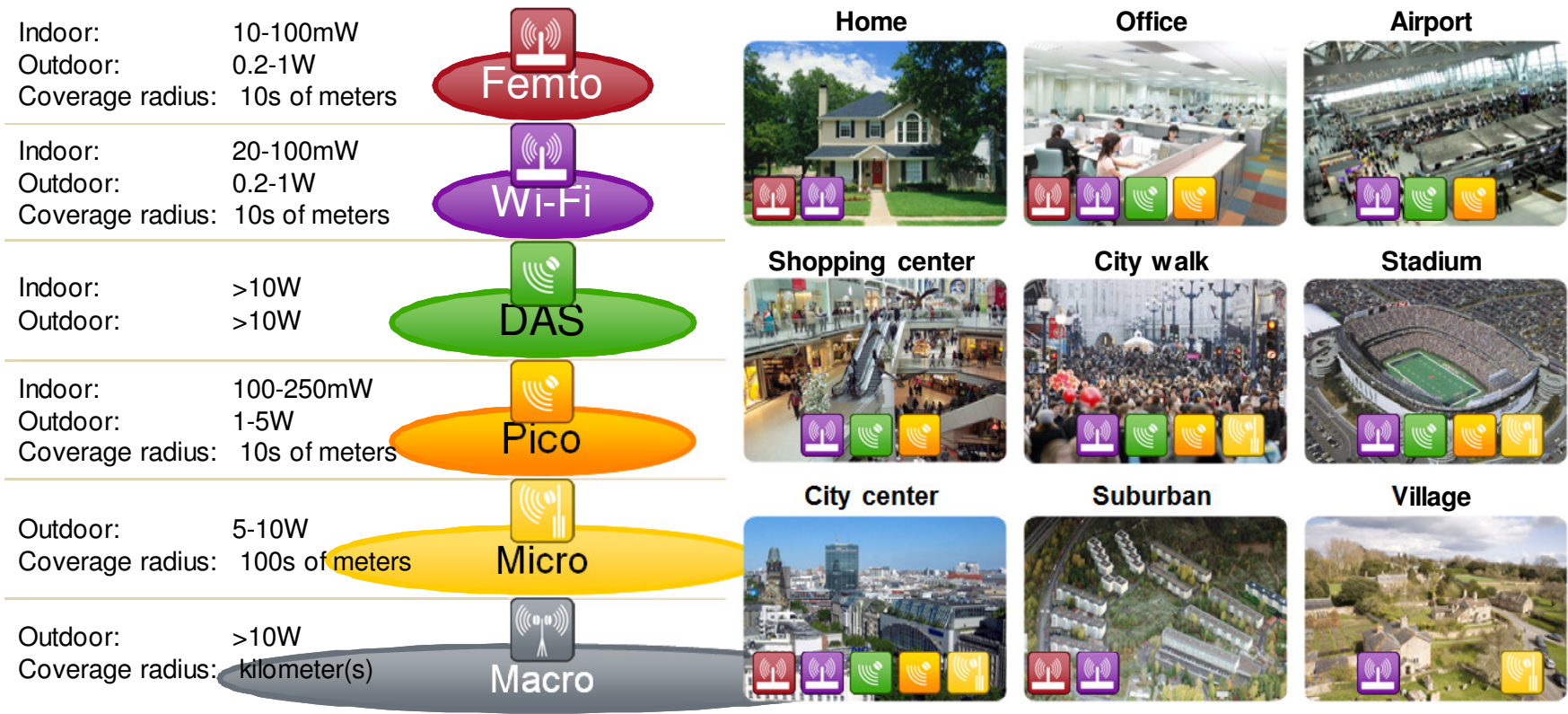


Wi-Fi

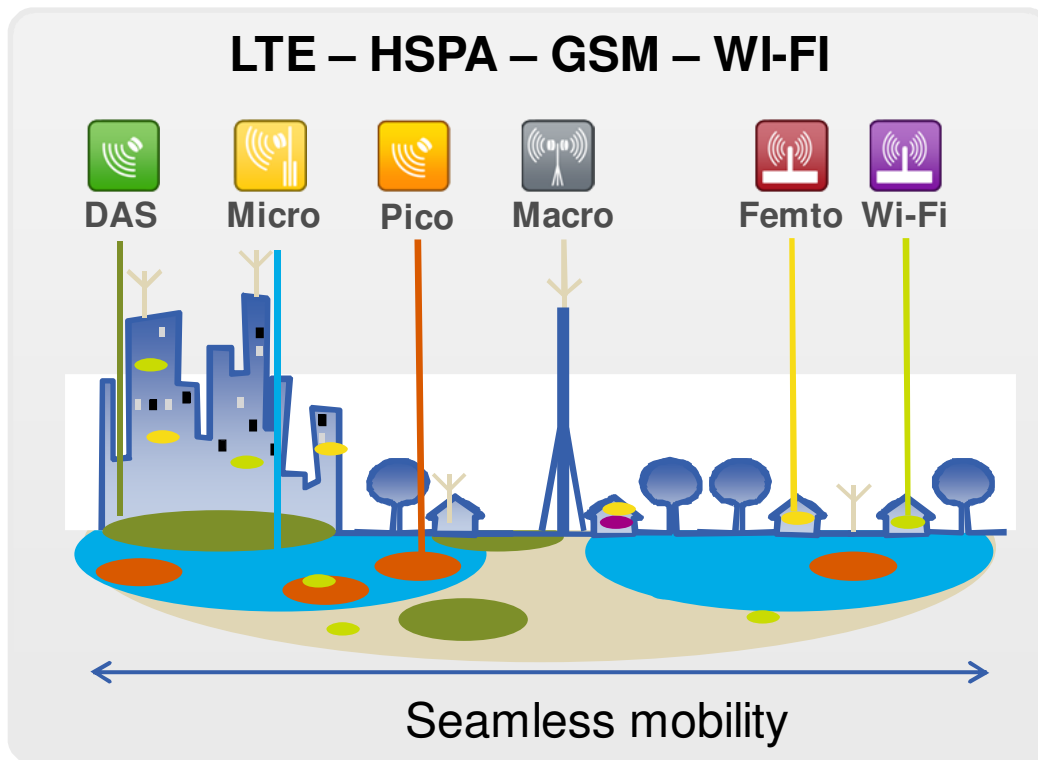


Offloading

Different small cell deployment scenarios



Small cells and heterogeneous network



Always best connected user experience

Seamless interworking between different cell sizes, frequency layers and radio technologies

Interference management

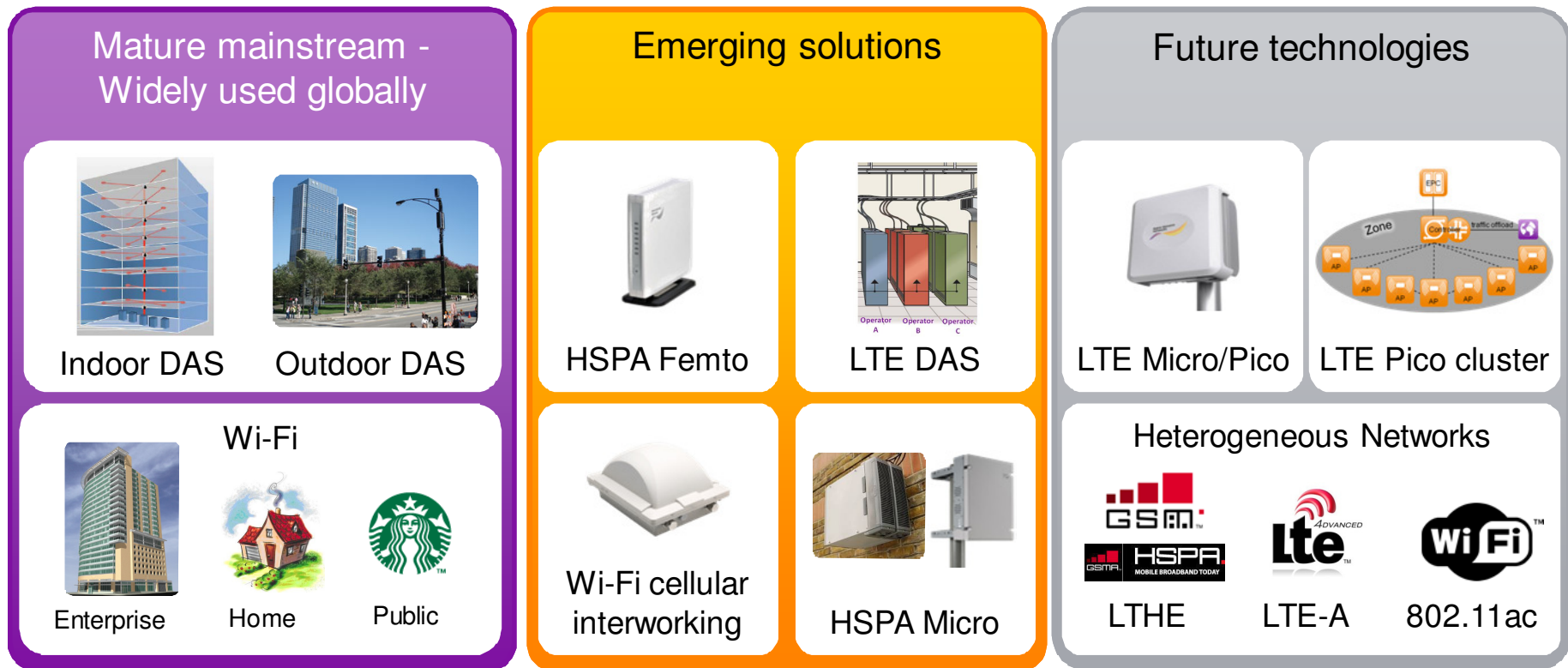
Layer optimization and traffic steering

Scalable smart network management and SON automation

Users expect always best connected experience










Maturity level of different small cell technologies



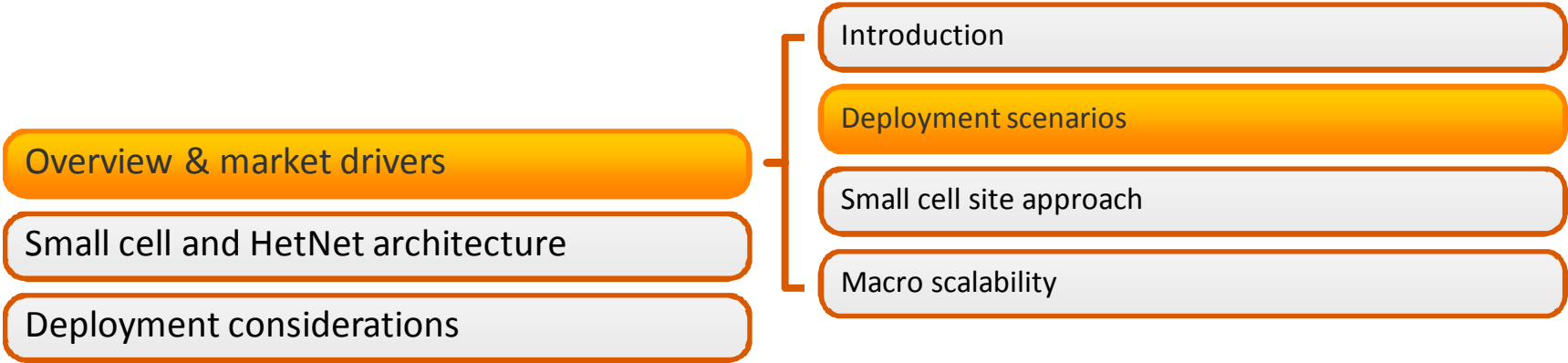
Factors impacting operator small cell deployment timing



Definitions of different small cell types

	Indoor			Outdoor				
								
	Wi-Fi	Femto	Pico	Wi-Fi	Femto	Pico	Micro	Macro
Output transmit power	20mW - 100mW	Residential 10 -100mW Enterprise 100-250mW	100mW - 250mW	200mW - 1W	200mW – 1W	1 - 5W	5 - 10W	>10W
Architecture	LAN	Gateway	Macro / Gateway	Gateway	Gateway	Macro / Gateway	Macro	Macro
Coverage radius	<50 meters	<50 meters	<100 meters	10s of meters	10s of meters	~100 meters	100s of meters	Kilometer(s)
Size and weight	<1L <1kg	<1L <1kg	2-4L 1-3kg	3-8L 2-5kg	3-8L 2-5kg	5-10L 5-10kg	10-50L 8-20kg	30-500L 30-200kg
Max users	20-30	8-16	16-64	30-150	8-32	16-64	64-256	>256
Typical deployments	Consumer Enterprise Cafe	Consumer	Enterprise	Lamp posts Building walls Utility poles	Lamp posts Building walls Utility poles	Lamp posts Building walls Utility poles	Lamp posts Building walls Utility poles	Tower masts Rooftops

Contents



Small cell deployment example: City center

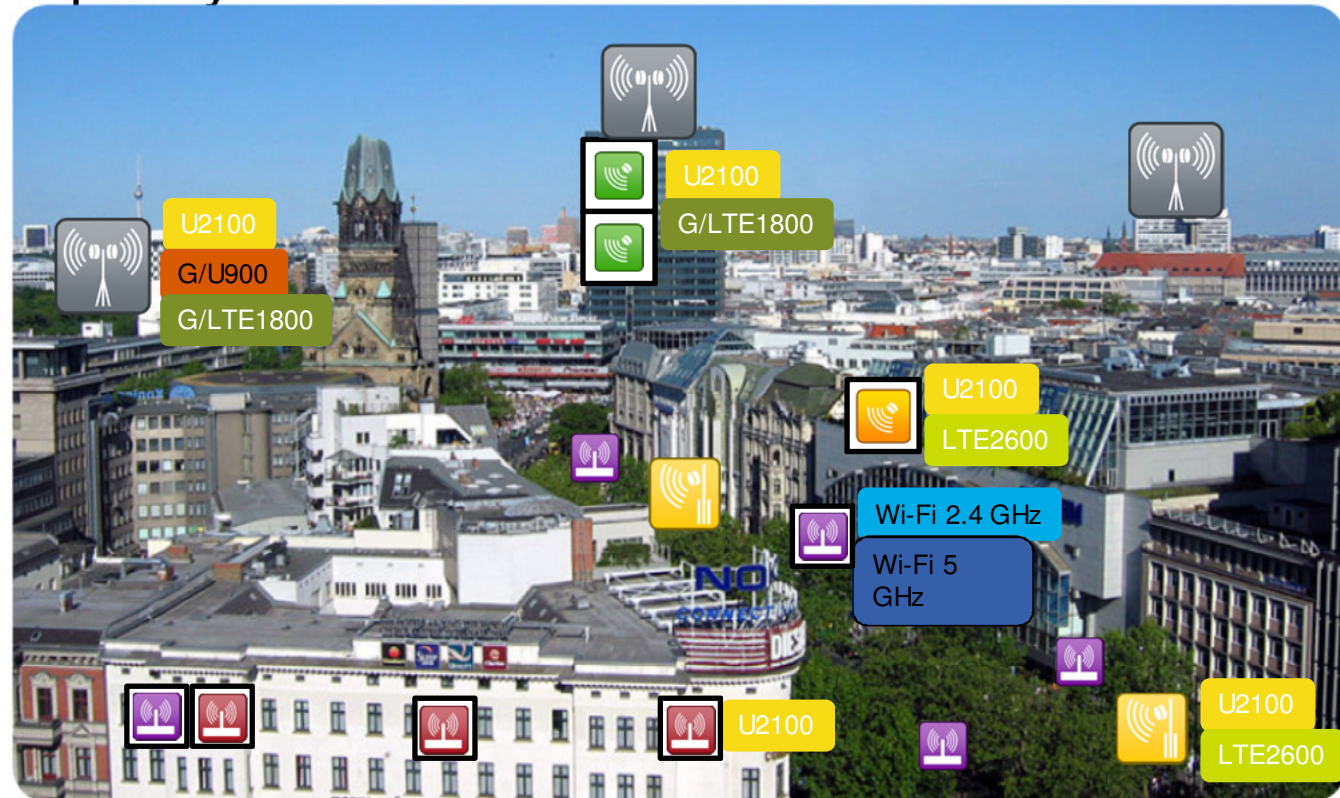
Example EMEA frequency use scenario

indoor

-  Public Wi-Fi
-  Femto
(10-100 mW)
-  Pico
(0,1 – 1 W)
-  DAS
(macro)

outdoor

-  Public Wi-Fi
-  Pico/Micro
(1 – 10 W)
-  Macro
(> 10 W)



Small cell deployment alternatives: City walk

Multiple options for different use cases



Outdoor DAS

- All devices, CS+PS services
- Can be shared with other operators
- Part of macro network



Outdoor pico/micro

- All devices, CS+PS services
- Typically operator specific
- Offload traffic from macro network
- Can be combined with outdoor Wi-Fi




Outdoor Wi-Fi

- Broadband connection for laptops, tablets and smartphones
- Offload data from cellular network

Small cell deployment alternatives: Stadium


Need for dense capacity



Outdoor DAS

- Can be shared with other operators
- Part of macro network
- Additional capacity using carrier Wi-Fi


The diagram shows a stadium with several green and purple antenna icons distributed around the perimeter and inside the stadium, connected to a central base station icon.



Remote radio heads

- Typically operator specific
- Fiber fronthaul to centralized baseband
- Part of macro network topology
- Additional capacity using carrier Wi-Fi


The diagram shows a stadium with several yellow and purple antenna icons connected to a central base station icon via fiber optic lines.



Micro/pico cells

- Typically operator specific
- Part of macro network topology
- Additional capacity using carrier Wi-Fi

The diagram shows a stadium with several yellow and purple antenna icons distributed around the perimeter and inside the stadium, connected to a central base station icon.



Pico cluster

- Typically operator specific
- Local cluster network topology
- Carrier Wi-Fi can be co-located with pico BTSs

The diagram shows a stadium with several yellow and purple antenna icons distributed around the perimeter and inside the stadium, connected to a central base station icon.

Small cell deployment example: Suburban

Femto coverage & offloading, private Wi-Fi for fixed BB extension

indoor



Private Wi-Fi



Femto
(10-100 mW)

outdoor



Macro
(> 10 W)



Small cell deployment examples: Village

Missing mobile coverage and no permission for macro site

outdoor



Micro
(5 – 10 W)

- Permission and site easier to acquire
- Lower total cost of ownership
- Reduced coverage unless many micros are deployed



Small cell deployment alternatives: Residential home

Fixed access availability determines alternatives



Fixed access is the main broadband connection

- Macro provides cell coverage for indoor & outdoor
- Wi-Fi for sharing fixed broadband for computers, smartphones and connected devices
- Femto for voice & broadband for cellular devices



Cellular access is the only broadband connection

- Macro provides cell coverage for indoor & outdoor
- Additional coverage & capacity with nearby micro/pico
- Mobile router for sharing cellular connectivity for Wi-Fi capable devices

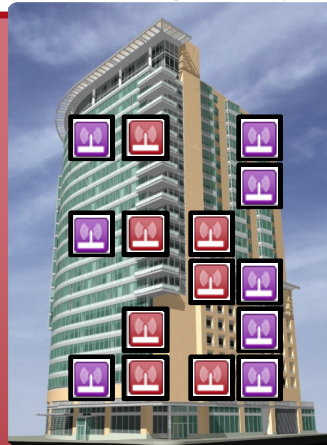
Small cell deployment alternatives: High rise building

Small cells for indoor coverage and capacity



In building DAS

- Initiated by real estate
- Typically multi-operator
- Open to all subscribers
- Utilizes macro base stations
- Planned interworking with macro
- Backhaul from building telco-room



Femto

- Planned and deployed by customer
- Dedicated to customer or open to all
- Utilizes femto gateway architecture
- Utilizes building LAN for backhaul



Pico

- Initiated by operator
- Open to all subscribers
- Part of macro architecture
- Planned interworking with macro
- Utilizes building cabling for backhaul

 Customer deployed private Wi-Fi and optional guest Wi-Fi