





Wireless: The Next Wave in Lighting Control

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For More Information

- Would you like to know more about this session?
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Why go wireless?

- 75 Billion sq ft of commercial floor space
- 4.7 million buildings
- Very little automated control
 - Eg dimming ballasts less than 3% of market



Why Go Wireless

- Spaces are often:
 - Overlit
 - Not using available daylight
 - Unoccupied
- **Adding controls can be:**
 - Expensive (hardware & installation)
 - Lacking in flexibility



Why go wireless?

- Wireless may be a cost effective way to add:
 - **Scheduling:** save 35 to 70%
 - **Daylight dimming:** where daylight is available, save 20 to 80%; reduce commissioning and wiring errors
 - **Occupancy sensing:** save ~30%; easier to move sensors around
 - **Personal control:** save 15% to 40%; increase satisfaction
 - **Demand response:** strategically turn lights off when utility asks



Wireless benefits

- Easier to install: save \$50 to \$100/ft of wiring; less disruptive; fewer wiring errors
- Reduced maintenance: wires can crack/fail, failures at connectors
- Flexibility: regroup fixtures; relocate sensors/switches
- Synergy with HVAC



The unknowns

- Cost: depends on granularity
- Interoperability: open vs proprietary
- Scalability: not yet tested for thousands of nodes
- Security/reliability: needs to be dependable
- Power requirements—reduce by:
 - Duty cycling
 - Reducing power needed
 - Scavenging



Wireless cost comparison

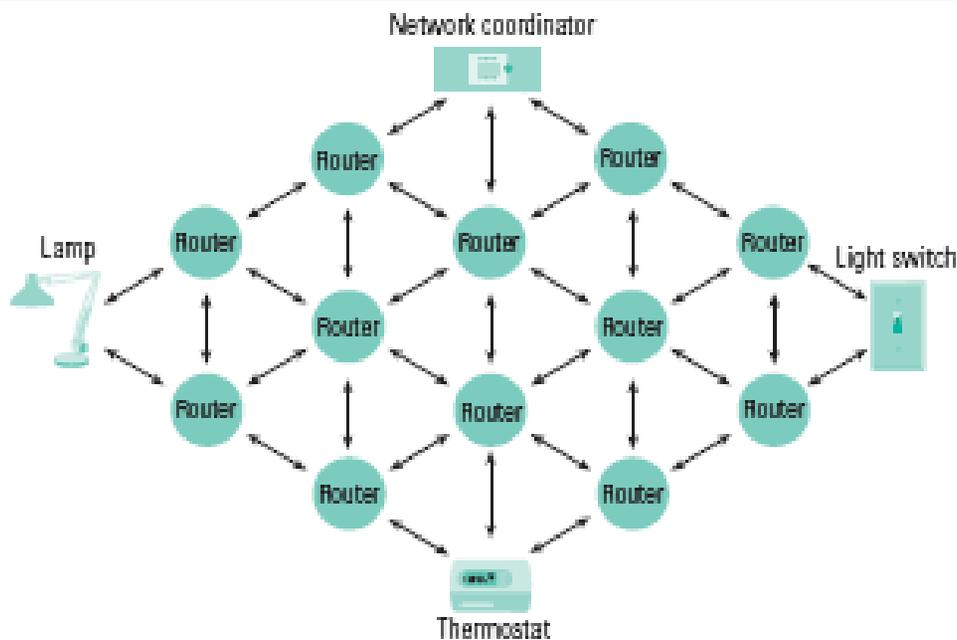
	Multilevel switching	Panel dimming	DALI	Wireless
Branch wiring (\$/sq ft)	[3-4]	[1.5-2]	[.75-1.25]	[0]
Total installation (including branch wiring) (\$/sq ft)	6-7	5.5-6.5	5-6	2-3
Total controls (\$/sq ft)	1-1.5	1.5-1.75	2-2.5	1.5-3
Commissioning (\$/sq ft)	0.1-0.15	0.1-.15	.5-.75	.5-.75
Total cost (\$/sq ft)	7.1-8.65	7.1-8.4	7.5-9.25	4-6.75

Data from Adura Technologies



Making a mesh

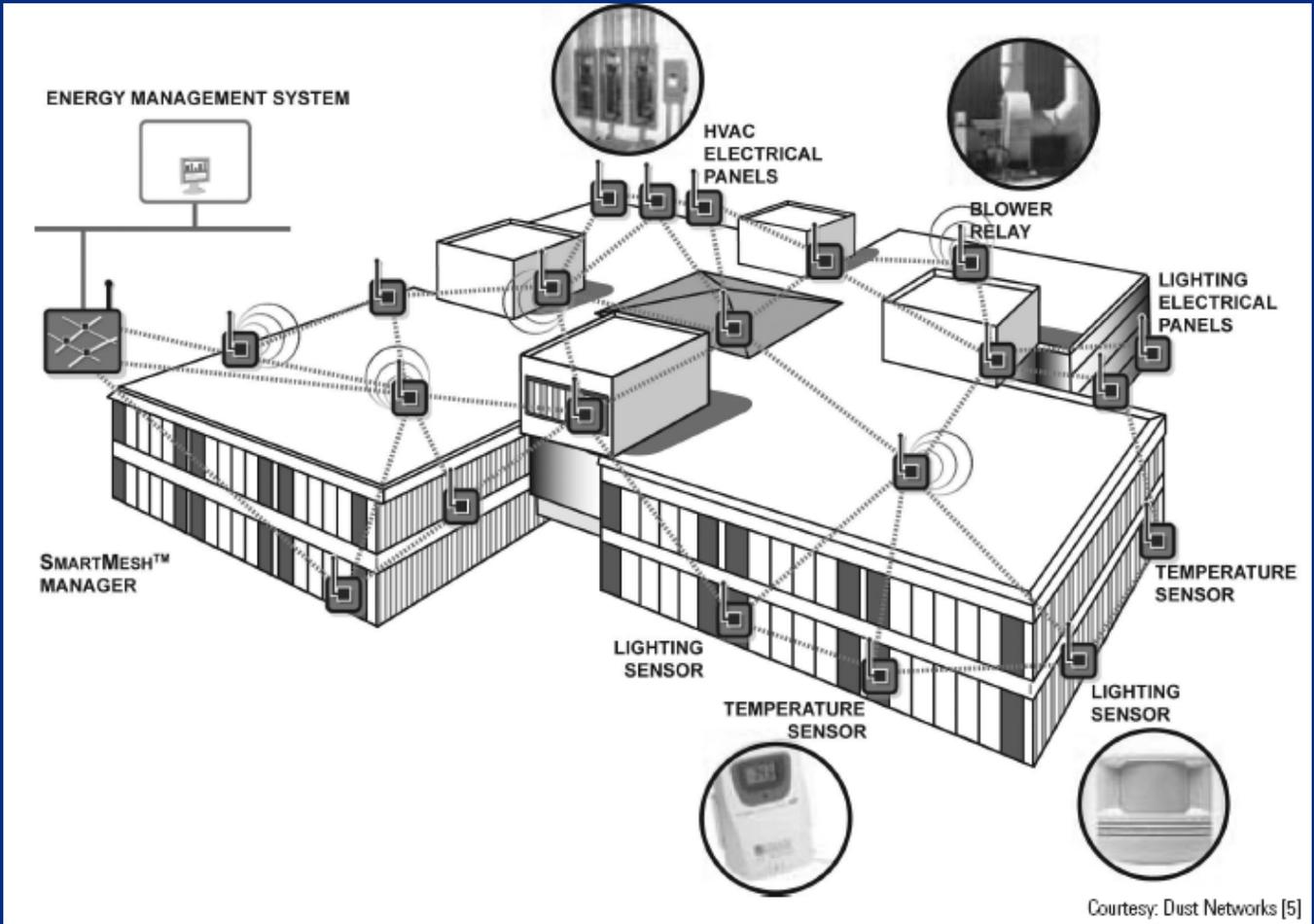
- Self-organizing
- Self-healing
- Low power requirements
- Scalable to large networks



Source: E source



Making a mesh



Courtesy: Dust Networks [5]



How to make a mesh: ZigBee

- ZigBee Alliance: More than 200 companies working to develop products using standard protocols
 - So far mostly residential
 - Two products at LightFair: EasyLite ballast controller; Sensorswitch bridge and transceiver



How to make a mesh:ZigBee

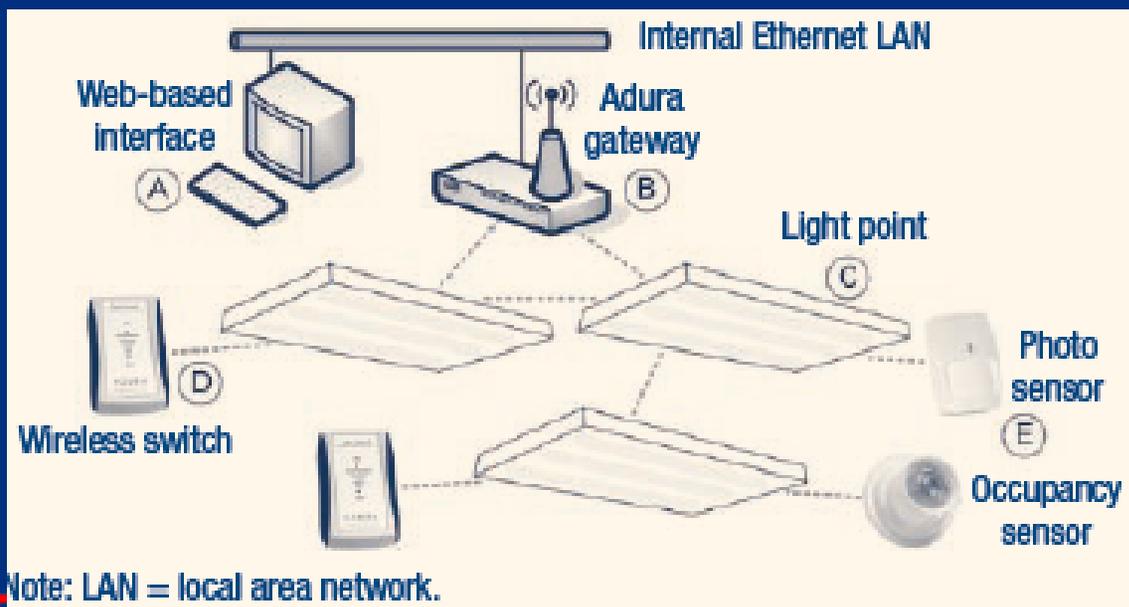
- EasyLite: Ballast controller, draws power from ballast, pilot installations this summer
- Sensor switch:
 - Bridge available now;
 - Transceiver by next year





How to make a mesh: Adura

- Proprietary, eg **Adura Tech**, wireless nodes install in less than 10 minutes; use existing ballasts
- Originated at Center for Built Environment, UC Berkeley, funding from California Energy Commission PIER Program





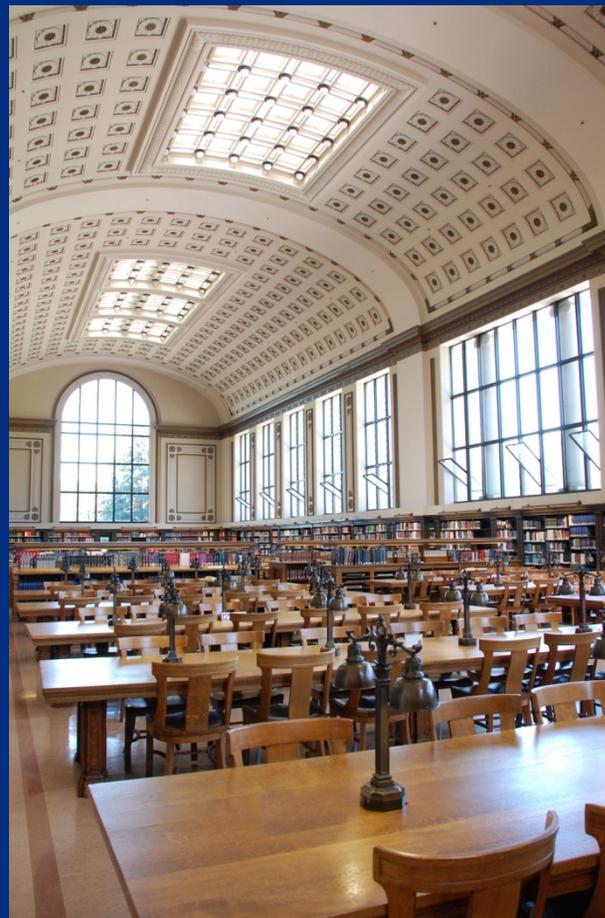
How to make a mesh: Acura

- Web-based software configures, sends commands to the proper devices.
- Easy to reconfigure
- Can start small and grow
- Includes wireless, battery-powered wall switches; photo sensors and occupancy sensors coming soon



How to make a mesh: Adura

- Field tests:
 - Early test: 65% energy savings through occupant preference
 - Current: two libraries at UCB, expect to save 170 MWh/yr through web-based scheduling and daylight dimming





How to make a mesh: EnOcean

- EnOcean: electrical energy from mechanical, luminous, and thermal energy—no batteries needed!
- Started in Europe
- Now a US alliance that includes: Leviton, Osram Sylvania, Texas Instruments, Masco Corp.



How to make a mesh: EnOcean

- Batteries can last two to five years
 - May need to change at same frequency as fluorescent lamps
- But an extra maintenance chore



The last word

- Commissioning
 - Wireless or not, commissioning is a must
 - Does wireless make it easier?



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