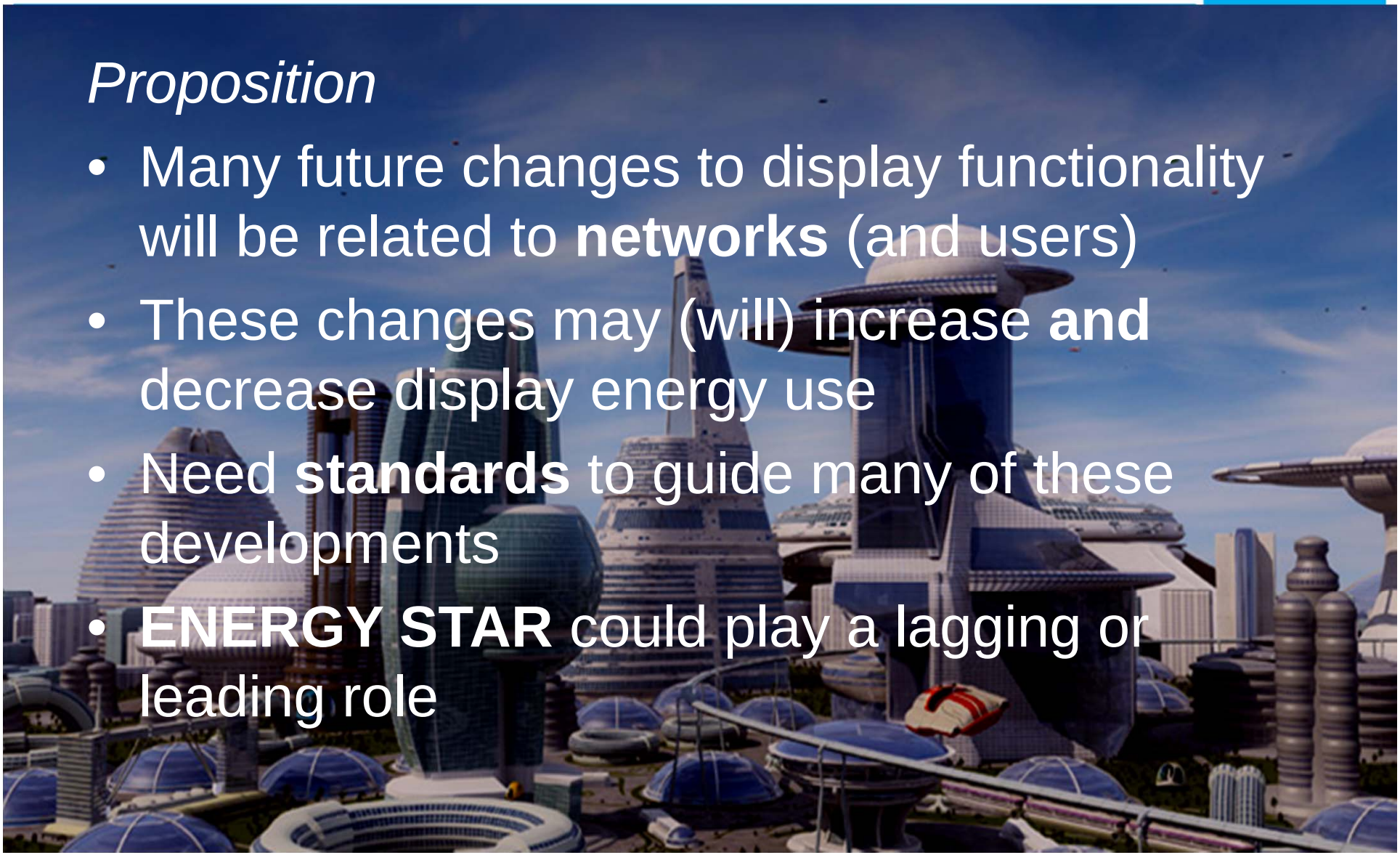
Emerging Display Technologies

- *Slides initially presented in 2008 stakeholder meeting – today have 2011 annotations*
- *Some technologies have since entered the market*

Key points

- *Need to adapt test procedures, specifications*
- *Need new user interaction conventions*

Future Networking of Displays



Proposition

- Many future changes to display functionality will be related to **networks** (and users)
- These changes may (will) increase **and** decrease display energy use
- Need **standards** to guide many of these developments
- **ENERGY STAR** could play a lagging or leading role

Future Networking of Displays

Proposition

- Many future changes to display functionality will be related to networking (and users)
- These changes may (will) increase **and** decrease display energy use
- Need **standards** to guide many of these developments
- **ENERGY STAR** could play a lagging or leading role

Some technologies have begun to enter the market

Standards development is lacking

Displays today

- Connected to a single source device
  - With a data, not network link
- Source only determinant of power state
  - (aside from power switch)
- No user input capability
- No environmental sensors

This simplifies

- Test procedures
- Specifications
- Product design
- Use

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Still true for most models, but not all

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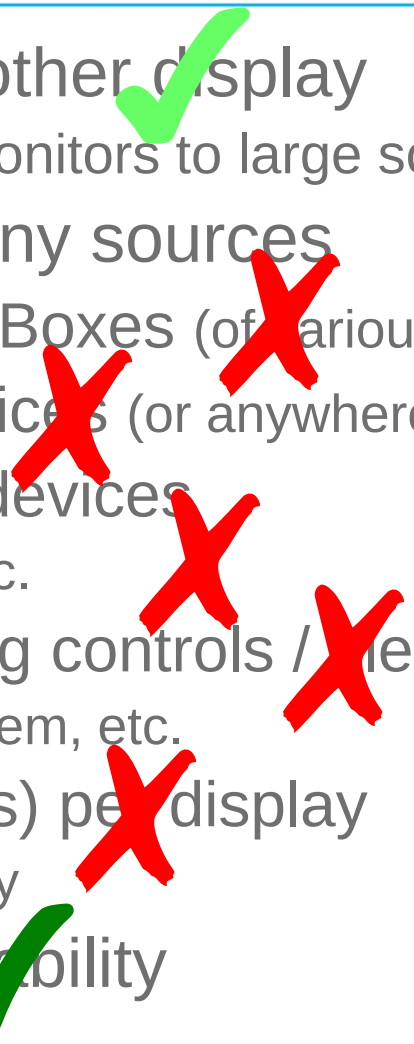
Future - Usage models

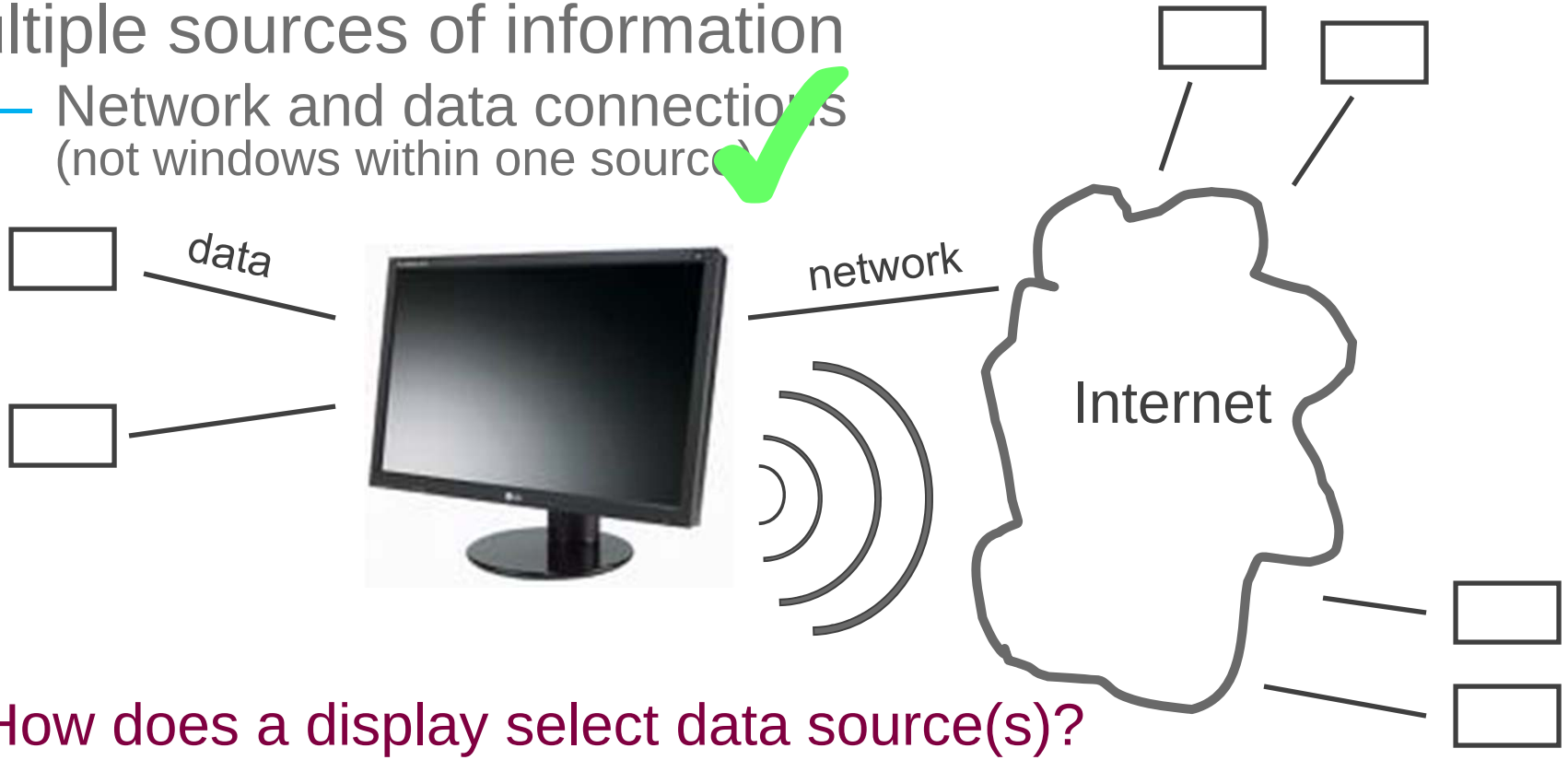
- Convergence of TVs and other display
  - Continuum from phones to monitors to large screen TVs
- Content available from many sources
  - Multiple PCs and Set-top Boxes (of various sorts)
  - Webcams in homes or offices (or anywhere)
  - User interfaces for other devices
    - Appliances, utility meter, etc.
  - User interfaces for building controls / elements
    - Lights, HVAC, security system, etc.
  - Multiple sources (windows) per display
    - Multiple displays per display
- Adding User Interface capability



Future - Sources

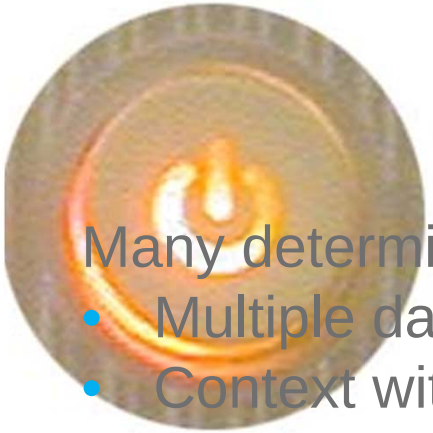
Multiple sources of information

- Network and data connections
  (not windows within one source)



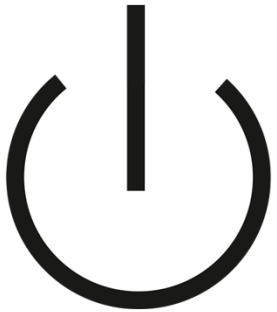
- How does a display select data source(s)?
- When should it “listen” (or not) to a source?
- What are power requirements for sources in different states?

Future - Power State



Power State: On, Sleep, Off

(Sleep has network connectivity)



Many determinants of display power state

- Multiple data sources
- Context within a source
- Environmental sensors
  - Ambient light, ambient sound, …
- Occupancy sensors
- User interfaces
  - Touch, cameras, remotes, …

- How to test shifting between power states?
- How to measure power for particular states?
- What are the implications for usage patterns (TEC)?

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Future - Inputs and Sensors

Possible User Interfaces

- Touch ✓
- Remotes
- Keyboards / Mice ✓
- Audio / Speech
- Cameras / Gestures ✓

Possible Sensors

- Ambient light ✓
- Ambient sound
- Occupancy (direct and inferred) ✓

Future - Inputs and Sensors

- How does the user know what inputs / sensors exist?
  - Symbols
- What inputs / sensors are active during sleep?
  - Indicators
- What (display or other) does an input or sensor wake up?
- What (display or other) do sensors influence?
- What are power requirements for inputs / sensors?
  - How active could / should they be?
  - How to test?

Impacts on ENERGY STAR

Test Procedures ✓

- Data / network context for testing
- Functions to enable / disable / exercise
- Key functions for particular power states
- What to report

Specifications ?

- Features to reward with additional power
- Features to
  - encourage / discourage
  - require / prohibit

Standards needs

User expectations / User interface

- Dynamic operation
- Symbols / terms / colors
  - Power state, sources, inputs/sensors

Data / network interfaces

- Mediation of power control
- Role of user inputs / sensors

What venues to address these?
How does ENERGY STAR engage?

Audio / Video Inter-Device Power Control

eetd.lbl.gov/ea/nordman/avcontrol

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Ideal Result

Use ENERGY STAR to help:

- Develop and bring into market new energy-saving features
- Discourage or reduce consumption of energy-intensive features
- Create a universal set of user expectations for how to use displays
  - Enhances user experience
  - Saves energy

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