

# Benefits of IPv6 to the Smart Grid

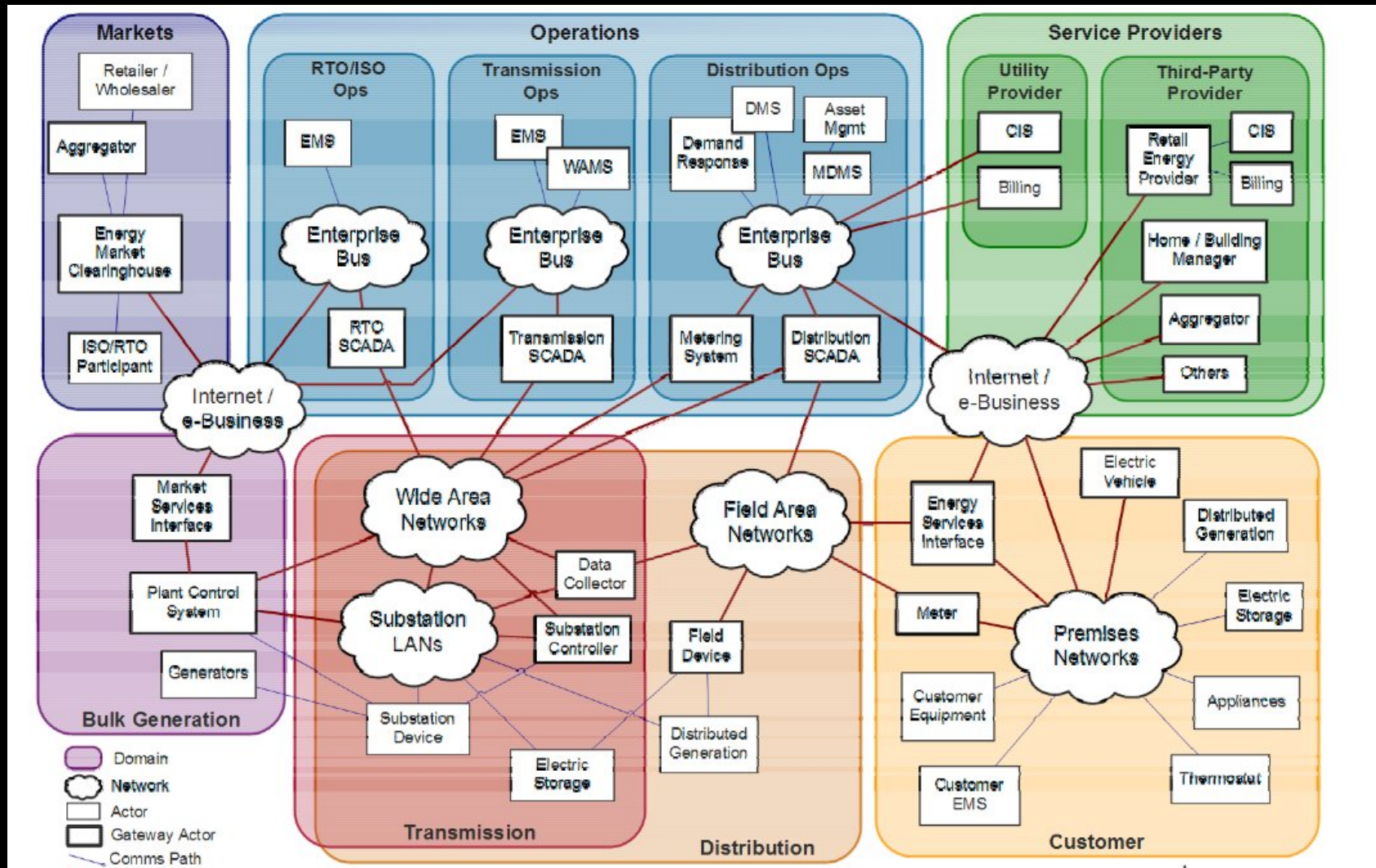
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# Why IP?

- Support for multiple Phys
  - 802.11, Ethernet, GPRS, PLC, Serial Lines, 802.15.4
- Existing Resources
  - Tools, Protocols, Knowledge
- Established transport and application models
- Established naming and addressing

Don't reinvent the wheel

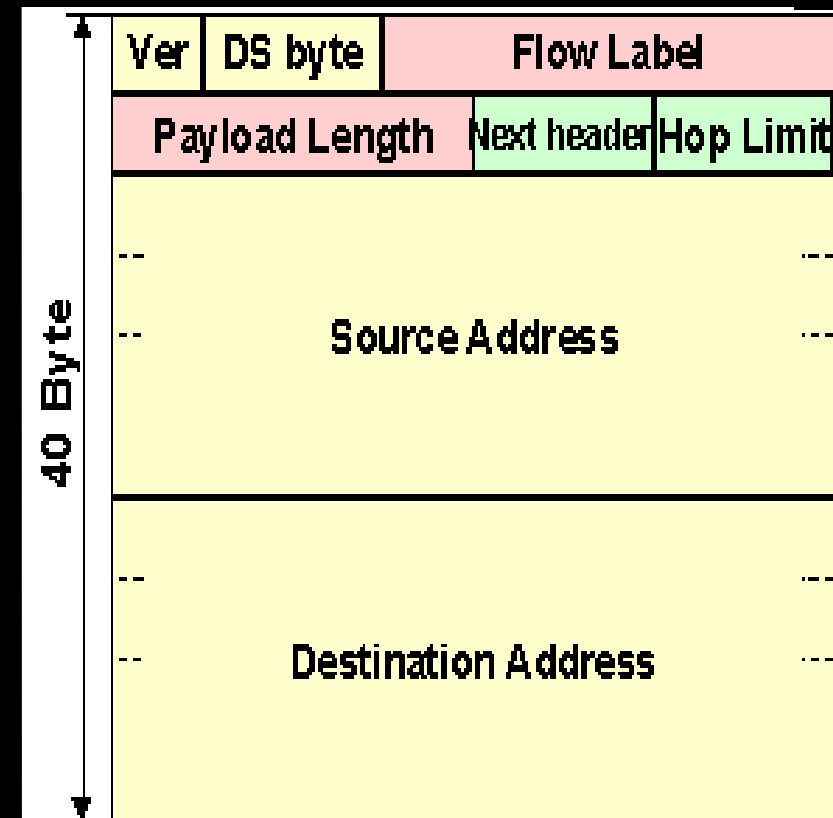
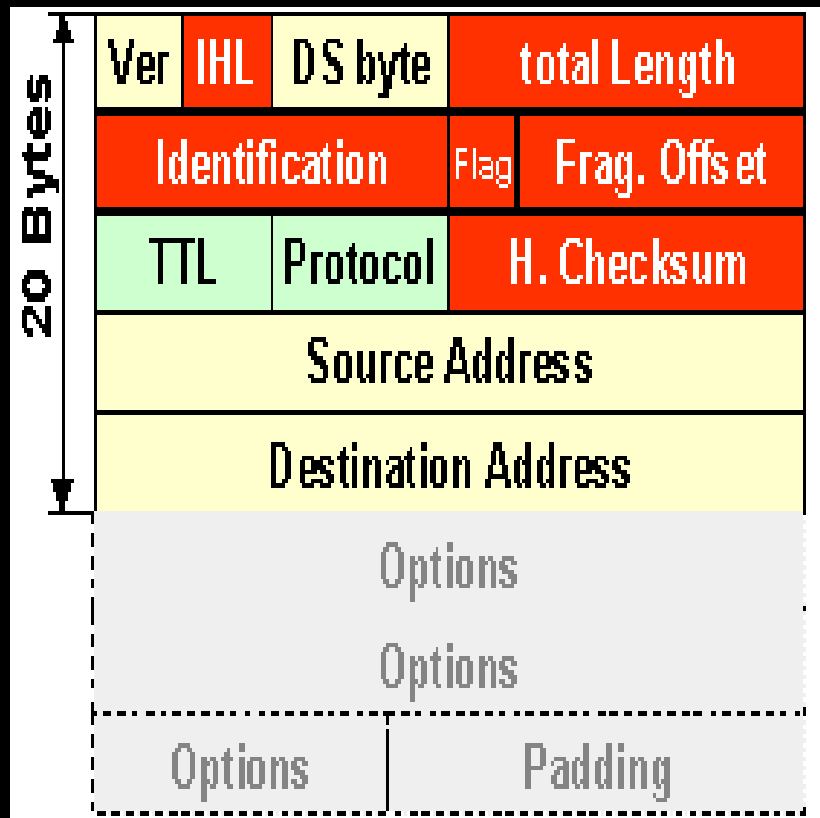
# Stovepipe Complexity



# What is IPv6?

- Simplified Header
- Huge Address Space
  - One for every grain of sand –  $2^{128}$  Addresses
- Stateless Address Autoconfiguration
  - DHCP servers not required
- No need for NAT
  - No NAT configuration

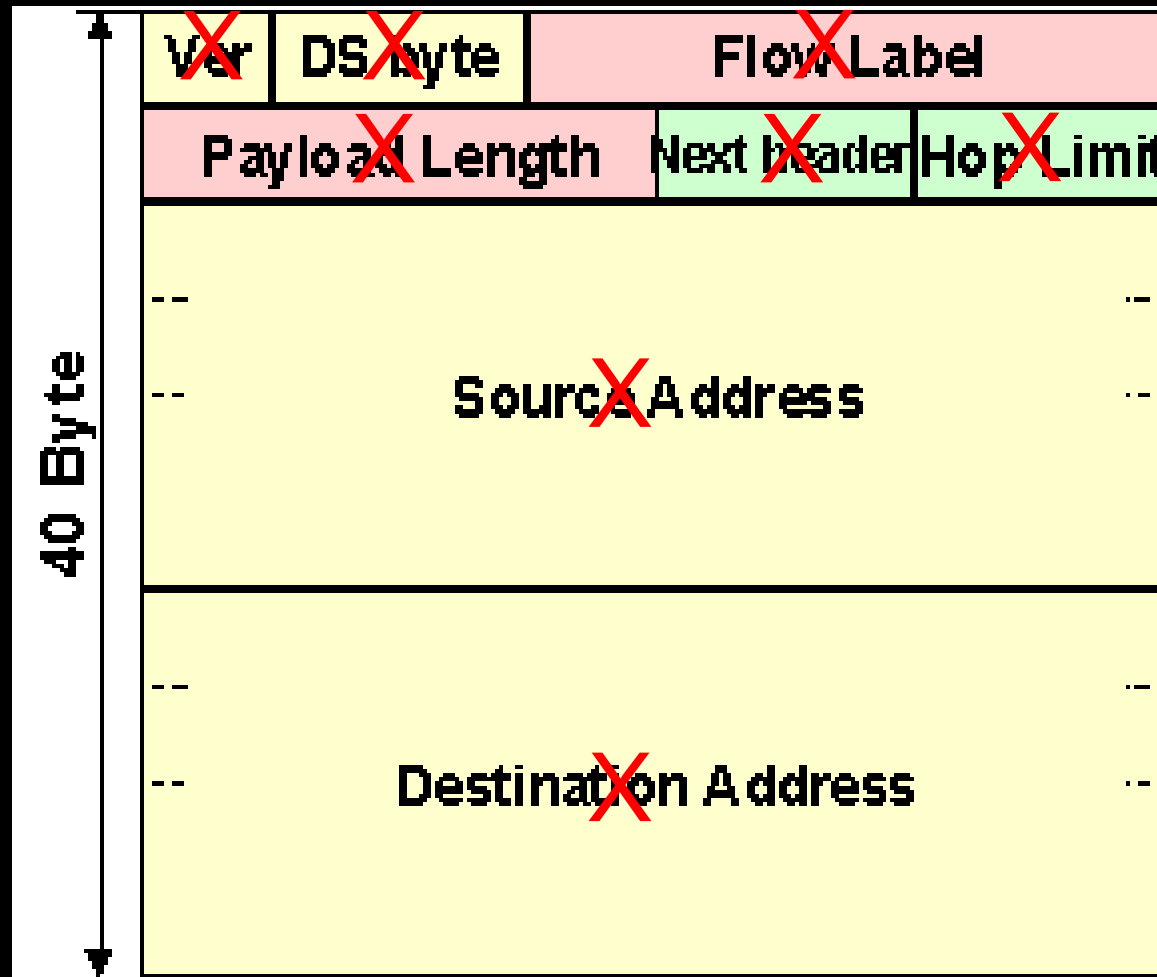
# IPv4 vs. IPv6



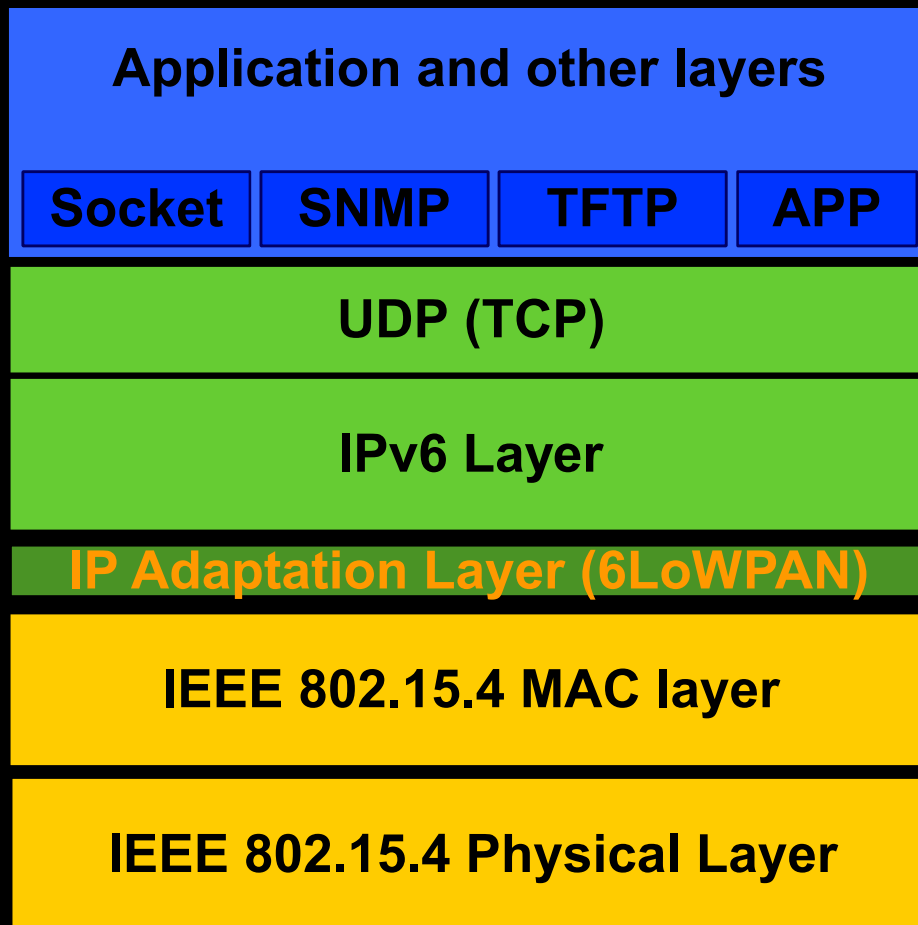
# What is 6LoWPAN

- Adaptation layer for IP over 802.15.4
- Stacked Headers
  - Pay only for what you use
- Header compression (3 bytes)
- An Open Standard!
  - RFC 4944
  - ISA100, IEE 1451.5

# 6LoWPAN HC



# Embedded IP Stack



- Code Size:
  - 11 – 17K
- Ram Size:
  - 2 – 8 K
- Packet Overhead
  - 3 – 12 bytes
- Implemented and available:
  - Atmel
  - Freescale
  - Jennic
  - TI



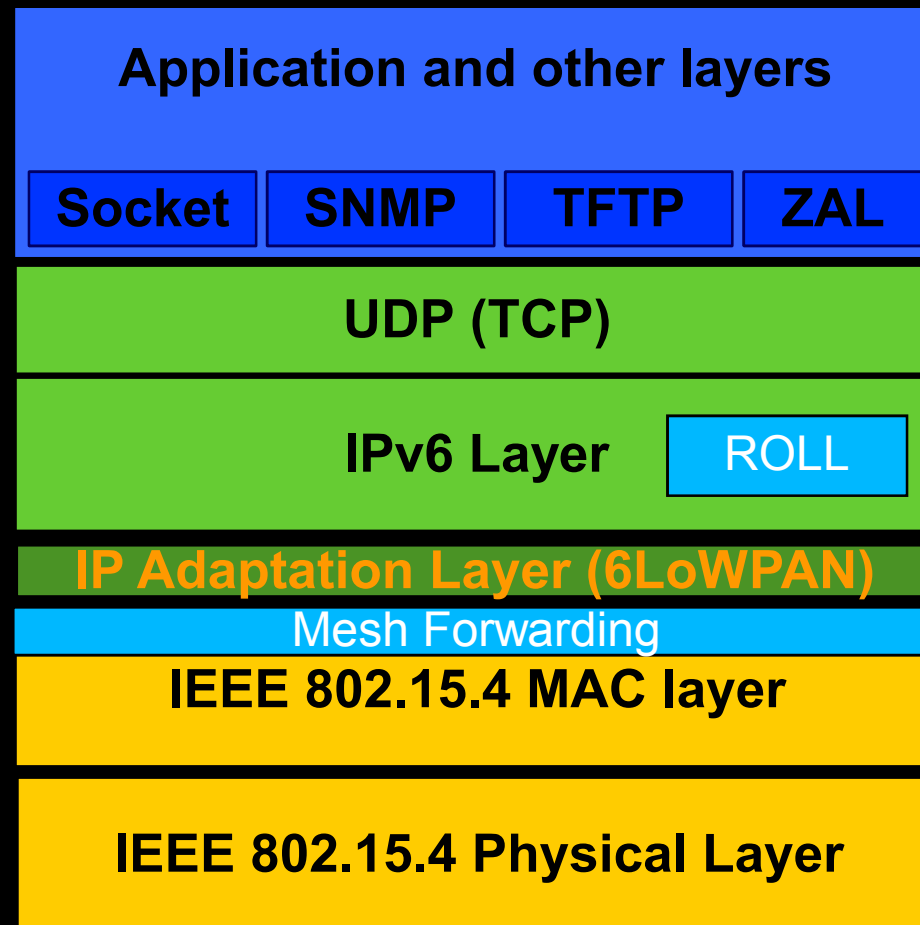
# Interoperability vs. “Optimization”

- Code Size
  - IP stack is not much larger, in some cases smaller
- Packet Size
  - 6lowpan provides highly compressed headers
  - Overhead: only pay for what you use
- System complexity
  - Gateways and Translators unnecessary

# Mesh Under vs. Route Over

- Mesh Under
  - Layer 2 Forwarding
  - Single IP Hop - Abstract 15.4 PAN as broadcast network
  - Packet format not interoperable
- Route Over
  - Layer 3 Forwarding
  - IP visibility of each hop
  - Packet format interoperable

# Mesh Under or Route Over



# Embedded IP Applications

- Smart Grid – DOE/NIST
  - AMI and AMR (Electric, Gas, Water)
- Parking Meter Monitoring
- Traffic Monitoring
- Environmental Monitoring
- Premise Security Monitoring
- Homeland Security Sensor Alarms
- Bridge Stress Monitoring Alarms
- In Home Power Usage display
- Vehicle/Asset Tracking
- Tank Level Monitoring
- Storm Drain Blockage Alarms

# The IPSO Alliance

“Promoting the use of IP in networks of Smart Objects”

- Create awareness of available and developing technology
- Promote and market use of IP in embedded systems
- Generate tutorials, white papers, technology demonstrations and highlight use cases
- Complement the IETF and other standards groups
- Support Interoperability Events

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# The Benefits of IP Smart Objects

- Unique addresses to connect EVERYTHING
- Nodes can easily “phone home”
- Use existing tools, knowledge, protocols
- Use existing infrastructure (no gateways/translators)
- Interoperability (Internet and Device)
- End to end security

# v6 Benefits

- Lots and lots of addresses
- No need to NAT
- Stateless configuration
  - No need for extra infrastructure
- No needless translation / gateways

# Thank You

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