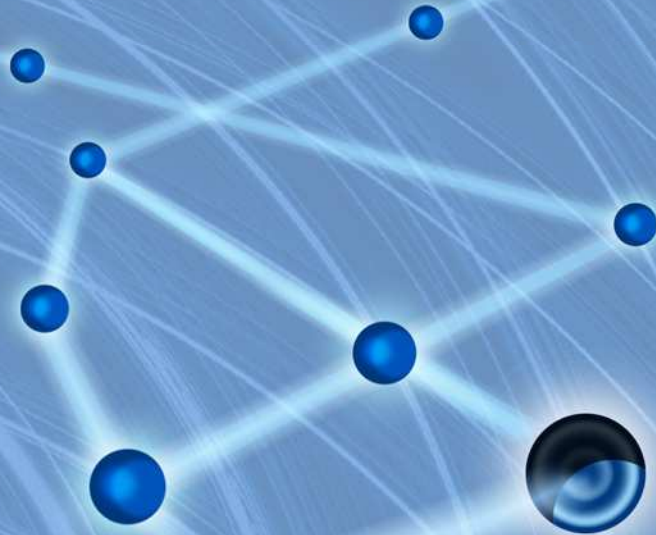




ARCHROCK

Arch Rock 6LoWPAN: *Low-Power Embedded IP*



Arch Rock at a Glance



Mission

To be the leader in IP and web-based sensor networking

Key Leadership

CEO & President: Roland Acra—CEO, Procket Networks, SVP/GM Cisco Systems

CTO & Founder: Dr. David Culler—Prof. UC Berkeley, Director Intel Research Berkeley

VP Engineering & Founder: Dr. Wei Hong—Chief Architect, Illustra & Cohera

Investors

NEA, Intel Capital, Shasta Ventures

Offerings

OEM technology licensing
Complete WSN Systems
Rapid pilot and prototyping

Customer Applications

Environmental monitoring, Energy awareness,
Condition-based maintenance, Item tracking,
Municipal services, Personnel safety and security

What is a Wireless Sensor Network?

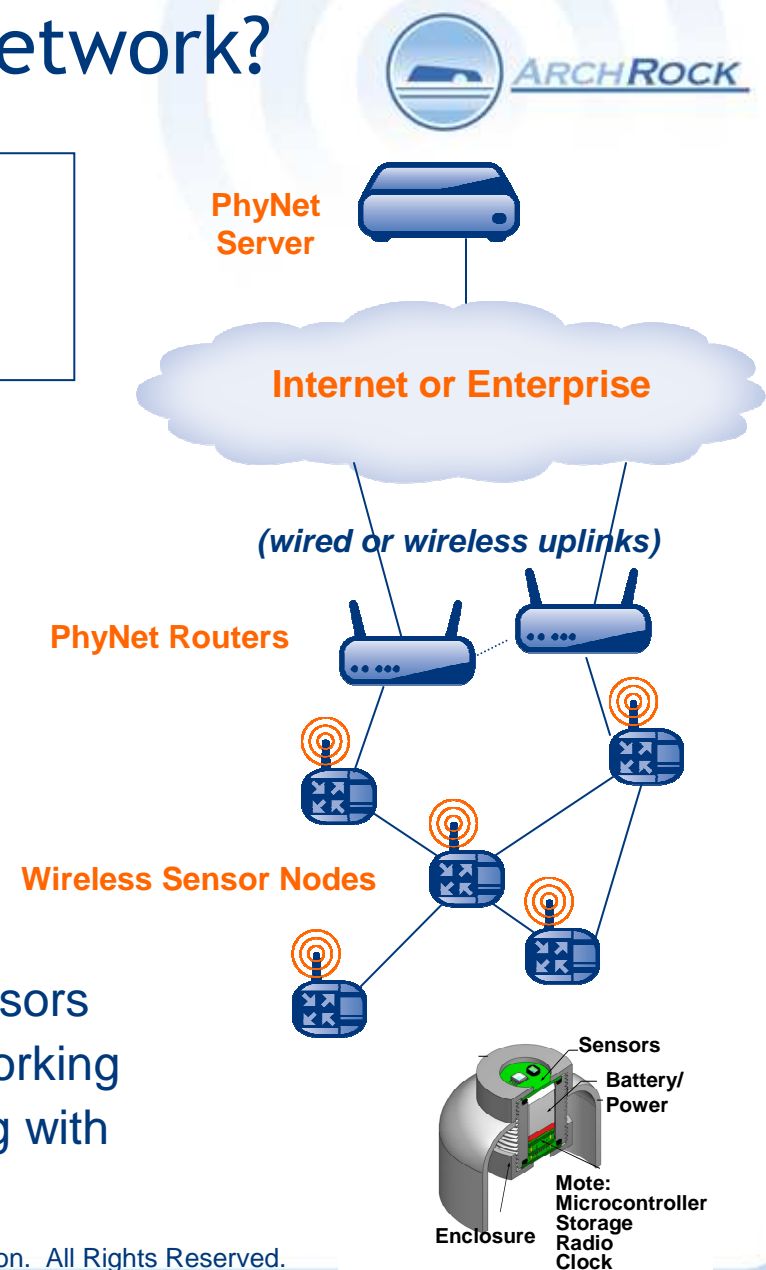
- Network of small-footprint computers
- Optimized for long-life on low power
- Equipped to sense physical data
- Networked using low-power radio

➤ Function:

- Sense any measurable parameter
 - Light, motion, chemicals, proximity, biometrics
- Form network and communicate
 - Automatic meshing and routing over the air
- Apply user-defined business logic
 - Sampling, summarizing, reporting events

➤ Form:

- Mote (Processor, Radio, Storage) + Sensors
- Embedded Operating System and Networking
- Servers and LoWPAN routers interfacing with Enterprise IT systems



Embedding the Physical World



- The world is outfitted with **billions** of devices sensing their environment
- Homes, offices, factories, streets, hospitals, automobiles....people
- Issue:
 - Data is **dropped** or remains “**stranded**”



- Arch Rock Solution:
 - **Extend reach** and lower cost through **IP-based** wireless mesh networks
 - Provide **global visibility** and **scale** by bringing sensors to the Web and the IP network



Arch Rock Driving Standards

Wide Adoption and Low Integration Cost



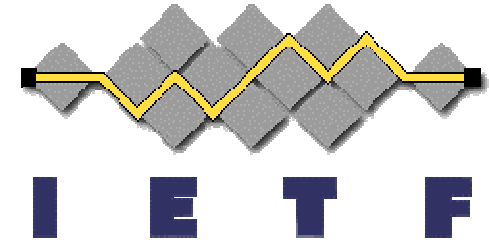
➤ Application

- SOA – Service Oriented Architecture
- W3C standard web services



➤ Networking

- IP – IETF standard Internet Protocols
- IPv4/IPv6/6LoWPAN inter-networking



➤ Radio

- IEEE 802.15.4 standard low-power radio
- IP architecture future-proof to future radios

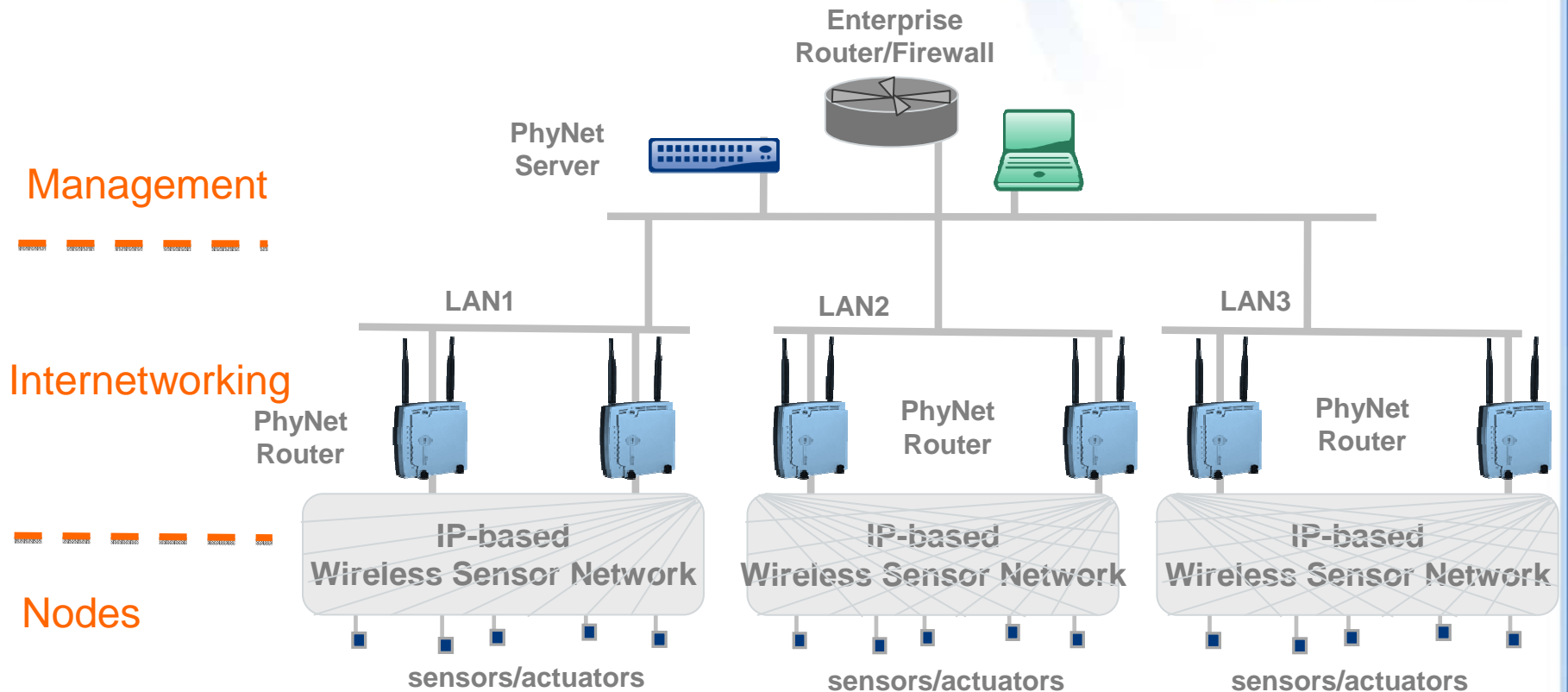


➤ Node OS



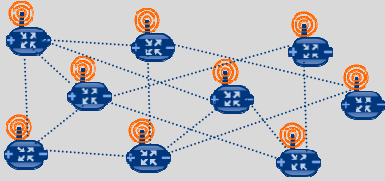
- TinyOS 2.0-based node operating system
- Hardened and optimized over reference OS
- Leading microcontroller and radio silicon



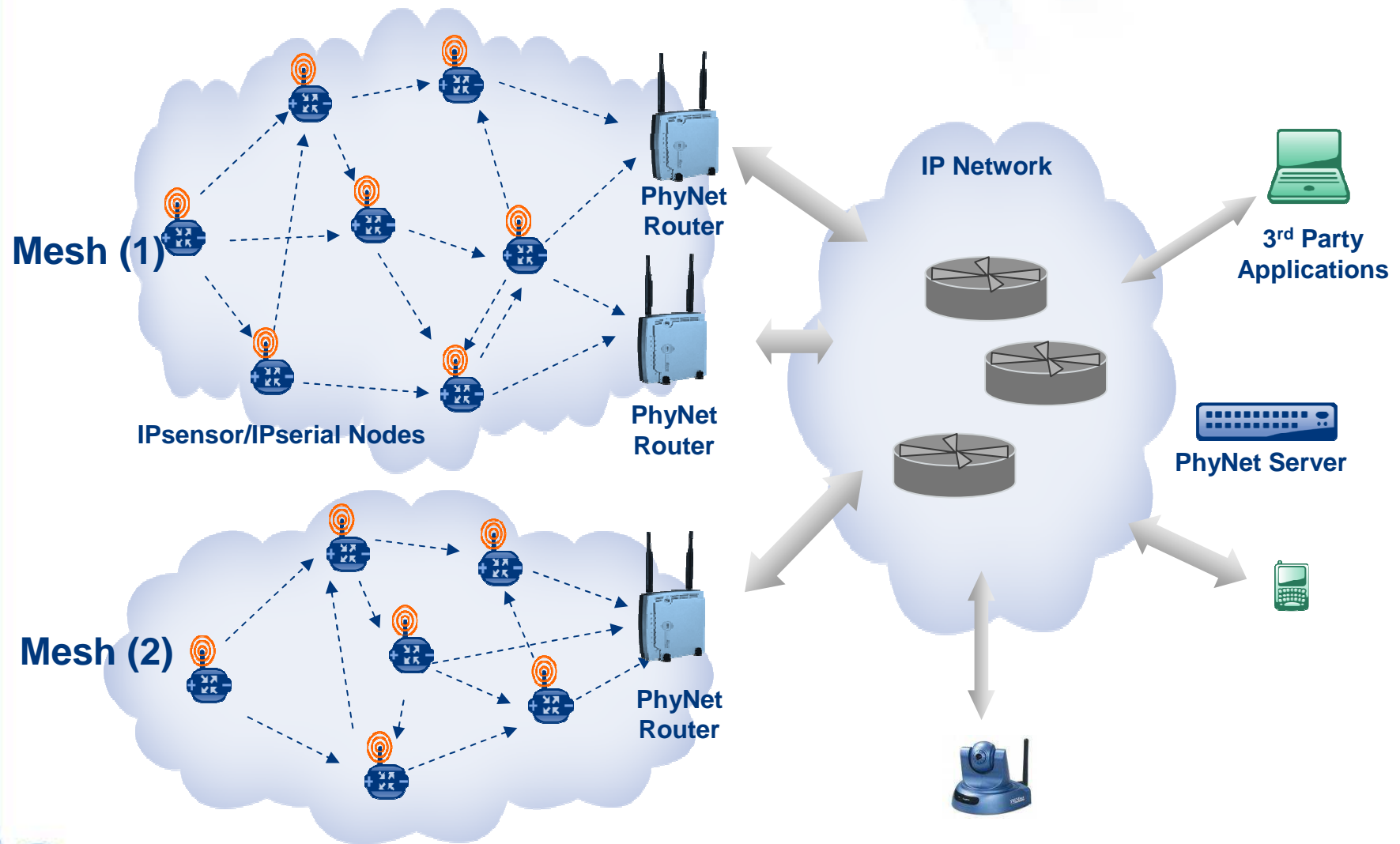
Arch Rock Tiered Architecture



Arch Rock PhyNet™ Tiers

| Server | Router | IP Nodes |
|--|--|---|
| <p>System Management Router Management</p> <p>Data Management, Visualization and Warehouse</p>  | <p>Network Management PAN/WAN/LAN</p> <p>Node Association Protocol Translation</p>  | <p>Mesh Routing Sensors and Actuators Embedded Web Services</p>  |

End-to-End IP



Arch Rock Customer Solutions



Shipping/Logistics
High value item tracking and visibility



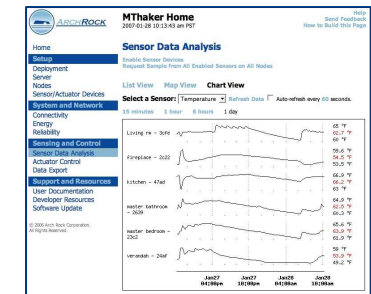
Utility Monitoring
Production, transport, Storage, distribution; consumers apps



Financial Services
Data Center monitoring



Telco/Service Provider
Home monitoring



Arch Rock Products & Technology

Retail
Work flow and inventory intelligence



Urban/Municipal
Smart Public Spaces and environmental monitoring





What People are Saying...

Gartner

Arch Rock named one of five “Cool Vendors in Emerging Technologies” for 2007.

-March 14, 2007

The 451 Group

Arch Rock is named a company “at the Forefront of Disruption” for its products and technology that “...integrate wireless sensor networks with enterprise infrastructure using Web services.”

-2007 Preview – Networks

“Arch Rock has successfully combined two hot technologies: WSNs and Web services. Its founders have a proven track record with TinyOS, and the company's products build on that well.”

-The 451 Impact Report

ARC Advisory Group

“Primer Pack, with its web services layer, and its ability to present the WSN as an IP network has its ticket punched in the right places for this market.”

-Briefing: Arch Rock Corporation

ABI Research

“You have targeted the Primer Pack well. Nothing is missing.”

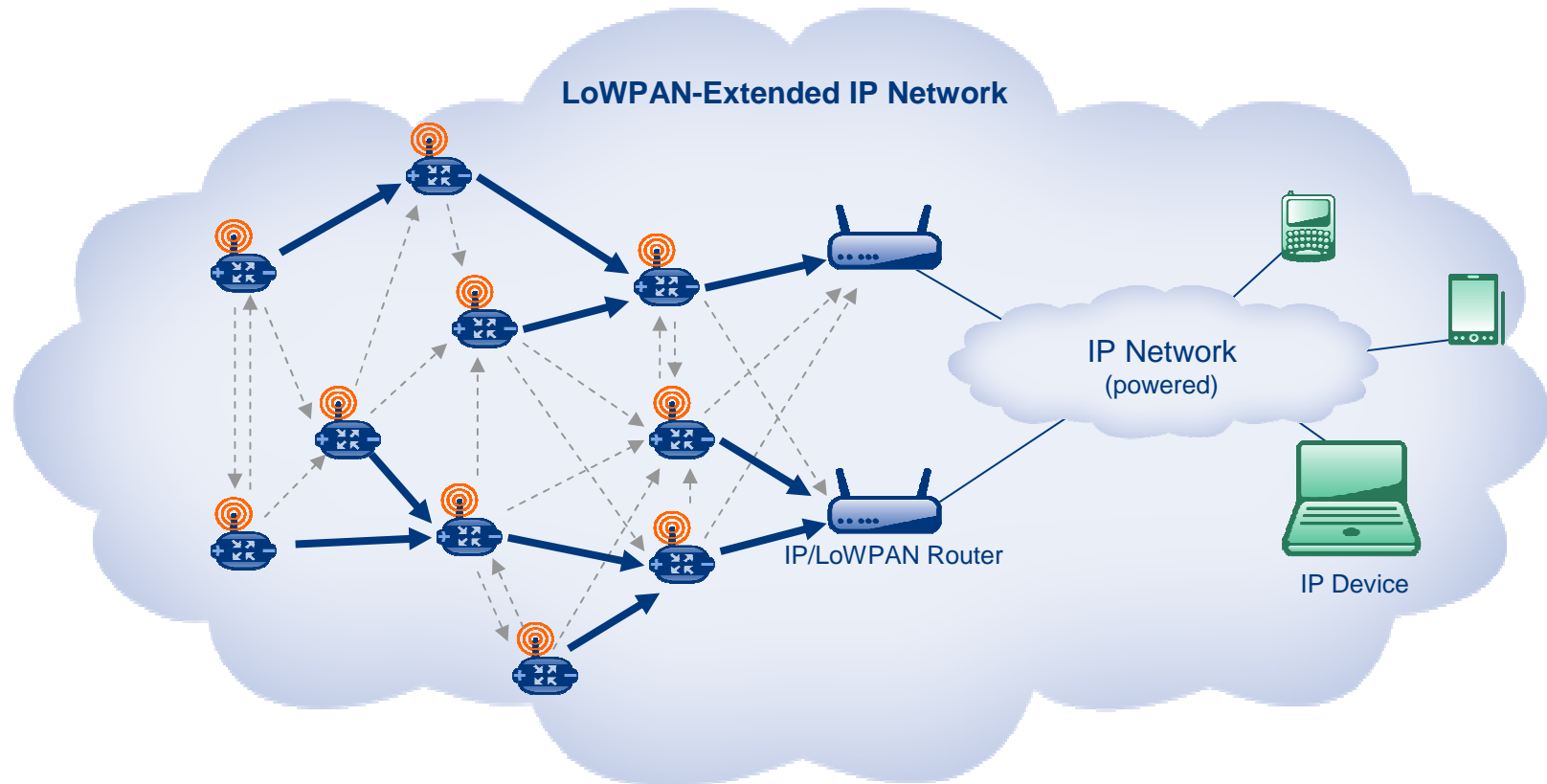
-September 2006 Analyst Briefing



IEEE 802.15.4 and 6LoWPAN

-Now a Member of the IP Family

- Provides a wireless alternative “below” IEEE 802.11 WiFi
- 1% of the power, 100x the lifetime, fraction of the cost
- Now interoperable with all the other IP links





Internet Standards

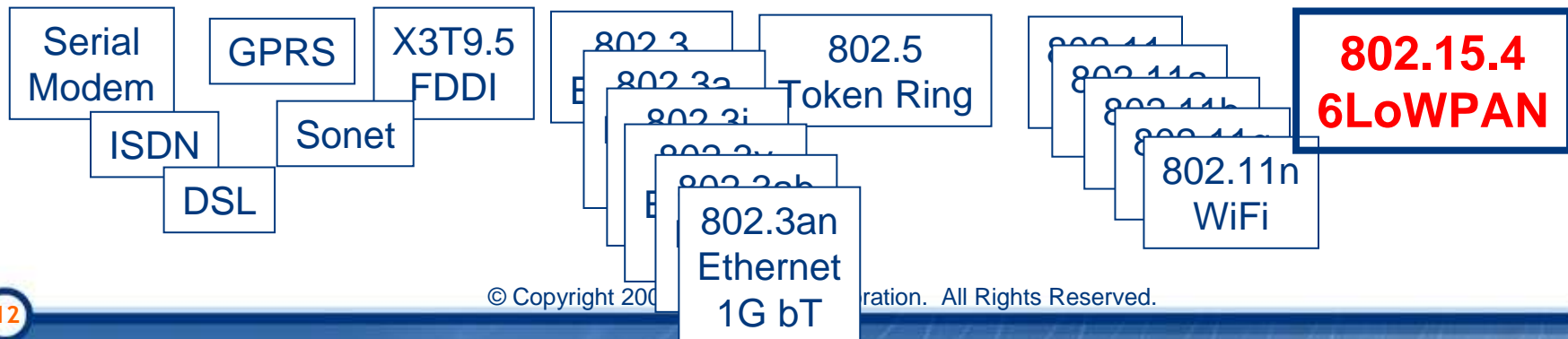
- The Internet Engineering Task Force (IETF), formed in 1986, “is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet”
- Layered architecture provides interoperability for diverse applications across broad and evolving communications technology
- Today: Half a billion to a billion IP hosts → demonstrated scale

Diverse Object and Data Models (HTML, XML, ...)

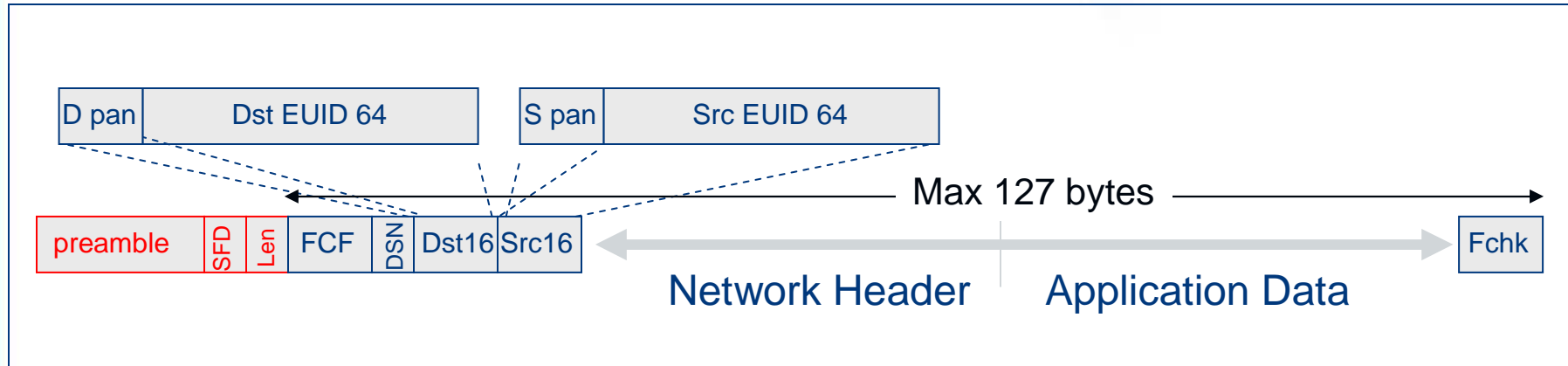
Applications (Telnet, FTP, SMTP, SNMP, HTTP)

Transport (UDP/IP, TCP/IP)

Network - Internet Protocol (IP) Addressing, Routing



IEEE 802.15.4 - The Low Power Wireless Standard



- Low bandwidth (250 kbps), low-power (1 mW) radio
- Moderately spread spectrum (QPSK) for robustness
- Small packets for lower error rates and media sharing
- Simple MAC allows diversity of networking protocols
 - TinyOS-based protocols (MintRoute, LQI, BVR, ...), TinyAODV, Zigbee, SP100.11, Wireless HART, ...
 - New recommended choice for interoperability: IP with 6LoWPAN
- HW choice now available with many semiconductor suppliers

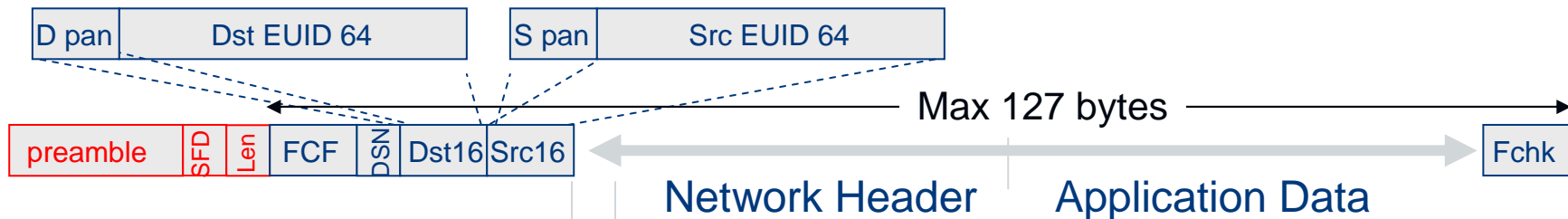
6LoWPAN - IPv6 over 802.15.4



-Format Design

- Orthogonal stackable header format
- Almost no overhead for the ability to interoperate over radio
- Pay for only what you use

IEEE 802.15.4 Frame Format



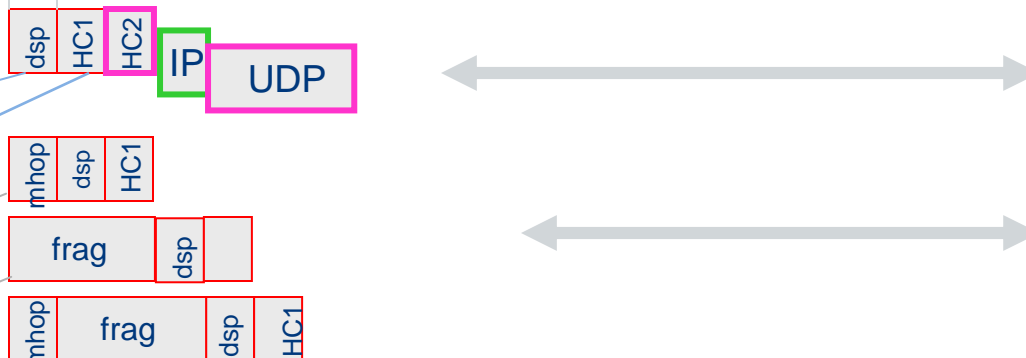
IETF 6LoWPAN Format

Dispatch: coexistence

Header compression

Mesh (L2) routing

Message > Frame fragmentation



The Many Advantages of IP



- **The test of TIME and investment protection:**
 - The IP architecture has stood the test of time with 20-25 year history
- **The test of SCALE and ability to expand:**
 - The IP architecture is the only demonstrated 1+ billion node scale network
 - Has gracefully evolved and accommodated diverse and tough applications
- **The test of SCOPE with MEDIA diversity:**
 - The IP architecture embraces dozens of legacy and new links, all in ONE network
 - Any-to-any communication: Dial, BPL, Ethernet, DSL, Cable, WiFi, Cell, 802.15.4...
- **The test of SCOPE with APPLICATION diversity:**
 - Architectural diversity: Client-Server, Peer-to-Peer, Web Services...
 - Application diversity: Email, File Transfers, IM, VoIP, Web, TVoIP, Video...
 - Device and operating system diversity: PC, PDA, Phone, Mainframe, Sensor...
 - Industrial applications: BACnet over IP, LonTalk over IP, CIP, SCADA ...
- **The test of LEVERAGE and non-reinvention:**
 - Management tools, security tools, deployment and configuration tools
 - Naming (DNS), Addressing (DHCP), Management (SNMP, Ping, Trace, ...)
- **The test of SECURITY:**
 - Highest security networks on IP: DoD, DoE, NSA, Treasury, Health, Banking/SWIFT
 - Understood threat models and remedies: Firewalls, Intrusion Prevention, Encryption



Arch Rock Summary

- **Rapid Application Development – Time to Market**
 - Auto-generation of annotated embedded code as web services
 - Well-packaged OEM kernel and development environment
 - TCP/UDP/IP-based networking interfaces
- **Industry-leading Network Performance**
 - Reliable, Secure, Low-power and Responsive
 - Adaptive, Tunable Latency, High-throughput
- **Leveraging Pervasive Standards**
 - Applications – Web Services (W3C, OASIS)
 - Networking – IPv4/IPv6/6LoWPAN (IETF)
 - Radio and Links – 802.15.4, 802.11, 802.3 (IEEE)
- **Ease of life-cycle management & Lower TCO**
 - Ease of Deployment, Maintenance, Upgrade, Scale-up
 - Lessons from large-scale, real-world deployments
 - Comprehensive tools thanks to embedded IP networking
- **Built for Enterprise Scalability**
 - Internet-style scalability architecture
 - Distributed intelligence at the edge



For additional information and updates:

www.archrock.com

or

email us at info@archrock.com