

A conceptual illustration of a globe with various landmarks and a computer monitor in the center. The globe is blue and green, with a white airplane flying above it, a red and white ship on the water, and a red and white truck on the land. The Statue of Liberty is visible on the right side. The background is a blue sky with a yellow sun and a large moon in the bottom left corner. Red lines representing network connections wrap around the globe. In the center, a computer monitor displays the Cisco Connection Online website.

# Networks In Motion

**Derick Linegar**  
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# Networks in Motion

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# Agenda

- **Networks of Network**
- **Mobile Access Router**
- **Land-based Networks in Motion**
- **Air-based Networks in Motion**
- **Conclusions**

# Communications Networks

## *Transportation Systems*

Cisco.com

**Communications are critical..**

- **System safety**
- **Meeting delivery commitments**
- **Increasing customer satisfaction**
- **Integration of core business applications**
- **Resource management and asset utilization**



# Communication Network Trends

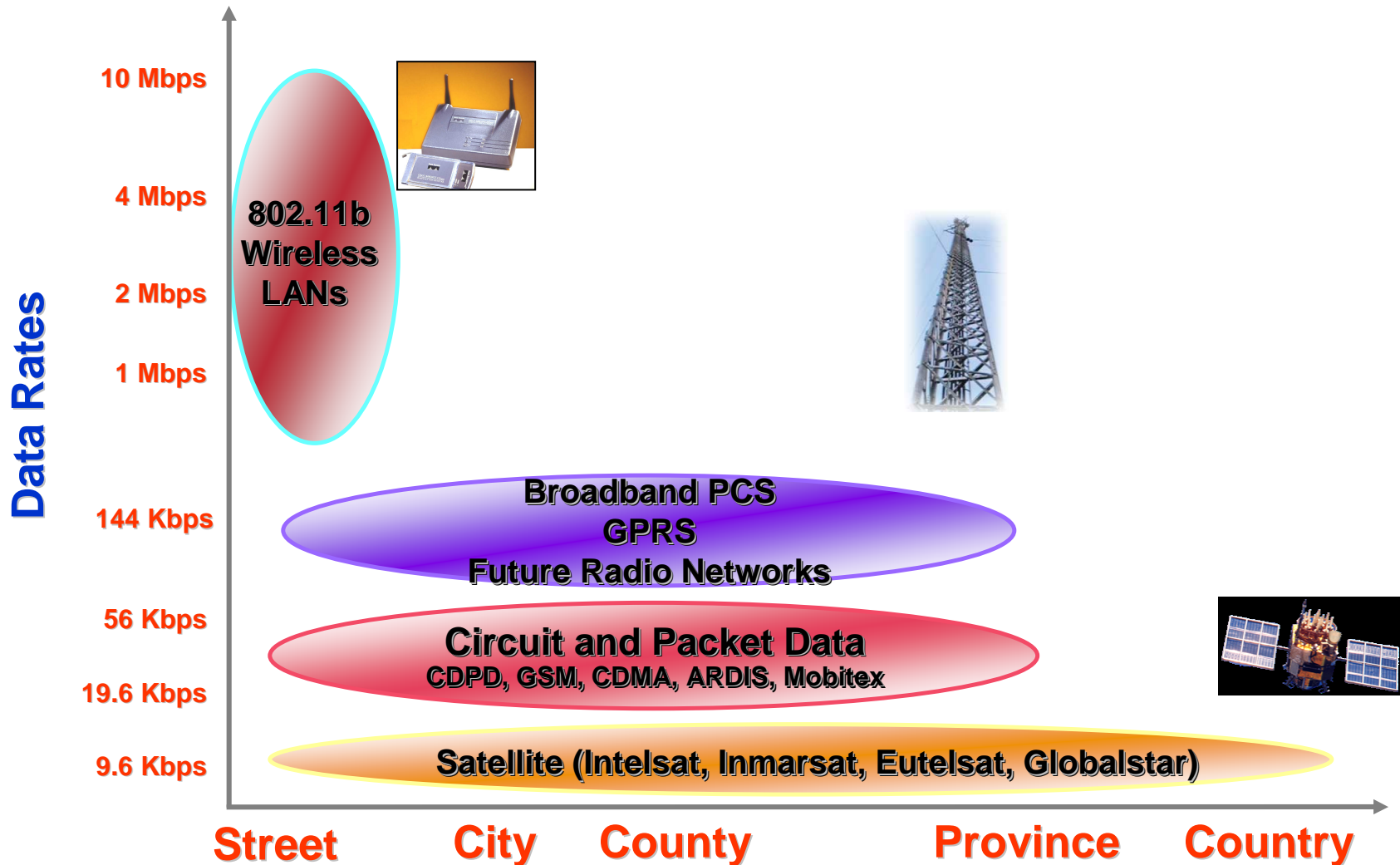
*.....Moving to the edge*

Cisco.com

- **Networked based applications are increasingly important to operations – desktop and field**
  - More profitable, faster, safer operations is the goal**
- **Advances in Wireless technologies**
  - Increased reliability, lower prices, better coverage**
  - 802.11b, CDPD, GPRS, CDMA, Satellite & PMR**
- **New demand for Mobile Networking**
  - Real time access to information, increased productivity and lower costs, increased safety**

# Wireless Coverage & Performance Options

Cisco.com



# Networking Transportation Systems

## Benefits

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- **Increased System Safety**
- **Efficiency of Delivery**
- **Better Management of Resources**
- **Better System Utilization**
- **Increased Customer Satisfaction**
- **More Competitive Service**



# Achieving Network Centric Mobility

## Challenges

Cisco.com

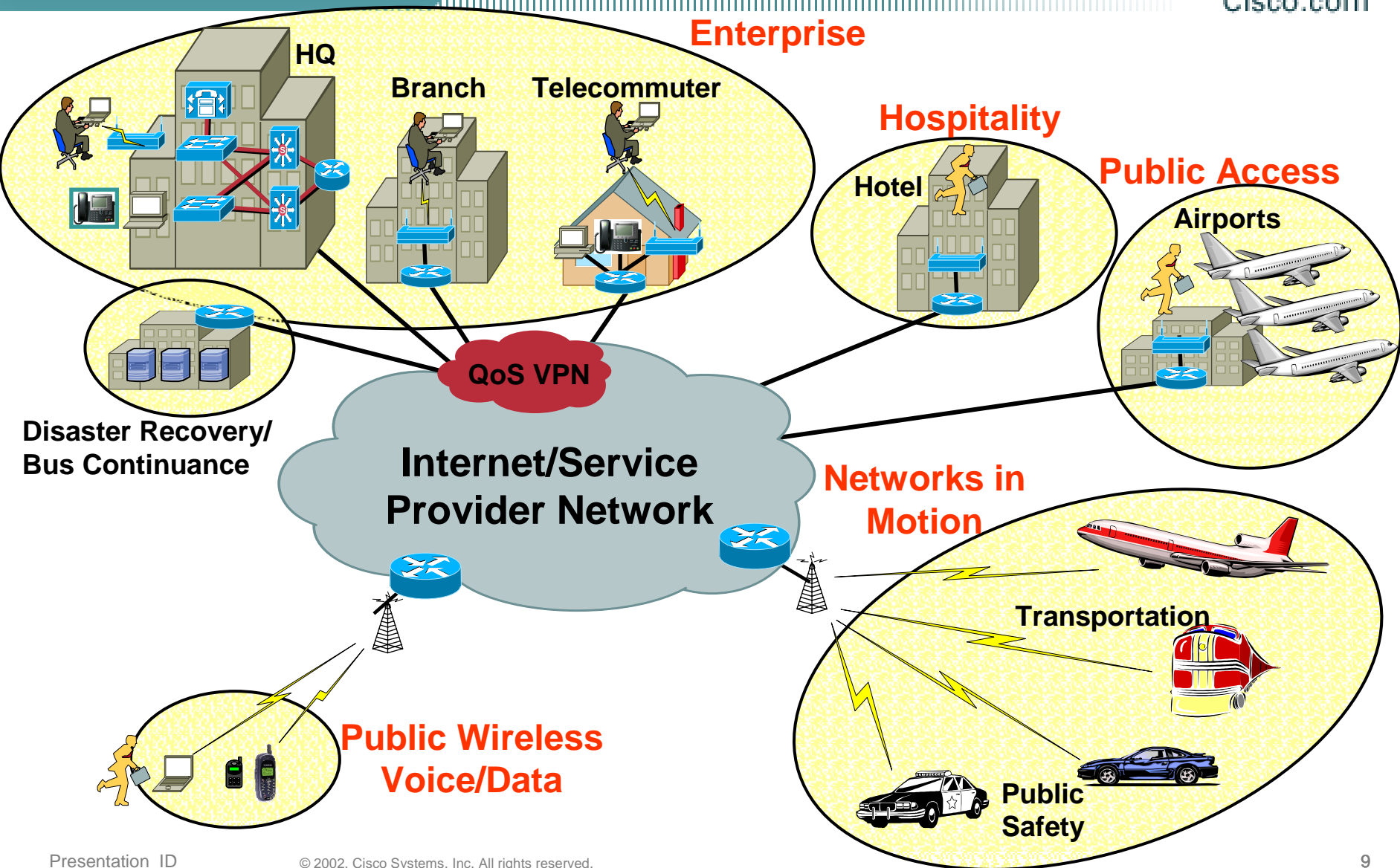
- **Seamless mobility across networks**
- **Form Factor - Power, Size, Weight, Hardened**
- **Security**
- **Interoperability**
- **Investment Protection**



# Cisco Networks in Motion

*Part of Network of networks*

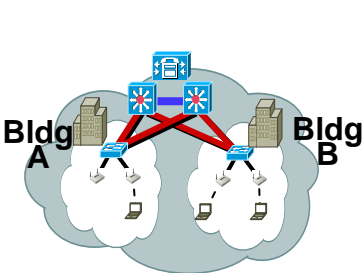
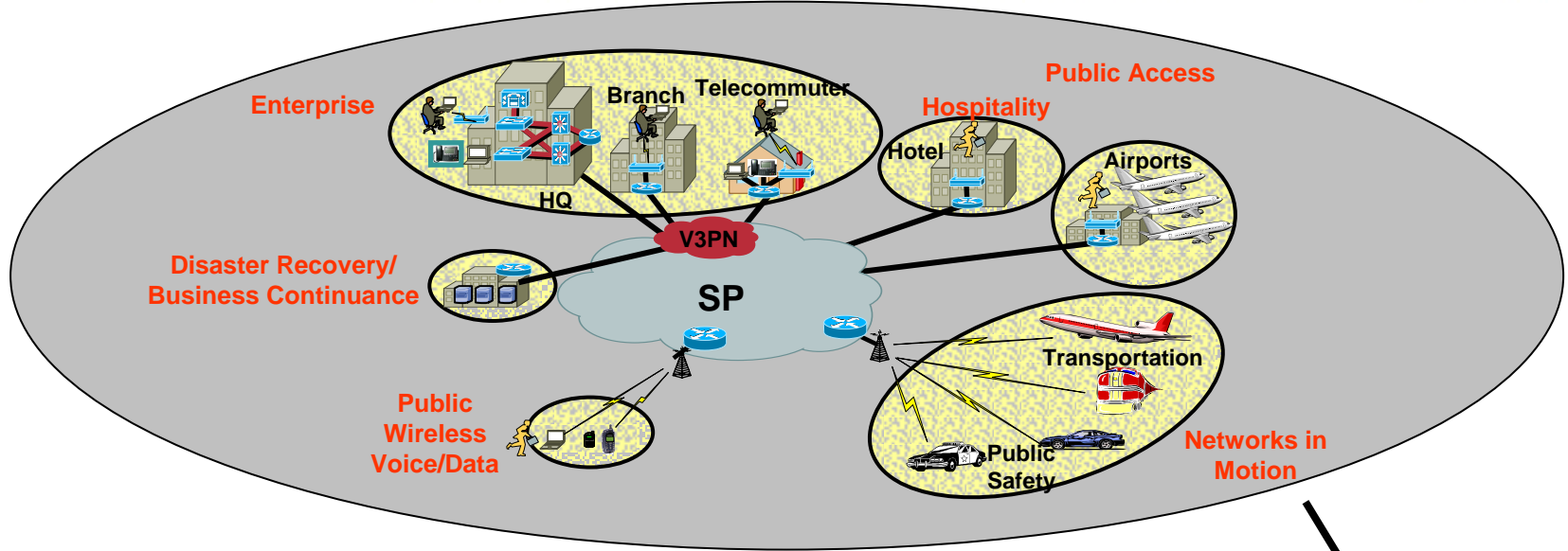
Cisco.com



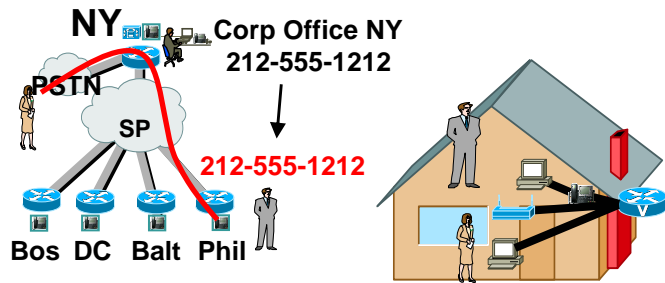
# Cisco Networks in Motion

*part of Network of Networks*

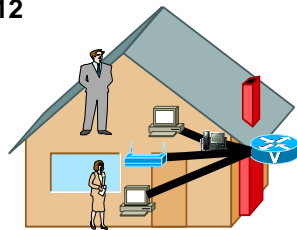
Cisco.com



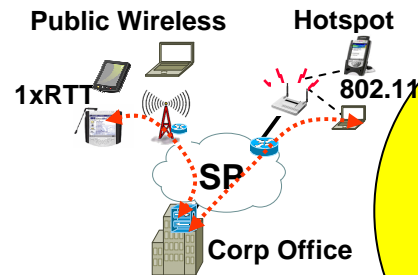
**Campus Mobility**



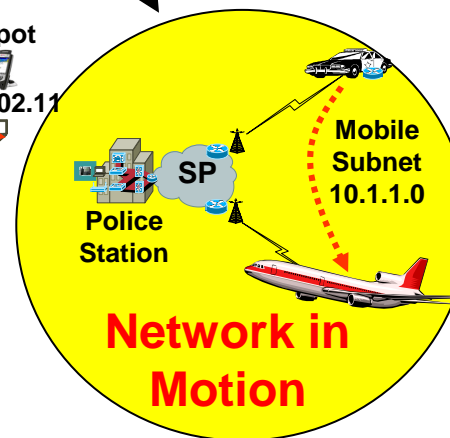
**Branch Mobility**



**Telecommuter**



**Users on the Move**



**Network in Motion**

# Cisco IOS Mobile Networks

## *What is it?*

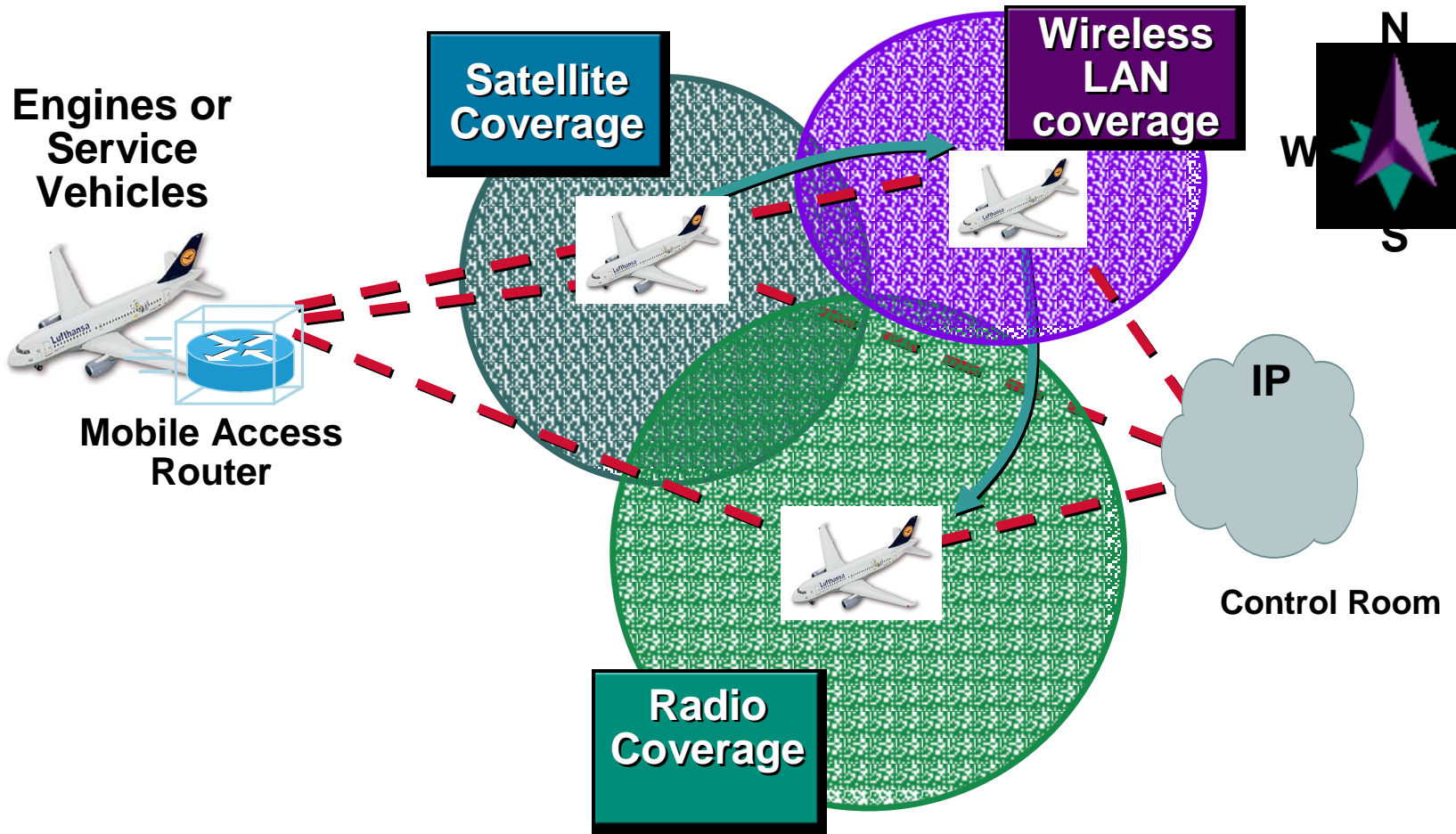
Cisco.com

- **Enables “always on roaming” IP connectivity for entire LAN segments**
- **Subnets are mobile without devices on those subnets being aware**
- **Mobile Router (MR) is in effect a Mobile IP Client**
- **Standards based solution RFC 2002 Mobile IP**
- **Both non-mobile IP clients as well as mobile IP-aware clients are supported**

# Cisco IOS Mobile Networking

*Seamless Internetworking*

Cisco.com



**Uninterrupted Access = Coverage + Bandwidth**

# Mobile IP Terminology

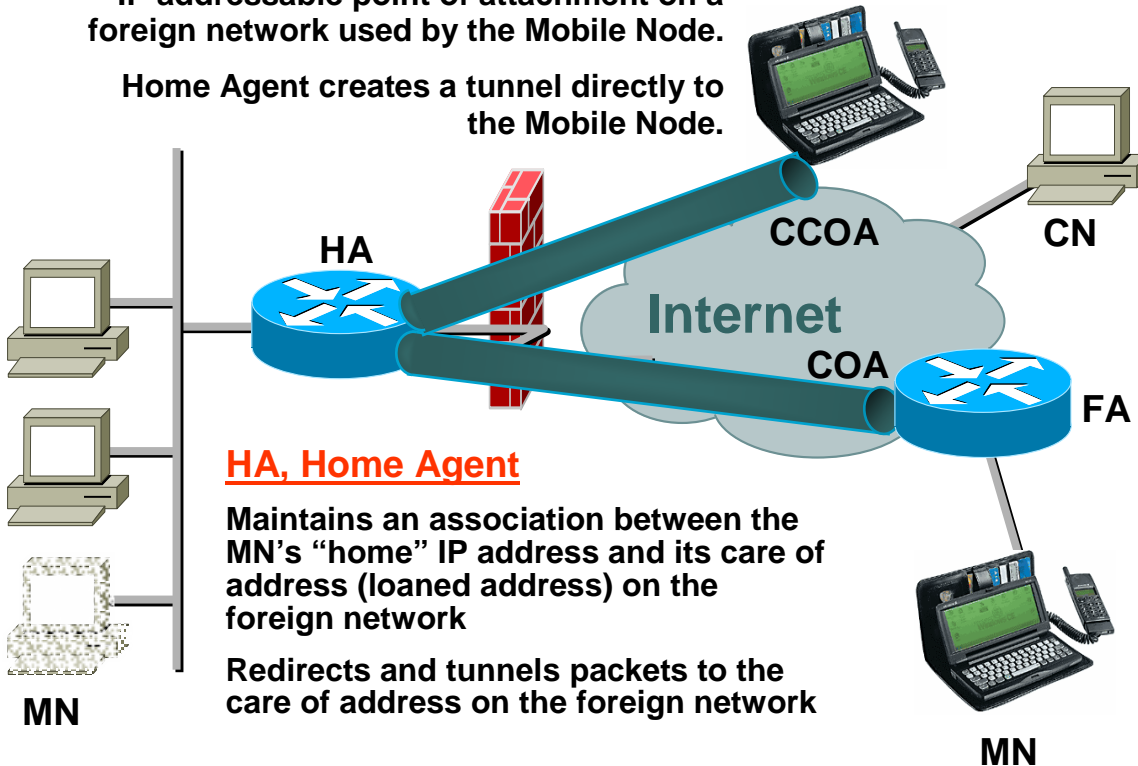
## Overview

Cisco.com

### CCOA, Co-Located COA

IP addressable point of attachment on a foreign network used by the Mobile Node.

Home Agent creates a tunnel directly to the Mobile Node.



### HA, Home Agent

Maintains an association between the MN's "home" IP address and its care of address (loaned address) on the foreign network

Redirects and tunnels packets to the care of address on the foreign network

### CN, Correspondent Node

Destination IP host in session with a Mobile Node

### FA, Foreign Agent

Provides an addressable point of attachment to the MN called Care Of Address (COA)

Maintains an awareness for all visiting MNs

Acts as a 'relay' between the MN and its Home Agent

Receives all packets for the MN from the MN's Home Agent

### MN, Mobile Node

An IP host that maintains network connectivity using its "home" IP address, regardless of which subnet (or network) it is connected to

# Agenda

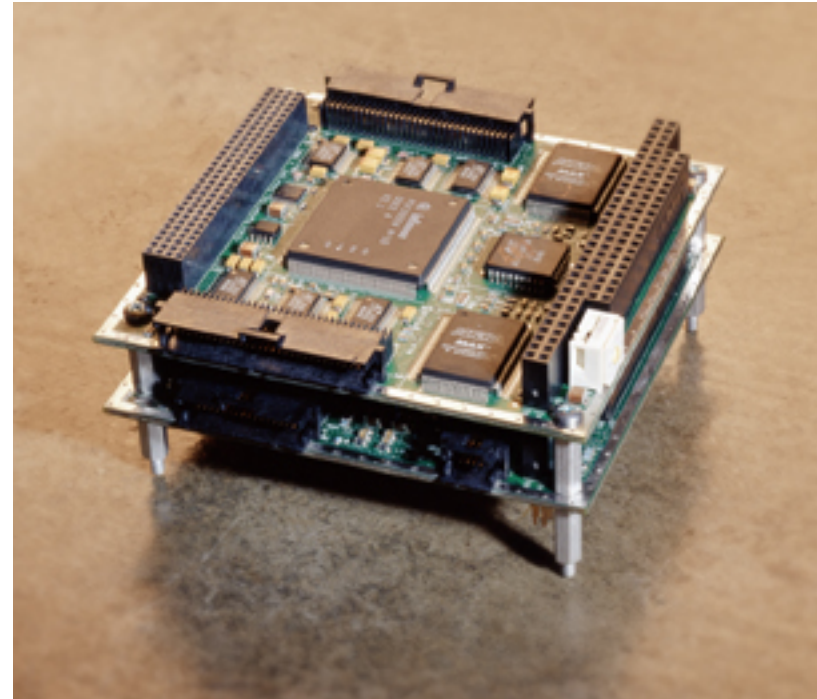
- **Networks of Network**
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# Cisco 3200 Mobile Access Router

## *Benefits*

Cisco.com

- **Seamless Mobility**  
independent of location  
movement or wireless  
network
- **High performance in a  
compact rugged design for  
use in vehicles**
- **Advanced IP services and  
interoperability with Cisco  
IOS software**



# Cisco 3200 MAR

*Form Factor*

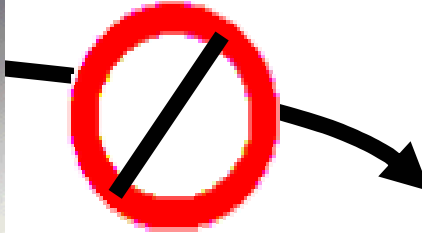
Cisco.com

## Traditional Networking Gear



## Field Requirements:

- DC Power
- Small size/footprint
- Lightweight
- Hardened for environments



**Need:** Deploy scalable networking technology in the field

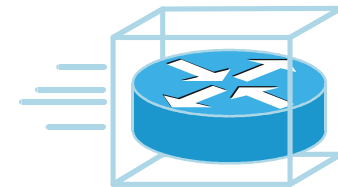
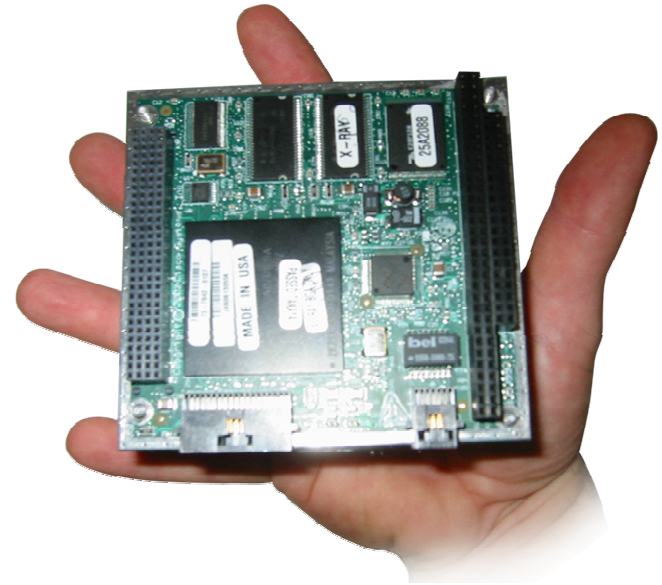


# Cisco 3200 MAR

*Form Factor*

Cisco.com

- **Small footprint**
- **Rugged design**
- **DC power**
- **High Performance**
- **Flexibility & Modularity**



# Mobile Access Router Card (MARC)

## Overview

Cisco.com

- MPC8250, running at 200MHz CPU core, 133MHz CPM core and 66MHz Motorola 60x Bus
- 32-bit PCI bus version 2.1 running at 33MHz, connects to Cisco MICs
- 128Mbyte 64 bit, Unbuffered, Synchronous DRAM
- 32Mbyte 16 bit of Flash memory
- Single 10/100 Fast Ethernet, full-duplex 100 Base-T, with auto negotiation
- Single Console, with modem flow control
- Single Asynchronous, RS-232 serial, for GPS/AUX devices
- Integrated host-to-PCI bridge (PCI bus version 2.1)



# Cisco 3200 MAR

## System View

Cisco.com

- **Mobile Access Router Card (MARC)**

High performance processor, One 10/100 Ethernet, one console, one aux port, fixed memory

- **Mobile Interface Cards (MICs)**

Serial MIC : 4 sync/async serial

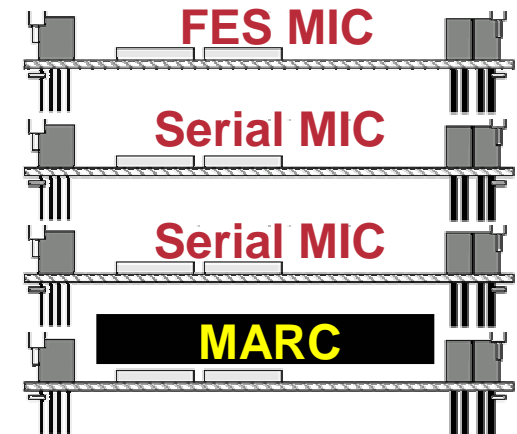
FES MIC: 10/100 Ethernet, with 4 port switch

- **3200 Series Mobile Access Router configuration limits**

Limit 3 MIC's per router, mix and match

1 Mobile Access Card mandatory per router

Limit 1 FESMIC per router



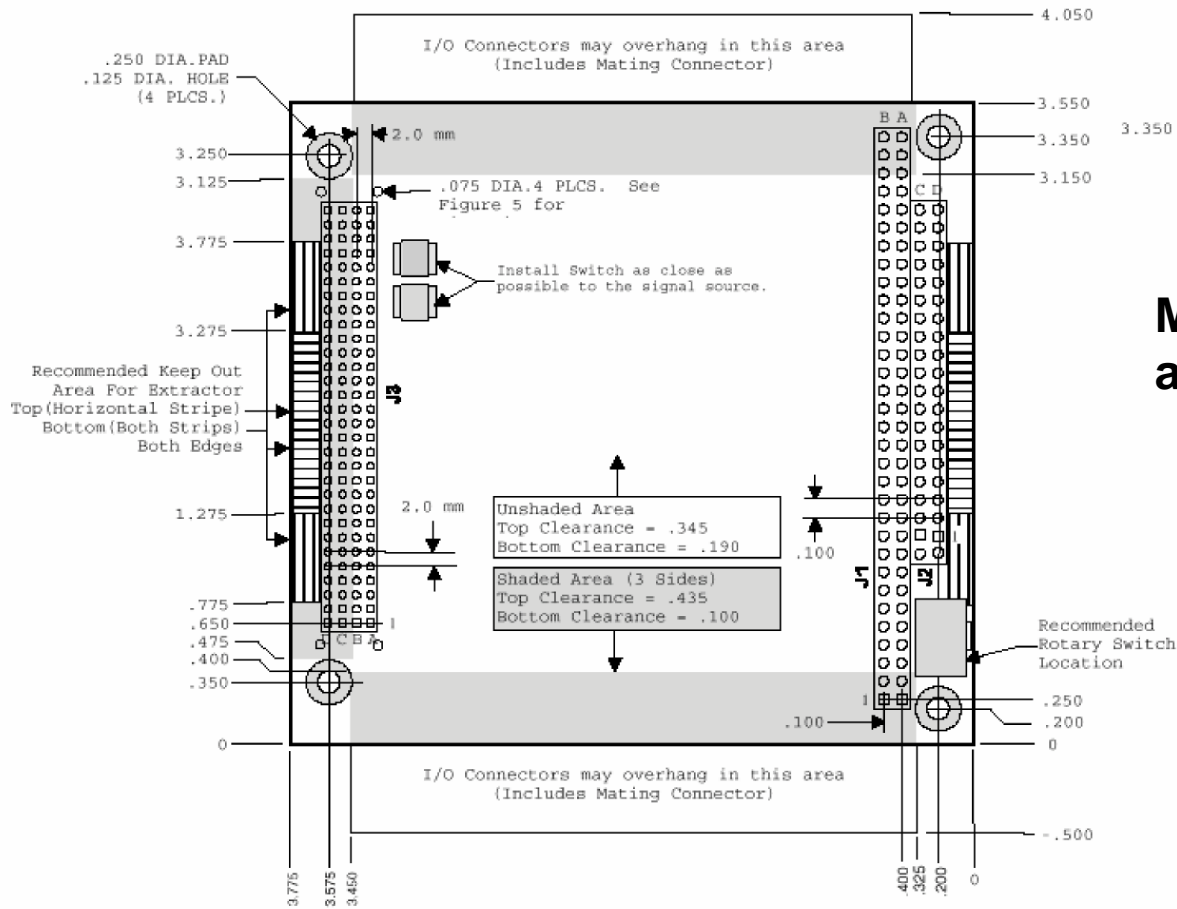
The stack shown above has 8 Serial interfaces, 1 FE port +4 FE Switch ports, 1 Console, 1 Aux

# Cisco 3200 MAR

## PC 104-Plus Mechanical Standard

Cisco.com

### Industry Standard Hardware form factor



More Specific information  
at [www.PC104.org](http://www.PC104.org)

Width = 3.775" x "3.55"

Source: PC104-Plus Specification Version 1.2

# MARC Card

## BUS Connectors and I/O Headers

Cisco.com

**Cables and Connectors  
provided by SI**

PCI Bus Connector  
120 pin, stack through, PCI BUS  
Connector (no key)

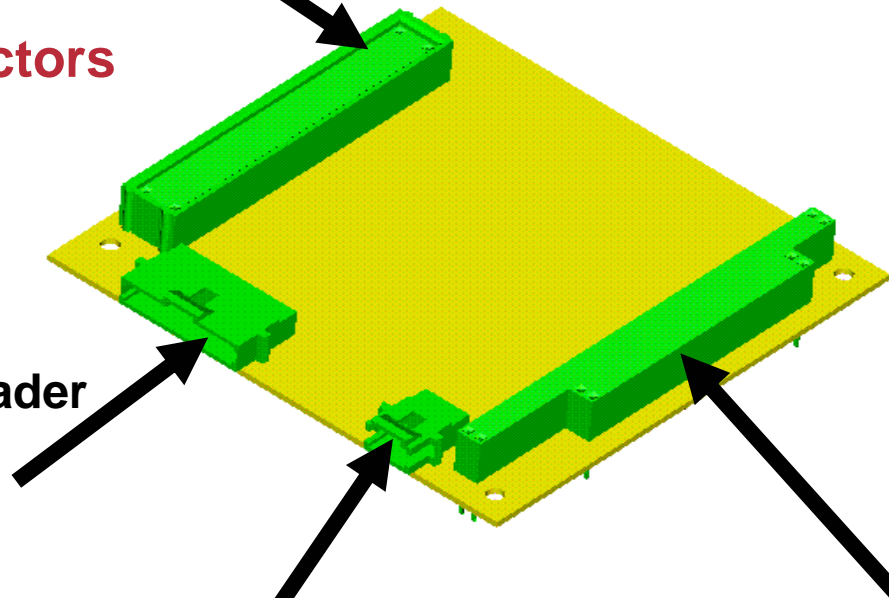
**Power provided  
By SI**

. Power supply is  
connected to the  
MARC Board via  
ISA/PCI connectors

34 pin, locking header  
Aux  
Console  
LED's  
5V power

10 pin, locking header, for  
MARC Fast Ethernet

ISA Bus Connector  
104 pin, Stack through, ISA Bus  
Connector (no key)  
No signals over ISA Bus

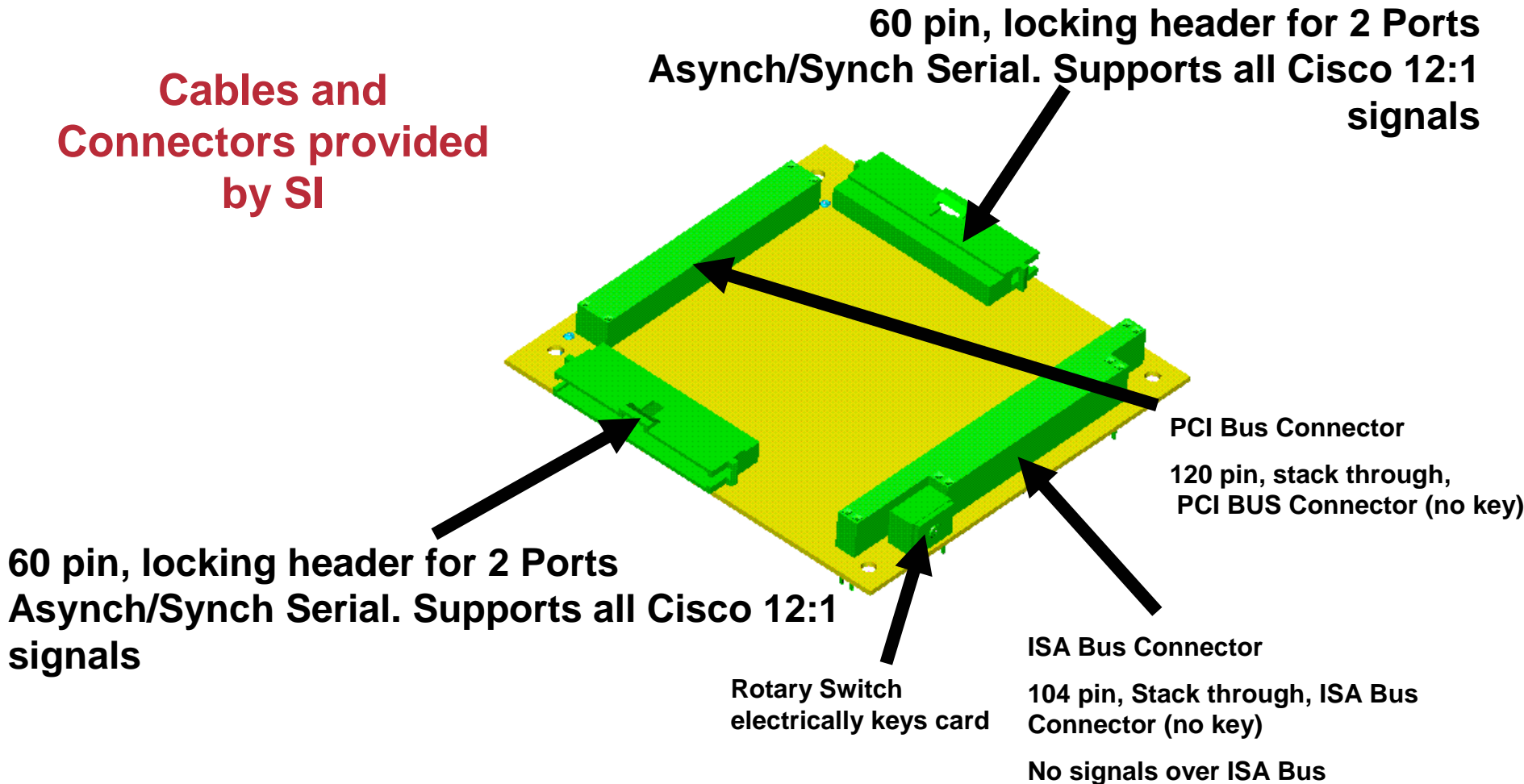


# SMIC Card

## *BUS Connectors, I/O Headers, and Rotary Switch*

Cisco.com

**Cables and  
Connectors provided  
by SI**



# Cisco 3200 MAR

## System Integration

Cisco.com

- **Stacking Cards**

The PC/104 Plus Specification shows the appropriate order (screw, standoff, then nut) and type of screws, standoffs and nuts to use to securely fasten a stack of boards

- **Housing Cards**

SI provides thermal management

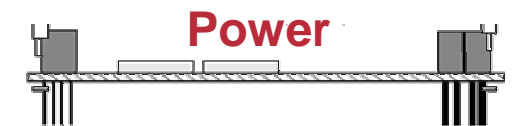
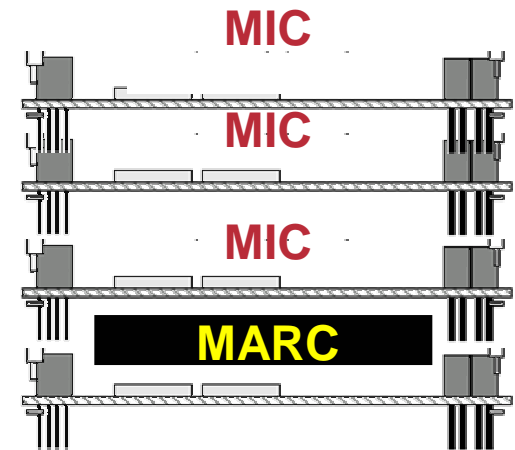
SI provides enclosure

SI provides cables

- **Power**

Power supply is connected to the MARC Board through the PCI & ISA bus connectors per the PC104-Plus standard Version 1.2

SI provides power supply



# Power Consumption

## PC104-Plus Standard

Supply	Min. Voltage	Max. Voltage	Max. Current	Max. Power
+3.3V	3.00	3.60	3A	10.8W
+5V	4.75	5.25	2A	10.5W
+12V	11.4	12.6	1A	12.6W
-5V	-5.25	-4.75	0.2A	1.05W
-12V	-12.6	-11.4	0.3A	3.78W

Source: PC104-Plus Specification Version1.2

**SI power supply provides 12V, 5V and 3.3 V to MRC and MIC's**

**Power Connects to MARC and MIC's via ISA bus and PCI Bus**

**Watt consumption per board: MARC & SMIC**

**MARC: theoretical worst case (not measured) 12.7W**

**SMIC: theoretical worst case (not measured) 6.7 W**

# Environment – MARC, SMIC & FESMIC

- **Actual operating ranges dependant upon enclosure provided by SI**
- **Industrial grade components used**
- **Target is to meet in our test (lab fixture) enclosure:**
  - **Temperature: -35C to +65C**
  - **Altitude: 45K feet**
  - **Humidity: 5 to 95% RH, non condensing**
- **SI partners must provide thermal management solutions which meet customer environmental requirements**

# Cisco 3200 MAR

## *Key IOS software features*

Cisco.com

- **PIM Multicast Sparse mode**
- **Mobile networks/Mobile IP**
- **Proxy Mobile IP**
- **OSPF, EIGRP, RIP**
- **IPV4**
- **VLAN**
- **RADIUS**
- **Co Located Care of Address**
- **QoS (DiffServ, IPprec, CoS)**
- **ACL/Firewall**
- **SNMP/RMON**

**Cisco IOS<sup>®</sup>**  
**S O F T W A R E**

**3200 images will be based on the release of 12.2T**

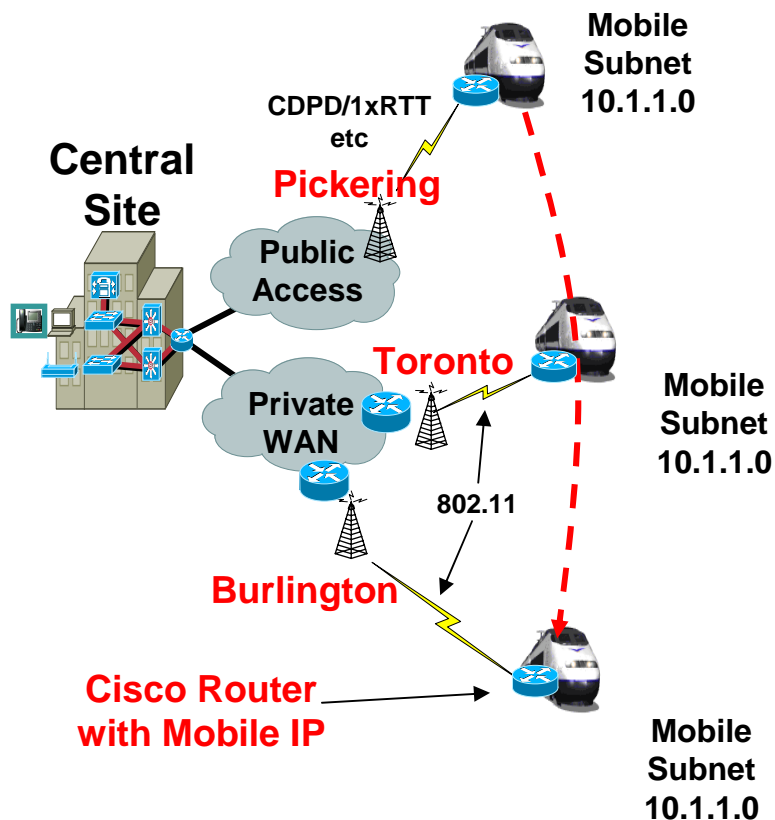
# Agenda

- **Networks of Network**
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- **Air-based Networks in Motion**
- **Conclusions**

# Networks in Motion

## *Solution Overview – Land-based*

Cisco.com



## Featured Elements

- Reducing OpEx to increase Productivity + Profitability - Today many non-standard applications each with their own communication system (Fare Collection, Video Surveillance + Storage, Telemetry, Maintenance Apps, GPS etc.)

*Standard network infrastructure for multiple industry applications with IP based Ethernet access*

- Migration from Legacy wireless access technologies

*Vehicle maintains network connectivity while in motion using the the MAR 3200 Mobile Router and a combination of Private and Public Wireless access media*

- New revenue stream potential

*Internet Access for passengers provides added revenue stream potential*

# Challenges of How to Stay Connected

*While in Motion*

Cisco.com

- **Breadth and diversity of terrain: bridges, tunnels, mountains, urban, rural, suburban, canyons**



- **Variable field environments add complexity to tracks, train yards, loading facilities road crossings**

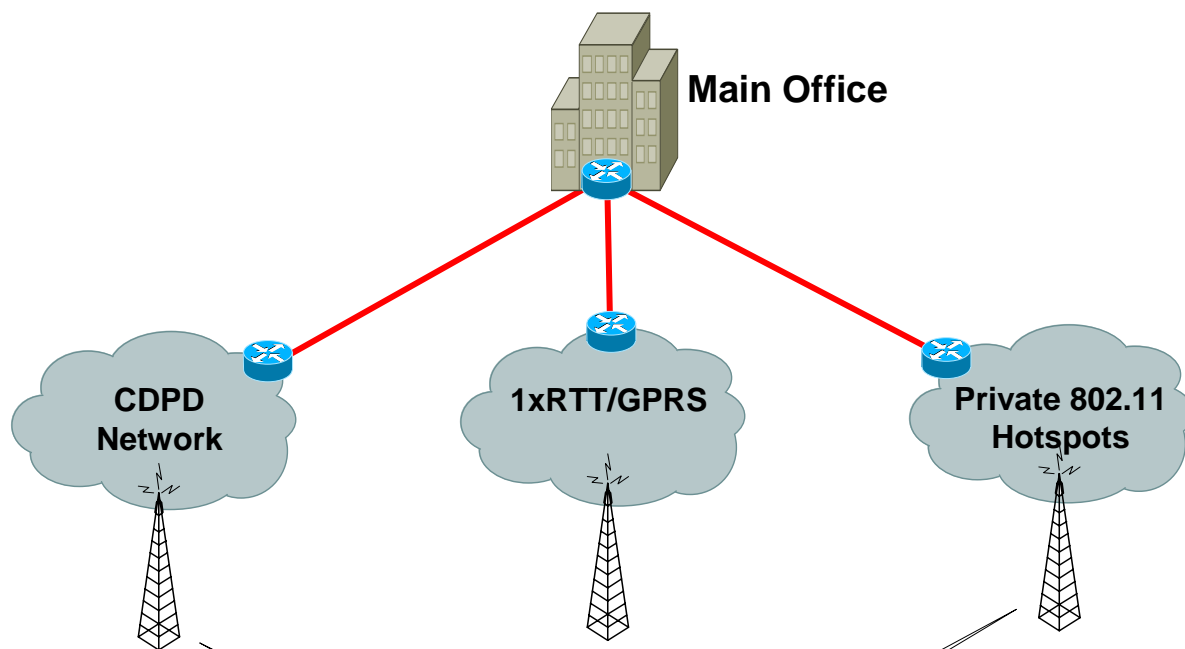
- **Multiple communities of interest must be connected: State, local, national**

**No single wireless network can economically meet all these challenges**

# Roles of the Mobile Router and 802.11

*using different uplinks*

Cisco.com



## Mobile Access Router

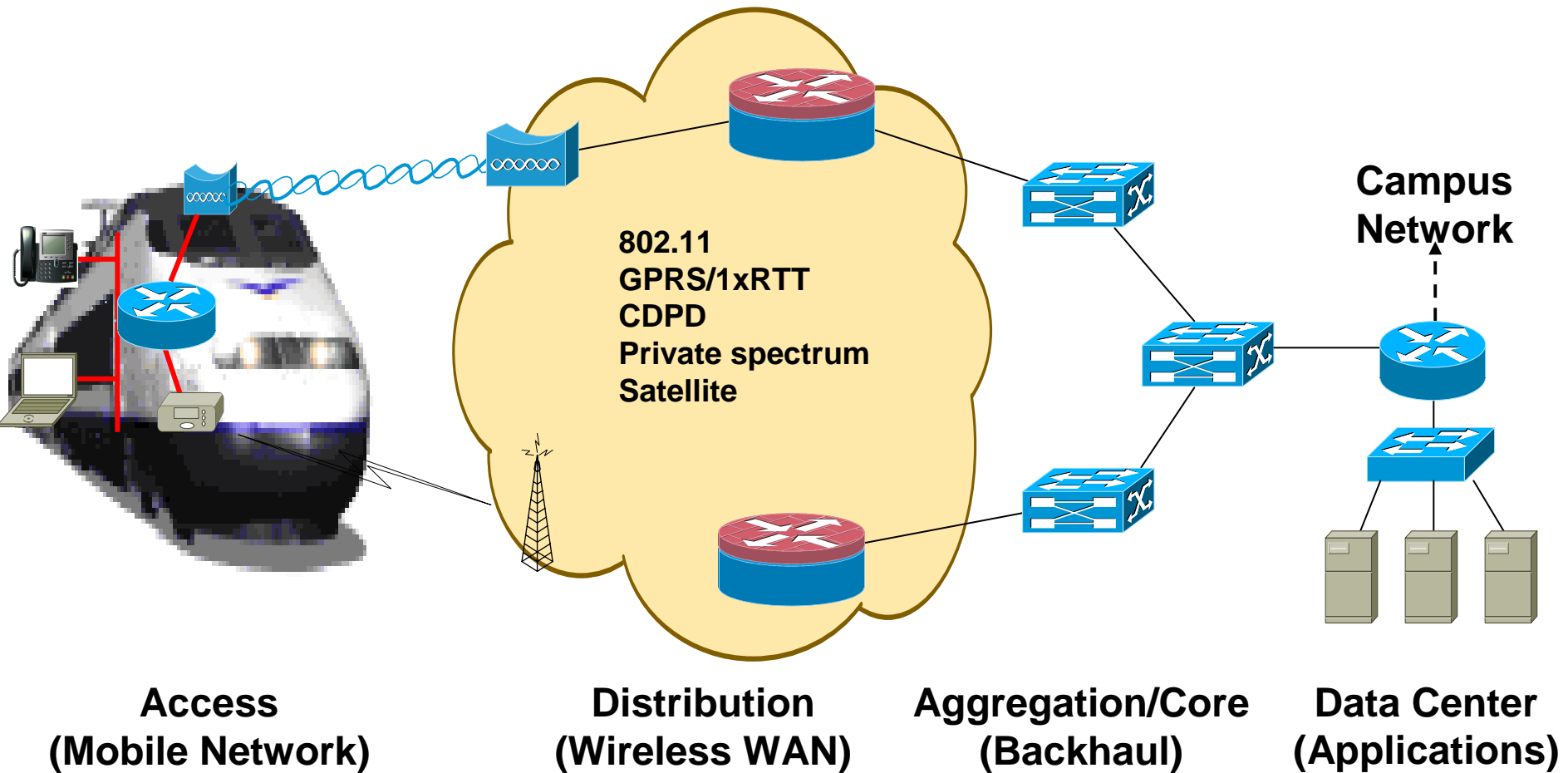
- Provides flexible migration from legacy wireless technologies
- Maintains onboard application transparency for networks in motion

## 802.11 Hotspot Access

- WLAN provides fast and inexpensive network access that serves as primary access medium augmented by existing wireless access technology
- WLAN provides added revenue potential for passengers

# High Level Architecture

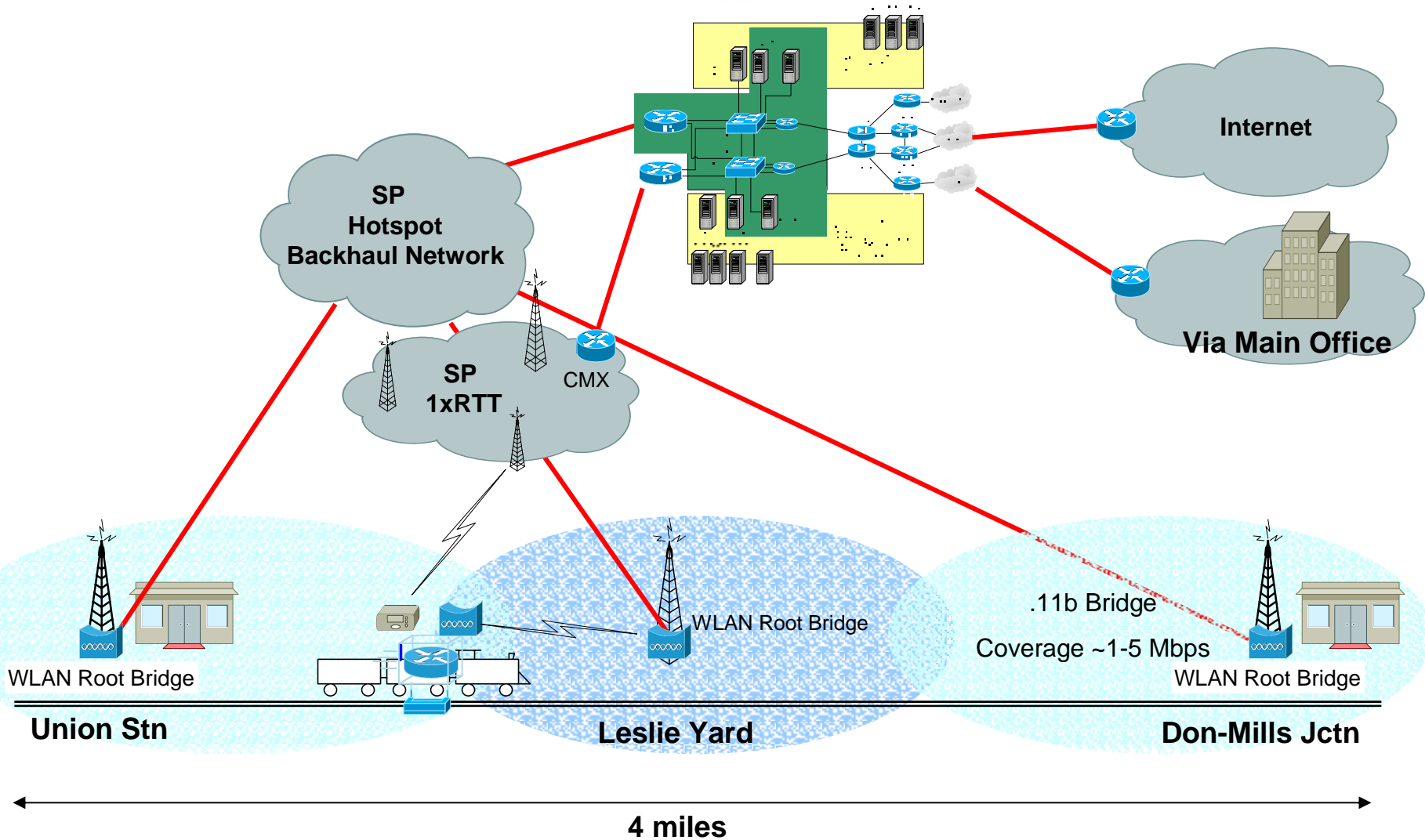
## *land-based Networks in Motion*



# Network In Motion

*example for a "Via-Rail"*

Cisco.com



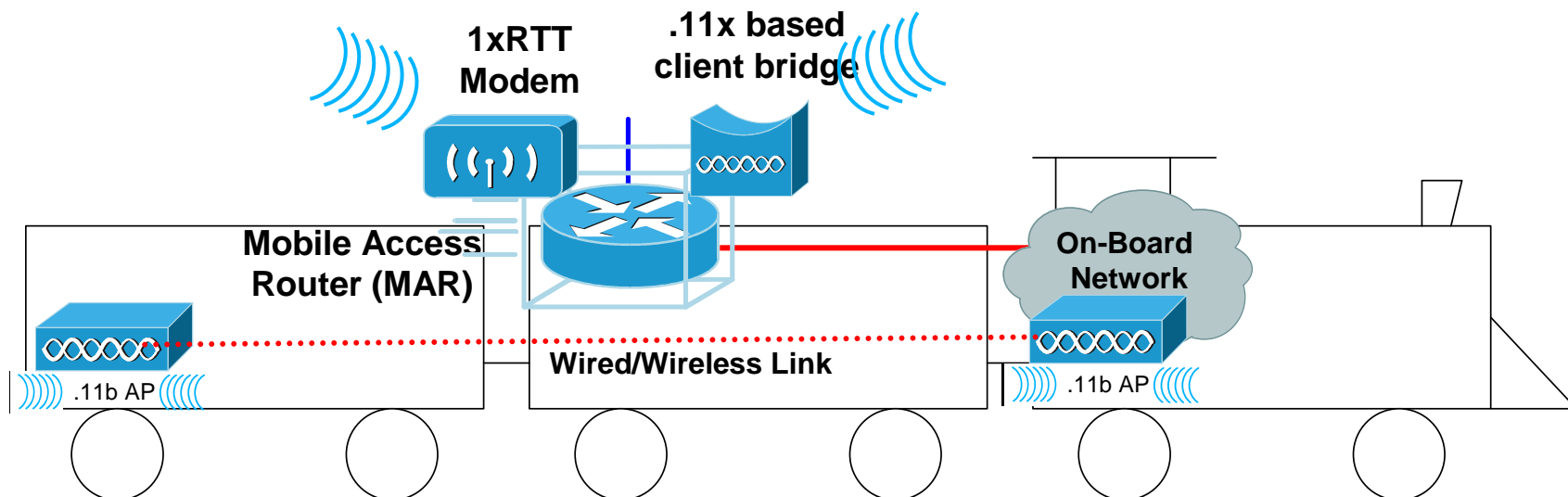
# Onboard IP Access

## Private/Public WLAN access

Cisco.com

Provide “On-Board” WLAN Access using VLAN’s/QoS/Security:

- Integrated Legacy Apps and Small WLAN Networks for future apps.
- Using MAR for optimized/customized network element installation
- Provide Nomadic Access, on-board WLAN coverage
- Providing preferential treatment of Mission Critical Applications



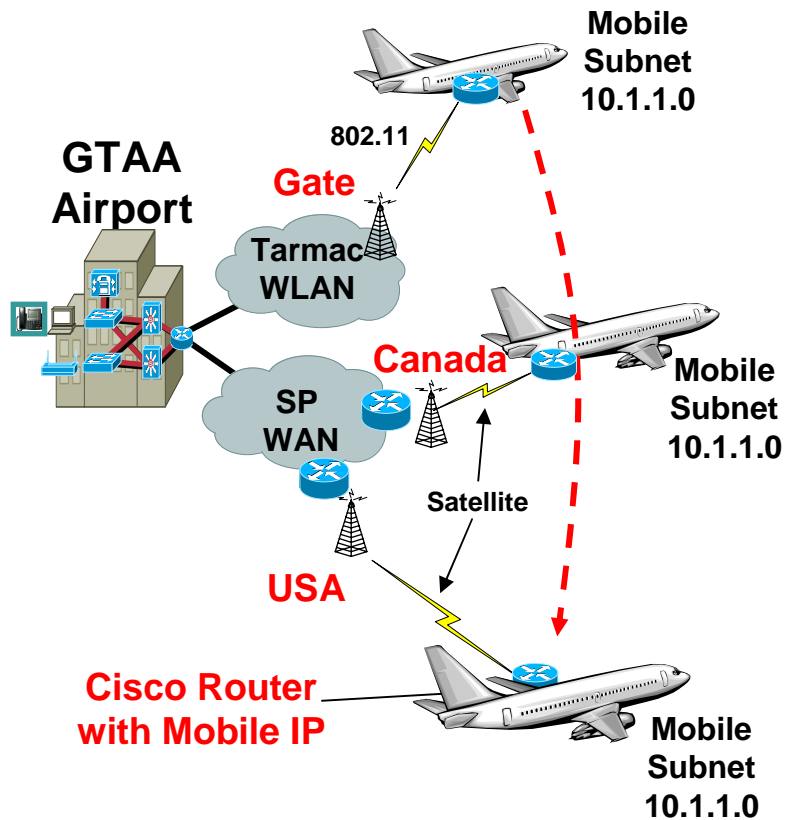
# Agenda

- **Networks of Network**
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# Networks in Motion

## Solution Overview – Air Based

Cisco.com



### Featured Elements

- Today many non-standard applications each with their own communication system (System Integrity, Video Surveillance + Storage, Telemetry, Maintenance Apps, GPS etc.)

*Standard network infrastructure for multiple industry applications with IP based Ethernet access*

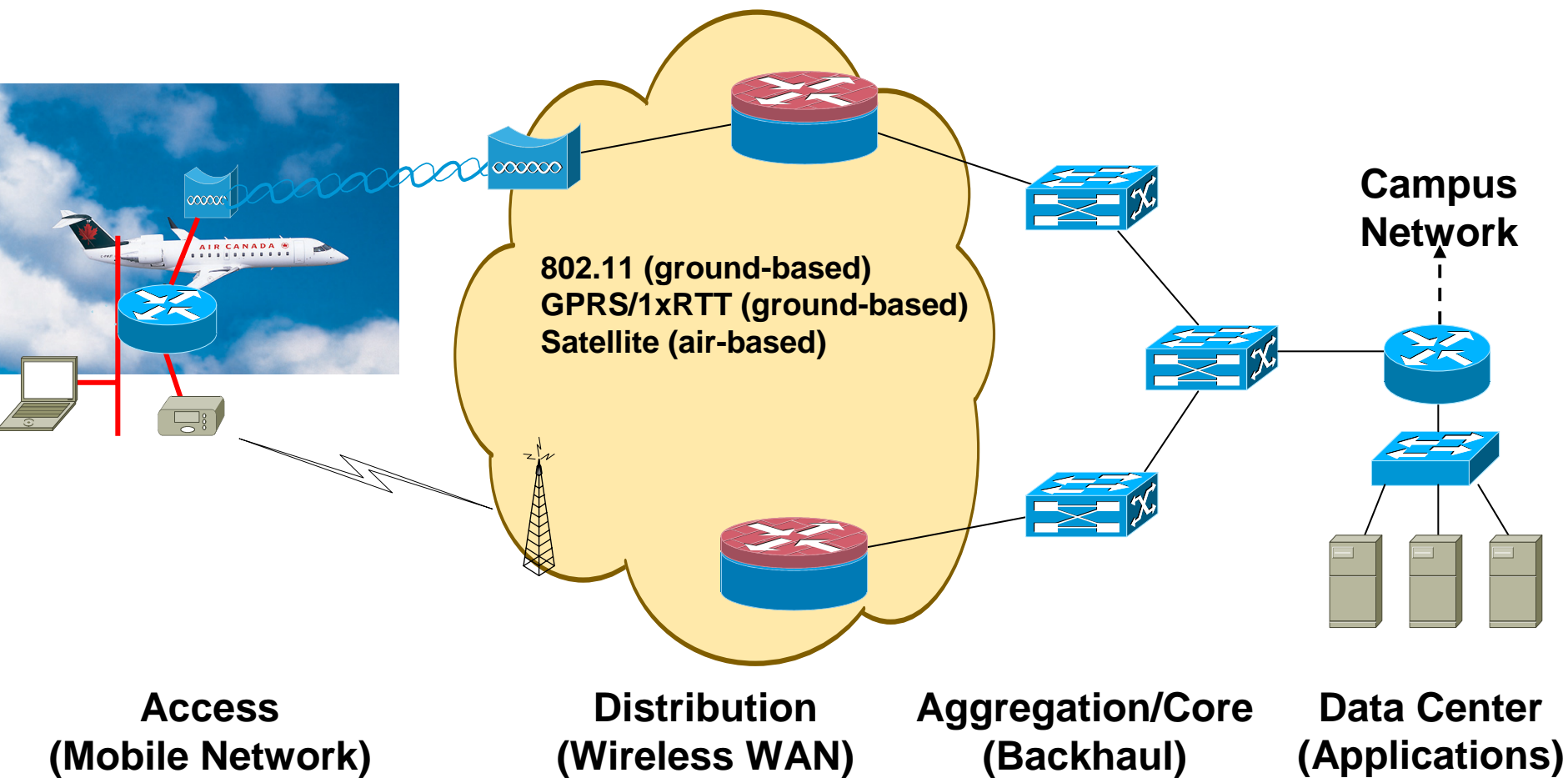
- Migration from Legacy wireless access technologies

*Aircraft maintains network connectivity while in motion using the the MAR 3200 Mobile Router and a combination of Private and Public Wireless access media*

- New revenue stream potential

*Internet Access for passengers provides added revenue stream potential*

# High Level “Networks in Motion” Architecture



# Network in Motion

*“In The Sky”*

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- **Boeing Connexion satellite Internet service**  
1.5-5.0 Mbps satellite link
- **Lufthansa, British Air have announced plans to deploy**  
In 2003, Lufthansa plans to start equipping its entire fleet of long-haul Boeing 747's & Airbus A340's
- **Broadband Internet Access from your airplane seat**
- **Uses wired Ethernet and 802.11 *inside the airplane***
- **“Flying Hotspot”**

connexion  
by Boeing™



# Lufthansa *Internet Jumbo*

## Broadband Internet Connection

Cisco.com



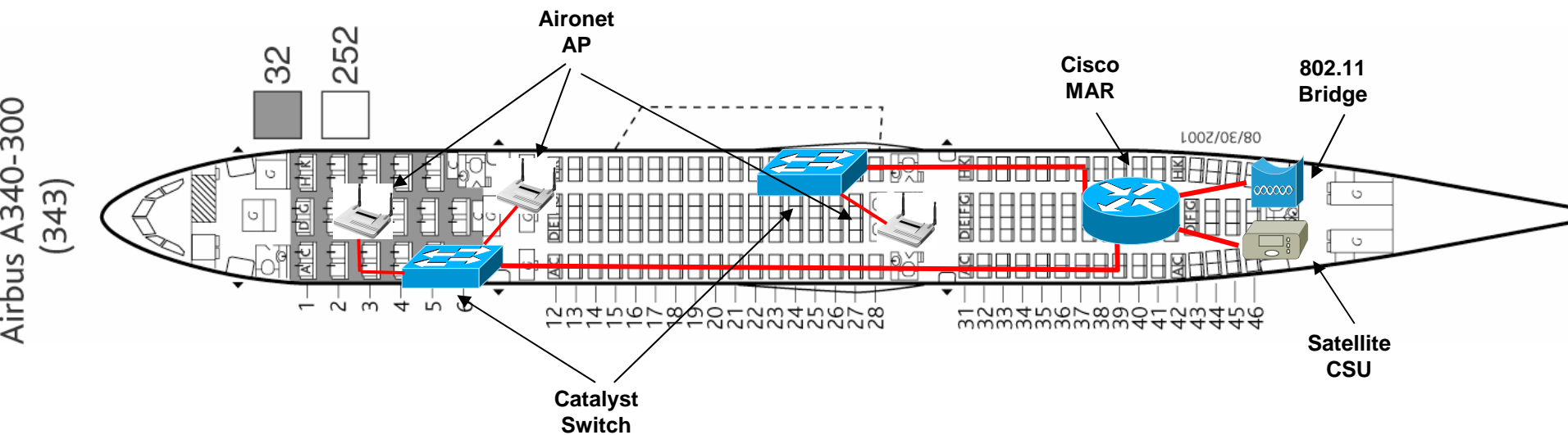
- Lufthansa uses Cisco Equipment for the cabin distribution network on the first “Internet Jumbo”.
- The components are aircraft qualified and SI’ed by Lufthansa Technik

# Physical Network Layout

*Airbus/Lufthansa*

Cisco.com

- MAR as CPE and Services Node
- Aironet 1100AP as Access
- Catalyst 2950 variant for Ethernet connection

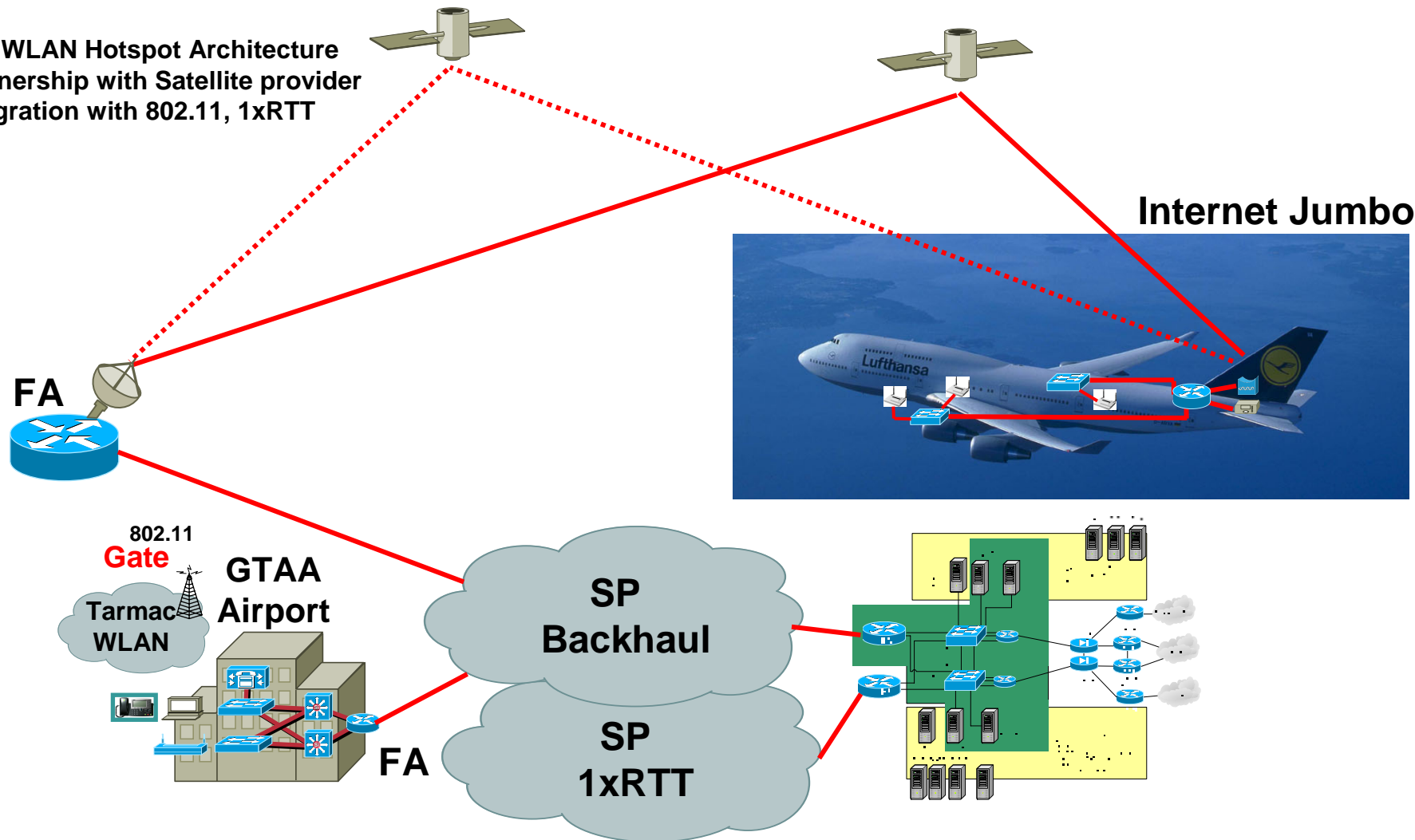


- Requires specialized SI for certification
- Power Consumption/cabling special to Airline Industry
- Needs to meet all relevant FAR and equiv's to get airworthy certificate.

# Backhaul Overview

## Air-Based Networks in Motion

- Use WLAN Hotspot Architecture
- Partnership with Satellite provider
- Integration with 802.11, 1xRTT



# CISCO SYSTEMS

