

Remote 2011 ***Monitoring & Control***

Understanding M2M: A Basic Guide to Available Wireless Communication Solutions

September 20-21 • Nashville, Tennessee

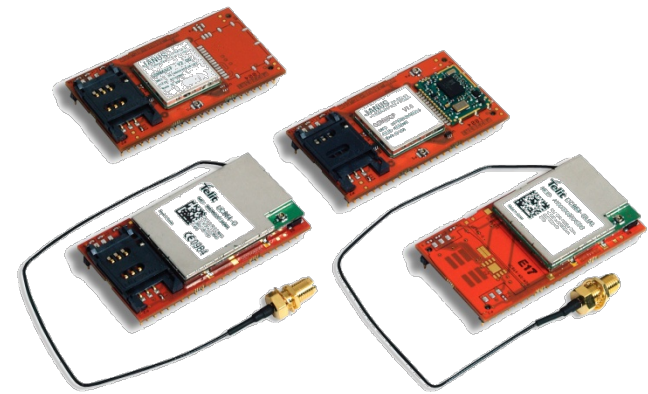
Dave Jahr
General Manager
Janus Remote Communications

SECTION I – INTRODUCTION

Janus Remote communications provides state-of-the-art wireless products and services, including Custom Design Solutions to the global M2M marketplace

Our Products are most often used in:

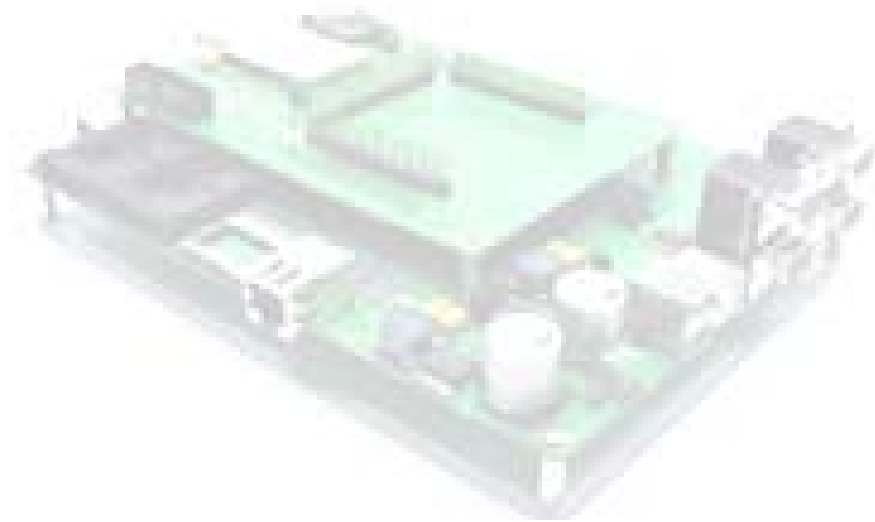
- Fleet Management
- Security Systems
- Healthcare Applications
- Remote Monitoring Systems
- Vending Machines
- Digital Signage



Any Telematics & Telemetry Applications

HISTORY OF JANUS

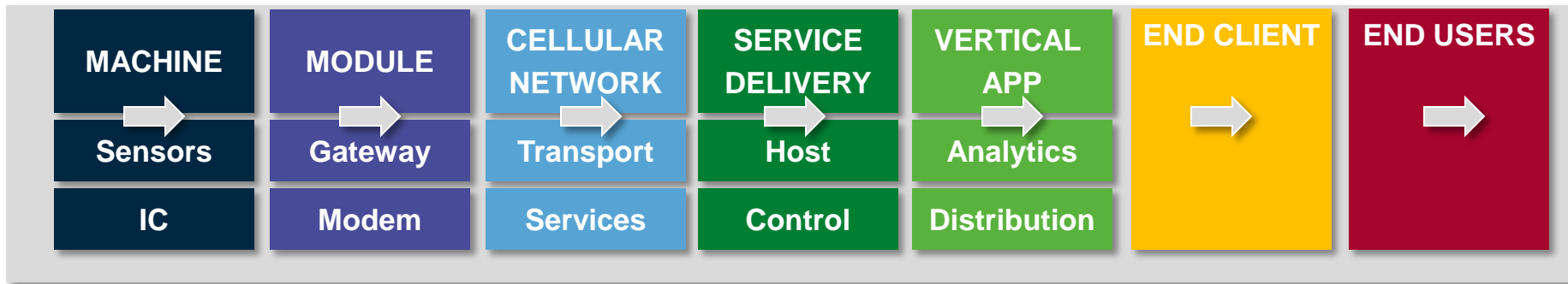
Nokia > Avnet > Sony Ericsson Distribution > > **Telit** wireless solutions



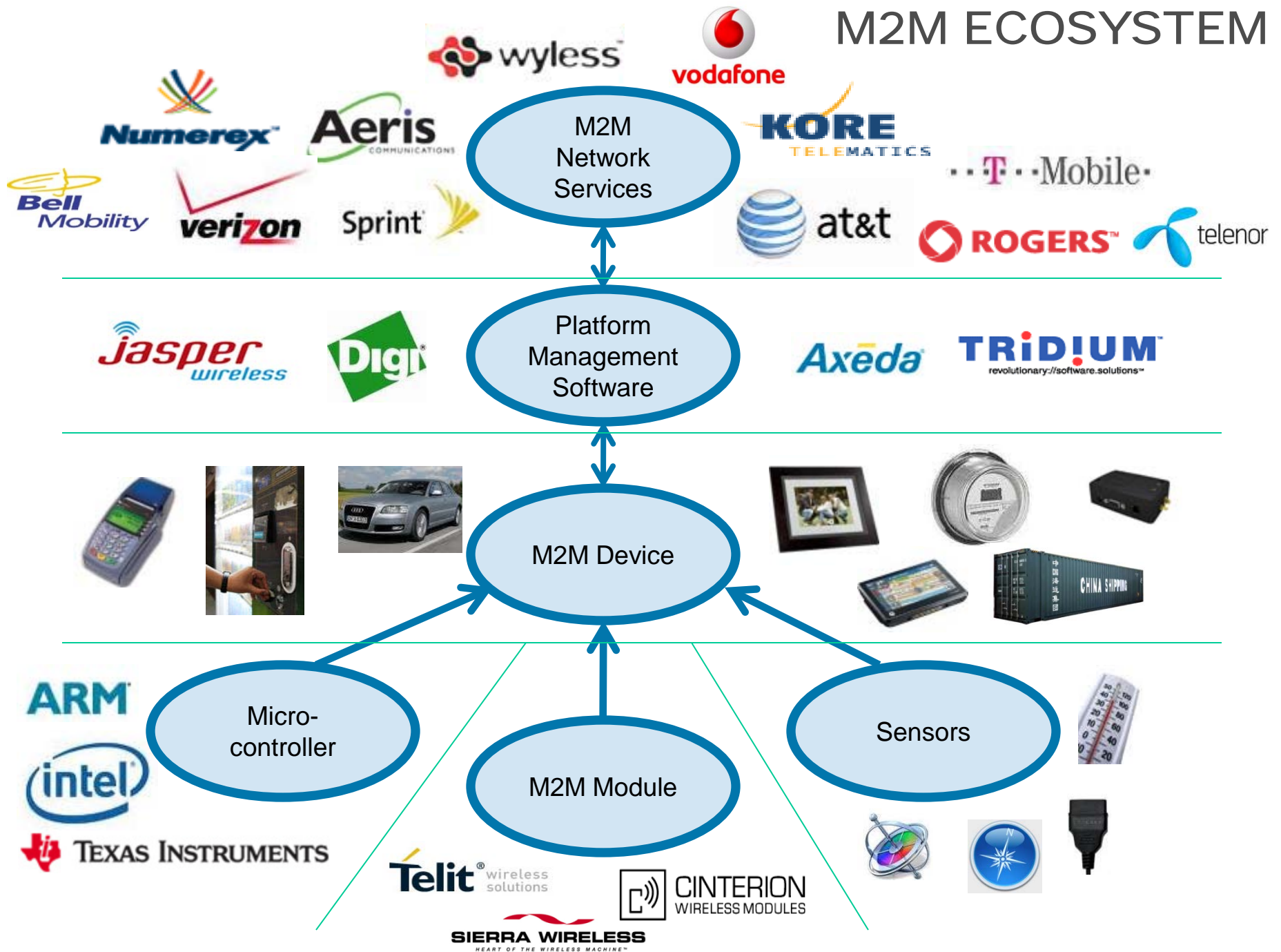
WHAT IS M2M

Simply stated: Devices communicating via wired or wireless networks –

M2M provides machines with the ability to communicate data, by connecting people, devices, networks, and objects, while interpreting much-needed information that can be acted upon in a real-time manner.



M2M ECOSYSTEM



M2M APPLICATION CATEGORIES

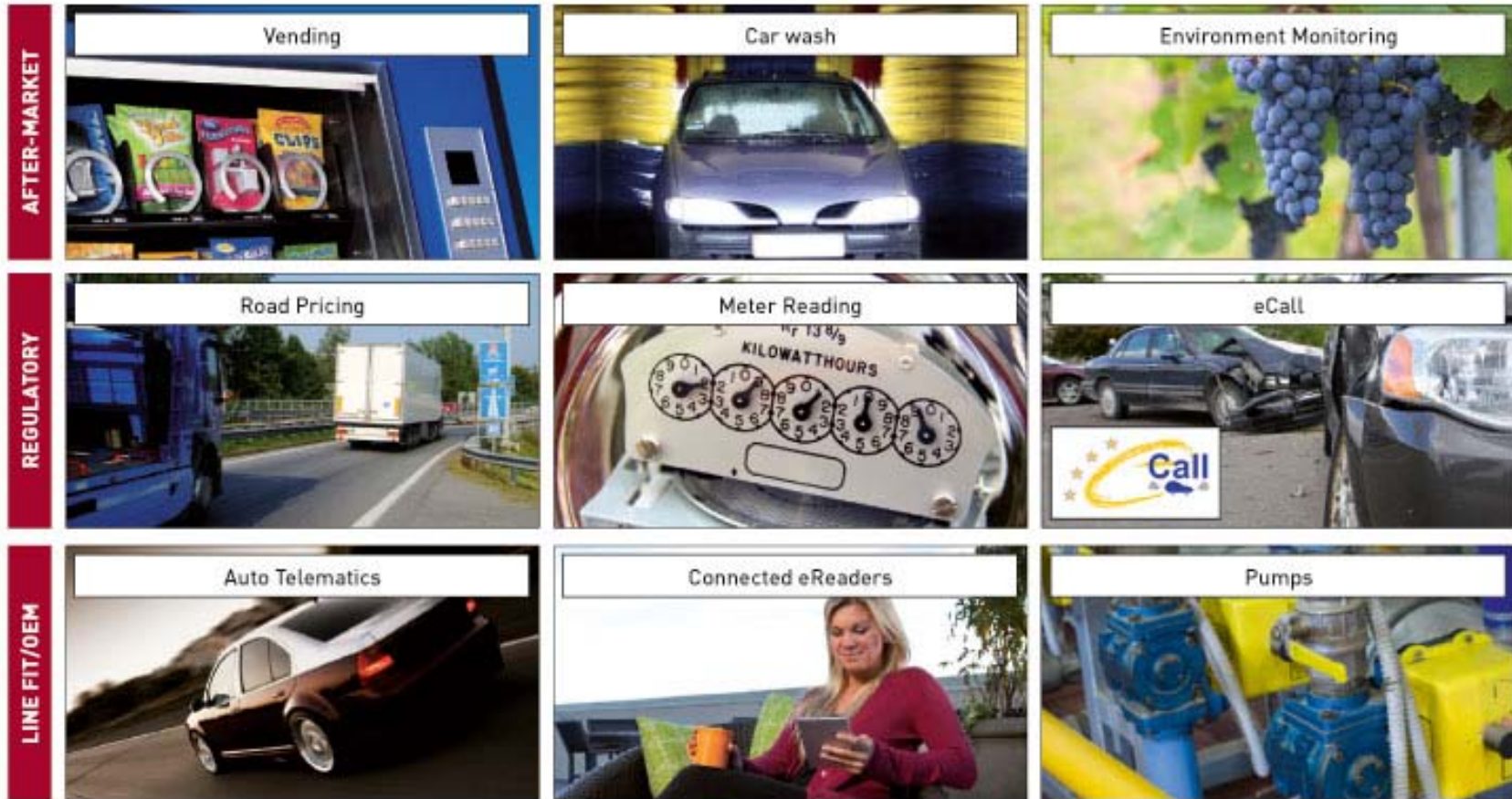
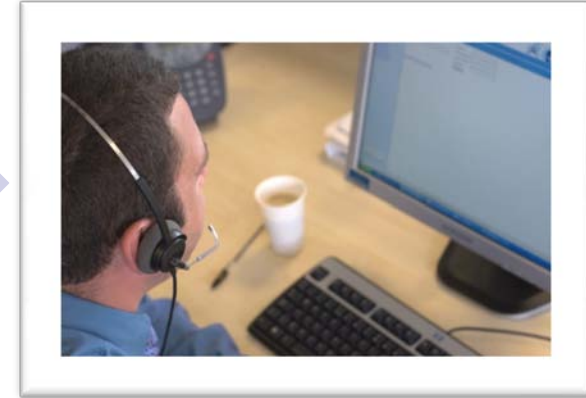
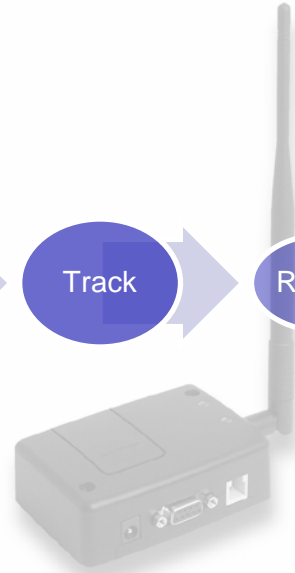


Figure 2: Categories of M2M Applications with Examples

Source: Beecham Research

APPLICATION: AUTO TRACKING



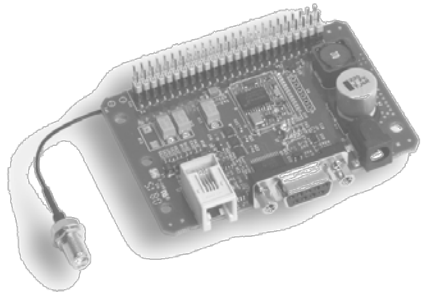
Challenge:

Adding wireless and location capabilities to a consumer vehicle.

Solution: Terminal Device

Pre-approved
Easy configuration
Easy installation

UTILITIES CASE STUDY



Control #23
is running
too hot

Alert is
immediately
sent to the
Control
Center

#23 is
Shut-Down
for
Maintenance

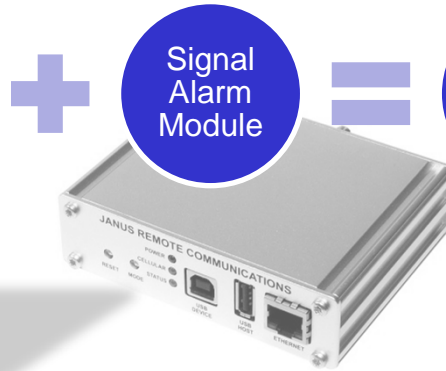
Challenge:
Remote meter reading

Solution:
Data telemetry via Open
Frame unit added to meter

UTILITIES CASE STUDY



Heat
Sensor
Monitoring



Signal
Alarm
Module

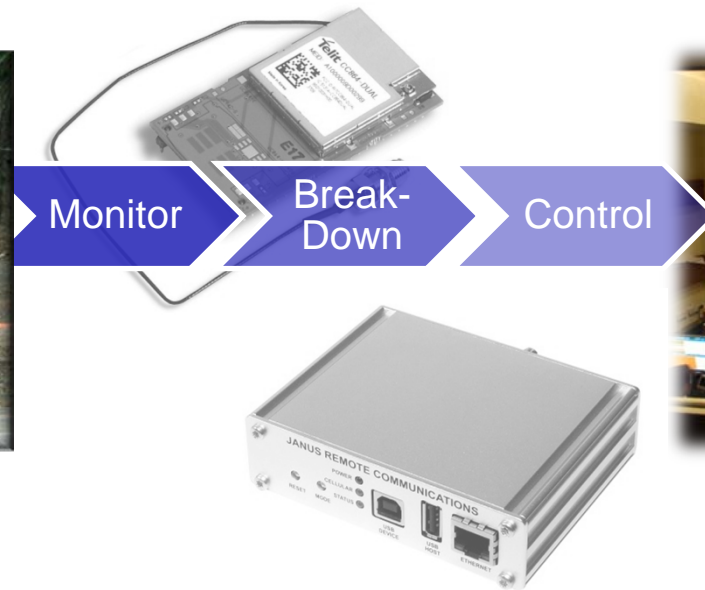
Control
Center
Alert



Challenge:
Remote sensor
monitoring

Solution:
Terminal or intelligent terminal
sending data to central location

INDUSTRIAL REMOTE CASE STUDY



Challenge:

Adding wireless monitoring and control to industrial vehicles or equipment.

Solution:

Open Frame cellular device added to existing hardware or intelligent terminal wireless board w/ processor.

DIGITAL SIGNAGE CASE STUDY



Digital Airport Signage

Security Alert Warning

Control Center Real-Time Remote Adjustments

Challenge:
Control of sophisticated remote billboards.

Solution:
Intelligent terminal

SECTION II – CELLULAR NETWORKS

I. Definition

- Radio Frequency Network covering areas or *cells*
- Cells are shaped for best radio performance –
Given the technology
- Each cell is served by transceivers or base stations
(cell sites)
- Each cell served by a set of frequencies defined by
technology
- Original cell technology was analog, now generally digital
- Several different types of cellular networks, including
proprietary
- Dubbed First Generation (1G) wireless Technology

SECTION II – CELLULAR NETWORKS

II. History

- First used widely for two-way radio applications: dispatch of police, taxis, ambulances, trucks, etc.
- Earlier systems had users change frequencies (band or channel) as they traveled around cells
- Hand-over allowed users to travel in and between cells without changing bands
- First widely used (1G) Cellular network for mobile phones in North America was the Advanced Mobile Phone System (AMPS) introduced by Bell Labs between 1983 and 2008
- AMPS Frequency was in the 800MHz Cellular FM Band
- Other 1G Technologies include: TACS and ETACS, Mobitex, and DataTAC (Mot)

SECTION II – CELLULAR NETWORKS

III. 2G REVOLUTION

- 2G stands for 2nd Generation Wireless Technology
- First launched GSM (Global System of Mobile Communication) in Finland in 1991
- 2G Networks are Digital
- 2G GSM/GPRS Frequencies: 850, 900, 1800, 1900Mhz
- 2G became the prevalent worldwide standard
- Other 2G Technologies include: IS-95 or CDMA (ultimately CDMA2000), iDen (Nextel), IS-136 or D-AMPS
- 2G CDMA Frequencies in US: 800Mhz and 1900Mhz
 - Advantages: Lower power, encryption reduced fraud, Digital allowed data in SMS, e-mail.
 - Disadvantages: Dropped calls or poor service in less populated areas due to lack of appropriate coverage

SECTION II – CELLULAR NETWORKS

IV. 2.5G and 2.75G

- Advances in 2G technology released over time
- 2.5G adds packet switched data capabilities
- GSM adds General Packet Radio Service (GPRS @ 115kbits/s)
- CDMA2000 adds 1xRTT
(1 Times Radio Transmission Technology)
- 1xRTT has rates up to 153.6 kbits/s
- GPRS and 1xRTT allows for greater data rates to allow for SMS, MMS, Internet use
- GPRS networks evolved to 2.75G in 2003
- 2.75G includes EDGE (Enhanced Data rates for GSM Evolution)
- EDGE data rates are up to 236.8 Kbits/s

SECTION II – CELLULAR NETWORKS

V. 3G Technology

- 3rd Generation Mobile Telecom
- Universal Mobile Telecommunications System (UMTS) first offered in 2001
- UMTS is basically an upgraded GSM product
- AT&T Mobility has been offering versions of UMTS since 2003
- CDMA2000 moved to 1xEV-DO (Evolution Data Optimized)
- Verizon began offering 3G EV-DO in 2003

SECTION II – CELLULAR NETWORKS

VI. 3.5G and 3.75G

- UMTS latest upgrades are HSPA and HSPA+ (High Speed Packet Access)
- HSPA+ has theoretical rates of 56 Mbits/s down and 22 Mbit/s up
- Latest CDMA upgrades include EV-DO rev A, EV-DO rev B
- EV-DO rev B has peak rates of 14.7mbits/s down

SECTION II – CELLULAR NETWORKS

VII. 3.9G (Pre 4G)

- Long Term Evolution (LTE) First release does not comply for full 4G status, but is 4G
- First release LTE has been in the marketplace since 2009
- Mobile Worldwide Interoperability for Microwave Access (WiMax 802.16e)
- Pre 4G WiMax has been available since 2006
- LTE and WiMax that do not meet the ITU-R 4G specs of 1Gbits/s are Pre 4G
- All current WiMax and LTE implementations are considered 4G

SECTION II – CELLULAR NETWORKS

VIII. 4G Technology

- Two technologies currently considered 4G: LTE Advanced and WiMax (802.16m)
- According to the ITU-R, 4G compliance requires the following attributes:
 - Peak rates of 1Gbits/s for low mobility applications
 - Peak rates of 100Mbits/s for high mobility applications
 - All IP Packet switched network
 - Scalable channel bandwidth
 - Dynamic network resource utilization

SECTION II – CELLULAR NETWORKS

IX. 5G Technology

- Will be the next generation of Cellular Networks

SECTION II – OTHER RF NETWORKS

Wifi (IEEE 802.11a/b/g/n)

- Wireless Local Area Network (WLAN)
- 2.4 GHz ISM Band
- Unlicensed ISM band released by FCC in 1985
- Able to secure with WEP, WPA, WPA2
- Used in public and private networks
- Found in many homes and business for internet access worldwide

Mesh Networks

- Data transmitted locally by short range radios
- Mesh nodes capture and send information
- Nodes also relay information from other nodes through the network – usually other ISM Radio Bands

SECTION II – OTHER RF NETWORKS

ZigBee (IEEE 802.15.4)

- ZigBee is a wireless mesh networking standard
- Short range, low cost, low power radios
- Called Low Rate Wireless Personal Area networks (LR-WPANs)
- Primarily used in sensor networks and/or other local low data networks

SECTION II – OTHER RF NETWORKS

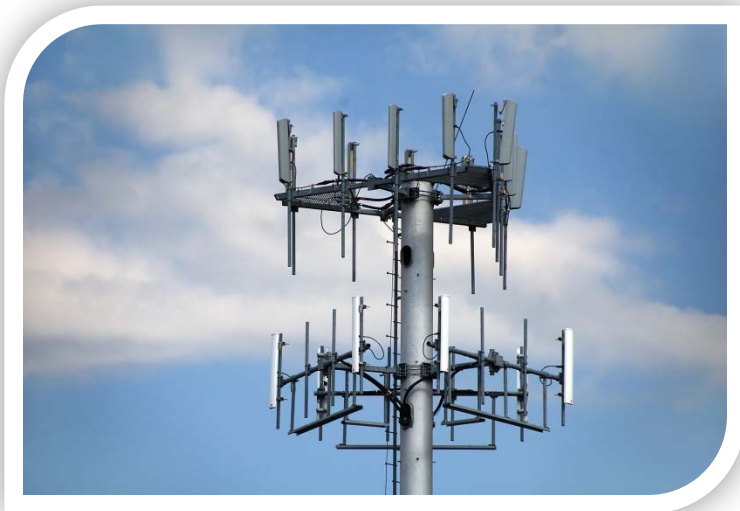
Satellite Networks – Voice and Data Services

- Communication satellites (or comsat) provide communication from space
- Usually either Low Earth Orbits or Geostationary orbits
- Coverage includes most of the earth
- Generally more expensive for hardware and data
- Used in M2M applications where total coverage is necessary

SECTION III – CELLULAR CARRIERS

Mobile Network Operators (MNO)

- Organizations that own radio spectrum purchased from the Government
- Usually bought at auction
- Technology determines spectrum



SECTION III – CELLULAR CARRIERS

MNOs primarily serving North America:

- **GSM/GPRS (2G, 2.5G):**
 - AT&T
 - T-Mobile
 - Rogers (Canada)
- **CDMA (2G, 2.5G):**
 - Verizon
 - Sprint
 - Bell Mobility (Canada)
 - Telus Mobility (Canada)
 - Sasktel Mobility (Canada)
 - TracFone Wireless
 - MetroPCS
 - US Cellular
 - Cricket
 - Qwest Wireless
- **UMTS, HSPA (3G):**
 - AT&T
- **EVDO (3G)**
 - Verizon
 - Sprint
- **LTE (3G, 4G)**
 - Verizon
 - Sprint
 - AT&T (4G)
- **WiMax (3G, 4G)**
 - Clearwire

SECTION III – CELLULAR CARRIERS

Other notable MNOs around the world:

- Vodaphone (Europe)
- Orange (Europe)
- China Mobile (China)
- SingTel (South East Asia)
- Telcel (Central and South America)
- Telefonica (Central and South America)
- Telenor (Europe)
- T-Mobile – Deutsch Telecom

SECTION III – CELLULAR CARRIERS

Mobile Virtual Network Operators (MVNO)

- Sell service but do not have a spectrum license
- Reselling MNO services
- Many hundreds of MVNOs around the world
- Many dozen MVNOs just in North America

SECTION III – CELLULAR CARRIERS

Most common M2M MVNOs in North America are:

- Kore Telematics (AT&T/Verizon/Rogers)
- Wyles (T-Mobile/Sprint/O2)
- CrossBridge Solutions (AT&T/Sprint/Vodafone)
- Raco Wireless (T-Mobile)
- Jasper Wireless (AT&T)

SECTION III – SATELLITE CARRIERS

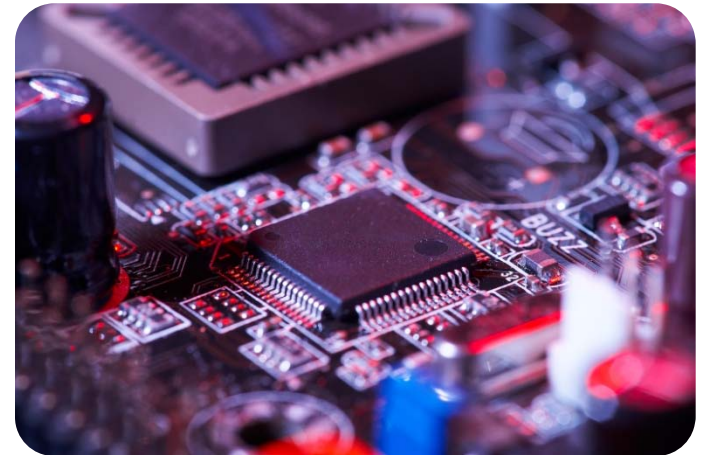
- Iridium Satellite
- ORBCOMM
- Imarsat
- Globalstar, Inc.
- LightSquared



SECTION IV – CELLULAR HARDWARE

Chipsets

- Cellular RF Transceivers
- Requires a great deal of Engineering integration work
- For very high volume applications
- High certification costs
 - Texas Instruments
 - Infineon
 - Qualcomm
 - ST Ericsson
 - Broadcom
 - Freescale
 - Atheros



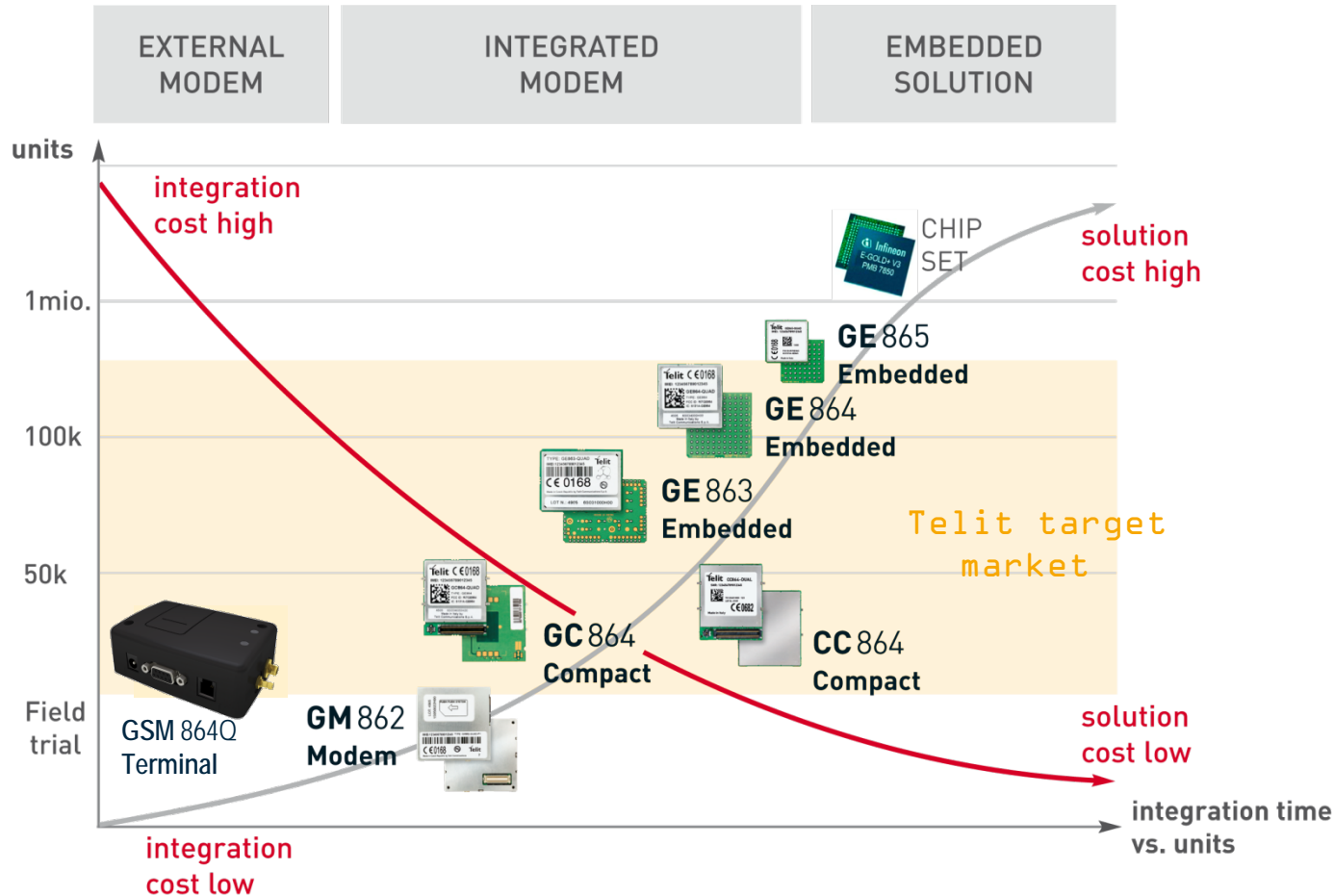
SECTION IV – CELLULAR HARDWARE

Embedded Wireless Modules

- Embedded Cellular Chipsets
- For medium and high volume applications
- High certification costs
 - Telit/Motorola
 - Cinterion
 - Sierra Wireless
 - Huawei
 - Ublox
 - SimCom
 - Enfora



BENEFITS OF PRE-CERTIFIED MODULES



Customer Benefits

- Time to market
- Design risk
- Extensively tested on chosen network
- Less certification
- Reduced component obsolescence risk
- Manufacturing complexity

SECTION IV – CELLULAR HARDWARE

Modems/Terminals/Routers

- Off-the-shelf products using cellular modems
- Generally PTCRB and carrier certified for use in the US
- Also CE certified for use around the world
- From simple pass-through devices to complex cellular single board computers
- Generally have Serial, Ethernet, and/or USB connectivity
- Controlled by AT commands or middleware

CalAmp

Digi international

Sierra Wireless

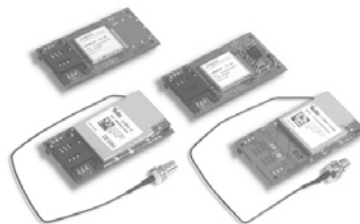
Multi-Tech

Falcom

Janus Remote Communication

Sixnet

Enfora



SECTION IV – CELLULAR HARDWARE

Other M2M Hardware

- Embedded Satellite Modems

- Digi Quake Global



- Satellite M2M terminals

- SkyWave Hughes Quake Global



- Open frame short range RF radios

- Telit Anaren RFM Digi

SECTION V – APPLICATION PLATFORMS

Platforms:

M2M software development platforms provide users with the ability to quickly develop a method of communicating with devices.

- Axeda
- Sensor Logic
- NPhase (Qualcomm)
- Jasper (AT&T)
- Sierra Wireless
- Multi-Tech
- Enfora



SECTION V – APPLICATION SOFTWARE

Back-End Software Applications:

- Ready-to-use interfaces for remote M2M devices
- Moving data from remote devices into easily accessed, interpreted, and viewed information
- Hundreds of products exist
- Sometimes aligned by carrier
 - Agilis (mapping)
 - GPSgate (mapping)
 - Exosite (sensor networking)
 - Isidorey (remote management)

The logo for Agilis Group features the word "AGILIS" in a bold, orange, sans-serif font. Below it, the word "GROUP" is written in a smaller, teal, sans-serif font, with each letter separated by a small gap.

SECTION V – MIDDLEWARE

Used to mediate communication between remote devices and user

- **Commands are simplified**
- **Easiest way to interface with device**

- Softmaxx
- Multi-Tech
- Sierra Wireless
- Enfora



SECTION VI – CERTIFICATIONS

Major Certification Requirements

A. PTCRB

- Originally stood for PCS Type Certification Review Board
- Established by Carriers in 1997 for GSM based networks
- Provides certification in the US for GSM based cellular devices
- PTCRB certification ensures compliance with US networks
- Costs around \$40k for a Terminal device incorporating a certified cellular module
- Usually done by 3rd party labs such as Cetecom or 7 Layers

SECTION VI – CERTIFICATIONS

Major Certification Requirements

B. Federal Communications Commission

- In the US, the FCC oversees all aspects of electronic communication
- Certifications are device dependant
- Radio hardware usually requires some level of FCC certification
- Cellular modules require certification
- Cellular terminals using certified modules use the module certification

SECTION VI – CERTIFICATIONS

Major Certification Requirements

C. CE Marketing

- CE" stand for "Conformité Européenne"
- Used since 1993
- Mandatory for many products in the European Market
- CE assures conformity to applicable EU directives
- Affixed by manufacturer or authorized representation
- Can self-certify

SECTION VI – CERTIFICATIONS

Major Certification Requirements

D. UL

- No wireless industry requirements for UL
- Might be required by end customer
- Used especially for consumer products

SECTION VI – CERTIFICATIONS

Major Certification Requirements

E. Carrier

- Each carrier in each country has different requirements
- AT&T requires PTCRB and their own testing
- T-Mobile requires only PTCRB
- Sprint and Verizon have their own testing requirements
- CE is the only requirement for Europe
- Carriers might require submission of units and/or paperwork

SECTION VII – M2M ALTERNATIVES

M2M Sourcing Alternatives

- **Direct**
- **Representatives**
- **Distributors**
- **Integrators**
- **Value Added Resellers**

M2M DESIGN CONSIDERATIONS

- Who will be doing the design (in-house vs. outsourced)?
- How many units will I be building?
- What are my power and size requirements?
- What is my manufacturing BOM cost target?
- What is my time-to-market requirements?
- Will the device be used next to the human body?
- What carrier/operator will you use?
- What are my bandwidth requirements?
- What geographies will the application be deployed?

CONCLUSION

Navigating through the Machine to Machine marketplace can be hazardous for those companies with little or no experience in the area. Here are a few tips to avoid the many current M2M pitfalls that exist:

- Find a trusted mentor with experience in M2M Marketplace
- Fully define your requirements
- Shop around – There are many sources for M2M solutions
- Verify before you buy
- Make sure you have appropriate support – internal and external
- Expect superior performance from Suppliers and their products



QUESTIONS?

**When in doubt, call Dave Jahr!
630-499-2121**