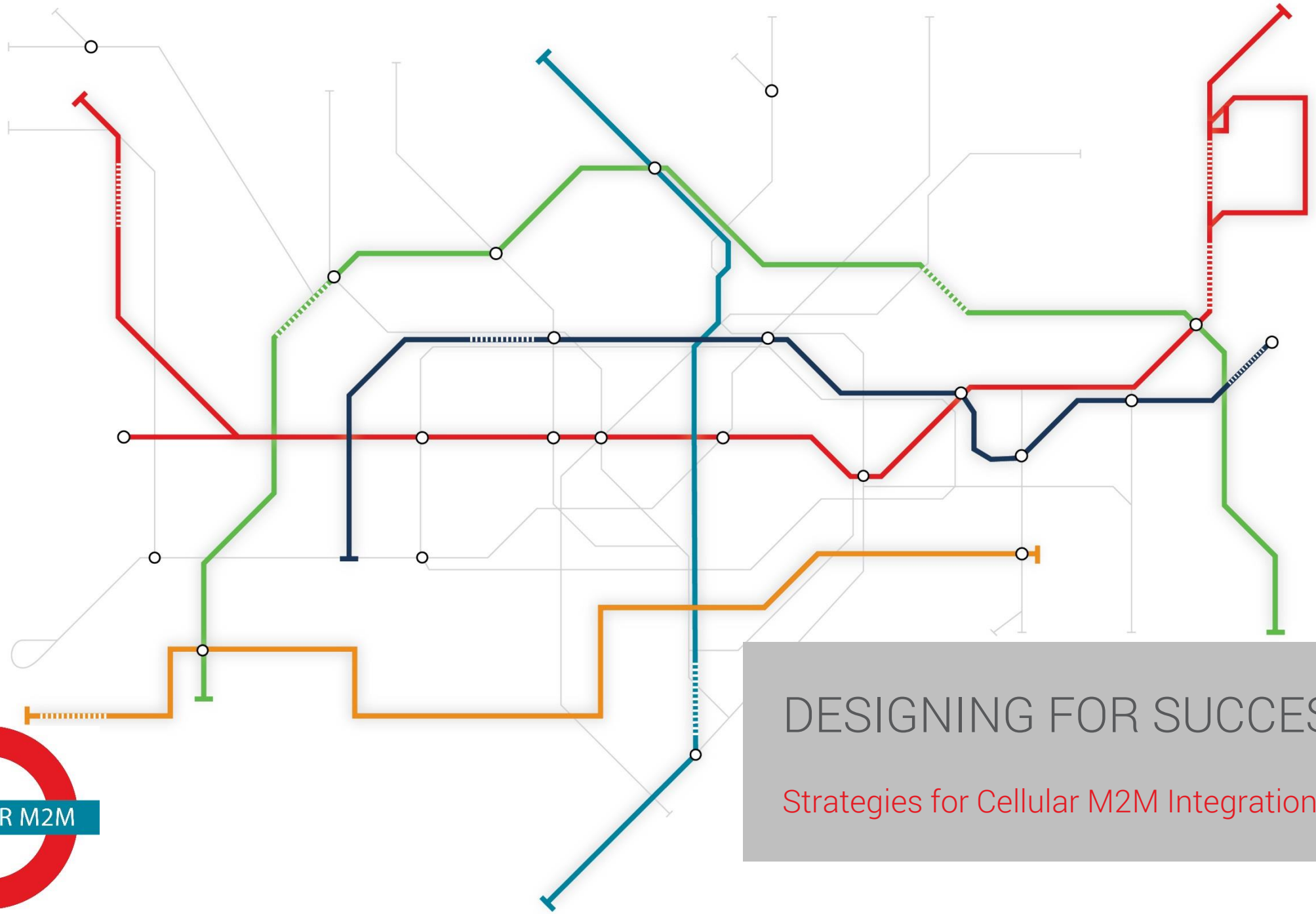


DESIGNING FOR SUCCESS

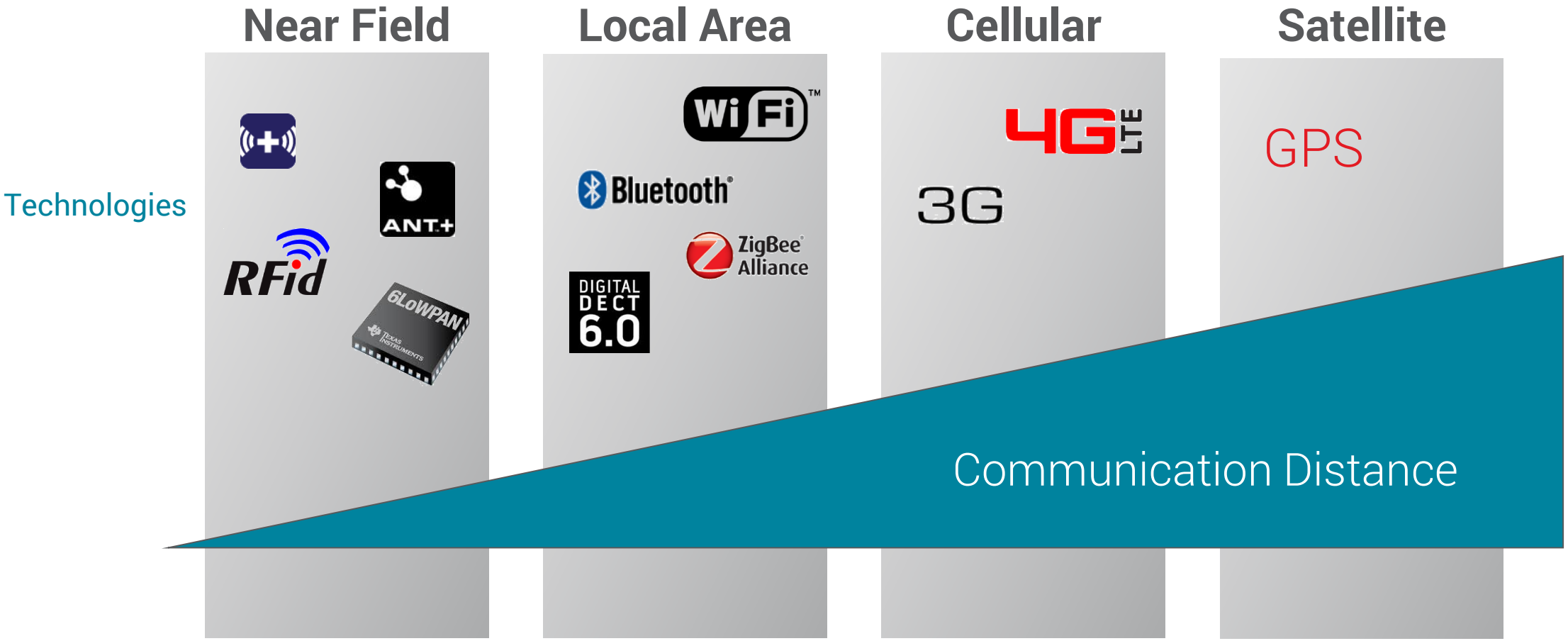
Strategies for Cellular M2M Integration

Today's Agenda

- The Cellular M2M Technology Opportunity
- Key Considerations of Cellular M2M Design
- Designing for Cellular Integration
- 4 Strategies for Defining an Effective Product Roadmap for Cellular M2M
- Question and Answer

The Cellular M2M Technology Opportunity

True expertise is knowing which technology will best meet the needs of your customer



What sets Cellular apart from other wireless technologies?

Availability

- Deployed and accessible in nearly all regions of the globe
- Designed to provide seamless coverage across entire network

Ease of Deployment

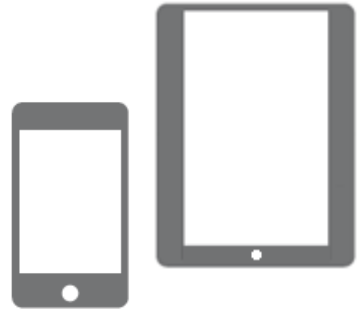
- Provision prior to deployment
- Design to auto-provision in the field
- Network is ‘self-sufficient’ vs. Wi-Fi

Simplified Support

- Cellular carriers own, operate, and maintain network
- Single point of contact for support

Key Considerations of Cellular M2M Design

A cellular M2M system will typically require 4 elements to function

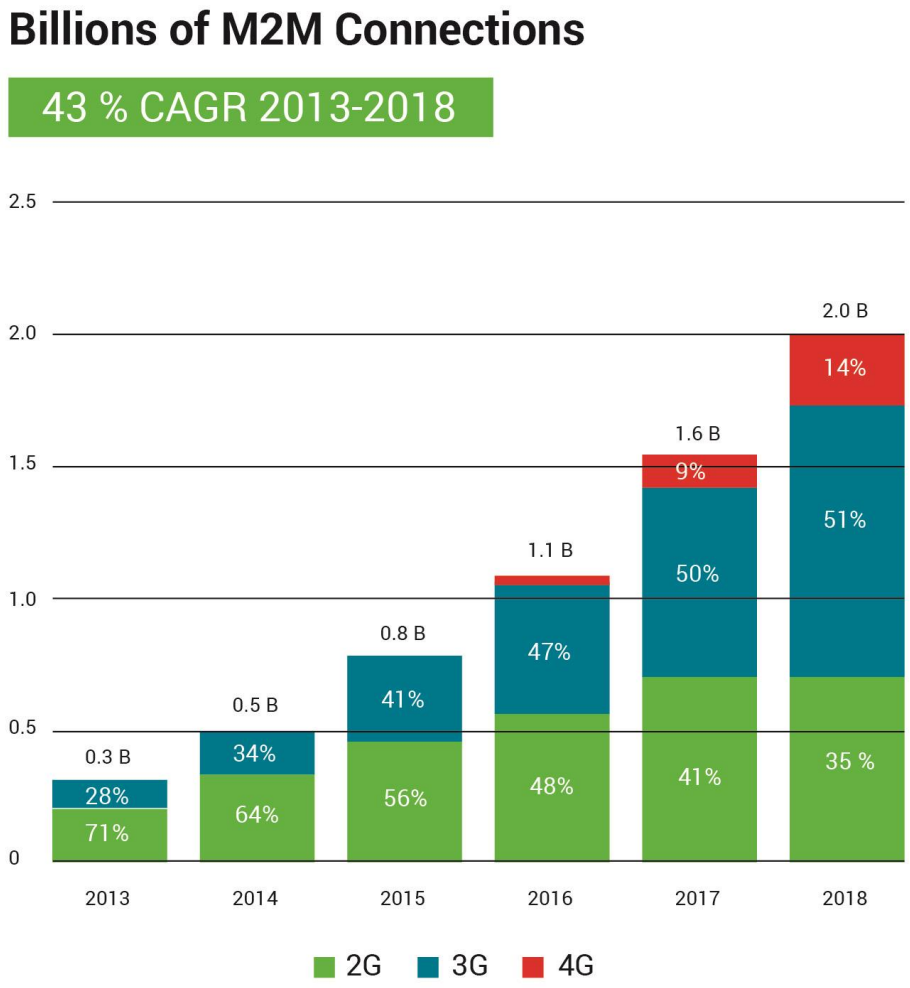
1	2	3	4
			
Cellular Enabled Product	Network Carrier or MVNO	Cloud Server	Mobile App or Web Portal

Cellular technologies have evolved in response to performance demands of cellphone market

For M2M applications, is newest always best?

Cellular M2M is in the midst of explosive growth across technology generations

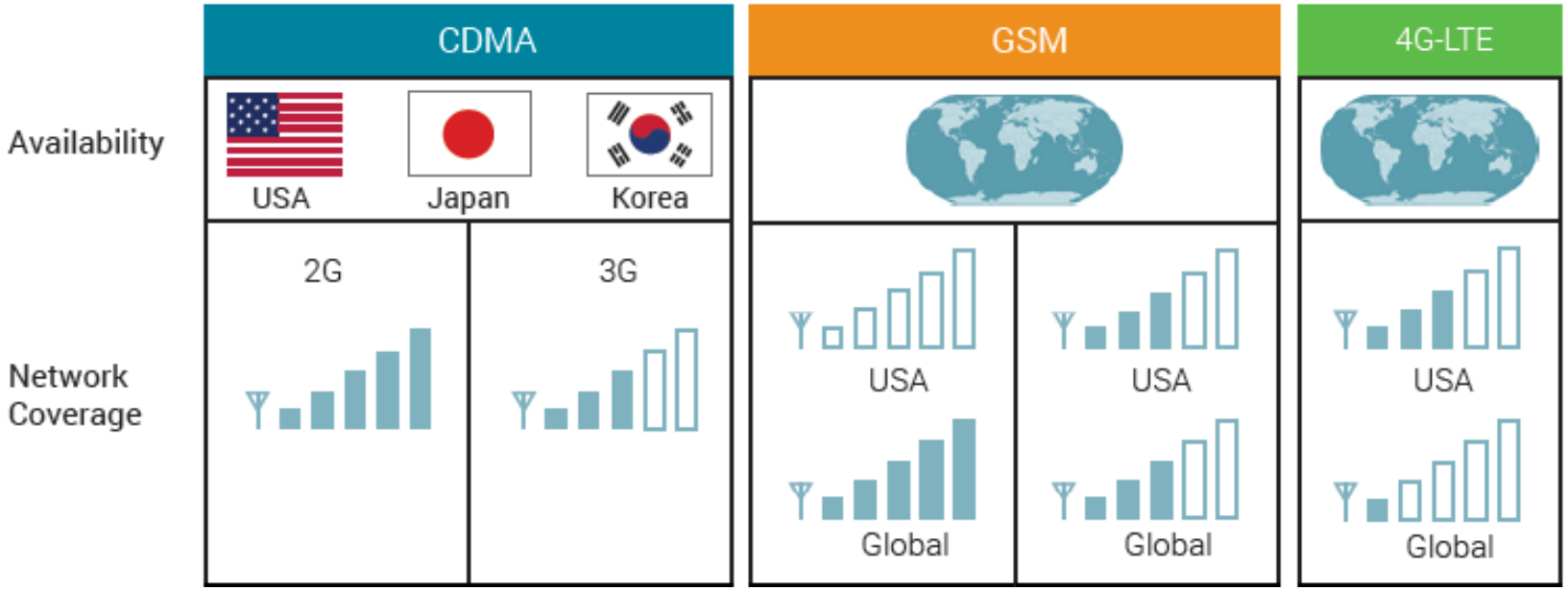
By 2018, industry estimates over 2 billion M2M connections supported by 2G, 3G, and 4G cellular technologies



Source: Cisco VNI Mobile, 2014

The right choice for your M2M application depends on 3 factors:

1. Where will the product be used?



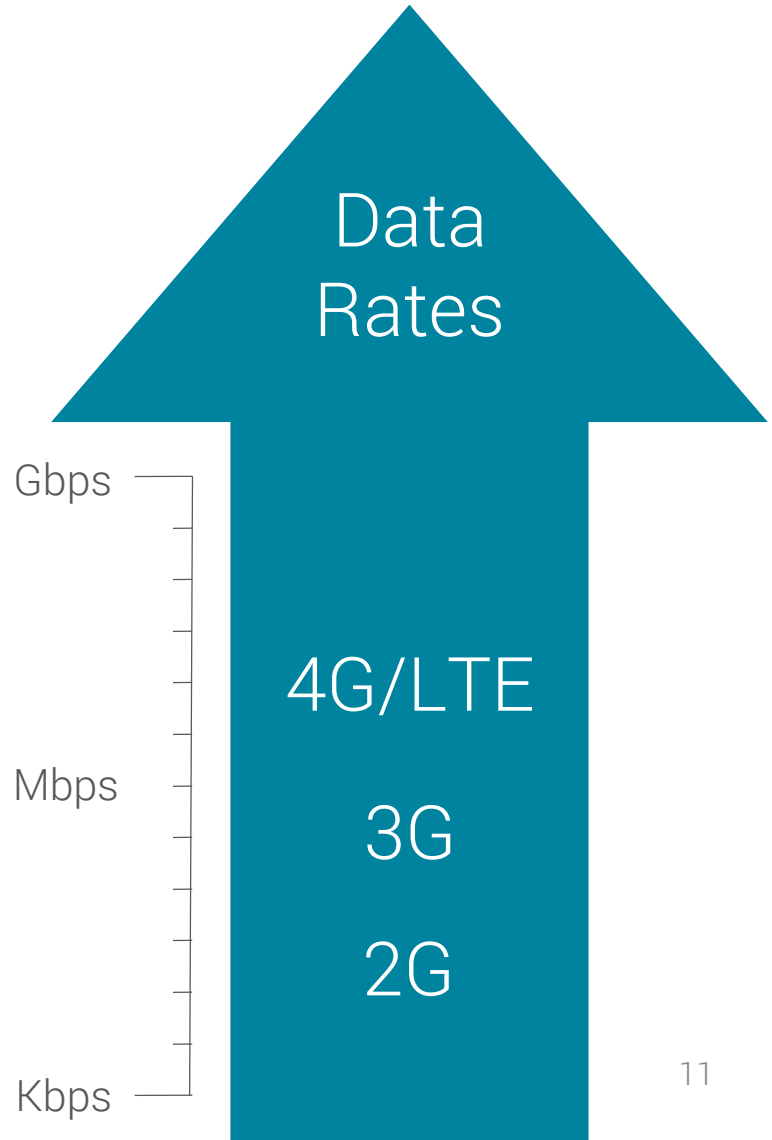
The right choice for your M2M application depends on 3 factors:

2. What is the nature of the data being transmitted?

M2M applications utilize cellular networks differently than smartphone application

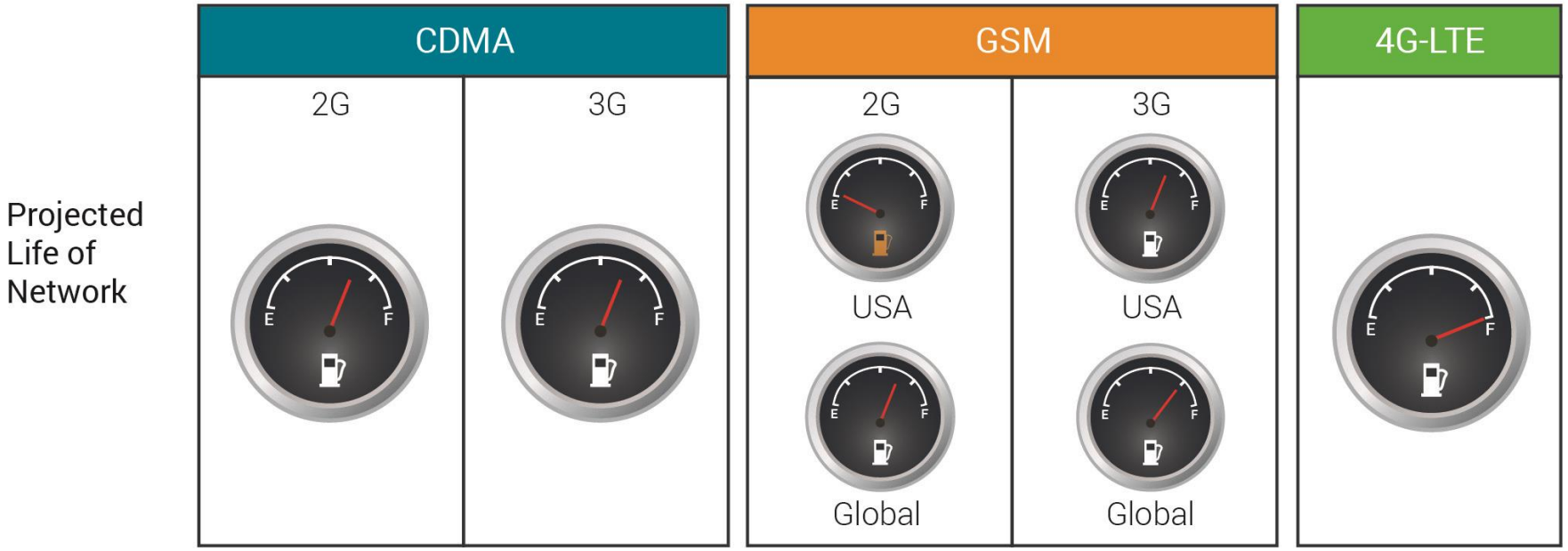
Higher data rates for specialized M2M applications:

- High resolution data tracking
- Real-time streaming data
  - e.g. Video or audio



The right choice for your M2M application depends on 3 factors:

3. What is the targeted life of the product?



Numerous carrier options are available for the cellular technology you choose

Network Carrier

Own, operate, and support their cellular networks

Mobile Virtual Network Operator (MVNO)

Buy and re-sell network service from a Carrier

Bundle network with value-add services for M2M

- Customized billing plans
- Security
- Advanced device management

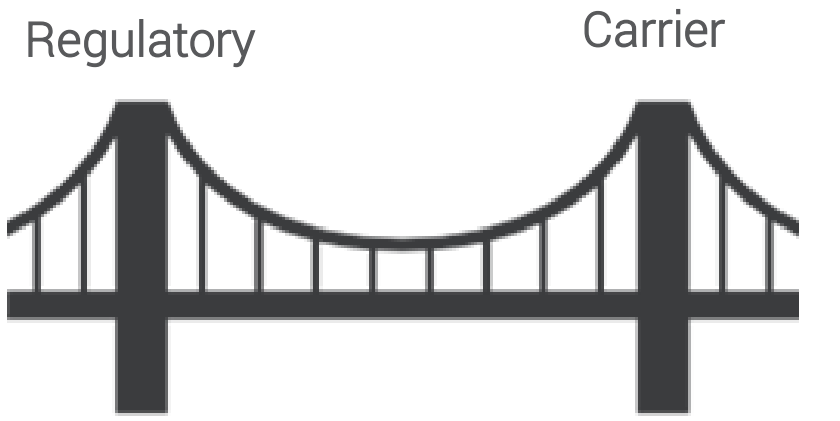
In assessing network partners, focus on their M2M-specific capabilities

M2M applications have unique needs compared to cell phones

- Limited user interface
- Size and Frequency and data transmissions
- Level of support and information needed to solve unexpected device behavior

Design of cellular-enabled devices must pass two sets of requirements

2 Certification Requirements:



Ensure other devices are not impacted negatively

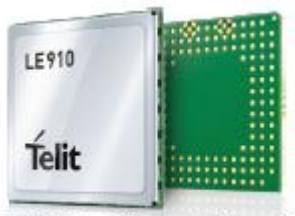
Ensure performance & Stability of overall network

ISSUE: Most companies who have never done a cellular implementation before, fail their first certification

SOLUTION: Pre-Scans should be performed on every board spin

Modem modules are effective options to reduce risk & cost of both design and certification

Cell modems come in 2 types of modules:



Telit LE 910 (www.telit.com)

Pre-Certified Module

A pre-certified module has been tested and approved by network operators to conform to the low-level cellular protocols and RF requirements

Additional approvals required for specific application.

Ideal for mid- to high-volume productions, or where small form factor is critical


Multi-Tech Systems SocketModem® iCell (www.multitech.com)

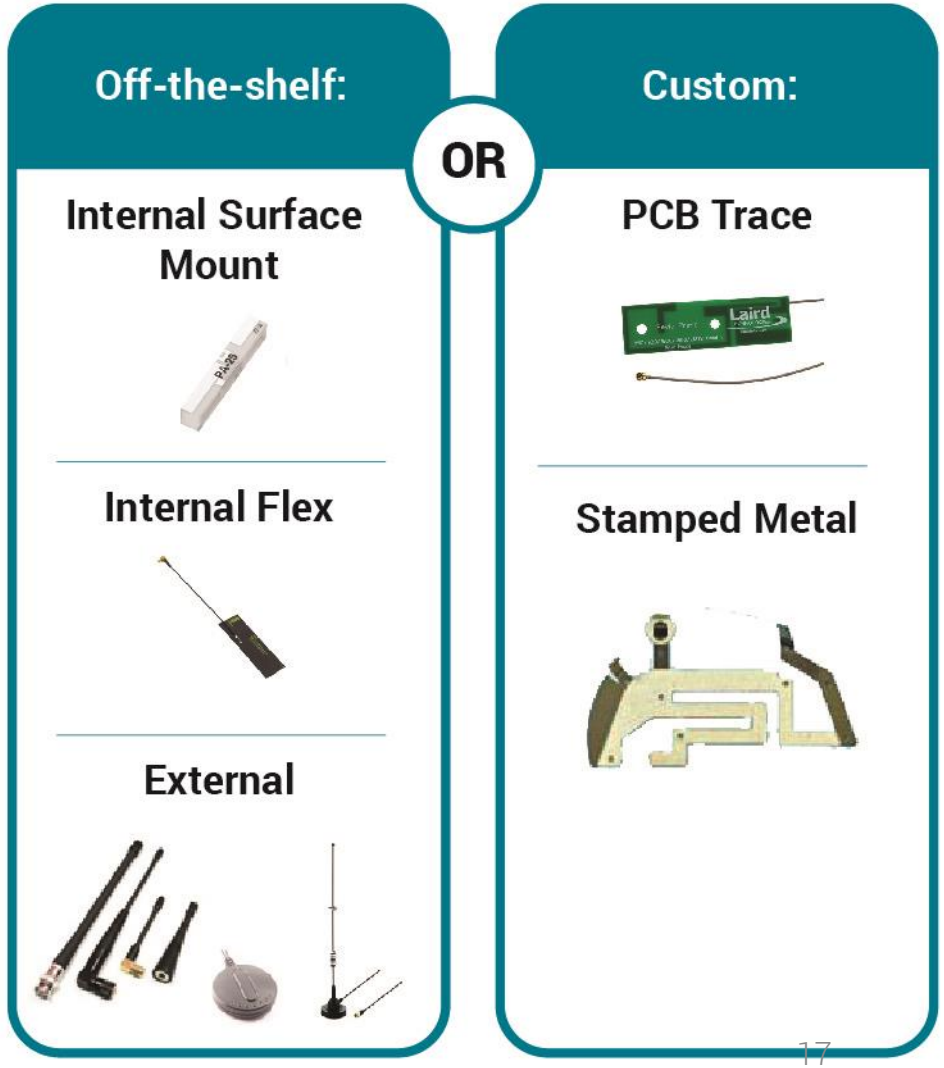
End-Device Certified Module

Includes the antenna along with necessary power and control circuitry, so no additional carrier certifications or approvals are required (beyond system level emissions testing).

Ideal for low-volume productions without stringent size constraints

The antenna is at the heart of a system's cellular performance

- A variety of off-the-shelf and custom design options exist
- The key is to concurrently approach the product design and the antenna/RF design
  - Enclosure design
  - Materials selected
  - Layout of circuitry
  - Placement of antenna



Designing for Cellular Integration

A cellular M2M system will typically require 4 elements to function

1

Cellular Enabled Product

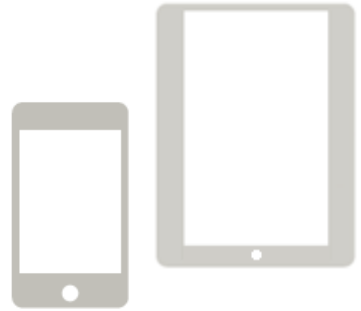
2

Network Carrier or MVNO

3

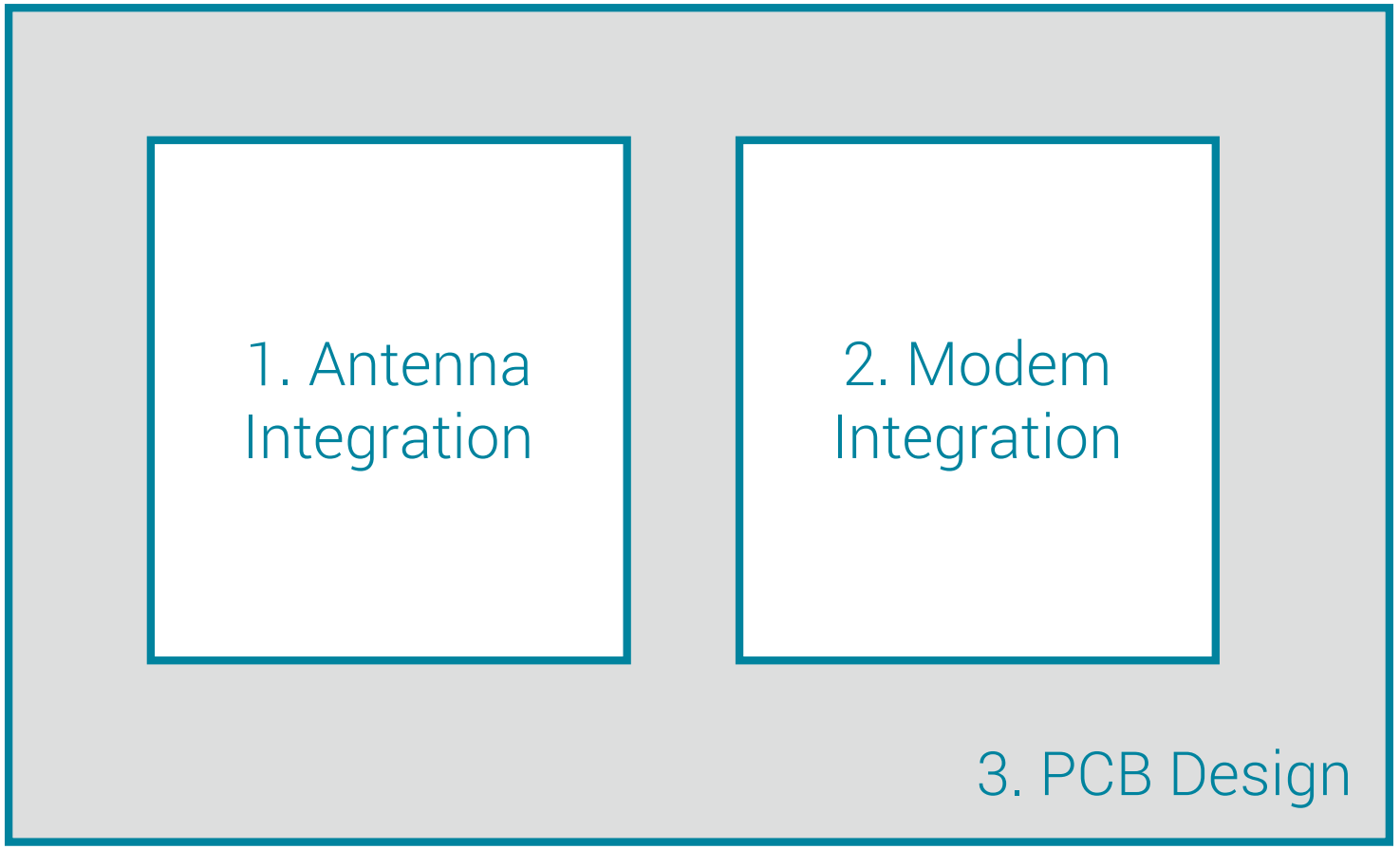
Cloud Server

4

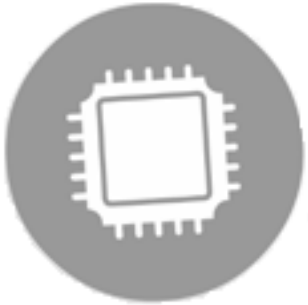


Mobile App or Web Portal

There are 3 key elements of a RF Hardware design that determine certification success



Software has two responsibilities in a cellular-enabled device

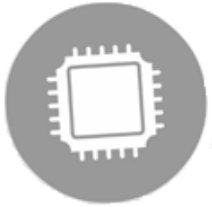


Cellular Modem

+

Cellular Network

Software has two responsibilities in a cellular-enabled device



Cellular Modem

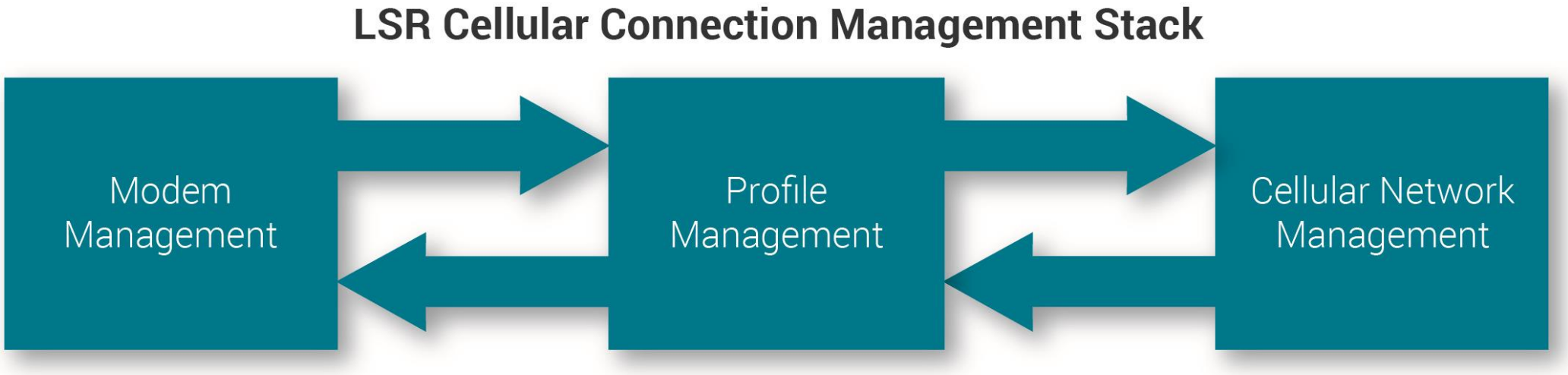
Typical Requirements	Challenges
• Power Management • AT Command Communication • Modem Configuration	• Complexity of AT command sets • Modem responses are non-deterministic

Software has two responsibilities in a cellular-enabled device

Cellular Network

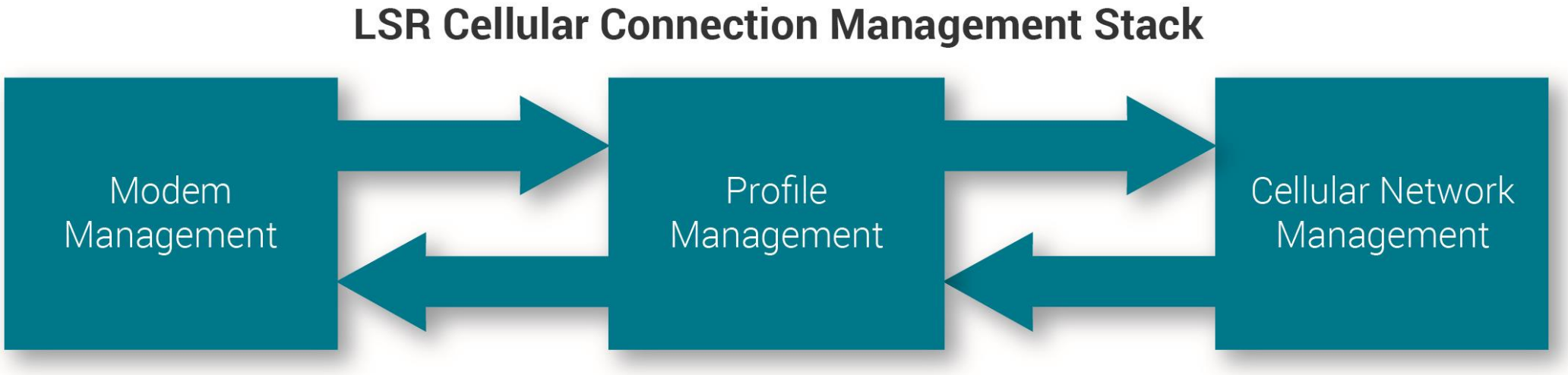
Typical Requirements	Challenges
• Network • Internet • Cloud/Server (TCP/UDP sockets) • SMS Messages • Provisioning (CDMA Only) • Voice Calls	• Network behavior is dynamic • Challenging to simulate • Operation varies between carriers

LSR's CCM Solution dramatically simplifies cellular integration efforts



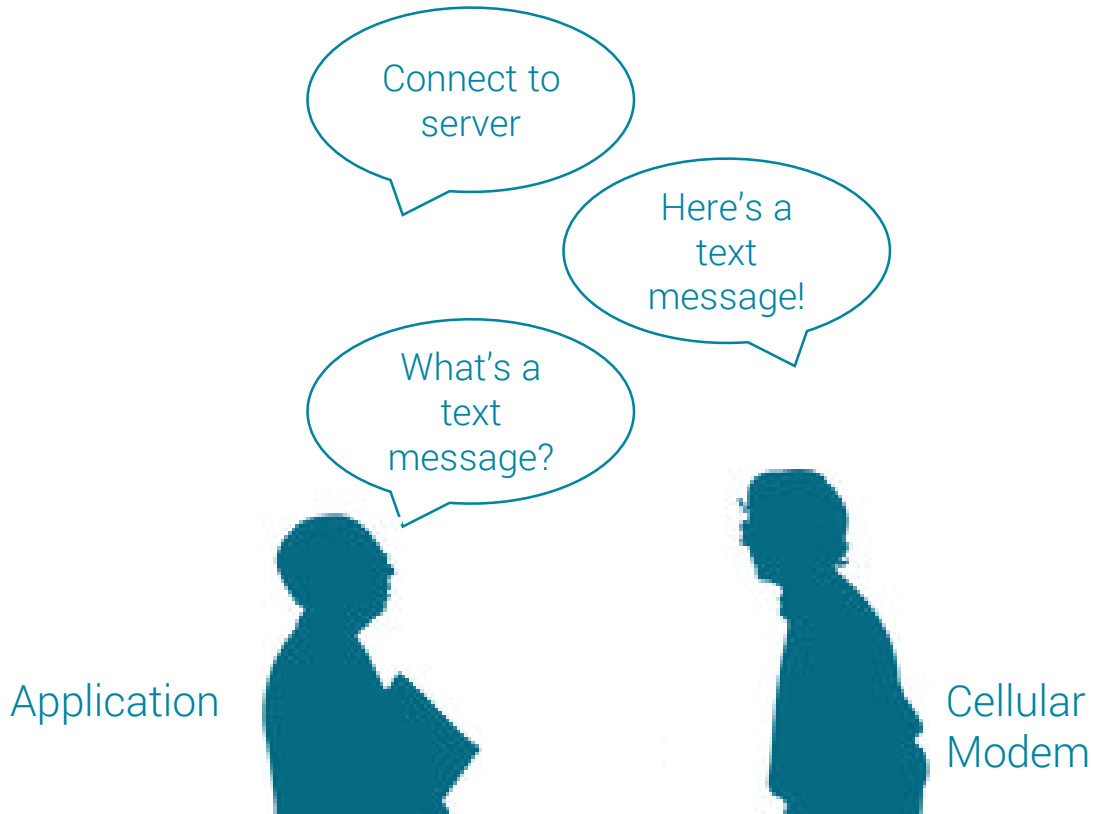
One Solution handles all communication to both the Modem Module and Cell Network

LSR's CCM Solution dramatically simplifies cellular integration efforts



Handles all the AT command sequences for management of the Cellular Modem

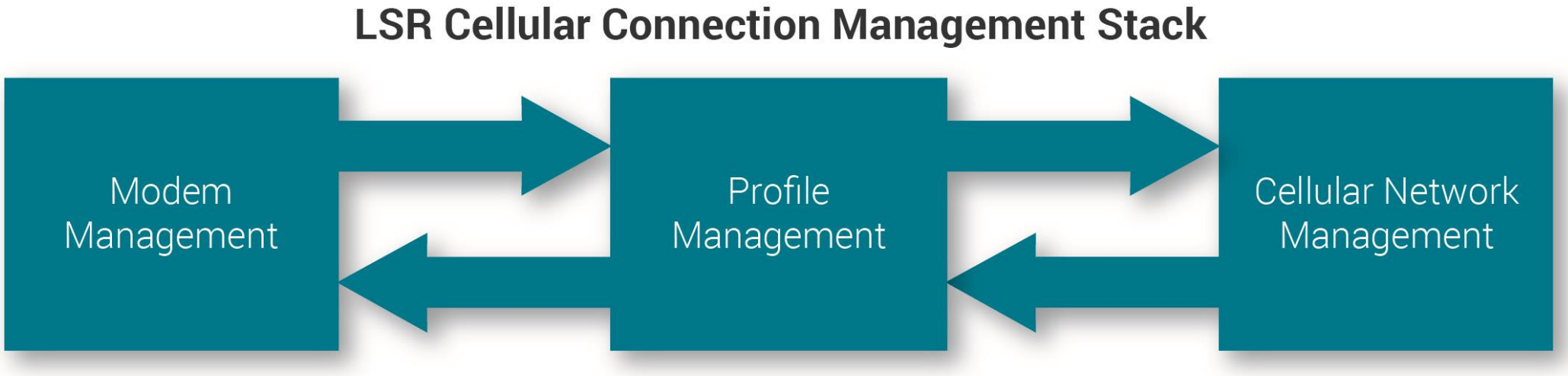
CCM's Modem Management element prevents communication breakdowns



Potential Results if Unaddressed:

- Intermittent failures
- Loss of data
- Reduced battery life
- Unresponsive device
- Unexpected behaviors

LSR's CCM solution dramatically simplifies cellular integration efforts



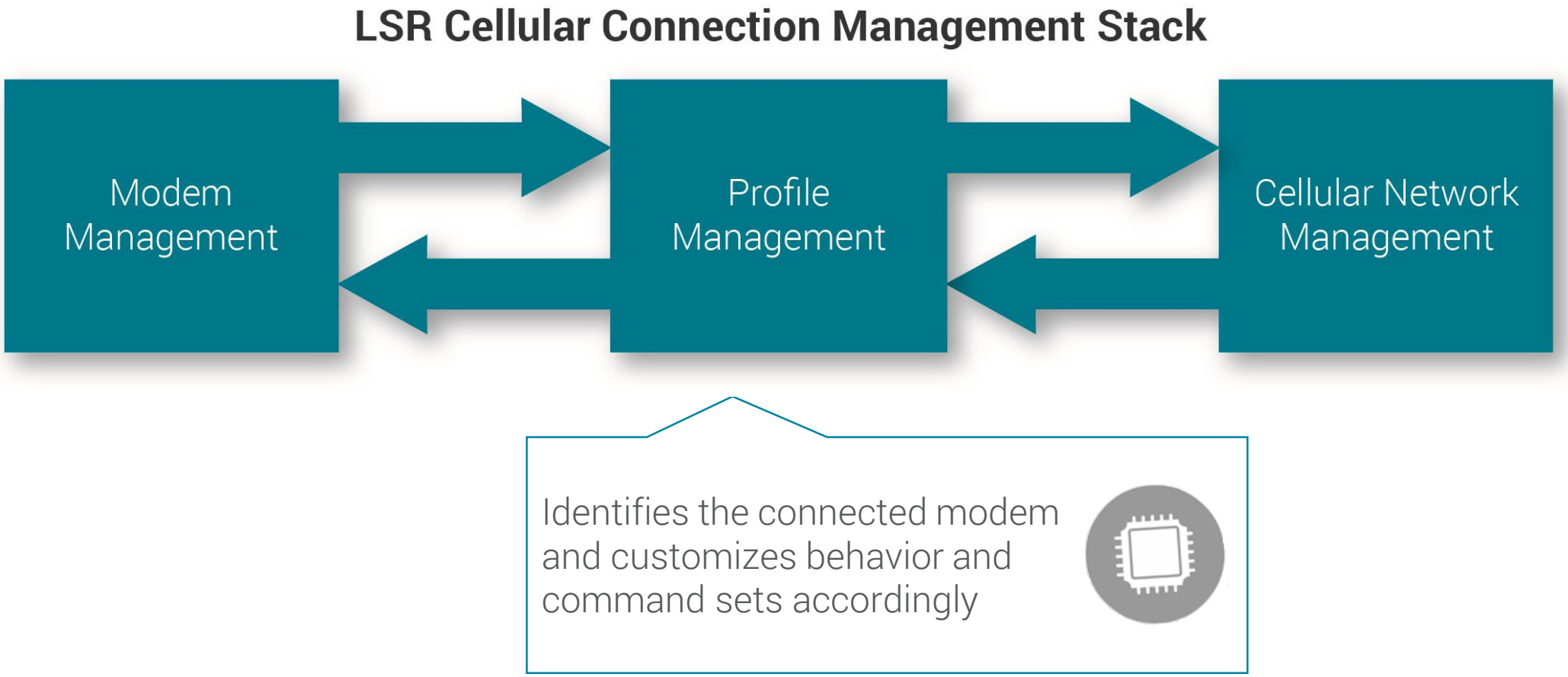
Establishes and maintains connections through the cellular network, intelligently addressing any issues that occur

CCM's Connection Management reduces complexity by minimizing possible error states

Scenario: Opening a socket TCP connection with a server

AT Commands	vs	CCM Function
A. AT+CREG? B. AT#SGACT=1,1 C. AT#SCFG=1,1,0,0,90,50 D. AT#SCFGEXT=1,1,0,0,0,0 E. AT#SD=1,0,<port>,<address>		ccmSocket_tcpOpen( )
Result: 2^5 = 32 possible code paths		Result: 2 possible code paths

LSR's CCM Solution dramatically simplifies cellular integration efforts



CCM Profile Management offers maximum flexibility for your product's cellular roadmap

	CDMA		GSM		4G-LTE
Availability	USA, Japan, Korea		Global		Global
Network Coverage	2G	3G	USA, Global	USA, Global	USA, Global
Module Cost	$	$$	$	$$	$$$

Modem hardware compatibility offers some, but not all, the flexibility you may want

Shortcomings of hardware only design flexibility

- Fundamental differences between CDMA & GSM
  - Carrier Requirements
  - Internet Access
  - Over the Air Provisioning vs SIM Card
- Different Power On/Off sequences
- Limited to modem family

Utilizing the CCM software expands your design flexibility

- Intelligently manages:
  - Technology Differences
  - Different power on sequences before identifying the modem
  - Subtle behavior differences
- Not limited to product family or even manufacturer

4 Strategies for Defining an Effective Product Roadmap for Cellular M2M

Planning for Success occurs with a multi-phase roadmap strategy for your cellular-enabled products

Benefits of a Multi-Phase Product Strategy

Planning for Success occurs with a multi-phase roadmap strategy for your cellular-enabled products

Considerations for your cellular roadmap:

1) Define the scope of your initial product release
   - Both “In scope” and “Out of scope”
   - Use “Out of scope” features to populate requirements for later phases of product roadmap

Planning for Success occurs with a multi-phase roadmap strategy for your cellular-enabled products

Considerations for your cellular roadmap:

1) Define the scope of your initial product release
2) Consider Design Simplifications to Minimize Risk
   - Would an End-Device Certified Module fit within your cost and size specifications?
   - Would an external antenna be feasible for this application?
   - How could a software cellular management stack be implemented?

Planning for Success occurs with a multi-phase roadmap strategy for your cellular-enabled products

Considerations for your cellular roadmap:

1) Define the scope of your initial product release
2) Consider Design Simplifications to Minimize Risk
3) Design Now to Support Future Development
   - Adding Over-the-Air (OTA) software update capabilities
   - Leverage footprint compatibility offered by modem manufacturers

Planning for Success occurs with a multi-phase roadmap strategy for your cellular-enabled products

Considerations for your cellular roadmap:

1) Define the scope of your initial product release
2) Consider Design Simplifications to Minimize Risk
3) Design Now to Support Future Development
4) Focus on Your Expertise
   - Find a design services partner who has the depth of cellular experience needed
   - Complement the expertise and capabilities of your internal team

Planning for Success occurs with a multi-phase roadmap strategy for your cellular-enabled products

Considerations for your cellular roadmap:

1) Define the scope of your initial product release
2) Consider Design Simplifications to Minimize Risk
3) Design Now to Support Future Development
4) Focus on Your Expertise

Remember the most critical design consideration of all:
“Will our solution meet and exceed our customers’ expectations?”

Want to learn more?

Please download and share our free e-Book, **“Mind the Map: Creating a Product Roadmap for Cellular M2M Integration”**

http://www.lsr.com/services/cellular-m2m-services

Questions and Answers