



## ***SDR BGAN - Combining Software Defined Radio Technology and Satellite Communications***

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# Agenda

- Who is Inmarsat?
- The Inmarsat BGAN Network
- Combining Software Defined Radio Technology and Satellite Communications
- Who is GateHouse?
- Realizing SDR BGAN
- Summary



# Who is Inmarsat?

# Who is Inmarsat?

## ➤ Leading Provider of Global Mobile Satellite Communications Services

- Established in 1979 as an international co-operative and privatized in April 1999
- Voice and high speed data for maritime, aeronautical and land mobile users
- Delivers its communication solutions through a worldwide network of over 450 distributors and other service providers in over 80 countries to end users in the maritime, land and aeronautical sectors

## ➤ Global Provider of Safety Services

- Maritime (GMDSS) and Aeronautical

## ➤ Satellite System Procurement & Operations

- More than 25 years of experience in designing, implementing and operating satellite networks
- Global coverage with eleven in-orbit satellites.

# Core Business Markets

## Maritime



- ➔ 177,000 terminals
- ➔ Sole provider of GMDSS
- ➔ Drivers: ship management and automation, crew welfare, new ships
- ➔ Key service: FleetBroadband, simultaneous voice and data up to 492kbps

## Land Mobile



- ➔ 80,000 terminals
- ➔ 60-65% government business
- ➔ Drivers: government/military activity, aid agencies, media on-the-spot reporting
- ➔ Key service: BGAN, voice and data up to 492kbps
- ➔ New global handheld satellite phone service launched in June 2010

## Aeronautical



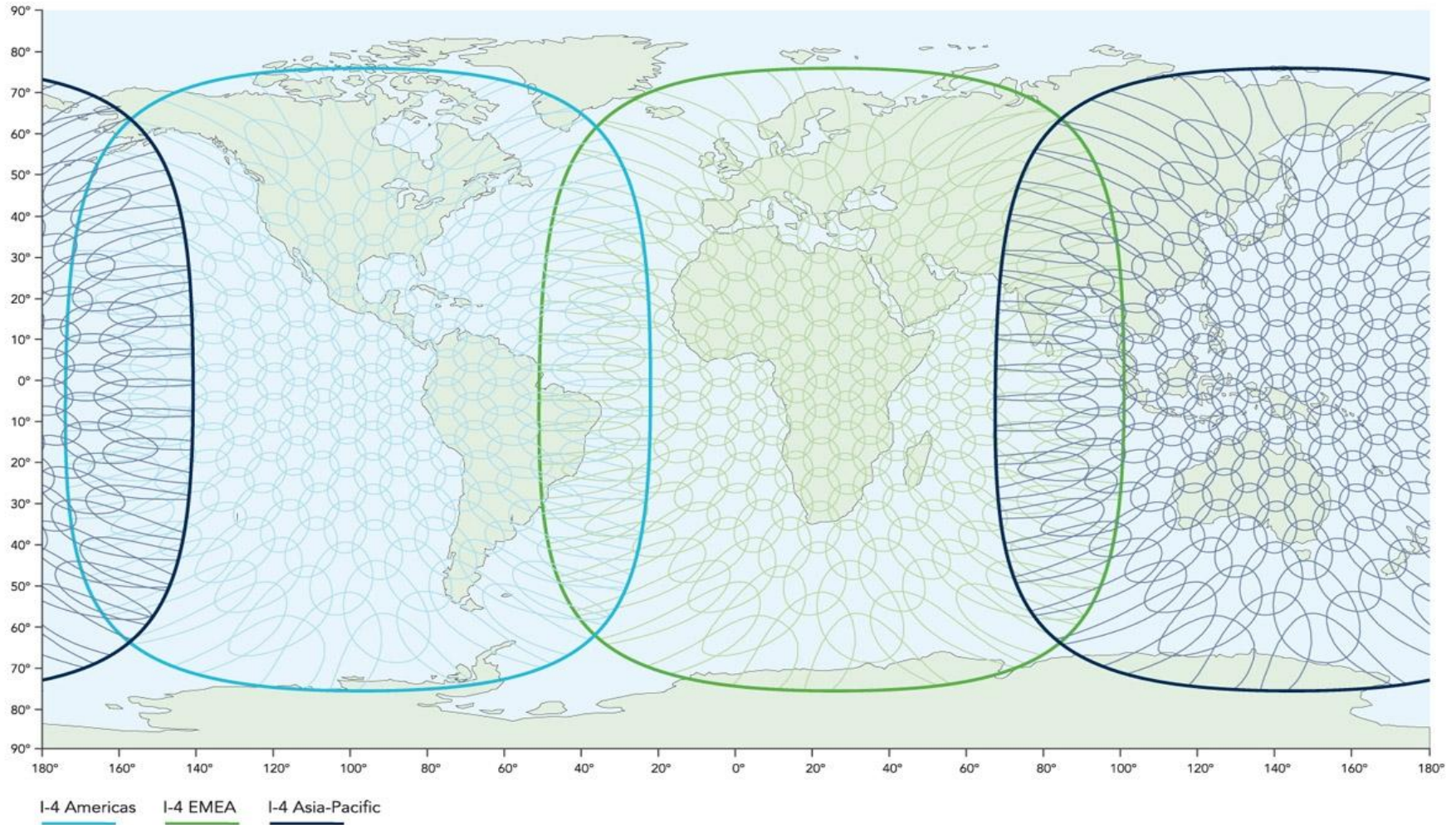
- ➔ 11,700 terminals
- ➔ 65-70% government business
- ➔ Drivers: large government aircraft, large business jets
- ➔ Key service: SwiftBroadband, simultaneous broadband data up to 492 kbps and voice – rapidly building market acceptance



# The Inmarsat BGAN Network



# I-4 Global Coverage



# BGAN Family in a nutshell...



Worlds 1st mobile communications service to offer:

Broadband data (up to half a megabit) plus voice.

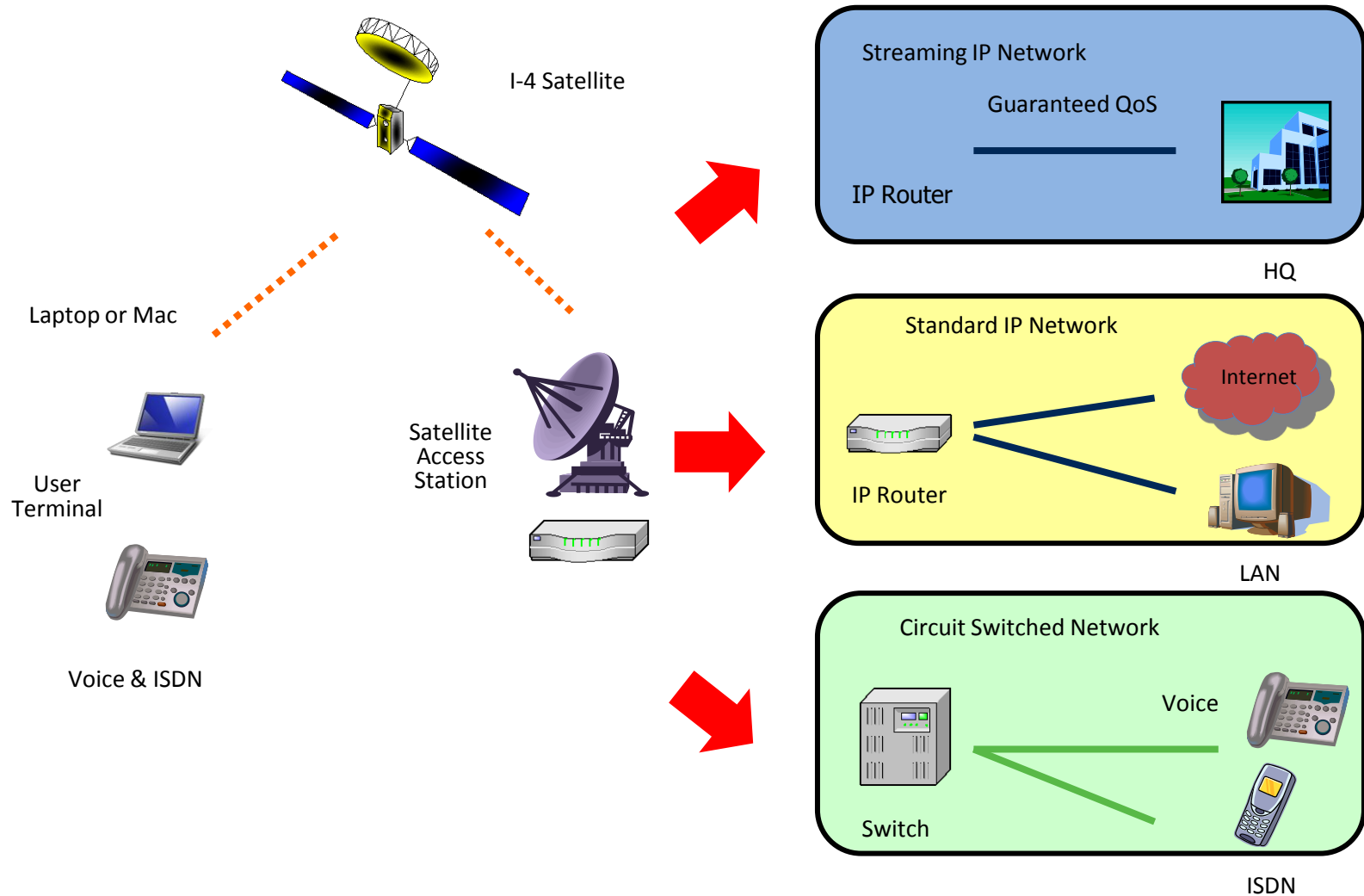


Accessible simultaneously through a single compact device with guaranteed data rates on-demand.

Available worldwide.



# BGAN: One device, three networks



# BGAN Mobile Terminals

## BGAN Baseline

### Portable



## BGAN Extension

### Aeronautical



### Maritime



### Land-vehicular





# Combining Software Defined Radio Technology and Satellite Communications

# Integrating the Communications Platform

- Communications systems and networks have been historically inflexible
  - Functionality heavily dependent on hardware
  - Limited interoperability
  - No upgradeability
- And satellite communications have been no exception!
  - “Too different” from terrestrial systems
  - Highly customized hardware and network features\
- SDR can bring satellite waveforms and network functionality to the realm of terrestrial networks.

# JTRS Study Case

- The Joint Tactical Radio System (JTRS) program hosts a family of SDR based waveforms
  - Primary focus on supporting line-of-sight (LOS) network applications
  - VHF, UHF
  - The Mobile User Objective System (MUOS) is the only currently envisioned beyond line-of-sight (BLOS) supported waveform (US DoD funded)
- The introduction of SDR BGAN to the JTRS portfolio will bring **global** BLOS capability to JTRS users, enabling
  - Better interoperability
  - Greater flexibility
  - Streamlined operations for the end user
  - Lower ownership and operational costs



- Voice
- ISDN
- Broadband IP data







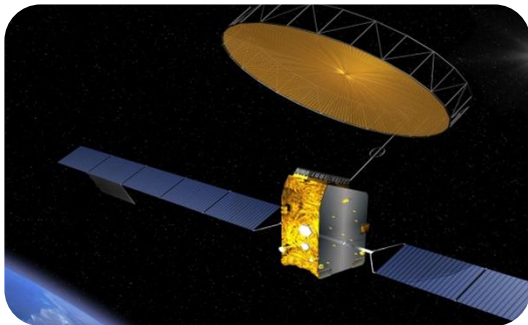
GateHouse

## Who is GateHouse?

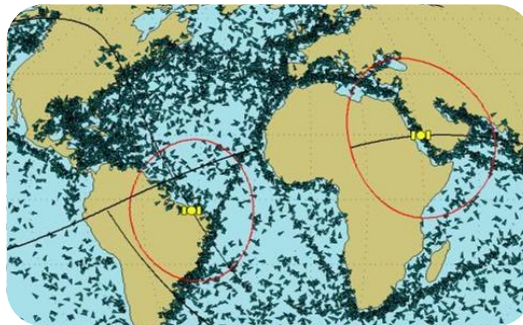
# Who is GateHouse?

- ➔ Embedded software and system integration company
- ➔ Founded in 1992, privately owned
- ➔ Located in Nørresundby/Aalborg, Denmark
- ➔ Main markets: B2B and government/military
- ➔ 3 business areas

## Satellite Communication



## Tracking & Monitoring



## Defence Consulting



# GateHouse Satellite Communication

- Focused on terminal software for Inmarsat's satellite services
- Expert knowledge within Inmarsat's BGAN system
- More than 100 man-years accumulated BGAN satcom experience
- BGAN software supplied to more than 90% of BGAN user terminal manufacturers
- >20 BGAN products currently type approved with GateHouse IPR
- Test tools to help customers decrease test costs and prepare for efficient Inmarsat approval process



GateHouse

# Realizing SDR BGAN

# Realizing SDR for BGAN

- Inmarsat contract with GateHouse to develop a complete, fully Inmarsat compliant, BGAN waveform
  - Covers all BGAN service classes (Land, Maritime, Aeronautical)
  - Development complete – waveform compliant with BGAN requirements
  - Available for porting into products
  - SCA compliance upgrade ongoing (2.2.2)
- Form basis for a range of BGAN products in Government/ Defence/ Military markets
- Northrop Grumman is committed to porting the BGAN waveform onto their SDMD platform (Software Defined Multi-Function Device)
- First product anticipated during 2013



# BGAN SDR reference design

- Developed using the Spectrum SDR-4021 platform
- Based on solid BGAN experience
- Tested to work on the Inmarsat I-4 satellites
- Available for manufacturers as a reference



# Challenges experienced

## > Complex waveform with multiple services

- Combined with advanced and optimized ACM air interface
- Combined with several terminal configurations

## > Implementation tradeoff considerations for each module

- Performance vs. development effort vs. platform requirements
- Hardware acceleration: VHDL takes 10 times longer to implement and verify than C code

## > Third party source code

- Difficult to shape
- Makes waveform distribution complicated (IPR issues)

# The road to BGAN SDR

- BGAN waveform readily available from GateHouse (including a reference platform and complete test setup)
- Basic requirement: an L-band modem platform
- Complete BGAN SDR must be type approved by Inmarsat
- Porting and Inmarsat type approval effort can be undertaken by manufacturer or GateHouse
- Estimated porting and approval completion time: 12-24 months depending on
  - Platform maturity
  - Porting resources
  - Special requirements

# Summary

- SDR BGAN combines the flexibility and scalability potential of SDR with the robustness and global reach of BGAN
- Reliable BLOS voice and data communications capability on-the-move, on-the-pause, on land, air and water
- Waveform available for porting projects now!!
- First introduction to the military market in collaboration with Northrop Grumman
- Any terminal manufacturer with an L-band modem SDR platform can develop a BGAN SDR product
- Time and cost efficient road to BGAN SDR

# Thank you for your attention!

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