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EXPLORING WATER'S DEPTHS

12-15 MAY | LAUNCESTON, TAS

AUSTRALIAN HYDROGRAPHERS ASSOCIATION

Direct to Cell
Direct to Device
Satellite via your Cell phone

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Direct to Cell &Direct to Device

Enabling Cell Phone to Satellite Connectivity

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What is Direct to Cell/ Direct to Device?

Direct to Cell & Direct to Device

Direct-to-device connectivity is a new technology which allows everyday devices:

- like mobile phones, smart watches, or cars
- industrial machinery and transport operators
- Telemetry users

to connect seamlessly to both terrestrial and satellite coverage.

Who invented it / who is promoting it?

The 3GPP Group “invented” / Set Standards for it

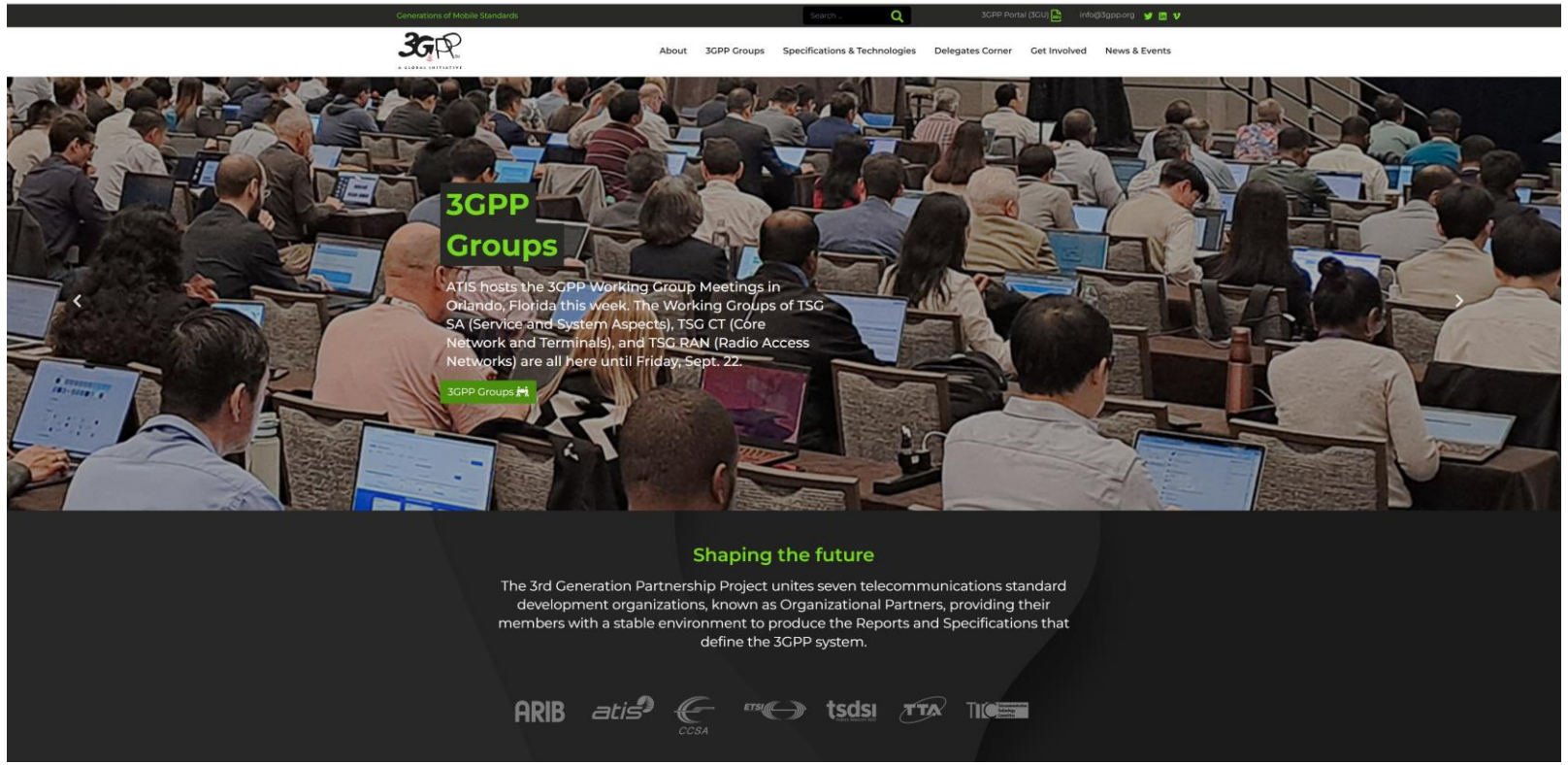
The major players promoting and developing systems based on it:

- ViaSat / Inmarsat
- Starlink (they call it Direct to Cell)
- Apple/ Globalstar
- Others.

What is the 3GPP?

- The 3rd Generation Partnership Project (3GPP) is a consortium with seven national or regional telecommunication standards organizations and a variety of other organizations.
- They are key players in the telecommunications ecosystem with the primary goal of developing mobile communications protocols.
- They define standards for cell phone components / modem manufacturers.

What is the 3GPP?



The 3GPP Release 17 Non-Terrestrial Networks (NTN)

What are the key features of Rel-17?

One of the primary characteristics that distinguishes it from previous ones is the support for non-terrestrial networks (NTN) such as satellites or high-altitude platforms.

NTN capabilities introduced in Rel-17 enable 3GPP protocols for broadband (NR protocol) and for massive IoT (NB-IoT and eMTC) to be used for satellite communications.

NTN capabilities are considered pivotal to help meet the increasing demand for connectivity in remote and underserved areas where traditional terrestrial networks may not be available.

Who is Skylo?

Perhaps the most important piece of the puzzle!

Skylo Technologies is a satellite network service provider based in Palo Alto, CA, offering a hybrid capability that allows off-the-shelf, NTN-capable cellular chipsets and devices to connect directly over existing satellites.

Devices connected over satellite are managed and served by Skylo's commercial NTN vRAN, featuring a 3GPP standards-based cloud-native base station and core.

Skylo works with existing satellite operators, terrestrial mobile network operators, and device makers to provide subscribers an anywhere, anytime connectivity solution that seamlessly roams between terrestrial and satellite networks.

Who are building Cell Phone Modems to support Direct to Device

ViaSat Position

- ViaSat is leading innovation within the ecosystem, and along with its partner Skylo, was first to launch a global D2D network. Working with our partners from MNO, chipset, and module manufacturers, to OEM and IoT solution providers, we are rapidly developing new services that use D2D technologies to make universal connectivity possible.
- Additionally, we are a founding member of the Mobile Satellite Services Association (MSSA), a non-profit industry association that seeks to advance global mobile connectivity for Direct-to-Device (D2D) and IoT services.
- At ViaSat, we are thrilled to lead the charge in new D2D connectivity solutions that merge satellite and terrestrial technologies. Our partnership with Skylo is set to transform connectivity for industrial IoT, consumer devices, and vehicles everywhere, promoting seamless communication even in the most remote areas.

Quote - Andy Kessler,
ViaSat - Vice President,
Enterprise and Land Mobile

Viasat™

Starlink Position

- On January 2, 2024, we launched to orbit our first six Starlink satellites with Direct to Cell capabilities. Launch and early tests of the technology were all completed without issue. On Monday, January 8, less than 6 days after launch, we sent and received our first text messages to and from unmodified cell phones on the ground to our new satellites in space using T-Mobile network spectrum.
- This ***validates that our link budget closes***, and the system works! The top six Direct to Cell Satellites stacked and ready for launch. The Direct to Cell network will expand Starlink's vision by providing ubiquitous connectivity and seamless access to text, voice, and data for LTE phones and devices across the globe. Text service begins this year, followed by voice, data, and Internet of Things (IoT) services in 2025.

STARLINK

Apple / Globalstar Position

- Apple uses the Globalstar Network to provide emergency SOS via Satellite.
- The service is free for two years. Beyond that, Apple hasn't shared how much it will cost or if there will actually ever be a charge to access the feature.
- Apple's $1.5 billion deal with Globalstar will change direct-to-device satellite game, says GlobalData.
- Following the news that Apple plans to invest $1.1 billion in satellite communications company Globalstar alongside a further $400 million for a 20% equity stake in the business;
- This is arguably the largest and most significant consumer OEM low Earth Orbit (LEO) deal to date, and the arrangement puts Apple in a clear leading position among western OEMs for extended direct and mass-market voice satellite texting and even calling services for both emergency and remote use cases.

Globalstar

Four service use cases to consider for Direct to Device

Case 1	Case 2	Case 3	Case 4
• Send SOS/ 911/ 000 emergency messages via satellite	• Send normal text messages via satellite	• Send message-based telemetry messages, like Iridium SBD Satellite & Lora	• Send normal but smaller IP telemetry messages via satellite

Message Based Services

Messages are easier, it is like a normal SMS, you get the message and consider the message and respond in an hour or a day

- They are short and require less power
- They can be long latency, no problem if it takes a minute to send
- Iridium SBD and Lora have been doing short messages for years
- Message efficiency is higher with messages. Less acknowledgement packets
- General utility is lower because most systems expect full IP communications

Full IP Packet Services

Sending full IP packet Messages is harder to do, it is a conversation between two parties, it needs to be an ongoing conversation in real time

- The TCPIP protocol expects acknowledgements in 1 to 10 seconds
- Full IP expects packets are generally 1KB size and latency of 1 to 10 seconds
- Message efficiency is lower with Full IP Packet services
- Utility and operability is better with Full IP Services because most systems use Full IP

Likely outcome for D2D?

- Most Message Services should work
- Some Full IP Services may work, but packet sizes will be smaller
- Don’t expect to stream videos over Direct to Device Services
- Some applications are ideal for smaller packet capacity services, Groundwater for example
- Perhaps Apple / Globalstar will become dominant?
- Perhaps Starlink will become dominant?
- Perhaps ViaSat will become dominant?

Globalstar STARLINK Viasat

Key Issues

Satellite Link Margins- Transmit Power & Distance

- Equatorial Satellites are 50,000kms away from earth. They are large and their transmit power is high, but there is a lot of signal loss along the way and the round trip for data is about half a second.
- Low Earth Orbit Satellites are about 1000kms away from earth. They are small and their transmit power is low, but they have less signal loss. They are closer, so the round trip for data is about a tenth of a second.
- Sending and receiving data is all about having a good link margin and a low data latency, and perhaps Low Earth Orbit Satellites are more likely to dominate in this sector.

Key Issues

Regulatory Environment

- Telecommunications is regulated around the world
- How can this new technology live within the regulatory environment?
- Who will enforce the regulations?
- The old model of licensing across country borders seems outdated now
- Anyone can take a Starlink satellite system into any country, who can stop them
- See The link below

Starlink satellites posing cyber security and regulatory concerns

Key Issues

Commercial Sustainability

- Telecommunications companies need to make a profit to be sustainable.
- How can they be sustainable when services are at a much lower price.
- They need to sell millions of services to achieve reasonable profitability.
- Many years ago, the industry believed that satellite phones would make ordinary cell phones obsolete. They did not, and many satellite companies went broke.

Thank You

"We know Comms / Telemetry / IoT, well!"