Dissemination of Real-Time and Post-Mission value added GNSS data – A Global Operator's Perspective

Noor Raziq – GNSS Network Manager Australia

The Fiji GNSS CORS workshop

18 – 20 September 2018

- when it has to be **right**

Leica Geosystems

HEXAGON

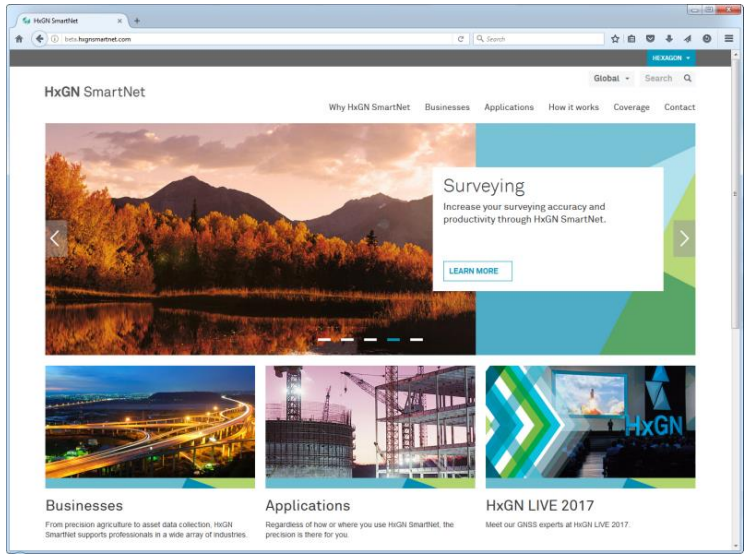
Outline

- HxGN SmartNet
  - Introduction
  - How do we do it in Australia
  - Real time and post processing GNSS data dissemination

- Fiji CORS
  - What do we have and where to
  - How to do it in Fiji and Pacific
    - Importantly how not to do it
- HxGN SmartNet Operations
  - Hands On Demonstration
    - Later in the session

HxGN SmartNet – Correction Service

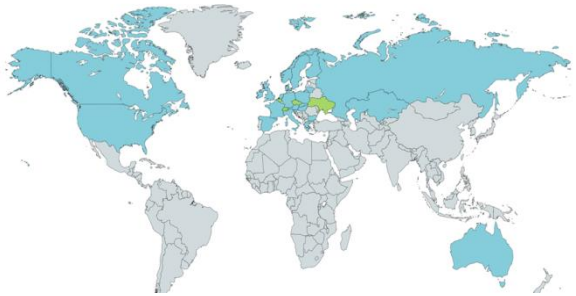
- Cloud based service to provide **centimeter-level** accuracy to GNSS rovers via mobile internet **in seconds** with **24/7/365 availability**
- Largest network with over 4,500 Reference Stations world-wide available in 22 countries is providing **Open Standard GNSS correction** for RTK positioning
- Over 11 years experience in the correction service market with a globally experienced team



HEXAGON

Evolution to HxGN SmartNet

From single base solution to a world-wide network correction services build on technology from Leica Geosystems



- 2000 | 2001 - 2005 | 2006 - Today | Future

SmartNet
powered by Leica Geosystems

HEXAGON

HxGN SmartNet Applications & Businesses

Land Surveying

Agriculture

Machine Control & Construction

GIS

Utilities

UAV

Automotive

Agriculture

Logistics

Telecoms

Asset Data Collection

IoT Applications

HEXAGON

HxGN SmartNet: Commercial Service Offering

Commercial service offering differs from country to country (market driven)

B2C offering

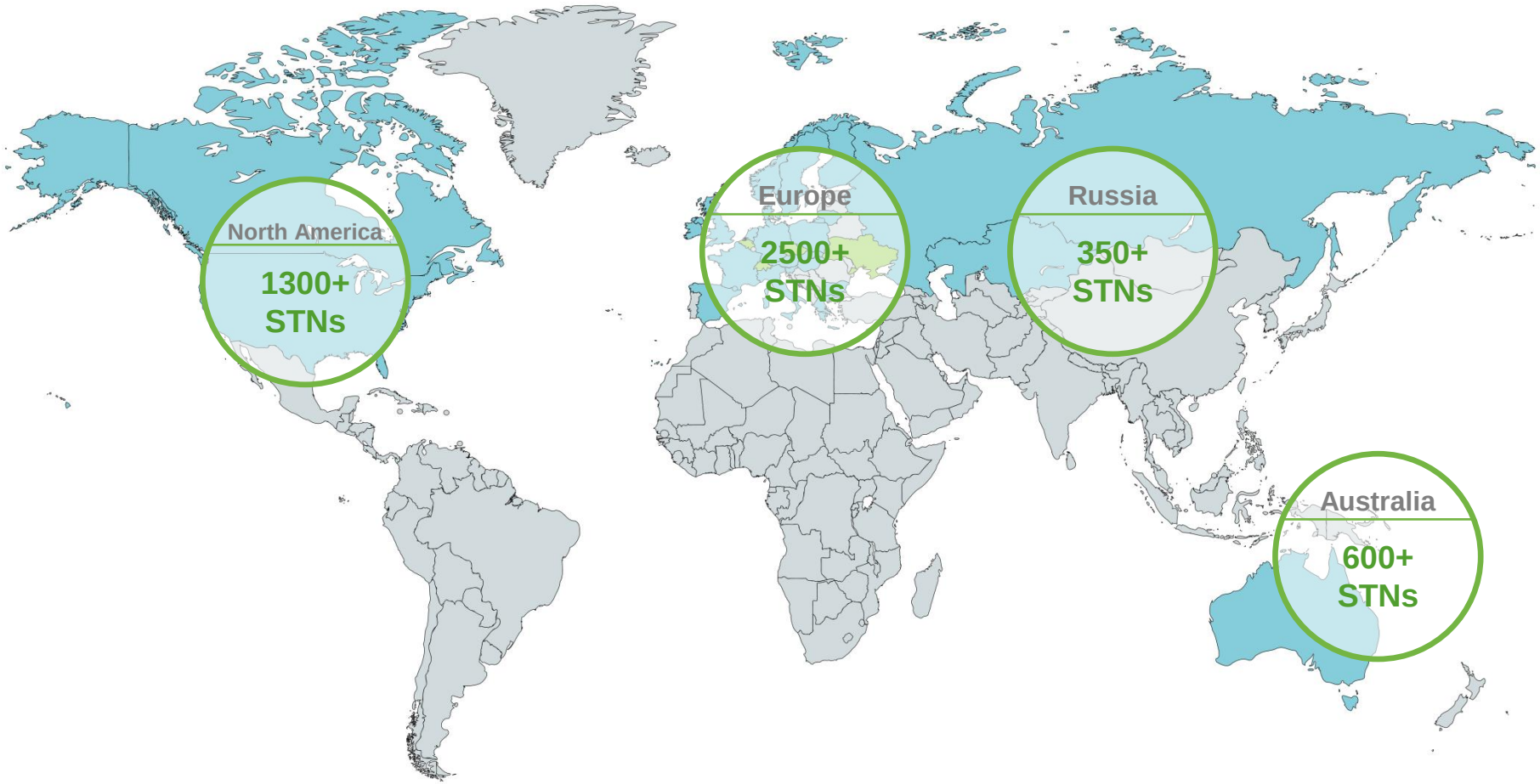
- Real time correction data streams as
  - Flat rate subscription
  - Consumption-based subscription
- Download of post processing products (RINEX files, Online Post-Processing, etc.)
- Mobile app and web page access

B2B offering

- Enterprise subscription models (Consumption or based on the number of users)
- Integration of API for automation of subscription administration
- Integration of API for post processing automation (using X-pos technology)

HEXAGON

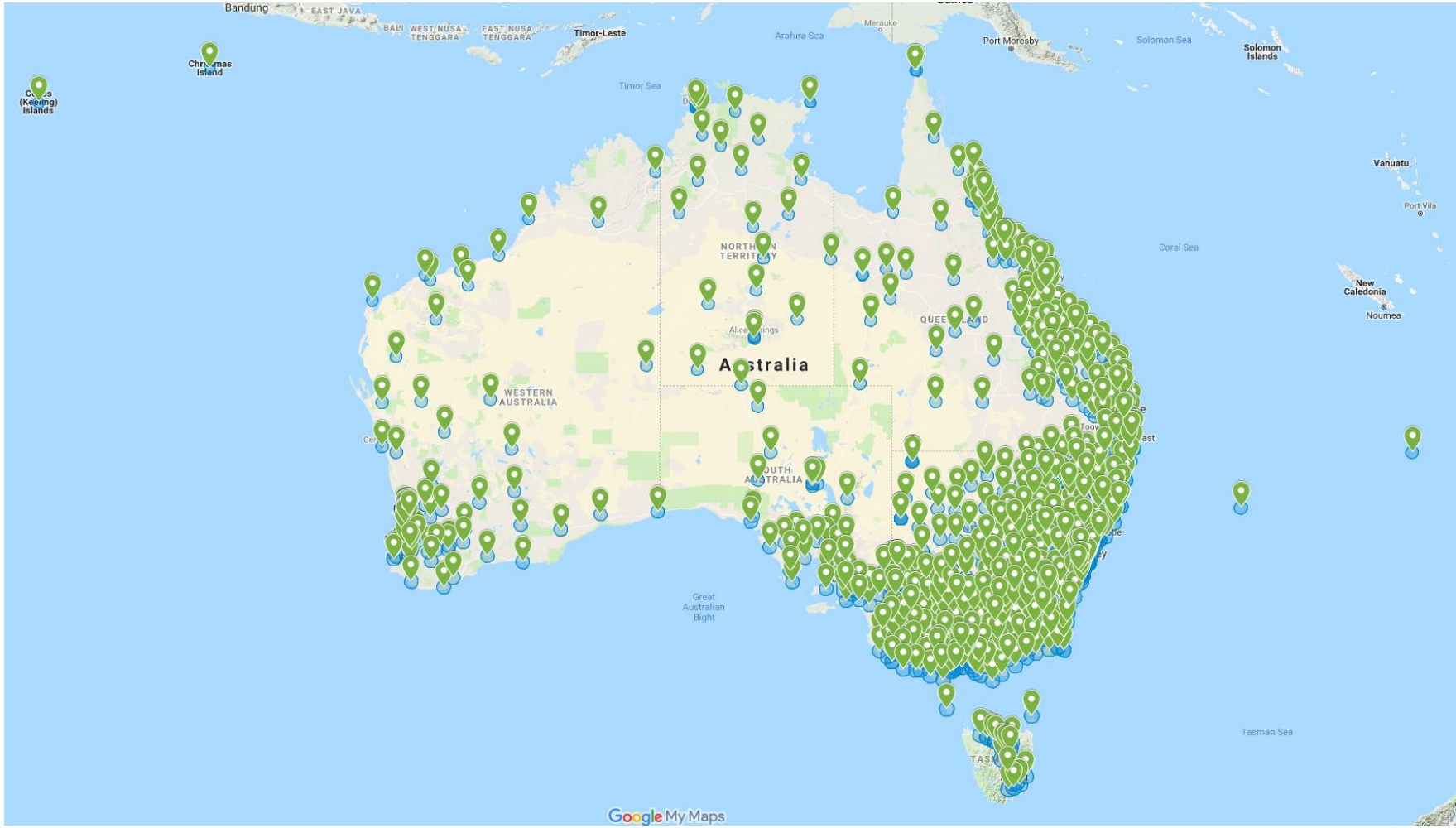
Correction Service on a worldwide scale build on over 4,500 reference stations



HEXAGON

HxGN SmartNet - Australia

- Largest provider of CORS service (630+) in Australia since 2009.



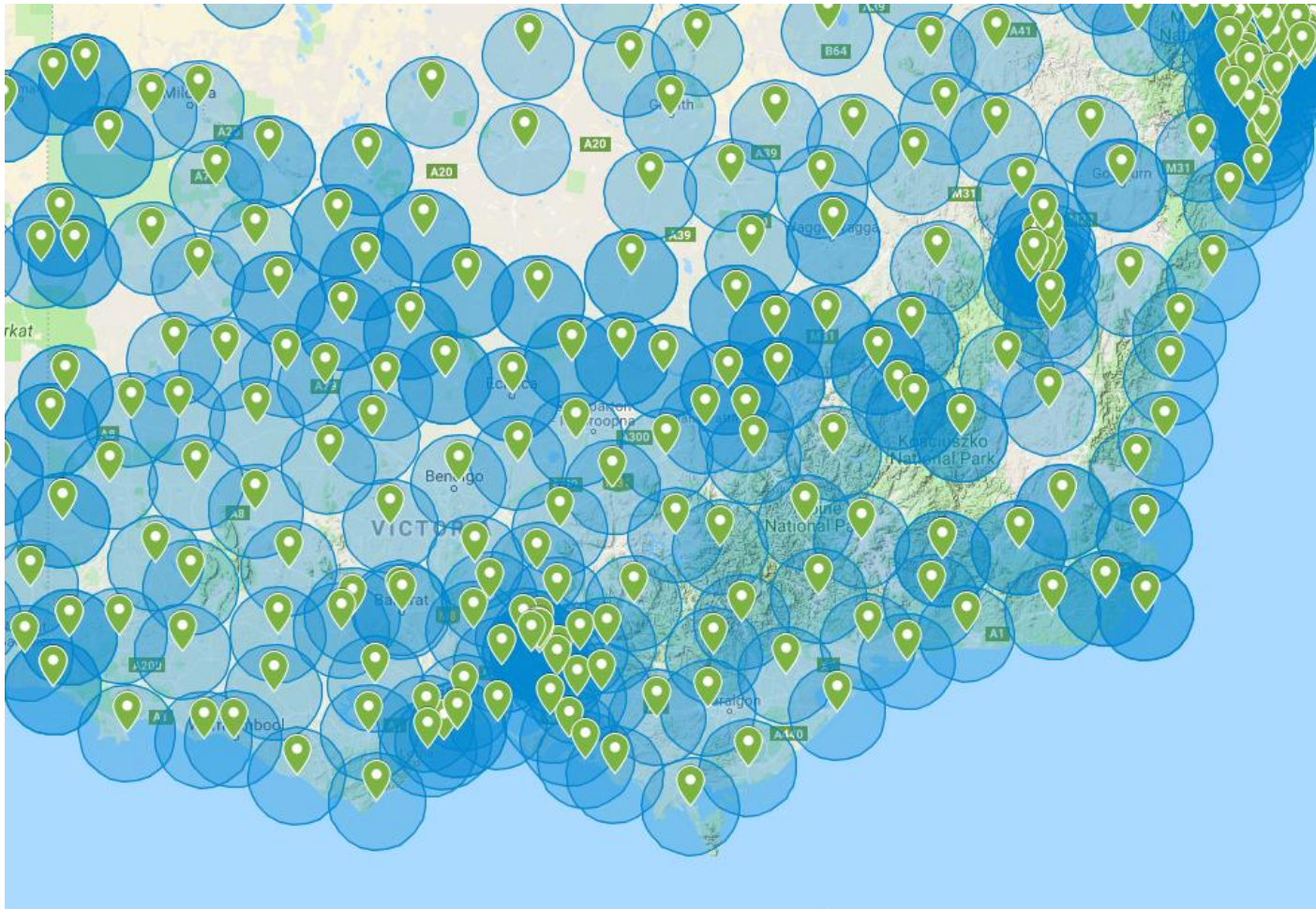
HEXAGON

HxGN SmartNet - Australia

Department of Environment, Land, Water & Planning

State Government Victoria

- Coverage – Victoria (122 sites)
  - Agreement with DELWP VIC = 114
  - GA = 1
  - HSN = 7
  - Integration of cross-border sites (SA & NSW)



HEXAGON

HxGN SmartNet - Australia

- Coverage – New South Wales (216 sites)
  - DFSI-SS = 180
  - GA = 11
  - HSN = 25
  - Continuous coverage from SA and VIC through to QLD

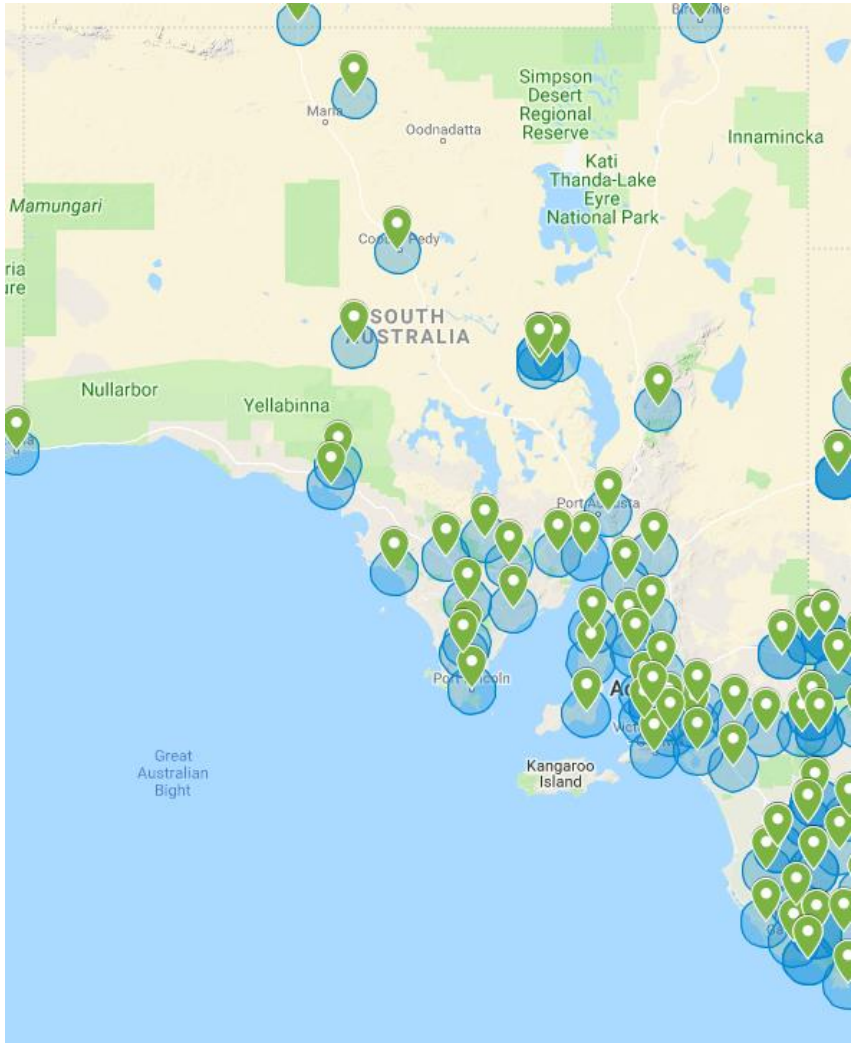
HxGN SmartNet - Australia

- Coverage – Queensland (143 sites)
  - GA (DNRME) = 35
  - HSN = 108
  - SE QLD, Fitzroy Basin, Townsville, Mackay & Cairns
  - Unparalleled coverage

HEXAGON

HxGN SmartNet - Australia

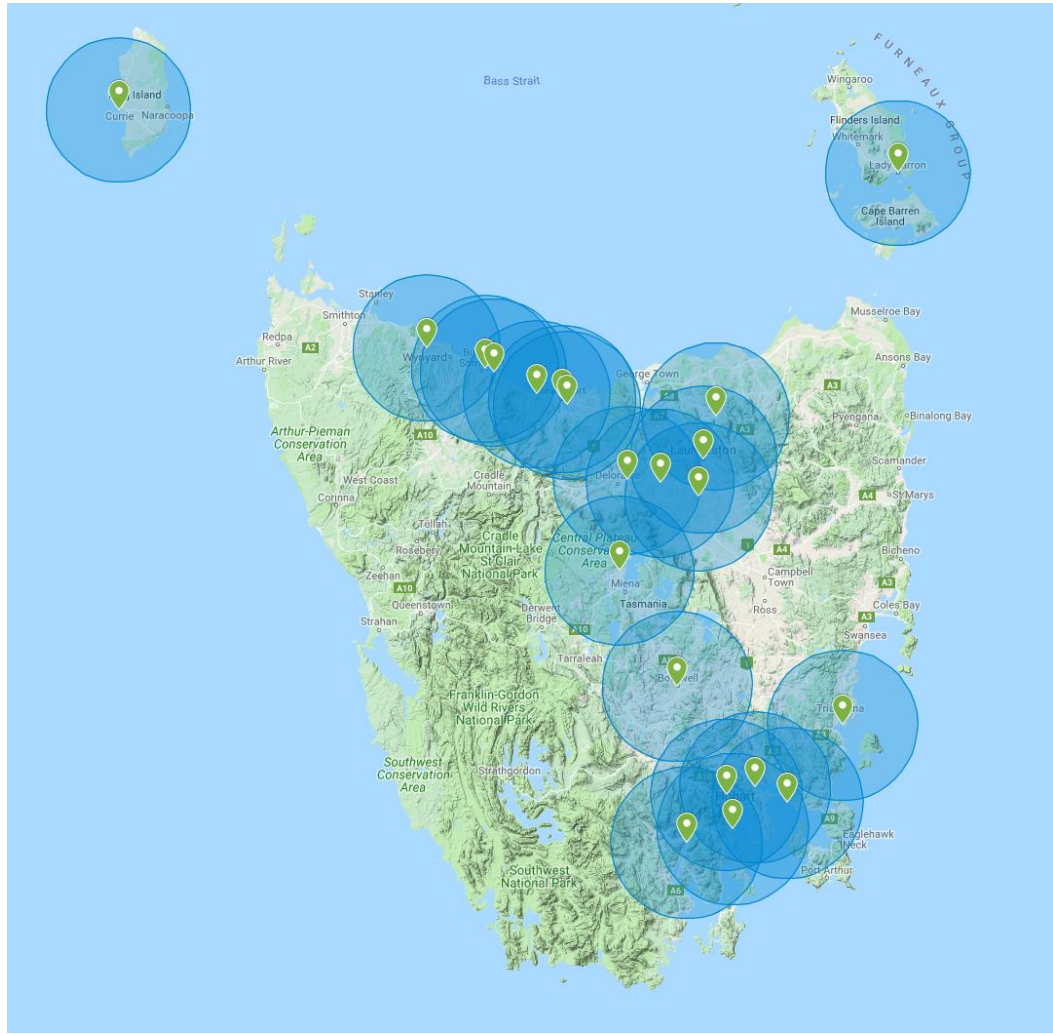
- Coverage – South Australia (48 sites)
  - GA = 11
  - HSN = 37
  - Coverage is expanding
  - Offer cross border service – SA & VIC



HEXAGON

HxGN SmartNet - Australia

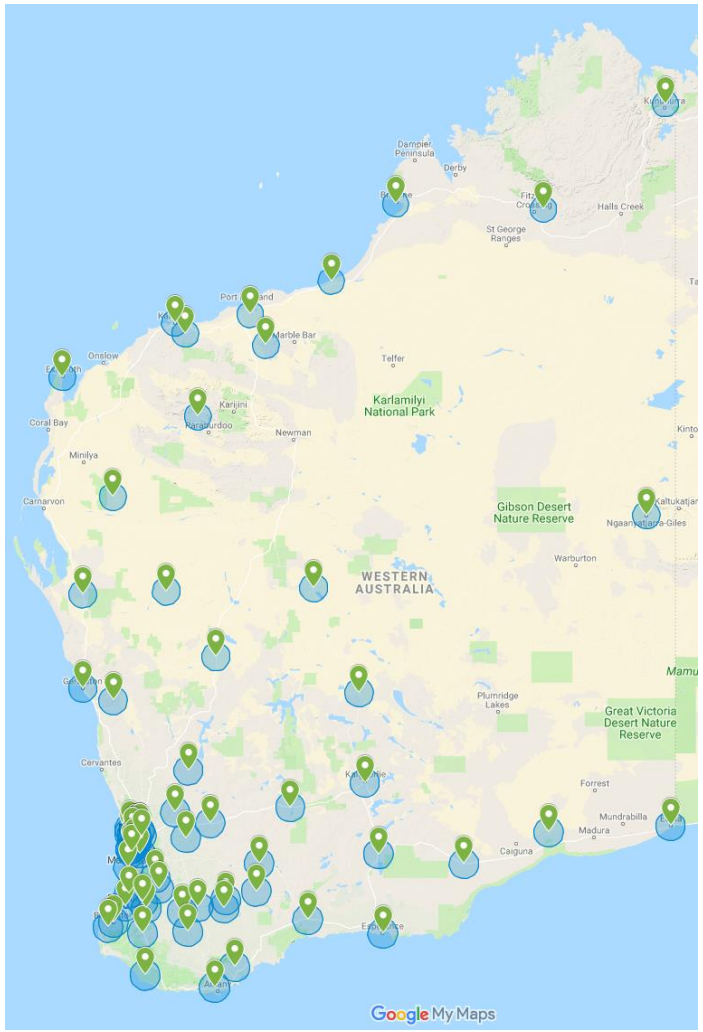
- Coverage – Tasmania (21)
  - GA = 9
  - HXN = 12
  - Predominately Ag usage in North
  - Plans to expand coverage between the main towns

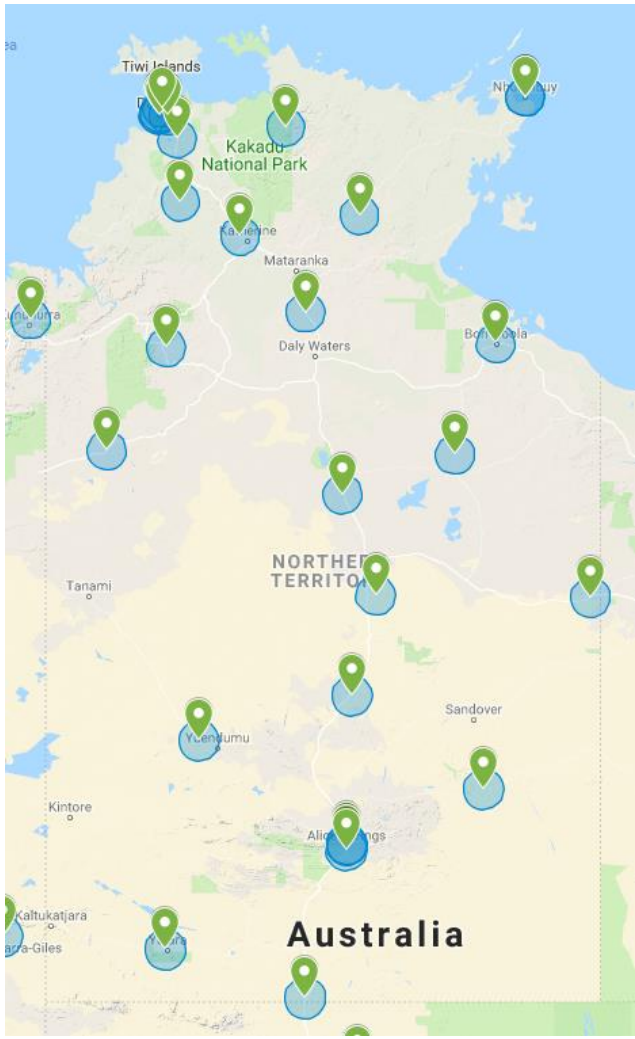


HEXAGON

HxGN SmartNet - Australia

- Coverage – Western Australia and Northern Territory (92 sites)
  - GA (Land NT + LandGate) = 55
  - HSN = 37
  - Coverage is growing
  - Focus on expansion around metro Perth

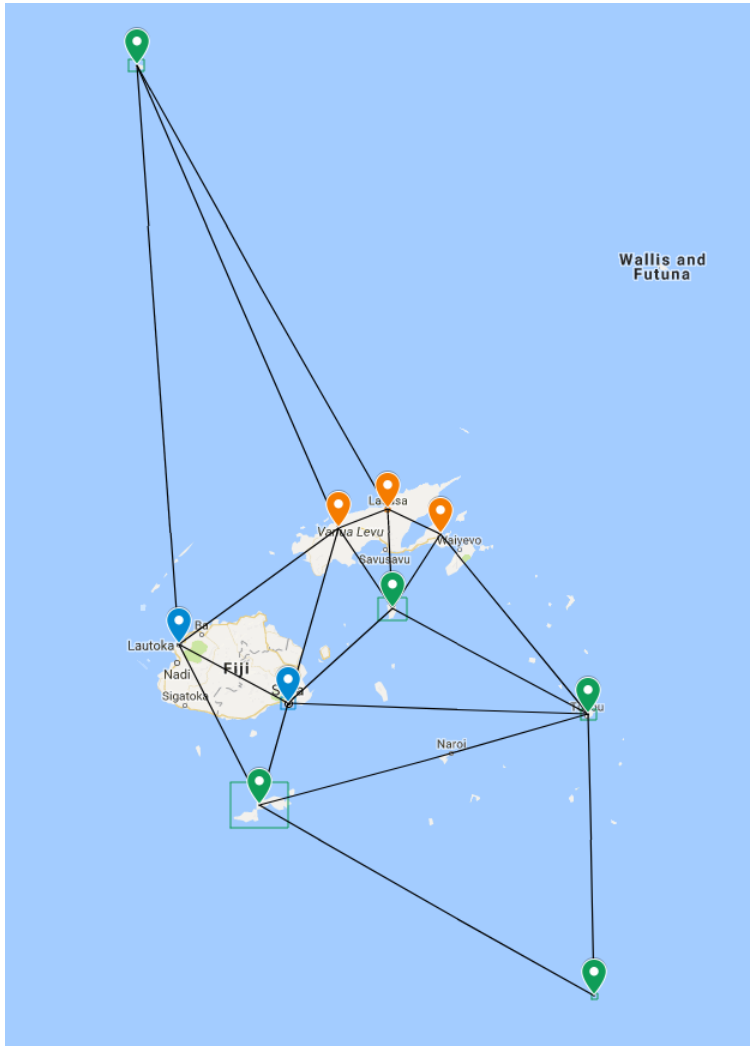




HEXAGON

Fiji CORS Network

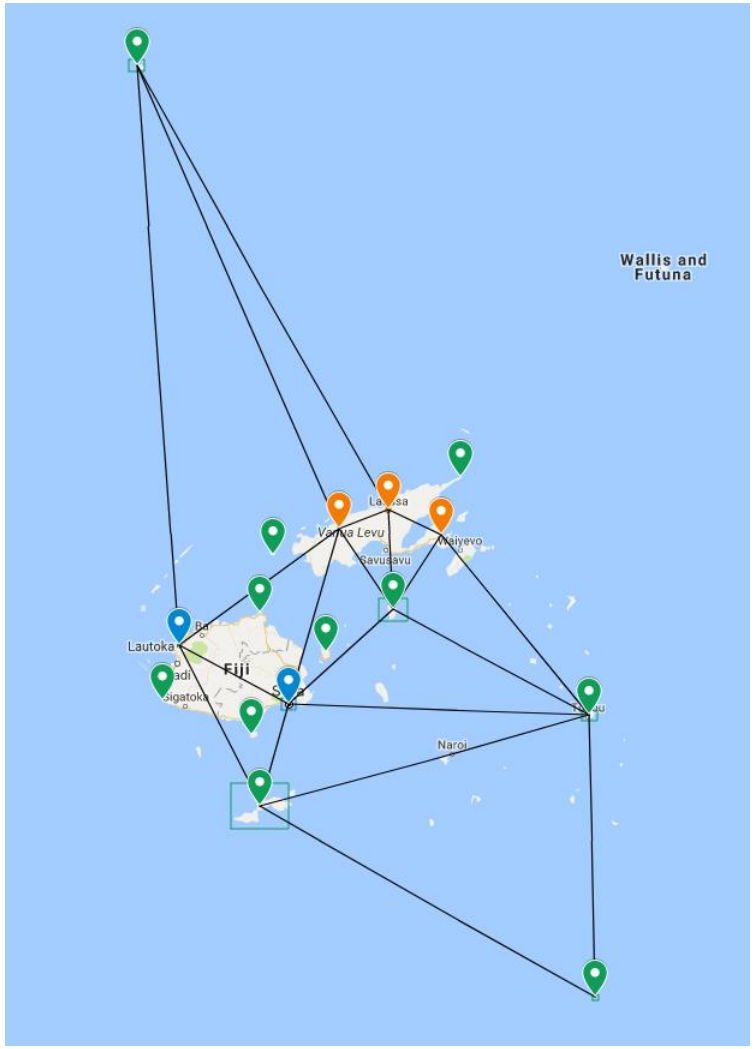
- Current Network – Base Stations
  - Geosciences Australia / South Pacific Community Sites
    - LTK
    - SUV
  - High Target Sites
    - LAB
    - TAV
    - NAB
  - Leica Geosystems
    - ROT
    - KOR
    - KDV
    - LAK
    - ONO



HEXAGON

Fiji CORS Network

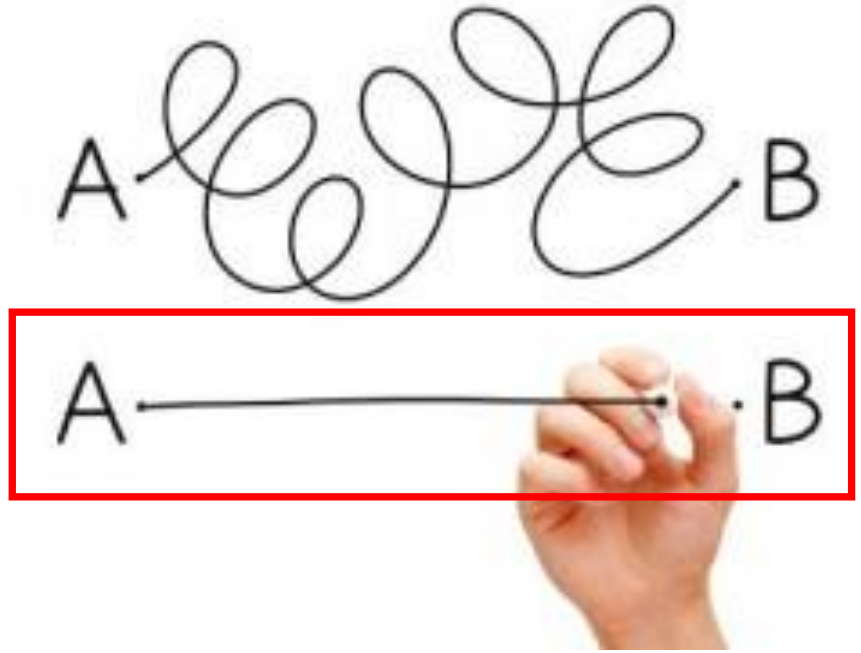
- Future
  - Base stations currently being installed
    - More Base Station
    - Upgrade of stations
  - Networking Software Installation and Operation
    - What software
  - Public Private Partnership
    - Business model
  - Expected adoption by the industry / private and public sector
    - Operation and maintenance



HEXAGON

GNSS Data Dissemination

- Seems simple
  - Get data from base stations
  - Provide to end users

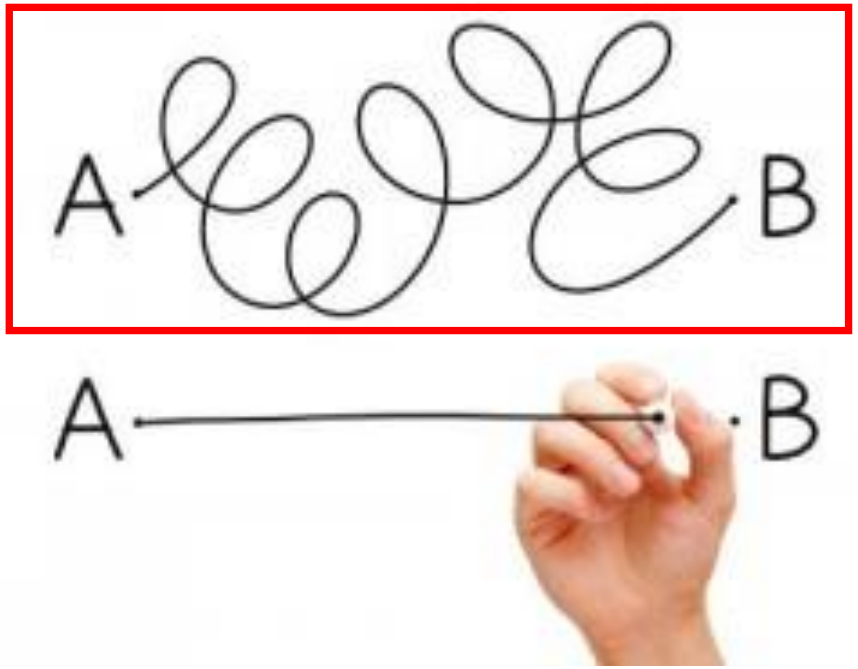


HEXAGON

GNSS Data Dissemination

- Extensive Network
  - 630+ sites
- Range of Users
  - Different applications
    - Agric
    - Survey
    - Machine Control
    - UAVs
    - Utilities finding
    - PPK users
  - Different work areas
    - State
    - National

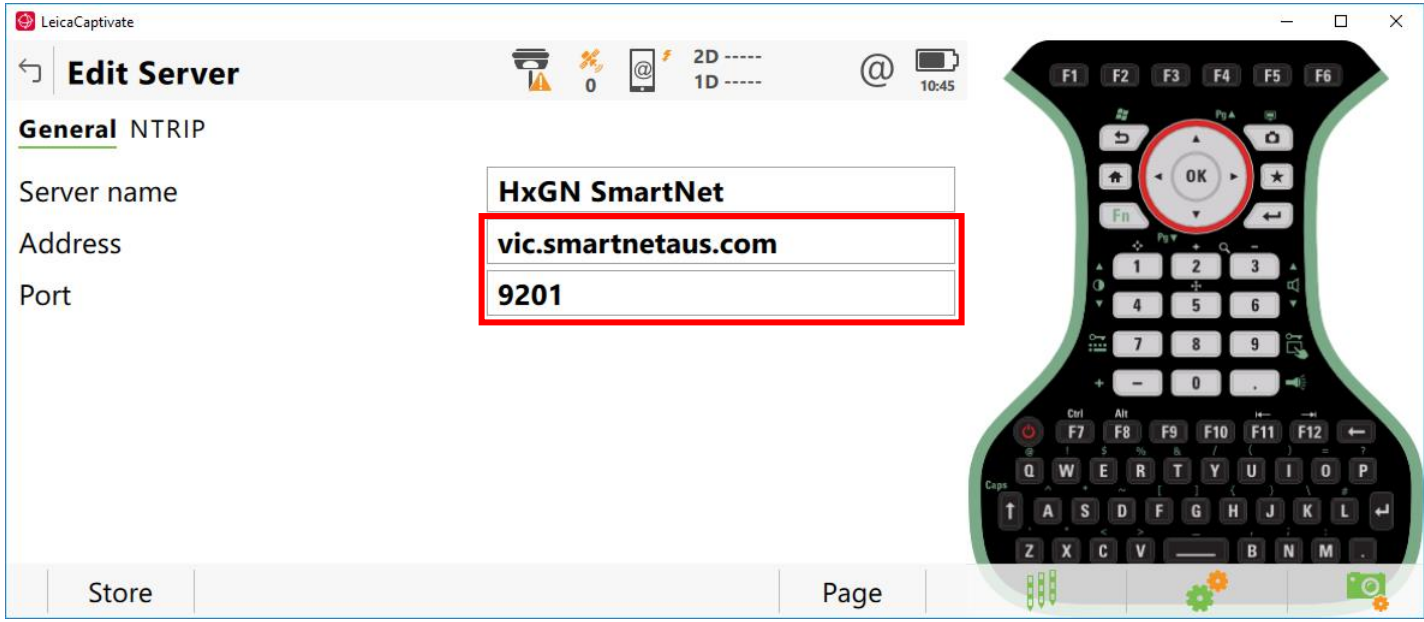
- Real Time Data
  - Most users
- Post Processing Data
  - PPK users
- Processing Methodology
  - Network
    - MAC
    - VRS
    - FKP
    - SSR
- GNSS
  - GPS only
  - GPS+GLONASS
  - Everything
- Datums
  - GDA94
  - GDA2020



HEXAGON

Real-Time Data Dissemination

- Application Based Division
  - Survey and everything else except some GIS
  - Agric
  - Some GIS

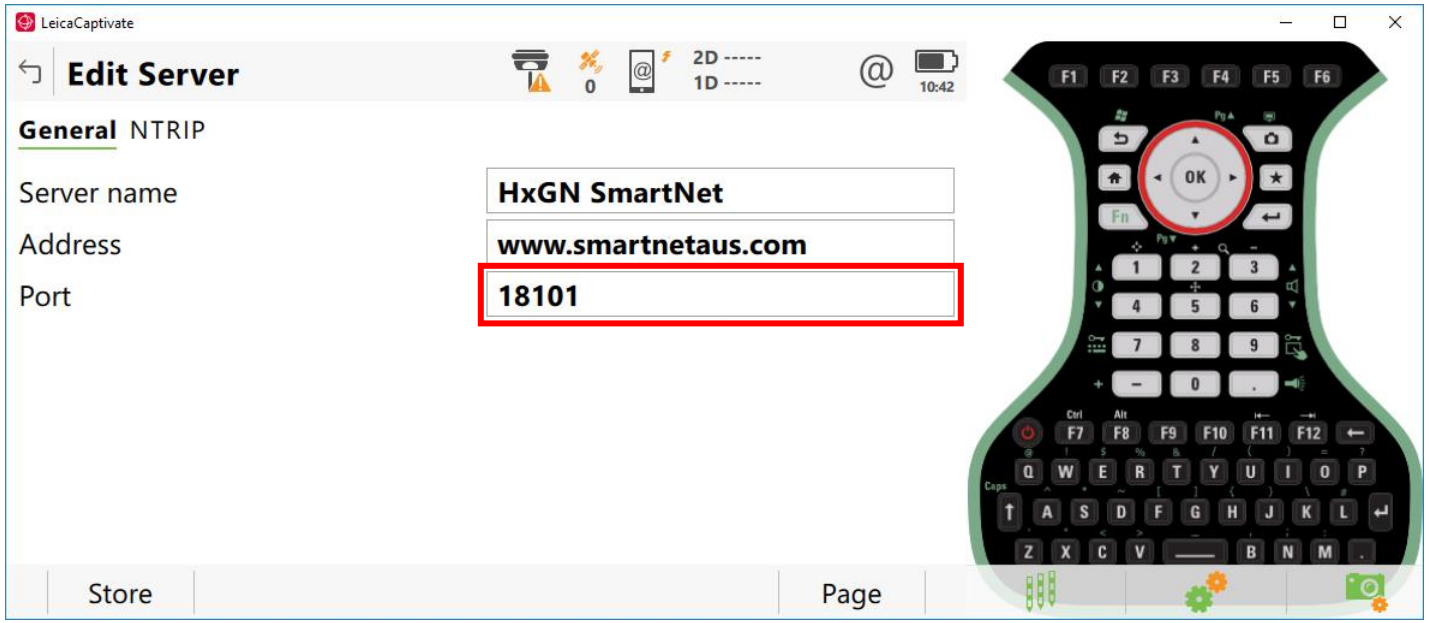


HEXAGON

Real-Time Data Dissemination

- Geographic Based Division
  - Single State License => Following Post Code
    - Most users
      - NSW
      - VIC
      - QLD
      - SA
      - WA
      - TAS
      - NT
  - National License
    - Some users
    - Will need to change port number when move states

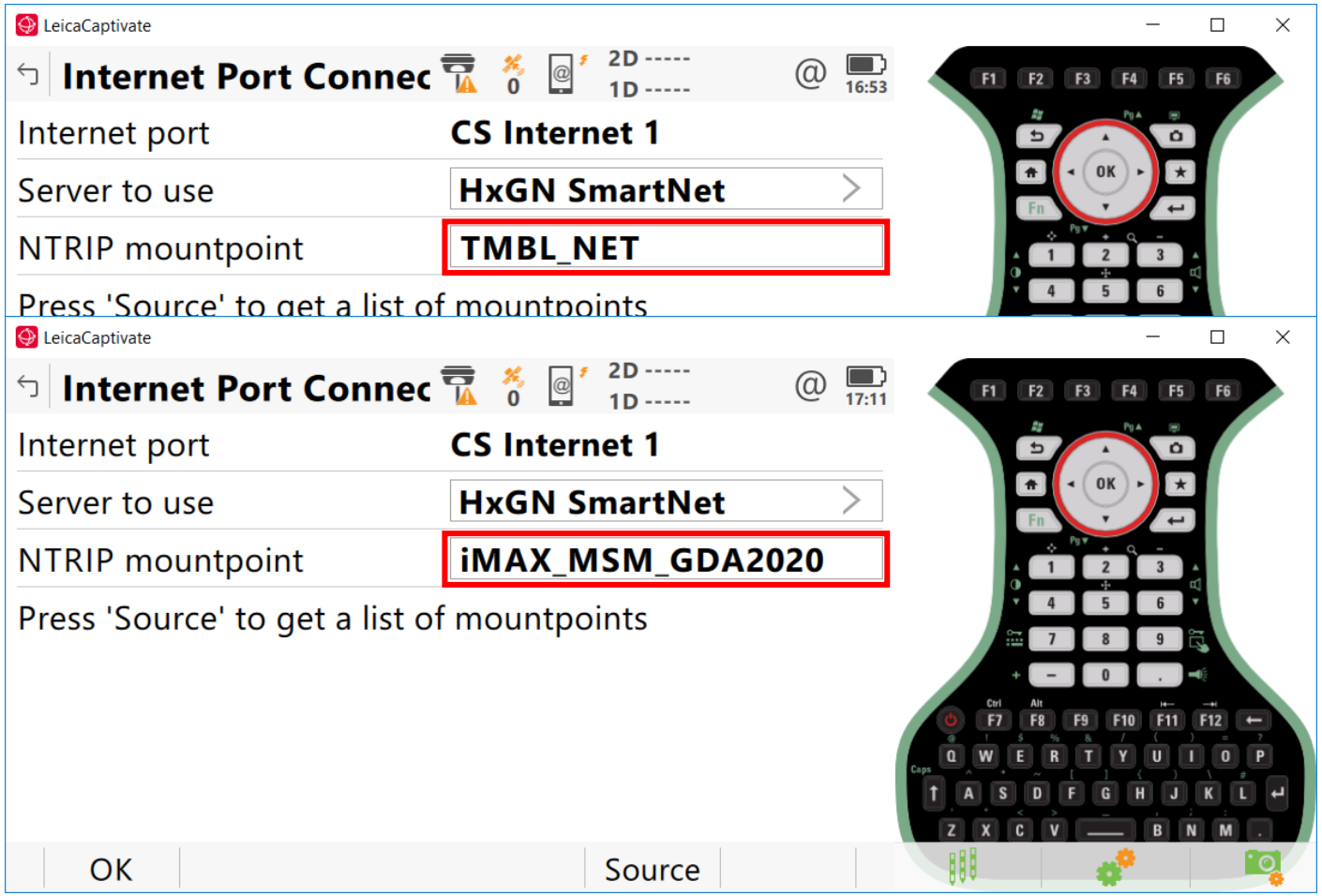
- Currently working on an ubiquitous National and possibly Global solutions
  - Change settings automatically when crossing borders



HEXAGON

Real-Time Data Dissemination

- Formats
  - Mount Point Names
    - MSM
    - RTCM 3.x
    - RTCM 2.3
    - CMR+
- Correction Methodology
  - Mount Point Names
    - MAC
    - VRS
    - iMAX
    - Others
- Datums
  - Mount Point Names



HEXAGON

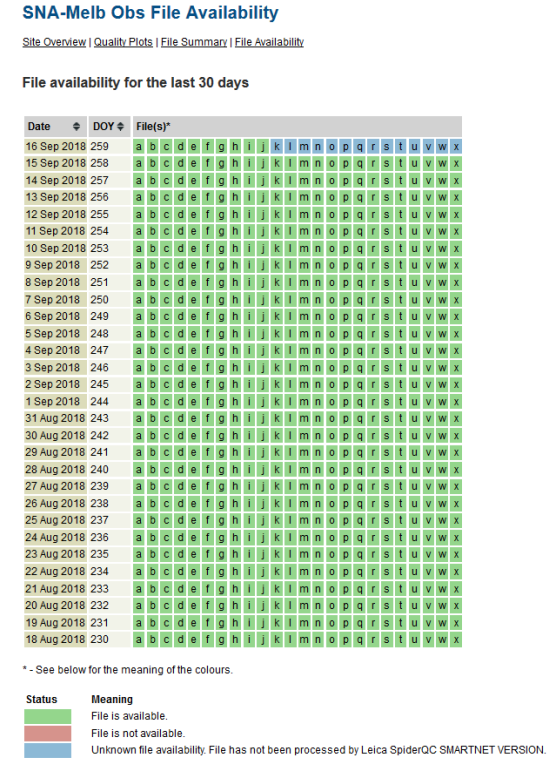
Fiji CORS – Real Time Data Dissemination

- DNS Name = fj.hxgnsmartnet.com
  - Ports
    - Survey = 9101
    - GIS = 9102
    - Agric = 9103
    - MC = 9104

HEXAGON

Post-processing Data Dissemination

- RINEX files
  - Multi-GNSS RINEX 3.XX from the new portal
  - RINEX 2.XX from the old portal
  - Basic QC information
    - Data completeness
    - Multipath



SNA-Melb Obs File Availability

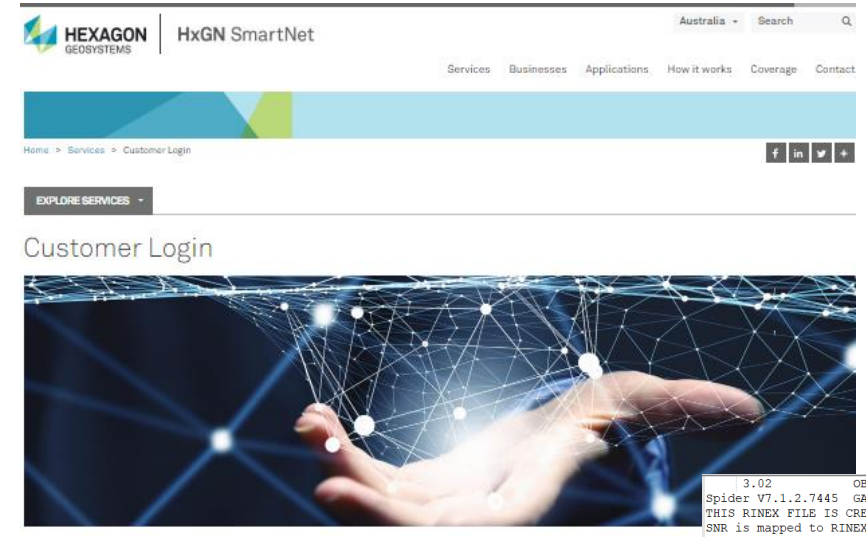
Site Overview | Quality Plots | File Summary | File Availability

File availability for the last 30 days

Date	DOY	File(s)*
16 Sep 2018	259	a b c d e f g h i j k l m n o p q r s t u v w x
15 Sep 2018	258	a b c d e f g h i j k l m n o p q r s t u v w x
14 Sep 2018	257	a b c d e f g h i j k l m n o p q r s t u v w x
13 Sep 2018	256	a b c d e f g h i j k l m n o p q r s t u v w x
12 Sep 2018	255	a b c d e f g h i j k l m n o p q r s t u v w x
11 Sep 2018	254	a b c d e f g h i j k l m n o p q r s t u v w x
10 Sep 2018	253	a b c d e f g h i j k l m n o p q r s t u v w x
9 Sep 2018	252	a b c d e f g h i j k l m n o p q r s t u v w x
8 Sep 2018	251	a b c d e f g h i j k l m n o p q r s t u v w x
7 Sep 2018	250	a b c d e f g h i j k l m n o p q r s t u v w x
6 Sep 2018	249	a b c d e f g h i j k l m n o p q r s t u v w x
5 Sep 2018	248	a b c d e f g h i j k l m n o p q r s t u v w x
4 Sep 2018	247	a b c d e f g h i j k l m n o p q r s t u v w x
3 Sep 2018	246	a b c d e f g h i j k l m n o p q r s t u v w x
2 Sep 2018	245	a b c d e f g h i j k l m n o p q r s t u v w x
1 Sep 2018	244	a b c d e f g h i j k l m n o p q r s t u v w x
31 Aug 2018	243	a b c d e f g h i j k l m n o p q r s t u v w x
30 Aug 2018	242	a b c d e f g h i j k l m n o p q r s t u v w x
29 Aug 2018	241	a b c d e f g h i j k l m n o p q r s t u v w x
28 Aug 2018	240	a b c d e f g h i j k l m n o p q r s t u v w x
27 Aug 2018	239	a b c d e f g h i j k l m n o p q r s t u v w x
26 Aug 2018	238	a b c d e f g h i j k l m n o p q r s t u v w x
25 Aug 2018	237	a b c d e f g h i j k l m n o p q r s t u v w x
24 Aug 2018	236	a b c d e f g h i j k l m n o p q r s t u v w x
23 Aug 2018	235	a b c d e f g h i j k l m n o p q r s t u v w x
22 Aug 2018	234	a b c d e f g h i j k l m n o p q r s t u v w x
21 Aug 2018	233	a b c d e f g h i j k l m n o p q r s t u v w x
20 Aug 2018	232	a b c d e f g h i j k l m n o p q r s t u v w x
19 Aug 2018	231	a b c d e f g h i j k l m n o p q r s t u v w x
18 Aug 2018	230	a b c d e f g h i j k l m n o p q r s t u v w x

* - See below for the meaning of the colours.

Status	Meaning
	File is available.
	File is not available.
	Unknown file availability. File has not been processed by Leica SpiderQC SMARTNET VERSION.

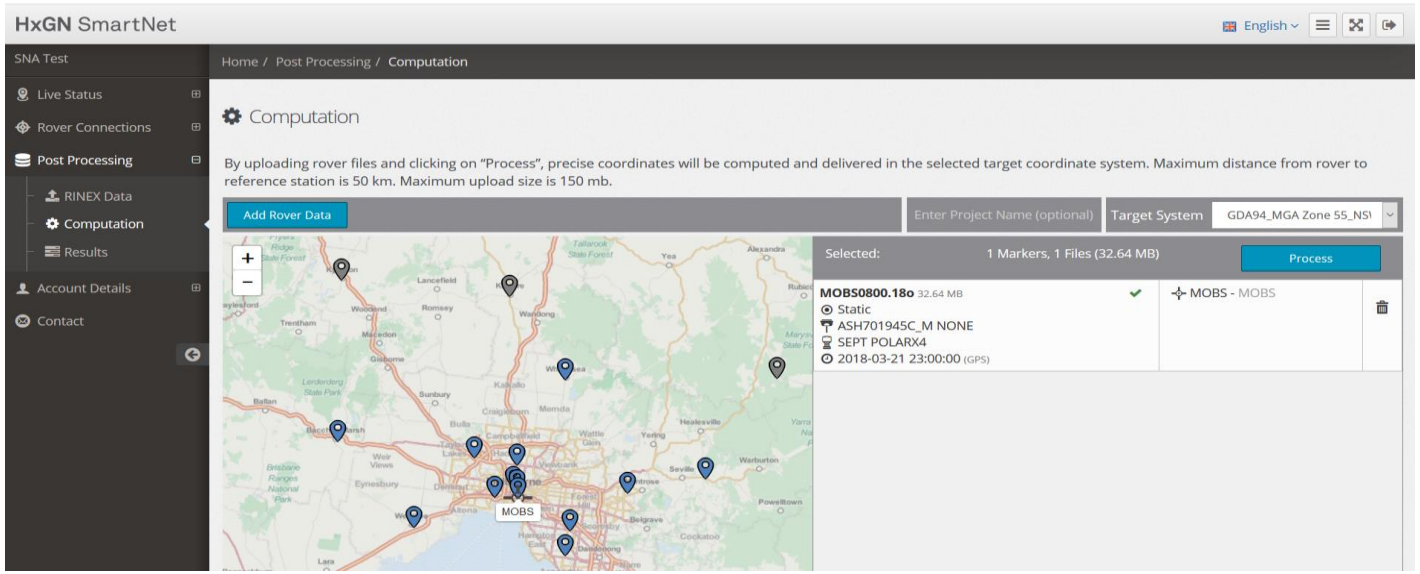


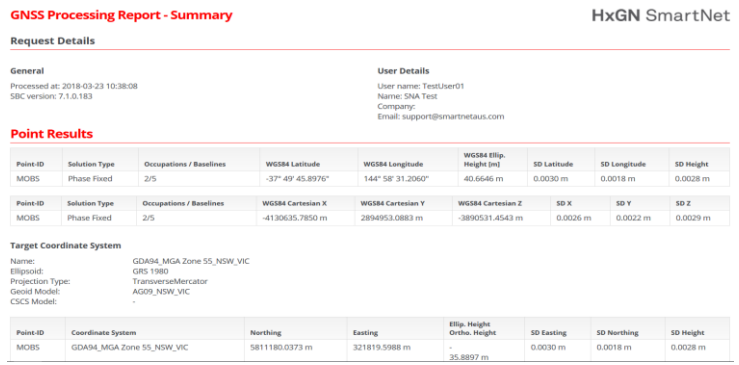

```
     3.02           OBSERVATION DATA    M: MIXED            RINEX VERSION / TYPE
Spider V7.1.2.7445  GA                  20180402 060756 UTC PGM / RUN BY / DATE
THIS RINEX FILE IS CREATED FROM RTCM V3.0 DATA              COMMENT
SNR is mapped to RINEX snr flag value [1-9]                 COMMENT
LX:      < 12dBHz -> 1; 12-17dBHz -> 2; 18-23dBHz -> 3      COMMENT
       24-29dBHz -> 4; 30-35dBHz -> 5; 36-41dBHz -> 6       COMMENT
       42-47dBHz -> 7; 48-53dBHz -> 8; >= 54dBHz -> 9       COMMENT
Product                                                     COMMENT
Site Information :                                          COMMENT
Melbourne Observatory                                       COMMENT
Victoria                                                    COMMENT
Australia                                                   COMMENT
MOBS                                                        MARKER NAME
50182M001                                                   MARKER NUMBER
Ryan Ruddick        Geoscience Australia                    OBSERVER / AGENCY
3007645             SEPT POLARX4        2.9.6               REC # / TYPE / VERS
CR20020709          ASH701945C_M    NONE                    ANT # / TYPE
 -4130635.7881  2894953.0968 -3890531.4629                  APPROX POSITION XYZ
       0.0000         0.0000         0.0000                 ANTENNA: DELTA H/E/N
G   12 C1C L1C S1C C2L L2L S2L C2W L2W S2W C5Q L5Q S5Q      SYS / # / OBS TYPES
R    9 C1C L1C S1C C2P L2P S2P C2C L2C S2C                  SYS / # / OBS TYPES
E    9 C1C L1C S1C C7Q L7Q S7Q C8Q L8Q S8Q                  SYS / # / OBS TYPES
C    6 C1I L1I S1I C7I L7I S7I                              SYS / # / OBS TYPES
J    9 C1C L1C S1C C2L L2L S2L C5Q L5Q S5Q                  SYS / # / OBS TYPES
DBHZ                                                        SIGNAL STRENGTH UNIT
    1.000                                                   INTERVAL
  2018    04    02    05    45    0.0000000     GPS         TIME OF FIRST OBS
  2018    04    02    05    59   59.0000000     GPS         TIME OF LAST OBS
     0                                                      RCV CLOCK OFFS APPL
G L2S -0.25000                                              SYS / PHASE SHIFT
G L2X -0.25000                                              SYS / PHASE SHIFT
R L2P  0.25000                                              SYS / PHASE SHIFT
E L8Q -0.25000                                              SYS / PHASE SHIFT
 24 R01  1 R02 -4 R03  5 R04  6 R05  1 R06 -4 R07  5 R08  6 GLONASS SLOT / FRQ #
    R09 -2 R10 -7 R11  0 R12 -1 R13 -2 R14 -7 R15  0 R16 -1 GLONASS SLOT / FRQ #
    R17  4 R18 -3 R19  3 R20  2 R21  4 R22 -3 R23  3 R24  2 GLONASS SLOT / FRQ #
                                                            GLONASS COD/PHS/BIS
    18    18  1929     7                                    LEAP SECONDS
                                                            END OF HEADER
```


HEXAGON

Post-processing Data Dissemination

- Online PPK Processing Engine
- X-POS Positioning Server
  - Leica Geosystems Infinity Kernel
  - Static or Kinematic
- Customised Processing Parameters
  - Single Base Processing
  - Loose Network Processing – Many base stations
  - Tight Network Processing – Combined network solution
- Detailed Reports
  - With full error ellipses and uncertainty values

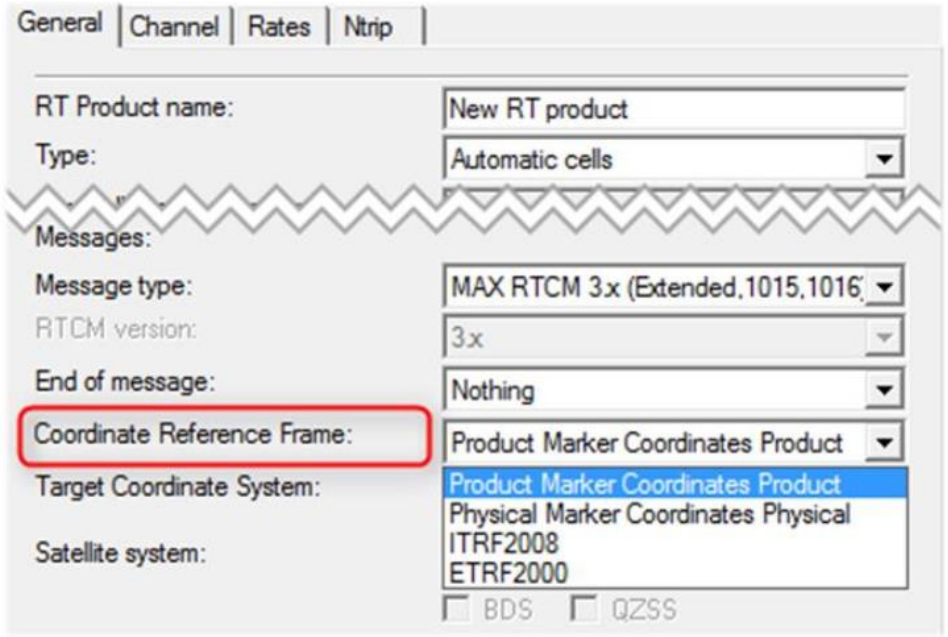




HEXAGON

HxGN SmartNet Multiple Reference Frames Support

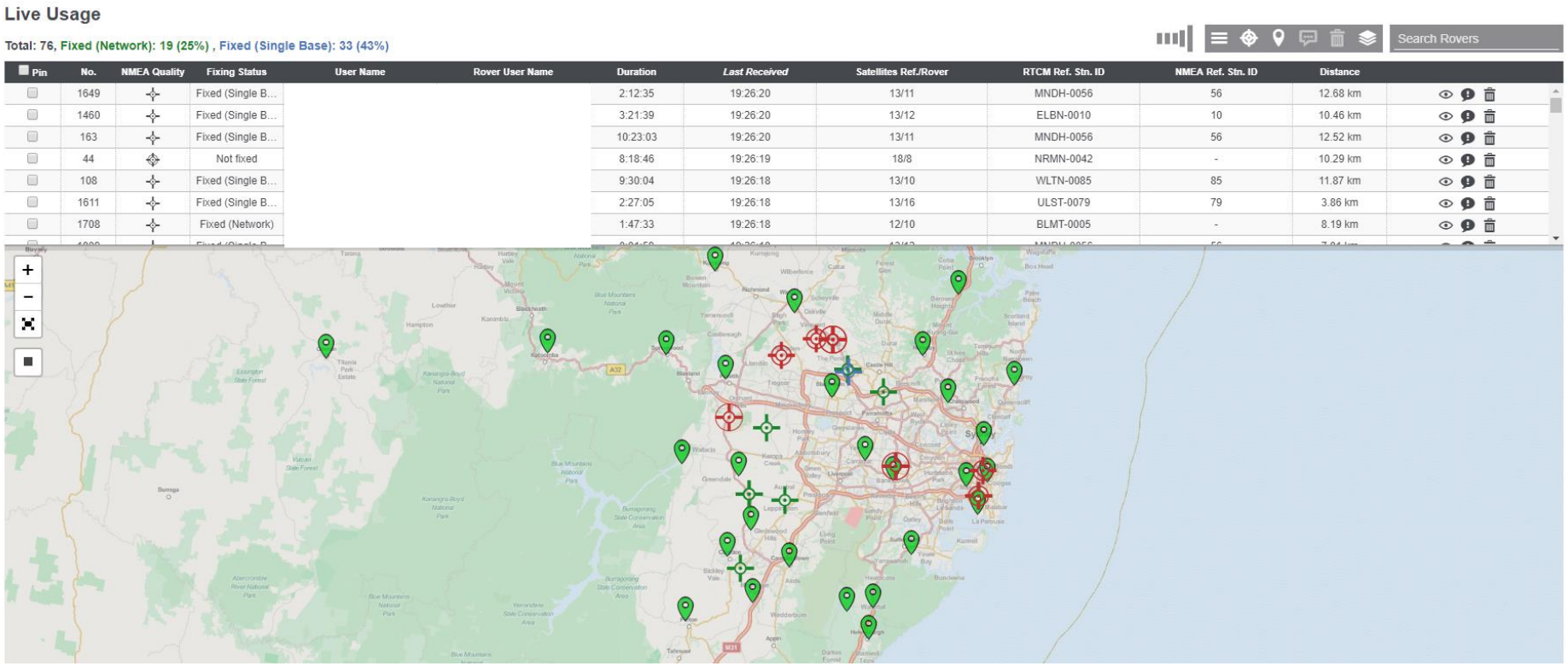
- Maintenance of **multiple reference frames** in one installation
- Send out raw data and RTK corrections in a selected reference frame
  - allowing the rover user position directly in their chosen reference frame without the need for transformation.



HEXAGON

HxGN SmartNet Web and App Tools

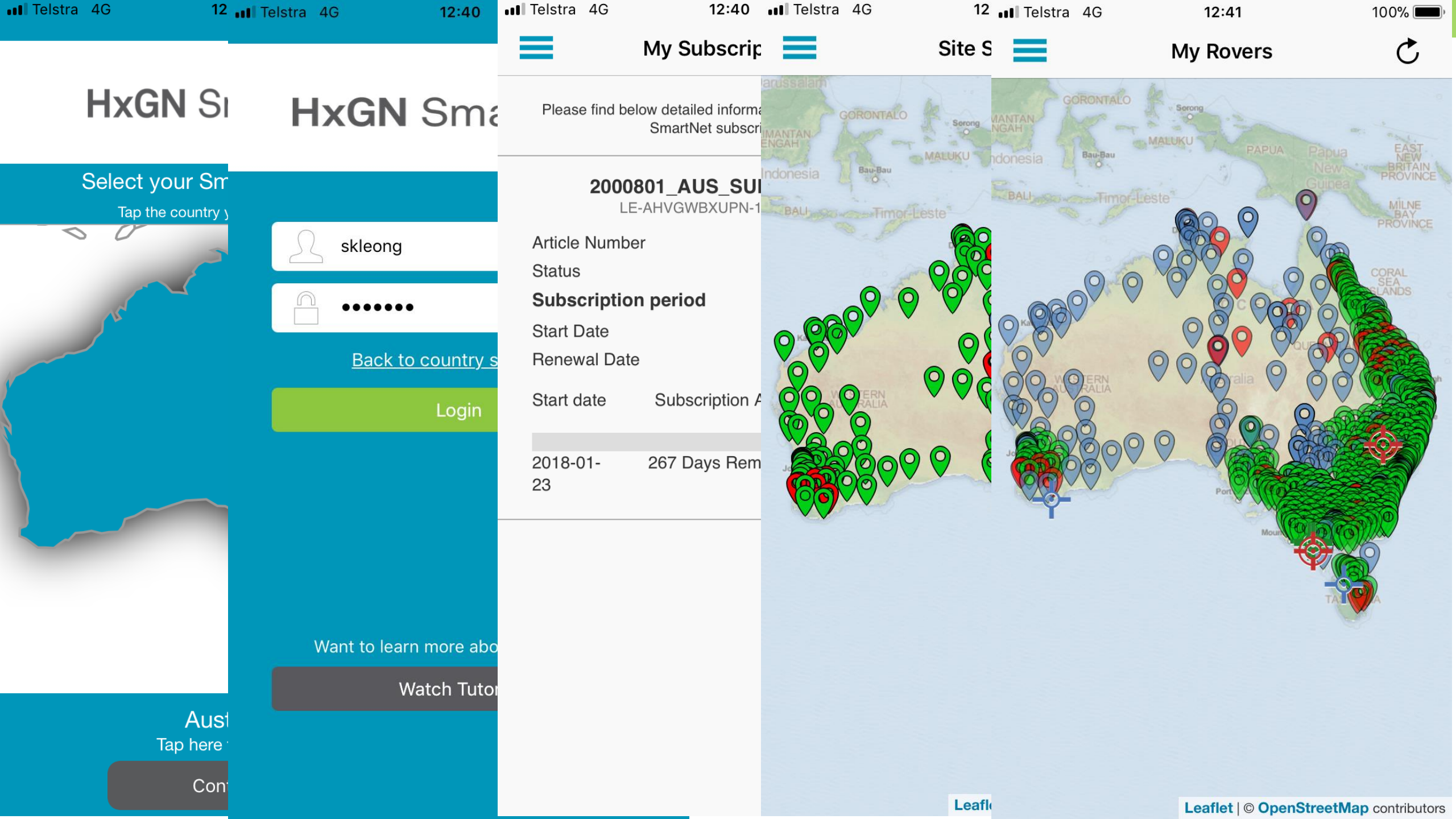
- HxGN SmartNet web access
  - More transparency into your subscriptions (logins, rovers, status)



HEXAGON

HxGN SmartNet Web and App Tools

- HxGN SmartNet app
  - Ideal for checking Site Status & Rover Credentials in the field
  - Network Status & NTRIP port connectivity
  - NTRIP login (username, password)
  - Mount tables
  - Subscription status


Telstra 4G 12
HxGN Sr
Select your Sm
Tap the country
Aust
Tap here
Telstra 4G 12:40
HxGN Sma
skleong
Back to country s
Login
Want to learn more abo
Watch Tuto
Telstra 4G 12:40
My Subscrip
Please find below detailed informa
SmartNet subscri
2000801_AUS_SUI
LE-AHVGWBXUPN-1
Article Number
Status
Subscription period
Start Date
Renewal Date
Start date
Subscription A
2018-01-23
267 Days Rem
Telstra 4G 12
Site S
Telstra 4G 12:41 100%
My Rovers
GORONTALO
Serong
MALUKU
PAPUA
Indonesia
Bau-Bau
BALI
Timor-Leste
Leaflet | © OpenStreetMap contributors

Thank you for your attention!
Vinaka!

Visit our web page: https://au.hxgnsmartnet.com
Email: Noor.Raziq@Hexagon.com

HEXAGON