LPWAN Workshop

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Murray Wireless

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Outline

• Introduction
• Background information
• What are IoT & LPWAN?
• LPWAN Technologies
• LPWAN Hardware
• The Australian IoT scene
• Conclusion
Introduction

• Abstract
• Who Is Dr Boyd Murray?
• Q&A: How can I help you?
Abstract

The Internet of Things (IoT) is the next big thing in the wireless revolution. It is a natural evolution of the Internet and, as the name suggests, goes beyond the connection of people to the Internet by connecting ‘things’ such as computers, machines, & sensors.

The addition of wireless in the form of low power wide area networks (LPWANs) makes for a ‘killer app’ which will explode onto the world in millions of applications and implementations over the next decade.
Who Is Dr Boyd Murray?

- Lifelong fascination with wireless (1’st transmitter at 8)
- Education: BEng (Elec), MEng (Telecoms), PhD (Telecoms)
- Employee: AWA, Plessey, Optus, CSIRO, Macquarie Uni
- Startup Founder:
  - Telys (VoIP)
  - Murray Wireless (consulting/design/deployment)
- Patents (Details on LinkedIn)
  - 6Gbit/s Shorthaul (2-5km) Backhaul Point-to-Point mmWave Radio System Operating at e-Band (70-80GHz)
  - Multi-Gbit/s Longhaul (10-40km) Backhaul Point-to-Point mmWave Radio System Aggregating Vacant Channel in the 6, 8, & 12GHz Microwave Bands
- Publications: (Details on LinkedIn)
Q&A: How can I help you?

• What do you already know about IoT?
• What do you need to know about IoT?
• Or ... do you not know what you don't know?
• What will you do with this info?
• How could I help further?
Background Info

- A Brief History of Wireless/Internet/IoT
- Wireless Networking Categories
A Brief History of Wireless/Internet/IoT

- **600BC** Greeks: Rubbed amber to attract fluff
- **1747** Benjamin Franklin: Electricity (lightning)
- **1819** Oersted: Practical electromagnetism
- **1831** Faraday: Electromagnetic induction
- **1873** Maxwell: Theory of electromagnetism
- **1887** Hertz: Radio waves
- **1888** AC Motor
- **1895** Marconi: Radio telegraph
- **1907** First public use of radio
- **1911** First mobile transmitter (Zeppelin)
- **1915** First wireless voice transmission
- **1927** First car radio
- **1928** First TV broadcast
- **1933** FM Radio
- **1958** First mobile phone (Germany, in-car)
- **1973** First hand-held mobile phone
- **1979** 1G cellular mobile (NTT, Japan)
- **1981** Internet precursor (ARPANET)
- **1982** First wireless IoT connection (Coke machine, GSM)
- **1988** International Internet
- **1990** World Wide Web
- **1991** 2G cellular mobile (GSM)
- **1994** Bluetooth
- **1997** Wi-Fi (CSIRO, IEEE)
- **1998** 3G cellular mobile (UMTS)
- **2008** 4G cellular mobile (LTE)
- **2020?** 5G cellular mobile
- **2020** 20 Billion IoT devices (projected)
Wireless Networking Categories

NOTE: IoT participates in ALL of these categories

- PAN = Personal Area Network
- BAN = Body Area Network
- LAN = Local Area Network
- WLAN = Wireless Local Area Network
- MAN = Metropolitan Area Network
- WAN = Wide Area Network
- LPWAN = Low Power Wide Area Network
Wireless Networking Categories

NOTE: IoT participates in ALL of these categories
What is IoT & LPWAN?

- Overview
- Applications
- Killer App: LPWAN
Overview

- IoT = Internet of Things
- Coined in 1999 by Kevin Ashton for RFID
- Sometimes referred to as IoE (Internet of Everything)
- Classical Internet connects people to information servers
- IoT is a network of ‘things’ (objects)
  - Physical devices, vehicles, buildings, etc
  - ‘Things’ are embedded with electronics, software, sensors, and ...
  - Network connectivity (fixed and wireless)

KILLER APP

KILLER APP
Applications

- **Health** (remote monitoring/logging, auto-diagnostics, emergency notification, etc)
- **Building/Home Automation** (lighting, heating, water, utility monitoring/billing, remote monitoring/control, etc)
- **Energy Management** (‘smart home/building/city’, ‘smart-grid’, etc)
- **Transportation** (person-vehicle, intra-vehicle, inter-vehicle, vehicle-infrastructure, tolling, self-driving vehicle, safety/maintenance monitoring/notification, road assistance, emergency, traffic monitoring/control, location, etc)
- **Economic Activity** (advertising, purchasing, ticketing, etc)
- **Infrastructure** (electricity grid, utilities, bridges, public transport, traffic, road condition monitoring, waste management, incident/emergency management, ‘big-data’ collection for government, etc)
- **Manufacturing** (machine control, process control/optimization, supply chain monitoring/control/optimization)
- **Many other** applications (only limited by creativity)
Killer App: LPWAN

• LPWAN = Low Power Wide Area Network

• Features
  • **Low power** (enabled by low datarates & frequency bandwidths)
  • **Long battery life** (because of low power)
  • **Low data rates** (opposite of cellular)
  • **Low frequency bandwidths** (enabled by low datarates)
  • **Small size** of user equipment (enabled by low power, small batteries)
  • **Low cost**
  • **Easy remote deployment** (enabled by wireless networking & low-power/long battery life)
  • **Remote processing enabler** (complex processing referred to ‘The Cloud’, enabled by wireless networking, allows small low-powered devices)

• Use scenario
  • Remote metering/sensing
LPWAN Technologies

- Overview
- Non-LPWAN
- Proprietary LPWAN
- Cellular LPWAN
- Which Technology?
Overview

- Non-LPWAN (will skim - included for completeness only)
  - Existing BAN, PAN, MAN, WAN
  - Originally designed for other purposes (voice/data)
  - Adapted for IoT
- Proprietary LPWAN
  - New technologies (specifically for IoT)
  - First-to-market (since 2011)
  - Currently trying to establish dominance
- Cellular (3GPP) LPWAN
  - Specific IoT add-ons to existing 4G cellular standard
  - Only software upgrades to basestations
  - Leveraging off 4G reputation & installation base
  - Just rolling out now (2016-Q4)

Low power, long battery-life, cellular range
Non-LPWAN

- Bluetooth
- Zigbee
- Z-Wave
- Wi-Fi
- NFC
- Cellular - 2G/3G/4G
Bluetooth

- PAN
- Standard: Bluetooth 4.2 core specification
- Frequency: 2.4GHz (ISM)
- Range: 50-150m (Smart/BLE)
- Data Rates: 1Mbps (Smart/BLE)
- Application: Cord replacement
Zigbee

- PAN
- Standard: ZigBee 3.0 based on IEEE802.15.4
- Frequency: 2.4GHz
- Range: 10-100m
- Data Rates: 250kbps
- Low-power
- Application: home automation, data-muling
Z-Wave

- LAN
- Standard: Z-Wave Alliance ZAD12837 / ITU-T G.9959
- Frequency: 900MHz (ISM)
- Range: 30m
- Data Rates: 9.6/40/100kbit/s
- Application: ‘data-muling’
Wi-Fi

• LAN, WLAN
• Standard: Based on 802.11n (most common usage in homes today)
• Frequencies: 2.4GHz and 5GHz ISM bands
• Range: Approximately 50m
• Data Rates:
  • 600 Mbps maximum
  • 150-200Mbps is more typical
  • Latest 802.11-ac standard offers 500Mbps to 1Gbps
    • Data rate depends on channel frequency used and number of antennas
• Application: Wireless Local Area Network (WLAN)
NFC

• NFC = Near Field Communication
• PAN
• Standard: ISO/IEC 18000-3
• Frequency: 13.56MHz (ISM)
• Range: 10cm
• Data Rates: 100–420kbps
• Application: Contactless ‘proximity’ connection
Cellular – 2G/3G/4G

- Standards: GSM/GPRS/EDGE (2G), UMTS/HSPA (3G), LTE/LTE-A (4G), TBA (5G)
- Frequencies: 900/1800/1900/2100MHz
- Range: 35km max for GSM; 200km max for HSPA
- Data Rates:
  - 35-170kps (GPRS)
  - 120-384kbps (EDGE)
  - 384Kbps-2Mbps (UMTS)
  - 600kbps-10Mbps (HSPA)
  - 3-10Mbps (LTE)
  - 1Gbps (LTE-A)
  - 10Gbps (5G)
- Application: Mobile voice & data (high datarate)
- Power consumption: high (low battery-life)
Proprietary LPWAN

- SigFox
- LoRaWAN
- Taggle
- Neul
- On-Ramp/Ingenu
- Others ???
Sigfox

- Founded: 2009 (France)
- Standard: Sigfox (proprietary)
- Technology: UNB (Ultra Narrow Band)
- Power: 50 microwatts (compared to 5000 microwatts for cellular communication)
- Battery Life: 20 years with a 2.5Ah battery (compared to only 0.2 years for cellular)
- Frequency: 900MHz
- Frequencies: ISM bands – Australia: 915-928MHz
- Modulation: Downlink: GFSK, Uplink: DBPSK
- Packet size: ~12bytes (depends on info type)
- Duplexing: Mainly uplink, downlink only after uplink packet
- Range:
  - Between Wi-Fi & Cellular
  - 30-50km (rural environments)
  - 3-10km (urban environments)
- Data Rates: 10-1000bps
- Rollout
  - Europe
  - USA
  - Australia (2016/2017, Thinxtra)
- Application: Low power, wireless monitoring/sensing & control
LoRaWAN

- Released: Jul-2015
- Standard: LoRaWAN (Version R1.0)
- LoRa = Long Range
  - Physical Layer only
- LoRaWAN = Long Range Wide Area Network
  - Physical layer + datalink (protocol) layer
- Frequencies: ISM bands – 433.05-434.79MHz, 902-928MHz (Australia: 915-928MHz)
  - New 928-933 MHz licensed band being added in Australia sometime before 2022
- Data Rates: 0.3-50 kbps (also adaptive according to conditions)
- Duplex: 3 different modes (asynchronous downlink included)
- Frequency bandwidth: 125kHz primarily
- Modulation: CSS (Chirp Spread Spectrum)
- Tx Power: 19dBm
- Packet size: 256 bytes max
- Range: 2-5km (urban), 15km (suburban)
- Rollout
  - Europe: France, Holland (KPN), Switzerland, Belgium
  - Africa: South Africa
  - Asia: SK Telecom (South Korea)
  - Australia:
    - 2016/2017: NNNCo – Ergon trial in Townsville, QLD
    - 2016: Meshed – small number of gateways - Castlecrag, Wollongong, UTS, Barangaroo, JCU, others??
    - Municipal councils
    - Private?
    - Telcos? – unlikely – waiting for NB-IoT
    - Other operators?
Taggle

• Australian startup
• History
  • 2007: Founded
  • 2008-2009: LPWAN IC
  • 2010: First deployment to water industry
  • 2012: Network, data analytics products
  • 2016: 100,000 devices installed around Australia
• Deployments
  • 21 water utilities
  • >100,000 devices installed
    • Water meters, sewer overflow sensors
    • Rain gauges, pressure sensors etc.
• Awards
  • Mackay Regional Council: “Transformation of a Water Business”
• Technology Specs
  • Proprietary
  • Hard to get info
Neul

• Released: 2013
• Standard: Neul Weightless
• Power: Optimized for low-power consumption
• Frequencies: 900MHz (ISM), 458MHz (UK), 470-790MHz (White Space)
• Range: 10km
• Data Rates: Few bps up to 100kbps
• Company Neul
  • UK-based
  • Acquired by Huawei in Sep-2014
Ingenu / On-Ramp

- WAN
- On-Ramp rebranded to Ingenu on 11-Sep-2015
- Founded: 2009
- Standard: RPMA (Random Phase Multiple Access)
- Battery Life: 20+ years
- Frequencies: 2.4GHz (free ISM band)
- Range: 20km
- Data Rates: Up:624kbps, Down:156kbps
- 38 networks deployed worldwide
- Rumours about Australian deployment
Cellular LPWAN

- LTE-MTC / LTE-M / Cat-M / Cat-M1
- NB-IoT / Cat-NB1 / Cat-M2
- 5G
LTE-MTC / LTE-M / Cat-M / Cat-M1

- WAN
- Overlay of existing cellular 4G (LTE) – compatibility !!!
  - Only need base station software upgrade
- LTE-MTC = Long Term Evolution Machine-Type Communications
  - A.k.a: LTE-M, Cat-M1, Cat-M
- Standard: LTE-MTC (3GPP release 13)
- Released: 11-Mar-2016 (VERY NEW!!)
- Frequencies: (reuse 2G-4G frequencies)
- Frequency bandwidth: 1.4 MHz
- Data Rates: 2 Mbps
- Range: Cellular (5-50km ???)
- Potential users: Cellular operators - Telstra, Optus, Vodafone
- Competition: SigFox, LoRaWAN
- Node power consumption high(ish) – battery unlikely
NB-IoT / Cat-NB1 / Cat-M2

- NB-IoT = Narrowband Internet of Things
- Requires upgrades to some basestation hardware – not significant
- Simpler technology (cheaper?)
- Standard: NB-IoT (3GPP release 13)
- Standards released: 11-Mar-2016 (VERY NEW!!)
- Device chipsets: U-Blox (Dec-2016), Qualcomm, HAC
- Network rollout
  - 4Q-2016 (T-Mobile, Netherlands) <- RIGHT NOW!!
  - 1Q-2017 (Vodafone, Germany, Ireland, Netherlands, Spain)
  - 3Q-2017 (Vodafone, Australia)
- Frequencies: (reuse 2G, 3G, 4G frequencies)
  - Operation: In-band, guard-band, separate band
- Frequency bandwidth: 0.2 MHz (200kHz)
- Modulation: Downlink: OFDM, Uplink: SC-FDMA
- 20dB better link budget than GSM -> lower transmit power or deeper penetration
- Range: Cellular (5-50km ??)
- Data Rates: 0.2 Mbps (200kbps)
- Applications: environmental monitoring, smart buildings, sensor monitoring
- Potential users: Cellular operators - Telstra, Optus, Vodafone
  - Trialling with user nodes with pre-standard chipsets
- Competition: SigFox, LoRaWAN
  - Vodafone, Optus, Telstra, Huawei all intending to implement
  - Carriers seem to have already chosen NB-IoT over LoRaWAN, Ingenu, Neuel, etc
4G LTE Comparison

<table>
<thead>
<tr>
<th>existing</th>
<th>new narrowband LTE IoT technologies (release 13+)</th>
<th>March 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE Cat-4 and above</td>
<td>LTE Cat-1</td>
<td>LTE Cat-M1 (eMTC)</td>
</tr>
<tr>
<td>&gt;10 Mbps n x 20 MHz</td>
<td>Up to 10 Mbps 20 MHz</td>
<td>Variable rate up to 1 Mbps 1.4 MHz narrowband</td>
</tr>
</tbody>
</table>

Source: Qualcomm
IoT Applications by LTE Category

LTE-MTC/LTE-M/Cat-M/Cat-M1 & NB-IoT/Cat-NB1/Cat-M2 complement each other – even while Cat-1 & Cat-4 applications will remain the same.

Source: Sequans
5G

- **WAN**
  - Standard:
    - Due ~2020
    - Possibly enhancement of 4G LTE-MTC
    - Possibly totally new technology
  - Other info: Anybody’s guess at this stage
### Which LPWAN Technology?

<table>
<thead>
<tr>
<th>Technology</th>
<th>Proprietary</th>
<th>Link Labs LoRa</th>
<th>Sigfox UNB</th>
<th>Ingenu RPMA</th>
<th>Nwave Weightless</th>
<th>LTE-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>868.8 MHz</td>
<td>868.8 MHz</td>
<td>868.8 MHz</td>
<td>2.4 GHz</td>
<td>868.8 MHz</td>
<td>1.8 - 2.7GHz</td>
</tr>
<tr>
<td>Max urban range with 99% reliability, m.</td>
<td>16 600</td>
<td>7 200</td>
<td>9 500</td>
<td>4 600</td>
<td>4 100</td>
<td>640</td>
</tr>
<tr>
<td>Maximum link budget, dBm</td>
<td>166</td>
<td>151</td>
<td>156</td>
<td>163</td>
<td>147</td>
<td>147</td>
</tr>
<tr>
<td>Node bandwidth</td>
<td>100 Hz</td>
<td>125 kHz</td>
<td>100 Hz</td>
<td>1 MHz</td>
<td>200 Hz</td>
<td>192 kHz</td>
</tr>
<tr>
<td>Spectrum efficiency</td>
<td>High</td>
<td>Very Low</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Gateway mode</td>
<td>Full Duplex</td>
<td>Half Duplex</td>
<td>Half Duplex</td>
<td>Half Duplex</td>
<td>Uplink Only</td>
<td>Full Duplex</td>
</tr>
<tr>
<td>Nodes per gateway</td>
<td>1 350 000</td>
<td>40 000</td>
<td>50 000</td>
<td>50 000</td>
<td>20 000</td>
<td></td>
</tr>
<tr>
<td>Scalability</td>
<td>High</td>
<td>Very Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Simultaneous demodulation capacity</td>
<td>120 000</td>
<td>8</td>
<td>25</td>
<td>4 000</td>
<td>25</td>
<td>64</td>
</tr>
<tr>
<td>Security</td>
<td>XTEA 256 bit</td>
<td>32 bit</td>
<td>16 bit</td>
<td>AES 128 bit</td>
<td>No</td>
<td>128 - 256 bit</td>
</tr>
<tr>
<td>Minimum node cost, USD</td>
<td>$1.99</td>
<td>$29.00</td>
<td>$1.99</td>
<td>$5.00</td>
<td>$19.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>Battery lifetime</td>
<td>10 years</td>
<td>10 years</td>
<td>10 years</td>
<td>10 years</td>
<td>10 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Sector antennas</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Commercial Deployment</td>
<td>100+</td>
<td>100+</td>
<td>100+</td>
<td>30</td>
<td>10</td>
<td>N/A until 2020</td>
</tr>
<tr>
<td>First commercial project</td>
<td>2011</td>
<td>2014</td>
<td>2010</td>
<td>2010</td>
<td>2013</td>
<td>2020</td>
</tr>
</tbody>
</table>

Comparison of some IoT LPWAN technologies
Which LPWAN Technology?

• Readiness for market?
  • SigFox, LoRaWAN, Neul standards have existed for several years
  • Sigfox LPWAN being rolled out in ANZ right now
  • LoRaWAN LPWAN rollout not happening?
  • Will first-to-market dominate in each national market?

• Well-respected standard?
  • 3GPP is the world-dominant cellular standards body
  • Produced 2G, 3G, 4G standards
  • Equipment used world-wide
  • LTE-MTC (LTE-M) & NB-LTE-M are just software upgrades to existing basestations
  • NB-IoT already very popular
  • Very fast rollout for regional/national networks (due 2017-Q3)

• Fit for purpose?
  • Power, battery, spectrum, datarate requirements
  • Duplexing (SigFox is mainly downlink)

• Ecosystem?
  • Basestations
  • Nodes/Sensors
  • Platform

• Cost
• Multiple chipsets
LPWAN Hardware

- Gateways
- CPUs
- RF/sensor modules
- Smart Metering
- Platforms
Gateways

- SigFox
  - Proprietary franchise in designated regions/countries
  - Franchises source directly from Sigfox ??
- LoRaWAN
  - www.loriot.io
    - MultiTech: MultiConnect Conduit
    - Link Labs: LL-BST-8
    - Kerlink: LoRa IoT Station
    - Calao Systems: Toti-LoRa-pico
    - Raspberry Pi Foundation / Multitech:
      - Raspberry Pi B / B+ / 2 with LoRa mCard
      - Many others
- NB-IoT
  - Trials have used pre-release hardware
  - Already rolling out in Holland 2016-Q4
  - Australian rollout due 2016-Q4/2017-Q1
- Others??
CPUs

- Raspberry Pi - $35-79
- Arduino - $43
- STM Nucleo $17-172
- Libellium Waspmote
- Little Bird
- Others
RF/Sensor Modules

- LoraWAN
  - Adeunis
  - Semtech/Microchip - US$11-15
  - Others?
- SigFox
  - Adeunis
  - Radiocrafts
  - Axsem
  - Others?

- NB-IoT
  - U-Blox: SARA-N2 (chip due Dec-2016)
  - Qualcomm: MDM9207-1 (chip)
  - HAC (China)
  - Telit
  - Gemalto
  - Huawei
  - Quectel
  - Others?
Smart Metering Nodes

- Smart Water Meter
- Smart Electricity Meter (Single Phase)
- Smart Electricity Meter (Three-Phase)
- Smart Gas Meter
- Flush-Mount Parking Sensor
- Surface-Mount Parking Sensor
- Waste Monitoring Sensor
- Soil Moisture Sensor
- Pulse Interface
- Serial Interface
Platforms

• Platform = Web-Interface for SCADA
• SCADA – Supervisory Control And Data Acquisition
• Many platforms
  • AWS - Amazon Web Services
  • Axonise
  • Helian/SkyGrid
    • Australian Startup
  • IBM BlueMix
  • Microsoft Azure
  • Others (coupled to hardware)
The Australian IoT Scene

- Network rollouts
- Trials
- Deployment case studies
- Industry/interest groups
Network Rollouts

- Thinxtra (Sigfox)
  - National coverage: Australia / New Zealand
  - 2016-Q4 – Aus 63%, NZ 80% population coverage, all major cities
  - 2017-Q4 – 95% ANZ population coverage
  - Standard basestations: 1.5 million messages/day (versus LoRa 40k messages/day)
  - Mini basestations: 1/3 cost, 1/5 size, 30k messages/day, smart agriculture, cell-infill
- NNNCo
  - LoraWAN
  - Cisco partner
  - Multicast LoRaWAN with Ergon Energy
    - Townsville trial (2016/2017)
    - Future: Local or Australia-wide??
- Telstra, Optus, Vodafone
  - NB-IoT Hardware/Software upgrades
  - 2016-Q4/2017-Q1??
- Meshed
  - Location-specific – not a contiguous network (yet)
  - Free access?
  - Deployments
    - Castlecrag, Wollongong, UTS, Barangaroo, JCU
  - Future: Local or Australia-wide??
- City councils
- Others???
LPWAN Trials

- **Vodafone, Optus, Huawei**
  - NB-IoT
    - Apr-2016: South East Water (Victoria) - sewer monitoring
    - May-2016: Melbourne – smart metering (AMR/AMI) – continuing still
    - Using ‘pre-release’ hardware/software

- **Telstra**
  - LoRaWAN
    - But ... Telstra switching to NB-IoT now??

- **NNNCo**
  - Multicast LoRaWAN
    - Nov-2016
    - For Ergon Energy
    - Partnering with Actility
      - Network Server & IoT Platform
    - Multicast LoRaWAN with Ergon Energy
    - Location: Townsville, QLD
    - Usage
      - First: Granular electricity demand management (HWS)
      - Later: Public lighting, agricultural irrigation, water, Infrastructure, building automation

- **Others ??**
Deployment Case Studies

- GWM Water (Victoria)
  - Rural Pipeline Intelligence Project

- Ovass (Western Australia)
  - Smart Crop Data & Analytics
GWM Water

Rural Pipeline Intelligence Project

Company Background

- Victorian water utility
- Service 72,000 people
- Geographic area of about 30% of Victoria (~70,000 sq km, 330 x 210km). Area similar to Tasmania.
- Coverage: 13 municipalities
- Water Supply: 32,000 urban properties in 71 towns throughout the region
- Wastewater services: 27 of 71 towns
- Water supply: 11,000 rural customers
- Reclaimed water: 39 end users.
- Had some ‘unspent funds’ from previous project – so decided to spend on Rural Pipeline Intelligence Project
GWM Water

Rural Pipeline Intelligence Project

Objective & Business Case

- Project objective: Telemetry on rural meters / pipeline network
- Business Case / Benefits
  - Lower operating costs
  - Lower staff costs
  - Reduced pipeline breakages
  - Avoid/defer pipeline augmentation
  - Add residual value to asset
  - Improve water security
  - Reduce water loss
  - Improve on-farm efficiencies
  - Improve billing cycle
  - Improve billing accuracy
  - Reduced energy consumption & greenhouse gas emissions
  - Improve occupational health & safety
GWM Water

Rural Pipeline Intelligence Project

Architecture

- LPWAN Technology: Taggle (Australian)
- 46 gateways (a.k.a. hubs/basestations)
- 13,880 nodes (a.k.a. devices)
GWM Water
Rural Pipeline Intelligence Project
Gateways (a.k.a. hubs/basestations)

- 46 installed
GWM Water

Rural Pipeline Intelligence Project

Nodes

- Wimmera and Northern Mallee pipeline meters
- RTU (Remote Terminal Unit) added to 13,880 water-meters
  - Retrofits: Standard Elster V100 water-meter
  - Upgrades: New Elster V200 water-meter with integrated comms
- Battery-life: 10+ years
- 100% success retrieving data from each meter
- Data: Recorded every hour, transmitted daily
- Three node sub-types: MRC1, ADC1, HP1

MRC1 Node, Low-powered, 5,763 installed, 41% of total

ADC1 Node, Medium-powered, 4,515 installed, 33% of total

HP1 Node, High-powered, 3,602 installed, 26% of total
GWM Water
Rural Pipeline Intelligence Project

Platform

• Web portal
• PC/Tablet access
• Mobile phone access
• Customer Portal
• Management Tool
• Leak detection
Ovass

Smart Crop Data & Analytics

Company Background

- Startup
- Western Australia

A new dimension to crop data through the use of smart data & analyt...
Ovass

Smart Crop Data & Analytics

Objective & Business Case

- **Objective**
  - Agricultural data acquisition & telemetry

- **Business Case / Benefits**
  - Reduced operating costs
  - Up to 90% reduction in scouting effort (pests, disease, nutrition)
  - Sharing, collaboration, & benchmarking with peers/neighbours
  - Energy optimisation specifically for agriculture
  - Can add in existing data acquisition infrastructure
  - Informed analysis through data analytics
Ovass
Smart Crop Data & Analytics Architecture

- LPWAN Technology: LoRa (by LX Group)
Ovass
Smart Crop Data & Analytics
Gateways

LoRa gateway by LX Group
Ovass

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Nodes

LoRa node by LX Group

Soil sensor by Aquacheck
Ovass
Smart Crop Data & Analytics
Platform

Platform by Ovass (Proprietary)
Industry/Interest Groups/Blogs/News

- Others
Conclusion

• Summary
• Questions
Summary

• IoT is really cool !!!
• LPWANs are a world game-changer
  • Comparable to introduction of mobile phones & Internet
• Early days now
• Lots of activity – starting right now!!
• Lots of different players & standards
  • Who will win?
• Horses for courses
• Everyone is paddling furiously to jump on a gigantic wave
  • But it is not quite here (yet)
Questions?
If you wish to receive a copy of this presentation & other resources, please fill out the feedback form.

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