The Internet of Big Things

WasteMINZ, Oct 21, Rotorua
Coming in fast and low
How cheap chips are making the economics of infrastructure more sustainable.

WasteMINZ, Oct 21, Rotorua
How a wider use of sensors, algorithms and endemic networking will transform the waste, energy, water and transport businesses.
• Exponential tech power
• Ultra-cheap sensors
• Ubiquitous connectivity
• The Internet of (Big) Things
• A new type of infrastructure
• A data-breathing machine
• Services going global too
• Evaporating into the cloud
Moore’s law
Moore’s law turns 50
• Second half of chessboard
• 1971 chip Intel 4004 chip
• 2015 Core i5 chip
• 3,500 times faster
• 90,000 X energy efficient
• 60,000 times cheaper
• If 71 Beetle improved as much
• 300,000 mph and 2 mln mpg

WasteMINZ, Oct 21, Rotorua
An amazing machine

WasteMINZ, Oct 21, Rotorua
Watt’s steam engine

[Graph showing GDP per capita (Geary-Khamis dollars) over time from 1400 to 2000 for different regions such as Africa, Latin America, Asia, Eastern Europe, Western Europe, Western Offshoots, Former USSR, and World Average.]

WasteMINZ, Oct 21, Rotorua
A deflationary steam engine

WasteMINZ, Oct 21, Rotorua
Inside the engine
• 4.7/5.5’ touch HD screen
• Dual core 1.4 Gig processor
• M8 motion co-processor
• Altitude barometer
• Accelerometer, gyroscope, digital compass, GPS chip, NFC chip, iBeacon
• Proximity, light and touch sensors
• Two cameras with image stabiliser & facial recognition
• WiFi chip, 4G antenna
• Bluetooth chip
• Stereo speaker and jack
All for US$242.50
• Phone calls and texts
• Photos, videos and audio
• Mapping & health monitoring
• Payments & web browsing
• Music, video streaming
• Game playing
• Location tracking
• Translation and selfies
Music deflation

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Pay TV deflation
Taxi deflation
Telco deflation

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Hotel deflation
A very long view
A very, very long view

Chart 5: Short and long-term interest rates

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Here come the sensors

Figure 2. The Internet of Everything: Devices in Use Globally

A Nitrous Oxide sensor = 35c
IBM’s HyRef system

Advanced cloud imaging technology and sky-facing cameras track cloud movements

Sensors on the turbines monitor wind speed, direction and temperature

WasteMINZ, Oct 21, Rotorua
‘The Industrial Internet’
GE’s GM for Wind Keith Longtin

“Turbines talking to turbines. Wind farms talking to wind farms. Machines talking to machines.”
• Hybrid Renewable Energy Forecasting
• Sensors in everything and data being constantly crunched
• Weather forecasting networks
• Automated adjustments to turbines to increase efficiency 10%
• Enough to power 14,000 homes
• Conquering ‘intermittency’
Zhangbei Manjing wind/solar farm

WasteMINZ, Oct 21, Rotorua
Plus solar panels & batteries
• When the sun don’t shine
• It might be blowing
• And vice versa
• Forecasting/matching supply with demand
• 213 kms from Beijing
• Built in 2011 for US$2 bln
• 670 MW capacity

WasteMINZ, Oct 21, Rotorua
Envision Energy’s sensor-packed & LIDAR equipped turbines

WasteMINZ, Oct 21, Rotorua
• LIDAR = Light detecting & ranging
• 150 sensors per turbine
• Measuring vibration, wind speed and temperature
• Detects gusts before they arrive
• Pre-emptive maintenance/tuning
• 15% efficiency gains
• 20 tb data at a time. Up 50%/yr
Geosyntec’s Optistorm
• Lowering the peaks for storm water systems
• Cisterns emptied preemptively/automatically
• By ‘machine’ forecasting rainfall bursts using weather sensor networks
• Which means smaller pipes
MIT’s ‘Underworlds’ sewage sensor system

WasteMINZ, Oct 21, Rotorua
• Sewage mined for data
• Sensors test waste in real time for viruses and bacteria
• Predicting disease outbreaks
• Diabetes/obesity prediction?
• Pilot study in Cambridge, Mass
• MIT’s ‘SENSEable’ City lab
• Bomb detection – EU Emphasis

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MIT’s ‘Underworlds’sewage sensor system

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WasteMINZ, Oct 21, Rotorua
Christchurch’s ‘Sensing City’
• Plan for a network of sensors
• Under roads, in pipes, in lights
• Measuring air pollution, traffic congestion and air quality
• Sensing City Trust/Roger Dennis
• Infratil/Z Energy/Callaghan
• Big fanfare in 2013
• Quietly shelved last month
• ‘Complex stakeholder environment’
• Thank you
• Questions
• Challenges
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