Introduction

SLIDE: Introduction

Good afternoon everyone, and thanks *NAME* for that excellent introduction. I know it's pretty late in the afternoon, and many of you have travelled considerable distance to be here, so a huge thank you for coming to the beautiful city of Geelong - my home town - and for sticking around for the afternoon sessions.

I'm Kathy Reid, and I work at the intersection of emerging technologies, open source and technical communities. As the Vice President of Linux Australia, I help oversee open source initiatives in Australia, such as WordCamps, DrupalSouth and Linux Conference Australia, and as part of Creative Geelong I help champion the creative and digital industries in Geelong.

The title of my talk today - "They're jobs, Jim, but not as we know them" - is very deliberately intended. If you think of some of recent job titles emanating from Silicon Valley - like *Cloud Architect* or *Big Data Visionary* or *Clickthrough Analyst*, they seem almost surreal. As we hear daily reports of increasing automation and artificial intelligence, you could be forgiven for thinking that jobs of the future are from another planet, unrecognisable, an alien species to be studied.

SLIDE: Alien

So, over the next 30 minutes, I'll be leading us on a *mission*. A mission to learn, to explore, understand, and hopefully learn to engage with these alien jobs of the future.

SLIDE: Mission

We're going to take a look at;

- Some of the macro-economic factors that are driving shifts in jobs
- Some of the technology trends that are re-shaping jobs
- And we'll take a look at the skills that will be needed to secure employment in the future.

My intent is that you, as individuals or as businesses, will be able to use the key takeaways today to help think about how *you* might respond to the changing nature of jobs.

Back, back in time

First though, I'm going to jump in the time machine and explore for a moment what jobs of the past looked like.

SLIDE: Rat Catcher

So, being a Rat Catcher was a lucrative role in 1830s Kent - there were plenty of rats, which were carriers of pestilence such as the plague - and while the OH&S standards weren't very high, if you had elite dexterity skills, you could make a pretty penny. This role was like many of that time - piece-meal - you got paid based on the number of rats you caught.

SLIDE: Switchboard Operators

If Rat Catching wasn't your thing because, say, you were a woman and equal opportunity had't been invented yet (!), then you might tip your hand at being a manual switchboard operator. Again, this required good physical stamina, and precision and accuracy, but on the plus side it paid by the hour.

Obviously, both of these jobs have died out, but through differing

mechanisms. Rat catchers for instance lost business because better sanitation and urbanisation reduced the rodent infestation. Switchboards on the other hand became automated through technology advancement - PABXs.

Two drivers of jobs growth - population and technical advancement

SLIDE: Drivers of Australia's economic growth

So, while these two jobs - rat catching and switchboard operating - might have died out decades ago, there are similarities with the forces which are in play today. While urbanisation and technical advancement may have ended the career of the rat catcher and switchboard operator, *in contrast* it is these two forces which are likely to drive Australia's jobs growth in the future.

Australia's population is likely to reach *28 million* people over the next decade, and there will be an additional *2 million* people in the workforce. That additional population will drive growth in jobs like caring and construction and teaching, because more people will have health and education needs, and they'll need places to live.

Fourth industrial revolution

While population growth will likely represent *incremental* change, we're abuot to undergo massive paradigm shifts in the labour market due to that second factor - technical advancement.

SLIDE: Fourth industrial revolution

Everyone here will be familiar with the concept of industrial revolution - starting in the 1780s with the mechanisation of factories and mills around the world - and then the second industrial revolution in the late 1800s was driven - literally - by the steam engine and later the petrol engine.

The third industrial revolution is one some of you here may have lived through - when advances in integrated circuits gave us modern computers, and hard drives, and the internet, and eventually the cloud.

But we're now going through the *fourth industrial revolution*. This revolution isn't driven by steam, but it *is* driven by machines - smart machines and automation.

Creative Destruction

SLIDE - Creative Destruction

And just like the industrial revolutions that came before it, the *fourth industrial revolution* will bring with it a wave of *Creative Destruction* - disrupting almost every sector, introducing new business models, economies and roles. The key question of course is what the roles that are created after this widespread disruption look like - and how many of them there will be?

So let's continue our mission by putting some of these advancing technologies under the microscope, and examining how they're going to impact on jobs of the future.

Automation

SLIDE: Automation

The *automation* that started with the first industrial revolution and which

continued unabated through the second and third revolutions will only increase in pace and scope during the *Fourth Industrial Revolution*.

Where once factory jobs were at risk from mechanical automation, we're now seeing the introduction of advanced automation in service roles. Has anyone used the touch screen ordering system at McDonalds?

SLIDE: McDonalds touch screen

Soon not only will your order be taken by a computerised system, the actual food itself will be prepared via robots specifically designed for this purpose. So, what was once the introduction to the workforce for tens of thousands of teenagers will likely become the realm of robots.

Customer service roles are also experiencing more automation - note for instance the rise of self-service kiosks in shopping centres, or self-service lanes at supermarkets. How long will it be before even complex transactions are conducted with machines rather than humans?

Does increasing automation create any additional jobs - sufficient say to make up for the number that are automated away? The short answer is no - and this is a trend that we've seen play out for several decades.

Relationship between wages and productivity

SLIDE - Relationship between wages and productivity

If we look at the relationship between wages and productivity over time, we see this play out at a macro-economic scale. Since the 1970s, wages - and this is true for all OECD economies - wages have been stagnant when compared to output and productivity.

The simple reality is that machines are quicker, cheaper and more productive than human workers.

Machine learning

SLIDE: Machine Learning

But it's not just entry level, or service-based jobs that are challenged by new technologies.

Machine learning is a special type of artificial intelligence that provides computers the ability to learn without needing to have each new piece of learning programmed.

There's some really interesting ways in which machine learning is being used:

Facial recognition

Have you ever posted a photo to Facebook, and magically Facebook knows that the photo has a person in it, and is scarily good at picking which one of your friends? That's machine learning in action. Computers are trained on hundreds of thousands of images to know what's a face and what's not a face, and whose face it is.

Recommendation systems

Have you ever been on a shopping site, and put an item in your basket, and then the site suggests products that you might also like? Have you noticed that in the last few years those suggestions have become almost prescient? Again, that's machine learning at work, using the transaction data of hundreds of thousands of consumers to better identify what consumers just like *you* are likely to purchase next, and then suggesting it to you.

IBM Watson

SLIDE: IBM Watson

Everybody's heard of Watson, right - IBM's artificial intelligence that won Jeopardy in 2011? Well Watson uses machine learning as well, and is now being put to use in a range of fields such as radiology - and identifying which scans means something suspicious and which are benign - with incredible accuracy - rivalling even experienced radiologists.

So we're now seeing that machine learning is not just assisting people in choices - decision support - it's able to replicate the specialist and discipline specific knowledge - such as interpreting radiology scans and determining if someone has cancer - of experienced and skilled professionals.

Narrative Science and Quill

In fact, a company called Narrative Science in the United States offers a product called Quill - and this is essentially a machine learning program that replaces sports journalists entirely. The program uses statistics from the game, and data about players' history and past performances to construct a news article, in the same style as a sports writer. This is a further blow to any journalists in the room - who've already suffered serious disruption from smartphones, bloggers and citizen journalists.

Tay.ai

SLIDE: Tay.ai

Of course, not all machine learning attempts have been successful. In March of this year, Microsoft released a machine learning program called Tay, whose intent was to learn to interact with people on Twitter. Unfortunately, Tay got trolled, and was fed racist interactions, in turn

becoming a reflection of her environment. Tay was shut down after tweeting bigoted and racist tweets to her followers.

Perhaps Tay could have used a artificial intelligence trainer - a human to guide her learning and steer her development - much like a guidance counsellor would steer an adolescent. So, there's at least one new role that will be created as machine learning disrupts a number of established sectors.

But what will some of the other jobs of the future look like?

Let's continue our mission and take a closer look at what those jobs are going to look like.

7 Job Clusters

SLIDE: Job Clusters

In their recent report, the Foundation for Young Australians urged young Australians not to think in terms of specific careers, but around a professional portfolio of skills - job *clusters* that they can use to drive their professional development.

- *Generators* - these are jobs that require a high level of interaction - think about roles in retail, in sales, entertainment and hospitality - our 'people people'.
- *Artisans* - these are the jobs that require manual and dexterity skills - construction, production and maintenance. Builders, plumbers, electricians and tradie type roles are all in this cluster.
- *Carers* - nurses, doctors, personal trainers, and all the roles that provide personal health and well being services.

- *Informers* - our informers are those roles that involve professionals providing information, education or business services - for instance university lecturers, accountants, business advisors and so on.
- *Co-ordinators* - our co-ordinators are our back of house heroes - administrative and service workers who are often behind the scenes.
- *Designers* - these are the jobs that require skills in science, maths, engineering, lots of the STEM roles - engineers, architects, industrial designers and so on.
- *Technologists* - these are my people - the geeks of the world - roles that require skilled understanding of technology and digital systems.

If we apply this thinking to some of the careers that we might be familiar with, we get some exciting possibilities.

For instance, take an architect - part of the Designer cluster. The skills required for architecture - design, understanding of form and function, utility with materials - all of these skills equally apply for instance to industrial design, or indeed user experience design or even customer experience design. So in the future you may simply be a Designer - and work across a range of domains.

Similarly with the Carer cluster - we can see many crossovers between say medicine and nutrition or nursing and psychological health.

Demand for skills

SLIDE: WEF skills trends

But of course, the market demand for these skills is not equal at all.

When we look at what skills the World Economic Forum predicts will be required in the next 3 years to 2020, some clear trends emerge. Some of the skills that are predicted to be in highest demand are

- cognitive abilities - the ability to harness science, technology, engineering and design skills, identify and act upon new insights - and to *think*
- systems skills - the ability to conceptualise processes and components, how they fit together and interact, and how to make them better
- complex problem solving skills - to solve the *wicked* problems of the future - requiring research, analytical, experimental and entrepreneurial skills.
- content skills - not just business writing, but *engagement* skills - the ability to present convincingly, articulately and with passion - for instance in front of people - or in social media or virtual reality or augmented reality channels.
- social skills - empathy, emotional intelligence, the ability to work productively and harmoniously with other humans - will continue to be an in demand skill - particularly as globalisation and generational shifts in the workplace mean that we'll be working with people of all ages, cultures and backgrounds.
- technical skills - these will remain in high demand, but as automation and artificial intelligence continue to advance, these skills will move from the doing side of technology - more to the conceptual and design side.
- physical skills - the demand for physical skills - dexterity, physical strength and stamina - will continue to decline, other than in industries

where physical strength provides a distinct advantage - such as in building and construction.

Education and training

So, if we take into account the

How have the jobs evolved?

Distopia vs Utopia

SLIDE: Distopia vs Utopia

So, there's really two polarised views about the future of work. On one side we have the utopian view - that automation and the rise of AI will generate limitless new opportunities for employment in a range of exciting fields - nanotechnology, artificial intelligence, genetics, agricultural technology, automated transport and so on. This is tempered by the pessimistic view that advances will cause massive dislocation of employment - by both volume, sector and geography.

The reality of course lies somewhere in between these two extremes, specific to individual industries, regions and occupations.

Industries and occupations

So, let's examine more closely which industries and occupations are most likely to be affected.

@TODO - something in here around the WEF report on changes in the

labour market

Fourth industrial revolution

SLIDE: FOURTH INDUSTRIAL REVOLUTION

Skills shortages

WEF shows that there will generally be talent shortages across the board. We cannot wait for the next generation to become skilled - we have to take an active role in training for our digital future.

Key drivers of change

Putting our mission suits on, and getting our instruments to examine Jobs of the Future, we can already make some observations about how the labour landscape is changing.

Changing work environments

How many people here work from a co-work space? Quite a few, great! In fact, Knight Frank, a Melbourne real estate company recently reported that over the last year, there's been a 750% increase - that's 7 and a half times - growth in space being used for co-working in Melbourne. This is driven not just by smaller businesses and entrepreneurs, but also by more flexible work policies in corporate environments - telework, remote work and so on - and the underpinning technologies required to work in this way. Co-working also has the benefit of being able to mix and mingle - and be exposed to thoughts, ideas or skills that you wouldn't be able to if you were in a smaller

office.

We're also seeing a rise in people working from home - not just instead of working in a corporate office, but also running small businesses from home - and why wouldn't you - you pay rent or a mortgage on a premises, and you're away from it, not occupying it, for the whole work day.

Rise of Asia and the middle class

At a global level, we're also seeing a rise of Asia, China, India, Indonesia, all with burgeoning middle classes. China has a population of over a billion, India is approaching a billion and Indonesia has a quarter of a billion. Australia has a population of just 25 million. If you're making a product or delivering a cloud service, why would you go after the smaller market? This means that businesses based in Australia are likely to be engaging more with Asia, and of course that's a challenge. How many people here speak an Indian language - Hindi or Urdu or can read Devanagari, or Mandarin or Cantonese or Bahasa? Having an Asian language under your belt is going to give you an edge in an increasingly global world.

So, with our investigative hats on, we can see that both of these trends are going to shape *WHERE* we work and *WHO* we work with.

Climate change and natural resource scarcity

Of course, climate change is going to impact jobs of the future too.

It's OK, I won't take an hour here debating whether the science is right - let's just presume that 99% of the world's leading scientists and their myriad expertise is actually correct - climate change is going to impact on our working lives. It's going to be hotter, wetter with more extreme weather

events. It will be harder to grow produce - which will impact the agricultural sector significantly.

Climate change will also damage infrastructure - fires, floods and extreme heat cause billions of dollars of damage every year - and the money needed to repair that infrastructure means it won't be invested in other areas.

Paradoxically though, that renewal creates additional jobs.

Working note-takers

end of life care - end of life jobs - euthanasia planner - this sits at the intersection of aging and health care, but also a growing recognition of the role that mental health and wellbeing plays in a life well lived.

Talk about the intersection of a number of key trends, and what this means for jobs of the future.

The Gig Economy

Jobs are becoming more contingent Shorter term contracts Lack of real wages growth Many people overqualified for the roles that they are filling ? Are degrees undervalued Rise of short courses or just in time learning Example of Javascript fatigue - Javascript frameworks are evolving moe rapidly than ever, hard to keep up - even if you studied Javascript or programming at Uni,

Knowledge has a shorter shelf life

Skills required in the future

Complex problem solving Collaboration

Too many graduates, people are overqualified for their roles

how will this bookend with Dineli Mather's talk on graduates: wanted

Is education and training really the answer?

Different types of jobs in the future

Five different kinds of jobs from the Bernard Salt report

- The Care-givers
- The Technocrats
- The Specialist Professionals
- The Doers
- The Creatives

Rise of AI and automation

Impacting white collar and middle class jobs Administration heavily impacted

Are we seeing a return to bespoke and artisanal manufacturing?

AI-rtisans

^^^ love this concept - how long is it before AI is able to replicate or even build on original works by humans - we've seen Google's deep dream

neural network be trained on various artists and then 'imagine' its own artworks.

Deep dream

Google deep dream - example of AI creating 'original artwork'

What jobs will we need for the future

Machine ethicists Facial recognition disruption artist - using the makeup of disruption

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Reference List

SLIDE: Reference list