A Course in Network Architecture: Teaching how Technology Aligns with Business

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Network Architecture: What and Why?

- Architecting a building
  - Materials: bricks, glass, concrete, wood, …
  - Structures: integrity, aesthetics, …
  - Usage: office, museum, residential, …
  - Vision:
    - Environmentally friendly
    - Flowing open spaces
    - Lots of natural light

- Architecting a network
  - Devices: switches, routers, access points, …
  - Interconnections: technologies, media, protocols, …
  - Applications: video, p2p, sensor, …
  - Vision:
    - Engaging campus experience
    - Improve hospital efficiency
    - Provide nationwide broadband

Architecture: Top-down process of developing a system that meets the vision.
- Focus on breadth not depth
- Articulate the value of (and abstract) the underlying technology
Understanding the Business

Example 1: Uni Business Model Canvas

**Key Partners**
- Government
- NICTA (research)
- Alumni
- Community
- Industry
- “Service Providers” e.g. banks, cafe

**Key Activities**
- Teaching
- Course development
- Research
- Student Services (e.g. gym/dorm)

**Key Resources**
- Real Estate campus
- Staff
- $$$

**Value Proposition**
- Status (#46 world wide)
- Ground breaking research (robotics)
- High graduate starting salary
- Campus “experience”

**Relationships**
- Direct
- Self service

**Customers**
- School leavers
- Overseas
- Mature Age
- Short course (bridging)

**Channel**
- Distance education
- Campus
- Social Media

**Cost Structure**
- Staff $760M
- NonStaff $470M (water $650k, energy $4.3M 2004 KENS)

**Revenue Streams**
- Teaching $744M
- Research $348M
- Other $195M
UNSW: Aspirations, Objectives, Strategies

**UNSW ASPIRATION**

Continuously improve our position as a leading research intensive university in the Asia-Pacific region, focusing on contemporary and social issues through defined strengths in professional, scientific and technological fields.

**STUDENT EXPERIENCE**
- Develop globally focused graduates who are rigorous scholars, leaders and professionals.

**RESEARCH**
- Continue to build on our position as a peer of the best globally.

**COMMUNITY ENGAGEMENT**
- Be a valued partner with key communities.

**CAPABILITIES**
- Improve leadership and operations.

**RESOURCES**
- Maximise availability of resources and the assignment of resources to priority areas.

1. Being a destination of choice for students with the highest potential irrespective of background.
2. Setting progressive, rigorous and internationally relevant curricula.
3. Ensuring a learning and teaching environment that provides students with an outstanding learning experience through excellent teaching and exposure to research.
4. Enhancing capabilities, skills and knowledge of students to pursue professional careers nationally and internationally.
5. Providing a contemporary and engaging campus environment.
Students: Strategies and Objectives

Student Experience: Objective and Strategies

Develop globally focused graduates who are rigorous scholars, capable of leadership and professional practice in an international community by:

1. Being a destination of choice for students with the highest potential, irrespective of background.
2. Setting progressive, rigorous and internationally relevant curricula.
3. Ensuring a learning and teaching environment that provides students with an outstanding learning experience through excellent teaching and exposure to research.
4. Enhancing capabilities, skills and knowledge of students to pursue professional careers nationally and internationally.
5. Providing a contemporary and engaging campus environment.

“Ensuring a learning and teaching environment that provides students with an outstanding learning experience through excellent teaching and exposure to research.”

“Providing a contemporary and engaging campus environment.”

What (networking) capabilities might be required?
Network Capabilities

- WiFi access in all areas
  - Seamless user experience (poe, qos, multicast for video on wired -> unicast, dedicated wifi segment or shared with data?, security/auth model?)

- IP video surveillance
  - Campus safety and security (poe, multicast, qos, network partition, location of analytics centralized vs distributed (cloud based service?))

- Digital Signage
  - Contemporary campus, potential revenue stream for advertising for partners (poe, multicast, content caching/redirection,)

- Video communication
  - Collaboration with remote experts (guest lectures), industry participation (qos, federation to 3rd parties & security, voice and data integration considerations)

- Virtualization, Security, Management, Caching, …
UNSW: Network Capabilities

- WiFi access in all areas
  - Seamless user experience
- IP video surveillance
  - Campus safety and security
- Digital Signage
  - Contemporary campus, potential revenue stream for advertising for partners
- IP Video communication and distribution
  - Collaboration with remote experts (guest lectures), industry participation
Example 2: National Broadband Network

- Public (taxpayer funded) *not* private
- Goal 1: Coverage to *all* Australian premises
  - Large country, highly uneven population distribution
  - Architectural impact:
    - Mix of optical, wireless, satellite technologies
    - Hierarchical layout with replication (to lower cost)
NBN Inter-connection Architecture

- **Goal 2:** Wholesale-only *open-access* network
  - Retail service providers compete for customers
  - Level-playing field for retail service providers

- **Architectural impact:**
  - Layer-2 “sweet-spot” for interconnection
    - Layer-1 locks in provider, weakens competition
    - Layer-3 too complex (addressing, routing, IPv6, …)
  - Points-of-interconnect between NBN and RSP
    - Too few: NBN has to build backhaul, expensive
    - Too many: smaller RSPs cannot reach all customers
Learning Experience

- Students appreciated:
  - Exposure to the business model
  - Understanding better “why” they do things, not just “how”
  - Awareness of top-down process and frameworks (TOGAF, SONA)
  - Importance of breadth and abstraction in managing complexity

- Projects were key to learning:
  - Sample topics: smart office building, casino, gym, retail store, convention centre, airport, bank branch, hospital, …
  - Identified business needs for video analytics, location service, signage, etc. (to increase revenue and/or reduce costs)
  - Used these to derive network capabilities for transport, virtualization, security, manageability, etc.
  - Identified interactions and trade-offs amongst components, made choices and justified them.