MYREN Future Network

KONVENSYEN PENTADBIR (ICT) 2016,
M-SUITE HOTEL,
JOHOR BHARU 28 JULAI 2016
A bit about me.

- Assoc. Prof. Rahidzab bin Talib
- Faculty of Electrical Engineering, Department of Computer Engineering, University Technology of MARA (UiTM), Shah Alam (1989 – Present)
- Chairman, Jawatankuasa Kerja Kajian Penyediaan Infrastruktur Rangkaian, Kementerian Pendidikan Tinggi, Malaysia. (2014 – Present)
- Member, Jawatankuasa Pemandu ICT, Kementerian Pendidikan Malaysia. (2013 – Present)
- Member, Jawatankuasa Pemandu ICT, Kementerian Pendidikan Tinggi Malaysia. (2013 – Present)
- Chief Executive Officer, AKARI Software Asia Pacific Sdn. Bhd., a joint venture company between UiTM and AKARI Software Inc., Ireland. (2015 – Present)
UiTM Holdings Sdn Bhd
Jawatankuasa Kerja Kajian Penyediaan Infrastruktur Rangkaian KPT

**History, Terms of Reference, Chronology of Events and Findings.**
Brief History

- 2005 – First discussion about possibility of using dark fiber to consolidate all public universities network during MAPITA meeting.
- 2013 – UiTM was given the mandate to lead a committee within MAPITA to start work on consolidation of all public universities networks through MYREN.
- 2013 – The Prime Minister of Malaysia was asked by universities students during general election to provide a free and stable WiFi.
- 2013 – Presentation to the Mesyuarat Pengurusan Tertinggi KPM for the formation of JKKPIR, chaired by KSU of KPM.
- 2014 – Letter of appointment to all members was signed by KSU KPM and the chairman was given RM243,000 (managed by UiTM Bursar) for the committee expenses.
Chronology of events

2014

- Jan: JKKPIR Appointment by MOE 14/01/2014
- Feb: Meet ISP Providers 15 & 16/01/2014
- Mar: Committee Budget Received by UiTM
- Apr: Gap Analysis and Requirement Gathering
- May: Initiating POC for selected schools and MARA colleges
- Jun: Discussion with TM & JARING (Dark Fibre solution)
- Jul: Status Report to KU
- Aug: Workshop 5:
  - Cabinet Paper
  - KU Decision
  - MOOC Technical
  - METEOR Visit
  - VC Council
  - Universities Holdings
- Sep: JKKPIR Report Submission to KPT
- Oct: 2nd Interim Report to MPSPT
- Nov: Workshop 3: Presentation to MAPIPA
- Dec: Workshop 4: Report Writing

2015

- Jan: Decision Change from Cabinet Paper for RMK11 to Consortium Approach
- Feb: Meet EPU
- Mar: Discussions with VC Councils, University Holdings and KPT on formation of consortium
Terms of Reference

1. Menghasilkan satu dokumen perancangan penyediaan infrastruktur rangkaian yang memenuhi keperluan bandwidth semua Institusi Pendidikan di bawah Kementerian Pendidikan Malaysia (KPM)

2. Menyelaraskan dan mengenalpasti semua keperluan jaringan agensi-agensi di bawah KPM selaras dengan PSPTN dan PPPM.

3. Merekabentuk jaringan bagi memenuhi keperluan semua agensi di bawah KPM melalui perbandingan dan kajian terhadap pelaksanaan di negara-negara lain.


5. Menjalankan aktiviti yang membolehkan penggunaan rangkaian KPM untuk menghasilkan kandungan yang sesuai dengan keperluan P&P serta P&I.

6. Membuat perancangan struktur pentadbiran dan pengurusan rangkaian KPM
1. Assoc. Prof. Rahidzab bin Talib (UiTM) – Chairman
2. Prof. Dr. Safaai Deris (UTM)
3. Assoc. Prof. Dr Mat Ikram bin Yusof (UiTM)
4. Assoc. Prof. Hanizam bin Sulaiman (UTM)
5. Assoc. Prof. Dr. Suhaimi bin Napis (UPM)
6. Dr Fakhrul Hazman bin Yusoff (UiTM)
7. Mr. Nasrudin Bin Abd Shukor (UniMAP)
8. Mr. Mohd Radzif b. Abd Hamid (UTeM)
9. Mr. Farok Haji Azmat (UiTM)
10. Dr. Ariza bt Nordin (UiTM)
11. Mr. Kamal Hisham (MDeC)
12. Mr. Kamaruddin Mahad (UiTM)
13. Mr. Mohd Zahurin Ramli (UiTM)
14. Dr. Azwan (PADU, KPM)
15. Dr. Sulaiman (Lembaga Peperiksaan, KPM)
16. Wakil Bahagian Matrikulasi, IAB, Institut Pendidikan Guru dan PADU.
17. Bahagian Pengurusan Maklumat KPM – Urusetia
Final Report

Ministry of Education Malaysia
IT Infrastructure Working Committee Final Report:

AS-IS ANALYSIS
Towards Next Generation Giganet Malaysian Education and Research Cyberinfrastructure
Volume 1 of 2

Date: 27/07/2015

Ministry of Education Malaysia
IT Infrastructure Working Committee Final Report:

RECOMMENDATIONS
Next Generation Giganet Malaysian Education and Research Cyberinfrastructure
Volume 2 of 2

Date: 12/08/2015
Meeting on the ICT Network Infrastructure Study for the Ministry of Education Malaysia

Mesyuarat Penyediaan Infrastruktur Rangkaian ICT Kementerian Pendidikan Malaysia

Tarikh: 18 Mac 2015 (Rabu)
Masa: 3:00 – 4:00 petang
Tempat: Bilik Mesyuarat Ibnu Sina, Kementerian Pendidikan Tinggi, Aras 17 No 2, Menara 2, Jalan P5/6, Blok 5G2, Presint 5
Pengerusi: Dato’ Seri Ir. Dr. Zaini bin Ujang

3.0 KEPUTUSAN MESYUARAT

Mesyuarat telah membincangkan mengenai keperluan infrastruktur rangkaian KPM dan memutuskan perkara-perkara berikut:

(i) Mesyuarat bersetuju secara casar supaya MYREN dioperasikan melalui penggunaan dark fiber untuk rangkaian teras dengan menggunakan peruntukan kewangan secia ada tanpa KPM memohon peruntukan tambahan di bawah Rancangan Malaysia Ke-11.

Tindakan: JKKPIR dan Bahagian Pengurusan Maklumat

(ii) Sebuah universiti diminta untuk menjadi penyelaras kepada penubuhan konsortium melalui kerjasama dengan syarikat telekomunikasi yang boleh menawarkan dan membebankan dark fiber kepada institusi di bawah KPM yang merangkumi Universiti Awam dan Swasta, Politeknik, Kolej Komuniti dan institusi penyelidikan.

Tindakan: JKKPIR

4.0 PENUTUP

Mesyuarat ditangguhkan pada jam 4:00 petang dengan ucapan terima kasih oleh YBhg. Dato’ Seri Pengerusi.
Early notice on the formation of a consortium
Letter from MOHE to the GCEO of UiTM Holdings

KEMENTERIAN PENDIDIKAN MALAYSIA
Bahagian Pengurusan Maklumat (IT)
Ara 6, No. 2, Menara 2
Jalan P5/5, Presint 5
62200 W.P PUTRAJAYA

Ruj. Kami : KPMSP. 100-103/3
Tarikh : 30 April 2015

Encik Azlizan bin Fadzil
Group Chief Executive Officer
UiTM Holdings Sdn Bhd
Tingkat 4, Blok 1
INTEKMA Resort & Convention Centre
Persiaran Raja Muda, Seksyen 7
40000 Shah Alam
SELANGOR DARUL EHSAN

Tuan,

CADANGAN PENUBUHAM KONSORTIUM DALAM MENTADBIR URUS INFRASTRUKTUR RANGKAIAH ICT KEMENTERIAN PENDIDIKAN MALAYSIA

Dengan segala hormatnya merujuk kepada perkara di atas.


3. Hasil dari kajian yang dijalankan, JKKPIR mencadangkan satu infrastruktur rangkaian Giganet khusus dibangunkan kerana tujuan perluasan skop Malaysian Research and Education Network (MYREN)


5. Sehubungan dengan itu, KPM berbesar hati melantik UiTM Holdings Sdn Bhd untuk menjadi penyelaras kepada penubuhan konsortium tersebut. Kerjasama tuan dipohon untuk menjalankan hubungan kerjasama/kolaboratif antara Universiti Awam ke arah penubuhan konsortium tersebut untuk mentadbir usus MYREN bagi menyokong peranan infrastruktur rangkaian Giganet dalam transformasi pembelajaran dan penyelidikan negara.

“BERKHIDMAT UNTUK NEGARA”

Saya yang menurut perintah,

(NIK AZMIN BIN NIK HUSSAIN)
b.p. Ketua Setiausaha II
Kementerian Pendidikan Malaysia
Meeting on the consortium

Minit mesyuarat mengenai cadangan penubuhan konsortium untuk mentadbir urus infrastruktur Rangkaian ICT Kementerian Pendidikan Tinggi

Tarikh: 25 Ogos 2015 (Selasa)
Masa: 5:00 - 6:45 petang
Tempat: Bilik Mesyuarat Ibnu Sina, Kementerian Pendidikan Tinggi, Aras 17, No 2, Menara 2, Jalan P5/6, Blok 5G2, Presint 5
Pengerusi: Dato’ Seri Ir. Dr. Zaini bin Ujang

V. KEPUTUSAN MESYUARAT

5.1 Mesyuarat mengambil maklum dan memutuskan perkara-perkara berikut:

a. Semua universiti awam bersetuju dengan penubuhan konsortium bagi mentadbir urus rangkaian MYREN. Oleh itu, semua universiti digalakkan untuk melangkah (subscribe) kepada rangkaian yang akan disediakan oleh konsortium. Walau bagaimanapun, pembentangan kepada Majlis Naib Canselor/Rektor Universiti Awam perlu diadakan berkaitan komitmen universiti terutama dari segi kewangan.

Tindakan: JKKPIR dan UiTM Holdings Sdn Bhd

b. Pada peringkat awal, UiTM Holdings Sdn Bhd akan menjadi penyelaras dalam penubuhan konsortium untuk mentadbir urus rangkaian ini. Konsortium perlu memberi penerangan terperinci mengenai manfaat yang diperoleh oleh pelajar, pensyarah dan penyelidik selain kos yang rendah.

Tindakan: UiTM Holdings Sdn Bhd

c. Dalam tempoh sebulan, UiTM Holdings Sdn Bhd perlu memberi penerangan yang lebih terperinci berkaitan way forward penubuhan konsortium termasuk prospektus, pegangan ekuiti dan revenue generation untuk dibentangkan kepada universiti.

Tindakan: UiTM Holdings Sdn Bhd


Tindakan: UiTM Holdings Sdn Bhd

VI. PENUTUP

Other meetings

- 14 July 2016 - TAKLIMAT MENGENAI STATUS PENUBUHAN KONSORTIUM UNTUK MENTADBIR URUS INFRASTRUKTUR RANGKAIAN ICT KEMENTERIAN PENDIDIKAN TINGGI
  - All Vice Chancellors
  - All Chairmans of LPU
  - All IT Directors
  - Chaired by YB Menteri KPT
  - Attended by: YB Timbalan Menteri KPT, KSU, KP JPT, all TKSU, Vice Chancellors, LPU Chairmans, IT Directors.

- 26 – 27 July 2016 – Technical Advisory Committee meeting and workshop with representatives from AARNet and SINET.

- 28 July 2016 – Meeting of all Public Universities Holdings at UPSI to finalise the share holding structure in the consortium.
As-Is

SCHOOLS AND INSTITUTIONS OF HIGHER LEARNING
AS-IS in MALAYSIA

TIEN 3

INTERNET

Institusi Pendidikan MARA
Kolej Matrikulasi
Schools
IPG
IAB

Regional PoP

Universiti

Kolej Komuniti

Politeknik
Issues: What are our capacities today?

- Not all campuses are connected to MYREN; not all students get access to MYREN
- Connection to TEIN4
  - MYREN = 622 Mbps vs Other countries = 2.5 to 10 Gbps

Today’s capacities

- On-ground reality about MYREN’s connectivity
- Limitation imposed by use of current ISP for research and education
  - Education uses large capacity over long duration (e.g. for lectures, assignment research) vs Research uses huge capacity over short period of time (e.g. Big Data mining)
- Research universities’ current connection to MYREN
  - Up to 2 Gbps each
- Average current bandwidth per student
  - 0.05 Mbps (range: 0.01 to 0.19 Mbps)
Public Institutions of Higher Learnings spending

<table>
<thead>
<tr>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of students in public universities, polytechnics and community colleges</td>
</tr>
<tr>
<td>Annual estimated spending</td>
</tr>
<tr>
<td>Total bandwidth (Mbps)</td>
</tr>
<tr>
<td>Bandwidth per student (Mbps)</td>
</tr>
<tr>
<td>Cost per student per month for 1 Mbps</td>
</tr>
</tbody>
</table>

This figure is excluding the cost for connection for
- schools through 1BestariNet,
- Individual contracts for IAB, IPG, Matriculations etc.
- MARA education institutions.
- Other government training institutes.
Lawatan Ke Sarawak

Pandangan dari bangunan pejabat Sekolah Menengah Sains Kuching yang menunjukan kedudukan menara SACOFA yang disambungkan dengan fiber diluar pagar sekolah.
Faktor Motivasi – Lawatan Ke Sarawak

*Satellite Dish* di Sekolah Kebangsaan Jagoi, Bao yang digunakan untuk capaian keinternet.
Faktor Motivasi – Lawatan Ke Sarawak

- Gambar menunjukan kedudukan laluan kabel fiber yang berada pintu masuk ke Sekolah Kebangsaan Jagoi, Bau
Faktor Motivasi – Lawatan Ke Sarawak

Bergambar dengan guru besar Sekolah Kebangsaan Jagoi.
Faktor Motivasi – Lawatan Ke Sarawak

Menara SACOFA yang disambungkan dengan fiber berada diluar pagar sekolah di Serikin. Sekolah ini juga menggunakan sambungan melalui satelit.

SACOFA mendapati bahawa 63% sekolah di Sarawak berada kurang daripada 5 km daripada laluan fiber.
Research and Education Network

MYREN AND GLOBAL RESEARCH AND EDUCATION NETWORKS
What is Research and Education Network

- Dedicated and specialized internet service provider.
- Only for supporting the requirement from research and education communities within a country and within nations.
- Specializing on providing dedicated network for research requiring elephant traffic through dark-fibre.
- Not a new terminology.
- Internet was born out of Research and Education Network.

Map of scientific collaborations from 2005 to 2009
Computed by Olivier H. Beauchesne @ Science-Metrix, Inc.
Data from Scopus, using books, trade journals and peer reviewed journals
GÉANT At the Heart of Global Research Networking

GÉANT and sister networks enabling user collaboration across the globe

DANTE www.dante.net

This document has been produced with the financial assistance of the European Union. The contents of this document are the sole responsibility of DANTE and can under no circumstances be regarded as reflecting the position of the European Union.
Global Research & Education Network Infrastructure

- **Via Mumbai**: 10G, 622M
- **Via Beijing**: 10G, 10G
- **Multiple 100G (4x100G)**

**Key TEIN4 Member Countries**

<table>
<thead>
<tr>
<th>Country</th>
<th>Current Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Japan</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Korea</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Singapore</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>India</td>
<td>2.5 Gbps</td>
</tr>
<tr>
<td>Indonesia</td>
<td>622 Mbps</td>
</tr>
<tr>
<td><strong>Malaysia</strong></td>
<td><strong>622 Mbps</strong></td>
</tr>
<tr>
<td>Thailand</td>
<td>622 Mbps</td>
</tr>
<tr>
<td>Vietnam</td>
<td>622 Mbps</td>
</tr>
<tr>
<td>Philippines</td>
<td>155 Mbps</td>
</tr>
</tbody>
</table>
GEANT by DANTE
TEIN 2 Success
TEIN 3 Upgrade
Saving lives in Thailand through Geant and TEIN
YB Menteri visit to KEK, Tsukuba Campus, Tokyo

- Malaysian Flag shows collaboration between KEK and a researcher in Malaysia, Prof Wan Ahmad Tajuddin from Universiti Malaya.
- Due to limitation of bandwidth available to UM through MYREN, the collaboration is very limited to processed data.
- Raw Data (huge) is very crucial to researchers like Prof Wan to be at the frontier of knowledge.
- During this visit, YB Menteri made the crucial decision that Malaysia needs to be at par with others, at least in the region.
SINET (Science Information Network, Japan)

- SINET5 aims to attain the world’s most-advanced network, strengthen international connectivity, and enhance upper-layer services including cloud services and academic information circulation to meet various user demands.

**SINET4**

1. 40-Gbps lines between core sites
2. Four 10-Gbps international lines
3. Advanced network services such as VPNs and bandwidth on demand

+ High availability even for the big earthquake

**SINET5 (from April 2016)**

1. 100-Gbps lines between all prefectures
2. High-performance international lines
3. Enhancement of upper-layer services
   - Promotion of utilizing cloud services
   - Promotion of open access and open science
   - Network services dedicated to above

- Domestic line (100 Gbps or more)
- International line (100 Gbps)
- International line (10 Gbps)

Environment surrounding SINET

- Many research fields desire higher bandwidth
- Cloud services have increased traffic volume
- 100-Gbps lines become popular in many NRENs such as Internet2 and GÉANT.
Australia Academic and Research Network (AARNet)

- National backbone links: 10 to 100 Gbps
- Customer site connections: 1 to 10 Gbps
- End-user services: mostly 1 Gbps Ethernet and prevailing Wi-Fi capacity
- Eduroam (roaming within education community networks) services are available at Wi-Fi performance levels
- Peers with external content providers and ISPs to increase its performance and availability
- AARNet continues to sustain traffic growth rates of 50% per annum year-on-year over the preceding decade

“Throughout their life, a major driver for the very high capacities of advanced Research and Education Internet networks including AARNet has been to meet the needs of data-intensive research across a wide range of research disciplines in both the sciences and the humanities.”
KOREN is a testbed network infrastructure established for facilitating R&D and international joint-research cooperation. It provides quality broadband network testbed for domestic and international research activities to the industry, academia and research institutions, enabling testing of future network technologies and supporting R&D on advanced applications.
Pakistan Education & Research Network (PERN)

- 1 Gbps connectivity to every universities/institutes
- 10 Gbps fibre rings in Karachi, Lahore and Islamabad
- 10x Gbps nationwide fibre link
- 2.5 Gbps Commodity Internet
- 155x Mbps R&E link to other NRENs of the world

“PERN interlinks all of Pakistan’s public/private sector chartered universities/degree awarding institutes registered with the Higher Education Commission. The interconnectivity of these universities/institutes integrate data banks, help collaboration for research and development activities and up-grade teaching and learning skills.”
Research and Education Network USA (Internet2)

- 25,294 km of own dark fibre + 3,862 km partnered capacity
- 100 Gbps of hybrid Layer 2 and Layer 3 capacity
- 8.8 Tbps total capacity
- 317 US Institutions of HE
- More than 90,000 community anchor institutions
- 70 government agencies
- 42 regional and state education networks
- 84 leading corporations
- More than 65 national research and education networking partners representing more than 100 countries

"Internet2 is a member-owned advanced technology community founded by the nation's leading higher education institutions in 1996. Internet2 provides a collaborative environment where US research and education organizations can solve common technology challenges and develop innovative solutions in support of their educational, research and community service missions."
GARR-X: the network

Landing Station:
- Catania
- Ragusa
- Mazara del Vallo
- Bari

Connected to:
- 120 research sites
- 500,000 researchers
- 270 schools
UNINET: Thailand Research and Education Backbone Network

- Fiber optic network nationwide (> 50,000 Km)
- Multiple wavelength channels (10 Gbps each)
- Network bandwidth capacity (50 Gbps)
- 80 distribution nodes in the backbone network
Key Points

- Established RENs are using their own infrastructure by either laying their own fiber or by leasing from fiber operators.
FAQ

ISP's may be hesitant to invest in very high speed network that is utilised by small communities or over very short period due to Return of Investment (ROI) concern.

Research & Education Network (REN) needs can be very specific, rare or even narrowly particular to a specific research that may not be in alignment with ISP’s commercial interest.

Why not just use Internet Service Providers (ISPs)?

ISP’s may have the sizeable scale to provide common services economically (e.g. Internet access) but the cost to meet specialised requirements (e.g. research) can be huge.

ISP’s cutting-edge communications network in providing services are often closely-guarded trade secrets that very few innovations are released to the public domain.
Future of MYREN

INFRASTRUCTURE, SERVICES, GOVERNANCE AND CONSORTIUM
11 Shifts in PPPM: Shift 7

- Provide internet access and virtual learning environment via 1BestariNet for all 10,000 schools

- Augment online content to share best practices starting with a video library of the best teachers delivering lessons in Science, Mathematics, Bahasa Malaysia and English language

- Maximise use of ICT for distance and self-paced learning to expand access to high-quality teaching regardless of location or student skill level
PPPM ICT Initiatives Progression by Wave

Wave 1
2013-2015
Enhance the Foundation
• ensure students and teachers have sufficient access to ICT devices
• provide the education system with a learning platform and sufficient network bandwidth to use ICT services
• ensure all teachers have basic competency in ICT
• refine existing monitoring systems to provide more accurate assessments of progress in ICT initiatives
• infuse ICT into the curriculum and providing quality, cost-effective content

Wave 2
2015 - 2020
Introduce ICT Innovations
• To study additional opportunities to transform ICT usage in the classroom such as through EduWeb TV.
• lower student-to-computer ratios to a maximum of 10:1 to achieve the critical mass in ICT devices
• Continuously update implementation strategy to reflect new findings from international research on how to leverage ICT in developing higher-order thinking skills.

Wave 3
2020 -2025
Maintain Innovative, System-wide Usage
• To fully embed ICT throughout the pedagogy and curriculum.
• Scale up and intensify ICT usage among students and teachers.
• Maximize usage of ICT for distance and self-paced learning
Towards Realising MOHE’s 10 Shift in HE Initiative

Digital Content, Massive Open Online Courses (MOOC), Learning Analytics (Big Data), 21st century classroom

Cyberinfrastructure, Network, Storage, Collaborative and Application Services

Science Data Access, Ranking, Nobel Laureate Research

Cyberinfrastructure is the GAME CHANGER
Malaysian Higher Education Blueprint 2015-2025

- **Shift No 8: Global Prominence**
  - Globally-connected higher education player that is renowned for its academic and research expertise

- **Shift No 9: Globalised Online Learning**
  - Robust cyber infrastructure that can support the use of technologies like videoconferencing, live streaming and Massive Open Online Courses (MOOCs)
  - Establishing the required cyber infrastructure and strengthening the capabilities of the academic community to deliver online learning at scale

**MYREN TO SUPPORT THE ASPIRATION OF THE FUTURE OF EDUCATION IN**

- Providing Gigabit computing infrastructure for national and global research and education purposes
- Acting as inter-institution network, connecting academicians, researchers and scientists nationwide and worldwide via high-speed backbone network
- Enabling high speed, dedicated connectivity to the education sector while expanding research capabilities in Malaysia and beyond
## Better Bandwidth Overall

<table>
<thead>
<tr>
<th>Type of Institution</th>
<th>Current Capacity per Institution</th>
<th>Future Capacity per Campus*</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research universities</td>
<td>2 Gbps (2,000 Mbps)</td>
<td>Up to 100 Gbps</td>
<td>↑ 5,000%</td>
</tr>
<tr>
<td>Comprehensive universities</td>
<td>2 Gbps (2,000 Mbps)</td>
<td>Up to 100 Gbps</td>
<td>↑ 5,000%</td>
</tr>
<tr>
<td>Other public universities</td>
<td>2 Gbps (2,000 Mbps)</td>
<td>Up to 10 Gbps</td>
<td>↑ 500%</td>
</tr>
<tr>
<td>Polytechnics</td>
<td>0.05 Gbps (50 Mbps)</td>
<td>Up to 10 Gbps</td>
<td>↑ 20,000%</td>
</tr>
<tr>
<td>Other public institutions of higher learning</td>
<td>Up to 2 Gbps</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Bandwidth provisioned will depend on Research and Education requirements (e.g. on-demand burstable needs, number of students).
Reflecting Tomorrow’s Realities

100 Gbps
- Research Universities
- Premier Polytechnics
- Teacher Training Institutes

2 Gbps
- Matriculation colleges
- Community colleges
- Aminuddin Baki Institute

400 Gbps on-demand

More contents by universities (e.g., Massive Open Online Courses)

Increase use of video (e.g., Video Conferencing, Telepresence, VOD)

Students & Researchers

Increase use of technology & collaboration in education (e.g., Global Online Learning)

Increase collaboration in research (e.g., Large Hadron Collider, Big Data)

Up to 2 Gbps international connection for research universities to be at par with other countries connected to TEIN, GEANT and Internet2
## Phases of Implementation

### Implementation Location & Timeline

<table>
<thead>
<tr>
<th>Phase</th>
<th>Location</th>
<th>Q4 '16</th>
<th>Q1 '17</th>
<th>Q2 '17</th>
<th>Q3 '17</th>
<th>Q4 '17</th>
<th>Q2 '18</th>
<th>Q3 '18</th>
<th>Q4 '18</th>
<th>Q1 '19</th>
<th>Q2 '19</th>
<th>Total Campus</th>
<th>Percentage of Completion</th>
<th>Cumulative Completion Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>West Coast Peninsula - Central to Southern region</td>
<td>41</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td>69</td>
<td>33.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Phase 2</td>
<td>West Coast Peninsula - Central to Northern region</td>
<td>16</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>49</td>
<td>23.8%</td>
<td>57.3%</td>
</tr>
<tr>
<td>Phase 3</td>
<td>East Coast Peninsula - Malaysia</td>
<td>20</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>45</td>
<td>21.8%</td>
<td>79.1%</td>
</tr>
<tr>
<td>Phase 4</td>
<td>East Malaysia</td>
<td>8</td>
<td>5</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>13</td>
<td>26</td>
<td>12.6%</td>
<td>91.7%</td>
</tr>
<tr>
<td>Phase 5</td>
<td>Throughout Malaysia</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>17</td>
<td>8.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Number of Campus

<table>
<thead>
<tr>
<th>Phase</th>
<th>Public Universities</th>
<th>Polytechnics</th>
<th>Community Colleges</th>
<th>Total Campus</th>
<th>Percentage of Completion</th>
<th>Cumulative Completion Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>41</td>
<td>10</td>
<td>18</td>
<td>69</td>
<td>33.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Phase 2</td>
<td>16</td>
<td>9</td>
<td>24</td>
<td>49</td>
<td>23.8%</td>
<td>57.3%</td>
</tr>
<tr>
<td>Phase 3</td>
<td>20</td>
<td>9</td>
<td>16</td>
<td>45</td>
<td>21.8%</td>
<td>79.1%</td>
</tr>
<tr>
<td>Phase 4</td>
<td>8</td>
<td>5</td>
<td>13</td>
<td>26</td>
<td>12.6%</td>
<td>91.7%</td>
</tr>
<tr>
<td>Phase 5</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>17</td>
<td>8.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Total Sites

<table>
<thead>
<tr>
<th>Public Universities</th>
<th>Polytechnics</th>
<th>Community Colleges</th>
<th>Total Campus</th>
<th>Percentage of Completion</th>
<th>Cumulative Completion Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>33</td>
<td>88</td>
<td>206</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Project Location – Peninsular Malaysia

Phase 1
33.5% completion
69 sites

Phase 2
23.8% completion
49 sites

Phase 3 (i)
21.8% completion
45 sites

Phase 3 (ii)
Project Location – Sabah & Sarawak

Phase 4
12.6% completion
26 sites
## Fibre Construction Technology

| Fibre to be installed | Trunk: 144 core  
<table>
<thead>
<tr>
<th></th>
<th>Access: 48 core</th>
</tr>
</thead>
</table>
| Laying method         | Open trenching  
|                      | Micro trenching 
|                      | Horizontal Direct Drilling (HDD)  
|                      | Fibre through sewer pipe |
| Acceptable quality of optical characteristics | Attenuation Coefficient:  
|                      | • 0.35dB/km in 1310nm region  
|                      | • 0.22dB/km in 1550nm region  
|                      | Dispersion Coefficient:  
|                      | • ≤3.5 ps/km.nm in the 1310 nm wavelength  
|                      | • ≤18 ps/km.nm in the 1550 nm wavelength |
Fibre Construction Technology

Open trenching

<table>
<thead>
<tr>
<th>Cost</th>
<th>★★★★★</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>★★★★★</td>
</tr>
<tr>
<td>Environment</td>
<td>★</td>
</tr>
<tr>
<td>Work permit</td>
<td>★</td>
</tr>
</tbody>
</table>

Micro trenching
Fibre Construction Technology

Horizontal Direct Drilling (HDD)

<table>
<thead>
<tr>
<th></th>
<th>★★★★★</th>
<th>★★★★</th>
<th>★★★★★</th>
<th>★★★★★</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>★</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>★★★★</td>
<td>★★★</td>
<td>★★★★★</td>
<td>★★★★★</td>
</tr>
<tr>
<td>Environment</td>
<td>★★★★</td>
<td>★★★</td>
<td>★★★★★</td>
<td>★★★★★</td>
</tr>
<tr>
<td>Work permit</td>
<td>★★★★★</td>
<td>★★★</td>
<td>★★★★★</td>
<td>★★★★★</td>
</tr>
</tbody>
</table>

Fibre through sewer pipe
Proposed Network Topology
Network Overview

MYREN Data Centre: NMS, Infrastructure, Connectivity and Contents

To other RENs

Internet

IP

To other RENs

TIEN 10Gbps

MYREN REGIONAL POPS

Multiple 100G DWDM Trunk Connectivity to MYREN Data Centre

Multiple Services (1Gbps-100Gbps) via DWDM and Metro Ethernet connections to the Universities

Network managed by MYREN

Network managed by Universities locally

Universities Internal LAN
Proposed Solution Services

Open Access to and Sharing of Academic Data
- Collaborative Institutional Repository (IR) of research data
- Open Access academic information and circulation

Inter-Universities Cooperation
- Collaborative enhancement of authentication for mutual resource utilisation via Identity Federation

Cloud Services
- Cloud services such as Google, Microsoft and Amazon offer resource sharing of research and education environment

Security and Performance Enhancement
- Enhanced security level
- Network flow analysis and dynamic flow control for High Performance Computing

High-Technology, High-Performance Network
- 100 Gbps nationwide backbone
- 2 Gbps international connection to TEIN
- Dedicated fibre core and data centre

A network for us, by us

The exclusively-managed dark fibre infrastructure would enable MYREN to offer and promote directly connected data-oriented high-speed and secure cloud services
## Cost Analysis

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Future</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of students in public universities, polytechnics and community colleges</strong></td>
<td>650,000</td>
<td>650,000</td>
<td></td>
</tr>
<tr>
<td><strong>Total bandwidth (Mbps)</strong></td>
<td>33,000</td>
<td>3,250,000</td>
<td>9848.5% increase</td>
</tr>
<tr>
<td><strong>Bandwidth per student (Mbps)</strong></td>
<td>0.05</td>
<td>5.00</td>
<td>9848.5% increase</td>
</tr>
</tbody>
</table>

A presentation file size for the typical 1 – 2 hrs of lecture slides with multimedia contents would be about. 10 MB

If a student were to download her lecturer’s presentation slides of equivalent size at the Current bandwidth (5 Kbps), it would take **4 hours 39 minutes 37 seconds** to complete.

But with the Future bandwidth speed (5 Mbps), the download will only take **16 seconds**.

(*Calculated by download-time.com)
Global Research & Education Network Infrastructure

Multiple 100G (4x100G)

Key TEIN4 Member Countries

<table>
<thead>
<tr>
<th>Member Countries</th>
<th>Current Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Japan</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Korea</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Singapore</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>India</td>
<td>2.5 Gbps</td>
</tr>
<tr>
<td>Indonesia</td>
<td>622 Mbps</td>
</tr>
<tr>
<td><strong>Malaysia</strong></td>
<td><strong>622 Mbps</strong></td>
</tr>
<tr>
<td>Thailand</td>
<td>622 Mbps</td>
</tr>
<tr>
<td>Vietnam</td>
<td>622 Mbps</td>
</tr>
<tr>
<td>Philippines</td>
<td>155 Mbps</td>
</tr>
</tbody>
</table>
Dedicated 100Gbps Research Network: What the project will deliver

Dedicated 100Gbps Research Network
- Main research universities as research, data centre & testbed platform
- 100Gbps interconnectivity
- 400Gbps on demand
- Direct connection to international gateway and TIEN up to 2 Gbps
- Dedicated fibre core and data center

METRO NETWORK DIAGRAM

Aggregation Cloud
1. 10Gbps Interconnectivity
2. Dedicated fibre connection for administration, students & teaching purposes
3. Supported by 100Gbps backbone & connected to research & testbed platform
Summary Benefits

**Area of Interests**

Research collaboration with global academic and research communities
- Sharing of resources
- Access to data, instrument, laboratories and libraries

Better intranet & internet connection

Emphasizing the roles of higher learning institutions with easy access to universities
- Sharing of resources
- Access to data, instrument, laboratories, content and libraries
- Access to formal and informal tertiary education

Easy access to content locally and globally

**Benefits**

- Cost saving
- Time saving
- Global presence in research & education

- Cost saving due to low prices for local internet connection
- Time saving due to better communication within higher education system
- Quality connection due to better speed and capacity

- Cost saving due to low prices for local internet connection
- Time saving due to better communication within higher education system
- Quality connection due to better speed and capacity

- Global presence and up-to-date knowledge and information
- Cost saving
- Time saving
THANK YOU