AENEAS WP4 Update

Analysis of Global SKA Data Transport and Optimal European Storage Topologies

Current Status

WP4 Milestones

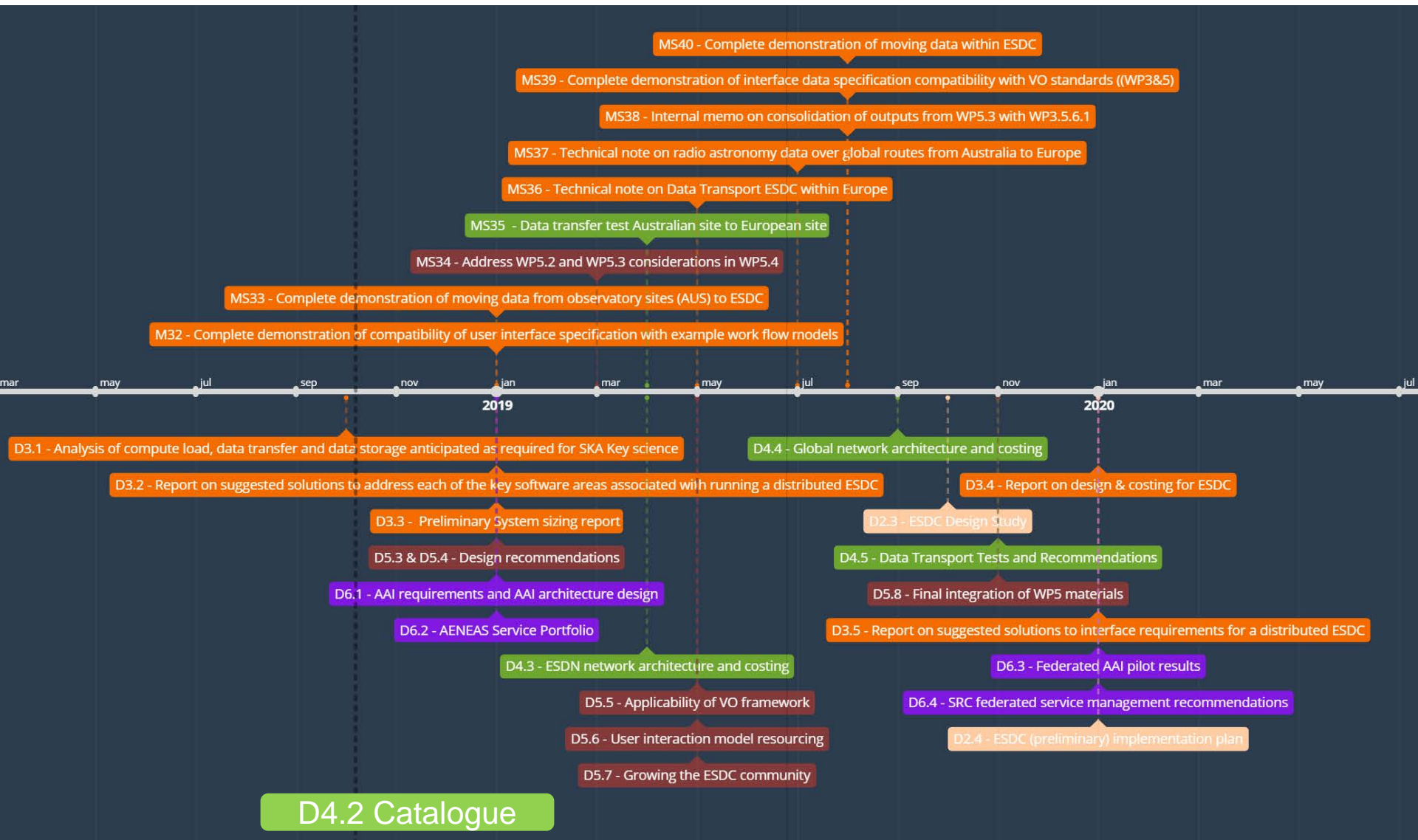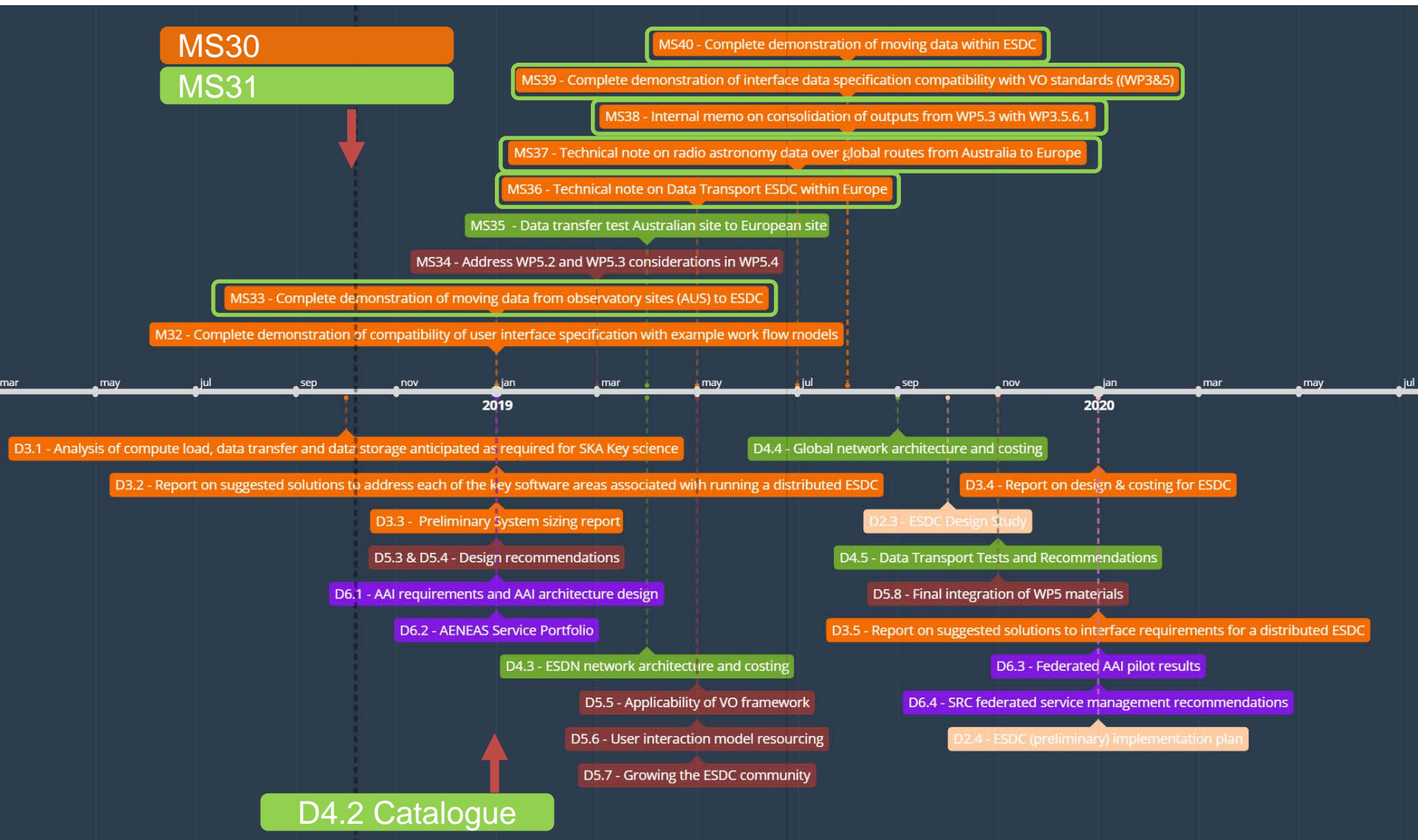| Milestone number	Milestone name	Related WP(s)	Due date	Means of verification	Status
6	Protocols and end hosts evaluation	WP4	7	Technical note written	Completed
7	Storage sub-systems evaluation	WP4	8	Technical note written	Completed
10	Joint Milestone (WP3) on data moving applications & tools	**WP3** WP4	9	Internal memo	Completed
11	List of possible regional site locations	WP2 **WP4**	9	List of possible sites established	• Selection criteria discussed • NREN survey documented • Questionnaire written
19	Data transfer test South African site to European site	WP4	13	Technical note written	Completed
20	Joint Milestone (WP4) on SKA Sci DMZ recommendations	**WP3** WP4	14	Internal memo	Completed
21	Best practice recommendations Data moving applications, protocols & storage	WP3 **WP4**	14	Deliverable 4.1 written	Completed
22	Specification for SKA Science DMZ	WP3 **WP4**	14	Specification document written	Completed
25	radio astronomy data over global routes from South Africa to Europe	**WP3** WP4	18	WP3 Technical note written	Completed
27	demonstration of moving data from observatory sites (SA) to ESDC	WP3 **WP4**	19	Demonstration completed	**In Progress**
30	Joint Milestone (WP4) on data replica manager	**WP3** WP4	21	Internal memo	**Just started**
31	Specifications for SKA Replica Manager	WP3 **WP4**	21	Specification document written	**To start**
35	Data transfer test Australian site to European site	WP4	27	Technical note written	**In Progress**

Deliverable D4.2

- D4.2 delivered as indicative.
- It demonstrates how the site catalogue could be created.
- The catalogue has 4 sections listing the technical responses:
  – Network Connectivity and Data Transfer Capabilities
  – Storage Units
  – Network Distributed file Systems
  – Tape Libraries
- Expect to be finalised within the next 3 months.

Capability / Site	Site A	Site B	Site C	Site D	Site E
Current_Site – NREN access link	10 Gbit/s	10 Gbit/s	1G	10 Gbit/s	100 Gbit/s
Expected bandwidth of the access link by 2020	100 Gbit/s	N x 10 Gbit/s	10 Gbit/s	100 Gbit/s	N x 100 Gbit/s
Do you run a Local storage system?	YES	YES	YES	YES	YES
Does your site currently have designated servers for data transfers? If so how many current nodes?	YES 8	YES 6	NO	YES 4	YES 140
Technology and Bandwidth of the Network Interfaces (NIC) in the Data Transfer Nodes (DTN)	40 GE	N x 10 GE IB 10/40 Gbit/s		10 GE	40 GE
By 2020 / 2022 will your site plan to have DTNs? If so, how many?	>64	plan	plan	more	
Monitoring tools in use	Nagios, Mellanox & Intel tools		Nagios, Ganglia	mrtg, ganglia, NREN Tools	
What methods does the site currently implement for its security policies	not disclose	ACL and Firewall	Firewall	ACL and Firewall for services	ACL and Firewall for services
Is the site capable of implementing access control lists (ACLs) and/or a stateless firewall at bandwidths in excess of 10 Gigabits/s? Please briefly describe the capabilities and give the bandwidth		ACL on 10G and firewall up to 30G for packets inspection	Sonicwall 4600 ACL at 10 Gbit/s	ACL allows 9,8 Gbit/s in single stream	100 Gbit/s and N x 100 Gbit/s on demand
Does the site have a Science DMZ?		YES	NO	YES	YES
Does the site plan have a Science DMZ?		YES	YES	YES	YES
By 2020/2022, will the site's network device at the boundary of the site (i.e. your site's demarcation point with your ISP) be upgraded?	1.2 Tbits metroplitan network federate 3 data centres	10/100 Gbit/s capable interfaces	Upgrade to 10 Gbit/s planned and then to 100 Gbit/s	100 Gbit/s if required	Yes, if needed

The Next Period

Ivona's Timeline

MS40 - Complete demonstration of moving data within ESDC

MS39 - Complete demonstration of interface data specification compatibility with VO standards ((WP3&5)

MS38 - Internal memo on consolidation of outputs from WP5.3 with WP3.5.6.1

MS37 - Technical note on radio astronomy data over global routes from Australia to Europe

MS36 - Technical note on Data Transport ESDC within Europe

MS35 - Data transfer test Australian site to European site

MS34 - Address WP5.2 and WP5.3 considerations in WP5.4

MS33 - Complete demonstration of moving data from observatory sites (AUS) to ESDC

M32 - Complete demonstration of compatibility of user interface specification with example work flow models

| mar | may | jul | sep | nov | **jan 2019** | mar | may | jul | sep | nov | **jan 2020** | mar | may | jul |

D3.1 - Analysis of compute load, data transfer and data storage anticipated as required for SKA Key science

D4.4 - Global network architecture and costing

D3.2 - Report on suggested solutions to address each of the key software areas associated with running a distributed ESDC

D3.4 - Report on design & costing for ESDC

D3.3 - Preliminary System sizing report

D2.3 - ESDC Design Study

D5.3 & D5.4 - Design recommendations

D4.5 - Data Transport Tests and Recommendations

D6.1 - AAI requirements and AAI architecture design

D5.8 - Final integration of WP5 materials

D6.2 - AENEAS Service Portfolio

D3.5 - Report on suggested solutions to interface requirements for a distributed ESDC

D4.3 - ESDN network architecture and costing

D6.3 - Federated AAI pilot results

D5.5 - Applicability of VO framework

D6.4 - SRC federated service management recommendations

D5.6 - User interaction model resourcing

D2.4 - ESDC (preliminary) implementation plan

D5.7 - Growing the ESDC community

D4.2 Catalogue

MS30

MS31

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mar	may	jul	sep	nov	jan	mar	may	jul	sep	nov	jan	mar	may	jul
					2019						**2020**			

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D4.2 Catalogue

Task 4.3: MS30 (WP3) & MS31 (WP4)
MS30 Milestone on Data Replica Manager
MS31 Specifications for SKA Replica Manager

- How do we get the SKA requirements?
  - Examine compute needed to get the science
  - Volume of data, number of files
  - Federated catalogues, flat or hierarchical file systems
- What do we choose to specify?
  - Build on the experience of using WLCG tools - from WP3
  - Ruchio
  - DIRAC
  - Take input from big data centers

Domenico & Rohini working on this

Deliverable D4.2

Site Catalogue of the Storage and Network Capabilities

- D2.1 has published a list of sites
  - There are 52 sites.
  - A triaged list to be agreed with WP2
- Need to use the questionnaire as a guide for structured interviews with each site.
- GDPR compliance has an impact on using the questionnaire and storing the data.

- Too much work for Mauro – help is needed

Mauro to lead

AENEAS WP2 Questionnaire Response overview

	Type	Radio Astronomy	Computing	Storage	Network
United Kingdom					
1. Cambridge University	A	Y	Y	Y	y
2. Edinburgh University (incl. EPCC)	A	Y	Y	Y	y
3. UK Astronomy Technology Centre	G	Y	N	N	N
4. DiRAC collaboration	A/N	y	Y	Y	y
5. Jisc (Janet network)	C	y	N	n	Y
6. Manchester University	A	Y	Y	Y	y
7. UK GridPP	A	n	Y	Y	y
8. STFC Scientific Computing Department	A/N	n	Y	Y	y
Netherlands					
1. ASTRON	A	Y	y	y	y
2. Computer Centre University of Groningen	A	Y	Y	Y	y
3. SurfSARA	N	Y	Y	Y	y
4. SurfNET	N	Y	N	N	Y
5. Commercial Provider	C	N	Y	Y	y
Sweden					
1. Onsala Space Observatory	A	Y	y	y	y
2. SNIC - Swedish National Infastructure for Computing	A	y	Y	Y	y
3. Sunet or NORDUnet	A	n	N	N	Y
Italy					
1. INAF	G/N	Y	Y	y	y
2. GARR	N	n	N	y	Y
3. CINECA	N	n	Y	Y	y
France					
1. INRIA (National Institute for Research in Computer Science and Control)	A	N	Y	Y	y
2. Bull, Atos Company	C	N	Y	y	y
3. RENATER Groupement d'Intérêt Public REseau NAtional pour la Technologie, l'Enseignem	N	Y	N	N	Y
4. CDS (Strasbourg Astronomical Data Centre)	A	Y	y	y	y
5. Observatoire de Paris/CNRS-DIO	A	Y	Y	Y	y
6. Observatoire de Paris/CNRS/Université d'Orléans – USN	A	Y	Y	y	y
7. Observatoire de Paris/CNRS – PADC	A	Y	N	N	N?
8. Observatoire de Paris/PSL Research University – MesoPSL	A	N	Y	Y	y
9. Observatoire de la Côte d'Azur	A	y	Y	Y	y

Spain					
1. Red-IRIS-NOVA	A	N			Y
2. Instituto de Astrofísica de Andalucía	A	Y	Y	Y	y
3. Barcelona Supercomputing Center (BSC)	A	y	Y	Y	y
4. Fundación Pública Galega Centro Tecnolóxico de Supercomputación de Galicia (CESGA)	A	N	Y	Y	y
5. Physics Institute of Cantabria (IFCA)	A	y	Y	Y	y
6. University of Malaga (UMA)	A	N	Y	Y	y
7. Fundación del Centro de Supercomputación de Castilla y León (FCSCL)	A	N	Y	Y	y
8. Zaragoza - Institute for Biocomputation and Physics of Complex Systems (BIFI)	A	N	Y	Y	y
9. Supercomputing and Visualisation Center of Madrid (CeSViMa)	A	N	Y	Y	y
10. La Palma - Canary Islands Astrophysics Institute (IAC)	A	y	Y	Y	y
11. University of Valencia (UV)	A	N	Y	Y	y
12. Consorci de Serveis Universitaris de Catalunya (CSUC)	A	N	Y	Y	y
13. CénitS-COMPUTAEX	A	N	Y	Y	y
14. Universidad Autónoma de Madrid (UAM)	A	N	Y	Y	y
Germany					
1. Karlsruhe Institute of Technology (KIT)	A	N	Y	Y	y
2. Forschungszentrum Jülich	A	Y	Y	Y	y
3. Deutsches Elektronen-Synchrotron (DESY)	A	N	Y	Y	y
4. Leibniz Supercomputing Centre	A	N	Y	Y	y
Portugal					
1. FCCN - RCTS	A	N	Y	Y	Y
2. ENGAGE SKA - Institute de Telecomunições (IT) + FCUP	A	Y	y	y	y
3. ENGAGE SKA – U. Évora (UE)	A	n	Y	y	y
4. LCA - Laboratory for Advanced Computing	A	N	Y	y	y
5. Altice Data Centre (ADC)	C	N	N	Y	y
6. IBM Portugal	C	N	N	N	y
Legend:					

Work with WP2 this week to develop criteria for selection for the WP4 questionnaire.
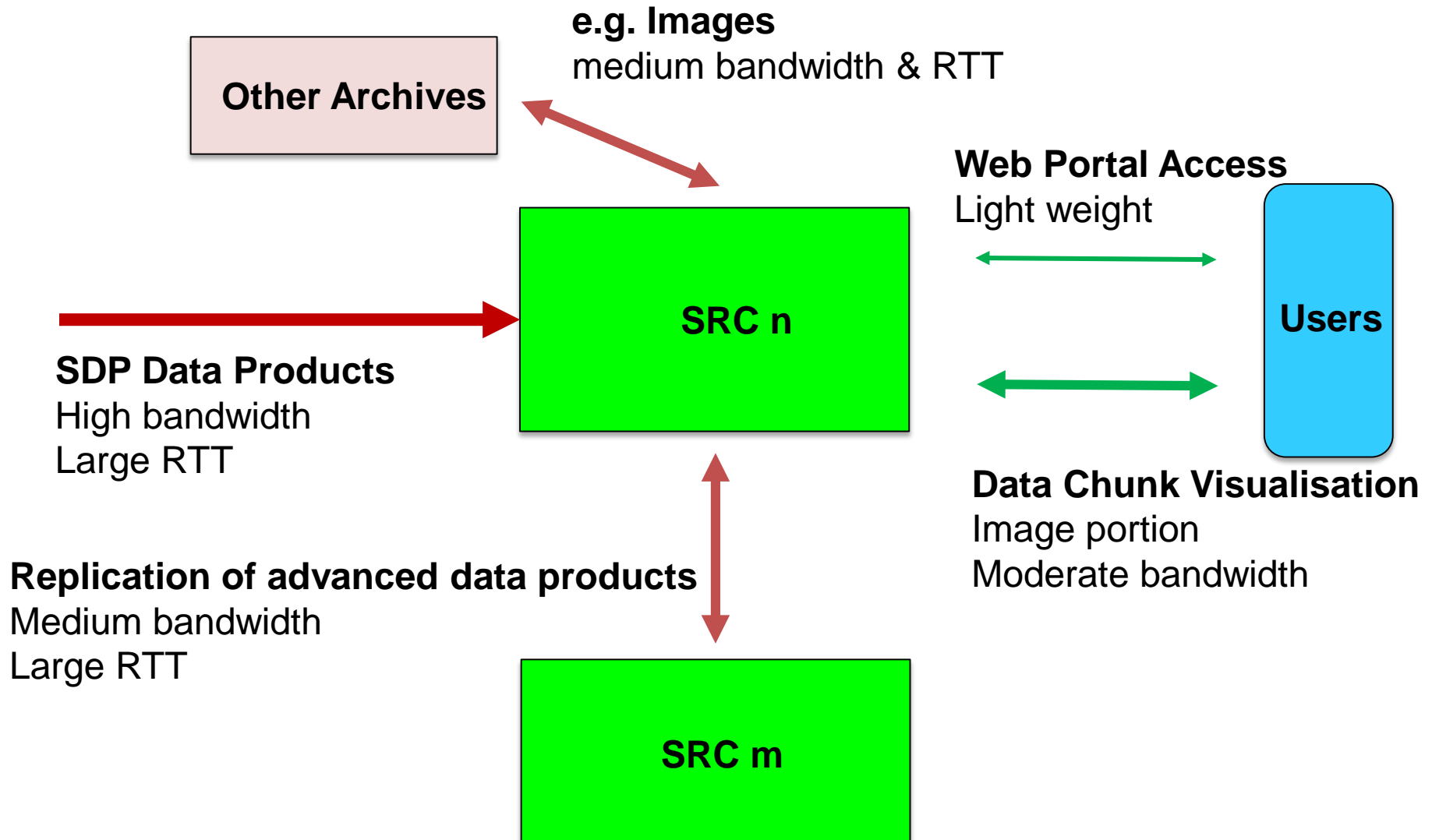
Deliverable D4.3

Architecture and cost model for European ESDN network.

- Need to know which European sites will be involved?
  – To be able to obtain NREN costs
- What type of compute will the site do?
  – data product delivery paths from SDP
- How will the work-flows operate?
  – Accessing data inter-site from a compute node

- Need for a technical workshop with WP3 & Science working groups.

??

Task 4.3: Network Connectivity to the ESDC

e.g. Images
medium bandwidth & RTT

Other Archives

Web Portal Access
Light weight

SRC n

Users

SDP Data Products
High bandwidth
Large RTT

Data Chunk Visualisation
Image portion
Moderate bandwidth

Replication of advanced data products
Medium bandwidth
Large RTT

SRC m

Task 4.3: Network Model within the ESDC

- Assumptions
  - Take 7 sites over Europe
  - 20 Gbits/s at a time from each Telescope
    peak 40 Gbit/s to a site
  - At a given time:
    all of the information from 1 section of a data product goes to one site
  - 10 Gigabits/s to other ESDC sites
  - 10 Gigabits/s to non SKA data Archives
  - 10 Gigabits/s to other RDC

- 70 Gigabit/s (peak) to each site.

- Say 100 Gigabit/s to each site for SKA in 2024/25. This is affordable.
  (c.f. the UK WLCG sites which have 10-40 Gbit/s dedicated links now)

Deliverable D4.4

Architecture and cost model for World-wide network for SKA.

- This really depends on:
- Data Placement for the input flows of SDP data products
- Compute models for transfers between SRCs

- Assume little inter SRC traffic mainly replication of advanced data products

- Architect and cost to several different scenarios of global flows:
  - One copy at SDP One replica at a SRC – each has 1/5 of the data
  - All SRC have a replica
    - Direct transfer
    - Store and replicate
  - SRC have physics specific data   Richard, Tim, Siju,
    - Each SRC has 1/5 of the data with
      ESDN has all the Pulsar and 70% of the EoR

Task 4.3: Models of Data Flows to a SRC One copy at SDP One replica at a SRC – each has 1/5 of the data

100 Gig flows

| →SRC 1 | →SRC 2 | →SRC 3 | →SRC 4 | →SRC 5 |

Time →

20 Gig flows

→SRC 5

→SRC 4

→SRC 3

→SRC 2

→SRC 1

Time →
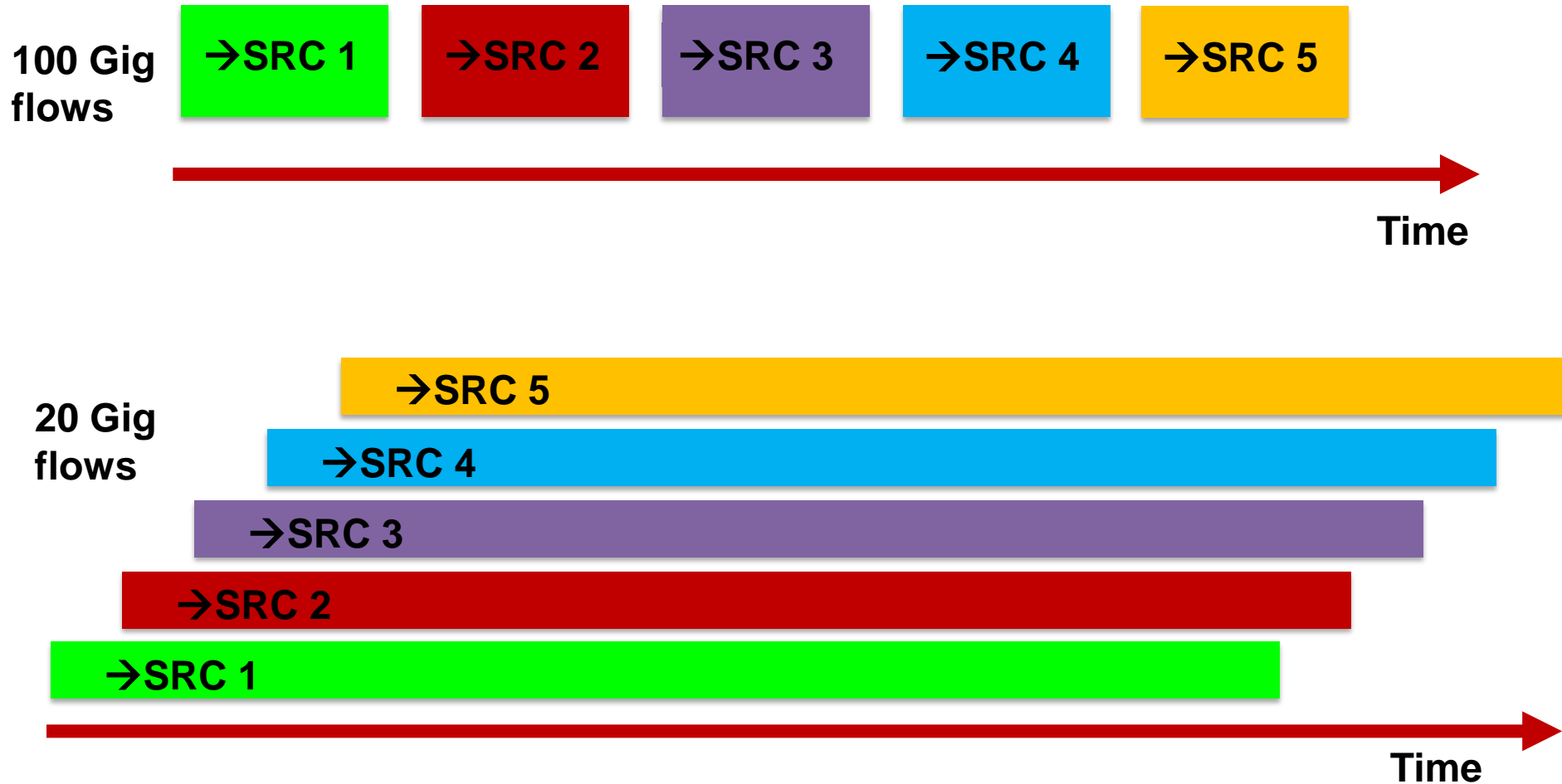
Task 4.3: Create different diagrams for the Data Placement Scenarios

- Use overlay networks and dedicated links
- L3 VPNs linked over the academic network
- Dedicated links from both telescopes
- 1 PetaByte/day pushed by SDP from each Telescope → 100 Gigabit/s
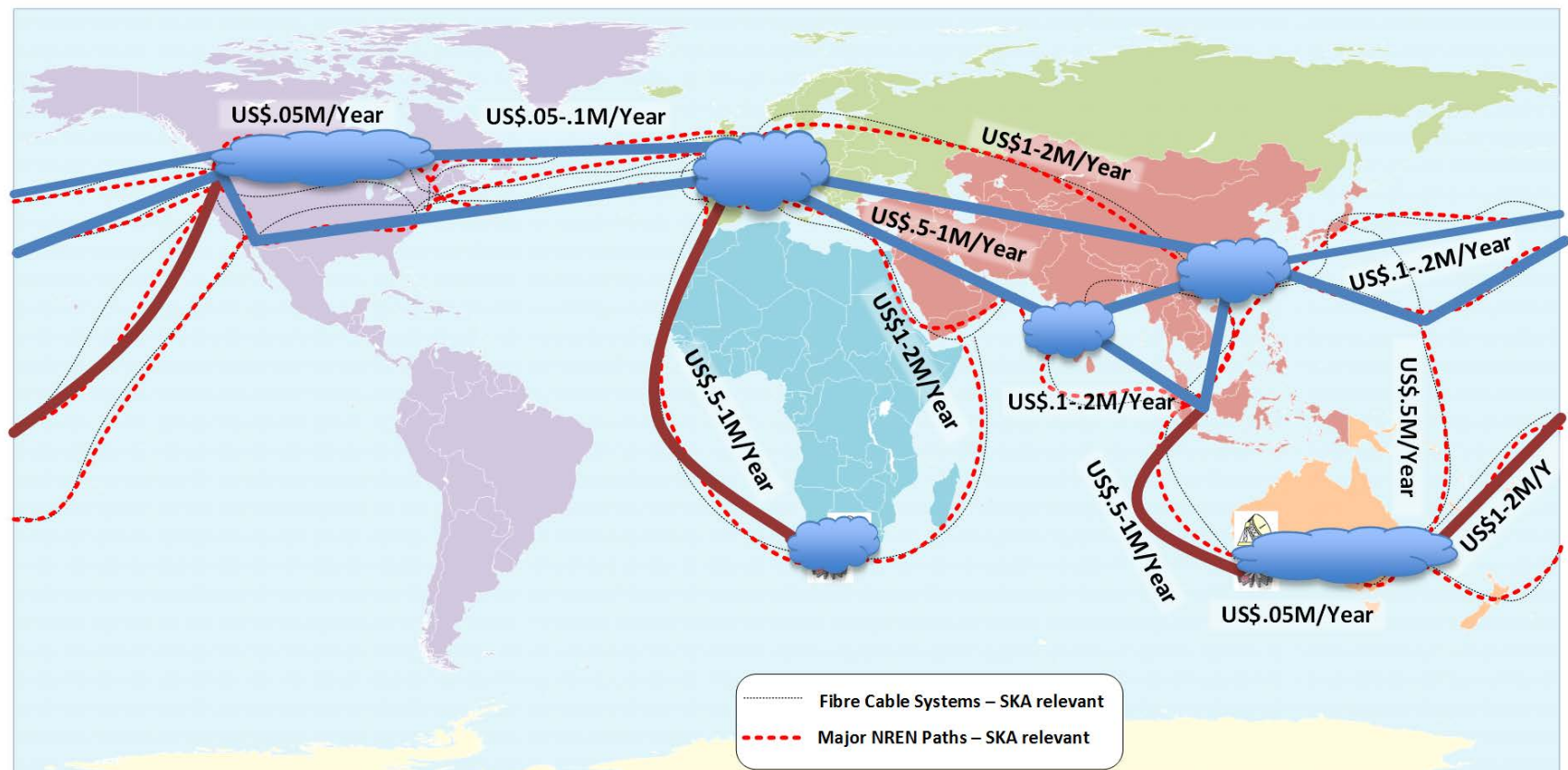
Deliverable D4.5

Report on Data Transport Tests and Recommendations.

- European transfer performance
- Global (Australia & South Africa) to Europe transfer performance
  - WP3 & WP4 MStones
  - Working with Enlighten your Research MRO-ASTRON, MeerKAT-ASTRON
- Strong links with WLCG DOMA project
- Test new applications & data moving protocols
  - Xrootd with xrootd
  - Xrootd with WebDAV/https Davix
- Evaluate low level protocols
  - TCP BBR
  - WDT facebook Warp Data Transfer ??
  - Quic IETF UDP based protocol

Richard, Simon, Jimmy, Tim, Siju, WP3

The next Milestones

Milestone number	Milestone name	Related work package(s)	Due date (in month)	Means of verification	Notes
25	radio astronomy data over global routes from South Africa to Europe	**WP3** WP4	18 Jun 18	WP3 Technical note written	Continuation of MS19
27	Joint Milestone (WP4) on demonstration of moving data from observatory sites (SA) to ESDC	WP3 **WP4**	19 Jul 18	Demonstration completed	
30	Joint Milestone (WP4) on data replica manager	**WP3** WP4	21 Sep 18	Internal memo	
31	Specifications for SKA Replica Manager	WP3 **WP4**	21 Sep 18	Specification document written	
33	Joint Milestone (WP4) on demonstration of moving data from observatory sites (AUS) to ESDC	WP3 **WP4**	24 Dec 18	Demonstration completed	
35	Data transfer test Australia site to European site	**WP4**	27 Mar 19	Technical note written	
36	Report on Data Transport ESDC within Europe	**WP3** WP4	28 Apr 19	Technical note written	
37	radio astronomy data over global routes from Australia to Europe	**WP3** WP4	30 May 19	WP3 Technical note written	
40	Joint Milestone (WP4) on demonstration of moving data within ESDC	WP3 **WP4**	31 Jun 19	Demonstration completed	

Joint Milestone	
Related WP	
WP4 Lead	
Deliverable	

Thanks to Richard Hughes-Jones