The e-VLBI Scheduler (eskd)

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1st International VLBI Technical Workshop
Westford, MA
October 22, 2012

MIT Haystack Observatory, Westford, MA
e-VLBI Scheduling

• Present approach to scheduling e-VLBI non-real time transfers (e-transfers)
  – Send an email to a wiki site with the subject containing:
    • [start time]_[experiment name]_[sent from]_[sent to]_[preset transfer rate]_[tsunami port]_[raid]_start
  – Manually check the site to determine if you are oversubscribing the link
  – Perform e-transfer

• This works well if everyone uses it
  – Not everyone does
  – Look at over subscription (knowledge of link capacity, etc)

• Oversubscription of lines
  – Results is poor performance
e-VLBI Scheduling

• NVI has requested end-stations / correlators network characteristics
  – Resulting table on the next slide

• Goal is to include e-transfers as part of the IVS service
  – Manually scheduling of e-transfers is as only as good as the usage of wiki

• In setting up the service determine how to allocate bandwidth and prioritize scheduling
## e-TRANSFER RATE CHART

**Wednesday, August 29, 2012**

<table>
<thead>
<tr>
<th>STATIONS</th>
<th>Useable Rate</th>
<th>Local Data</th>
<th>Recording Units</th>
<th>xmitting Units</th>
<th>to Bonn</th>
<th>to Hays</th>
<th>to WACO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aira</td>
<td>&lt;128Kb</td>
<td>4.6 TB</td>
<td>one set of K5s</td>
<td>none</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Badary - M5B &amp; EVN</td>
<td>270</td>
<td>850 GB</td>
<td>M5B+</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Chichijima</td>
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<td>5.1 TB</td>
<td>one set of K5s</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Fortaleza</td>
<td>225</td>
<td>none</td>
<td>one M5A</td>
<td>one M5A</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>HartRAO 15m - EVN - M5B</td>
<td>350</td>
<td>none</td>
<td>one M5B+</td>
<td>one M5B+</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>HartRAO 26m - EVN - M5B</td>
<td>Mbps</td>
<td>none</td>
<td>one M5B</td>
<td>same as 15m</td>
<td>X</td>
<td>not X</td>
<td></td>
</tr>
<tr>
<td>Hobart 26m</td>
<td>500</td>
<td>23 TB</td>
<td>one M5A</td>
<td>one M5C</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Hobart 12m - M5B</td>
<td>500</td>
<td>23 TB</td>
<td>one M5B+</td>
<td>same as</td>
<td>X</td>
<td>not X</td>
<td></td>
</tr>
<tr>
<td>Ishigakijima</td>
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<td>4.9 TB</td>
<td>one set of K5s</td>
<td>none</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Kashima-34m</td>
<td>600</td>
<td>25 TB</td>
<td>K5</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Kashima-11m</td>
<td>600</td>
<td>22 TB</td>
<td>K5</td>
<td>K5</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Koganei</td>
<td>600</td>
<td>10 TB</td>
<td>K5</td>
<td>K5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Kokee - M5B</td>
<td>100</td>
<td></td>
<td>one M5B+</td>
<td>one M5A</td>
<td>N/A</td>
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<td>Kunming</td>
<td>64</td>
<td>none</td>
<td>M5B+</td>
<td>M5B+</td>
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<td>N/A</td>
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<tr>
<td>Medicina - EVN</td>
<td>10 Gbps</td>
<td>none</td>
<td>M5A</td>
<td>M5A</td>
<td>X</td>
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<tr>
<td>Metsahovi - 3mm &amp; EVN</td>
<td>512</td>
<td>3 TB</td>
<td>M5A, M5B+, PC-EVN</td>
<td>PC-EVN</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Mizusawa</td>
<td>1 Gbps</td>
<td>11 TB</td>
<td>one K5/VSSP</td>
<td>one M5B</td>
<td>X</td>
<td>X</td>
<td>N/A</td>
</tr>
<tr>
<td>Noto - EVN</td>
<td>1 Gbps</td>
<td>none</td>
<td>VLBA4</td>
<td>VLBA4</td>
<td>not yet</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Ny Alesund - M5B</td>
<td>95</td>
<td>none</td>
<td>M5B</td>
<td>M5A</td>
<td>X</td>
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<tr>
<td>Onsala - EVN &amp; 3mm</td>
<td>700</td>
<td>8 TB</td>
<td>M5A, M5B+, PC-EVN</td>
<td>PC-EVN</td>
<td>X</td>
<td>X</td>
<td>not</td>
</tr>
<tr>
<td>Parkes M5B</td>
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<td>none</td>
<td>one M5B+</td>
<td>same</td>
<td>X</td>
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<td></td>
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<tr>
<td>Sesan 25m - EVN &amp; M5B</td>
<td>512</td>
<td>none</td>
<td>M5A, M5B, M5A</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Simeiz - M5B</td>
<td>8-10</td>
<td>none</td>
<td>M5A, M5B+</td>
<td>M5B+</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Shintotsukawa</td>
<td>&lt;128</td>
<td>5.9 TB</td>
<td>one set of K5s</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Svetloe - M5B &amp; EVN</td>
<td>70</td>
<td>850 GB</td>
<td>M5B+</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Syowa</td>
<td>1 Mbps</td>
<td>8 TB</td>
<td>one K5</td>
<td>K5</td>
<td>X</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Tsukuba</td>
<td>512</td>
<td>50 TB</td>
<td>one set of K5s</td>
<td>5 servers</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Urumqi - M5B &amp; EVN</td>
<td>20</td>
<td>none</td>
<td>one M5B+</td>
<td>one M5B</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Warikworth - M5B</td>
<td>512</td>
<td>32 TB</td>
<td>M5B+, M5C</td>
<td>same</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Westford - M5B</td>
<td>100</td>
<td></td>
<td>one M5B+</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wettzell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Yebes - M5B &amp; EVN</td>
<td>2 Gbps</td>
<td>1.6 TB</td>
<td>M5B+</td>
<td>M5B+, M5C</td>
<td>X</td>
<td>not</td>
<td>not</td>
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<tr>
<td>Zelenchukskaya M5B &amp; EVN</td>
<td>280</td>
<td>850 GB</td>
<td>M5B+</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Bonn’s Maximum Input Rate:** 1 Gbps

**Haystack’s Maximum Input Rate:** 6

**WACO’s Maximum Input Rate:** 600 Mbps

**Haystack’s Recording Units:** one set of K5s

**WACO’s Recording Units:** one set of K5s

**Mizusawa’s Recording Units:** one K5/VSSP

**Sesan’s Recording Units:** one set of K5s

**Syowa’s Recording Units:** one K5

**Urumqi’s Recording Units:** one set of K5s

**Warikworth’s Recording Units:** one set of K5s

**Westford’s Recording Units:** one M5B+
Scheduling Problem

• Limitations
  – Network resources
    • Source and destination
  – Storage
  – Ports
    • Security : firewall rules

• Priorities of sessions for processing
  – Rapids
  – R&D’s
  – etc.

• Deadlines to when all of the data should arrive for processing
e-VLBI scheduling service (eskD)

• Inputs:
  – Requests for e-transfers
    • Bandwidth
    • Session
    • Source

• Outputs:
  – Grants usage
    • Bandwidth allocation
    • Start date
    • End date
    • Port
    • Destination storage server
• Input mechanisms
  – email
    • As presently used with the wiki supported by Bonn
  – Web service
  – Other
• Output format
  – email
    • Message sent back to the initiator
    • Subject line contains configuration information
      – Content contains additional information
  – Web-service
    • Configuration information
      – XML
eskd Software Architecture
Scheduling Engine

• Input is session queue
  – Jobs are prioritized
  – Contains information about request
    • Data rates
    • Deadlines
  – Additional information is added
    • Amount of data (session, stations)
    • Network performance matrix's
    • Critical deadline (established by correlator)
Initial Assumptions

• Session queue uses periodic scheduling
  – Based upon deadline of e-transfer session
    • Guarantee fairness in allocating bandwidth
  – All requests for a single session processed at one time
  – Not a FCFS queuing mechanism

• For scheduling algorithm
  – Finite number of transactions being scheduled
  – Network resources are shared
  – Users requests are greedy
    • To maximize network bandwidth
  – Correlators drive deadline
    • based on processing of session begins
Schedule

• Presently
  – Scheduling algorithm has been implemented using initial assumptions

• within 2 months
  – Add in email agent
  – Simple authentication mechanisms
  – Data base schemas
  – Test with site, e.g. USNO
Schedule

• within 6-9 months
  – More complete scheduling engine
    • Multiple session types
    • Allow for users specifying completion date
      – Back to back e-transfers of different sessions / destinations
  – Web agent interface

• 1 year
  – Add in performance metrics
    • MRTG data for networks
    • Storage performance
Collaboration

• Unfunded initiative

• Looking for collaboration with:
  – Greater community
    • Functionality
  – Software developers

• Starting a working group
  – e-transfer scheduling
Thank you / Questions?