



e-VLBI Updates in CVN

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Outline



- ❖ **CVN e-VLBI Network**
- ❖ **CVN e-VLBI Applications**
- ❖ **Future**



CVN e-VLBI Network



❖ Stations

- Sh – Shanghai Sheshan, 25m, 1987
- Ur – Xinjiang Urumuqi, 25m, 1993
- Bj – Beijing Miyun, 50m, 2006
- Km – Yunnan Kunming, 40m, 2006
- Tm – Shanghai Tianma, 65m, 2013

❖ Data Center

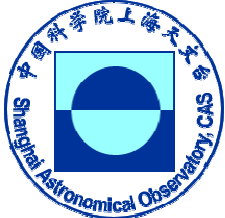
- Shanghai VLBI data processing center
 - C&C center of VLBI tracking system for CLEP, 2007
 - IVS Correlator Center, 2012
 - Scientific data processing: astrophysics, pulsar, ...

❖ History

- Started: 2006
- Supported by CLEP Project



CVN e-VLBI Network





CVN e-VLBI Sites



Ur, XAO



VLBI C&C Hall
ShAO



Bj, NAOC



Sh, ShAO



Km, NAOC



VLBI Center
Server Room



Tm, ShAO



Outline



- ❖ **CVN e-VLBI Network**

- ❖ **e-VLBI Applications**
 - **CLEP Phase I/II/III**
 - **Shanghai IVS Correlator**

- ❖ **Conclusion**



e-VLBI for CLEP



❖ VLBI Tracking and Measurement System

- Service for M&C system
- Phase I(CE-1), Phase II(CE-2/3/4), Phase III(CE-5T1/CE-5/6)
- Real-time Requirement
- Additional Function
 - Receiving-recording-distributing data to hw/sw Correlators in data center
 - Two data pipelines to make sure high reliability and availability



e-VLBI for CLEP Summary

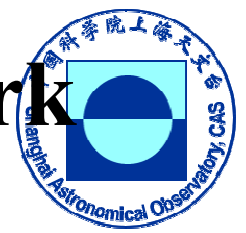


Mission	Mode	Network Line	VLBI Raw Data rate	Network Line Failover	Realtime Requirement	Realtime Performance
CE-1	Near realtime	Telecom/CNC (SDH 34Mb/s)、CSTNET IP-VPN (100Mb/s)	16Mb/s	Manually, >30m	10m	<6m
CE-2	Near realtime	Telecom/CNC MSTP (100Mb/s)	32Mb/s	Manually, >15m	10m	<4m
CE-3	Realtime	Telecom/Unicom (SDH 155Mb/s)	64Mb/s	Automatically, <3s	1m	<40s
CE-5T1	Realtime	Telecom/Unicom MSTP (100Mb/s)	64Mb/s	Automatically, <3s	1m	<40s
CE-5	Realtime	Telecom/Unicom (SDH 155Mb/s)	128Mb/s	Automatically, <3s	1m	2017

- Long term period: Low network bandwidth for fringe testing
- Dedicated network fiber closed after mission

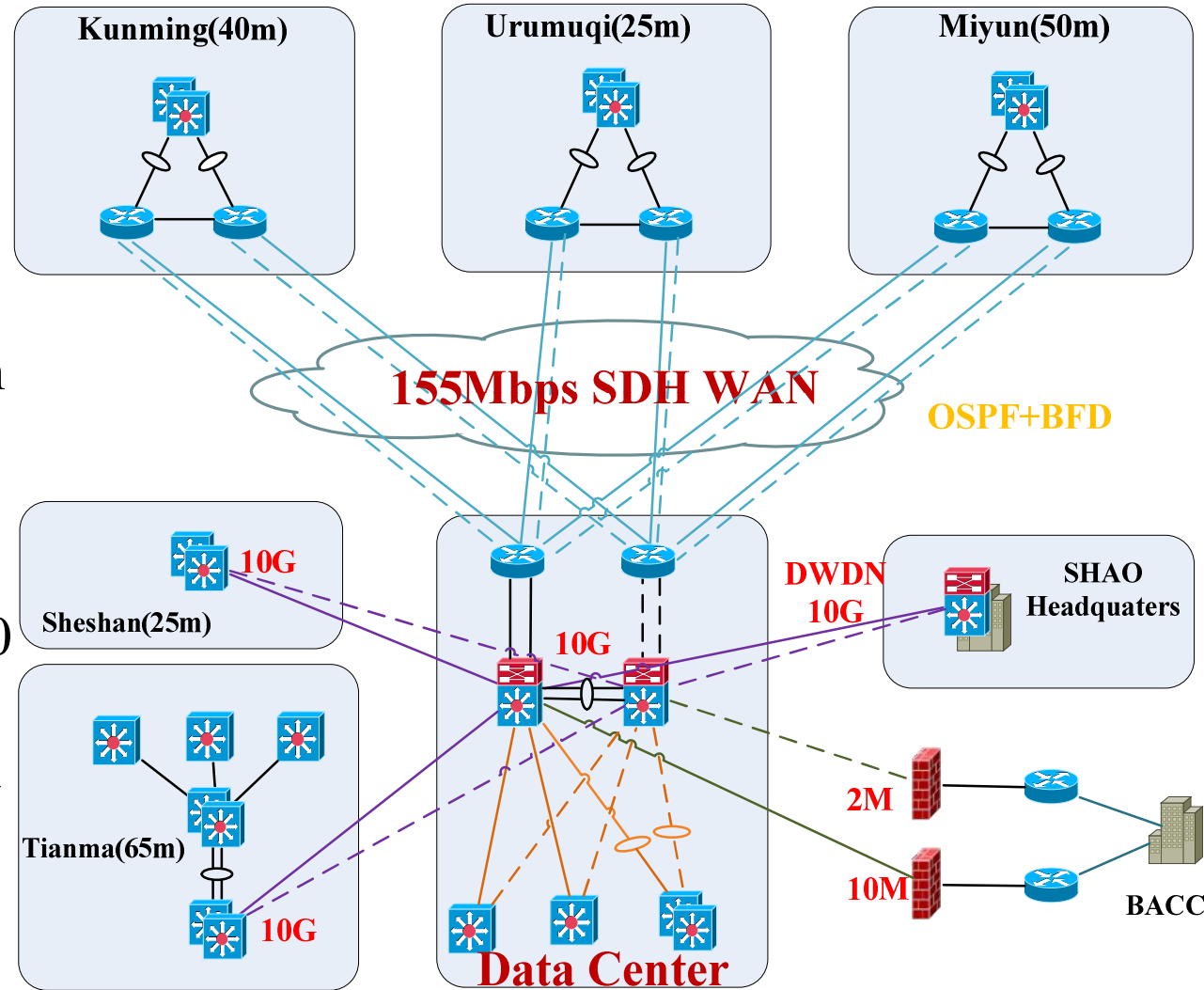


CE-3/5T1 e-VLBI High Availability Network



❖ Km, Ur, Bj, Sh, Tm

- Long Range Network
Backbone is not so reliable
- OSPF+BFD protocol to detecting and switching backbone network link when accidental failure:
switch time < 3s
- Network failovers times > 20
- Buffer data for network link switching, then retransmit after link recover
- TCP Protocol Performance Tuning





e-VLBI Transfer System

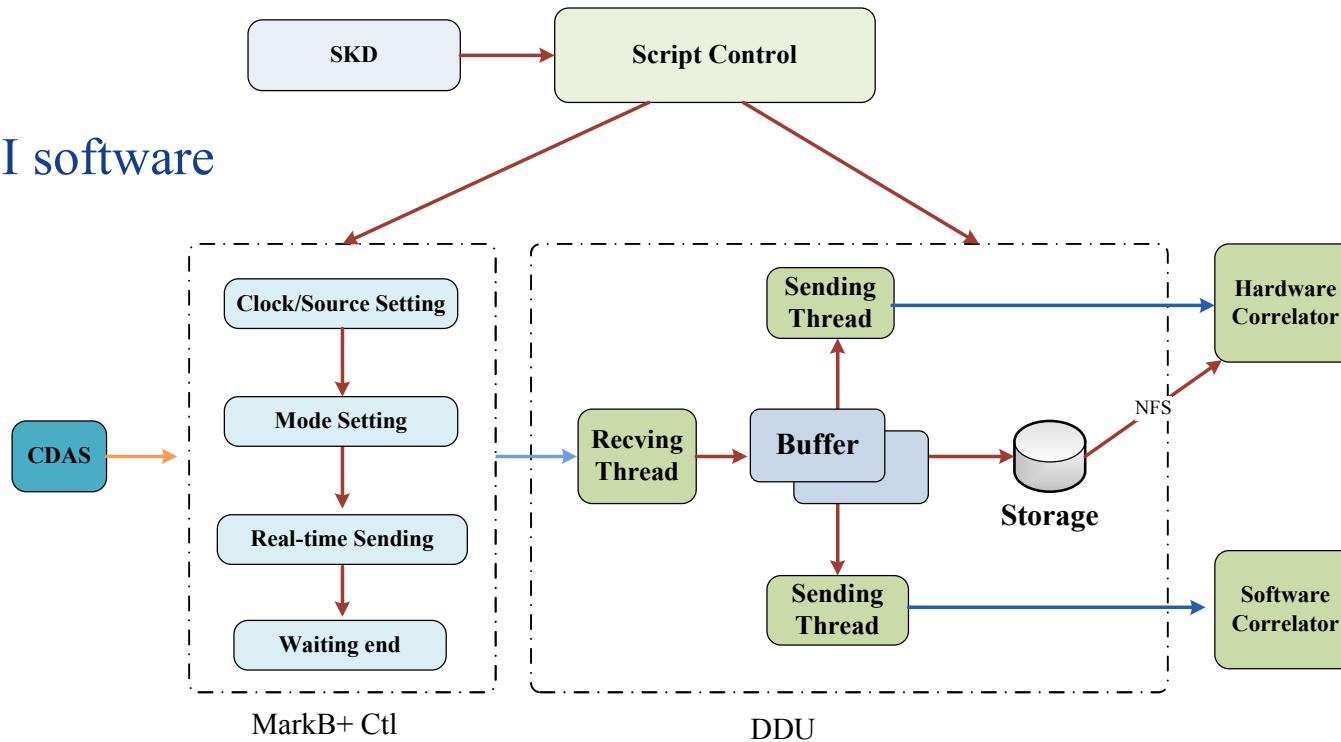


❖ Stations

- CDAS
- Mark5B+ (2/station)
- Modified Mark5B+ e-VLBI software
- Two level buffer: HW/SW

❖ Data center

- Data Distribute Unit
- COST Servers (5+1)+DAS
- Data Receiving
- Data Distribution
- Ring Buffer



❖ Protocol: TCP (UDP, IPv6)

❖ Control

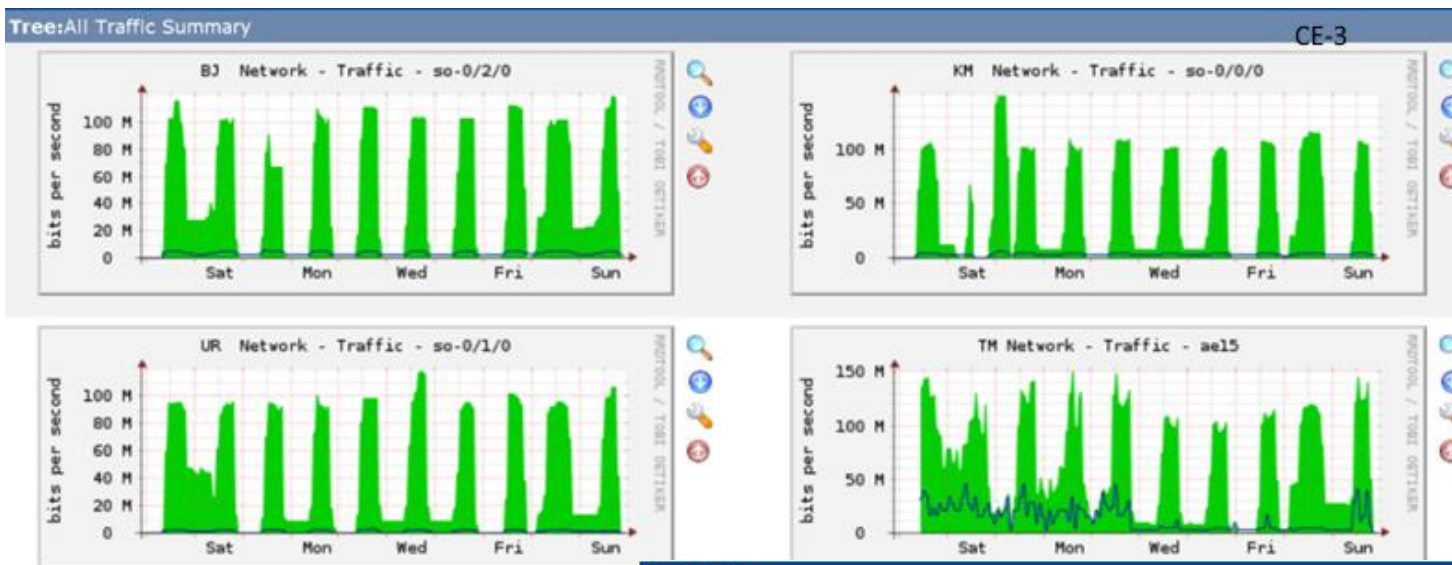
- Script Control



e-VLBI Network flow



❖ e-VLBI



Graph Filters

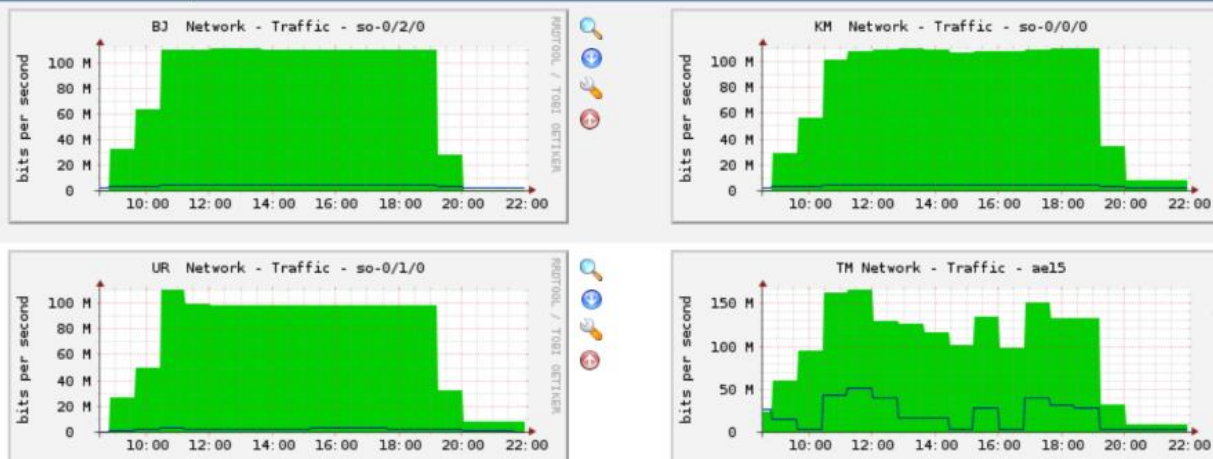
Presets: Custom From: 2014-10-28 08:30 To: 2014-10-28 22:00 1 Day Refresh Clear

Search: Graphs per Page: 10 Thumbnails: Go Clear

CE-5T1

Showing All Graphs

Tree:All Traffic Summary





Outline



- ❖ CVN e-VLBI Network
- ❖ e-VLBI Applications
 - CLEP
 - **Shanghai Correlator for IVS**
- ❖ Conclusion



Shanghai Correlator for IVS



❖ IVS Correlator Center

- Bonn, Haystack, IAA, Kashima, Tsukuba, Washington, Shanghai (2012, Madrid, IVS GM Meeting)

❖ Data Processing

- DiFX
- CVN Software correlator: under development

❖ Data Transfer

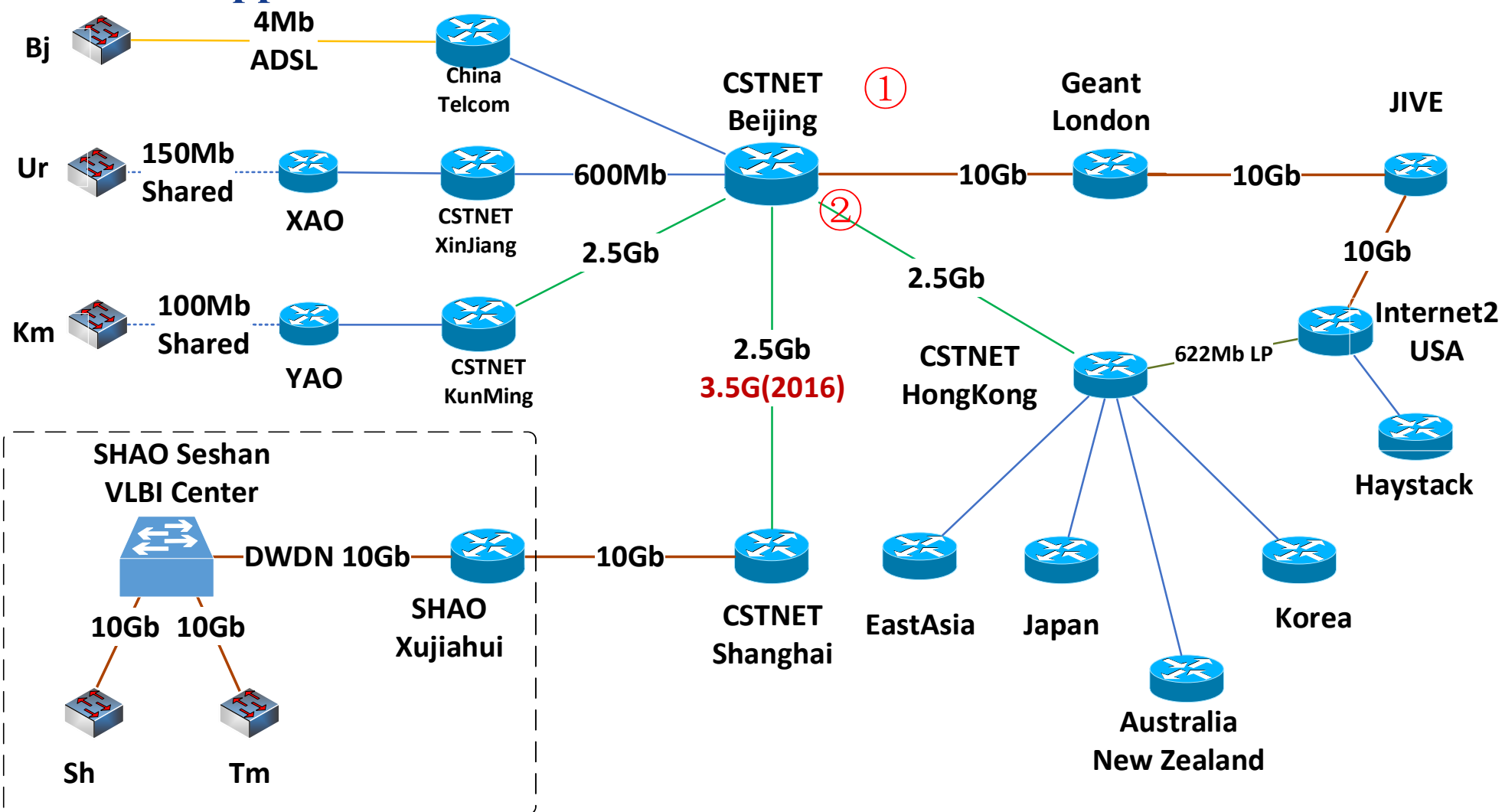
- Internet based e-Transfer: from most stations & correlators
- Disk Shipping: Kokee, ...



CVN Internet B/W



- ❖ Via CSTNET(Chinese Science&Technology Network, CAS)
- ❖ Network Service on Demand(email, phone...)
- ❖ IPv6 supported





Shanghai Correlator e-Transfer data rate



Country	Institutes	Network B/W	To/From Shanghai
Germany	Bonn MPRiFR	900Mb/s	800Mb/s
Japan	NICT	10Gb/s	1Gb/s
Japan	GSI	10Gb/s	1Gb/s
South Korea	NGII	1Gb/s	800Mb/s
Italy	IRA	10Gb/s	800Mb/s
South Africa	Hartebeesthoek	10Gb/s	550Mb/s
Australia	University of Tasmania	10Gb/s	800Mb/s
New Zealand	Auckland University of Technology	10Gb/s	800Mb/s
Brazil	IPNE	1Gb/s	200Mb/s
Netherlands	JIVE	10Gb/s	1Gb+/s
Russia	IAA	1Gb/s	500Mb/s
USA	Haystack	1Gb/s	600Mb/s
Malaysia	University of Malaya	100Mb/s	90Mb/s



International e-VLBI Testing/Transfer



❖ CSTNET

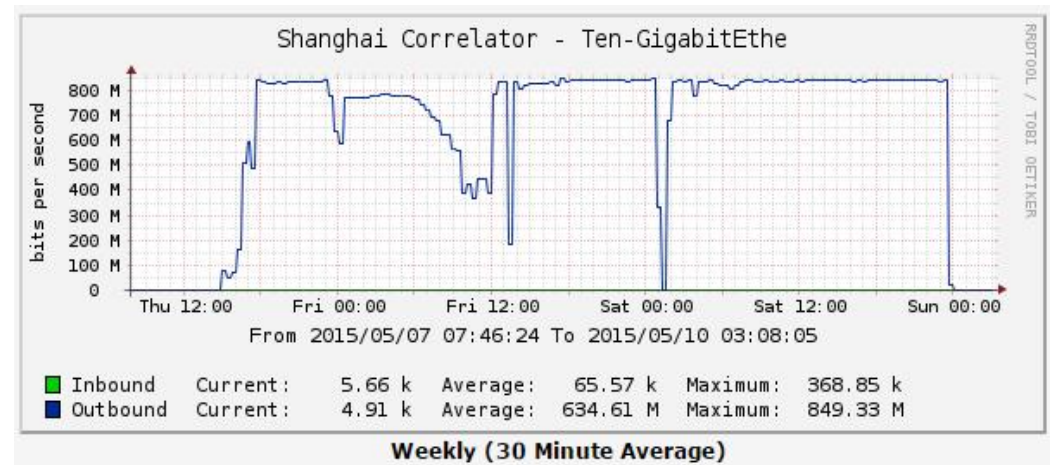
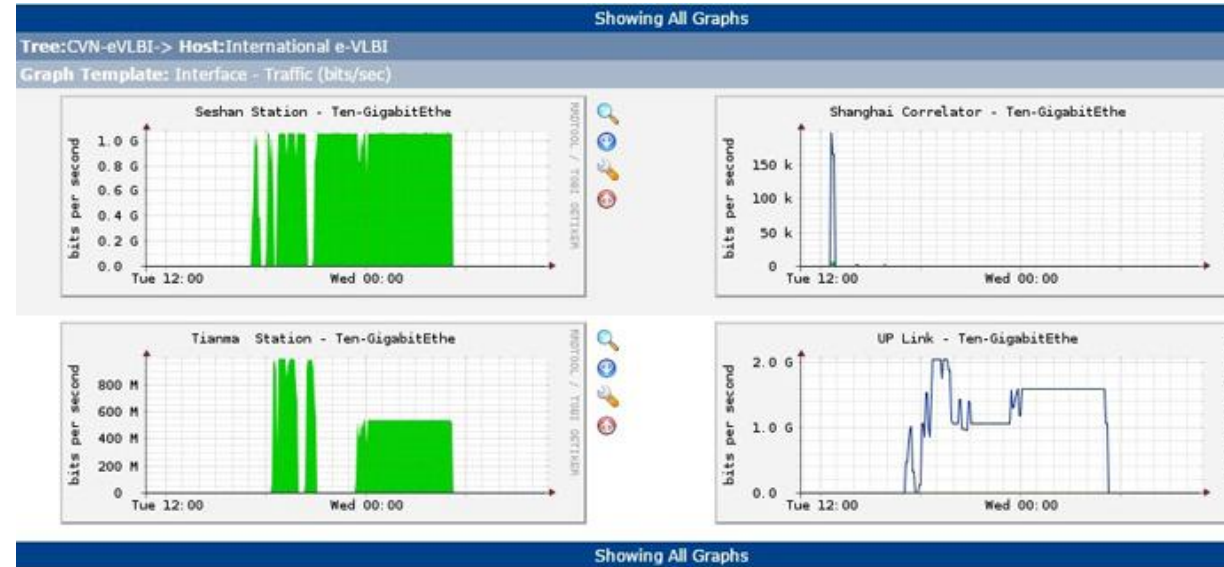
- EVN: 12 w/1.1Gbps
- IVS: 12 w/128Mbps

❖ Sh/Tm → JIVE

- 2015. 4. 17
- e-EVN
- Total: 1.5Gbps
 - Sh:1Gbps
 - Tm:0.5Gbps

❖ Sejong → Sh

- 2015. 05
- e-Transfer





Future



❖ Deep space tracking system services

- CLEP Phase III (CE-5, CE-4...), Mars exploration, etc

❖ Science observation e-VLBI

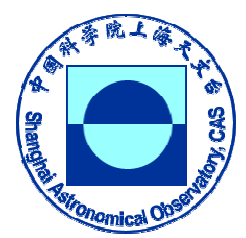
- EVN, VGOS, EVAN, IVS/AOV

❖ Device and Network

- CDAS2, VDIF
- Network bandwidth expansion, ipv6 usage
- e-Transfer Status Web page, mpifr-bonn or own web

❖ Challenges

- Big volume data transfer: VGOS, SKA
- CVN
 - R&E backbone network bandwidth limitation: CSTNET, Km, Ur
 - Last mile to stations: Bj, FAST, QTT
 - Transfer
 - Automatically e-VLBI/e-Transfer



Thanks !