Sub-group report on DAS (Data Analysis)

N.Kanda on behalf as DAS subgroup

KAGRA face to face meeting

31st July 2012, ICRR, Kashiwa

Aims and roadmap of 'Data Analysis' subgroup

- **Construct a data storage and computing system**
- **Construct GW event search pipelines, and adopt it for observation data**
- **Search and Analyze GW events**
- **Analysis with other collaborations**

				iKAGRA		bKAGRA	
Target	Prepare Data Analysis for 4th year			System Test	Build up full data system	Analyze Continuously Followup with Other Obs.	
Hardware	small cluster mini-system		partial system		**full system**	+ cpu, storage, peripherals	
Software	Construct common environment Implement GW search			**whole data pipeline test**			

Scientific focuses (Main search tasks)

(1)Compact Binary Coalescence

- NS-NS, NS-BH, BH-BH binary coalescence
- Waveform : Inspiral (PN) + Merger (NR) + BH ringdown (Perturbation)

(2)Burst GW

- from stella-core collapse of Supernovae
- from pulser glitch

(3)Continuous GW

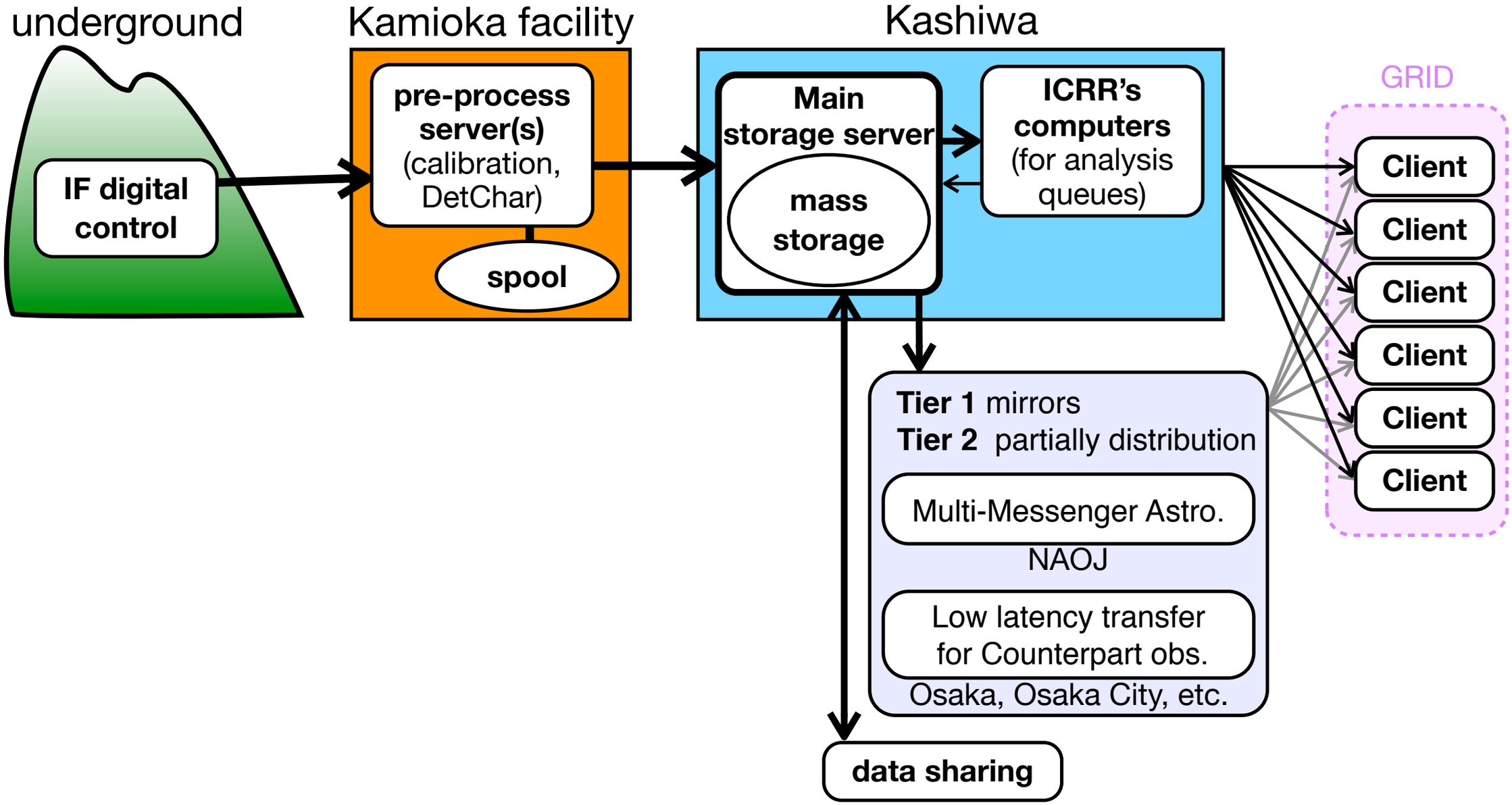
- rotating pulsars
- magneters

(4)Stochastic Background GW

- almost isotropic radiation from early univ., string etc..
- anisotropic source from overlapping huge astronomical sources

KAGRA will have to search for these typical candidates by own pipeline (software), and also to contribute for the international detector network.

Overview of data flow



Recent Progress

(1)Working member meeting

5/25, 7/3

- design of ICRR interoperable computer system
- KAGRA data archive system (and GRID)
- cooperative analysis plan(s) with

  India : Chi-square study using TAMA data, Radiometry
  Korea : Multi-variative analysis, artificial neuron
  Australia : GPGPU for time-domain search

(2)GWPAW

- 2012 @ AEI Hannover, Germany, 6/4-7

  KAGRA displayed its activity in this field. 4 talks and 5 posters from Japan.
- 2013 end (December) @ IUCAA, Pune, India
- **2015 mid (candidate: 3rd - 6th June 2015) @ Japan**

Recent Progress (cont'd)

(3)Learning 'Data Analysis of KAGRA'

for people to start / to attend future KAGRA data analysis,
coordinator : H.Tagoshi
[1st] 2011/5/11, by Tagoshi and Kanda, 'Basics of Inspiral Analysis' 'Outline of Data Flow'
[2nd] 2011/6/21, by K.Hayama, 'Burst analysis'
[3rd] 2011/11/11, by Y.Itoh, 'Continuous GW analysis'
[4th] 20th, July 2012. 'Practice of frame data' by Kanda

(4) 'KAGRA Data Analysis School'

- [1st] **3rd - 5th September @ RESCEU**
  coordinated by **Y.Itoh**, H.Tagoshi, K.Tsubono, J.Yokoyama
  deadline of participation : 20th August (or 9th Aug. with travel cost support)
- ([2nd] in this winter, @NAOJ)
  coordinated by K.Nakamura, K.Hayama

Computing and Data Branch

(1) We expect to use ICRR's next interoperable computers for GW searches

- Design of the ICRR computer system are going.
- We must re-estimate actual performance of CPU core(s) for typical calculation. Benchmark test is in preparation.
- Connection / data transfer from KAGRA data archive is important.

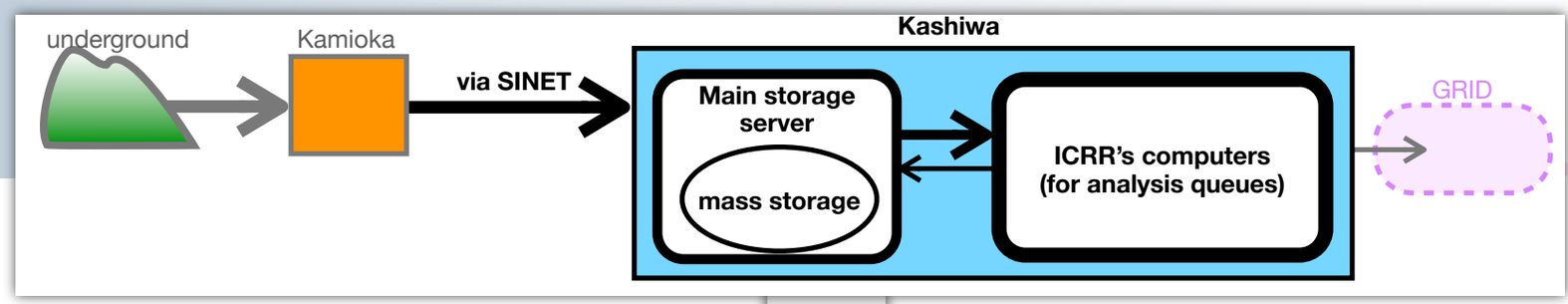
(2) KAGAR data distribution

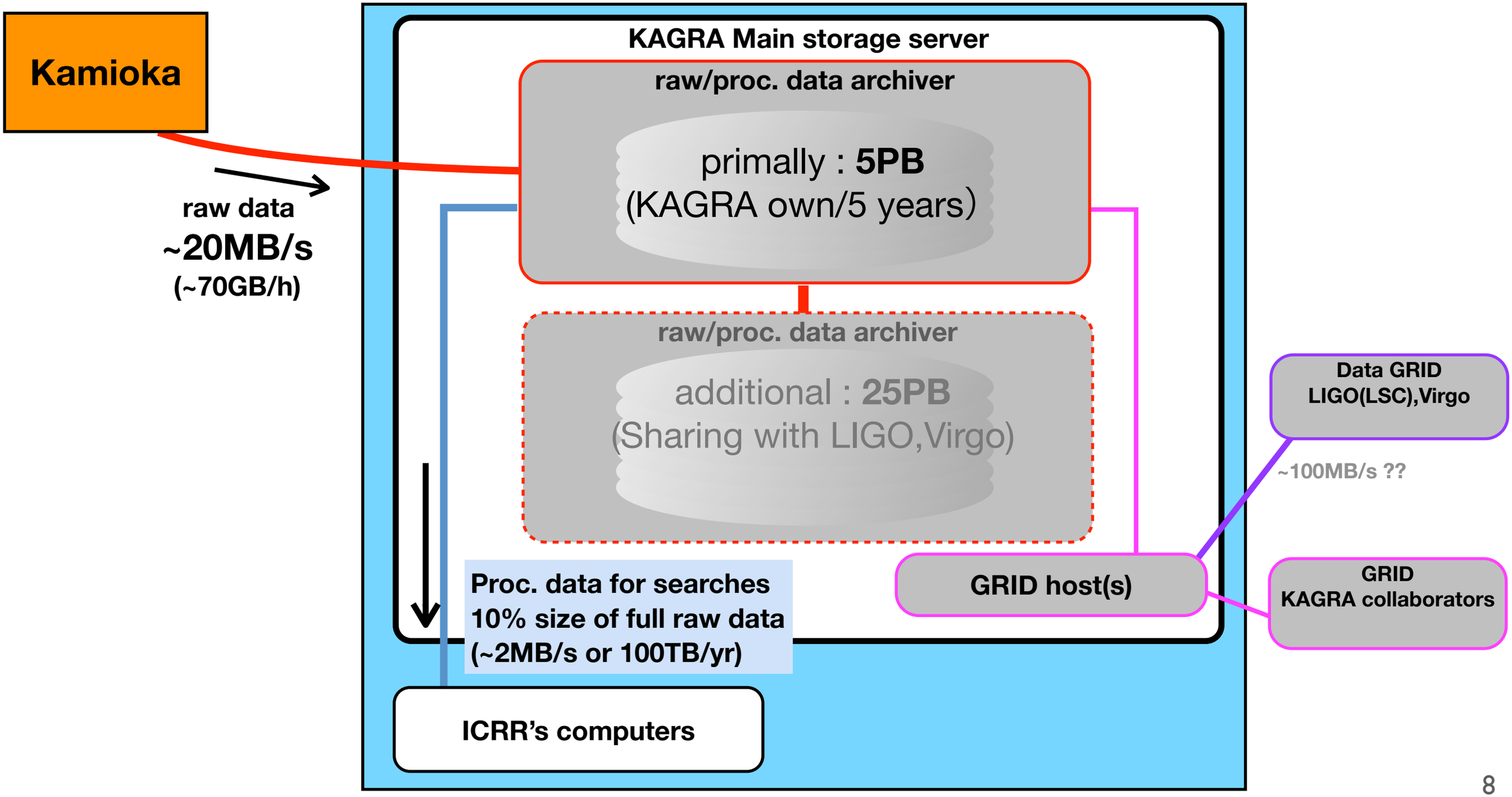
- Data distribution (Tier structure) are studying.

(3) GRID

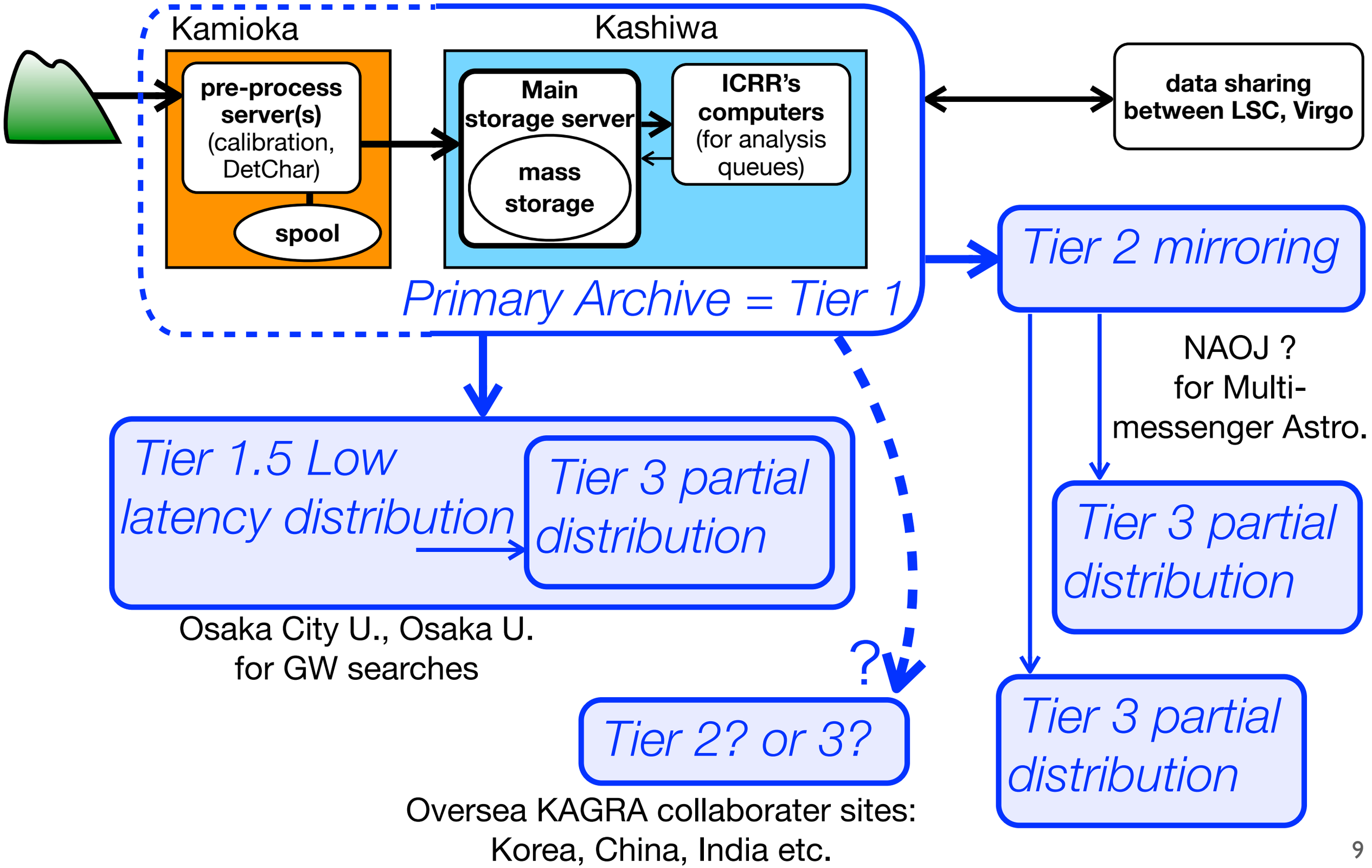
- Our (KAGRA's) own GRID environment should be tested in 2012.
- How to connect with LSC data GRID when we will start the data exchange ?

Design Progress





Data Tier : Overview



Branches (Tier #)

We did not designed the data for n-th Tier yet. This is tentative plan.

Tier	Site(s)	Purpose	Raw	Calibrated	Detecter Characterization	Amount of data	event alarts
(0?)	Kamioka	DAQ	partial (spool)	partial (spool)	partial (spool)	500TB	partial
1	Kashiwa	Main Storage	○	○	○	5~30PB	(Not yet discussed)
1.5	Osaka City, Osaka	Low latency	NA or small amount	○	○	<1PB	○
2	NAOJ? Korea Site?	Mirroring	○	○	○	5~30PB	○
3	End users	Development	NA	partial	partial	(Not yet discussed)	NA

One more thing : quantization noise for data analysis

- We need to keep enough bit depth and quantization noise level for interferometer main signal.

In case of TAMA, the situation was simple, because quantization by ADC is once just final terminal of analog circuit (front end of DAQ). However, in KAGRA ...

We (Data Analysis and Digital System) start discussion and a quantitative estimation.