Developments of the K5 VLBI System

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K3 System (1983~1990)




- Purpose : Participation to the International/Global VLBI Observations (CDP, IRIS, ...)
- Objective : Develop an independent VLBI observing/data processing system by maintaining compatibilities with the Mark-III System

K4 System (1990~1999)

- Objectives : Transportability, Compactness, Automation, High Sensitivity, High Reliability
- Grown to the VSOP system, KSP system, and Gigabit VLBI system

VLBI Systems : From K3 to K5


K3 Correlator (Center)
K3 Recorder (Right)

K4 Terminal

K4 Correlator


K5 Data Acquisition Terminal

K3 System

1983~
Longitudinal Recorder
Open Reel Tapes
Hardware Correlator

K4 (KSP) System

1990~
Rotary Head Recorder
Cassette Tapes
Hardware Correlator
e-VLBI with ATM

K5 System

2002~
PC based system
Hard Disks
Software Correlator
e-VLBI with IP

Concept of the K5 System

	K3	**K4**	**K5**
Data Recorders	Magnetic Tapes Longitudinal Recorders	Magnetic Tapes Rotary Head Recorders	Hard Disks
e-VLBI	Telephone Line	ATM	IP
Correlators	Hardware	Hardware	Software
	1983~	1990~	2002~
	M96 Recorder, K3 Formatter, K3 VC, K3 Correlator	DIR-1000, -L -M, DFC1100, DFC2100, K4 VC (Type-1, 2), TDS784, ADS1000, GBR1000, GBR2000D, K4 Correlator, KSP Correlators, GICO, GICO2	IP-VLBI (K5/VSSP), PC-VSI (K5/VSI), ADS1000, ADS2000,

K5 Family : Concept

ADS1000
(1024Msample/sec 1ch 1bit or 2bits)

ADS2000
(64Msample/ch·sec, 16ch, 1bit or 2bits)

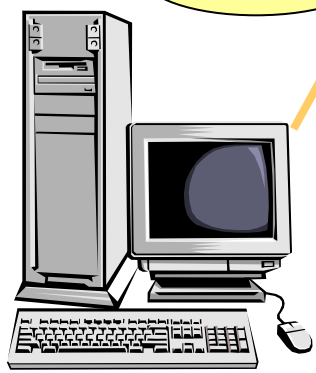
VSI

PC-VSI Board
(Supports VSI-H specifications)

VSI

Correlator
other DAS

Internet



PC : Data Acquisition
Correlation

IP-VLBI Board
(~16Msample/ch·sec, ~4ch, ~8bits)

K5 Family : Selection of Samplers

	K5/VSSP	ADS1000	ADS2000
Sampling Speed	40, 100, 200, 500kHz, 1, 2, 4, 8, 16MHz,	1024MHz	64MHz
Sampling Bits	1, 2, 4, 8	1, 2	1, 2
No. Channels	1, 4, 16 (with 4PCs)	1	16
Max. Data Rate	512Mbps (with 4PCs)	2048Mbps	2048Mbps

K5/VSSP

ADS1000

ADS2000

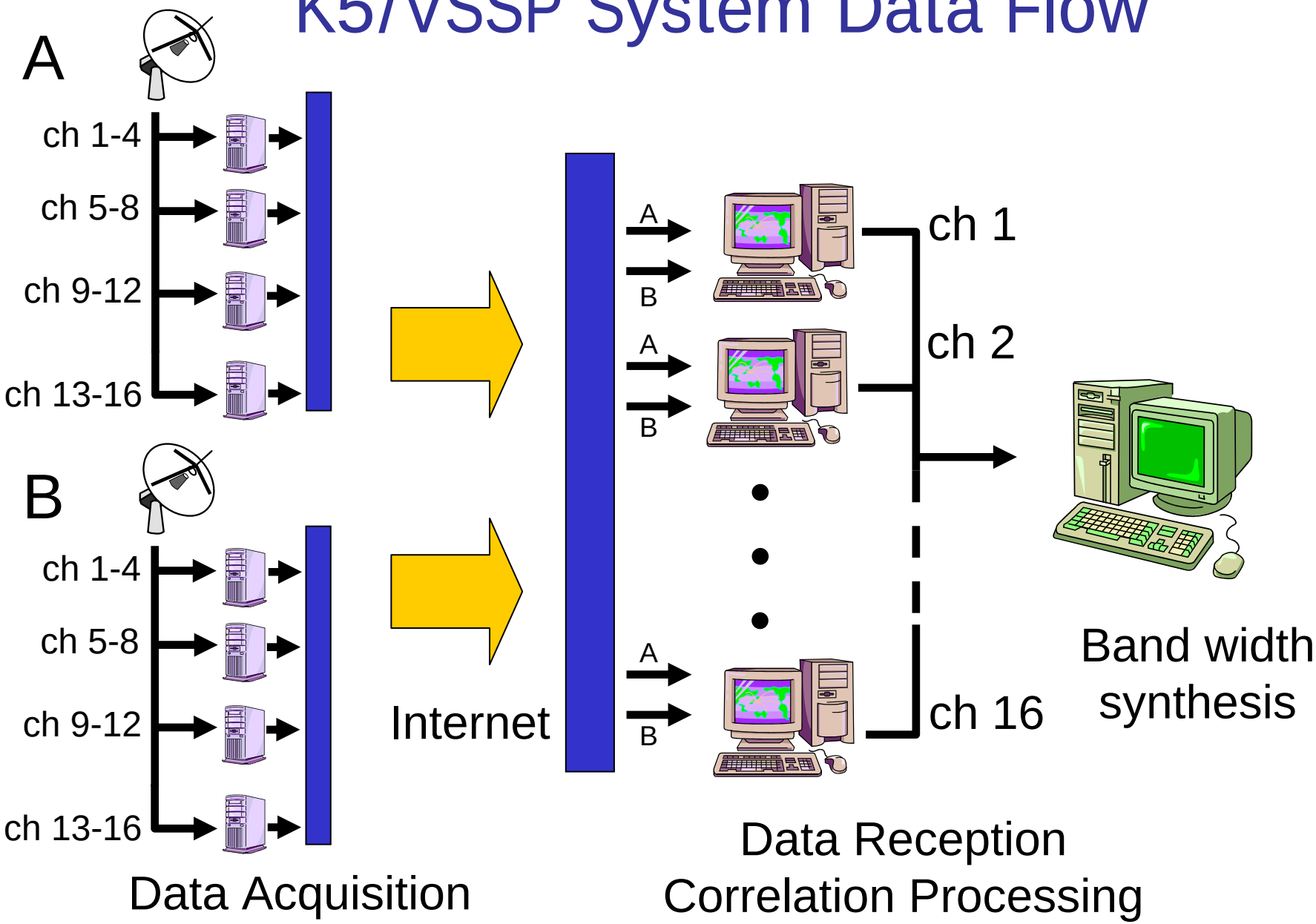
K5/VSSP System

- VSSP = Versatile Scientific Sampling Processor
- 4 Pentium PCs
  - CPU : Pentium-4
    - 1.2GHz (1st Unit)
    - 2.4GHz (2nd Unit)
  - OS : FreeBSD (Linux is also possible)
  - One K5.VSSP board (PCI) in each PC
  - 120Gbyte HDx4x4 ~ 2.8days@64Mbps
- 16ch base-band signal amplifier
- Standard Signal Distributor
  - 10MHz and 1PPS signals for 4 units

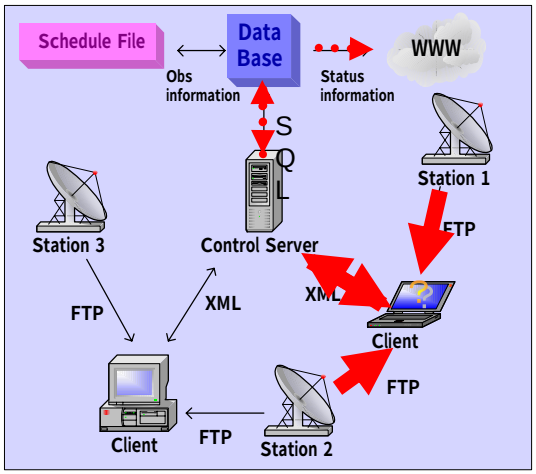
K5 Systems in use

- IVS stations
  - Kashima (34m, 11m) : NICT
  - Koganei (11m) : NICT
  - Tsukuba (32m) : Geographical Survey Institute
  - Syowa, Antarctica (11m) : NIPR
  - Mizusawa (20m) : NAO/VERA
- non-IVS stations
  - Peru, Huancayo (34m)
  - many astronomical VLBI stations in Japan
- Software Correlator Program
  - JIVE, CSIRO/ATNF, e-MERLIN, KVN (in planning), Viena U. Tech. (license agreement in progress)

K5/VSSP System Data Flow



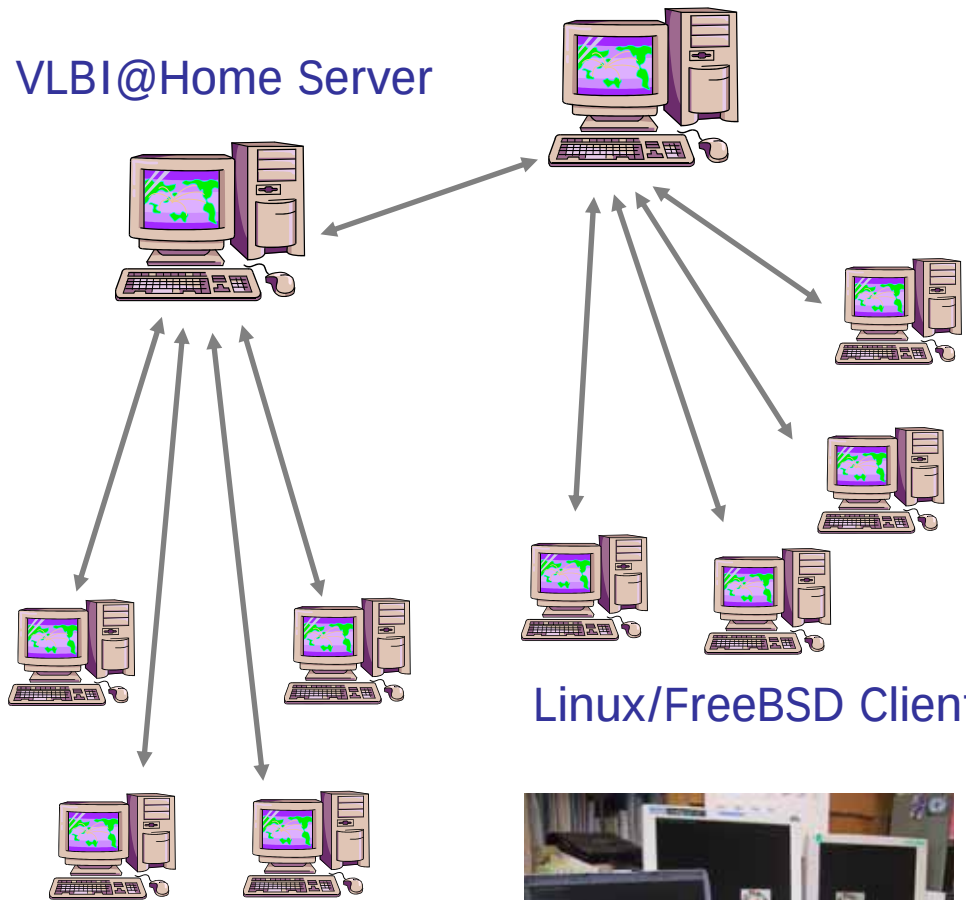
Distributed Software Correlation



Correlation Master Table / Database

Master Server

VLBI@Home Server

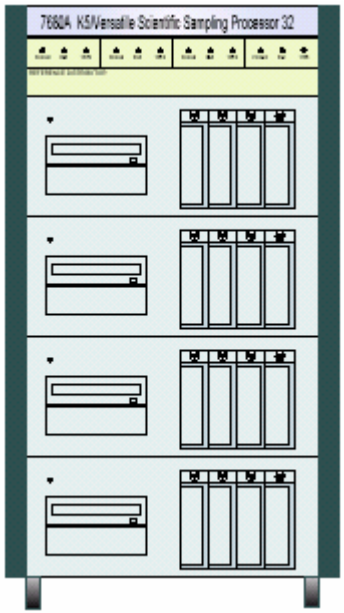


Linux/FreeBSD Clients

VLBI@Home Client PCs

Future Plans (1)

- Upgrade of K5 : K5/VSSP32 using USB2.0



Interface	K5/VSSP32	K5/VSSP
Sampling Speed	40kHz ~ 32MHz	40kHz ~ 16MHz
Sampling Bits	1, 2, 4, 8	1, 2, 4, 8
No. Channels	16	16
Max. Data Rate	1024Mbps	512Mbps
Interface	USB2.0	PCI

Future Plans (2)

- VSI-E demonstration
- VSI-H Output from K5
- Control from fs9 (by using VSI-S)
- K5/Mark5 e-VLBI Intensive Sessions
  (Tsukub32-Wettzell baseline, 1 hour / 1 Week)
- Digital BBC (partially realized)
- Generate PIVEX database from software correlator outputs
- Generate FITS file from software correlator outputs