



Past and Present International Meteorological Communications and the evolution to WIS2.0

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Objectives of this workshop

- 1) To understand the development status of WIS 2.0 and the expected changes of WMO telecommunications circumstances.
- 2) To share skills and knowledge relevant to WIS 2.0 acquired through “GISC Tokyo Cloud Project”, such as MQPs system and cloud storage direct downloading, aiming at smooth migration from GTS to cloud-based “shared platform” data exchange system.
- 3) To discuss user requirements in the region, to be reflected in WIS2.0 architecture and transition process.

Outline

- History of GTS/WIS overview
- WIS Status – Why evolution is needed?
- Information and Technology Trends
- WIS 2.0 Strategy
- WIS 2.0 Implementation Approach
- WIS 2.0 Implementation Plan

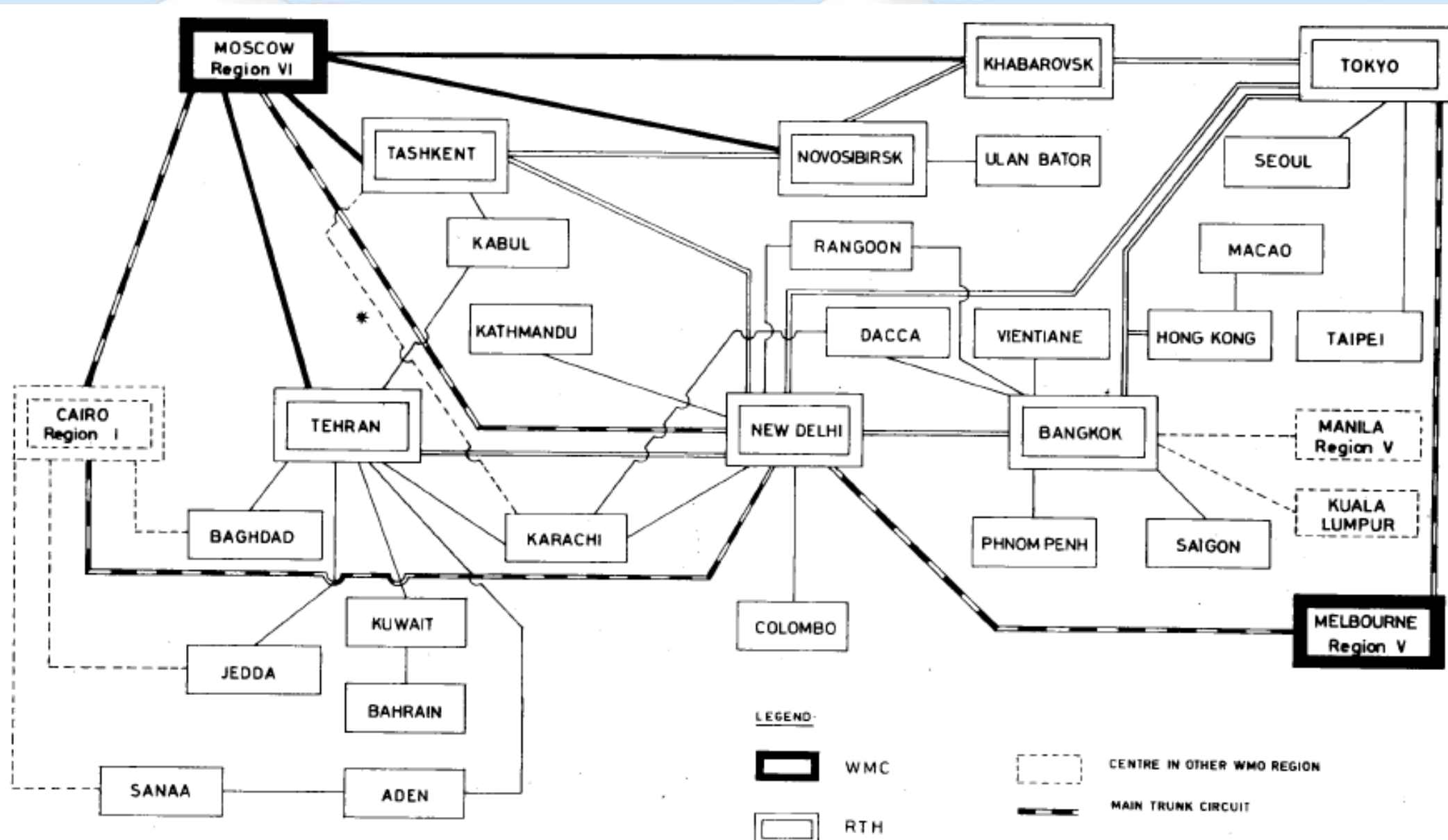
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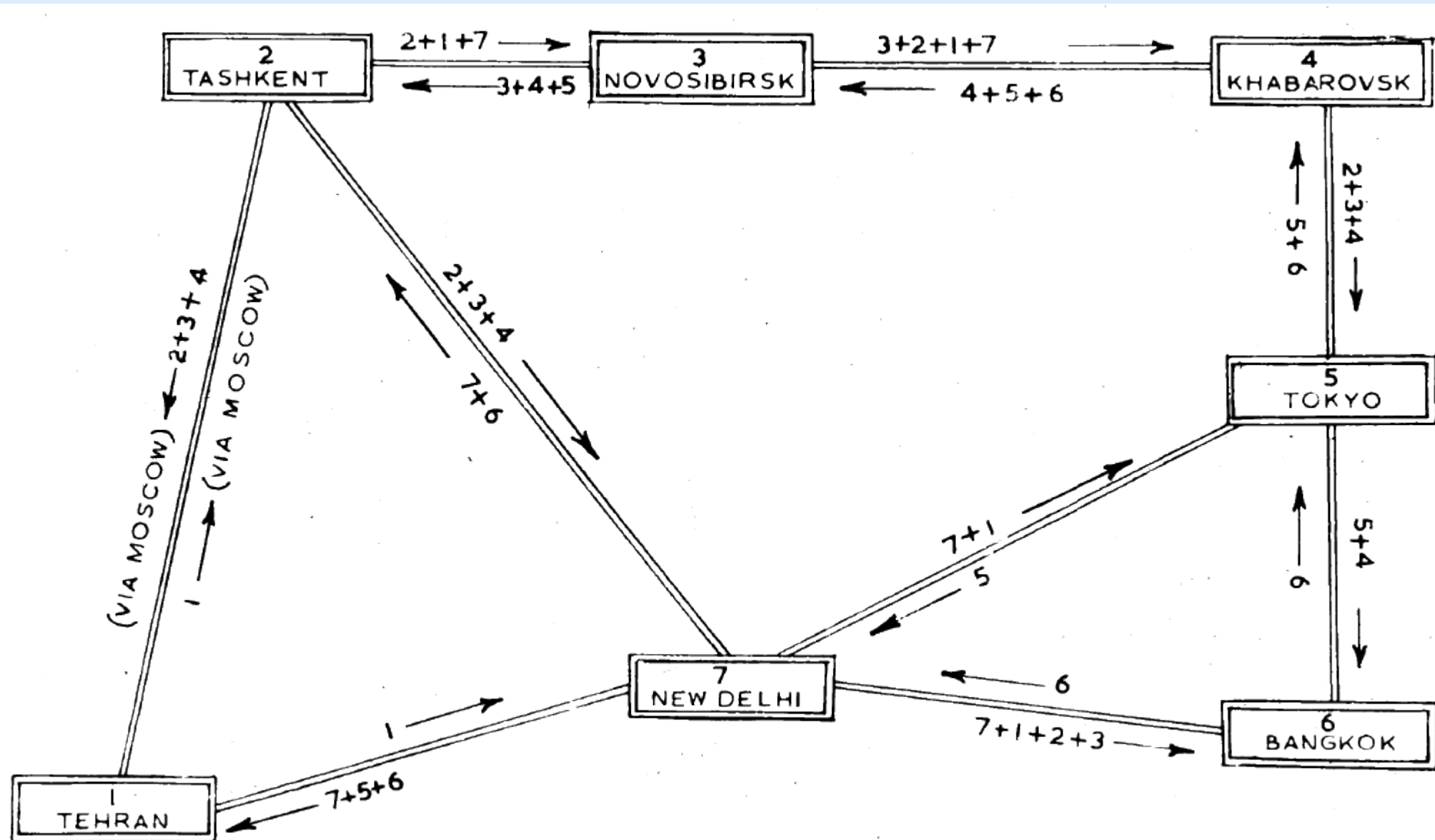
History of GTS/WIS overview

- GTS started carrying indispensable, time-critical data among NMHSs around 1970, to support WWW program.
- Cg-14 (2003) agreed to develop the future “WIS” for all WMO and related international programs.
- The concept of WIS was formalized at Cg-15 (2007), and the first contributing centers approved at Cg-16 (2011).
- WIS was built on and incorporated GTS, adding a data catalog and discovery portal plus complementary methods to subscribe and download data.
- WIS is becoming obsolete nowadays. It needs to evolve to WIS2.0.

In 1969, RAI approved Regional Meteorological Telecommunication Network (by radio broadcasting)



RAI Main Regional Circuits in 1969 (between RTHs)



Regional Meteorological Telecommunication Network in Region II

As of October 2019 (based on annual survey produced by RA-II EG-WIS)

GTS Centre

- : RTH in RA II
- : NMC in RA II
- : Centres in other RA

GTS Type

- : MTN
- : Regional & suplimental regional circuit
- : Interregional circuit
- : Additional / Other circuit

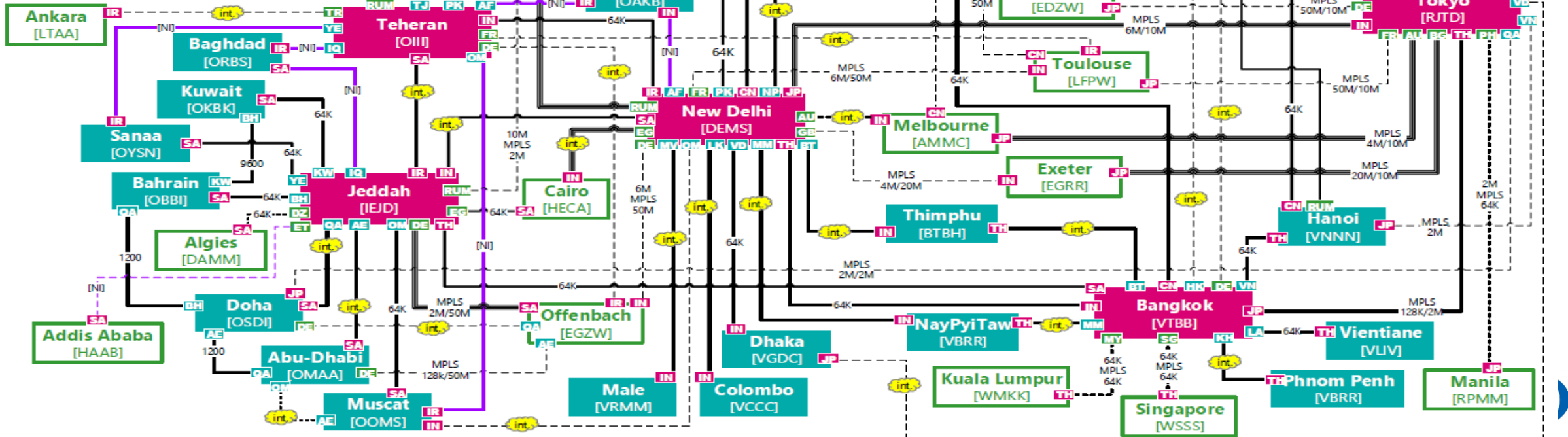
Link Connector

- : Connection to RTH, NMC and centres in other RAs

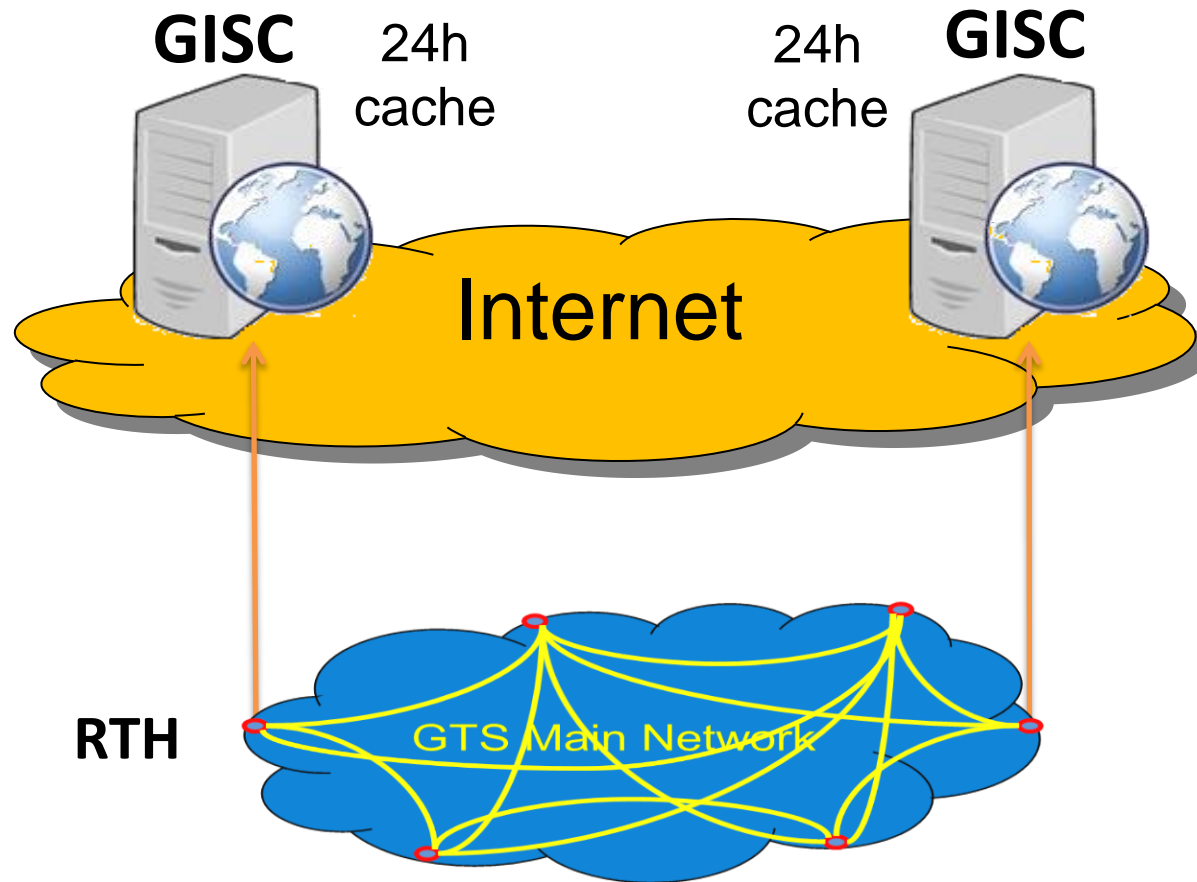
2digits code : ISO 3166-1
 RU[H, M, N] : RTHs in Russian Federation
 H --- Khabarovsk
 M --- Moscow
 N --- Novosibirsk

Constitution

- : Bandwidth guarantee (MPLS, etc)
- : NI (No Implementation)
- : Internet (Besteffort)



Current WIS



DAR Part:

- Ad-hoc data
- Large volume data
- Search and retrieve
- Metadata
- Internet quality

GTS Part:

- Time-critical data
- Operation-critical data
- Dedicated connection
- Managed data routing
- Closed network

Current WIS(GTS/DAR) services

- Collection and dissemination service for time-critical and operational critical data (GTS)
 - Real-time push mechanism via dedicated connections
 - Data Discovery, Access and Retrieval service (DAR)
 - Request and reply pull mechanism with relevant data
- WIS is very reliable and robust with its well-coordinated system. (including system redundancy and “backup GISC” approach)

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WIS Status – Why evolution is needed?

- WIS Architecture

- private Multiprotocol Label Switching (MPLS) networks:

- (complex networking, contractual complexities, high cost for limited bandwidth, so limiting the amount and types of data exchange.)

- TTAAii bulletin header on the one hand, DAR metadata on the other hand.

- current WIS is largely inherited from the pre-existing GTS and the technical solutions available twenty years ago

WIS Status – Why evolution is needed?

- **WIS and WMO Programmes**
 - Majority of products and services in WIS relate to real-time information, primarily associated with WWW Programme.
 - WIS/GTS is a niche infrastructure that supports the expert meteorological community.
- **Metadata**
 - The WIS DAR Catalogue comprises around 150 000 metadata records
 - Fine-grained metadata dominated by GTS bulletins deluged with search results

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Information and Technology Trends

- **BIG Data**
 - Massive amounts of data (volume), velocity (frequent data creation), variety, and veracity (data quality)
 - Push solution no longer be possible.
- **The Cloud computing**
 - The Cloud and the associated services (applications, processing and storage) are likely to be a very cost-effective way for the WIS

Information and Technology Trends

- Search Engines
 - Nowadays, the “gates” for all content on the Internet are search engines such as Google and Bing.
 - Users require WIS to use the de facto standards and common practice of the Internet.
- Messaging and Social Networking
 - Sharing notifications, messages and alerts through the social media has become common place.
 - These technologies offer new opportunities for sharing meteorological data in real time

Information and Technology Trends

- Application Programming Interfaces and Web Services
 - Application Programming Interfaces (APIs) and Web services are now very common solutions for machine-to-machine interaction.
 - WIS should provide lightweight interfaces to allow users to interact with it. Use official or de facto data standards (JSON, XML, CSV,)
 - Use standard protocols and formats.

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WIS 2.0 Strategy

- WIS 2.0 Strategy was approved at EC-69 in 2017(revised at EC-70)
- WIS 2.0 Strategy says:
 - Changes in data supply patterns and user expectations over the past decade present new challenges that the current WIS struggles to meet. At the same time, changes in technology (e.g. cloud computing infrastructure, messaging, search engines, web services) present new opportunities.
 - WIS 2.0 will evolve into a model where end users are pulling selected information.

Technical aspects of WIS2.0

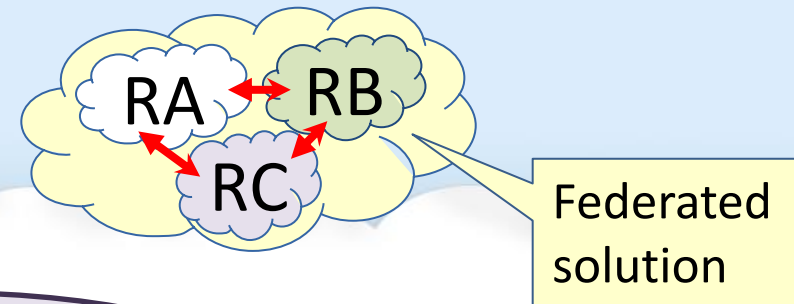
- Use of cloud computing infrastructure to host shared components (such as data repositories and applications) and enable users to work with high-volume data in-situ rather than require download for local use;
- Use of Web standards, Web services and well-defined Application Programming Interfaces (APIs);
- Use of common open data formats (e.g. JSON, CSV, XML, netCDF, HDF) complementing Table-driven Code Forms (GRIB, BUFR);

Technical aspects of WIS2.0

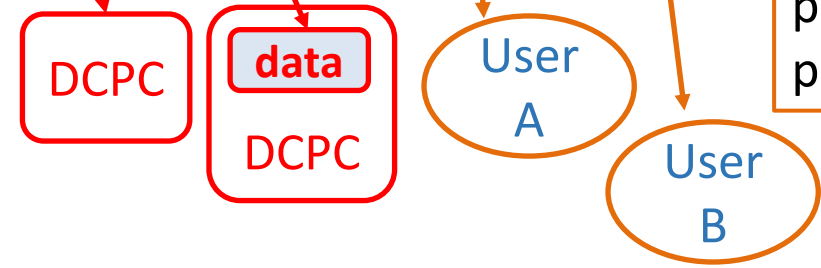
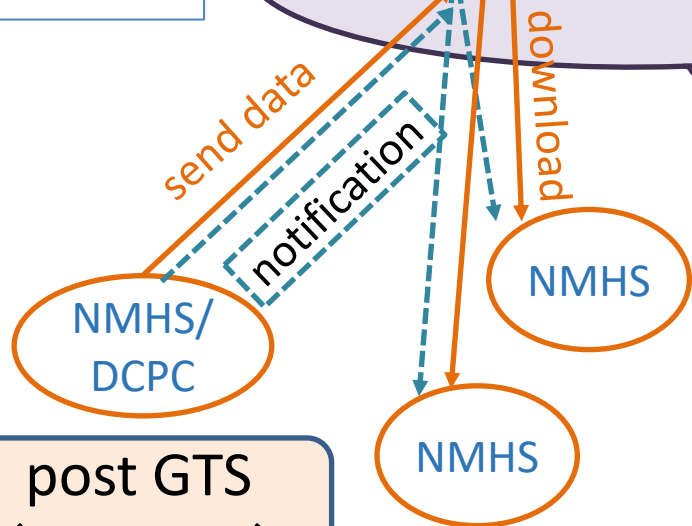
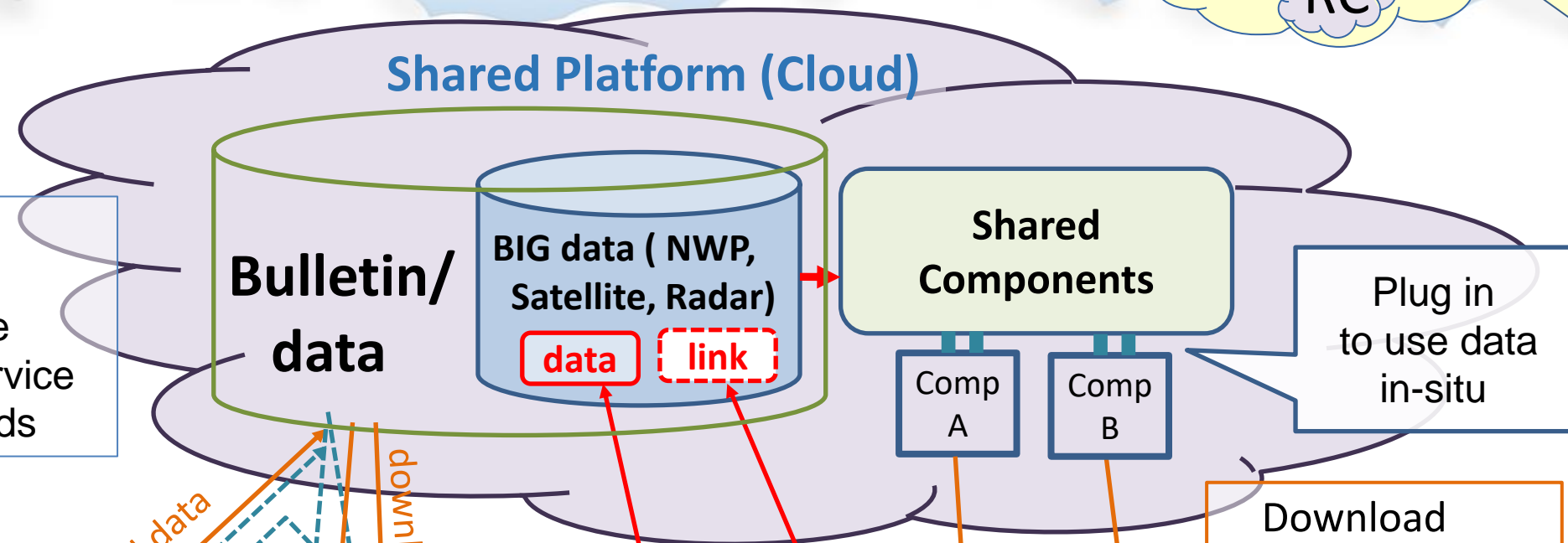
- Integration with global search engines (such as Google, Bing or Yahoo);
- Integration with third-party identity management services (such as eduGAIN) to simplify authentication of users;
- Retirement of traditional GTS message switching as the basis for operational, real-time data exchange in favour of industry standard data distribution methods and protocols such as secure file transfer and publish-subscribe messaging;

Picture of WIS2.0

- WIS 2.0 Strategy(2017) visualization by GISC Tokyo -



- Use
- Internet
 - Search engine
 - API & web service
 - Open standards



Download processed data/products

post GTS (Pub/Sub)

2024: Start step by step transition
2030: Terminate the operation of GTS



Incremental change (based on management of risks)

- Considering the operational aspects of WIS and the risks involved in a “big-bang” approach, WIS 2.0 will be implemented step by step with defined and manageable incremental phases.
- The evolution must not disrupt the present systems, which have established very high availability, robustness and performance. These qualities are also required in WIS 2.0.

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WIS 2.0 Implementation Approach

- In accordance with WIS 2.0 Strategy, WIS2.0 Implementation approach was approved at Cg-18 in 2019 (resolution 57/ Cg-18/ INF. 6.2(3))
- Eleven technical changes to WIS (principles) are outlined that support delivery of the WIS 2.0 vision.

<https://wmo-teams.atlassian.net/wiki/spaces/WIS2/pages/167379256/WIS+2.0+Principles>

WIS 2.0 Implementation Approach

Principle 1: WIS 2.0 adopts Web technologies and leverages industry best practices and open standards.

Particularly open standards from the Internet Engineering Task Force (IETF), World Wide Web Consortium (W3C), the Open Geospatial Consortium (OGC)

Principle 2: WIS 2.0 uses Uniform Resource Locators (URL) to identify resources (i.e. Web pages, data, metadata, APIs) (i.e. the network 'location' and the communications protocol to be used)

WIS 2.0 Implementation Approach

Principle 3: WIS 2.0 prioritizes use of public telecommunications networks (i.e. Internet) when publishing digital resources

The specification of the AMDCN (managed network vs. Internet) is a responsibility of the GISC, taking into account reliability, security, availability, cost/use ratio and capabilities at DCPCs and NCs.

Principle 4: WIS 2.0 requires provision of Web service(s) to access or interact with digital resources (e.g. data, information, products) published using WIS.

Most Members were ill-prepared for the predicted explosion in data volumes.

WIS 2.0 Implementation Approach

Principle 5: WIS 2.0 encourages NCs and DCPCs to provide 'data reduction' services via WIS that process 'big data' to create results or products that are small enough to be conveniently downloaded and used by those with minimal technical infrastructure.

Use 'data reduction' Web services to process high volume, complex data remotely.

WIS 2.0 Implementation Approach

Principle 6: WIS 2.0 will add open standard messaging protocols that use the publish-subscribe message pattern to the list of data exchange mechanisms approved for use within WIS and GTS.

Low effort for data providers to distribute data in real-time to large numbers of consumers.

Principle 7: WIS 2.0 will require all services that provide real-time distribution of messages (containing data or notifications about data availability) to cache/store the messages for a minimum of 24-hours, and allow users to request cached messages for download.

GISCs retain the responsibility to operate a 24-hour cache of data within their Area of Responsibility.

WIS 2.0 Implementation Approach

Principle 8: WIS 2.0 will adopt direct data-exchange between provider and consumer.

Faster transmission of real-time data by avoiding latency introduced by message switches at intermediate GTS nodes.

Principle 9: WIS 2.0 will phase out use of routing tables and bulletin headers.

Faster setup of new data-sharing arrangements as there is no need to wait for intermediate nodes to update their routing table configuration.

WIS 2.0 Implementation Approach

Principle 10: WIS 2.0 will provide a Catalogue containing metadata that describes both data and the service(s) provided to access that data.

WIS 2.0 enables data and Web services to be discovered via commercial search engines, thereby enhancing the discoverability of authoritative weather, water and climate data

Principle 11: WIS 2.0 encourages data providers to publish metadata describing their data and Web services in a way that can be indexed by commercial search engines.

Efforts will be made to harmonize the metadata required for the revised WIS Catalogue and for indexing by commercial search engines to avoid unnecessary duplication of effort by data providers.

Demonstration Projects

- Demonstration Projects will be used to illustrate, evolve, validate and/or refine the concepts, solutions and implementation approach of WIS 2.0 – and also to demonstrate some of the key benefits that WIS 2.0 will bring to the meteorological community.
- Initial tranche of demonstration projects have been identified – at least one for each Region. Demonstration projects will run through to end 2024.

Demonstration Projects

Earth System domains

- Global Cryosphere Watch
- Open Access to the GTS (Open-GTS)
- WMO Hydrological Observing System (WHOS)

LDCs and SIDSs

- Interconnection of GISC Casablanca to the National Meteorological Centres within its area of responsibility
- WIS 2.0 Malawi Automatic Weather Stations data exchange

Services

- GMAS: CAP messages exchange with Message Queuing Protocols (MQP)

Data Exchange

- GISC Tokyo cloud project
- EUMETNET Supplementary Observations Data-Hub (E-SOH)
- Exploring the use of message queuing protocols for GTS data exchange
- Experimental WIS 2.0 data exchange for data in WMO CF-NetCDF profiles

Data Discovery

- GISC Beijing Web services catalogue projects
- Discovery Metadata exchange and harvesting

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WIS 2.0 Implementation Plan

- WIS2.0 Implementation Plan was approved at EC-73 in 2021
- A high-level activity plan and timeline for WIS 2.0 implementation are provided. The WMO Secretariat will work in cooperation with the Regional Associations to ensure the detailed implementation plan suits local and regional needs.
 - Activities for WMO secretariat, Commissions, RAs, and GISCs
 - GISCs are required to monitor and support the transition.

Timeline

	Projects	Normative
2020 EC-72	Demonstration projects established	
2021 Cg-2021 EC-73	Demonstration projects progress report and engage a wider community	
2022 EC-74		WIS 2.0 draft architecture
2023 Cg-19 EC-75	Demonstration projects final report	WIS 2.0 Technical Regulation (message protocols, metadata specifications etc.) approved with 'Operational Status' Guidelines for WIS 2.0 implementation published



Timeline and milestones (2024-2030)

- 2024 - Operational WIS 2.0 Catalogue and portal provided by GISCs
 - Old WIS DAR Catalogue 'frozen'
 - MSS solutions implementing new message protocols available
- 2026 - Rationalized set of data and services migrated from original WIS to WIS 2.0.
 - Original WIS DAR Catalogue deprecated.
 - 70% of GTS routing table configuration items migrated
- 2030 - Migration to use of new message protocols complete
 - All GTS routing table configuration items migrated and use of routing tables deprecated

Summary (1/2) : Evolution to WIS2.0

- Increasing volumes and variety of information, presents WIS new challenges.
- At the same time, changes in technology present new opportunities.

To simplify data exchange

- Evolve into a model where end users are pulling selected information.
- The operation of GTS (with routing tables and bulletin headers) will be terminated in 2030, by installing pub/sub messaging systems.
- Enable users to process high-volume data in-situ, rather than download it for local use.



Summary (2/2): Evolution to WIS2.0

To simplify data processing (make web services available), and for the use of broader community:

- Use common open data formats (e.g. JSON, CSV, XML, netCDF, HDF).

For the incremental change:

- Wis 2.0 will be implemented step by step with defined and manageable incremental phases.
- Ensure the detailed implementation plan suits local and regional needs.



Thank you

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