

Cooperative ITS – Data Management Introduction

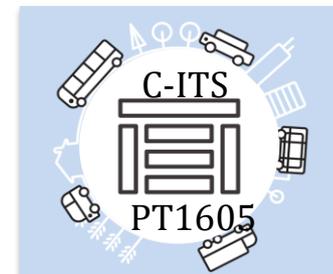
Organizer: SAMS Norway & ITS Norway

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Title: C-ITS, Key Enabling Technologies

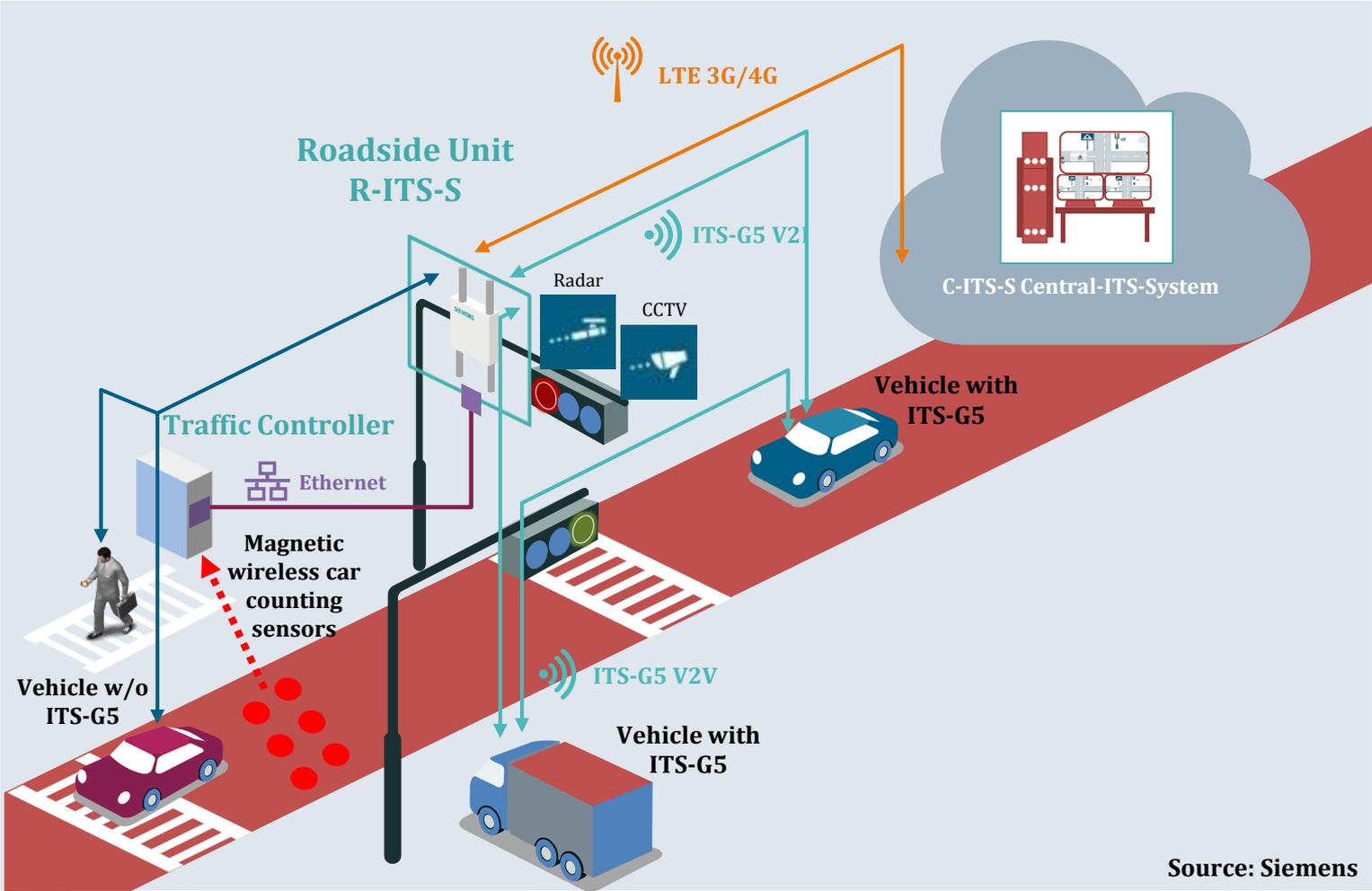


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- The purpose of CEN ISO/TS 21184 C-ITS – Global Transport Data Management (GTDM) framework standard is to **provide a 2-way data conversion concept between infra-structure applications and sensor and control networks (SCNs)** of e.g., roadside units, vehicles and ITS, diagnostic, ... applications.
- CEN ISO/TS 21184 GTDM specifies **differentiated and secure access to data based on certificates with role information and complies with GDPR (General Data Protection Regulation)**. It integrates with the communication security mechanisms specified in CEN ISO/TS 21177.
- CEN ISO/TS 21184 GTDM specifies the **data models** for SCN protocols and its proprietary data formats (**SCNDF**), conversion information into the Global Transport Data Format (**GTDF**) based on standardized data types.
- The major benefit is a “**one time data translation**” to satisfy Roadside, Vehicle, Personal, and Central ITS station ITS Station Facility Layer Data Management.

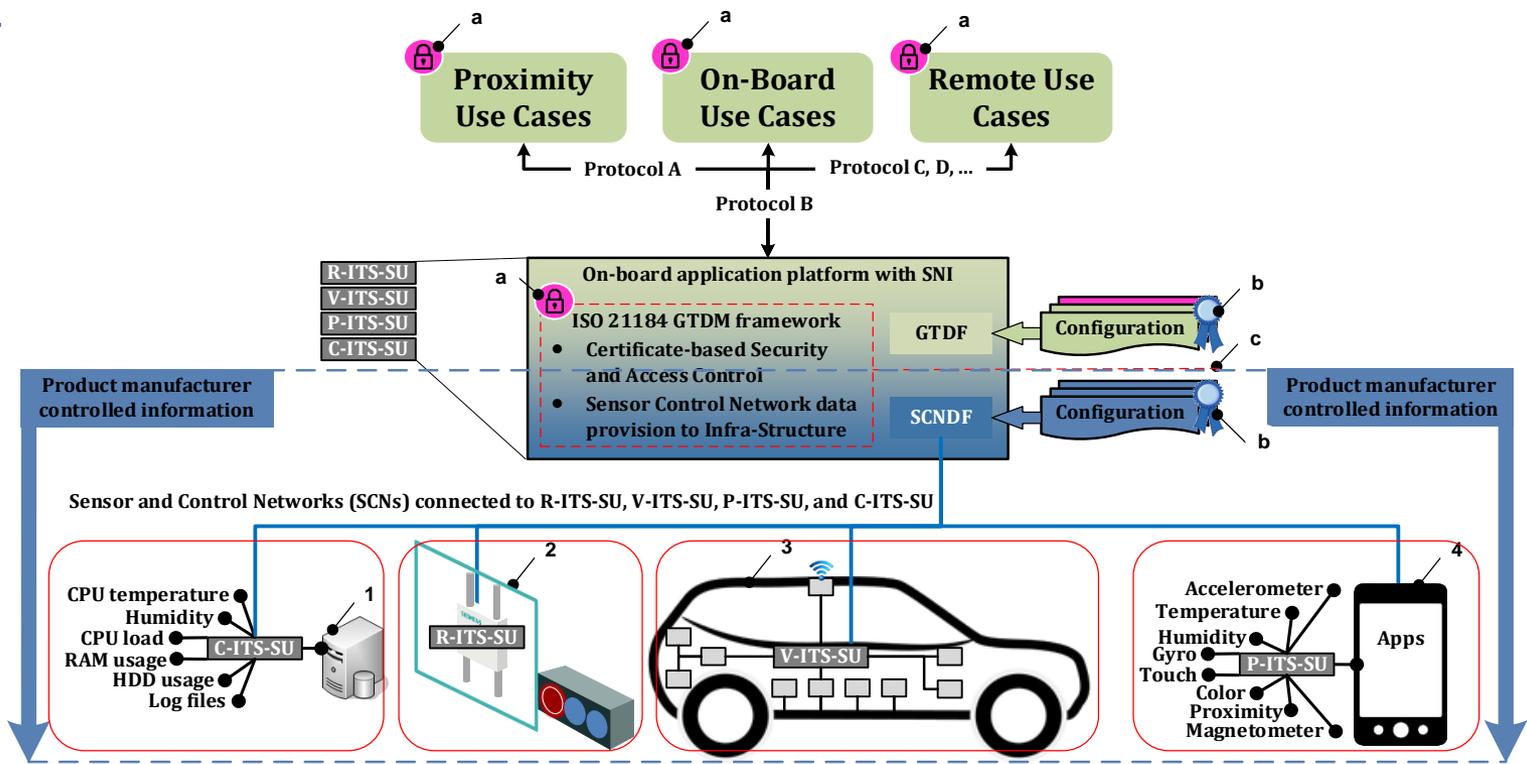
- R-ITS Station connected to a Traffic Controller and Remote C-ITS Station



Source: Siemens

- R-ITS Station Use Cases (source: Siemens)
 - Traffic Controller calculates Collision Avoidance based on V-ITS Stations CAM (Cooperative Awareness Message).
 - Traffic Controller controls traffic lights and monitors proper functioning
 - Traffic Controller connects e.g. Camera, Radar, Magnetic Wireless Car Counting Sensors
 - Traffic Controller broadcasts SPAT (Signal Phase and Time) messages which describe the signal state of the intersection and how long this state will persist for each approach and lane that is active.
 - Traffic Controller broadcasts MAP (Map Data) messages to inform drivers about the physical geometry of one or more intersections.
 - The SRM (Signal Request Message) requests preempt or priority services for selected user groups.
 - The SSM (Signal Status Messages) describes the internal state of the signal controller.
 - Inspection, Maintenance, and Diagnosis in case of malfunction
- C-ITS Station Use Cases
 - Remote monitoring of roadside furniture (equipment/R-ITS Station)
 - Remote diagnosis in case of error information received from R-ITS Station
 - City traffic management (status information collection of all R-ITS Station)
 - ...

- Proximity Use Cases
 - Connect P-ITS-S to V-ITS-S for Inspection & Maintenance, Diagnostics & Repair, ...
- On-Board Use Cases
 - P-ITS-SU updates Software of V-ITS-SU, Electronic Control Units connected to the SCN(s), ...
 - R-ITS-SU App installation to monitor and report traffic at rush hours, V-ITS-SU App installation P-A-Y-D, ...
- Remote Use Cases
 - C-ITS-SU City Traffic Management Application changes R-ITS-SU Traffic Signal Time Intervals at rush hours, ...

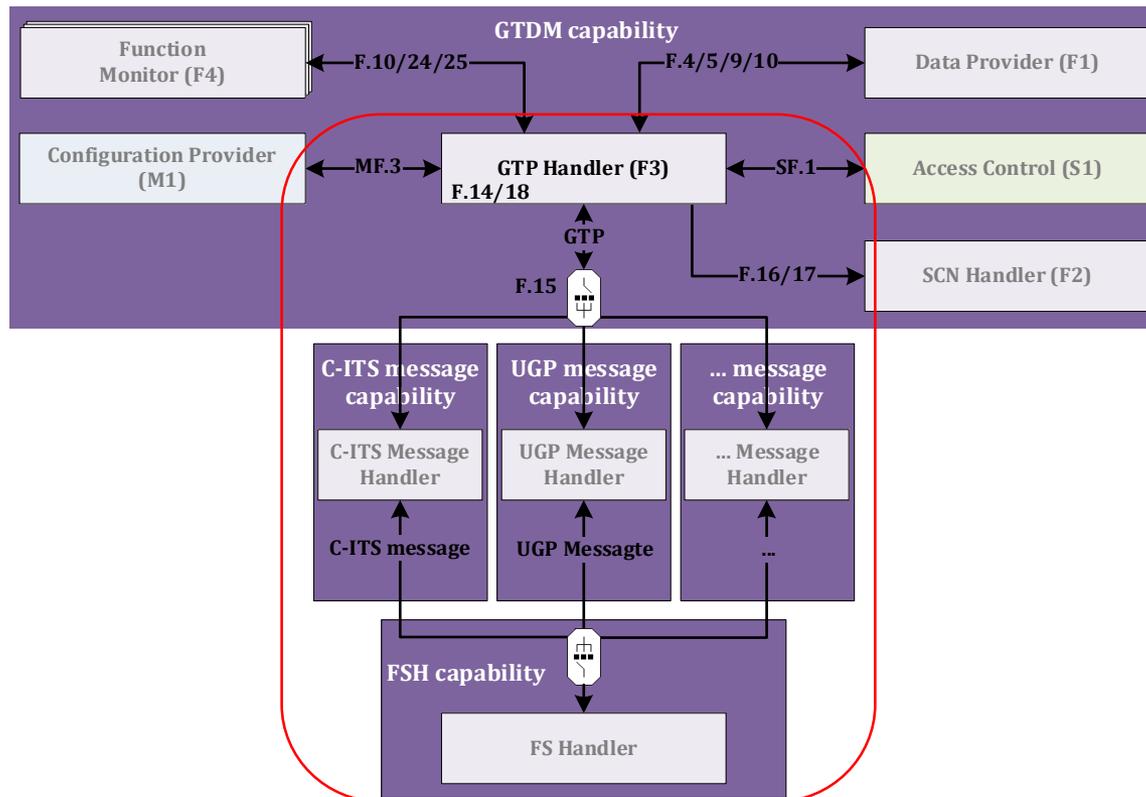


- Data is a key enabler in achieving transport mobility objectives
 - Open, secure data is a competitive advantage in a mobile society

- Manufacturers have a right to protect their intellectual property and to demand secure access to proprietary sensor & control networks

- The CEN/ISO TS21184 standard is designed to support the rights and requirements of all parties in mobility ecosystems
 - Vehicle manufacturers are the experts in identifying and provisioning data access to the in-vehicle network (vehicle sensor & control network)
 - Roadside equipment manufacturers are the experts in identifying and provisioning data access to the sensor & control network (SCN)
 - Commercial service and application stakeholders are the experts in identifying their domain (traffic management, diagnostics, P-A-Y-D, ...) requirements

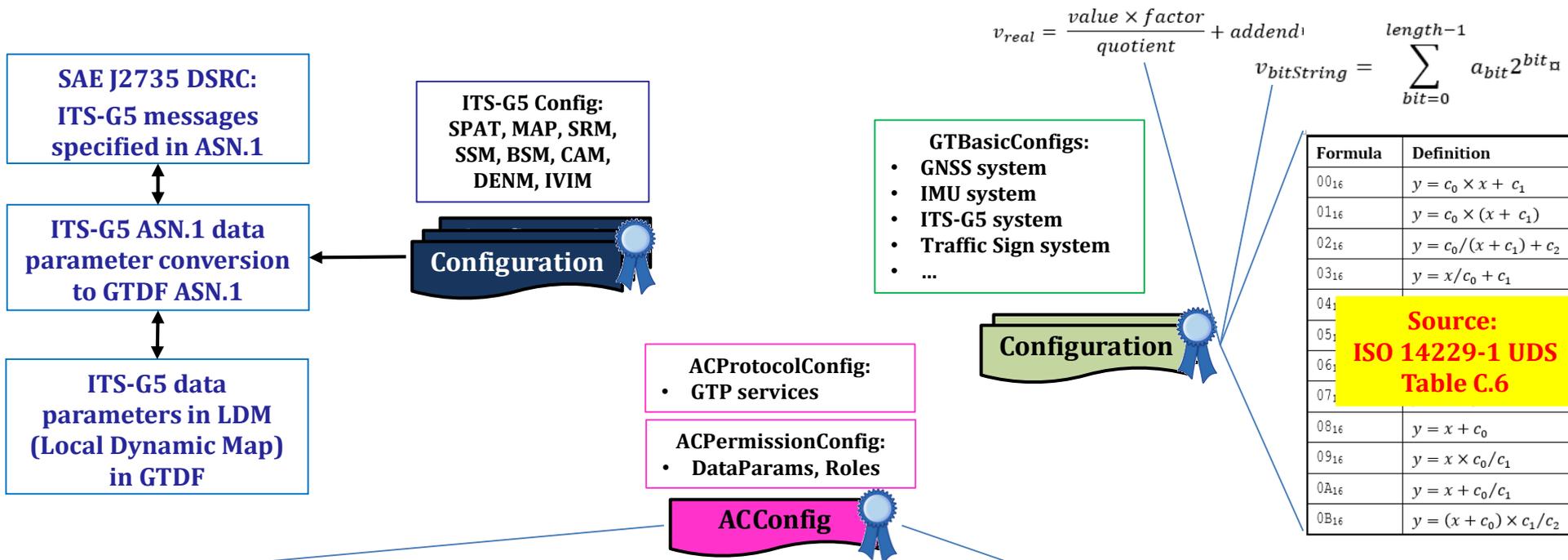
- The purpose of the GTP Handler is to support a “single set of protocol services” to be used in conjunction with AccessControl configuration information.
- Supporting multiple different protocols in conjunction with AccessControl configuration information would cause continuous software changes in AccessControl which results in much higher vulnerability of the ITS station.



- The global transport protocol (GTP) services are used to access data items and control functions in an ITS station.
- The GTP services provide a superset of functionality of protocols e.g., ISO 13185-2 ITS - UGP, ISO/IEC 19464 IoT-AMQP, IoT-MQTT, Google ProtBuf (SensorIS), W3C VIS (GENIVI/W3C) used in the industry.
- A protocol service mapping and a bi-directional data format converter (e.g. JSON to ASN.1) needs to be installed for each protocol to interface with the GTP services.

Table 82 — Overview of GTP messages

REQ	F.13 ITS-S Facilities - GTPMessage	
The GTP Handler (F3) shall provide the GTPMessage according to the ASN.1 definition specified in A.6 . The GTPMessage shall provide the following services.		
Service choice	Primitive	Description
GetStationUnits	Call, Reply	get the identifiers list of all current station units
GetSupportedInfo	Call, Reply	retrieve the supported information (ECUDataParams, DTCs, Messages) of a given station unit
SubscribeValues	Call	subscribe to ECU data parameter value changes
PublishValues	Reply	publish ECU data parameter value changes
SetValues	Call	set ECU data parameter values local or in the SCN
ControlValues	Call, Reply	control elements in the SCN
SubscribeMessages ^a	Call	subscribe to GTMessages
PublishMessages ^a	Reply	publish GTMessages
SubscribeDtcInfo	Call	subscribe to DTC info
PublishDtcInfo	Reply	publish DTC info
ClearDtcInfo	Call	clear DTC info
EnablePassThru	Call	enable pass thru
ListFiles	Call, Reply	list files
ManageFiles	Call, Reply	download, upload and delete files
Reset	Call	reset the ITS-SU
PositiveReply	Reply	reply positive to a service without own Reply primitive
NegativeReply	Reply	reply negative to any service
^a SubscribeMessages and PublishMessages shall be supported as client and server		

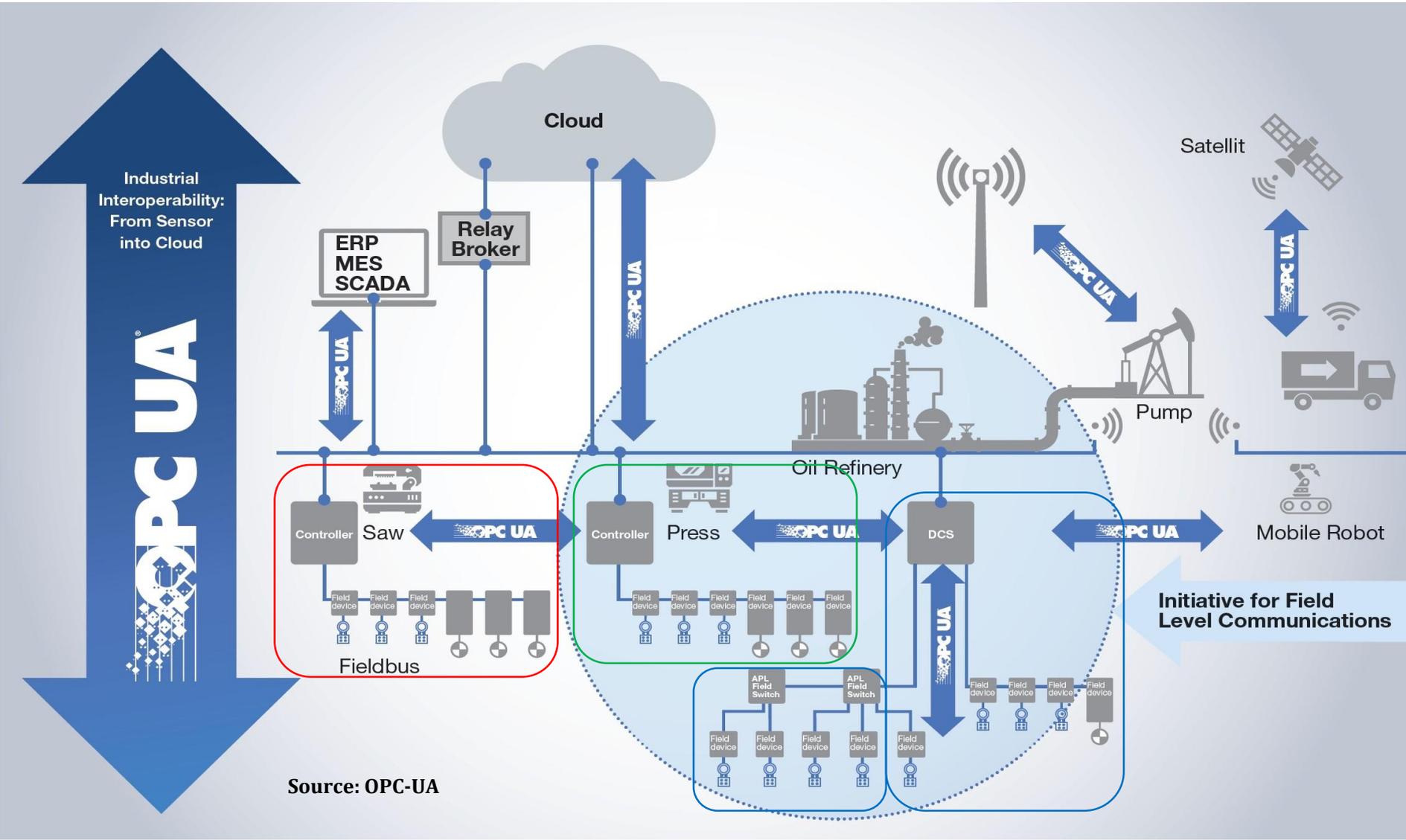


Access Control high level examples: GTP service, data params	Role 1	Role 2	Role 3
SubscribeMessage incl. GNSS, ITS Station Type, ...	X	---	---
GetSupportedInfo (ECUDataParams, DTCs, Messages)	X	X	X
SubscribeValues incl. all ITS station software and versions	X	X	X
ManageFiles (Download GTDF configs)	---	X	X
ManageFiles (Upload, Delete GTDF configs)	---	---	X
ListFiles	---	X	X

**CEN ISO TS 21177
IEEE 1609.2 Certificate**

- Role 1:** "Road Traffic Monitoring and Reporting to C-ITS Station"
- Role 2:** "Remote Roadside Station Diagnostics"
- Role 3:** "Roadside Station Software & Configuration Update"

CEN ISO/TS 21184 applies the same methodology as specified in Industry IoT 4.0 OPC-UA



Source: OPC-UA

1. Interoperable data exchange requires data format standards
2. CEN ISO/TS 21177 certificates support fine-grained data access control
3. CEN ISO/TS 21184 is based on the same principles as applied in Industry IoT 4.0 OPC-UA
4. Worldwide and manufacturer-specific data
 - can be created using the same authoring process
 - can be merged into the same product via configuration files
 - can be mapped to a standardized identifiers (incl. data conversion)
5. Applications from different use case groups require support of different protocols and data formats (there is no single protocol to fit all use cases)
6. A data configuration file concept is more flexible and less vulnerable against attacks than software updates