IRS Integrating the Railway System

IRS Cargo – Integrating the railway system

Interoperability of ICT-systems in the rail sector

www.bahnindustrie.at

fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

Verband der Bahnindustrie

IRS-Cargo – Integrating the Railway System
Exploratory project March 2022 – March 2023

IRS | Integrating the Railway System

- Verband der Bahnindustrie
  - consortium leadership
- University of Applied Sciences Technikum Wien
  - Know-how interoperability in the health and energy sector
- University of Applied Sciences St. Pölten
  - Expertise in the fields of railway technology and logistics

Verband der Bahnindustrie

FH University of Applied Sciences TECHNIKUM WIEN

The project IRS Cargo is funded from the program Mobility of the Future by the Austrian Research Promotion Agency (FFG) under project number 891459

Bundesministerium Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie

fh st.pölten

FFG Promoting Innovation.

fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

Verband der Bahnindustrie

Digitalization in the rail system
What are the current framework conditions?

IRS | Integrating the Railway System

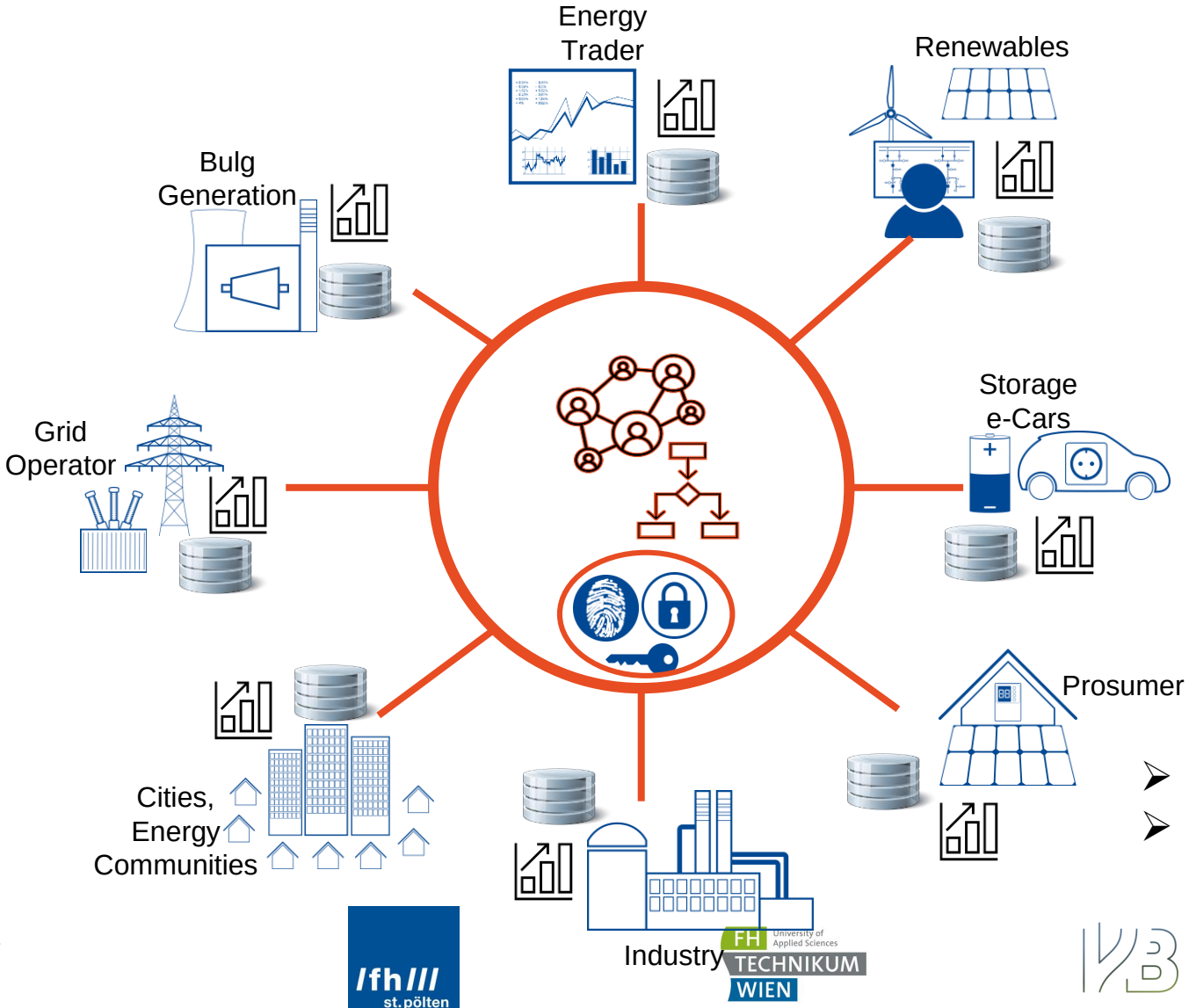
- **National Lock-in effects: structural lack of cross border traffic**
  Cross border traffic of passengers and goods is prevented because of proprietary data silos and a lack of interfaces among national operation systems

- **System integration fails: competitive disadvantage of European rail system**
  The cooperation of heterogeneous, national systems is only possible with difficulty and involves a great deal of effort

- **System costs increasing: more technology still leads to higher unit costs**
  Proprietary solutions and their operation lead to higher system costs and prevent scaling effects and subsequent cheaper solutions in the technologies

Digitalization in of data exchange processes
Communication Infrastructure required

IRS | Integrating the Railway System



Central Datahub:
- Loss of data sovereignty
- No governance
- Not possible for critical infrastructure

Communication Infrastructure
- Data „only once“
- Common governance
- Standarized interfaces

- ➢ Data access only per defined Use Case
- ➢ Data exchange is also possible cross vertical and cross border

fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

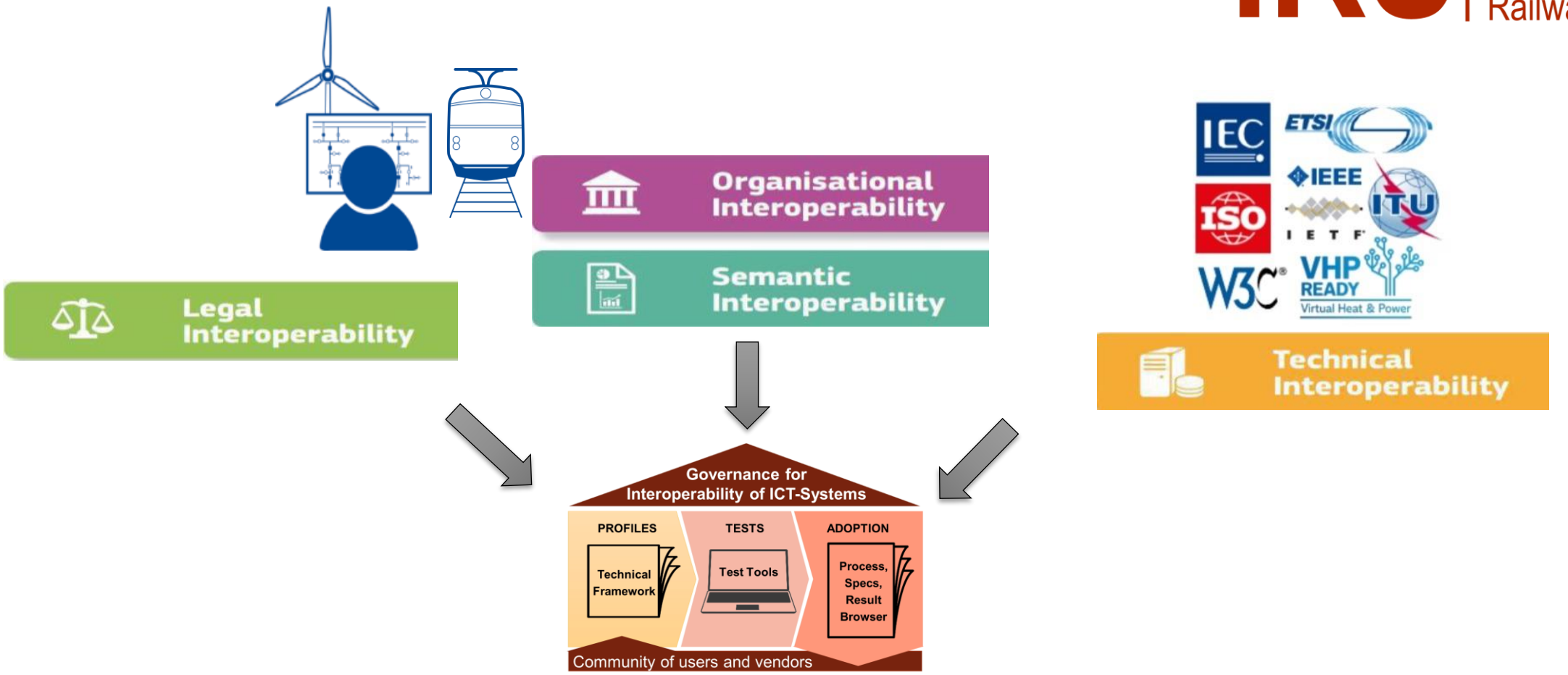
European Interoperability Framework
Layers of Interoperability

IRS | Integrating the Railway System

- **Legal Layer**
  - defines the legal basis for data exchange
- **Organizational Layer**
  - defines the business processes required for data excha
- **Semantic Layer**
  - describes the meaning and value of exchanged data
- **Technical Layer**
  - Describes the required technical systems and standarc

Interoperability requirements
for Use Cases in interconnected systems

IRS | Integrating the Railway System



Need of a **cooperative** and **transparent** process

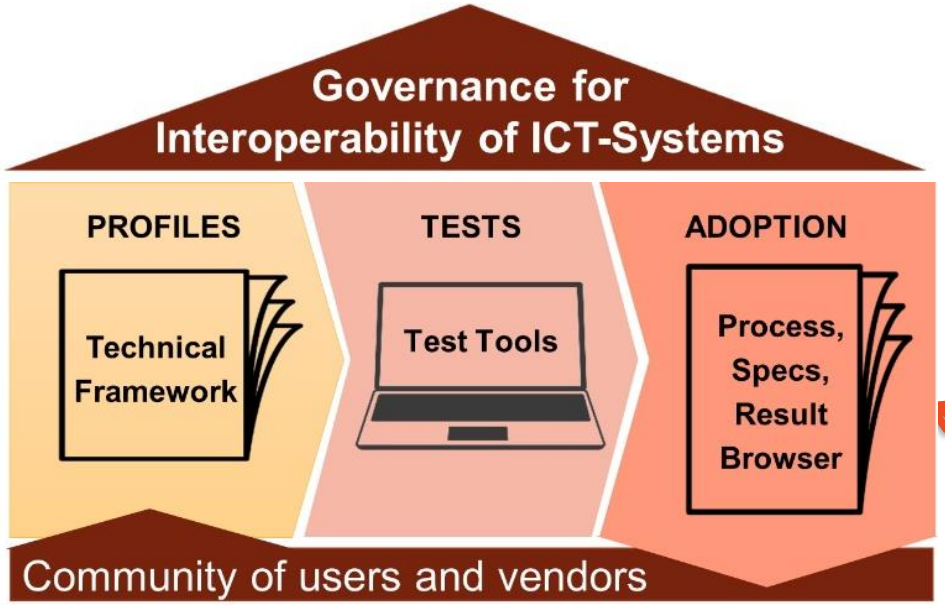
ifh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

Three pillars of the entire Process
Process chain to achive Interoperability

IRS Integrating the Railway System



„Profiles“
Use case based, cooperative specification of data exchanges using existing standards

„Tests“ Connectathon
vendors test their prototypes in an early stage of implementation

„Adoption“
building a community as process owner and share publicly accessible results (profiles, tests)

ifh st.pölten
FH University of Applied Sciences TECHNIKUM WIEN
VB Verband der Bahnindustrie

Interoperability process as Cross-sector Know-how Transfer

IRS Integrating the Railway System

IHE Integrating the Healthcare Enterprise → IES Integrating the Energy System → IRS Integrating the Railway System

Health sector:

- 1989 Founding of the non-profit organization IHE
- has a governance for open cooperation (ISO TR 28380)

Energy sector:

- 2016-2019
- first cross-sector know-how transfer
- Adaptation of the IHE methodology (ISO TR 28380)
- Proof of Concept

Railway sector:

- 2022-2023
- Cross-sector know-how transfer
- Based on IHE / IES experience
- White Paper for standardization of the sector neutral model process

IRS Integrating the Railway System

Interoperability Testing

/fh/// st.pölten
FH University of Applied Sciences TECHNIKUM WIEN
VB Verband der Bahnindustrie

IHE Interoperability testing - synergy for other sectors

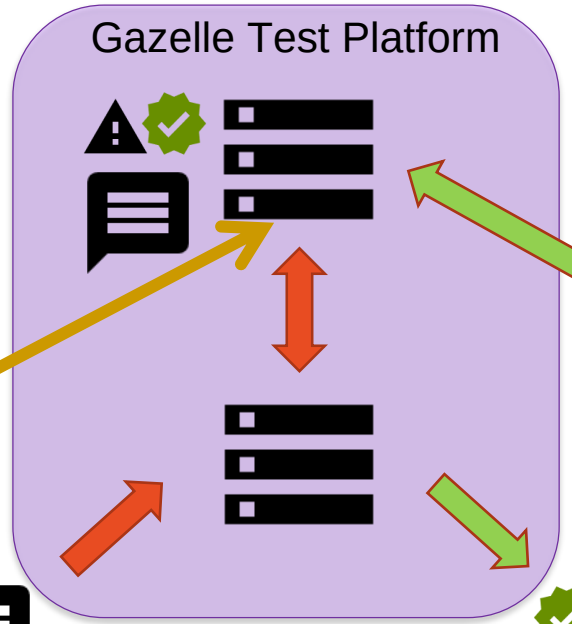
IRS | Integrating the Railway System

IHE Integrating the Healthcare Enterprise

Gazelle Validators
Check message conformance

Gazelle Test Management
Keep track of things

Software under Test
generate and receive messages



What do we need to add a new sector or domain?

Add new validators.
Keep the rest.

ifh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

IRS Integrating the Railway System

Interoperability Test Platform Gazelle

/fh/// st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

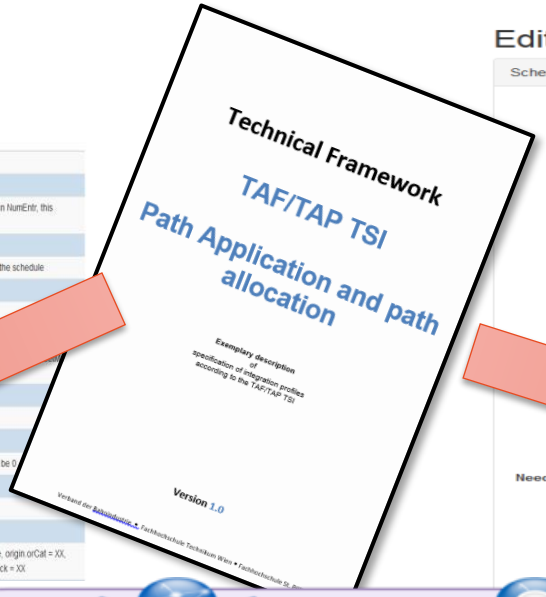
VB Verband der Bahnindustrie

Testing: Technical Framework from sepecification to interoperability test

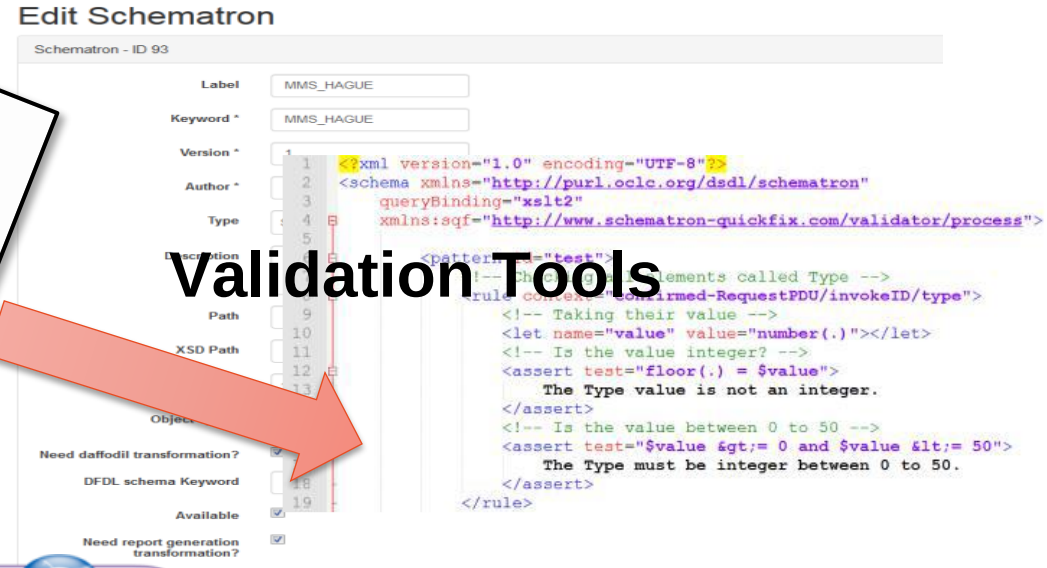
IRS | Integrating the Railway System

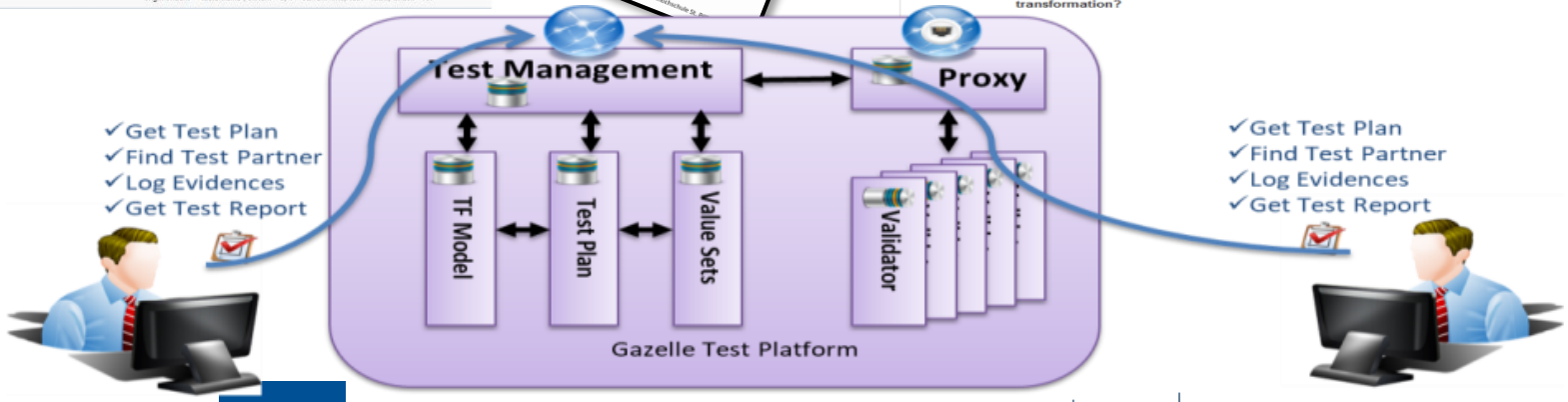
Test Case Definition

Step Index	Initiator Role	Responder Role	Transaction	Secured	Message Type	Option	Description
10	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_SchdIntv_Units	Required	Send Unit from Schedule Intervale
	Input and Output Contextual Information (0 - 0)						
15	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_ValASG_Unit	Required	Write the physical unit of the ValASG. Based on the number communicated in NumEntr, this message SHALL be sent multiple times
	Input and Output Contextual Information (0 - 0)						
20	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_NumEntr_SetVal	Required	Communicate the number of values (x suffix in ValASG) that are included in the schedule
	Input and Output Contextual Information (0 - 0)						
30	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_SchdReuse_SetVal	Required	Defines whether the schedule is reusable. setVal SHALL be 0
	Input and Output Contextual Information (0 - 0)						
40	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_ValASGx_SetMag_mulpleTimes	Required	Based on the number communicated in NumEntr, S… SHALL be a FLOAT32
	Input and Output Contextual Information (0 - 0)						
50	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_StrTm_SetCal	Required	Set start tim…
	Input and Output Contextual Information (0 - 0)						
60	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_IntvPer_SetVal	Required	SetVal for the… al. 0 means no repitition of the schedule. SHALL be 0
	Input and Output Contextual Information (0 - 0)						
70	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_SchdReuse_setVal	Required	Defines whether the schedule is reusable. setVal SHALL be 0
	Input and Output Contextual Information (0 - 0)						
80	TPKTInitiator_FSCH	TPKTResponder_FSCH	SPS-01		SPS-01_VldReq	Required	Sending the Validate Request (Oper, type "Oper_Boolean", with ctlVal = true, origin orCat = XX, origin.orident = "testername", ctlNum = 0, T = currentTime, Test = false, Check = XX



Validation Tools





Source: IHE Services

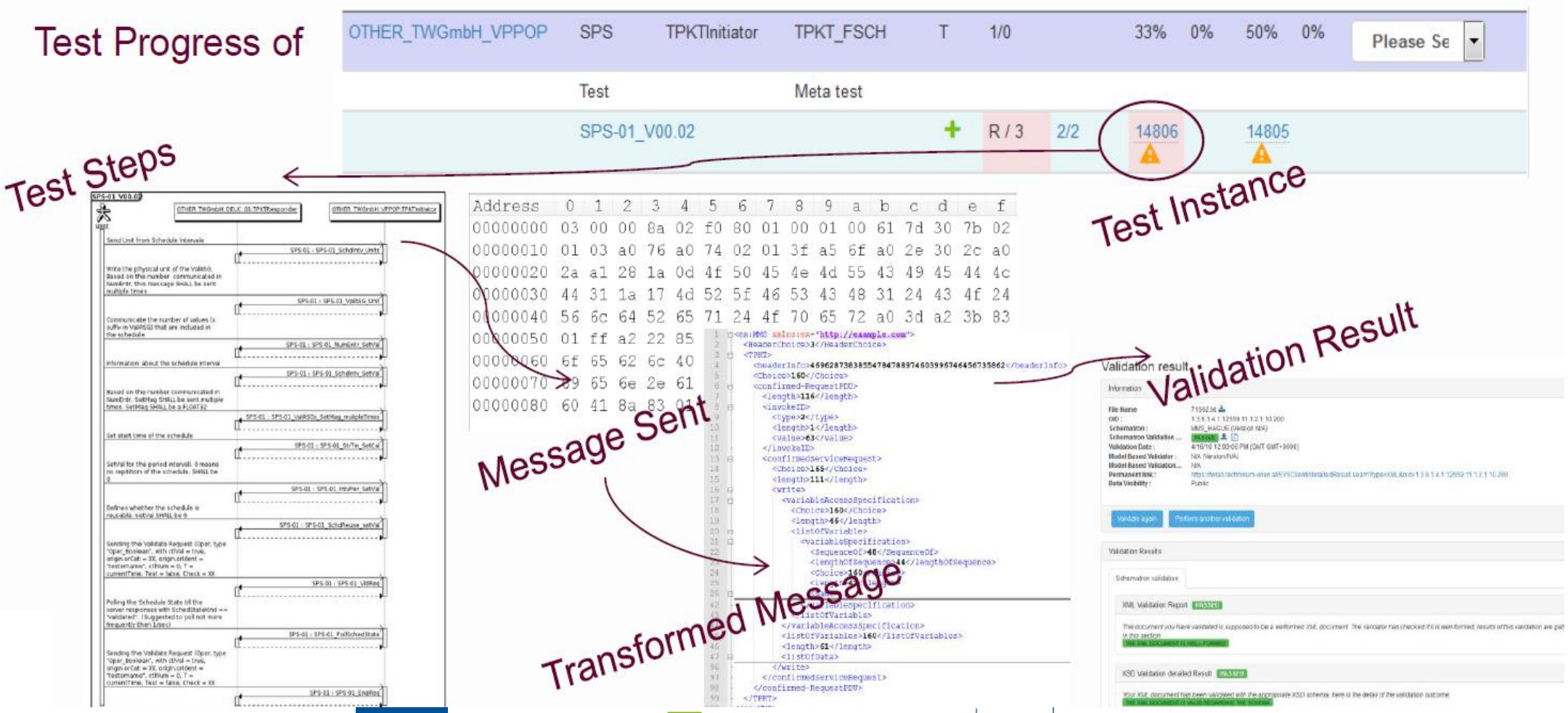
fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

Verband der Bahnindustrie

Interoperability Testing
Test platform GAZELLE

IRS | Integrating the Railway System



fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

Verband der Bahnindustrie

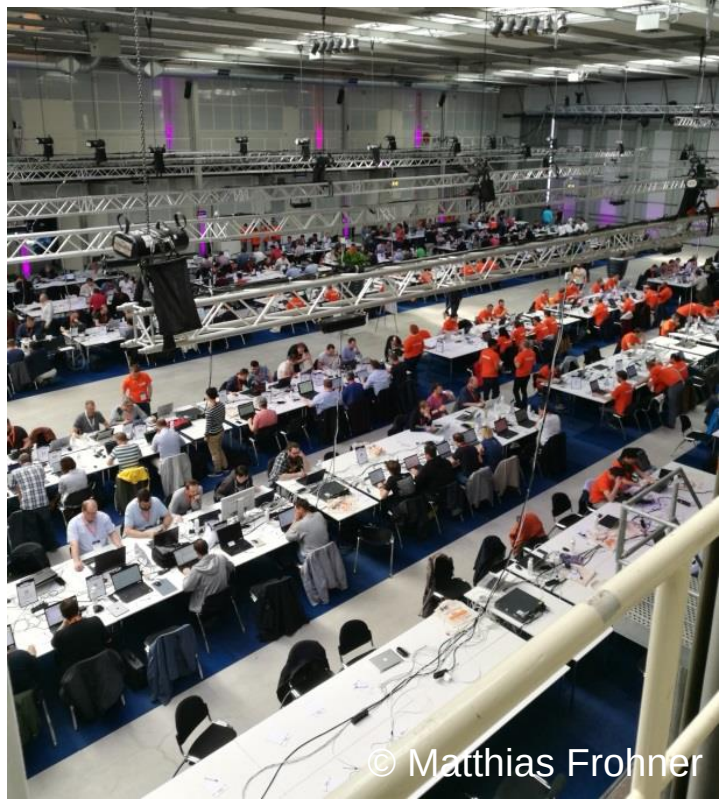
Interoperability Testing
What is a Connectathon?

IRS | Integrating the Railway System

Vendors perform Peer-to-Peer tests with other vendors according to the specifications

IES Connectathon Energy
Vienna, January 2019

IHE Connectathon
The Hague, April 2018



fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

IRS Integrating the Railway System

Exemplary implementation of IRS

Benefits for applying the methodology: Extension / Improvement / Implementation of existing regulations through use case description

fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

TAP/TAF TSI
Use Case: Path Request

IRS | Integrating the Railway System

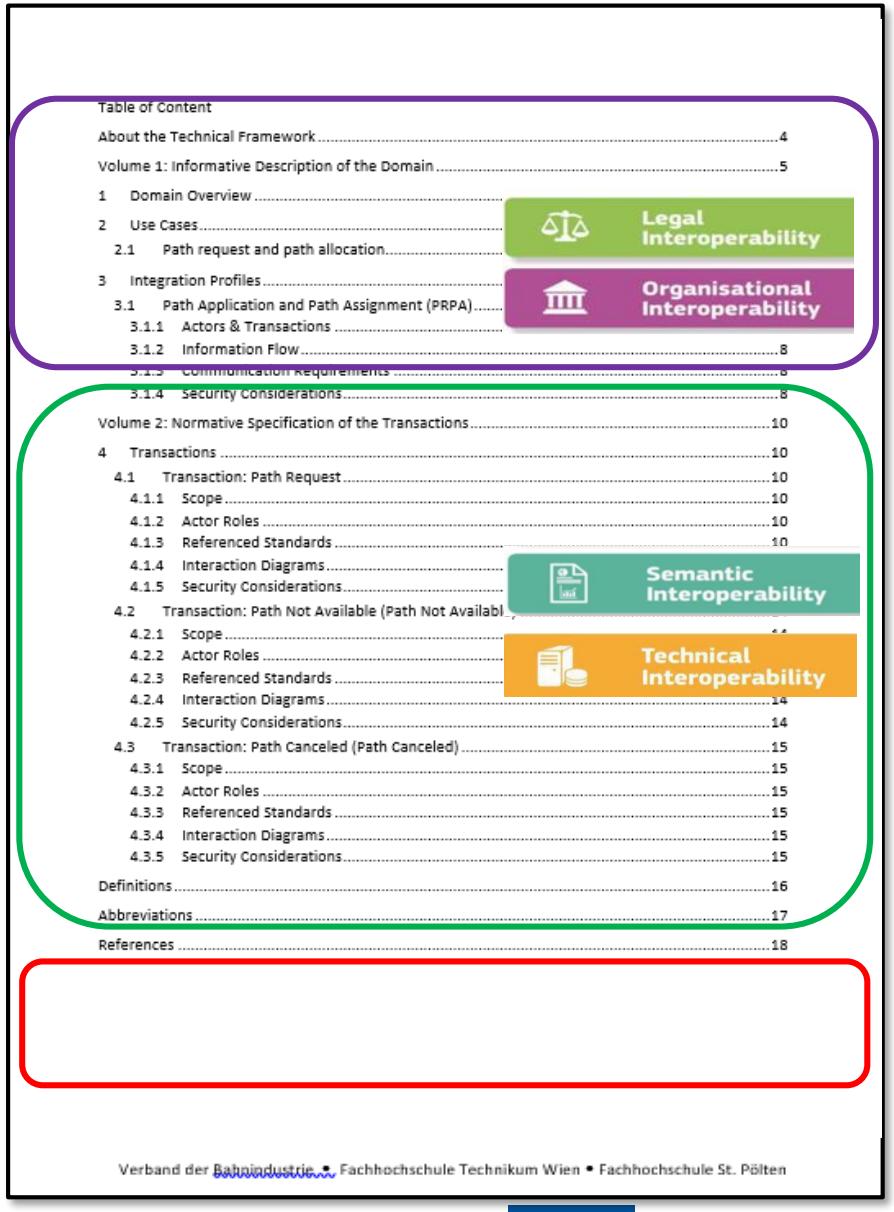
- TAP/TAF TSI defines
  - principle business proceses e.g. Path Request
  - data formats of messages
  - on European Level

- The implementation of the technical interface
  - requires some effort
  - Interoperability is not guaranteed

What does the IRS methodology provide?

- Structured, use case description based on TSI
- Specification of the interface between the systems
- Test options for vendors

fh st.pölten | FH University of Applied Sciences TECHNIKUM WIEN | VB Verband der Bahnindustrie



The Technical Framework

IRS | Integrating the Railway System

Volume 1: informative description

Technical Framework General information
Chapter 1: Domain Overview: Outline of the application scope
Subsystem TAP/TAF TSI
Chapter 2: Description of Use Cases
e.g. Path application and allocation
Chapter 3: Integration profiles
„technical“ description of the Use Cases

Volume 2: normative specification

Chapter 4: Transactions
Flow charts of transactions, Messages, …

Volume X (optional)
national specifics

fh st.pölten
FH University of Applied Sciences TECHNIKUM WIEN
Verband der Bahnindustrie

IRS Integrating the Railway System

Exemplary implementation of IRS

Benefits for applying the methodology: Use of a structured process via use case description for new interfaces to be developed

/fh/// st.pölten
FH University of Applied Sciences TECHNIKUM WIEN
VB Verband der Bahnindustrie

Possible Implementation of IRS:
Digital Automatic Coupling

IRS | Integrating the Railway System

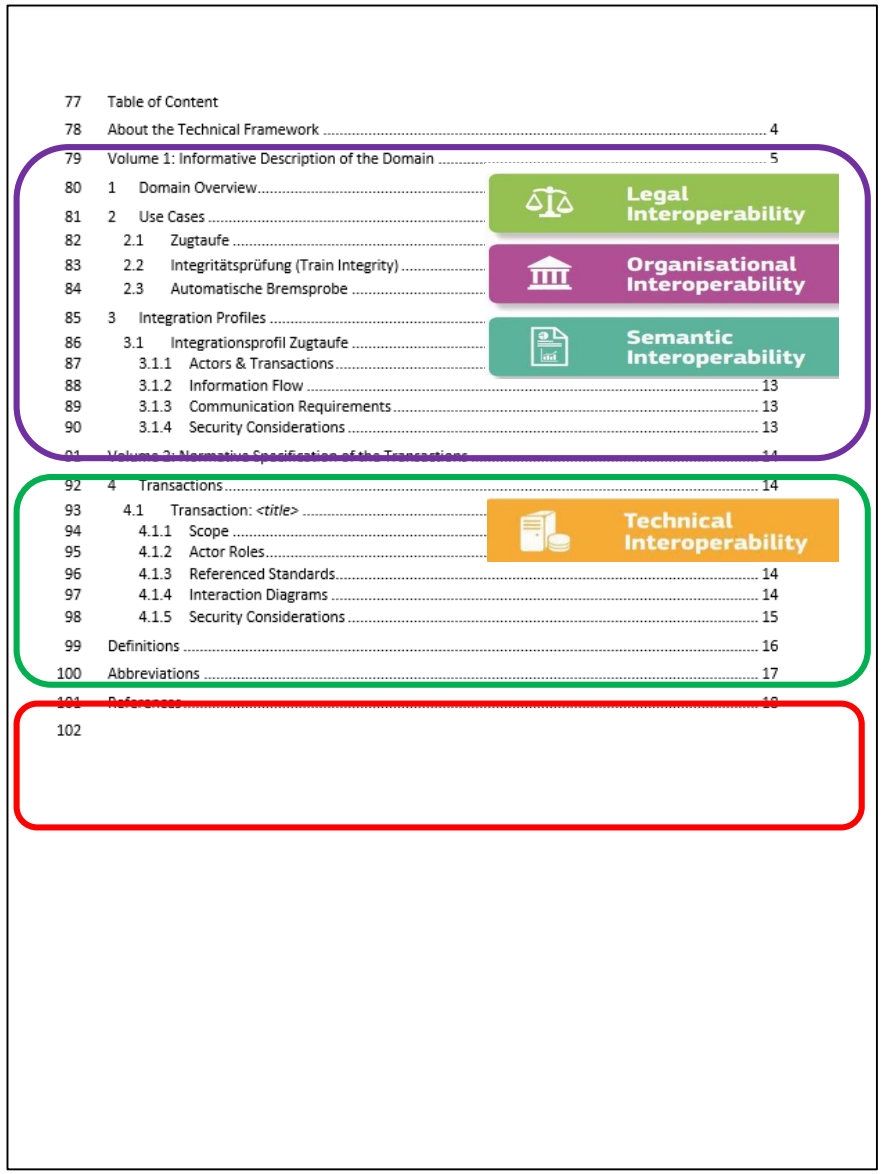
Interoperability as a success factor

- Common definition of business processes
- Uniform interfaces through normalized application of standards

What does the IRS methodology provide

- Structured, moderated process for all levels of interoperability
- test options for vendors
- Cross-sector know-how transfer
- Reference and synergies with other sectors

Quelle: Rail Cargo Group Blog



The Technical Framework

IRS | Integrating the Railway System

Volume 1: informative description

Chapter 1: Domain Overview
Overview of the DAC application area
Chapter 2: Use Cases
e.g. train inauguration, integrity check, autom. brake test, ...
Chapter 3: integration profiles
more "technical" description of the use cases

Volume 2: normative specification

Chapter 4: Transactions
Flow of transactions, messages, ...

Volume X (optional)
national characteristics

IRS Integrating the Railway System

Vision for the implementation of the Interoperability Approach

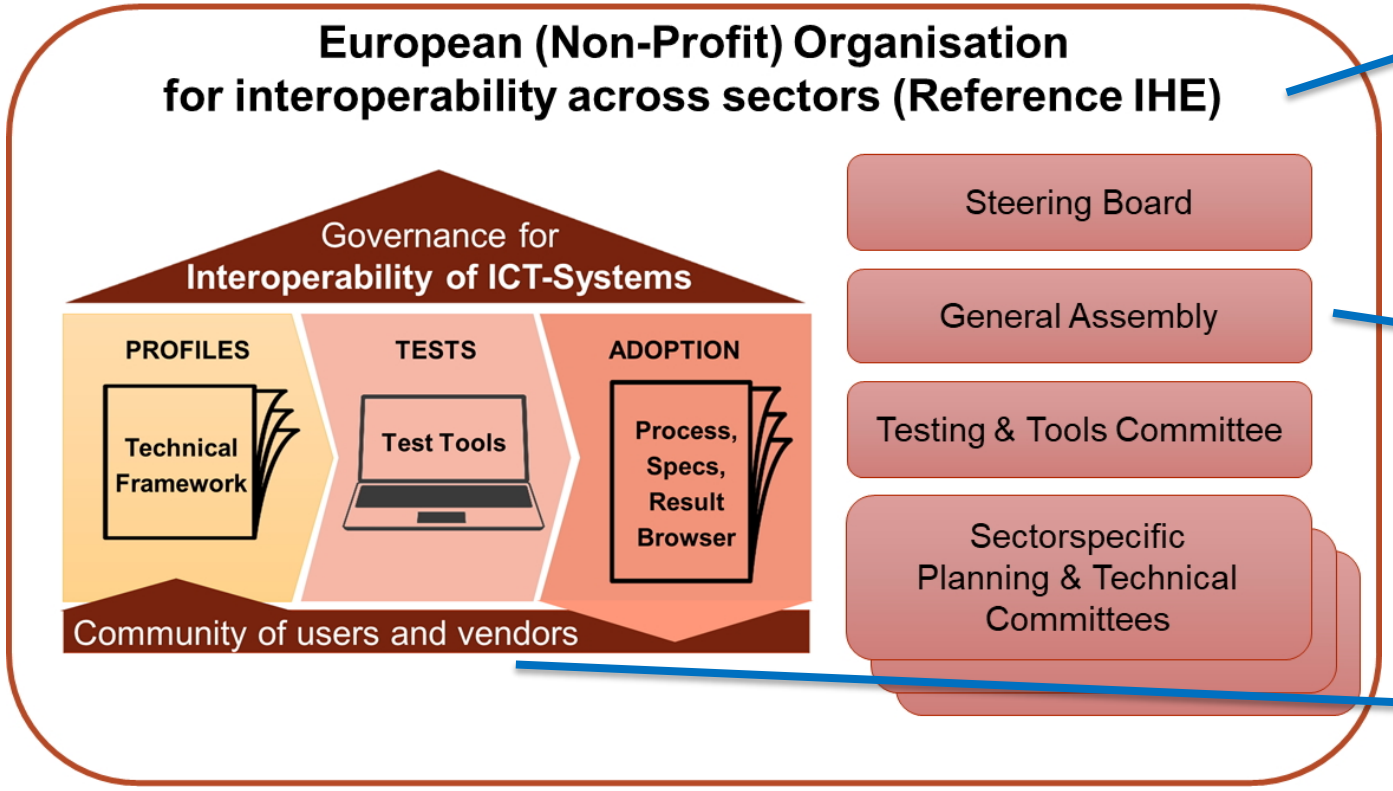
fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

Interoperability Community for a specific sector

IRS | Integrating the Railway System



Policy: Formalised according White Paper (ISO TR 28380)
Legal Conditions: anchoring in Regulation, Guidlines, …

Process: Involvement of relevant stakeholders (public bodies, standardization, manufacturers, users)

Results:
Specified digital interfaces

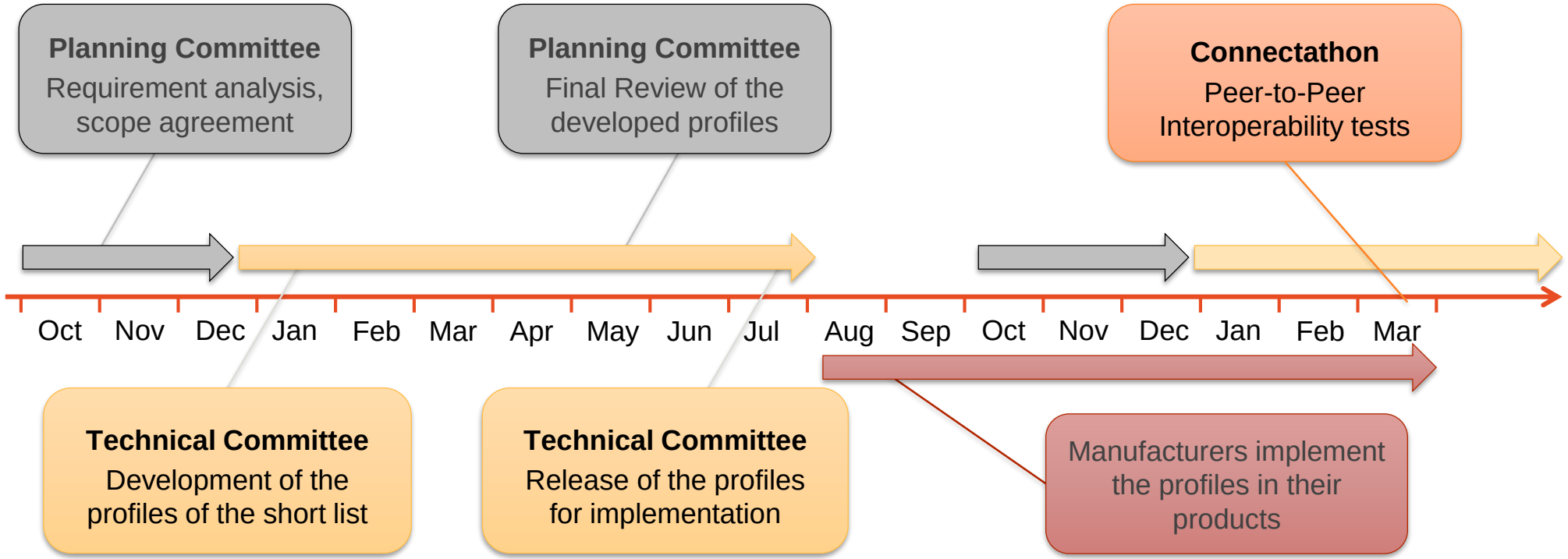
ifh /// st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

Governance: The interoperability process is a srtuctured, rolling workflow of committees

IRS | Integrating the Railway System



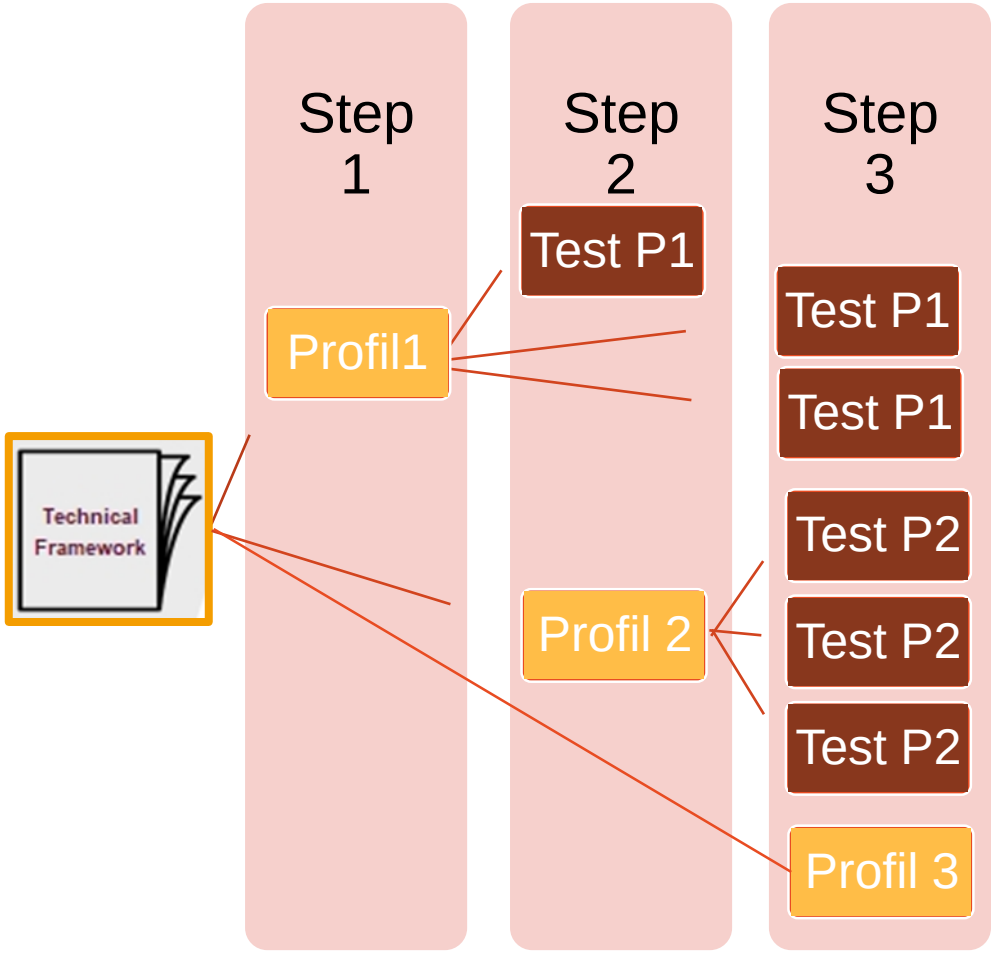
fh st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB Verband der Bahnindustrie

Step by step to a Technical Framework
reduces the complexity to implement a system

IRS | Integrating the Railway System



TF …Technical Framework
Profile … Profile as part of aTF
Test P …Test of a profile

Interoperability is a key factor for the digital transition of ICT-systems

IRS | Integrating the Railway System

„Become part of the Interoperability Initiative“

Angela Berger
Lead Initiative IES / IRS
Verband der Bahnindustrie
E: angela.berger@bahnindustrie.at
P: +43 664 883 481 54
W: www.bahnindustrie.at

ifh /// st.pölten

FH University of Applied Sciences TECHNIKUM WIEN

VB | Verband der Bahnindustrie