

CIP4 Technologies II

JMF and XJMF

JDF Communication Model

AuditPool

Digital Planning Board

(X)JMF Message Family

Examples: Job Submission, Abort Job, Device Capabilities

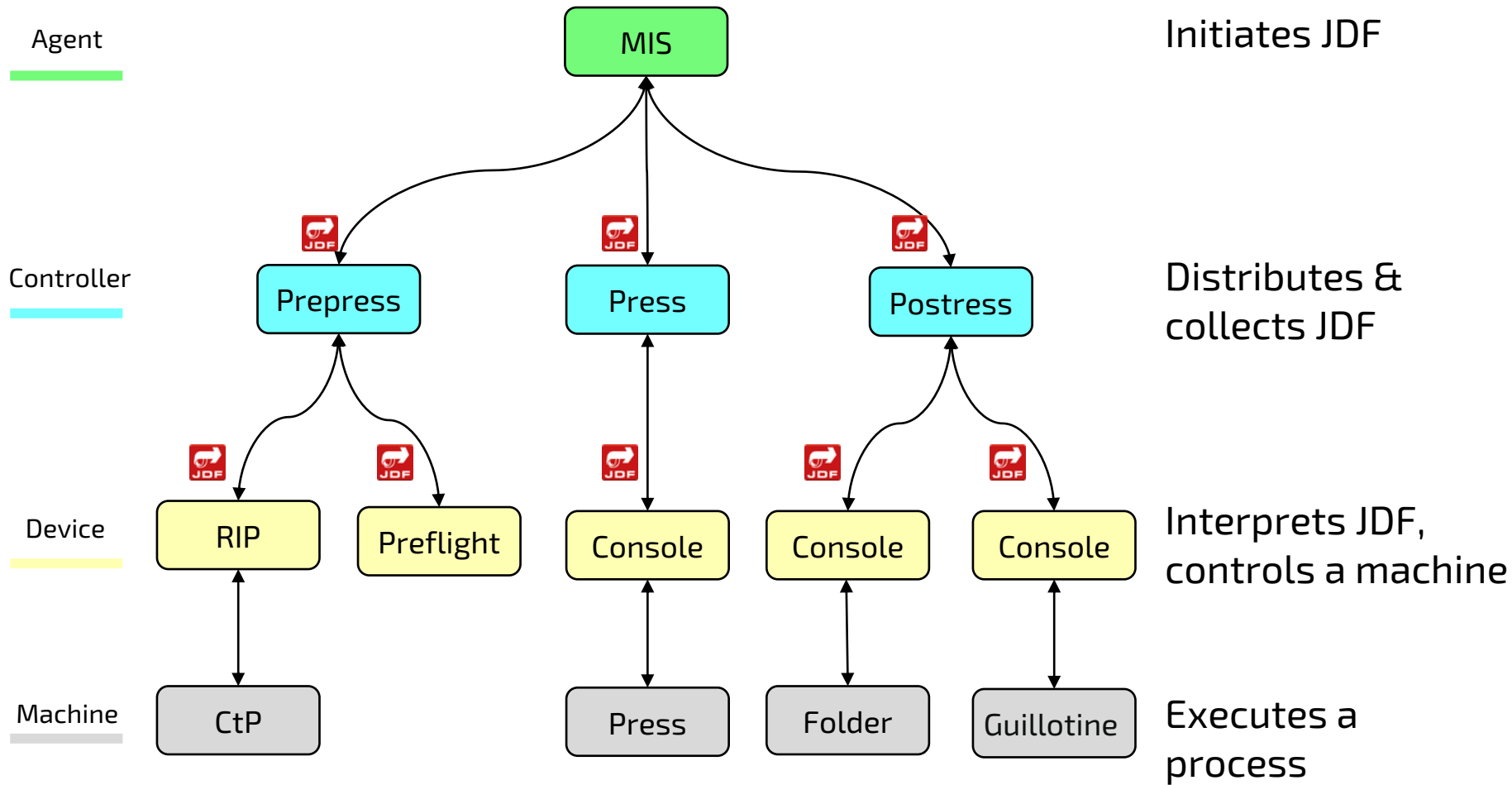
ICS

Thomas Hoffmann-Walbeck

Summary about (X)JMF Communication

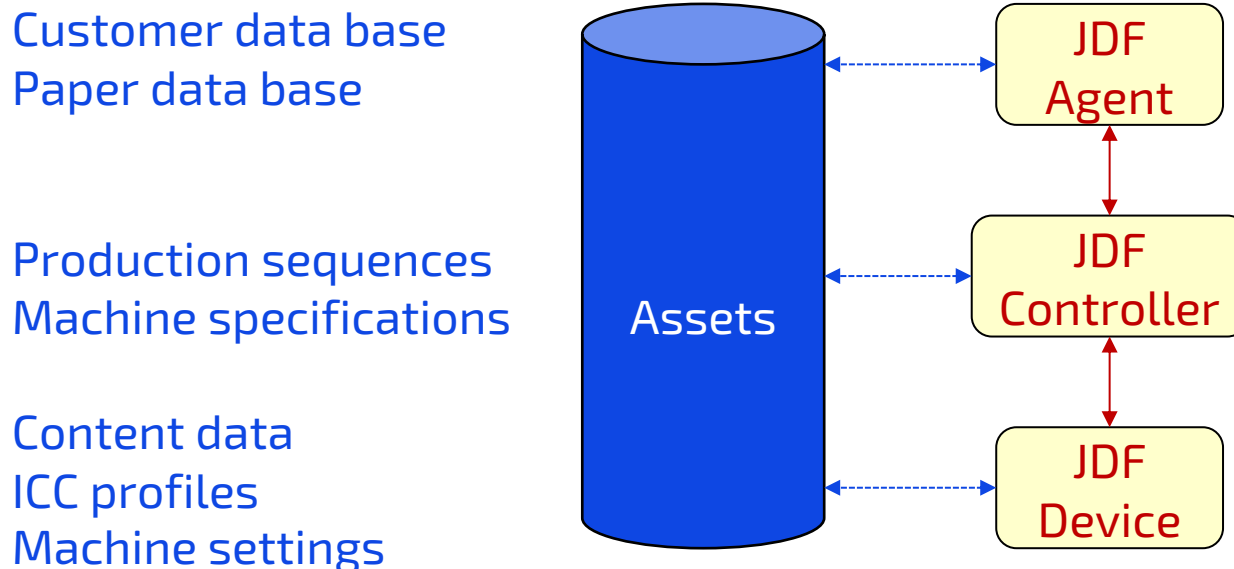
- ▶ CIP4 does not specify how (X)JDF data is communicated.
- ▶ The JDF element *Auditpool* contains a production protocol after the process is done with the execution.
- ▶ JMF and XJMF is a messaging formats which (often) goes together with JDF and XJDF.
- ▶ Among other things, these messaging formats transport operational data.
 - »The “SMS” in the graphical arts industry to inform about the current status of a device, for example
- ▶ Interoperability requirements (ICS) of (X)JDF devices and controllers.

Original JDF Communication Model



Assets are referenced

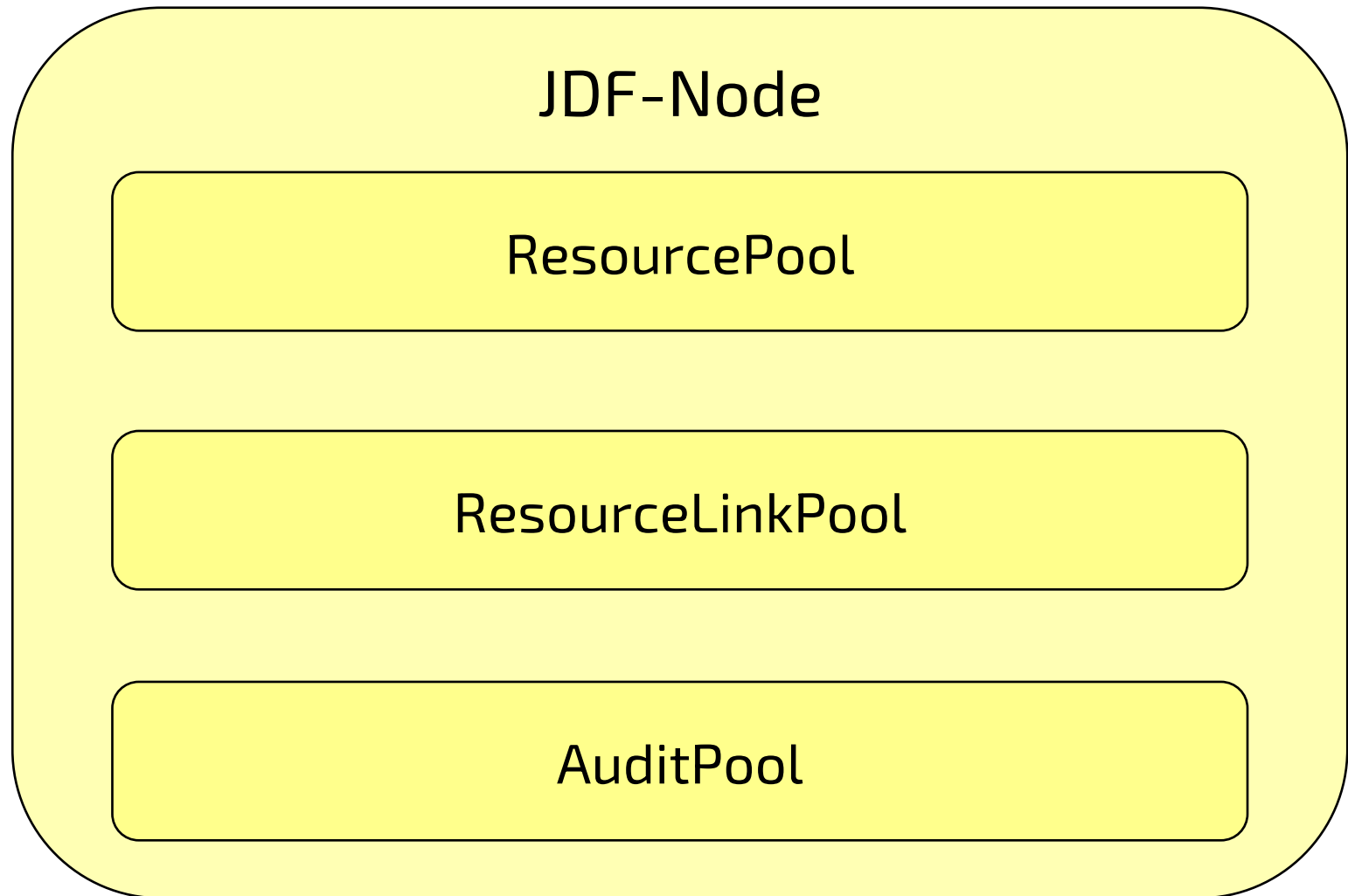
- ▶ Assets are not part of the (X)JDF files.
 - » They are stored in a file system or in a database.
 - » Assets are not forwarded via JDF/JMF but rather referenced



Production Protocol: *Audits*

- ▶ Summary report of a process at the end of execution.
- ▶ Data for later use, e.g., for production cost analysis.
 - » Who created, modified or deleted a JDF-node at what time,
 - » Process times (*Start, End,...*),
 - » Status of process end (*Completed, Aborted, Stopped,...*),
 - » Used, generated or missing resources (paper etc.).
- ▶ After a process is terminated the *Audits* should not be changed any more.
- ▶ *Audits* are pooled in *AuditPools*.

Example of a Basic JDF Node

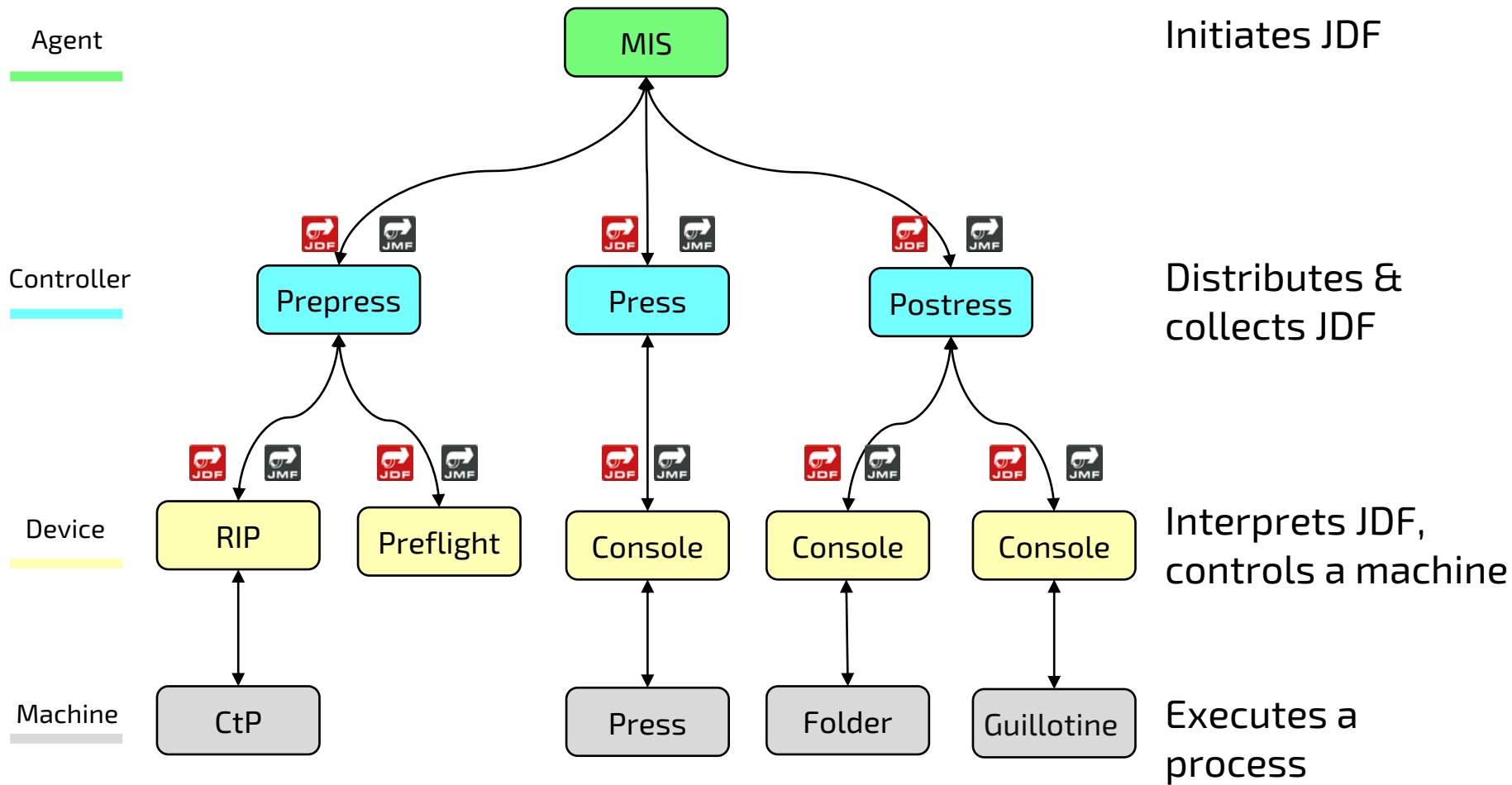


Audit Element *PhaseTime*

- ▶ A *Phase* is a subsection of a process.
 - » Examples: setting up a device, maintenance, washing, downtimes as a result of failure, breaks,...
 - » Attributes: *Start, End, Status,...*
 - » Sub-elements of *PhaseTime*: *Device, Employee, ResourceLink,...*

- ▶ In a *ResourceLink* inside the *PhaseTime* element the used or produced resources in a phase are recorded.
 - » E.g., *ComponentLink* for a *Component* Resource.
 - » E.g., Number of good print sheets that have been produced, number of waste sheets.

Original JDF/JMF Communication Model



Job Messaging Format (JMF & XJMF)

- ▶ Messaging protocol between the parties supporting **dynamic interaction**
 - » MIS, production, administration, external companies
- ▶ Main tasks:
 - » Job submission, job tracking, material consumption, system control, system set-up, queue control, pipe control
 - » Real-time messages
- ▶ (X)JMF is optional
 - » Only ICS at higher levels require some (X)JMF messages
- ▶ (X)JMF messages are (small) XML data sets
 - » "JMF"/"XJMF" are the root-element; based on http



Digital Planning Board: JDF and JMF

HEIDELBERG

Datei | Bearbeiten | Ansicht | Gerät | Werkzeuge | Hilfe
 Maschinensicht | Tagessicht | Wochensicht | Gesamtsicht | Übersicht Einzelauftrag | Auslastung | Personalplanung

Gesamtsicht (0:00 - 24:00) Maschinenset: PR+100JO 1. April 2016 - 29. Juni 2016

SM102-12P7L_DT
 XL75-6P3+L
 SM52-6L_DT
 KH78_1
 Polar176_1
 ST450
 Suprasetter_145(image

Drucken
 Ausführung am: Di, 5 Apr 16 08:00 - 08:18 (00:18)
 Auftrag: 102810 - 100 Jahre Offsetdruck
 Bogen: 001_CoverSchendruck
 Kunde: PIXEL AG
 Bedruckstoff: 100069 (ALLEGRO)
 Format: 500x350
 Liefermenge: 500
 Fälligkeitstermin: Mo, 2 Mai 16 18:00 (<-> = 0:00)
 Kommentar:

Voreinstellungen **0/144 2** Belegen/Freigeben Verwerfen Aktivieren

Checkpoint Filter aus Listen tauschen: @Production

Auftrag: Kunde: Bedruckstoff: Farben: Maschine:

Fälligkeitstermin Status Auftrag

Bogen	Beginn	Dauer	Arbeitsgang	Maschine	Menge	Bedruckstoff	Format	Farben	Gesamtfr
2. Mai 2016 (58)									
unverplant (21)									
Wartend (37)									
102810 - 100 Jahre Offsetdruck (16)									
OH1601272_Bro68S - Imp63 (21)									
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Innenteil_1	05.04.16 10:44	00:16	Platten belichten	Suprasetter_145(imageSetter...	8	596820065922 (LuxaSatin dull)	1030x790	4/4(CMYK)(CMYK)	
Innenteil_1	05.04.16 14:39	00:35	Falzen	KH78_1	513	596820065922 (LuxaSatin dull)	914x660		
Innenteil_1	05.04.16 11:23	00:23	Drucken	SM102-12P7L_DT	546	596820065922 (LuxaSatin dull)	914x660	0/4(CMYK)	
Innenteil_2	05.04.16 11:00	00:16	Platten belichten	Suprasetter_145(imageSetter...	8	596820065922 (LuxaSatin dull)	1030x790	4/4(CMYK)(CMYK)	
Innenteil_2	05.04.16 12:54	00:35	Falzen	KH78_1	513	596820065922 (LuxaSatin dull)	914x660		
Innenteil_2	05.04.16 12:09	00:23	Drucken	SM102-12P7L_DT	546	596820065922 (LuxaSatin dull)	914x660	0/4(CMYK)	
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- ▶ Integration of MIS and production.
 - » MIS provides product and production description via (X)JDF, deadlines for planning software.
 - » Production devices provide actual status, material consumption etc. via (X)JMF.
 - » XJDF/JDF (parts) are sent to devices with *NodeInfo* resource in production order.
 - » Process dependencies must be observed.
 - » The goal is short make-ready times for devices.
 - » Manual / automatic planning.
 - » Dynamic adjustments to new situations.
- ▶ Scheduling is the champions league of integration.

Scheduling

- ▶ Scheduling is a crucial task in a **smart factory**.
- ▶ The job production order is determined by a scheduler observing different constrains.
 - » E.g., availability of resources.
 - » The job order need to be planned from back to front
 - E.g., Deadlines ⇒ Postpress processes ⇒ printing ⇒ platesetting ⇒ RIPing ⇒ imposing ⇒ approval,
 - E.g., shortly before printing a job in offset, plates should to be imaged in the right order
 - » On the other hand: scheduling for best utilization of devices
 - » E.g., Printing order according to material, color, ink coverage,...

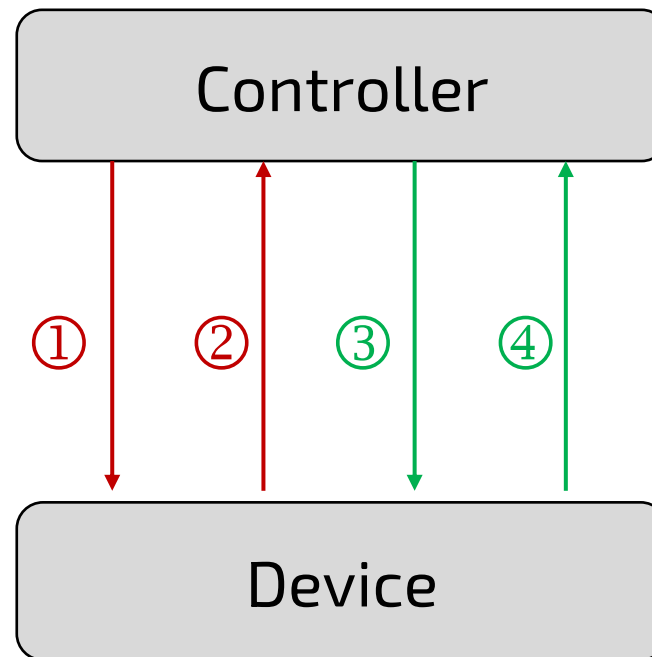
Main Communication (X)JDF and (X)JMF

(X)JDF

- ① (Parts of a) Job Ticket
- ② Updates, Audits

(X)JMF

- ③ Commands, Queries
- ④ Response, Signals



I Am a Folder - You Are My Controller!

- ▶ What do you tell me? What do you expect from me?

		Category	Example
JDF	Controller2Device	machine set up info	Sheet size = 25x19, fold catalog = F16-6
		job information	JobID, deadlines, number of copies
		Customer Info	Name = "Bob", Phone: 123456789
	Device2Controller	Report of Process outcome (AuditPool)	Material used, time needed
JMF	Controller2Device	Queries	What is your status? Do you handle job 007?
		Commands	Delete job 007 in queue,
		Registration / subscription	Inform me regularly about your status
	Device2Controller	Response	My current Status is idle
			DeviceCapabilities : maximal format is...
		Acknowledgement	Command completed
		Signals	12% of folding is done

JMF Message Families

- ▶ JMF *Query*: Query (Q),
- ▶ JMF *Command*: Command (C),
- ▶ JMF *Signal*: Periodic status description (S),
- ▶ JMF *Response*: Synchronous response to Q or C,
- ▶ JMF *Acknowledge*: asynchronous response to Q or C
- ▶ JMF *Registration/Subscription*: Request to send messages/signals to some controller regularly

(X)JMF Examples

- ▶ Command: Jobs can be sent by means of the *SubmitQueueEntry* command in two ways.
 - » Queue controller gets the job through the file system.
 - » Queue controller gets the job over http "get".
- ▶ Command: *AbortQueueEntry* .
- ▶ Unidirectional messages (often: "fire and forget").
 - » E.g., status changes.
 - » Receiver can subscribe to signals from the transmitter.
 - » The receiver can use it to update a progress bar, for example.

DeviceCapabilities

- ▶ I) A controller stores features of devices (hard-wired).
 - »E.g., Screening options, number of possible folds, colour zones.
- ▶ II) Controller queries features interactively.
 - »In JDF called *DeviceCapability; Query and Response* via JMF.
 - »Device must return appropriate information, e.g., possible values for attributes.
 - »Complex relationship: number of folds depend on type of paper, folding options depend on the configuration of the machine.
 - »Performance values: average set-up time and production speed, resource consumption, ...
 - »Implementations? Or rather pre-defined feature set?

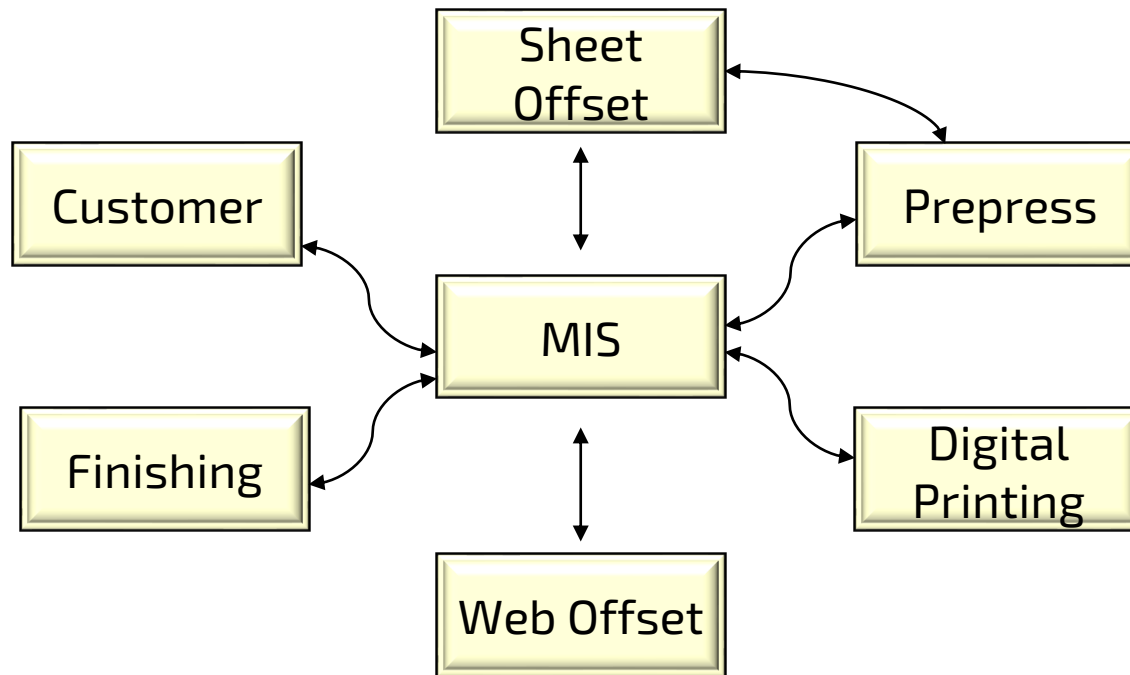
Interoperability Conformance Specification

- ▶ The (X)JDF specification is enormous and no (X)JDF-compatible software can cover everything
 - » (X)JDF-software implements only a subset of the functionality
 - This increases the risks of **incompatibilities between JDF modules**
 - A folding machine will not understand press features and, may be, not even all (optional) entries in *FoldingParams*
- ▶ Therefore, well-defined subsets are specified
 - » Print production **interfaces** are specified in several ICS-papers
 - » Agreements on (X)JDF entries that should be written or read by entities such as the MIS, prepress, press, finishing..
 - » ICS are papers, not machine-readable interfaces
- ▶ [ICS Documents](#), [Integration matrix](#)

[Asking the right...](#)

ICS Interfaces

- ▶ ICS Interfaces are “coarse-grained”.
 - » Few “internal” interfaces are specified, like Layout-Imposition.



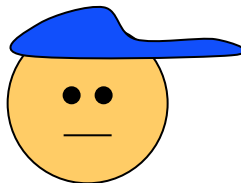
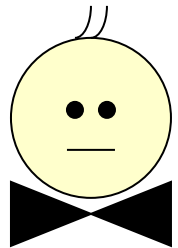
- ▶ Certifications according ICS requirements.

ICS - Levels

- ▶ The ICS Papers specify different levels.
 - »E.g., three different conformance levels for ICS-MIS-1.5.
 - »Levels are based on each other: level n+1 based on level n.

▶ Manager-Worker

- »The *Manager* sends *JDF Instances*, *JMF Messages* and other data to a *Worker* (a *Device* or *Controller*) and may receive information back from a worker.
- »The *Worker* receives *JDF Instances*, *JMF Messages* and other data from a *Manager* (a *Controller* or *MIS*) and may send information back to a *Manager*.



▶ Each JDF node should state the conformance Level

- »E.g., `ICSVersions="Base_L2-1.5 MIS_L2-1.5"`

Examples for *Manager* and *Worker*

- ▶ A *Gray Box* is written by a *Manager* and read by a *Worker*.
- ▶ A process node is supplied by a *Manager* and read by a *Worker*.
- ▶ The resource *BinderySignature* is written by a *Manager* and read by a *Worker*.
- ▶ A *Command* is send by the *Manager* and read by the *Worker*.
- ▶ The *Signals* are written by a *Worker* and read by a *Manager*.

Further Information

- ▶ [JDF and XJDF specifications](#)
- ▶ [Messaging ICS](#)