

Radiologists will love the
APPC
Austrian **P**ACS **P**rocedure **C**ode

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What is the APPC?

- A coding system for radiologic anatomy, modalities and procedures to support automated retrieval of relevant prior studies out of your own or “foreign” PACS
 - What problem is solved
 - How is coding done
 - What will be the further development

Where are we now ?

- Different imaging machinery feeds data into PACS
- We read everything on our workstation
- We exchange data inside the hospital, the hospital chain, **inside OUR own organization**
- **We do not access someone else's PACS**
- Why?? (privacy, legal stuff etc.)
- Technically: OUR PACS can not “intelligently” interpret the data of a “foreign” PACS – no “language interpreter” available

What link is missing?

- Everything works fine inside YOUR OWN organization
- Even machinery of different vendors cooperate smoothly in YOUR hospital, where YOU have defined everything
- Till now nobody cared finding stuff in someone else's PACS
- Missing link: trans organizational search for imaging data – till now not acknowledged as problem and therefore not addressed

Why a new Code??

- Austria is beginning to connect all existing PACS
- all vendors
- all different hospital-chains
- all radiologists offices
- All stored images of all citizens should become accessible
- Working group “Radiology and ELGA”
- Seems we only stumbled into the problem first

What's the problem??

- Proper privacy of medical data
- Extensive existing hard and software with different structure, wording and coding
- No commonly accepted terminology for radiologic procedures
- No defined wording for anatomical regions and structures needed in Radiology
- (RadLex !!!)

Problems of existing coding systems

- In most cases vendor-specific
- Most coding systems developed for accounting or reimbursement purposes
- Too little or too much granularity
- Virtually impossible to get vendors to use another vendors codes (license fees)
- Without a number-based generally accepted exchange-code no “intelligent” image exchange between different vendors PACS

Solution A

- **New standard**
- means all existing stored imaging data get obsolete,
- all Hard- and Software to be renewed.
- Utopic, unpractical because of costs involved
- Industry would not cooperate

Solution B

- **New Standard with “translation” to existing coding systems**
- Free of costs (licenses)
- Global (language independent)
- Existing hard and software and all stored imaging data saved from obsolesce

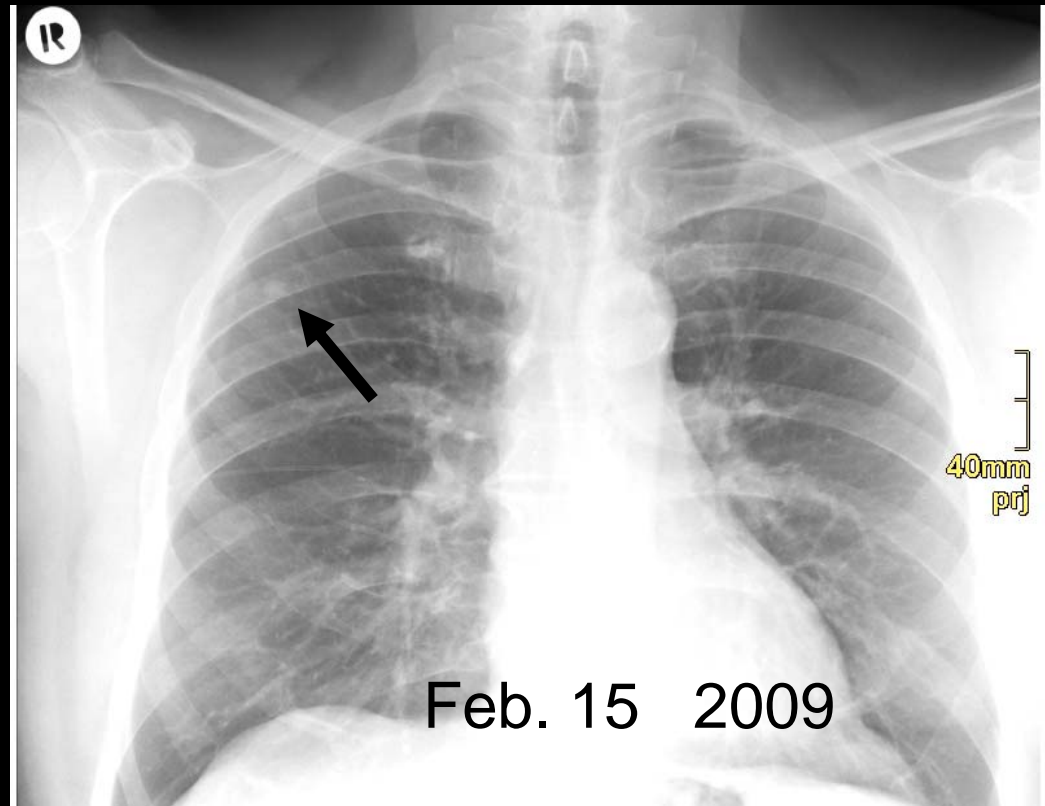
Chest

- Chest pa and lateral
- Chest
- Heart and Lung
- Thorax
- Lung
- If all those names were connected to the same number they could be found and retrieve automatically

We need old images of the chest of Mr. John Doe

- “solitary lung nodule”
 - Chest films 10 years back
 - CT of the chest if available
- Result:
 - Hospital 1
 - Hospital 2
 - Hospital 3
 - private office A
 - private office B

“Data mining”



190S

PHILIPS

Directory

Review

Analysis

Film

Report

Help

Review

Analysis



CT Viewer



PWA

Archive Manager



Delete



Quick Film



Copy To



Sub-selection



Multimedia Viewer

Queue Manager

Waiting: 0

Failed: 0

Print: 0

Log out

Preferences

16.02.09

15:13:20

Local

CDR

EOD

57%

81%

0%

Studies (15/15)



QR-Viewer



Stop



Search

Patient name: frühlwald f*



Clear Filter



Refresh

Patient Name	Patient ID	Time	Procedure	# Images	Date of Birth
fr*					
FR	4848484851	Feb 19, 2008 12:01	LUNG BDS	2	Feb 28, 1957
FR	4848484851	Nov 29, 2005 11:12	US MODALITD	32	Feb 28, 1957
FR	4848484851	Jul 8, 2003 12:29	LWS	93	Feb 28, 1957
FR	4848484851	Feb 12, 2002 16:53	ABDOMEN	24	Feb 28, 1957
FR	4848484851	Nov 22, 2004 14:12	PANORAMA F	3	Feb 28, 1957
FR	4848484851	Jun 29, 2004 09:08	KNIE LI	138	Feb 28, 1957
FR	4848484851	Oct 2, 2007 11:16	US MODALITD	21	Feb 28, 1957
FR	4848484851	Sep 17, 2007 14:32	US MODALITD	7	Feb 28, 1957
FR	4848484851	Jun 29, 2005 07:59	HANDGEL.RE	133	Feb 28, 1957
FR	5049505357	May 2, 2008 13:54	HWS	67	Jul 18, 1954
FR	5049505357	Oct 31, 2008 14:44	HWS	62	Jul 18, 1954
FR	5049505357	May 10, 2005 08:09	LWS	69	Jul 18, 1954
FR	5049505357	Nov 9, 2004 13:12	SCHULTER BD	18	Jul 18, 1954
FR	4848535449	Jun 28, 2007 12:22	SCHULTER LI	148	Jan 30, 1936
FR	4848535449	Jul 8, 2002 17:26	LWS	64	Jan 30, 1936

Series (0/0)

Files (0/0)

Reports (0/0)

States (0/0)

Series No.	# Images	Modality	Type	Description	Scan Type
------------	----------	----------	------	-------------	-----------

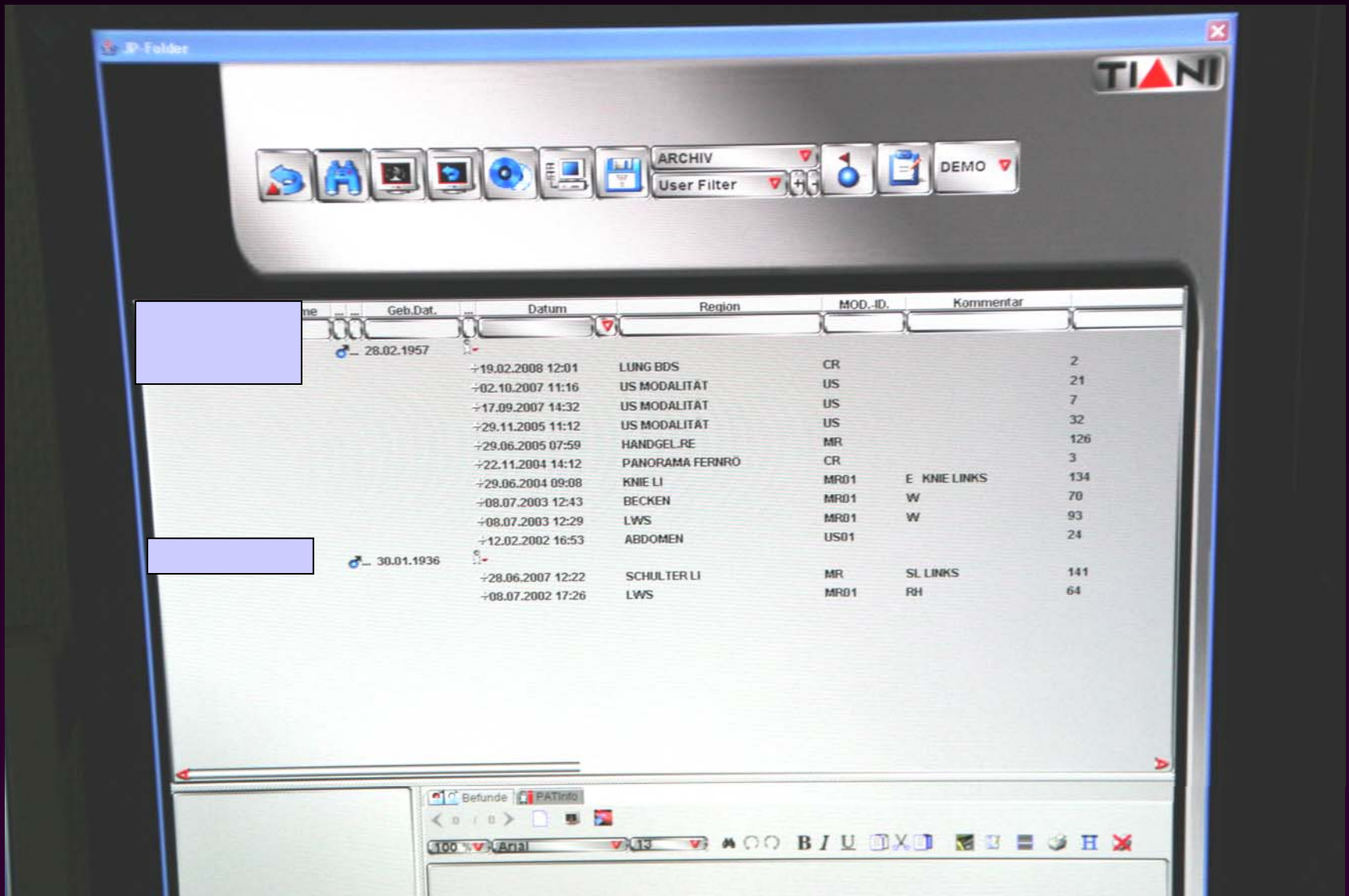
Quick Preview

Screen layout of different vendors differs enormously **BURA**

Alter **51/11**

Bkl

Nr	Datum	Zeit	Typ	Info
1	30-09-08	10:26	E:	NUKSDLAB, An den behandelnden Arzt
2	04-04-08	08:11	E:	NUKSDLAB, Dr. FIEDLER Lothar
3	19-02-08	13:16	E:	RTHM, Dr. FIEDLER Lothar
4	18-09-07	07:21	E:	SOUBM, An den behandelnden Arzt
5	29-11-05	11:49	E:	SOABM, Dr. PALLAMAR Walter
6	29-06-05	10:51	E:	MRHAGR, Dr. PALLAMAR Walter
7	22-11-04	14:28	E:	RZS0, RHD0, Dr. PALLAMAR Walter
8	29-06-04	09:56	E:	MRKNGL, Dr. PALLAMAR Walter
9	29-06-04	09:55	E:	RKGL, Dr. PALLAMAR Walter
A	08-07-03	16:20	E:	MRLWS, MRBE, Dr. PALLAMAR Walter
B	01-07-03	13:31	E:	RLWSL0, Dr. PALLAMAR Walter
C	13-02-02	07:15	E:	SOOB0, Dr. PALLAMAR Walter
D	26-04-99	15:19	E:	RHGN0, An den behandelnden Arzt
E	10-12-98	09:44	E:	RVFL, An den behandelnden Arzt
F	10-02-98	12:48	E:	RTHM, An den behandelnden Arzt
G	28-01-97	08:09	E:	RNH0, RTHM,
H	24-09-96	08:26	E:	MRSPGR, Dr. LUBRICH Heinz-Joachim
I	04-12-95	17:09	E:	RTHM, Dr. LUBRICH Heinz-Joachim
J	06-02-95	10:02	E:	RTHM,
K	29-08-94	15:09	F:	MRKNGR, Dr. LUBRICH Heinz-Joachim



Screen layout of different vendors differs enormously **BURA**

Hospital 1

Doe	John	30.12.1966	chest	15.02.2009
			barium enema	15.01.2008
			ribs	22.08.2007
			CT thorax	11.09.2006
			chest	05.03.2006

Hospital 2

Doe	John	30.12.1966	upper GI	15.02.2008
			knee	01.02.2008
			hip	05.06.2005
			hands	05.06.2005
			feet	08.04.2004
			chest	04.04.2004

Hospital 3

Doe John 30.12.1966 Finger 15.05.2006

private office A

Doe	John	30.12.1966	15.01.2007	barium enema
			22.08.2006	ribs
			11.09.2005	CT Abdomen
			05.03.2002	chest
			15.02.2003	chest

private office B

30.12.1966 John Doe

US abdomen 03.03.2008

nuk Thyroid 28.01.2005

chest film 14.01.1999

MRI Knee left 15.08.2001

Desperately needed

- Overview
- Source
- Chronologic
- Highlighted
- Intelligently compressed

	A	B	C	D	E	F	G	H
1								
2								
3	Hospital 1	Doe	John	30.12.1966		chest	15.02.2009	
4						barium enem:	15.01.2008	
5						ribs	22.08.2007	
6						CT thorax	11.09.2006	
7						chest	05.03.2006	
8								
9								
10	Hospital 2		Doe	John	30.12.1966		upper GI	15.02.2008
11							knee	01.02.2008
12							hip	05.06.2005
13							hands	05.06.2005
14							feet	08.04.2004
15							chest	04.04.2004
16								
17	Hospital 3	Doe	John	30.12.1966		Finger	15.05.2006	
18								
19								
20	private office A	Doe	John	30.12.1966	15.02.2003	chest		
21					15.01.2007	barium enema		
22					22.08.2006	ribs		
23					11.09.2005	CT Abdomen		
24					05.03.2002	chest		
25								
26								
27								
28	private office B	30.12.1966	John	Doe	US abdomen		03.03.2008	
29					nuk Thyroid		28.01.2005	
30					chest film		14.01.1999	
31					MRI Kenne left		15.08.2001	
32								

	A	B	C	D	E	F
1	Source	name	surname	born	study	study date
2		Doe	John	30.12.1966		
3						
4	Hospital 1				chest	15.02.2009
5	private office B				US abdomen	03.03.2008
6	Hospital 2				upper GI	15.02.2008
7	Hospital 2				knee	01.02.2008
8	Hospital 1				barium enem:	15.01.2008
9	private office A				barium enem:	15.01.2007
10	Hospital 1				ribs	22.08.2007
11	Hospital 1				CT thorax	11.09.2006
12	private office A				ribs	22.08.2006
13	Hospital 3				Finger	15.05.2006
14	Hospital 1				chest	05.03.2006
15	private office A				CT Abdomen	11.09.2005
16	Hospital 2				hip	05.06.2005
17	Hospital 2				hands	05.06.2005
18	private office B				nuk Thyroid	28.01.2005
19	Hospital 2				feet	08.04.2004
20	Hospital 2				chest	04.04.2004
21	private office A				chest	15.02.2003
22	private office A				chest	05.03.2002
23	private office B				MRI Kenne le	15.08.2001
24	private office B				chest film	14.01.1999
25						

Chronological display with source indicated

BURA

	A	B	C	D	E	F	G
1	Source	name	surname	born	study	study date	
2		Doe	John	30.12.1966			
3							
4							
5							
6	Hospital 1				chest	15.02.2009	
7	private office B				US abdomen	03.03.2008	
8	Hospital 2				upper GI	15.02.2008	
9	Hospital 2				knee	01.02.2008	
10	Hospital 1				barium enem:	15.01.2008	
11	private office A				barium enem:	15.01.2007	
12	Hospital 1				ribs	22.08.2007	
13	Hospital 1				CT thorax	11.09.2006	
14	private office A				ribs	22.08.2006	
15	Hospital 3				Finger	15.05.2006	
16	Hospital 1				chest	05.03.2006	
17	private office A				CT Abdomen	11.09.2005	
18	Hospital 2				hip	05.06.2005	
19	Hospital 2				hands	05.06.2005	
20	private office B				nuk Thyroid	28.01.2005	
21	Hospital 2				feet	08.04.2004	
22	Hospital 2				chest	04.04.2004	
23	private office A				chest	15.02.2003	
24	private office A				chest	05.03.2002	
25	private office B				MRI Kenne le	15.08.2001	
26	private office B				chest film	14.01.1999	
27							

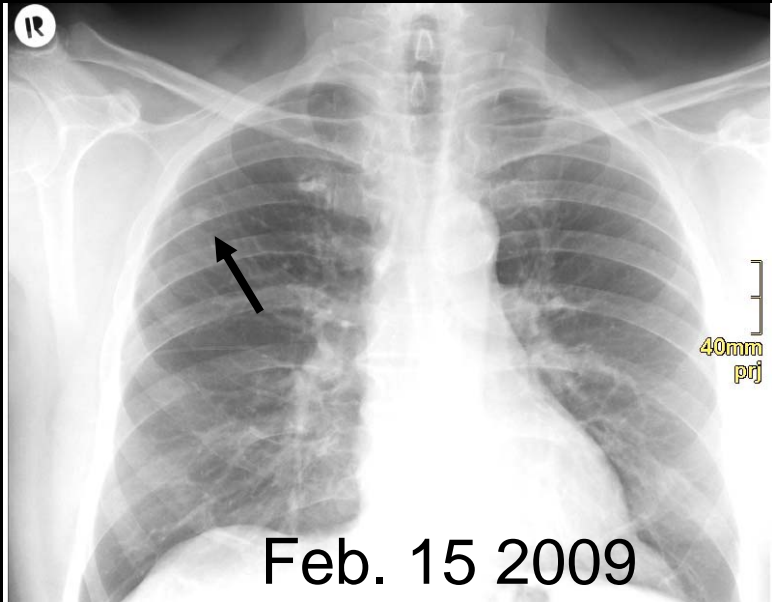
Relevant prior examinations highlighted

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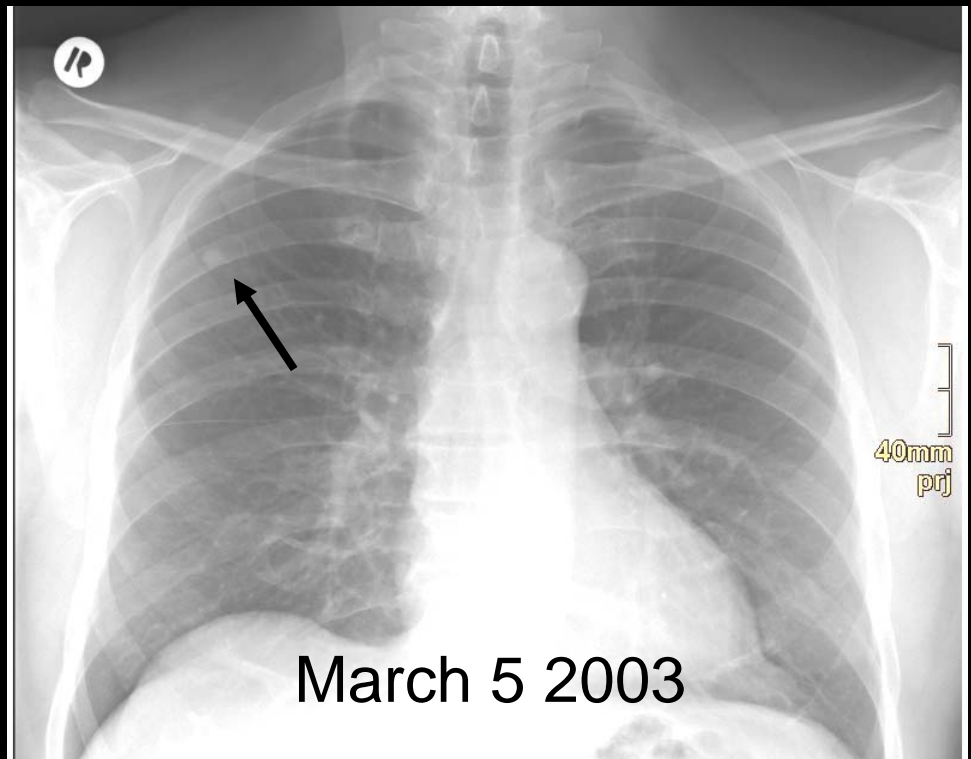
	A	B	C	D	E	F	G	H
1	Source	name	surname	born	study	study date	images	
2		Doe	John	30 12 1966				
3								
4								
5								
6	Hospital 1				chest	15.02.2009	<u>2</u>	
7	Hospital 1				CT thorax	11.09.2006	<u>255</u>	
8	Hospital 1				chest	05.03.2006	2	
9	Hospital 2				chest	04.04.2004	1	
10	private office A				chest	15.02.2003	2	
11	private office A				chest	05.03.2002	2	
12	private office B				chest film	14.01.1999	2	
13								

Compressed view with relevant information's only

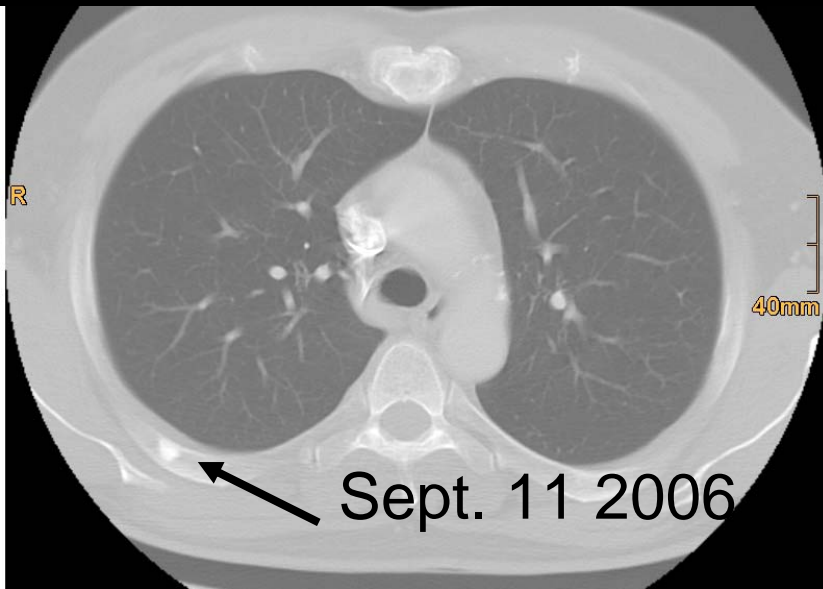
BURA



Feb. 15 2009



March 5 2003



Sept. 11 2006

John DOE

John Doe's pulmonary nodule turns out to be a harmless bony island of a rib. No further examinations required!

Solution B

- **New Standard with “translation” to existing coding systems**
 - Free of costs (licenses)
 - Global (Language independent)
 - Existing Hard and software and all stored imaging data saved from obsolesce
- Must be widely accepted to become a (global) standard
- Should be somehow logical (at least from a physicians point of view)
- Should support search for images in “foreign PACS” (where we have no influence on the structure)



APPC translates
between different languages,
typewriting as well as different internal number coding

Requirements for a good radiologic exchange code

- Abstract (numbers, no words)
- Logic, hierarchic
- supporting search for “regions”, not diseases
- Enough / not too much granularity
- Unlimited expandability
- Open to be connected to accounting and referral systems

Tasks for workstation developers

- Who gives us the smartest searching tools?
- Who supports us best in (preferably automated) finding all relevant studies to compare them to our recent study?
- Who is best in applying my favorite hanging protocols to foreign image data?

What support do Radiologists need when all patients images are accessible?

- Automated search for relevant studies / images we need to read the recent study
- “seamless integration” of imagery of other houses
- Display arranged using our own DICOM viewer and the hanging protocols we are used to
- (No more CD-ROM or DVD material with viewers we are not used to)

Hanging protocols



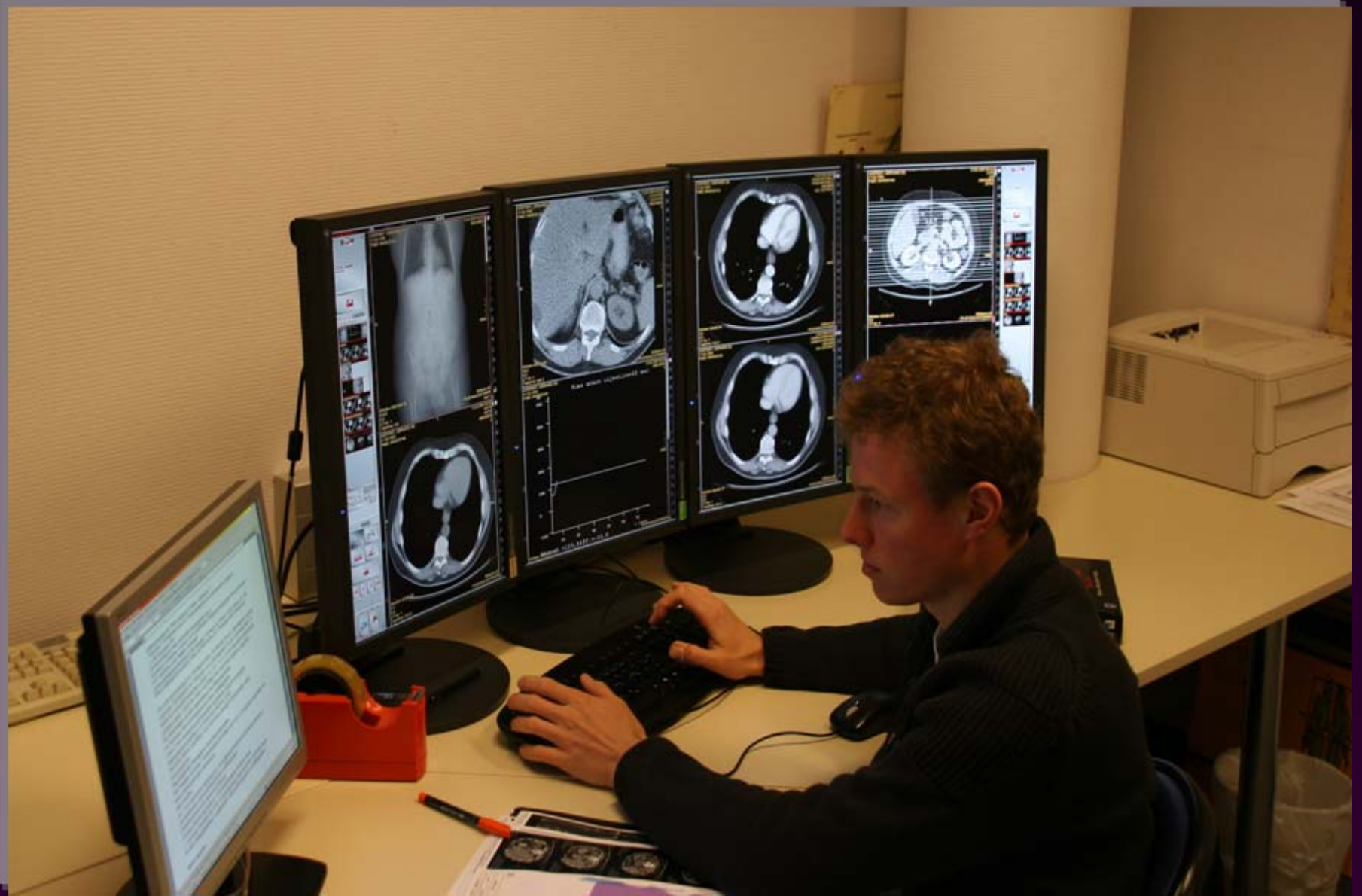
On viewing boxes

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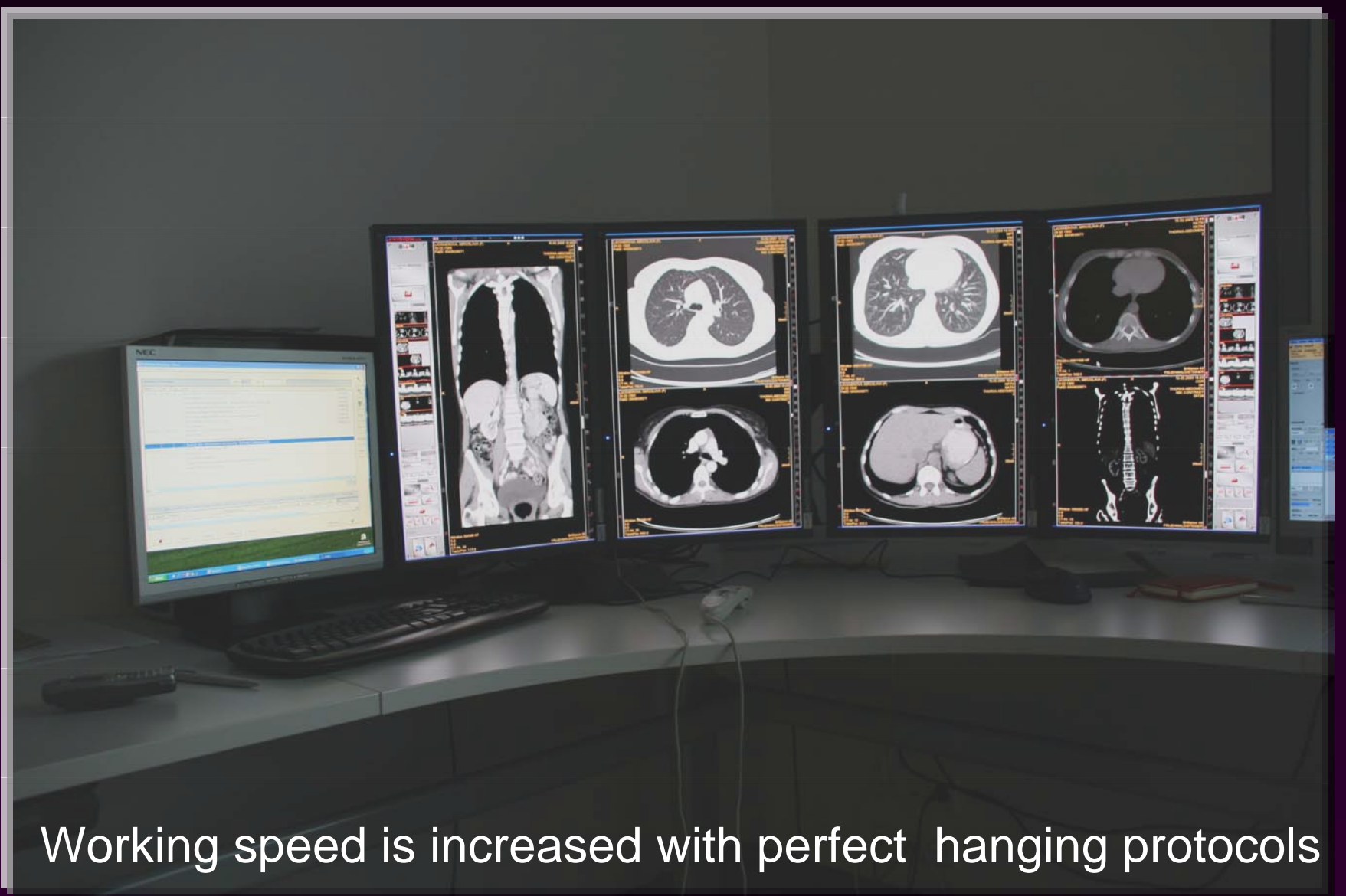
Customarized screen layouts

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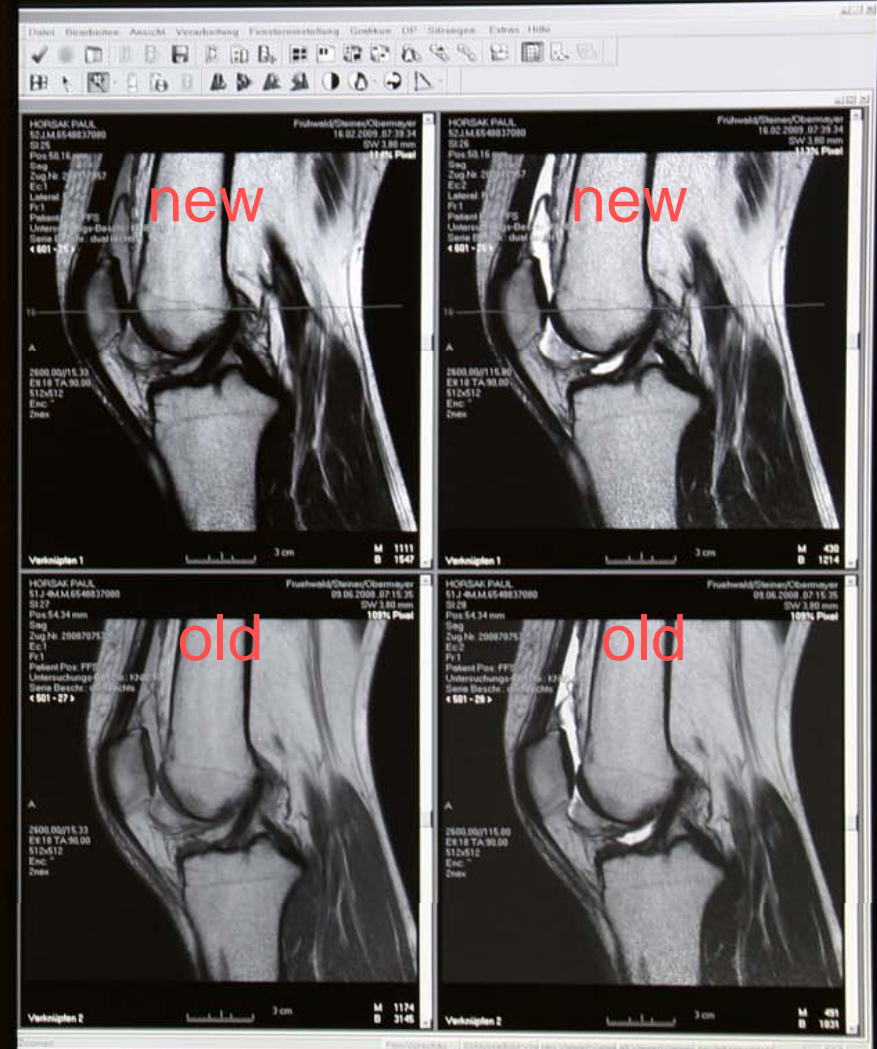
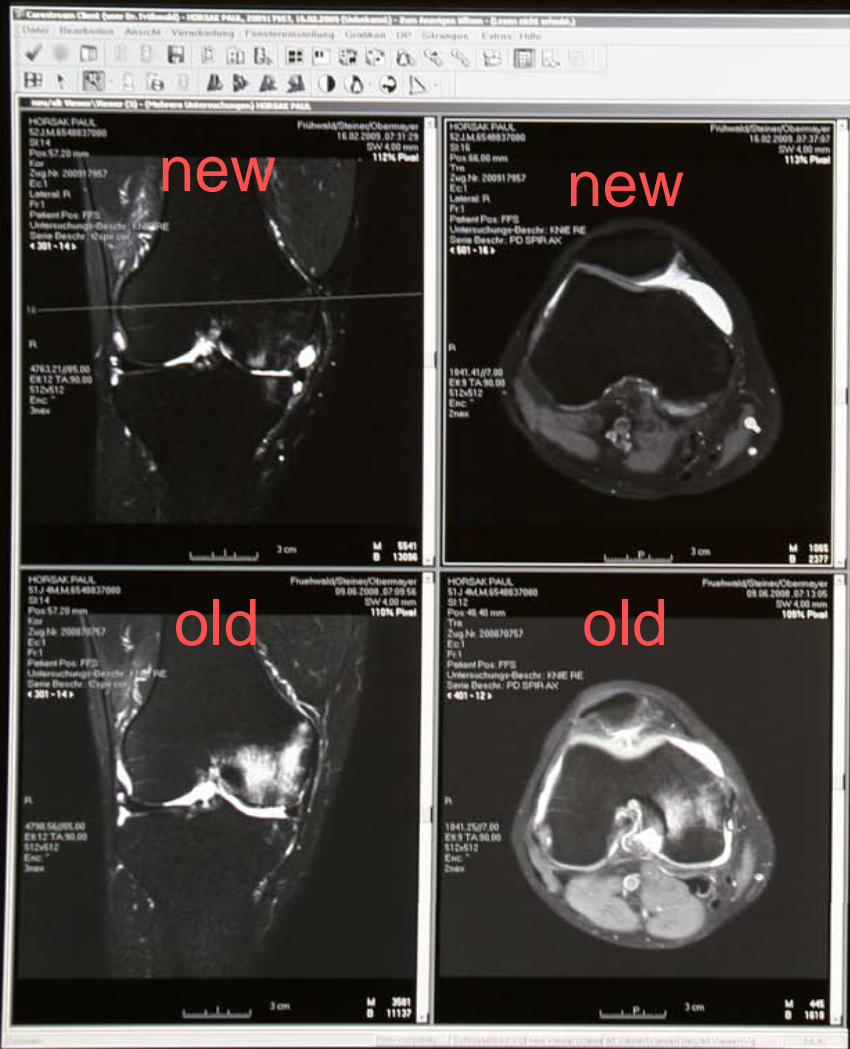
Every radiologist likes his personal layout

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Working speed is increased with perfect hanging protocols

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Enhanced reading speed with perfect identical arrangement of old and new images

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Standards

- DICOM defines images
- HL 7 defines documents
- ICD 10 defines clinical situations and illnesses
- RadLex defines radiologic vocabulary
- Presently no generally accepted standard number code for radiologic procedures, modalities
- Presently no ideal coding system for regions and anatomy necessary in radiology

How will trans organizational PACS access change radiologic work?

- Increase in workload (everything stored is accessible !!)
- Massive slowdown of working speed when all existing imaging data need to be at least shortly acknowledged
- Increased liability if clues from old data are missed because not viewed

How do Radiologists search for relevant prior studies ?

- They go for the region (e.g. abdomen, chest, head, neck etc.)
- Not so much very specific
- They like all existing modalities
- They like to filter the time period
- Sometimes they want it super specific when it is a follow up examination

APPC

Austrian PACS Procedure Code

- Developed to support trans - organizational image data research
- Supported by all scientific and professional radiologic organizations in Austria
- En route to become standardized in the HL 7
- Matched with the vocabulary of RadLex

APPC

- 4 Axes:
 - Modality
 - Laterality
 - Procedure
 - Anatomy

APPC

- Modality

- 0 undefined
- 1 X-Ray
- 2 CT
- 3 MRI
- 4 Ultrasound
- 5 Nuclear Medicine
- 6 PET

- Laterality

- 0 undefined
- 1 right
- 2 left
- 3 bilateral
- 4 unpaired organ
- 5 atypical Situation
(transplant etc.)

APPC

- Procedure

0 undefined

1 Imaging of preformed ducts

2 Quantitative Analysis / Reconstructions

3 Documentation of Interventions
(via artificial access)

4 Imaging with open radioactive substances

APPC

- Anatomy

0 undefined

1 Head

2 Neck

3 Thorax

4 Abdomen

5 Musculoskeletal

6 Vascular System

7 Breast

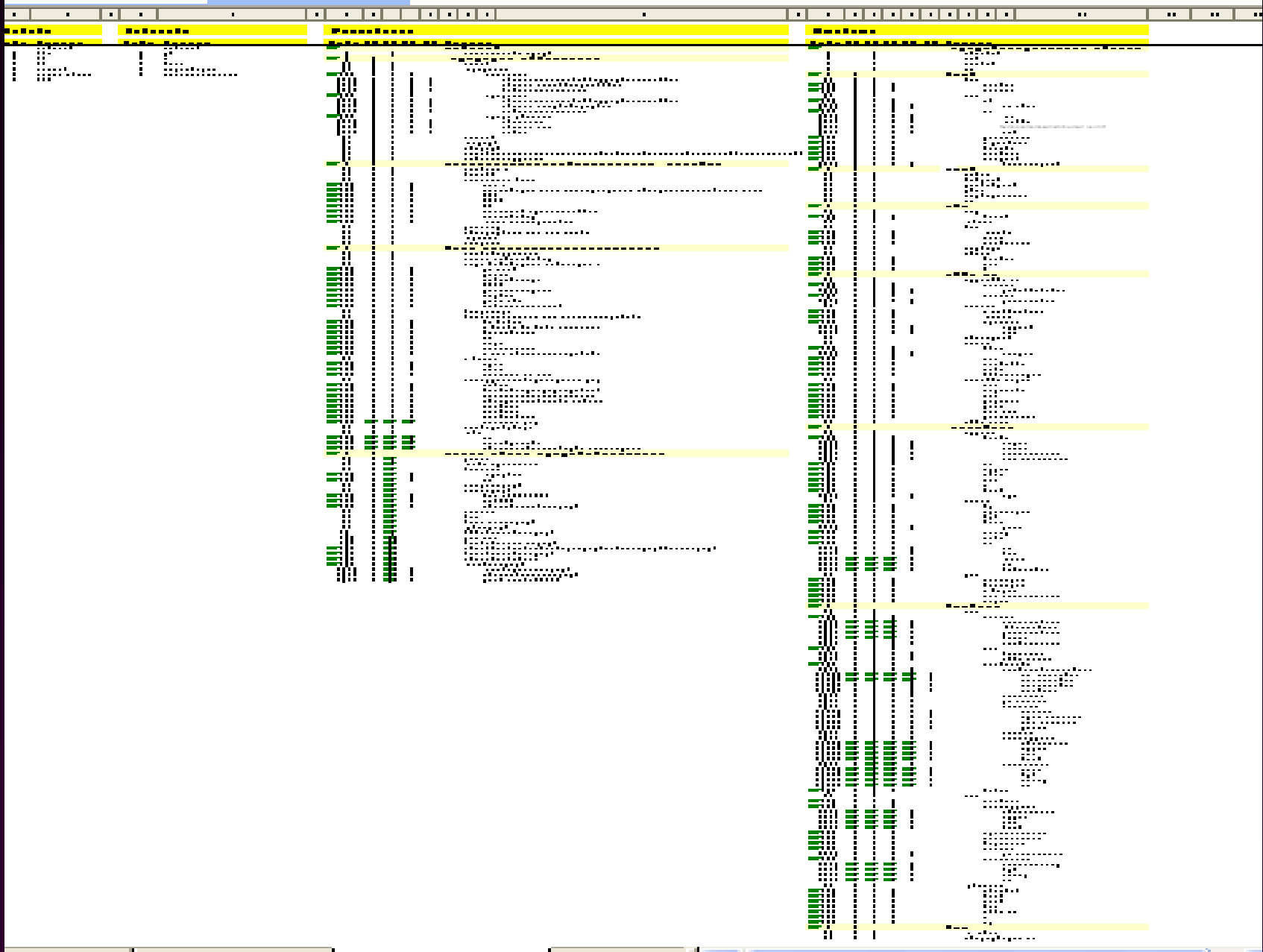
Anatomy

Code	L 1	L 2	L 3	L 4	L 5	Description
2	2					neck
2-1	2	1				trachea
2-2	2	2				thyroid gland
2-3	2	3				parathyroid gland
2-4	2	4				pharynx
2-5	2	5				esophagus (cervical)
2-6	2	6				larynx
3	3					thorax
3-1	3	1				lung
3-1-1	3	1	1			bronchi
3-2	3	2				mediastinum
3-3	3	3				heart
3-3-1	3	3	1			myocardium
3-3-2	3	3	2			valves
3-3-3	3	3	3			conduction system
3-4	3	4				esophagus
3-5	3	5				chest wall
3-5-1	3	5	1			bony thorax
3-5-2	3	5	2			sternum
3-5-3	3	5	3			ribs
4	4					abdomen

Anatomy

Code	L 1	L 2	L 3	L 4	L 5	Description
5	5					musculoskeletal
5-1	5	1				upper extremity
5-1-1	5	1	1			shoulder
5-1-1-1	5	1	1	1		scapula
5-1-1-2	5	1	1	2		clavicle
5-1-1-3	5	1	1	3		sternoclavicular joint
5-1-1-4	5	1	1	4		acromio-clavicular joint
5-1-2	5	1	2			axilla
5-1-3	5	1	3			arm
5-1-4	5	1	4			elbow
5-1-5	5	1	5			forearm
5-1-6	5	1	6			wrist
5-1-7	5	1	7			hand
5-1-7-1	5	1	7	1		finger

	F	G	H	I	J	K	L	M	N	O
1										
2		Procedures								
3										
4		Code	L 1	L 2	L 3	L 4	Description			
43		3	3				documentation of interventions via artificial access			
44		3-1	3	1			needle biopsy / puncture			
45		3-2	3	2			vacuum assisted needle biopsy			
46		3-3	3	3			(long term-) Catheder placement / drainage / stoma			
47		3-3-1	3	3	1		permacath			
48		3-3-2	3	3	2		portacat			
49		3-3-3	3	3	3		catheter – drainage			
50		3-3-4	3	3	4		TIPPS			
51		3-3-5	3	3	5		percutaneous gastrostomy			
52		3-3-6	3	3	6		nephrostomy			
53		3-3-7	3	3	7		pacemaker			
54		3-3-8	3	3	8		endovascular ultrasound			
55		3-4	3	4			Bougienage			
56		3-5	3	5			dilatation / recanalisation / removal of calculi / foreign bodies			
57		3-5-1	3	5	1		thrombo-fibrinolysis			
58		3-5-2	3	5	2		embolektomiy / thrombektomy / recanalisation			
59		3-5-3	3	5	3		balloon dilatation			
60		3-5-4	3	5	4		stent			
61		3-5-5	3	5	5		stentgraft			
62		3-5-6	3	5	6		filter (vena cava filter)			
63		3-5-7	3	5	7		removemebnt of calculi or foreign bodies			
64		3-6	3	6			embolisation			
65		3-6-1	3	6	1		organ			
66		3-6-2	3	6	2		aneurysm			
67		3-6-3	3	6	3		arterio-venos malformation			
68		3-7	3	7			local application of drugs / energy / local sampling			
69		3-7-1	3	7	1		nukleolysis			
70		3-7-2	3	7	2		blockade of ganglia (ganglia block)			
71		3-7-3	3	7	3		facet joints (facet joint intervention (infiltration))			
72		3-7-4	3	7	4		radiofrequency ablation / thermoablation			
73		3-7-5	3	7	5		cryoablation			
74		3-7-6	3	7	6		laserablation			
75		3-7-7	3	7	7		alcoholablation			
76		3-7-8	3	7	8		veneous sampling			
77		3-8	3	8			vertebroplasty, kyphoplasty			
78		3-9	3	9			markers			
79		3-9-1	3	9	1		wire			
80		3-9-2	3	9	2		colored particles (dye)			
81		3-9-3	3	9	3		radioactive substances (radiopharmaceutical particles)			



Full extent of APPC – not very huge!

BURA

Coding

- Important for search in foreign PACS:
 - Region
 - Modality
- Important for own PACS
 - Maybe everything, depending on how you use your system

Coding example

Modality . **Laterality** . **Procedure** . **Anatomy**

Barium enema:

1. 0 . 1. 4-2-3
X-ray . undefined . preformed ducts . Colon

CT colonography

2. 0 . 2-3-7. 4-2-3
CT . undefined . virtual endoscopy . Colon

Filtering for studies

- All abdominal Studies 0.0.0.4
- All bowel images 0.0.0.4-2-3
- All CT-studies 2.0.0.0
- All MRI arthrographies
of the right knee 3.1.1-5.5-2-4
- All existing material 0.0.0.0

Implementation

- 1 additional field in your RIS or PACS for the APPC – number of any examination or procedure you perform in your organization
- Predefine what should be searched for (a task for workstation developers)
- Everything preprogrammed – the direct user is not forced to code anything

Further development of the APPC

- Maintenance: by the professional radiologic organizations of Austria
- Yearly updates planned
- Feedback and propositions for new entry's welcome
- New language translations for all interested (presently English and German versions are available)
- Lobbying to get connected to DICOM and HL7 standards

APPC website for download

- www.BURA.at
- Comments welcome
- Mailing list for all who want to be informed of new releases
- E-mail account for feedback and proposals of new entry's

Summary

- What problems exist in work with trans organizational PACS
- How the APPC could help to solve those
- How the APPC is used and coding is performed
- How the APPC will be developed in the future
- Radiologists will love the support in their daily work

Thank you